ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025 and EN 15804

Declaration holder	**FDT FlachdachTechnologie GmbH & Co. KG**
Publisher	Institute Construction and Environment e.V. (IBU)
Programme holder	Institute Construction and Environment e.V. (IBU)
Declaration number	EPD-FDT-20130059-IAA1-EN
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Valid until	03.04.2018

Rhepanol fk

FDT FlachdachTechnologie GmbH & Co. KG

Institut Bauen und Umwelt e.V.

www.bau-umwelt.com / https://epd-online.com

FDT FLACHDACH·TECHNOLOGIE

1. General information

FDT FlachdachTechnologie GmbH & Co. KG

Programme holder
IBU - Institut Bauen und Umwelt e.V.
Rheinufer 108
D-53639 Königswinter

Declaration number
EPD-FDT-20130059-IAA1-EN

This Declaration is based on the Product Category Rules:
Plastic and elastomer roofing and sealing membrane systems, 09.07.2012
(PCR tested and approved by the independent Committee of Experts (SVA))

Issue date
04.04.2013

Valid until
03.04.2018

Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Prof. Dr.-Ing. Hans-Wolf Reinhardt
(Chairman of the Expert Committee (SVA))

Rhepanol fk

Holder of the Declaration
FDT FlachdachTechnologie GmbH & Co. KG
Eisenbahnstr. 6-8
D-68199 Mannheim

Declared product/unit
1 m² produced roofing membrane Rhepanol fk 1.5 mm

Area of validity:
Rhepanol fk is manufactured in 69502 Hemsbach, Germany.

The holder of the Declaration is liable for the information and evidence on which it is based.

Verification

The CEN EN 15804 standard serves as the core PCR.

Verification of the EPD by an independent third party in accordance with ISO 14025

☐ internal ☒ external

Matthias Schulz,
Independent auditor appointed by the SVA

2. Product

2.1 Product description

Rhepanol fk is a bitumen-compatible polyisobutylene (PIB) synthetic roofing membrane comprising PIB of high molecular weight, co-polymers and functional additives as well as a synthetic non-woven fleece on the underside. For the purpose of joining seams, Rhepanol fk contains either a self-adhesive sealing edge or a weldable seam for hot-air welding.

2.2 Application

Rhepanol fk is used for sealing purposes on both flat and inclined roofs in mechanically fastened or adhered layers and for gravel or used roofs with the exception of green roofs.

The manufacturer's installation instructions must be observed during processing.

2.3 Technical data

Structural data

Description	Value	Unit
Water vapour diffusion resistance value μ, DIN EN 1931 (method B)	≥ 260,000	
Tensile force, DIN EN 12311-2 (version A)	≥ 400	N/50 mm
Tensile strain, DIN EN 12311-2 (method A)	≥ 50	%
Seam peel resistance, DIN EN 12316-2	≥ 80	N/50 mm
Seam shear resistance, DIN EN 12317-2	≥ 200 (tearing outside the seam)	N/50 mm
Resistance to abrupt loads, rigid and/or flexible underlay, DIN EN 12691	≥ 700 and ≥ 700	mm
Resistance to static loads, DIN EN 12730 (method A/B)	≥ 20	kg
Hail, rigid underlay / flexible underlay, DIN EN 13583	≥ 25 / ≥ 35	m/s
Tear Resistance, DIN EN12310-2	≥ 150	N
Dimensional stability after warm storage, DIN EN 1107-2	≤ 0.5	%
Folding at low temperatures, DIN EN 495-5	≤ - 60	°C
Performance when exposed to bitumen, DIN EN 1548	passed	
Resistance to chemicals, DIN EN 1847 (List in Annex C)	fulfilled	
UV radiation, DIN EN 1297	Class 0 (5000 h)	h
Water tightness, DIN EN 1928 (method B)	≥ 400	kPa

2.4 Placing on the market / Application rules

Rhepanol fk is a bitumen-compatible PIB synthetic roofing membrane with a synthetic non-woven fleece underside in accordance with DIN EN 13956 and DIN V 20 000-201: DE/E1 PIB-BV-K-PV-1,5.
FPC certificate no. 1343-CPD-K06-0660.15

2.5 Delivery status

The nominal thickness of the sealing layer is 1.5 mm; its dimensions are 15 m x 1.05 m / x 0.65 m / x 0.52 m / x 0.35 m x 2.5 mm (incl. 1.0 mm synthetic non-woven fleece) and 10 m x 1.05 m x 2.5 mm (incl. 1.0 mm synthetic non-woven fleece).

