ORLEN
UNIPETROL

LITEN®

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LITEN®

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The **ORLEN Unipetrol** group is the biggest refinery and petrochemical company in the Czech Republic and the country's only crude oil processor. **ORLEN Unipetrol** is an indispensable part of Czech industry, and its specialization gives the group a unique position on the market. **ORLEN Unipetrol** is a significant producer and distributor of fuels, plastics, oils, lubricants, fertilisers and other products. It also operates ORLEN, the biggest network of petrol stations in the Czech Republic. **ORLEN Unipetrol** has been part of the multinational **ORLEN** refinery and petrochemical group since 2005.

Release: 03/2026

HDPE LITEN®
ORLEN UNIPETROL

MATERIAL CHARACTERISTICS AND PRODUCTION TECHNOLOGY

Produced by **ORLEN Unipetrol RPA**, **HDPE LITEN®** is a linear polyethylene which applies the following technologies:

- **UNIPOL™ gas phase technology with a capacity of 200 kta**, producing natural unimodal homopolymers, C4 and C6 copolymers
- **INNOVENE™ S slurry technology with a capacity of 270 kta**, producing both unimodal and bimodal grades, homopolymers and C6 copolymers, in natural or black colour

HDPE LITEN® is stabilized with an additive package which protects the material during processing, extends its service life and modifies the product's application properties.

HDPE LITEN®

INTEGRATED MANAGEMENT SYSTEM

ORLEN Unipetrol RPA produces **HDPE LITEN®** using an Integrated Management System (IMS) which includes processes for managing quality, the environment, safety and energy.

The IMS has been certified by Lloyd's Register Quality Assurance Limited (LRQA) according to the following standards:
ISO 9001:2015 (Quality Management System – QMS)
ISO 14001:2015 (Environmental Management System – EMS)
ISO 45001:2018 (Occupational Health and Safety Management System – HSMS)
ISO 50001:2018 (Energy Management System – EnMS)

Original QMS approval: 12 March 2008
Original EMS approval: 1 June 2008
Original HSMS approval: 9 August 2020
Original EnMS approval: 25 July 2016

Current certificate number: 10704811

LRQA CERTIFIED
ISO 9001 · ISO 14001
ISO 45001 · ISO 50001

REGULATORY COMPLIANCE

HDPE LITEN® grades meet the Czech and European hygienic requirements for contact with foodstuffs, and other regulations (as amended):

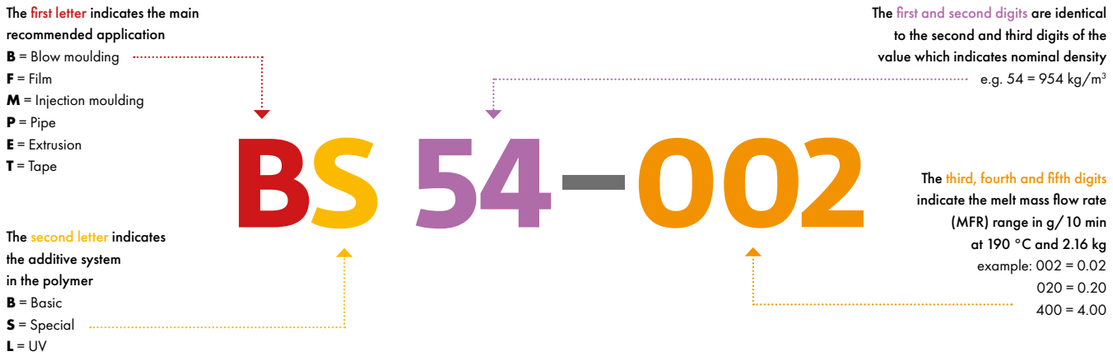
- Decree of the Ministry of Health No. 38/2001 of the Journal of Laws
- Regulation of the European Parliament and of the Council No. 1935/2004
- Commission regulation (EU) No. 10/2011
- REACH: **HDPE LITEN®** is not classified as a dangerous substance in accordance with Regulation (EC) 1272/2008 (CLP), nor does it contravene any of the other conditions set out in Article 31 of Regulation (EC) 1907/2006 (REACH). The document titled "Announcement" which replaces the Material Safety Datasheets contains information in accordance with Article 32 of Regulation 1907/2006 (REACH).

