



Chemicals

Pipes Alcudia® Polyethylene / Isplen® Polypropylene

Repsol

Repsol is an international company with business operations in the hydrocarbon sector, and one of the top ten private oil companies in the world. It is a people-oriented energy specialist, geared to creating value and ensuring a sufficient, safe and sustainable supply. Repsol operates in four continents, using its energy to reach hundreds of millions of people.

Chemicals

As part of a major oil company, Repsol's Chemicals Division has a high degree of integration with the Group's oil-refining business. Its production capacity is in excess of six million tonnes per year and markets its products in more than 95 countries all over the world.

In its chemicals activity, Repsol produces and markets a wide variety of products, ranging from base petrochemicals to derivatives. Base petrochemicals produces ethylene, propylene, butadiene and benzene.

Derivative chemical production includes:

- Polyolefins, with both high- and low-density polyethylene (HDPE and LDPE), polypropylene (PP) and its compounds; and ethylene vinyl acetate (EVA) and ethylene butyl acrylate (EBA) copolymers.
- Intermediate products, including propylene oxide (PO), styrene (SM), polyether polyols for rigid and flexible foams, CASE polyols, propylene glycols and expanded polystyrene (EPS).
- Synthetic rubbers, comprising hydrogenated rubbers (SEBS), thermoplastics (SBS) and solution-based styrene-butadiene rubber (SSBR).

These chemical products are used to manufacture everyday articles which improve people's quality of life, wellbeing and safety.




Polyethylene and polypropylene for pipes

For pipe applications, Repsol offers a full range of low, medium and high density polyethylene, as well as polypropylene.

Repsol Chemicals uses different production technologies: Autoclave and tubular for materials such as LDPE, EVA, EBA, slurry loop and bimodal for HDPE and slurry and Spheripol for PP. This versatility allows product optimisation and translates into structural differences which have a positive effect on processability and the properties of our products.

We offer a comprehensive range of products, for manufacturing:

- Water, gas and irrigation pressure pipes.
- Sewerage, drainage and cable protection pipes.
- Steel pipe coating.



Polyethylene and polypropylene pipes guarantee present and future needs by using natural resources to protect the environment.

Benefits of polyethylene and polypropylene pipes

The use of these materials to manufacture pipes offers innumerable benefits, the most significant of these being:

1. Drinking water quality

The water quality remains intact when transported by plastic pipes. In compliance with the strict European and national legislation.

2. Avoiding losses and waste

Polyethylene and polypropylene piping joints ensure watertightness throughout the network. They avoid both incoming and outgoing leakage, preventing loss of this invaluable natural resource.

3. Energy savings throughout their life cycles

The energy saving achieved in the course of production, transport, installation and use of these materials is of 32% in drinking water pipes, 70% in gas pipes and 14% in wastewater and drainage pipes (compared to traditional materials).

4. Long life

With a useful life of 50 years, their use reduces costs in material, labour, installation and maintenance.

5. Easy installation

They are light and flexible and installation requires less machinery. Moreover, thanks to their flexibility, they can be installed in narrow ditches and follow winding paths with less disruption of the natural environment.

6. 100% recyclable

The material obtained from recycling can be used to manufacture new products.

7. Energy source

A novel recycling alternative: transform the high calorific power of plastic into an energy source.

8. Lower emissions

An average reduction in emissions of greenhouse gases in all pipe applications throughout their life cycle, of up to 61% compared to traditional materials.

9. Safer and more resistant

Polyethylene and polypropylene pipes do not corrode, and require no internal or external coating. They are also impervious to the action of aggressive soils, providing reliable channels and maximizing their useful lives. They are also resistant to the action of alkalis, alcohols, detergents, bleaches and most of the chemical agents used in water treatment.

10. Unalterable hydraulic capacity

The extremely smooth internal surface and the virtual absence of incrustations enable the hydraulic section of the pipe and, therefore, its hydraulic capacity to remain consistent throughout its useful life.

11. More resistant to potential water hammer

Water hammer effects are 2 or 3 times lower in plastic pipelines than in those of other materials. The risk of damaging the fluid supply system and the risk of breakages in accessories such as taps or valves are minimised.

12. Resistant to galvanic currents

Plastic materials are electrical insulators and are not affected by the electrical currents flowing through the ground outside the circuits provided, avoiding corrosion.