2.6 Base materials / Auxiliaries

Rhepanol fk comprises (20-30)% high-molecular polyisobutylene, (6-12)% polyethylene, (2-5)% co-polymers, (30-50)% functional, mineralogical aggregates, (5-10)% titanium dioxide, (0.5-2.0)% carbon black and additives (a sterically-hindered armine as a light stabiliser and a phenol as an anti-ageing agent). Furthermore, Rhepanol fk features a plastic non-woven fleece and a sealing edge or weldable seam.

2.7 Production

The Rhepanol fk compound is manufactured with the aid of a continuous mixer in which the individual raw materials are combined to form a homogeneous blend. The finished mixture is then compacted by an extruder, pelletized and shaped by a foil extruder, supplied with a synthetic non-woven fleece and sealing edge or weldable seam, cut to length and packed as rolls.

Production is subject to the quality management system introduced in accordance with ISO 9001 (certificate register 12 100 22279 TMS). The certification agency is TÜV Süd Management Service.

External quality monitoring and tests are performed by the State Material Testing Institute in Darmstadt, the BBA (British Board of Agreement, certificate no. 02/3922), FM Approvals (index no. 3014745F) and INTRON Certificatie B.V. (KOMO attest).

2.8 Environment and health during production

Over and beyond national guidelines, environmentally-friendly processes are used in the production of Rhepanol fk, e.g.

> a combination of wet separators and bio-filters are used for waste air achieving a higher degree of waste air purity

> waste heat for heating and hot water is used in the energy-efficient production processes (EMS as per DIN 50 001) and

> the production waste incurred is redirected to the production circuit in the form of in-company recycling.

In order to ensure the health and safety of employees, workplace designs are continuously improved for the purpose of physical relief and optimised ergonomics and regular seminars are held on the topic of health and safety.

2.9 Product processing/installation

Rhepanol fk is rolled out on the roof and joined using prefabricated sealing seams or hot-air welding.

The following must be observed when cleaning Rhepanol fk seams with cleaning agents containing solvents:
- Avoid contact with the skin and eyes,
- Wear gloves,
- No smoking, no naked flames, avoid sparking,
- Do not inhale vapours; only use outdoors or in well-ventilated rooms.

No particular measures concerning health and safety are required when hot air welding Rhepanol fk with weldable seam.

Rhepanol fk is mechanically fastened, adhered or laid loosely and ballasted e.g. with gravel or paving, for example. More information on installation is outlined in the technical manual.

2.10 Packaging

Rhepanol fk is packed in reinforced cardboard boxes with wooden inserts to facilitate stacking. Each box contains six 15 m² rolls packed in individual PE bags.

All packaging materials are recyclable.

2.11 Condition of use

On the basis of long-term experience, there are no relevant changes concerning material composition for the period of use of Rhepanol fk.

2.12 Environment and health during use

There are no references to possible material emissions during the use phase for Rhepanol fk.

2.13 Reference Service Life (RSL)

Under normal conditions and correct installation, Rhepanol fk has a life cycle of 35 years and more; please refer to the attached BBA Agreement Certificate No. 02/3922.

2.14 Extraordinary effects

Fire

Description	Value
Reaction to fire tests EN 11925-2 / EN 13501-1	Class E / passed
Performance in case of external fire exposure to roofs ENV 1187 / EN 13501-5	B (t1) / passed

Note:
The B roof (t1) test results to ENV 1187 apply for the roof build-ups tested on behalf of FDT.

Water

The materials used for Rhepanol fk are not water-soluble.

Mechanical destruction

There are no known negative consequences for the environment in the event of unforeseen mechanical destruction of Rhepanol fk.

2.15 Re-use phase

Rhepanol fk is not re-used in its original form once the use phase has expired. When separated by type, Rhepanol fk can be directed to the "ROOF COLLECT" collection system (recycling system for synthetic roofing and sealing sheet systems). This collection system manufactures a recyclate from the old roofing

membranes which can be used or re-used for a variety of applications, e.g. for garden slabs or noise-insulating boards.

