IROGRAN® A 92 K 5031 DP

An all-round performer for industrial applications
IROGRAN® is the registered brand name for a broad range of thermoplastic polyurethane (TPU) from Huntsman. Delivering excellent performance, even in extreme environments, TPU materials in the IROGRAN® portfolio are renowned for their adaptability. With a grade available to suit most design and engineering challenges, IROGRAN® is hard to beat as a universally useful ingredient for injection molding and extruding projects.

IROGRAN® A 92 K 5031 DP

IROGRAN® A 92 K 5031 DP is the first product in a new family of premium grade TPU. Formulated with the needs of modern elastomer component manufacture in mind, it is ideal for industrial applications where compromise is not an option.

IROGRAN® A 92 K 5031 DP is a good all-round performer. It can be extruded or injection molded to create a range of products. It performs well as a base material for hydraulic seals and also has benefits for:

- Pneumatic tubes that need to perform at high operating temperatures
- Spiral hoses with good hydrolysis and heat resistance properties
- Cable jackets for high temperature applications
Unbeatable performance

In the production of flexible elastomeric parts, the most successful materials are those that offer infinite processing possibilities and performance scope alongside consistent quality.

IROGRAN® A 92 K 5031 DP is made using a novel technique developed by Huntsman. Employing raw materials economically, this process delivers optimized hard block products of a reliable standard and with performance properties including:

- Very good hydrolytic stability
- High heat resistance
- High crystallinity
- A low compression set at 100°C
- An extensive operating temperature range from -40°C to 130°C.
- Very high strength at room temperature and consistent performance up to 120°C
- Low extrusion affinity up to 130°C (hydraulic seal appl.)
- Low oil absorption, including good resistance against bio hydraulic oils
- Good burst pressure properties even at high temperatures
- Low abrasion at high temperatures
- Good form retention and stability

IROGRAN® A 92 K 5031 DP offers excellent gap extrusion performances
IROGRAN® A 92 K 5031 DP

- Hydraulic seals
- Pneumatic tubes

Hydraulic seals

With excellent rebound resilience and good oil and abrasion resistance, IROGRAN® A 92 K 5031 DP is an important raw material for seals that need to perform consistently, even in harsh conditions. It offers numerous physical properties including:

- High wear resistance
- Low compression set
- High extrusion resistance
- A wide temperature operating range
- High temperature resistance

Pneumatic tubes

IROGRAN® A 92 K 5031 DP shows very good burst pressure figures at high temperatures. It performs well up to 50°C and can be used in flexible tube applications where temperatures reach 100°C.

Offering good hydrolytic stability it can also be used in wet and humid environments as an alternative to ester-based tubes.
IROGRAN® A 92 K 5031 DP

- Timing belts
- Cables

Timing belts

IROGRAN® A 92 K 5031 DP is a reliable solution for timing belt applications.

A practical alternative to duroplastic elastomers it can be welded and comes with added benefits including high heat stability, meaning it can be used in machines where operating temperatures reach up to 120°C.

Cables

Cable enclosures made out of IROGRAN® A 92 K 5031 DP have high form stability and can be used at temperatures in excess of 120°C, a level far higher than normal ether-based TPU grades.

This is a key attribute for automotive specifiers who need cables that can function in high temperature brake or high power engine systems.
Technical information

Our new production process enables us to deliver high performance TPU grades with an improved compression set and heat dimension stability. The new process favors the building of microcrystalline hard segment domains. These domains and the raw material composition are responsible for the properties offered by IROGRAN® A 92 K 5031 DP.

DSC Graph

The DSC Graph (opposite) shows the melting of microcrystalline hard segment domains between 220°C to 240°C. Under normal processing temperatures these areas should not melt.

Morphology of TPU

The image on the right shows the two-phase structure of an amorphous soft phase and a high melting microcrystalline hard domain.
Hydrolysis

TPU components are often employed in applications where they are exposed to different chemical substances. High humidity or hydraulic oils that contain water, could affect the physical properties of the parts, causing them to fail. In the case of hydraulic seals, this could result in an oil splash.

IROGRAN® A 92 K 5031 DP shows excellent hydrolysis resistance over a long period of time. Capable of withstanding aggressive chemical substrates it can be used in a wide range of applications.
Temperature resistance

Anisothermal stress relaxation test for characterizing elastomers and polymers
The Brabender® TSSR meter (TSSR = Temperature Scanning Stress Relaxation) measures the thermo-mechanical properties of elastomers and polymers subjected to constant stress at a continuously rising temperature. The measured data supplies reliable information about the morphology phase of the material tested.

In contrast to conventional relaxation tests carried out at a consistent temperature, the heat in a TSSR test rises at a defined rate. This allows the maximum service temperature and relaxation spectrum of the sample material to be defined.

Seals

IROGRAN® A 92 K 5031 DP shares many of the same characteristics as our premium A 95 K 4977 sealing product. It is however fractionally more flexible and its tensile strength at room temperature is less.

IROGRAN® A 92 K 5031 / Standard seal grade

![Graph showing tensile strength over temperature range for IROGRAN® A 92 K 5031 DP and IROGRAN® A 95 K 4977.](image-url)
Pneumatic

Pneumatic tubes made out of IROGRAN® A 92 K 5031 DP show good burst pressure properties up to 60°C.

Timing belts

IROGRAN® A 92 K 5031 DP shows excellent properties in timing belt applications where temperatures are higher than 60°C.