Full regulatory compliance of individual grades is available upon request.

HDPE LITEN®
DESIGNATION SYSTEM

HDPE LITEN® grades produced by **Innovene™ S (slurry) technology** are designated by an internal code consisting of two letters and five digits:

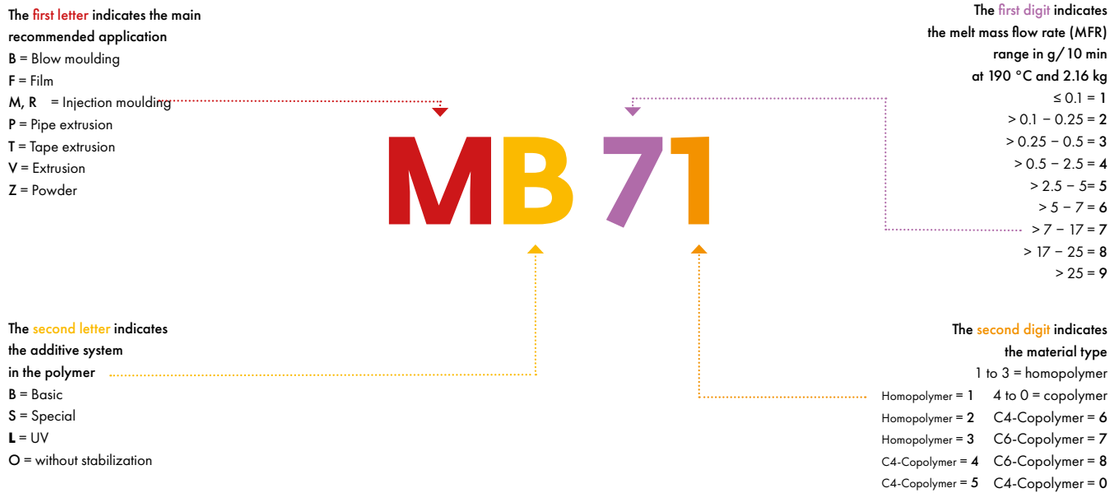
GRADES PRODUCED BY INNOVENE S TECHNOLOGY



HDPE LITEN® grades are identified by two internal designation systems according to the respective production technology.

HDPE LITEN® grades produced by **Unipol™ (gas phase) technology** are designated by an internal code consisting of two letters, two digits and additional letters (optional).

GRADES PRODUCED BY UNIPOL TECHNOLOGY



HDPE LITEN®
PROPERTIES

BASIC PROPERTIES

HDPE LITEN® is a thermoplastic material, solid, odourless and tasteless at room temperature. It exhibits a high degree of crystallinity, high temperature stability and resistance to most chemicals.

APPEARANCE

HDPE LITEN® is delivered in natural or black pellet form. Typical pellet length range is 2 – 7 mm and typical bulk density range is 500 – 620 kg/m^3.

PHYSICAL AND MECHANICAL PROPERTIES

HDPE LITEN®'s physical and mechanical properties are dependent on its molecular weight, molecular weight distribution, molecular structure and stabilization system. **HDPE LITEN®** exhibits very good mechanical properties such as impact strength and toughness, enabling many uses and technical applications. To evaluate a material's suitability for a particular application, the material's specification and processing parameters should be considered, including the temperature and time dependence of the mechanical properties.

LABORATORY TEST METHODS

PARAMETER	STANDARD
Melt mass flow rate (MFR)	ISO 1133-1
Density	ISO 1183-1
Yield stress	ISO 527-1,2
Yield strain	ISO 527-1,2
Tensile modulus of elasticity	ISO 527-1,2
Flexural modulus of elasticity	ISO 178
Charpy notched impact strength	ISO 179-1
ESCR F_{50} (50 °C, 100 % detergent)	ASTM D1693 B
ESCR F_{50} (55 °C, 6 MPa, 10 % detergent)	ISO 22088-2
FNCT (Full-notch creep test)	ISO 16770
Carbon black content	ISO 6964
Vicat softening temperature (10 N)	ISO 306

SHRINKAGE

The degree of shrinkage depends on processing parameters (temperature, hold pressure, cooling rate, throughput, product thickness, etc.). **HDPE LITEN®** shrinkage accounts for 2 – 3 % in injection moulded products and 3 – 4 % in pipe diameters. Shrinkage can be a maximum of 5 % in fittings made from pipe grades. Shrinkage can be determined with higher precision 24 hours after processing.

