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®

**MOLYKOTE**



## Anti-Friction Coatings Selection Guide

**DOW CORNING**

*Welcome to the  
MOLYKOTE®  
Anti-Friction Coatings  
Selection Guide  
from Dow Corning.  
In the following pages,  
you will find a complete  
overview of the Molykote  
Anti-Friction Coatings  
product range.  
It includes a variety of  
technical information  
that you will find helpful  
when selecting the  
right product for your  
specific application.  
If you cannot find  
the specific information  
you need, please  
contact your Molykote  
representative.*

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## MOLYKOTE® Anti-Friction Coatings

Anti-Friction Coatings (formerly known as bonded coatings) are paint-like products. They contain, instead of a colouring pigment, submicron-sized particles of solid lubricants dispersed through carefully selected resin blends and solvents. Important for the lubricating and corrosion protection properties are the choice of the raw materials and the volume concentration of the lubricant content. MOLYKOTE® Anti-Friction Coatings form a slippery film, which covers all surface roughness and thus optimises metal-to-metal, metal-to-plastic or plastic-to-plastic friction even under extreme loads and working conditions. These coatings can be applied by conventional painting techniques: spraying, dipping or brushing.

Other common application methods are spraying drums, centrifuges, electro-static or automatic spraying, printing or roller coating followed by well-known methods of industrial drying and curing. The time required for these drying and curing methods is between 3 minutes air drying and 60 minutes oven curing.

### *The Anti-Friction Coatings Product Line*

The current product line can be differentiated by the various solid lubricants, binders and solvent bases contained in the formulations.

### MOLYKOTE® Product line

| Product        | Lubricant        | Binder          | Thinner-compatible solvent |
|----------------|------------------|-----------------|----------------------------|
| D 321R         | MoS <sub>2</sub> | Titanate        | L 13                       |
| 3402-C         | MoS <sub>2</sub> | Special         | L 13                       |
| D 3484         | MoS <sub>2</sub> | Phenolic        | L 13                       |
| 3400A Leadfree | MoS <sub>2</sub> | Epoxy           | L 13                       |
| 106            | MoS <sub>2</sub> | Epoxy           | L 13                       |
| 7409/7620      | MoS <sub>2</sub> | Polyamide-imide | 7414                       |
| D 106          | MoS <sub>2</sub> | Epoxy           | Water                      |
| 7400           | MoS <sub>2</sub> | Acrylic         | Water                      |
| PTFE-N UV      | PTFE             | Acrylic         | L 13                       |
| D 708          | PTFE             | Epoxy           | L 13                       |
| D 96           | PTFE             | PU              | Water                      |
| 7405           | Synth.           | Polyamide-imide | 7414                       |
| D 10           | Graphite         | Polyamide-imide | 7414                       |
| D 88           | Special pigments | Polyamide-imide | 7414                       |

**Footnote:**

L13 is a mixture of organic solvents  
7414 is an organic solvent with flash-point >90°C

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MOLYKOTE® Anti-Friction Coatings

## Strengths/Potential weaknesses of Anti-Friction Coatings Technologies

### 1. Lubricating Substances

| Type                                     | Strengths  | Potential weaknesses   |
|--|--|--|
| MoS <sub>2</sub><br>Molybdenum Disulfide | <ul style="list-style-type: none"> <li>+ High load carrying capacity</li> <li>+ Wide temperature range</li> <li>+ Paintable</li> <li>+ Excellent adhesion</li> <li>+ Low coefficient of friction at high loads</li> <li>+ Protects against fretting corrosion</li> <li>+ Increases lifetime (Synergism with graphite)</li> <li>+ Electrical insulator</li> </ul> | <ul style="list-style-type: none"> <li>- High friction at low loads</li> <li>- Running-in at high loads</li> <li>- High coefficient of friction under humidity</li> <li>- Dark grey colour only</li> </ul> |
| Graphite                                 | <ul style="list-style-type: none"> <li>+ High temperature stability</li> <li>+ Separating effect (metal-forming)</li> <li>+ Good lubricant under humidity</li> </ul>   | <ul style="list-style-type: none"> <li>- Lower service life at room temperature (when compared to MoS<sub>2</sub>)</li> <li>- Electrically conductive</li> <li>- Black colour only</li> </ul>              |
| PTFE                                     | <ul style="list-style-type: none"> <li>+ Colourless</li> <li>+ Separation effect</li> <li>+ Low coefficient of friction at low load</li> <li>+ Electrical insulator</li> <li>+ Good chemical resistance</li> </ul>   | <ul style="list-style-type: none"> <li>- Decomposition (+315°C)= toxic vapour</li> <li>- Low load carrying capacity</li> <li>- Not paintable</li> </ul>  |
| Synthetics                               | <ul style="list-style-type: none"> <li>+ Colourless / colourable</li> <li>+ Extreme low coefficient of friction at low loads (curing temperature)</li> <li>+ Good chemical resistance</li> <li>+ Good fretting corrosion protection</li> <li>+ Low curing temperature</li> </ul>   | <ul style="list-style-type: none"> <li>- Low load carrying capacity</li> <li>- Limited temperature range</li> </ul>  |

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## Strengths/Potential weaknesses of Anti-Friction Coatings Technologies (continued)

### 2. Binders

| Type      | Chemical Resistance | Temp. Resistance | Air Curing | Corrosion Resistance | Remarks                                 |
|-----------|---------------------|------------------|------------|----------------------|---|
| Epoxy     | +++                 | +++              | -          | +++                  | High hardness, water-based feasible     |
| Polyamide | +++                 | +++              | -          | ++                   | Self lubricating/ difficult application |
| Phenolic  | ++                  | +++              | -          | +                    | Water-based feasible                    |
| Acrylic   | ++                  | ++               | +++        | -                    | Water-based feasible                    |
| Titanate  | -                   | ++++             | +++        | -                    | Limited film forming                    |

### 3. Solvents

| Type  | Flash Point | Evaporation Curing Ranking | Remarks              |
|-------|-------------|----------------------------|----------------------|
| Water | -           | 8                          | Non toxic/ corrosion |
| 7414  | + 93 °C     | 7                          | Skin irritant        |
| L13   | + 27 °C     | 4                          | Smell                |

### General differences to other types of lubricants

(in view of possibly replacing them)

*Anti-Friction Coatings usually provide the following advantages compared to greases and pastes:*

- Dry and clean lubrication, not affected by dust, dirt and humidity
- Lifetime lubrication in most cases
- Localized lubrication
- No aging, evaporation, oxidation
- Non flammable, dry film
- Can be applied in a film of controlled thickness
- Can often replace burnishing, hard chrome, lead plating, cadmium and galvanizing
- Fully effective even after prolonged shut down
- Vacuum and radiation resistant

*Potential limitations:*

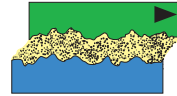
- Not recommended for high speed applications
- Under hydrodynamic conditions should only be used in combination with grease, oil, paste (they provide running-in aid and emergency lubrication)
- Comprehensive application process

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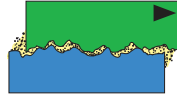
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General differences to other types of lubricants

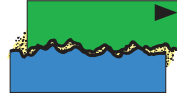
## Operating principles and conditions of Anti-Friction Coatings