13. Complete systems

The extensive choice of pressures and diameters of available pipes, and the range of accessories and auxiliary elements for every aspect of pipelines, allow for complete systems in plastics, making joints very simple and ensuring overall watertightness.

14. Resistance to abrasion

Plastics offer greater resistance to abrasion than conventional materials.

In short

Polyethylene and polypropylene pipes guarantee present and future needs while preserving natural resources and the environment. They also contribute to sustainable development by providing a plentiful, safe, efficient water supply.

Sources:

Statements numbers 1, 2, 4 - 7, 9 - 14:

- AseTUB - Spanish Association of Manufacturers of Pipes and Plastic Accessories. (2009) *Technical Report: Plastic piping and sustainable development (2009/022/IIT)*
- Balairón, L. [Lecturer at the University of Salamanca and Director of the Hydraulics Laboratory at the Centre for Experimental Public Works Studies (CEDEX)] and technical experts from AseTUB member companies. (2008) *Technical Manual: Polyethylene piping. AENOR*
- Balairón, L. and AseTUB technicians (2009) *Technical guide to plastic piping in hydraulics projects (2009/019/MT)*
- AseTUB (2011) *Installation manual for plastic piping systems for water supply, irrigation and drainage.*

Statements numbers 3 and 8:

- GUA (Gesellschaft für umfassende Analysen) now Denkstatt. (2005) *Report: The contribution of plastic products to resource efficiency.*

Water, gas and irrigation pressure pipes

Repsol offers a full range of polyethylene compounds for water and gas pressure pipes. These products are approved by European organisations of recognised standing for a wide range of pressure pipe applications from PE40 in LDPE, PE80 in MDPE and bimodal HDPE to PE100:

- **Monomodal and bimodal high density polyethylene (HDPE)** offering different standards of performance in terms of mechanical properties, like flexibility and processability, for the manufacture of PE80 and PE100 class pressure pipes.
- **Bimodal high density polyethylene (HDPE)** with special low sagging properties.
- **High density polyethylene (HDPE)** in orange for PE100 class gas piping.
- **Random polypropylene (PP)**, classed PPR80, for hot and cold water piping.
- **Low density polyethylene (LDPE)** in black with excellent flexibility, especially recommended for drip irrigation piping, classed PE40.



POLYETHYLENE

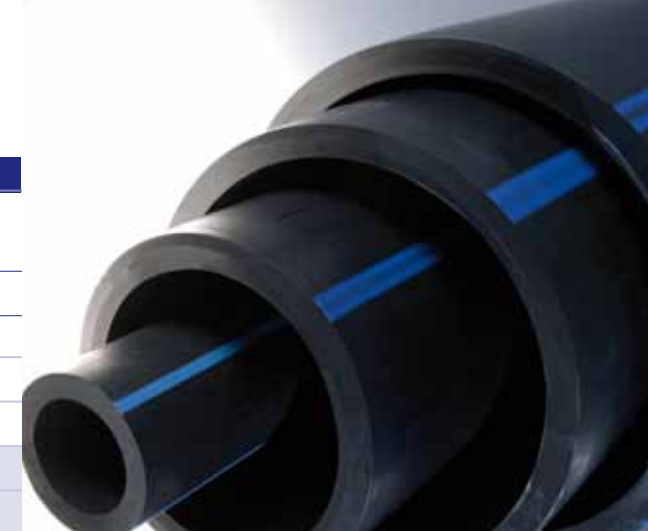
	Grade	Colour	MFI			Density	Polymer type	Classification	Applications
			ISO1133 (190°C) g/10'						
			2.16 kg	5kg	21.6 kg				
New	T40N	Black	0.25			932	LDPE Tubular	PE40	Water pressure pipes
	2202PN	Black	0.25			932	LDPE Tubular	PE40	Irrigation pipes
	3802N	Black	0.18	0.85	18	948	MDPE	PE80	Irrigation tapes
	T80N	Black	0.10	0.52	13	960	HDPE Bimodal	PE80	Water and gas pressure pipes
New	50080BSA	Blue	0.52			955	HDPE Bimodal		Strip material for water pressure pipes
	50080YSA	Yellow	0.52			955	HDPE Bimodal		Strip material for gas pressure pipes
	T100N	Black	0.10	0.36	10	962	HDPE Bimodal	PE100	Water and gas pressure pipes
	T100NLS	Black	0.27		7	962	HDPE Bimodal	PE100	Water and gas pressure pipes
New	51100BSA	Blue	0.37			955	HDPE Bimodal		Strip material for water pressure pipes
	51100YSA	Yellow-orange	0.37			955	HDPE Bimodal		Strip material for gas pressure pipes
	T100SC	Orange	0.10	0.37	10	952	HDPE Bimodal	PE100	Gas pressure pipes