THERMAL AND BURNING CHARACTERISTICS

HDPE LITEN® exhibits good thermal insulation properties. Products made of **HDPE LITEN®** may commonly be used in environments up to 100 °C. For products with higher mechanical strength and stiffness requirements, temperatures should not permanently exceed 70 °C, and intermittently only 90 °C. During common processing methods, temperature stability ensures that no material degradation occurs. When the recommended processing conditions are applied, the toughness of the material decreases with lower temperatures, and below -30 °C, the material becomes brittle.

PARAMETER	UNIT	STANDARD	INFORMATIVE VALUES
Crystalline fraction melting temperature (10 °C/min)	°C	ISO 11357-3	120 – 135
Linear thermal expansion coefficient	1/°C	ISO 11359	1.5×10^{-4}
Thermal conductivity	W/m.K	ISO 22007	0.38 – 0.40
Flammability	mm/min	UL 94	class HB
Specific heat	kJ/kg.K	ISO 11357-4	1.5 – 1.8
Oxygen index (thickness 4 mm)	%	ISO 4589-2	19
Hot wire ignition – HWI (thickness 3 mm)	s	UL 746A	25

HDPE LITEN®
PROPERTIES

CHEMICAL PROPERTIES

HDPE LITEN® exhibits high chemical resistance at both normal and raised temperatures due to its non-polar character. It resists most acids, alkalis and salt solutions across a broad range of temperatures and concentrations. It dissolves only in some solvents at higher temperatures (e.g., in halogenated and aromatic hydrocarbons) and is not resistant to strongly oxidizing agents (e.g. nitric acid, oleum, halogens). Liten has practically no hygroscopicity, therefore it can be used in environments with variable relative humidity without risking any change in product size or mechanical properties. Moisture condensation problems may occur during proccessing when the material is transferred to a warmer environment.

ELECTRICAL PROPERTIES

HDPE LITEN® grades exhibit good electrical-insulating and dielectric properties and a high specific volume resistance because of their non-polar molecular structure and relatively high chemical purity.

PARAMETER	UNIT	STANDARD	TEST CONDITIONS	TEST SPECIMENS, mm	INFORMATIVE VALUES
Relative permittivity	–	IEC 250	100 Hz, 1 mm 1 MHz, 1 mm	80 x 80 x 1	2.5 ± 0.05 2.3 ± 0.03
Dissipation factor (10^{-3})	–	IEC 250	100 Hz 1 MHz	80 x 80 x 1	2 – 6 0.8 – 2.2
Volume resistivity (10^{14})	Ω.m	IEC 93	100 V, 1 mm	80 x 80 x 1	5 – 13
Surface resistivity	Ω	IEC 93	100 V, 1 mm	80 x 80 x 1	10^{14} – 10^{16}
Electric strength	kV/mm	IEC 243-1	electrode configuration 25/75 mm, thickness 1 mm	80 x 80 x 1	20
Comparative tracking index (CTI)	–	IEC 112	thickness 3 mm, solution A	15 x 15 x 4	min. 600

HDPE LITEN®
LOGISTICS

PACKAGING, DELIVERY AND STORAGE

HDPE LITEN® is delivered in 25 kg PE bags or bulk loaded into trailer tanks. Bags are placed on pallets (net weight 1375 kg) and secured with PE shrink film to protect from damage and extend product lifetime.

Pallets are designed to be stacked in a maximum of two layers. **HDPE LITEN®** must be stored in a dry and ventilated roofed warehouse and protected from direct sunlight. The recommended warehouse temperature range is between -20 °C and +50 °C. The material must be kept at least 1 metre away from any heat source. The recommended maximum storage time for **HDPE LITEN®** in closed (sealed) bags under the above-mentioned conditions is 1 year. After longer storage periods, we recommend checking the material's condition before processing.

When stored at temperatures below 20 °C, we recommend conditioning the material at least 24 hours before processing in the production hall.

In case of surface moisture, the recommended drying temperature is 70–80 °C for 1–2 hours.