1. Hydrodynamic lubrication



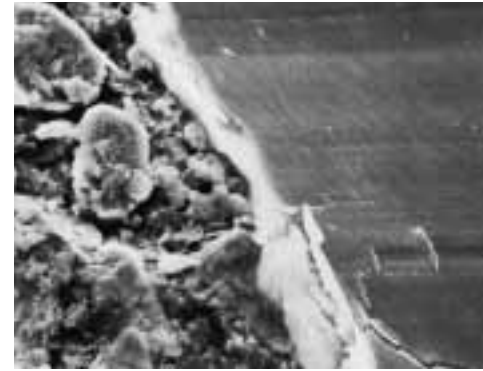
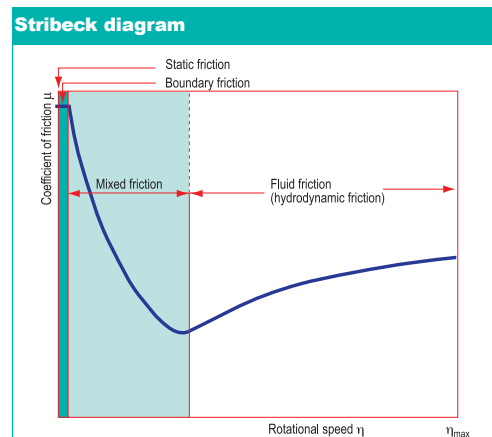
2. Boundary and mixed friction states



3. Mixed friction state plus Anti-Friction Coatings

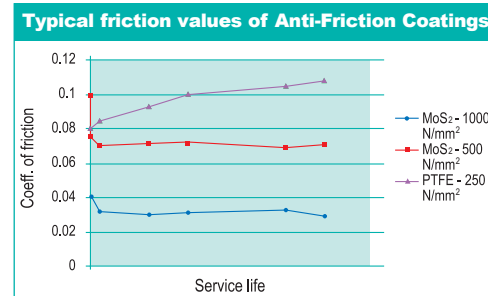
Anti-Friction Coatings are particularly effective in frictional states of boundary friction and mixed friction as illustrated in the Stribeck diagram (see below). In these two conditions a fluid hydrodynamic lubrication can not be realized and direct metal-to-metal contact and wear take place; the solid lubricants are kept on the surface by the bonding force of the resin package; in this way the surfaces are always separated by an effective dry film, also in conditions of very low speeds, oscillating movements and high loads.

Anti-Friction Coatings can also effectively support hydrodynamic lubrication during running-in conditions and assuring emergency-running properties in case of break down of the hydrodynamic film.



SEM photograph with 1000x magnification: MoS<sub>2</sub> Anti-Friction Coatings before (left) and after (right) load application

Applied Anti-Friction Coatings contain up to 70% solid lubricants. Solid lubricants with a lamellar structure like MoS<sub>2</sub> exhibit a floating effect in a wet film, whereby, as the film dries, they orient themselves horizontally and are deposited as individual layers. Under load, the structure of the film is further compacted producing an extremely smooth film surface covering the asperities of the carrier material.



Typical friction values of MoS<sub>2</sub> and PTFE based Anti-Friction Coatings under different loads.

(Values measured with the LFW1 test machine - ASTM-D-2714 method)

"In the diagram the typical running-in effect of MoS<sub>2</sub> based, Anti-Friction Coatings can be noticed"

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**Strengths/Potential weaknesses compared to other lubricant types**

| Lubricant              | MoS <sub>2</sub> AFC   | PTFE AFC              | Graphite AFC           | Synth. AFC                  |
|------------------------|------------------------|-----------------------|------------------------|-----------------------------|
| Mineral-Oil grease     | Sealing                | Sealing               | Sealing                | Sealing                     |
|                        | Noise reduction        | Noise reduction       | Noise reduction        | Noise reduction             |
|                        | Load carrying          | Temp. range           | Load carrying          | Load carrying               |
|                        | Temp. range            | Adhesion              | Temp. range            | Temp. range                 |
|                        | Adhesion               | Fretting corrosion    | Adhesion               | Adhesion                    |
|                        | Fretting corrosion     | Solid state friction  | Fretting corrosion     | Fretting corrosion          |
|                        | Solid state friction   | Chem. resistance      | Solid state friction   | Solid state friction        |
|                        | Chem. resistance       | Separating effect     | Chem. resistance       | Chem. resistance            |
| Synthetic grease       | Corrosion protection   | Colourless            | Oil resistance         | Separating effect           |
|                        |                        | Corrosion protection  | Solvent resistance     | Colour                      |
|                        | Sealing                | Sealing               | Sealing                | Sealing                     |
|                        | Noise reduction        | Noise reduction       | Noise reduction        | Noise reduction             |
|                        | Plastics compatibility |                       | Plastics compatibility |                             |
|                        | Load carrying          | (Temp. range)         | Load carrying          | Load carrying               |
|                        | Temp. range            | Adhesion              | Temp. range            | (Temp. range)               |
|                        | Adhesion               | Fretting corrosion    | Adhesion               | Adhesion                    |
| Fretting corrosion     | Solid state friction   | Fretting corrosion    | Fretting corrosion     |                             |
| Solid state friction   | (Chem. resistance)     | Solid state friction  | Solid state friction   |                             |
| (Chem. resistance)     | Separating effect      | (Chem. resistance)    | (Chem. resistance)     |                             |
| Corrosion protection   | Colourless             | (Oil resistance)      | Separating effect      |                             |
| Silicone grease        |                        | Corrosion protection  | (Solvent resistance)   | Colour                      |
|                        | Sealing                | Sealing               | Sealing                | Sealing                     |
|                        | Noise reduction        | Noise reduction       | Noise reduction        | Noise reduction             |
|                        | Plastics compatibility |                       | Plastics compatibility | Plastics compatibility      |
|                        | Load carrying          | Load carrying         | Load carrying          | Load carrying               |
|                        | Temp. range            | (Temp. range)         | Temp. range            | Adhesion                    |
|                        | Adhesion               | Adhesion              | Adhesion               | Fretting corrosion          |
|                        | Fretting corrosion     | Fretting corrosion    | Fretting corrosion     | Solid state friction        |
| Solid state friction   | Solid state friction   | Solid state friction  | Lower friction coeff.  |                             |
| Lower friction coeff.  | Lower friction coeff.  | Lower friction coeff. | Corrosion protection   |                             |
|                        | (Colourless)           | (Oil resistance)      | Colour                 |                             |
|                        | Corrosion protection   | (Solvent resistance)  |                        |                             |
| MoS <sub>2</sub> paste | Corrosion protection   | Corrosion protection  | Corrosion protection   | Corrosion protection        |
|                        | Adhesion               | Adhesion              | Adhesion               | Adhesion                    |
|                        |                        | Separating effect     |                        | Separating effect           |
|                        |                        | Colour                |                        | Colour                      |
| Grease paste           | Sealing                | Sealing               | Sealing                | Sealing                     |
|                        | Noise reduction        | Noise reduction       | Noise reduction        | Noise reduction             |
|                        | Load carrying          | Corrosion protection  | Load carrying          | Load carrying               |
|                        | Corrosion protection   | Adhesion              | Corrosion protection   | Corrosion protection        |
|                        | Adhesion               | Separating effect     | Adhesion               | Adhesion                    |
|                        |                        | Colourless            | Separating effect      | Separating effect           |
|                        |                        |                       | Oil resistance         | Colour                      |
|                        |                        |                       | Solvent resistance     |                             |
| Thread paste           | Sealing                | Sealing               | Sealing                | Sealing                     |
|                        | Easy application       | Easy application      | Easy application       | Easy application            |
|                        | Adhesion               | Adhesion              | Adhesion               | Adhesion                    |
|                        | Corrosion protection   | Corrosion protection  | Corrosion protection   | Corrosion protection        |
|                        |                        | Separating effect     | Separating effect      | Colourless                  |
|                        |                        | Colourless            | Oil resistance         | Very low coeff. of friction |
|                        |                        | Solvent resistance    |                        |                             |

■ = Strengths of Anti-Friction Coatings □ = Strengths of other lubricants

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Strengths/Potential weaknesses compared to other lubricant types

