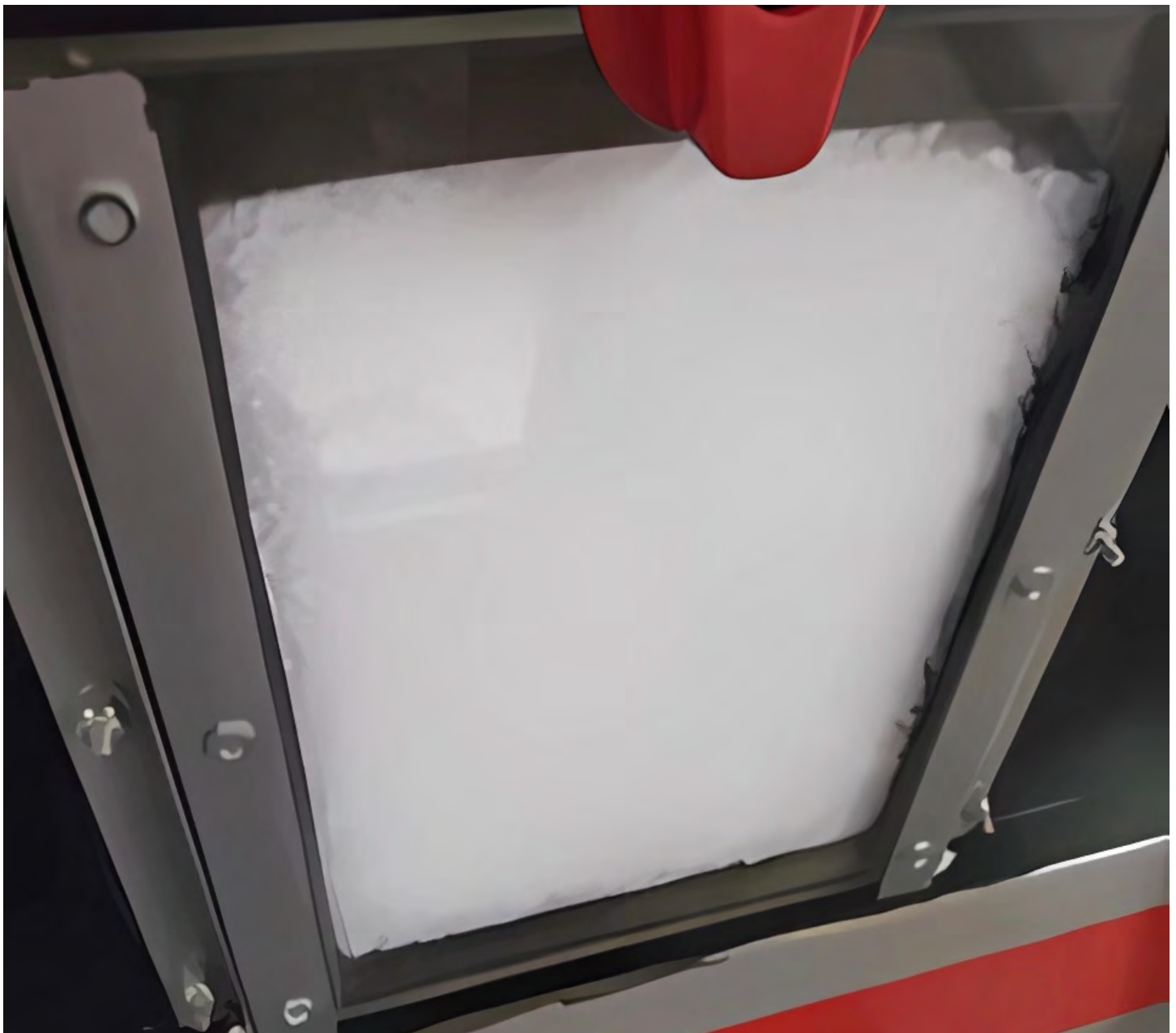




# Material Selection Guide: High & Low Density Polyethylene



Polyethylene, a type of thermoplastic polymer, is a highly versatile and durable material. One of the most commonly produced plastics, it's applicable in everything from everyday products like beverage bottles to industrial components like washers. Polyethylene (PE) plastics are available in several types, depending on how manufacturers generate the material, with each having its own strengths and weaknesses. Choosing the proper PE for your project is a critical part of the manufacturing process, regardless of your industry.