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NATURAL BASE POLYMER for identification stripes on polyethylene piping

Grade	MFI	Density	Polymer type	Strip material intended to be used with
	ISO1133 (190°C) g/10'	ISO1183 kg/m ³		
	2.16 kg 5 kg			
2202F	0.25	921	LDPE	T40N
TR135	0.60	938	MDPE	3802N
47100	0.50	945	PEHD	T80N
50080	0.52	948	HDPE Bimodal	T80N
51100	0.38	951	HDPE Bimodal	T100N, T100NLS



POLIPROPYLENE

Grade	Colour	MFI			Flexural modulus of elasticity	Polymer type	Classification	Applications
		ISO1133 — g/10'						
		230°C	190°C	230°C				
		2.16 kg	5kg	5 kg	ISO1183 kg/m ³	ISO TR9080		
PR210G4E	Natural	0.30	0.60	1.20	850	Random		Base stabilisation for pressure pipe for free additive application
PR210X6E	Natural	0.30	0.60	1.20	850	Random	PPR80	High thermal stability pressure pipes
PR210T757	Grey	0.30	0.60	1.20	850	Random	PPR80	High thermal stability pressure pipes
PR210T312	Green	0.30	0.60	1.20	850	Random	PPR80	High thermal stability pressure pipes
PR210T038	White	0.30	0.60	1.20	850	Random	PPR80	High thermal stability pressure pipes

Repsol adds value to its clients' business by reinforcing their trade opportunities with IIP, LNE and Din-Certco certifications in water and gas pressure piping.



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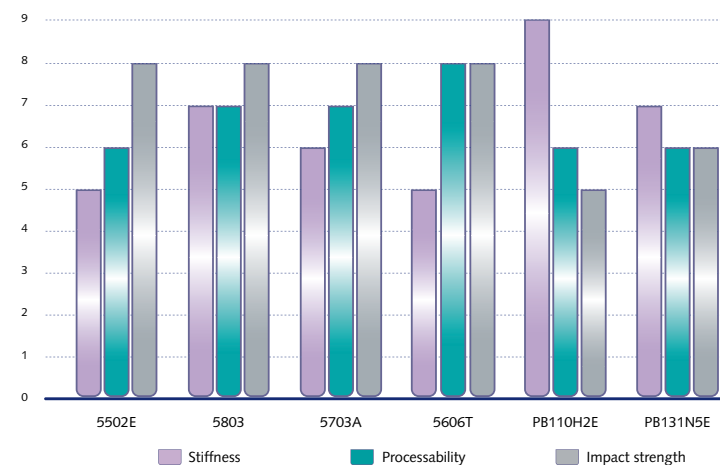


Sewerage, drainage and cable protection pipes

Repsol Chemicals' division offers an extensive portfolio of polyethylene and polypropylene products covering a wide range of stiffness and processability in corrugated and smooth piping, in both small and large diameters, depending on clients' requirements and the final application of the pipe (sewerage, drainage or cable protection).

Polyethylene and polypropylene pipes do not corrode, and require no internal or external coating.