Strengths comparison among PTFE and Synthetics- based Anti-Friction Coatings

|                  | PTFE-N UV              | D 708                  | D 96                   | 7405                   |
|------------------|------------------------|------------------------|------------------------|------------------------|
| <b>PTFE-N UV</b> |                        | Colourless             | Temperature resistance | Colourless             |
|                  |                        | Air drying             | Adhesion               | Air drying             |
|                  |                        | Aerosol                | Aerosol                | Aerosol                |
|                  |                        | Load carrying capacity | Water-based            | Load carrying capacity |
|                  |                        | Chemical resistance    | Low friction           | Low friction           |
|                  |                        | Corrosion protection   |                        | Chemical resistance    |
|                  |                        | Adhesion               |                        | Corrosion protection   |
| <b>D 708</b>     | Load carrying capacity |                        | Temperature resistance | Chemical resistance    |
|                  | Chemical resistance    |                        | Load carrying capacity | Corrosion protection   |
|                  | Corrosion protection   |                        | Chemical resistance    |                        |
|                  | Adhesion               |                        | Corrosion protection   |                        |
|                  |                        |                        | Adhesion               |                        |
|                  | Colourless             |                        | Colourless             | Low friction           |
|                  | Air drying             |                        | Air drying             | Higher flash point     |
| Aerosol          |                        | Water-based            |                        |                        |
| <b>D 96</b>      | Water-based            | Colourless             |                        | Colourless             |
|                  | Low friction           | Air drying             |                        | Air drying             |
|                  |                        | Water-based            |                        | Water-based            |
|                  | Temperature resistance | Temperature resistance |                        | Temperature resistance |
|                  | Adhesion               | Load carrying capacity |                        | Load carrying capacity |
|                  | Aerosol                | Chemical resistance    |                        | Chemical resistance    |
|                  |                        | Corrosion protection   |                        | Corrosion protection   |
|                  | Adhesion               |                        | Adhesion               |                        |
| <b>7405</b>      | Load carrying capacity | Low friction           | Temperature resistance |                        |
|                  | Low friction           | Higher flash point     | Load carrying capacity |                        |
|                  | Chemical resistance    |                        | Chemical resistance    |                        |
|                  | Corrosion protection   |                        | Corrosion protection   |                        |
|                  |                        |                        | Adhesion               |                        |
|                  | Colourless             | Chemical resistance    | Colourless             |                        |
|                  | Air drying             | Corrosion protection   | Air drying             |                        |
| Aerosol          |                        | Water-based            |                        |                        |

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- = strengths of the Anti-Friction Coatings in the row compared to the Anti-Friction Coatings in the column
- = strengths of the Anti-Friction Coatings in the column compared to the Anti-Friction Coatings in the row

Strengths comparison among PTFE and Synthetics based Anti-Friction Coatings

Strengths comparison among MoS<sub>2</sub> based Anti-Friction Coatings

|                       | D 321R   | D 3484  | 3400A Leadfree   | 3402-C   | 106   | 7409/7620  | D 106  | 7400  |
|-----------------------|--|---|--|--|---|--|--|---|
| <b>D 321R</b>         |  | Temp. resistance<br>Extreme load<br>Aerosol<br>Air curing                           | Low friction<br>Air drying<br>Aerosol<br>Higher flash point  | Temp. resistance<br>Low friction<br>Aerosol<br>Higher flash point<br>Non toxic   | Temp. resistance<br>Good adhesion<br>Air drying<br>Aerosol  | Air drying<br>Aerosol  | Temp. resistance<br>Air drying<br>Aerosol  | Temp. resistance<br>Good adhesion<br>Aerosol  |
| <b>D 3484</b>         | No chalking<br>Chem. resist.<br>Corr. protection<br>Temp. resistance<br>Extreme load<br>Aerosol<br>Air curing                  | No chalking<br>Chem. resistance<br>Corr. protection                                 | Low friction<br>Fast curing<br>Higher flash point<br>Temp. resistance<br>Corr. protection  | Low friction<br>Higher flash point<br>Non toxic<br>Temp. resistance<br>Air drying<br>MIL-spec.   | Low friction<br>Corr. protection<br>Fast curing<br>MIL-spec.  | Fast curing<br>Low friction<br>Temp. resistance<br>Chem. resistance<br>Corr. protection  | Water-based<br>No chalking<br>Water-based<br>Low friction<br>Fast curing   | Temp. resistance<br>Corr. protection<br>Air drying<br>Water-based<br>No flash point   |
| <b>3400A Leadfree</b> | Corr. protection<br>Chem. resistance<br>No chalking<br>Low friction<br>Air drying<br>Aerosol<br>Higher flash point             | Temp. resistance<br>Corr. protection  |  | Air drying<br>Temp. resistance<br>Corr. protection   | Temp. resistance<br>Corr. protection<br>Low friction<br>Lower curing temp.<br>Higher flash point                            | Temp. resistance<br>Corr. protection<br>Low friction<br>Chem. resistance<br>Higher flash point   | Temp. resistance<br>Chem. resistance<br>Corr. protection<br>Low friction<br>Water-based                                  | Temp. resistance<br>Chem. resistance<br>Corr. protection<br>Low friction<br>Air drying<br>Water-based<br>No flash point             |
| <b>3402-C</b>         | No chalking<br>Corr. protection<br>MIL-spec.<br>Temp. resistance<br>Low friction<br>Aerosol<br>Higher flash point<br>Non toxic | Temp. resistance<br>Air drying<br>MIL-spec.   | Air drying<br>Temp. resistance<br>Corr. protection   | Temp. resistance<br>Corr. protection<br>Air drying<br>MIL-spec.<br>Low friction<br>Higher flash point<br>Non toxic                     | Temp. resistance<br>Corr. protection<br>Air drying<br>MIL-spec.<br>Low friction<br>Higher flash point<br>Non toxic          | Air drying<br>MIL-spec.<br>Temp. resistance<br>Low friction<br>Chem. resistance<br>Corr. protection<br>Higher flash point<br>Non toxic | Temp. resistance<br>Air drying<br>MIL-spec.<br>Low friction<br>Water-based<br>Non toxic                                  | Temp. resistance<br>Chem. resistance<br>Corr. protection<br>MIL-spec.<br>Low friction<br>Water-based<br>No flash point<br>Non toxic |
| <b>106</b>            | Chem. resistance<br>No chalking<br>Temp. resistance<br>Good adhesion<br>Air drying<br>Aerosol                                  | MIL-spec.<br>Low friction<br>Corr. protection<br>Fast curing                        | Low friction<br>Lower curing temp.<br>Higher flash point<br>Temp. resistance<br>Corr. protection                                     | Low friction<br>Higher flash point<br>Non toxic<br>Temp. resistance<br>Corr. protection<br>Air drying<br>MIL-spec.                     | Temp. resistance<br>Corr. protection<br>Air drying<br>MIL-spec.<br>Temp. resistance<br>Chem. resistance<br>Corr. protection | Lower curing temp.<br>MIL-spec.<br>Temp. resistance<br>Chem. resistance<br>Corr. protection  | Storage stability<br>Lower curing temp.<br>MIL-spec.<br>Corr. protection<br>Water-based                                  | Temp. resistance<br>Chem. resistance<br>MIL-spec.<br>Air drying<br>Water-based<br>No flash point                                    |
| <b>7409 / 7620</b>    | Chem. resistance<br>Corr. protection<br>No chalking<br>Air drying<br>Aerosol   | Temp. resistance<br>Chem. resistance<br>Corr. protection<br>Fast curing             | Low friction<br>Chem. resistance<br>Higher flash point<br>Temp. resistance<br>Corr. protection                                       | Temp. resistance<br>Low friction<br>Chem. resistance<br>Corr. protection<br>Higher flash point<br>Non toxic<br>Air drying<br>MIL-spec. | Temp. resistance<br>Chem. resistance<br>Corr. protection<br>Lower curing temp.<br>MIL-spec.                                 | Temp. resistance<br>Chem. resistance<br>Corr. protection<br>Water-based  | Temp. resistance<br>Chem. resistance<br>Corr. protection<br>Storage stability<br>Water-based                             | Temp. resistance<br>Chem. resistance<br>Corr. protection<br>Air drying<br>Water-based<br>No flash point                             |
| <b>D 106</b>          | Corr. protection<br>No chalking<br>Water-based<br>Temp. resistance<br>Air drying<br>Aerosol                                    | Water-based<br>Low friction<br>Fast curing  | Low friction<br>Water-based<br>Non toxic<br>Temp. resistance<br>Chem. resistance<br>Corr. protection                                 | Low friction<br>Water-based<br>Non toxic<br>Temp. resistance<br>Air drying<br>MIL-spec.  | Corr. protection<br>Water-based<br>Storage stability<br>Lower curing temp.<br>MIL-spec.                                     | Temp. resistance<br>Chem. resistance<br>Corr. protection<br>Storage stability  | Air drying<br>No flash point<br>Temp. resistance<br>Corr. protection<br>Chem. resistance<br>Air drying<br>No flash point |   |
| <b>7400</b>           | Water-based<br>No flash point<br>Temp. resistance<br>Good adhesion<br>Aerosol  | Air drying<br>Water-based<br>No flash point<br>Temp. resistance<br>Corr. protection | Low friction<br>Air drying<br>Water-based<br>No flash point<br>Non toxic<br>Temp. resistance<br>Chem. resistance<br>Corr. protection | Low friction<br>Water-based<br>No flash point<br>Non toxic<br>Temp. resistance<br>Chem. resistance<br>Corr. protection<br>MIL-spec.    | Air drying<br>Water-based<br>No flash point<br>Temp. resistance<br>Chem. resistance<br>MIL-spec.                            | Air drying<br>Water-based<br>No flash point<br>Temp. resistance<br>Chem. resistance<br>Corr. protection                                | Air drying<br>No flash point<br>Temp. resistance<br>Corr. protection<br>Chem. resistance                                 |   |