At New Process Fibre Company, Inc., our experts have extensive experience working with a variety of materials, and we can help you find the one to suit your needs. In this eBook, we will explore the unique qualities, benefits, and applications of High-Density Polyethylene (HDPE) and Low-Density Polyethylene (LDPE) plastics.



## Small Thermoplastic Materials With Big Impact

Polyethylene is naturally inert, and both LDPE and HDPE offer superior electrical and mechanical properties and high impact resistance with a tensile strength that ranges between 0.02 and 0.40 N/mm<sup>2</sup>. They are resistant to chemicals, water vapor, and weathering, and these versatile thermoplastics are available in varying dimensions and colors to meet most project specifications.

While both PE plastics are the byproduct of petroleum polymerization, differences in their manufacturing processes give them their unique characteristics. LDPE possesses an unorganized amorphous structure, with polymer chains that branch and spread. Its structural properties make it flexible, lightweight, and soft.

In contrast, HDPE has a semi- or fully crystalline structure that allows for a sturdier and supremely durable material. It's ideal for creating custom-shaped containers that maintain their configuration even under pressure. HDPE is easy to mold, shape, and manufacture since the polymer can be melted into liquid form while maintaining its tight molecular structure.



The same industries use these two PE plastics, albeit for different applications. These sectors include:

- ◇ Automotive
- ◇ Electrical
- ◇ HVAC
- ◇ Aerospace and Military
- ◇ Plumbing
- ◇ Medical
- ◇ Container Seals
- ◇ Consumer Goods

# Evaluation Criteria: High-Density Polyethylene vs. Low-Density Polyethylene

The levels of elasticity and density in PE, which are based on the plastic’s molecular bond, determine its type. Both LDPE and HDPE offer a low-weight, low-cost, high-performance alternative to traditional materials like metal, offering properties that include chemical and temperature resistance, durability, and quick production options.

However, there are several important factors to consider when determining the best material for your application. Evaluate aspects such as:

◇ **Durability and mechanics:** What level of density or impact and tensile strength is important for your application?

◇ **Flexibility:** Does your component need to be malleable or rigid to meet application requirements?

◇ **Resistance capabilities:** What temperature ranges or stresses must your component handle, and are there any specific chemicals the plastic needs to be able to resist?

◇ **Installation:** Does your application require a component that is simple to install?

◇ **Industry requirements:** Must your product comply with any particular industry standards?



# Low-Density Polyethylene

Manufacturers create LDPE by utilizing an autoclave or tubular reactor, compressing monomer ethylene gas within to join those monomers and produce a polymer chain through radical polymerization. The corrosion-resistant material serves well as an electrical insulator and is easy to fabricate and install. LDPE sheets, rolls, and coils are available, and the plastic has extensive uses in packaging materials, films, and other applications.



## LDPE Characteristics

LDPE is flexible and offers good transparency with ample moisture barrier properties. At low temperatures, the material offers high impact strength. It also excels in its resistance to vegetable oils, acids, and bases. Since LDPE is softer and a recycling number 4 product, it is harder to recycle when compared to HDPE, which is a recycling number 2 product.