PACKAGING:

5 bags **(25 kg each)** per layer
11 layers
pallet **1375 kg net**
pallet dimensions **L1100 x W1300 x H1850 (in mm)**
PROTECTED by a stretch hood

DELIVERY:

delivered in **bags on pallets**
or bulk loaded in a **trailer**
or **IBC tanks**

STORAGE:

pallets are **stackedin a maximum of two layers**
stored in **a dry and ventilated roofed warehouse**
protect from **direct sunlight**
recommended temperature range **-20 °C to +50 °C**
recommended storage time **1 year, then retesting is recommended**

HDPE LITEN® APPLICATIONS

BLOW MOULDING

Typical products: bottles, jerry cans, containers and industrial tanks for various media, including detergents and cleaning agents, transportation boxes, pharmaceutical articles.

The **HDPE LITEN®** blow moulding portfolio offers medium to high molecular weight grades, with both unimodal and bimodal molecular weight distribution. This broad scope allows the production of vessels, including products with high chemical resistance (ESCR) and toughness, from several millilitres up to 5000 litres.

HDPE LITEN® blow moulding grades should be processed in an extruder with a screw of a minimum length of 25D. Machines equipped with a melt accumulator allow the production of larger volume vessels than standard continuous blow moulding machines.

Optimal processing conditions depend on the respective application and equipment. Good product quality requires homogeneous melting of pellets in the extruder.

RECOMMENDED MOULDING CONDITIONS

Melt temperature (°C)	Mould temperature (°C)
180 – 225	10 – 40

HDPE LITEN® APPLICATIONS

PIPES

Typical products: pressure and non-pressure pipes, casing pipes for multilayer heating systems, cable ducts, corrugated pipes and coatings.

The **HDPE LITEN®** portfolio offers black grades for the production of pressure pipes for water and gas supply, suitable up to very large diameters. The materials are classified for pressure class PE 100 (LS) and PE 100 RC.

Other **HDPE LITEN®** extrusion grades applicable in the construction industry are suitable for the production of non-pressure pipes, optical network distribution, corrugated pipes for electro installations and multilayer casing pipes for heating.

Optimal processing conditions depend on the respective application and equipment. Good product quality requires homogeneous melting of pellets in an extruder with a screw of a minimum length of 25D.

RECOMMENDED MOULDING CONDITIONS

Melt temperature pipe extrusion (°C)	Cooling water (°C)	Melt temperature fitting injection (°C)
180 – 220	15 – 20	210 – 250

HDPE LITEN® APPLICATIONS

FILM

Typical products: packaging film for both food and non-food applications, sacks, shopping and garbage bags, blends with LLDPE and LDPE.

The **HDPE LITEN®** film portfolio offers medium to high molecular weight materials, with both unimodal and bimodal molecular weight distributions. A density range from of 935–952 kg/m^3 allows application in LDPE and LLDPE blends, multilayer packaging systems, and as barrier layers, especially in biaxially oriented blown or cast films.

Optimal processing conditions depend on the respective application and equipment. Good product quality requires homogeneous melting of pellets in an extruder with a screw of a minimum length of 25D.

RECOMMENDED MOULDING CONDITIONS

Melt temperature (°C)	Neck height	Blow-up ratio
180 – 225	6 – 9 multiplied by the die diameter	3 – 5 multiplied by the die diameter

SHEET AND THICK FILM

Typical products: environmental landfill sheets, construction sheets for insulation, welded vessels and thermoforming.

The **HDPE LITEN®** portfolio contains a broad range of natural and black grades for the production of various geo-engineering applications.

Other **HDPE LITEN®** extrusion grades applicable in the construction industry are suitable for primary sheets processed by welding or thermoforming.

Optimal processing conditions depend on the respective application and equipment. Good product quality requires homogeneous melting of pellets in an extruder with a screw of a minimum length of 25D.

RECOMMENDED MOULDING CONDITIONS

Melt temperature (°C)	Cooling water (°C)
180 – 220	15 – 20

HDPE LITEN® APPLICATIONS

TEXTILES

Typical products: monoaxially oriented tapes for agricultural and bi-component fibres used to produce non-woven hygienic products.

HDPE LITEN® grades for tapes are processed from a 60 µm primary blown or cast film onto aligned tapes of 420 – 1200 dtex.