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■ = strengths of the Anti-Friction Coatings in the row compared to Anti-Friction Coatings in the column

□ = strengths of the Anti-Friction Coatings in the column compared to Anti-Friction Coatings in the row

Strengths comparison among MoS<sub>2</sub> based Anti-Friction Coatings

## Typical properties of MOLYKOTE® Anti-Friction Coatings

| MOLYKOTE®<br>Product | Solid lubricant  | Thinner - compatible<br>solvent | Colour                   | Service temperature range<br>[°C] | Load carrying capacity<br>(Falex test, ASTM-D-2625)<br>[N] | Endurance life<br>(LFW- 1 test, ASTM- D- 2714) |                                | Fretting corrosion<br>resistance (Deyber test)<br>[oscillations] | Typical corrosion<br>protection values (*)<br>(ISO R 1456) [h] | Curing schedule<br>[min/°C] | Flash point [°C] | Surface coverage m²/kg |
|----------------------|------------------|---------------------------------|--------------------------|-----------------------------------|--|--|--------------------------------|--|--|-----------------------------|------------------|------------------------|
|                      |                  |                                 |                          |                                   |  | [Revolutions<br>in thousands]                  | [Oscillations<br>in thousands] |  |  |                             |                  |                        |
| D 321R               | MoS <sub>2</sub> | L 13                            | grey                     | -180/+450                         | 15.000   | s=480  | s=210                          | 14x10 <sup>6</sup>   | -  | 5/20                        | +23              | 7                      |
| 3402-C               | MoS <sub>2</sub> | L 13                            | grey                     | -200/+315                         | 15.500   | s=150  | s=15                           | 5x10 <sup>6</sup>  | p+sp=120   | 120/20                      | +12              | 15                     |
| D 3484               | MoS <sub>2</sub> | L 13                            | grey                     | -70/+250                          | 15.500   | p=300  | p=350                          | 28x10 <sup>6</sup>   | p+sp=24  | 10/170                      | +23              | 10                     |
| 3400A Leadfree       | MoS <sub>2</sub> | L 13                            | grey                     | -200/+430                         | 20.000   | p=100  | p= > 50                        | 7x10 <sup>6</sup>  | p+sp=500<br>p+dp=240   | 30/200                      | < +21            | 15                     |
| 106                  | MoS <sub>2</sub> | L 13                            | grey                     | -70/+250                          | 15.500   | p=380  | p=280                          | 24x10 <sup>6</sup>   | -  | 60/150                      | +24              | 15                     |
| 7409                 | MoS <sub>2</sub> | 7414                            | grey                     | -70/+380                          | 15.800   | p=350  | p=100                          | > 36x10 <sup>6</sup>   | p+sp=300<br>p+dp=96  | 30/220                      | +28              | 12                     |
| 7620                 | MoS <sub>2</sub> | 7414                            | grey                     | -70/+380                          | 15.800   | p=400  | p=100                          | > 36x10 <sup>6</sup>   | p+sp=300   | 20/220                      | +28              | 14                     |
| 7400                 | MoS <sub>2</sub> | water                           | grey                     | -70/+200                          | 13.000   | p=200  | p=100                          | 9x10 <sup>6</sup>  | -  | 40/20                       | None             | 16                     |
| D 106                | MoS <sub>2</sub> | water                           | grey                     | -70/+250                          | 13.500   | p=300  | p=180                          | 24x10 <sup>6</sup>   | p+sp=24  | 60/200                      | +84              | 15                     |
| PTFE-N UV            | PTFE             | L 13                            | transparent              | -180/+240                         | 4.000  | p=15   | p=36                           | 20x10 <sup>6</sup>   | p+sp=24  | 120/20                      | -19              | 18                     |
| D 708                | PTFE             | L 13                            | black                    | -180/+240                         | 1.220  | p=9  | p=13                           | 1x10 <sup>6</sup>  | p+sp=500<br>p+dp=360   | 20/200                      | 0                | 18                     |
| D 96                 | PTFE             | water                           | transparent              | -40/80                            | -  | -  | -                              | -  | -  | 120/20                      | > +100           | -                      |
| 7405                 | Synt.            | 7414                            | yellowish<br>transparent | -70/+200                          | 15.000   | p=150  | p=100                          | > 36x10 <sup>6</sup>   | p+sp=200<br>p+dp=96  | 60/120                      | +41              | 16                     |
| D 10                 | Graphite         | 7414                            | black                    | -70/+380                          | 13.600   | p=6  | p=1                            | > 36x10 <sup>6</sup>   | -  | 30/180                      | +63              | 8                      |
| D 88                 | Special          | 7414                            | silver-grey              | -70/380                           | -  | -  | -                              | -  | p+sp=300<br>p+dp=120   | 20/210                      | +63              | -                      |

dp= application by dip-spinning – sp= application by spraying  
p= phosphated surface – s= sandblasted surface

(\*): as the performance in corrosion resistance is affected by the geometry of the parts coated, by the pre-treatment of the surface, by the application method and by the thickness of the applied dry film, these values should be considered typical.