Corrugated pipe properties: Depending on the grade used



POLYETHYLENE

Grade	Colour	MFI			Density ISO1183 kg/m ³	Flexural modulus of elasticity	Polymer type	Applications
		ISO1133 (190°C) g/10'						
		2.16 kg	5kg	21.6 kg				
PE033	Natural	0.30			922		LDPE	Internal layer corrugated pipes
2202F	Natural	0.25			922		LDPE Tubular	Internal layer corrugated pipes
2203F	Natural	0.30			922		LDPE	Internal layer corrugated pipes
2107F	Natural	0.70			921		LDPE	Internal layer corrugated pipes
TR135	Natural	0.11	0.60	12	938	800	MDPE	Cable protection plain pipes
47100	Natural	0.11	0.50	10	945	900	HDPE	Cable protection plain pipes
5502E	Natural	0.23	1.0	22	955	1,200	HDPE	Corrugated pipe with good processability-stiffness ratio
New 5503	Natural	0.25	1.10	25	955	1,100	HDPE	Corrugated pipe with good processability-stiffness ratio
5606T	Natural	0.60	2.0	40	956	1,400	HDPE	High processability corrugated pipes
5703A	Natural	0.42	1.50	30	957	1,550	HDPE	High stiffness corrugated pipes
5803	Natural	0.25	1.10	28	958	1,400	HDPE Bimodal	High stiffness corrugated pipes

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POLIPROPYLENE

Grade	Colour	MFI			Módulo elástico en flexión ISO 178	Polymer type	Applications
		ISO1133 — g/10'					
		230°C	190°C	230°C			
		2.16 kg	5 kg	5 kg			
PP020G3E	Natural	0.90			1,200	Homopolymer	Plain pipe for general use
PB110H2E	Natural	0.30	0.60	1.20	1,300	Block	High stiffness corrugated pipe for sewerage
PB115H3T	Natural	0.30	0.60	1.20	1,200	Block	High stiffness corrugated pipe for sewerage
New PB120H2E	Natural	0.80		3.20	1,200	Block	High stiffness corrugated pipe for sewerage
PB130G1M	Natural	1.30			1,100	Block	Small diameter corrugated pipe
PB131N5E	Natural	1.30			1,000	Block	High impact corrugated pipes for electrical cable protection
PB140G2M	Natural	3.50			1,150	Block	High procesability corrugated pipe

Coating of steel pipes

Repsol offers a comprehensive range of polyolefins:

- **Black compounds** LPDE, MDPE and HDPE for traditional applications.
- **White compound** of heterophase copolymer of PP for applications requiring resistance to high temperature.

The jointing connections of polyethylene and polypropylene pipes ensure watertightness throughout. The network preventing losses, leakages, infiltrations and exfiltrations.

Grade	Colour	MFI			Density ISO 178 kg/m ³	Polymer type	Applications
		ISO1133 — g/10'					
		230°C	190°C	230°C			
		2.16 kg	5kg	21.6 kg			
5605N	Black	0.45	1.70		956	HDPE Bimodal	Coating for metal pipe with good processability and properties
2202PN	Black	0.25			932	LDPE	Coating for metal pipe of lesser thickness
PB131A029	White			1.30	905	PP Block	Coating for metal pipe with resistance to high temperature

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Technical service and development

Repsol's capacity for innovation and appropriate resources, including its Technology Centre, are at its clients' disposal in the interests of continue improvement and development of its products. We optimise products and their performance at our clients' sites, in accordance with current standards and the requirements of the application, thus offering solutions, supporting development. These are competitive advantages for both parties.

Quality, safety and the environment

All petrochemical plants and part-owned subsidiaries run by Repsol Química use management systems complying with the current ISO 9001:2008 standards, concerning the quality of processes involved, ranging from manufacture to distribution, transport management and end product warehousing. Likewise, all petrochemical plants and production facilities or packaging and logistics centres run by Repsol Química use rigorous safety management systems which have obtained OHSAS 18001.2009 (Occupational Health and Safety Assessment Series) certifications. In addition, all facilities are certified ISO 14001 regarding environmental management and reducing impacts within their installations and ISO 14064 for the verification of annual greenhouse gas emissions inventories.

All products recommended for drinking water pipes comply with European directives on their application in contact with food.

- The products recommended for drinking water pipes comply with European standard EN 12201 – 1:2008
- The products recommended for gas pipes comply with European standard EN 1555 – 1:2011

Additionally, Repsol products have the following certifications for pressure pipes active:

Certification	AENOR Producto Certificado Proyecto 11-0-1	iip UNI	NF CERTIFIÉ PAR L'NF	DIN plus
Water	T40N, T80N, T100N & T100NLS	T80N, T100N & T100NLS	T100N & T100NLS	T80N & T100NLS
Gas	T100SC, T100N & T100NLS			

Technical Data Sheets and MSDS are available on: www.chemicals.repsol.com

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Polyethylene and polypropylene pipes are light and flexible and installation requires less machinery.

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