Cables

IROGRAN® A 92 K 5031 DP can perform at temperatures up to 40°C higher than normal TPU materials. Cables covered with IROGRAN® A 92 K 5031 DP generally also have a much longer life cycle.
The compression set figures of IROGRAN® A 92 K 5031 DP are significantly lower than standard TPU grades. This enables its use in hydraulic seals. For all other applications, where good compression set properties are needed, IROGRAN® A 92 K 5031 DP is a suitable choice.

Under longer test conditions, IROGRAN® A 92 K 5031 DP also performs well.
IROGRAN® A 92 K 5031 DP

Temperature resistance
- Tensile
- Vicat

Tensile

At 130°C IROGRAN® A 92 K 5031 DP has more than 10N/m² tensile strength. This is a better performance compared to other elastomers at room temperature.

Vicat

The vicat softening point of IROGRAN® A 92 K 5031 DP is typically 30°C higher than standard TPU grades. Only harder seal grades based on caprolactone show higher values.
IROGRAN® A 92 K 5031 DP

Chemical resistance

- ASTM 1
- ASTM 2

**ASTM 1**

Ether-based materials absorb small quantities of water. At low temperatures the water diffuses into the oil. This is the reason for weight loss at 80°C. At higher temperatures, the material absorbs small quantities of ASTM 1.

**ASTM 2**

 Ether-based materials commonly absorb more oil than caprolactone-based grades – a factor to consider during part design.

### ASTM OIL 1 absorption

<table>
<thead>
<tr>
<th></th>
<th>72h 80°C</th>
<th>168h 80°C</th>
<th>72h 100°C</th>
<th>168h 100°C</th>
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### ASTM OIL 2 absorption

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</table>
IROGRAN® A 92 K 5031 DP

Chemical resistance

- Bio oil
- Hydraulic oil

Bio oil

IROGRAN® A 92 K 5031 DP absorbs a maximum of 5% oil. For ether-based materials this is an excellent value. Good hydrolysis resistance allows usage in bio hydraulic oils.

Hydraulic oil

Oil absorption can have an effect on performance, especially in hydraulic applications. Reducing friction it can increase the life cycle of a seal.
IROGRAN® A 92 K 5031 DP

Product performance

Material preparation

IROGRAN® TPU grades are supplied pre-dried in moisture guarded sacks. To ensure trouble free processing it is preferable to dry IROGRAN® TPU. The recommended drying conditions are:

- 3 hours at 100-110°C / 212-230 °F in circulating air
- 3 hours at 80-90°C / 176-194 °C in dehumidified air
- Dew point: -30°C / -22 °C

For further advice on the use of additives during processing, please contact the IROGRAN® TPU technical service department.

Processing parameters

Typical processing parameters

<table>
<thead>
<tr>
<th>Processable using:</th>
<th>Injection molding</th>
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<tr>
<td>MVR</td>
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Temperature profile

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<tr>
<th>Barrel Zone 1</th>
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<tr>
<td>Nozzle 2</td>
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<td>410-445</td>
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<tr>
<td>Mold</td>
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<table>
<thead>
<tr>
<th>Injection molding</th>
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<tr>
<td>Mold</td>
<td>25-70</td>
<td>77-158</td>
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</tbody>
</table>

Physical Form:

- Type: Pellet
- Bulk density: 740 kg/m³

Typical physical properties

<table>
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<tr>
<th>Property</th>
<th>Key</th>
<th>DIN / ISO</th>
<th>Unit</th>
<th>Value</th>
<th>ASTM / ISO</th>
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<tr>
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<td>MPa</td>
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<td>Compression set 24hrs @ 100°C</td>
<td>M</td>
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<td>D-395</td>
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<td>%</td>
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<tr>
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<td>D-792</td>
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</table>

E = 0.025 extruded film cut to ASTM requirements.
M = Injection molded parts to meet DIN & ASTM requirements. Parts tempered for 20hrs @ 120°C prior to testing.
Storage

Supplied in easy flow pellet form to mitigate any metering problems, IROGRAN® A 92 K 5031 DP can be dried and transported dust-free. Like other IROGRAN® materials, it is hygroscopic. Even very low levels of moisture from the air and surrounding environment will impact on its final quality. This could cause an uneven surface or sticky residue to collect in extrusion tools or injection molds.

IROGRAN® grades are generally supplied in steam-tight bags or in octabins with a PE-lining. When stored in open bags, IROGRAN® can absorb up to 1.5% moisture after a relatively short period of time. It is therefore important that containers are closed after each measure of material is withdrawn.

Handling

Because of the hygroscopic nature of IROGRAN®, pre-drying is recommended. To ensure trouble-free processing and avoid any loss of quality, we suggest drying to achieve a moisture content of ≤ 0.05%.

In general, the drying period for a newly opened bag of resin will be between two and four hours but this may vary. The extent and rate at which drying occurs will be governed by the resin type, moisture content, drying temperature and surrounding environment.

Indicators that moisture content is too high may include foaming of the plasticized material or the formation of bubbles. If the granules are too moist, the extrudate's characteristics will change from smooth and glossy to foamy and gassy. Blisters or streaks may also occur on the surface of the finished components.
Huntsman Polyurethanes is committed to working closely with its customers and can offer a fast and flexible response to your needs. We offer direct links to our laboratories with full technical backup. Commercial support and dedicated customer service is available throughout Europe, the Middle East, Asia-Pacific and the Americas.

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The Huntsman-Story
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