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Typical properties of MOLYKOTE® Anti-Friction Coatings

**MOLYKOTE® Anti-Friction Coatings solutions for machine components**

| Solutions for  | Running-in damages           | Scuffing, scoring, seizure                             | High wear, pitting                        | Short service life because of high loads | Fretting corrosion                  | Stick-slip                                   | Unsteady coefficient of friction | Short lubrication intervals        | Contamination, chalking | Unsatisfactory surface quality        | Short service life because of extreme temperatures | Lubrication failure because of chemical attack | Environmental application problems | Corrosion                          |
|--|------------------------------|--|---|--|-------------------------------------|--|----------------------------------|------------------------------------|-------------------------|---------------------------------------|--|--|------------------------------------|------------------------------------|
| <b>Machine components</b>  |                              |  |   |  |                                     |  |                                  |                                    |                         |                                       |  |  |                                    |                                    |
| Hinges, springs, locks, switches, bolts, safety belts, ski-bindings                        | D 321R                       | 3400A<br>Leadfree<br>D 3484<br>7409<br>3402-C<br>D 106 | 3400A<br>Leadfree<br>7409<br>106          | D 3484<br>3400A<br>Leadfree<br>D 106     | 106<br>7409                         | 3400A<br>Leadfree<br>D 3484<br>7409<br>D 106 | 7405<br>PTFE-N UV                | D 3484<br>3400A<br>Leadfree        | 7405<br>7409<br>D 708   | D 321R<br>D 3484<br>3400A<br>Leadfree | D 321R<br>7409<br>3400A<br>Leadfree                | 7409<br>3400A<br>Leadfree<br>D 708<br>D 10     | 7400<br>D 106                      | 3400A<br>Leadfree<br>7409<br>D 708 |
| Brake parts, clutches, solenoids   | D 321R<br>7400               | D 106<br>7409<br>3400A<br>Leadfree                     | D 106<br>7409                             | 3400A<br>Leadfree<br>D 106<br>7409       | 106                                 | D 106<br>7405<br>7409                        | 7405                             | 106                                | 7405<br>7409<br>D 708   | D 321R<br>106                         | 3400A<br>Leadfree<br>D 321R<br>7409                |  | 7400<br>D 106                      | 7409<br>3400A<br>Leadfree<br>D 708 |
| Sleeve bearings, chain elements, self-aligning bearings, sintered metal bushings, bearings | D 321R                       | 106<br>3400A<br>Leadfree                               | 106<br>7409                               | 3400A<br>Leadfree<br>D 106<br>7409       | 106                                 | D 321R<br>7409                               | 7405                             | 106                                | 7405<br>7409            | D 321R<br>106                         | 3400A<br>Leadfree<br>D 321R<br>7409                | 3400A<br>Leadfree<br>7409                      | 7400<br>D 106                      | 7409<br>3400A<br>Leadfree<br>D 708 |
| Slides, spindles, bed ways, adjusting wedges, gear racks                                   | D 321R                       | D 321R<br>106<br>D 106                                 | 3400A<br>Leadfree<br>106<br>7409<br>D 106 | D 321R<br>106<br>D 106                   | 106                                 | D 321R<br>106<br>D 106                       | D 321R<br>106<br>7405            | 3400A<br>Leadfree<br>106<br>D 3484 | 7409                    | D 321R<br>D 106                       | D 321R<br>7409<br>3400A<br>Leadfree                | 7409<br>3400A<br>Leadfree                      | 7400<br>D 106                      | 7409<br>3400A<br>Leadfree<br>D 708 |
| Reactor parts lubrication  | D 321R                       | D 321R   | D 321R<br>7409                            | D 321R                                   | 7409                                | D 321R                                       | 7409                             | D 321R                             | 7409                    | D 321R                                | D 321R   | D 321R<br>7409                                 |                                    | 7409                               |
| Weapons, ammunition  | 3402-C                       | 3402-C<br>7409<br>3400A<br>Leadfree                    | 3402-C<br>3400A<br>Leadfree               | 3402-C<br>3400A<br>Leadfree              | 3400A<br>Leadfree<br>3402-C<br>7409 | 3402-C<br>3400A<br>Leadfree<br>D 708         | 7409<br>D 708                    | 7409<br>3400A<br>Leadfree          | 7409                    | 3402-C                                | 7409<br>3400A<br>Leadfree                          | 7409<br>D 708                                  |                                    | 3400A<br>Leadfree<br>7409<br>D 708 |
| Valves, carburetors, pumps   | 7409                         | 7409   | 7409                                      | 7409                                     | 7409                                | 7409   | 7409                             | 7409                               | 7409                    | 3400A<br>Leadfree                     | 7409   | 7409   | 7409                               | 7409                               |
| Nuts and bolts   |                              | D 708<br>7405  |   | 3402-C                                   | 3402-C                              | D 708<br>7405                                | 7405<br>D 708                    |                                    | 7405<br>D 708           | 7405                                  | D 321R   | 7405<br>D 708                                  | 7400<br>7405                       | 7405<br>D 708                      |
| Elastomer seals/profiles, plastic parts  | D 96                         |  |   | D 96                                     |                                     | D 96   | PTFE-N UV<br>D 96                | D 96                               |                         | D 96                                  |  |  | D 96                               |                                    |
| Aircrafts, rockets, helicopters, space stations  | D 321R                       | 7409<br>3402-C   | 7409<br>3400A<br>Leadfree<br>3402-C       | 3400A<br>Leadfree<br>3402-C<br>7409      | 106<br>7409                         | 3400A<br>Leadfree<br>3402-C<br>D 321 R       | 3402-C<br>7409                   | 3402-C<br>3400A<br>Leadfree        | 7409                    | D 321R<br>3402-C                      | D 321R<br>3400A<br>Leadfree<br>7409                | 7409<br>3400A<br>Leadfree                      | D 321R                             | 7409<br>3400A<br>Leadfree          |
| Pistons, hydraulic parts, cam shafts, gears  | D 10<br>D 88<br>7409<br>7400 | D 10<br>7409<br>D 88                                   | 7409<br>D 10<br>D 88                      | 7409                                     | 7409                                | 7409   | 7409                             | 7409<br>D 10<br>D 88               |                         | 3400A<br>Leadfree                     | 7409   | 7409<br>D 10<br>D 88                           | 7400<br>7409<br>D 10               | D 10<br>7409<br>D 88               |

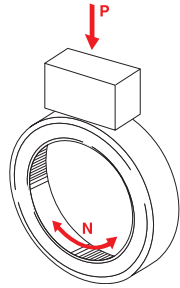
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MOLYKOTE® Anti-Friction Coatings solutions for machine components

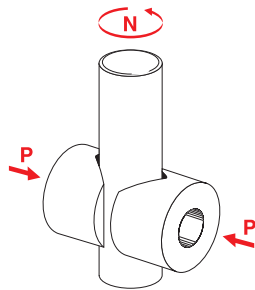
## Typical testing methods for Anti-Friction Coatings

The performance characteristics of Anti-Friction Coatings can be evaluated on standard test machines which can simulate the different tribological contacts; by changing the different testing parameters the performance of the lubricant on several machine elements can be simulated. Sketches and description of the operating principles of the machines are reported here.



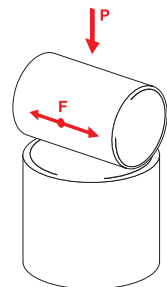
### Falex LFW1 (Block on Ring Test Machine)

- ASTM D 2714
- A stationary block is loaded against a rotating or oscillating ring
- Type of contact: line or area
- Type of friction: sliding friction
- Test criteria: friction force, sliding distance, number of oscillations/revolutions
- Measured properties: endurance life, friction value, load carrying capacity



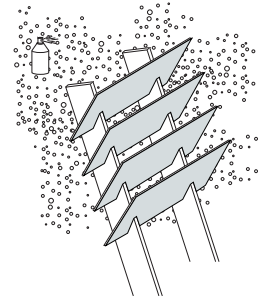
### Falex Pin and Vee Test Machine

- ASTM D 2625
- Two stationary vee blocks are loaded against a rotating pin specimen
- Type of contact: 4 lines
- Type of friction: sliding friction
- Test criteria: weld load, friction torque
- Measured properties: extreme pressure, load carrying capacity, endurance life