HDPE LITEN® LS 87 is suitable for spunbond technology and used in combination with **PP MOSTEN® NB 425** for the production of bi-component fibres which exhibit improved soft touch properties in the final textiles.

Optimal processing conditions depend on the respective application and equipment. Good product quality requires homogeneous melting of pellets in an extruder with a screw of a minimum length of 25D.

RECOMMENDED MOULDING CONDITIONS

Melt temperature (°C)	Max. temperature (°C)	Stretch ratio
210 – 240	godets – 120 air oven – 130 hot plate – 100	1:6 – 1:8

HDPE LITEN® APPLICATIONS

INJECTION MOULDING

Typical products: crates, transportation boxes, large containers, dustbins, technical parts, cartridges, caps, buckets, houseware and toys.

HDPE LITEN® injection moulding grades contain homopolymers, which are especially suitable for the production of returnable food packages, and C6 copolymers, which are suitable for more demanding technical applications requiring a balanced combination of stiffness and toughness.

Selected grades contain UV stabilization, ensuring a longer lifespan for outdoor product applications.

RECOMMENDED MOULDING CONDITIONS

Melt temperature (°C)	Mould temperature (°C)	Injection pressure (MPa)	Hold pressure (MPa)	Hold pressure time (s/1 mm of wall thickness)	Circumferential screw speed (m/s)	Cooling time (s)
210 – 250 (up to 290 for special applications)	10 – 40	maximum (without surface defects)	75 – 85 % of the maximum injection pressure	4 – 5	max 0.6	proportional to squared wall thickness (mm)

HDPE LITEN®

RECYCLING AND WASTE DISPOSAL FROM PE PROCESSING

HDPE LITEN® can be easily recycled, but because materials are subject to thermal degradation during initial processing, their mechanical properties may change. Products and non-contaminated waste during **HDPE LITEN®** processing can be recycled and further processed into other products. Material designation >PE< is used in compliance with ISO 11469. Material designation on products allows materials to be identified for the collection, classification, use or disposal of consumer waste.

HDPE LITEN® does not contain any lead, cadmium, mercury or hexavalent chromium, i.e., the total amount of these heavy metals does not exceed 100 ppm.

PE waste is classified by the waste producer in accordance with the applicable legal regulations.

Recommended waste processing methods are material and energy use for other materials or energy.

HDPE LITEN® CHEMICAL RESISTANCE

SUBSTANCE AND CONCENTRATION	CHEMICAL RESISTANCE AT 20 °C	CHEMICAL RESISTANCE AT 60 °C
ACIDS		
Acetic acid 10%	+	+
Citric acid	+	+
Formic acid	+	+
Hydrochloric acid (of any concentration)	+	+
Nitric acid 25%	+	+
Nitric acid 50%	/	– z
Oleum	–	–
Oxalic acid 50%	+	+
Perchloric acid 50%	+	/
Perchloric acid 70%	+	– z
Phosphoric acid 25%	+	+
Phosphoric acid 50%	+	+
Phosphoric acid 95%	+	/ z
Silicic acid	+	+
Stearic acid	+	/
Sulphuric acid 10%	+	+
Sulphuric acid 50%	+	+
Sulphuric acid 98%	+	– z
ALKALIS		
Ammonium hydroxide 30%	+	+
Calcium hydroxide 30%	+	+
Potassium hydroxide	+	+
Potassium hydroxide 30% aq.	+	+
Sodium hydroxide	+	+
Sodium hydroxide 30% aq.	+	+
HOUSEHOLD CHEMICALS		
Bleaches	+	+
Detergent	+	+
Face makeup	+	
Hand creams	+	+
Shampoo	+	
Soap	+	

SUBSTANCE AND CONCENTRATION	CHEMICAL RESISTANCE AT 20 °C	CHEMICAL RESISTANCE AT 60 °C
INDUSTRIAL CHEMICALS		
Acetaldehyde	+	/
Alkyl alcohol, 96%	+	+
Aluminium chloride	0 +	+
Ammonia gas	+	+
Ammonium chloride	0 +	+
Amyl acetate	+	+
Amyl nitrite	/	/
Aniline	+	+
Beeswax	+	00 / –
Benzaldehyde	+	+ /
Benzene	/	/
Benzyl alcohol	–	+
Benzyl chloride	/	/
Borax	+	+
Butyl glycol	+	+
Butyl acetate	+	/
Butyl alcohol	+	+
Calcium hypochlorite	0 +	+
Calcium chloride	0 +	+
Calcium nitrate 50%	+	+
Carbon dioxide	+	+
Cresol	+	+ z
Cyclohexane	+	+
Cyclohexanol	+	+
Cyclohexanone	+	/
Decalin	+	/
Dibutyl ether	+ –	–
Dibutyl phthalate	+	/
Diesel oil	+	+
Diethyl ether	+ /	/ x
Dichloroethylene	–	–
Dioxane	+	+