## Common Applications of LDPE

LDPE is useful for:

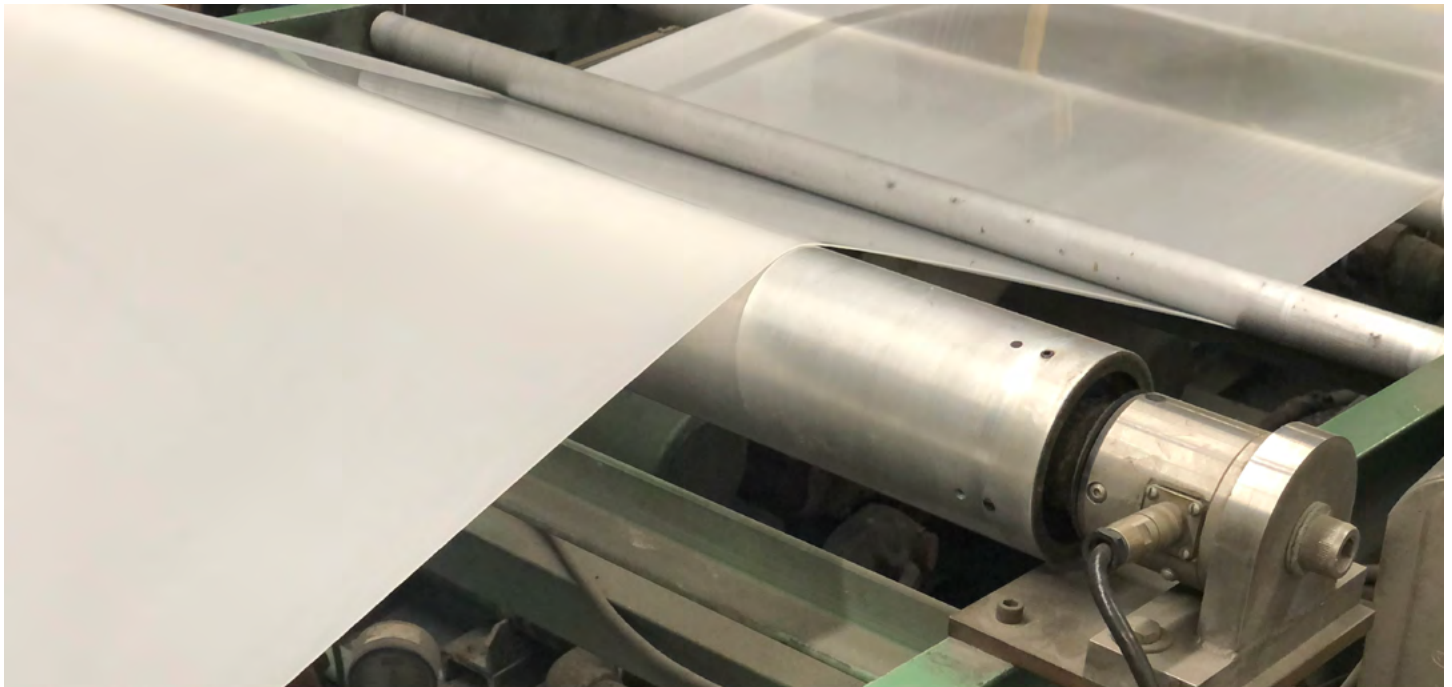
- ◇ Sealing washers and components
- ◇ Noise dampening
- ◇ Deterring vibration
- ◇ And much, much more!

# High-Density Polyethylene

Using extreme temperatures, manufacturers will form HDPE by heating petroleum. This process releases monomers of ethylene gas that join and create polymer chains. Its rigidity and high melting point allow it to be greatly abrasion and temperature resistant for versatile uses. It is also the ideal solution for projects requiring customized coloring or printing.

## HDPE Characteristics

While both thermoplastic materials have their own advantages, HDPE can create more durable products for a broad range of applications. HDPE has high tensile strength with the capability to be semi-flexible or hard. It has excellent chemical resistance and acts as a good moisture barrier. One concern is that, while HDPE is quite durable, it is prone to stress cracking due to the high crystallinity of its structure.