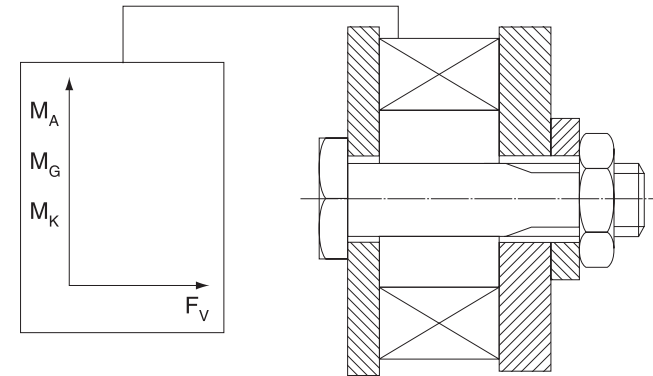
### SRV Test Machine

- DIN 51834
- A translatable oscillating ball or cylinder is loaded against a fixed flat disc specimen
- Type of contact: point (ball) or line (cylinder)
- Type of friction: sliding friction
- Test criteria: weld load, friction force, number of oscillations
- Measured properties: load carrying capacity, endurance life, friction value



### Salt spray test

- DIN 50021 – ASTM B 117
- Coated specimen or original parts are put in a chamber with salt water spray
- Test criteria: rust formation
- Measured properties: corrosion resistance



### Erichsen Test Machine

- Test equipment to measure the coefficient of friction on bolted connections at room temperature
- Type of contact: area (thread and underhead)
- Type of friction: sliding friction
- Test criteria: pretensioning force, tightening torque
- Measured properties: coefficient of friction on thread and underhead

All these test equipments are currently in operation at our technical centres. Furthermore our test fields are equipped with special test machines based on original automotive or industrial machine elements to evaluate the tribological behaviours under different environmental conditions.

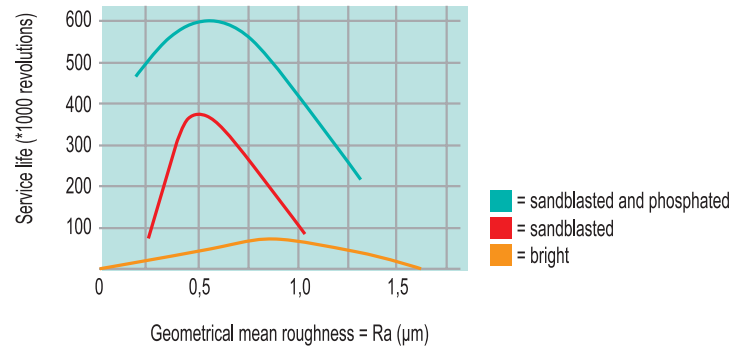
Based also on these capabilities we are confident to be able to offer to our customers the best solution to solve their dry lubrication problems.

## Surface pre-treatment of Anti-Friction Coatings

### Pre-treatment of metal surfaces

The adhesion and service life of Anti-Friction Coatings are greatly affected by the surface pre-treatment of components.

### Life of Anti-Friction Coatings



Effect of pre-treatment and surface roughness on the service life of Anti-Friction Coatings

### Degreasing

In order to achieve a uniform surface pre-treatment and satisfactory application of Anti-Friction Coatings, the components must first be degreased carefully. Even when corrosion is removed with acid, a thorough degreasing is necessary to achieve an even wetting in the bath.

Degreasing is particularly successful using organic solvents or ultrasonic cleaners and wash plant with alkaline aqueous agents. Because of toxicological and safety concerns, however, consider to using organic solvents with very low-aromatic content.

If steam degreasing equipment is not available, remove oil and grease residues by washing in a suitable solvent. The solvent should leave no residue after evaporation, e.g. acetone or white spirit. Repeat the washing operation several times using fresh solvent each time.

### Pre-treatment of corroded surfaces

Pretreat corroded surfaces by mechanical or chemical methods. As a mechanical method, sandblasting with aluminium oxide or with cast-steel (grain size 55 µm) is recommended. This produces an additional roughening of the component surface and provides better adhesion of the Anti-Friction Coatings. The acid and alkali treatments customary in electroplating are generally adequate. Baths should remove corrosion products but not unnecessarily attack the basic metal. Remove all traces of chemicals or solutions used in cleaning. Do not handle parts with bare hands.

### Phosphating

Phosphating is suitable for pretreating iron and steel, not stainless steel, and for galvanised iron parts. Manganese phosphating increases the load carrying capacity of the coating. Zinc phosphating increases its corrosion protection. Only use phosphating baths which produce very fine crystalline layers. The process should produce a maximum dimensional deposition between 3 and 8 µm at the surface. This is equivalent to an increase in weight between 5 to 15 g/m<sup>2</sup>.

The phosphate layer should have an even, uniform structure and its colour should range between grey and black. The components should not be speckled and, in particular, should exhibit neither specks of dried-on phosphating solution nor traces of corrosion. After treatment, parts should not be touched with bare hands.

Parts exhibiting a slightly irregular colour may be used. The Anti-Friction Coatings must be applied to the phosphated metal parts within 24 hours, otherwise corrosion may occur.

### Oxalic acid treatment of stainless steel

Special oxalic acid baths are required because of the corrosion resistance of stainless steels. The operating instructions of the manufacturer concerned should be observed.

### Sandblasting (after degreasing)

Sandblasting is recommended for parts made of steel, titanium, aluminium, copper, magnesium and their alloys. Aluminium oxide or cast-steel (grain size 55 µm) are most suitable for this purpose. It will produce an average surface roughness Ra between 0.5 and 1.0 µm. In most applications the dimensional change produced by sandblasting is of little significance, being less than 1.3 µm.

Remove adhering sand particles with dry, oil-free compressed air. To avoid corrosion, treated surfaces must not be touched with the bare hand and coated as soon as possible.

### Anodic oxidation (anodizing) of aluminium and aluminium alloys

Aluminium and aluminium alloys should be pretreated by electrolytic oxidation. Alloys with a copper content of 0.5% or more or with a total content of alloying additions in excess of 7.5% must be treated in a sulphuric acid bath.

All other aluminium alloys and aluminium can be treated in a chromic acid bath. A chromic acid bath produces a thin surface film that ensures good corrosion protection. For a good surface film to develop, use water of high purity (low chloride and sulphate content) for all baths.

|                        | Minimum weight of surface film | Thickness of coating |
|------------------------|--------------------------------|----------------------|
| Chromic acid process   | 2,15 g/m <sup>2</sup>          | 2,5 µm               |
| Sulphuric acid process | 6,50 g/m <sup>2</sup>          | 5,0 µm               |

## Surface pre-treatment of Anti-Friction Coatings (continued)

### Washing, drying and impregnation of surface film

- Chromic acid process: rinse thoroughly in hot water (65°C); allow to air dry.
- Sulphuric acid process: wash parts thoroughly in water and seal coating in a 5% sodium dichromate or potassium dichromate solution by dipping. Rinse and allow to dry. The temperature during drying should not exceed 102°C. The component must not be touched with the bare hand thereafter.

### Acid dip for copper and copper alloys instead of sandblasting

Copper and copper alloys are treated with a mixture of two or more of the following acids: sulphuric, phosphoric, chromic, nitric and hydrochloric acids. The mixing ratios and concentrations will vary greatly, depending on the alloy and surface conditions. Dipping times range from 5 seconds to 5 minutes. When pickling, take care that the basic metal is not attacked unnecessarily. When using nitric acid, toxic nitric oxide fumes must be removed by good ventilation. A quick-acting pickling bath can be used for flat components. For a large number of components or parts with complicated shapes, use a slow-acting bath. Follow any pickling with a thorough rinsing to remove any acid residue.