HDPE LITEN® CHEMICAL RESISTANCE

SUBSTANCE AND CONCENTRATION	CHEMICAL RESISTANCE AT 20 °C	CHEMICAL RESISTANCE AT 60 °C
Ethyl acetate	+	/
Ethyl alcohol 96%	+	+
Ethylbenzene	/	/
Ethylene dichloride	/	/
Ethylene glycol	+	+
Formaldehyde 40%	+	+
Glycerol	+	+
Glycol	+	+
Hydrazine hydrate	+	+
Hydrogen chloride (dry and moist)	+	+
Hydrogen peroxide 100%	+	–
Hydrogen peroxide 30%	+	+
Mercury	+	+
Methyl alcohol	+	+
Petrol - Benzene blend / 20%	/	–
Phosphate	+	+
Propylene glycol	+	+
Sea water	+	+
Silver nitrate	+	+
Sodium chloride, saturated aqueous solution	+	+
Sulphates	+	+
Sulphur	+	+
Sulphur dioxide (dry)	+	+
Sulphur dioxide (moist)	+	+
Sulphur chloride	–	
Sulphur trioxide	–	–
Tallow	+	+
Tannin 10%	+	+
Toluene	/	–
Urea 33%	+	+
Vaseline	00 + /	/

SUBSTANCE AND CONCENTRATION	CHEMICAL RESISTANCE AT 20 °C	CHEMICAL RESISTANCE AT 60 °C
FOOD		
Apple juice	+	
Beer	+	
Butter	+	
Carrot juice	+	
Grape juice	+	
Jam	+	
Ketchup	+	
Lemon juice	+	
Milk	+	
Orange juice	+	
Salt	+	
Sugar	+	
Tea	+	
Tomato juice	+	
Vinegar	+	
Wine	+	
Yeast	+	
OIL		
Coconut oil	+	/
Engine oil	+	+ /
Hydraulic oil	+	/
Linseed oil	+	+
Maize oil	+	/
Mineral oil	+	+ /
Engine oil	+	/
Paraffin oil	+	+
Silicon oil	+	+
Spindle oil	+ /	/
Transformer oil	+	/
Turpentine oil	+ /	/
Vegetable and animal oils	+	+ /

+ resistant (polymer swelling <3 % or mass drop of polymer <0.5 %, elongation does not change substantially)
/ resistant partially (polymer swelling 3 – 8 % or mass drop of polymer 0.5 – 5 %, polymer elongation decreases by 50 %)
– not resistant (polymer swelling >8 % or mass drop of polymer >5 %, polymer elongation decreases by >50 %)
z polymer colour change

0 aqueous solution at any concentration
00 valid at low mechanical load
x valid at boiling point

ORLEN UNIPETROL RPA
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PRODUCT INTELLIGENCE POLYOLEFINS

- Provision of basic application and technical information about manufactured products
- Consultation for the processability of HDPE LITEN and PP Mosten
- Participation in trials at the customer's site
- Arrangement of sample analyses for determining optimal solutions
- Measurement and interpretation of flow behaviour of polyolefin melt
- Collection and handling of customer requirements
- Arrangement of external tests at testing institutes
- Management of material specifications and other product documentation
- Development and modification of product portfolio

ORLEN UNIPETROL RPA – POLYMER INSTITUTE BRNO, R&D CENTRE

- Structural analyses of polymer matrices
- Analyses of chemical properties of plastics and composite materials
- Evaluation of polymer processing stability
- Determination of polymer matrix lifespans using artificial, accelerated ageing methods
- Optimisation of stabilisation compositions
- Determination of long-term mechanical properties using standard tests or alternative methods (on test specimens or products)

www.pe-liten.com