## Common Applications of HDPE

HDPE has applications in:

- ◇ Automotive
- ◇ Furniture
- ◇ Plumbing
- ◇ Marine
- ◇ Aerospace, Military, and Defense
- ◇ Agriculture
- ◇ Fitness Equipment
- ◇ Consumer Goods



# Properties and Performance of LDPE and HDPE

The following chart includes more specific information on LDPE and HDPE characteristics that are important to consider before choosing one material over the other for any given application.

Properties/Performance	LDPE	HDPE
Density	0.910-0.940 g/cm <sup>3</sup>	0.941-0.965 g/cm <sup>3</sup>
Tensile strength	6.9 to 15.9 MN/m <sup>2</sup>	21.4 to 38.0 MN/m <sup>2</sup>
Impact strength	High at cold temperatures	High
Resilience	Flexible	Semi-flexible to rigid
Reactivity	Nonreactive at room temperature	Nonreactive
Chemical resistance	Moderate	High, for most substances
Temperature resistance	Continuously: ≤ 80° C / Briefly: ≤ 95° C	Continuously: -50 to 60° C
Melting point	105 to 115° C	120 to 140° C
Electrical insulation	High	High
Intermolecular forces	Weak	Stronger than LDPE

## Sample Industrial Application Comparison: LDPE and HDPE Washers

Manufacturers utilize various materials such as rubber, metal, and plastic to generate washers, depending on the desired application. PE is a common thermoplastic material for fabricating washers because it offers beneficial properties like easy formability, material resilience, and affordability. Also, PE allows washers to form a tight seal on a joining surface between a nut and bolt, and it provides electrical insulation should an application require it.

While LDPE and HDPE are both wear-, impact-, and water-resistant materials, they offer distinct advantages for washers in many industrial applications. LDPE is resistant to both water and many corrosive chemicals, making this plastic ideal for washers with applications in the oil and gas, water or chemical processing, and marine sectors. Washers of this material are a beneficial choice for geometrically unique joints that still require a tight seal. Their flexibility enables LDPE washers to handle these unusual shapes, as well as frequent impact, pressure fluctuations, and vibrations, all with a reduced risk of cracking.



HDPE washers are also reliable when exposed to water and chemicals. They may be less elastic than the LDPE variety, but they are stronger and more durable for high-pressure and -impact applications. The material is resistant to abrasion and crushing, making HDPE washers invaluable in many mechanical and industrial tasks. The tensile strength of HDPE makes it the preferred choice for supporting fastening apparatuses and distributing pressure joints. There are also food-grade, FDA-compliant HDPE options available for food processing and handling uses.



## New Process Fibre and Your Next Project

For nearly 100 years, New Process Fibre has been committed to process innovation, comprehensive in-house services, and affordable high-quality products. Our family-owned company specializes in LDPE and HDPE thermoplastics, among other nonmetallic materials, for stamped and die-cut components. We are ISO 9001:2015-certified and REACH- and RoHS-compliant.

Our custom fabrication capabilities include extruding, slitting, shearing, stamping, and tool and die making, made possible by more than 75 high-speed and conventional punch presses, wire EDM equipment, and other advanced machinery. We aim to be your one-stop shop, and our team can assist in creating components in custom widths, thicknesses, shapes, and colors to meet the tolerances and quality standards that your project demands.

At New Process Fibre, we work on orders ranging in size from a single prototype to millions of components. [Contact us](#) for more information on our material selections, or review our catalogs of [HDPE](#) and [LDPE](#) product solutions.





## About Us

NPF's state-of-the-art tooling ensures we can accommodate a wide variety of designs and features to suit our customers' diverse needs. With our large selection of more than 75 conventional and high-speed punch presses, over 10,000 compound washer dies, and a massive material inventory, we can create custom tooling for your non-metallic stamped parts. Our state-of-the-art tooling includes:

- ◇ Free maintenance of your tool part design for the life of your program with a partial tooling charge
- ◇ CAD/CAM and wire EDM capabilities
- ◇ Custom die creations
- ◇ Compound and progressive dies
- ◇ Multi-cavity tools designed to save on material costs and improve throughput
- ◇ Economical and critical tolerance tooling applications

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