## Pre-Treatment methods

|  | Steel | Galvanised parts | Aluminium alloy | Copper alloy | Magnesium alloy | Titanium alloy | High-grade steel |
|--|-------|------------------|-----------------|--------------|-----------------|----------------|------------------|
| <b>Pre-treatment</b>                                       |       |                  |                 |              |                 |                |                  |
| Degreasing   | x     | x                | x               | x            | x               | x              | x                |
| Removal of oxides:   |       |                  |                 |              |                 |                |                  |
| - by pickling  |       |                  |                 | x            |                 |                | x                |
| - by sandblasting with aluminium oxide or cast-steel 55 µm | x     |                  | x               | x            |                 | x              |                  |
| Anodising to MIL-A-8625 C                                  |       |                  | x               |              |                 |                |                  |
| AMS 2488 (Ti-oxide Typ II)                                 |       |                  |                 |              |                 | x              |                  |
| Bichromate treatment to MIL-M-3171 C                       |       |                  |                 |              | x               |                |                  |
| Phosphating to DOD-P-16 232                                | x     | x                |                 |              |                 |                |                  |
| Oxalic acid treatment                                      |       |                  |                 |              |                 |                | x                |

Recommended pre-treatment methods for metal surfaces

### Pre-treatment of plastic surfaces

With plastics too, surface pre-treatment increases the adhesion and service life of Anti-Friction Coatings. This is done primarily by degreasing and cleaning.

Use only solvents that will not damage the substrate. Review relevant information supplied by the manufacturer of the plastic or plastic part. Adhesion can also be improved by roughening (e.g. fine sandblasting) or by activating the plastic surfaces in a low-pressure plasma. Before production starts, test the effectiveness of the chosen pre-treatment.

## Application of Anti-Friction Coatings

Depending on the nature of the parts being treated and the surface finish required, Anti-Friction Coatings are applied by spraying, dipping, or by using paint/spraying drums and centrifuges. The components should be appropriately pre-treated. In the case of partial coating of the components, it is advisable to use masking stencils or removable protective film. These must be removed before curing. Anti-Friction Coatings are supplied ready for use according to the recommended application processes (see technical data sheet of the considered product). Before application they need to be stirred thoroughly in order to obtain a uniform fluid. Only in cases where the film thickness has to be below 5 µm, it is necessary to dilute, stirring thoroughly. When handling non-water-based Anti-Friction Coatings use only electric mixers with explosion-proof motors. When applying such coatings, always comply with local safety regulations for handling paints and varnishes.

### Application to metal surfaces

#### Spraying

Apply sprays in spray booths. If it is done elsewhere, good ventilation should be provided. The volatile solvents can be dangerous: no naked flame must be in the room. A round-jet spray gun with a 0.8 mm nozzle is recommended for small areas. The spraying pressure should be of the order of 2 to 5 bar. The distance between component and spray gun should be such that the product is still moist when it strikes the surface. Tears or droplets should not occur. If the spray gun is held too far away from the component, the product will dry before reaching the surface. This will prevent the formation of a uniform Anti-Friction Coatings and the film will appear rough.

It is far more important to work with extreme care when applying Anti-Friction Coatings than when painting or varnishing, since an extremely thin but uniform film has to be produced. In order to produce a thicker film, several coats of Anti-Friction Coatings can be sprayed on. Each successive coat should, however, be applied to the previous coat when this is almost dry.

When spraying, use only compressed air that is free of water and oil. To apply the resin and the solid lubricant uniformly, the product must be stirred, especially after long breaks. In addition to spraying with compressed air, an electrostatic process may also be used. Before the coating hardens, sprayed parts must be handled with great care to prevent damages. Anti-Friction Coatings should dry in air for at least 10 minutes before being touched.

#### Dipping and centrifuging

If the shape and size of the parts permit, a dipping process can be used. Dip-spinning with a centrifuge is economical for applying Anti-Friction Coatings to large numbers of bulk goods like screws, nuts and small parts. Always dip-spin twice.

- Dipping; centrifuging; spreading on wire grids; drying
- Repetition of 1 to cover defects (contact points).

The required film thickness can be reached regulating the rotational speed of the centrifuge by the given viscosity of the Anti-Friction Coatings.

## Application of Anti-Friction Coatings (continued)

### Dipping individual components

Big bolts, bushings, rods, sections, tubes, etc. and in general flat parts which cannot be treated in a dip-centrifuge can be coated in a dipping bath, and then allowed to drip-dry. Use a controlled dipping action to prevent air from being dragged in. Adjust withdrawal speed to prevent tears and droplet formation and to regulate the desired film thickness. Circulate the contents of the dipping bath with a suitable pump and an overflow lip. When using Anti-Friction Coatings containing organic solvents, arrange an edge extractor directly above the maximum level. During a stoppage, cover dipping containers to minimize evaporation and prevent contamination.

### Brush application

Anti-Friction Coatings can also be brushed on. Even with fine-bristled brushes, the resulting film is often irregular. Consequently, consider alternative methods.

### Roll coating and printing

Anti-Friction Coatings can be applied with standard coil-coating machines, but simpler transfer roll coating methods can also be used. Silk-screen and pad printing techniques are used for partial application.

### Suitability for coating methods

| AFC-Product    | Centrifuging | Paint/<br>spraying drum | Automatic<br>dipping | Automatic<br>spraying | Brushing | Printing | Coil-<br>coating |
|----------------|--------------|-------------------------|----------------------|-----------------------|----------|----------|------------------|
| D 321R         | ✘            | ●                       | ✓                    | ✓                     | ✓        | ●        | -                |
| 3402-C         | ✘            | ✘                       | ✓                    | ✓                     | ✓        | ✘        | ✓                |
| D 3484         | ✘            | ✓                       | ✘                    | ✓                     | ✘        | ●        | ✓                |
| 3400A Leadfree | ✓            | ✓                       | ✘                    | ✓                     | ✓        | ✘        | ✓                |
| 106            | ✘            | ✘                       | ✘                    | ✓                     | ✘        | ●        | ✓                |
| 7409           | ✘            | ✓                       | ✓                    | ✓                     | ✘        | ✘        | ✓                |
| 7620           | ✘            | ●                       | ✓                    | ●                     | ✘        | ✓        | ✓                |
| 7400           | ✘            | ●                       | ✘                    | ✓                     | ✓        | ●        | ●                |
| D 106          | ✘            | ✘                       | ✘                    | ✓                     | ✘        | ●        | ✓                |
| PTFE-N UV      | ●            | ●                       | ●                    | ✓                     | ✘        | ●        | ●                |
| D 708          | ✓            | ✘                       | ✓                    | ✓                     | ✘        | ✘        | ✓                |
| D 96           | ✘            | ●                       | ✘                    | ✓                     | ✘        | ✓        | ●                |
| 7405           | ✘            | ✘                       | ✓                    | ✘                     | ✓        | ✓        | ✓                |
| D 10           | ✘            | ✘                       | ●                    | ●                     | ●        | ✓        | ✓                |
| D 88           | ✘            | ✘                       | ●                    | ●                     | ●        | ✓        | ✓                |

✓ = excellent    ✘ = good    ● = limited

### Curing

Heat cured coatings exhibit better resistance values. The corresponding curing times and temperatures are given in the data sheets. These are guidelines, which need to be verified under production conditions. The curing time must be extended for large parts, depending on weight and cross-section. Paint drying circulation ovens are recommended. It is also possible to use infra-red heat for curing. A wipe test using MOLYKOTE® 7414 thinner is recommended as a check of complete curing. If the coating is removed, the film is not fully cured.

### Coating thickness

The film thickness has a considerable influence on the service life, coefficient of friction and anti-corrosion properties of Anti-Friction Coatings. It should be greater than the surface roughness of the mating surfaces and is generally between 5 and 20 µm. It is better to apply as thin a coat as possible to both surfaces, rather than a relatively thick coat on only one surface, since thicker layers cannot stand as heavy mechanical loads.

The following methods can be used to measure the layer thickness:

1. Magnetic method in accordance with DIN 50 981/ISO 2178 on ferromagnetic basic substances.
2. Eddy current method in accordance with DIN 50 984/ISO 2360 on non-ferrous metals.
3. Beta back-scatter method in accordance with DIN 50 983/ISO 3543 on plastics.
4. In exceptional cases (when the above methods are not available), micrometer and optical methods.

### Removal of Anti-Friction Coatings (stripping)

In most cases, Anti-Friction Coatings can be removed from metal surfaces by placing the parts in MOLYKOTE® 7414 thinner overnight. Should this fail to produce the desired result, commercial paint removers for epoxy resins can also be used. Another efficient method (if permitted) is sand-blasting the coated surfaces.

### Application to plastic surfaces

#### Selection

When choosing the Anti-Friction Coating, bear in mind that coatings containing MoS<sub>2</sub> are suitable for reinforced plastics, and MoS<sub>2</sub>-free coatings for non-reinforced plastics. If a thermosetting Anti-Friction Coating is preferred to an air-drying Anti-Friction Coating, conduct a test beforehand to determine whether the plastic has sufficient thermal stability.

#### Application methods

Anti-Friction Coatings can be applied by spraying, dipping, brushing, roll coating and printing. The chosen method will depend on the shape, size, weight and quantity of the components. Consideration must also be given to the film requirements, as well as to the proportion and location of the sliding surfaces being coated.

#### Drying/curing

This depends on the coating used and can be obtained from the data sheets. Trial coating and testing for stress crack formation are required.

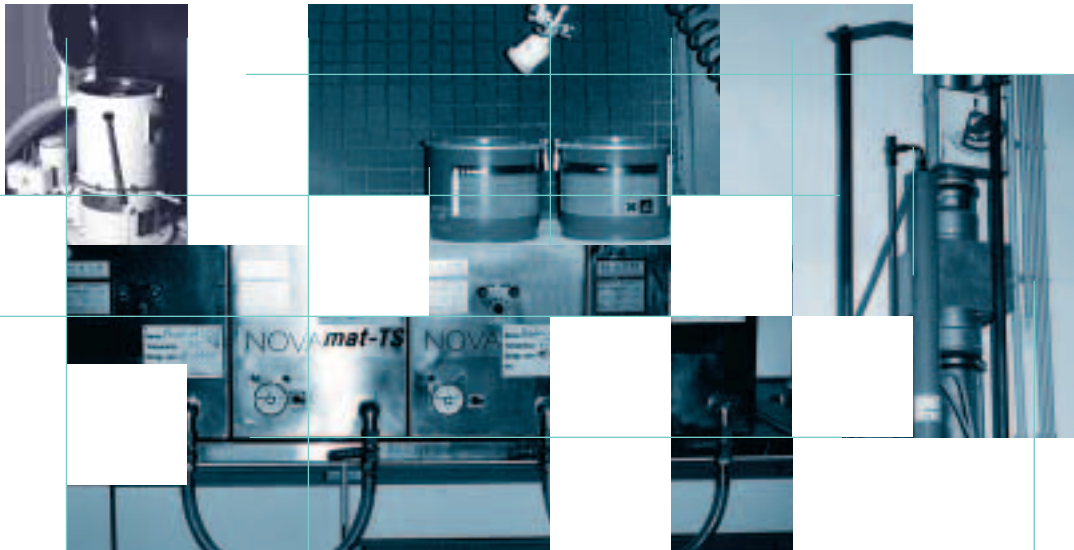
## Resistance of cured film layer

| Anti-Friction Coating product | Fuels | Brake fluid | Acids | Alkalines | Aromatics | Alcohols | Deionized Water | Ketone | Cutting fluids | Mineral oils | Synth. Oils | Dewatering fluids | Detergents | Radiation | Dielectric strength | Paintability |
|-------------------------------|-------|-------------|-------|-----------|-----------|----------|-----------------|--------|----------------|--------------|-------------|-------------------|------------|-----------|---------------------|--------------|
| D 321R                        | ●     | ●           | ●     | ×         | ●         | ×        | ✓               | ●      | ●              | ●            | ●           | ●                 | ×          | ✓         | ●                   | ×            |
| 3402-C                        | ✓     | ×           | ×     | ×         | ✓         | ✓        | ✓               | ●      | ✓              | ×            | ●           | ✓                 | ×          | ×         | ×                   | ×            |
| D 3484                        | ✓     | ✓           | ×     | ●         | ✓         | ✓        | ✓               | ✓      | ✓              | ✓            | ✓           | ✓                 | ×          | —         | ●                   | ×            |
| 3400A Leadfree                | ✓     | ✓           | ×     | ×         | ✓         | ✓        | ✓               | ✓      | ✓              | ✓            | ✓           | ✓                 | ×          | ✓         | ✓                   | ✓            |
| 106                           | ✓     | ×           | ×     | ●         | ✓         | ✓        | ✓               | ✓      | ✓              | ✓            | ✓           | ✓                 | ✓          | ✓         | ●                   | ✓            |
| 7409                          | ✓     | ✓           | ✓     | ×         | ✓         | ✓        | ✓               | ✓      | ✓              | ✓            | ✓           | ✓                 | ✓          | ✓         | ✓                   | ✓            |
| 7620                          | ✓     | ✓           | ✓     | ×         | ✓         | ✓        | ✓               | ✓      | ✓              | ✓            | ✓           | ✓                 | ✓          | ✓         | ×                   | ✓            |
| 7400                          | ×     | ×           | ●     | ●         | ●         | ×        | ×               | ●      | ×              | ●            | ×           | ×                 | ×          | —         | —                   | ×            |
| D 106                         | ✓     | ✓           | ✓     | ×         | ✓         | ✓        | ✓               | ✓      | ✓              | ✓            | ✓           | ✓                 | ×          | —         | —                   | ✓            |
| PTFE-N UV                     | ×     | ×           | ×     | ×         | ●         | ✓        | ✓               | ●      | ×              | ✓            | ×           | ×                 | ✓          | —         | ×                   | ●            |
| D 708                         | ✓     | ✓           | ✓     | ×         | ✓         | ✓        | ✓               | ✓      | ✓              | ✓            | ✓           | ✓                 | ✓          | —         | ✓                   | ●            |
| D 96                          | ×     | ●           | ●     | ●         | ●         | ×        | ×               | ●      | —              | ×            | ×           | —                 | —          | —         | ×                   | ●            |
| 7405                          | ×     | ●           | ×     | ●         | ×         | ✓        | ✓               | ✓      | ✓              | ✓            | ✓           | ×                 | ✓          | —         | ✓                   | ●            |
| D 10                          | ✓     | ✓           | ✓     | ×         | ✓         | ✓        | ✓               | ✓      | ✓              | ✓            | ✓           | ✓                 | ✓          | —         | ✓                   | ×            |
| D 88                          | ✓     | ✓           | ✓     | ×         | ✓         | ✓        | ×               | ✓      | ✓              | ✓            | ✓           | ✓                 | ✓          | —         | —                   | ×            |

✓ = excellent    × = good    ● = limited    — = n.a.

## Application engineering

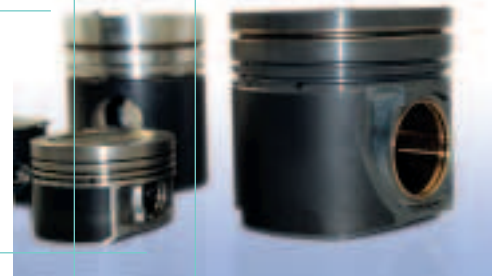
Our application facility is another strong asset of our technology leadership. In this dedicated laboratory area the most common application machines for Anti-Friction Coatings are in operation to produce prototype samples for customers, or for optimising the application parameters for new projects.



## Application examples



AV01643



AV5898



AV05999



AV05998



AV05991