Thermal utilisation is also possible with the result that the energy contained in Rhepanol fk is released and used during incineration.

2.16 Disposal

After Rhepanol fk has fulfilled its function, it is directed towards thermal utilisation; please refer to 2.15. The roofing membranes can be allocated to number 170904 or 200139 in the List of Wastes Ordinance.

2.17 Further information

More information on Rhepanol fk in the form of brochures, data sheets, installation instructions and technical manuals can be found on the FDT Web site (www.fdt.de).

3. LCA: Calculation rules

3.1 Declared unit

The declared unit is 1 m² Rhepanol fk 1.5 mm of roofing membrane produced.

Declared unit

Description	Value	Unit
Declared unit	1	m^2
Basis weight	2.600	kg/m^2
Strength	1.5	mm
Sealing type	Thermal welding or connection using seaming tape and primer	-

3.2 System boundary

This Life Cycle Analysis addresses the life cycle stage of product manufacturing (cradle to gate). The product stage comprises Module A1 (Raw material supply), A2 (Transport), A3 (Production) in accordance with EN 15804 including the provision of all materials, products and energy. Waste indicated in A1-A3 only concerns that which is recycled internally.

3.3 Estimates and assumptions

Polybutylene was used as a conservative estimate for polyisobutene as the exact data record for the polymer was not available. This is modelled as 100% for raw material mixtures in which one component accounts for at least 95%.

3.4 Cut-off criteria

All data from the operating data survey was taken into consideration in the analysis, i.e. all starting materials used according to the recipe, the thermal energy used as well as electricity. Transport costs were considered for all inputs and outputs.

3.5 Background data

The primary data was provided by FDT FlachdachTechnologie GmbH Co. KG. The background data was taken from the GaBi software data base offered by PE INTERNATIONAL AG (GaBi 5 2012). The German power mix was applied.

3.6 Data quality

The data recorded by FDT FlachdachTechnologie GmbH Co. KG for production year 2011 was used for the various recipes for modelling the product stage associated with the synthetic roofing membranes. All other relevant background data records were taken from the GaBi 5 software data base and are less than 7 years old. The representativity can be classified as very good.

3.7 Period under review

The data for this Life Cycle Analysis is based on data records from 2011. The volumes of raw materials, energy, auxiliaries and consumables used are considered as average annual values in the Hemsbach manufacturing plant.

3.8 Allocation

Production waste which is re-used internally (the edge trims in production) is modelled as closed-loop recycling in Modules A1-A3.

3.9 Comparability

As a general rule, EPD data can only be compared or evaluated when all of the data records to be compared have been drawn up in accordance with DIN EN 15804 and the building context or product-specific performance features are taken into consideration.

4. LCA: Scenarios and other technical information

Disposal
It can be assumed that in 80% of current roof refurbishments the roofing membranes remains on the roof and serves as an underlay for a new covering. Accordingly, in most cases disposal of the roofing membranes occurs later when the building is demolished and this subsequent use means that it is no longer within the system boundaries considered here. Under such conditions, disposal as municipal solid waste can therefore be assumed for 20% of waste (25% incineration, 75% landfilling).
No scenarios are considered in this Life Cycle Analysis of synthetic roofing sheet systems.

5. LCA: Results

SYSTEM BOUNDARIES (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

Product stage			Construction process stage		Use stage							End-of-life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacture	Transport	Construction installation process	Use / Application	Maintenance	Repairs	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction	Transport	Waste treatment	Disposal	Re-use, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

LCA RESULTS - ENVIRONMENTAL IMPACT: 1 m² Rhepanol fk 1.5 mm

Parameter	Unit	A1 - A3
Global Warming Potential	[kg CO_2 equiv.]	6.57E+00
Ozone Depletion Potential	[kg CFC11 equiv.]	2.60E-08
Acidification Potential of Soil and Water	[kg SO_2 equiv.]	3.45E-02
Eutrification Potential	[kg PO_4^3 equiv.]	1.48E-03
Photochemical Ozone Creation Potential	[kg ethene equiv.]	5.48E-03
Abiotic Depletion Potential non-Fossil Resources	[kg Sb equiv.]	5.80E-06
Abiotic Depletion Potential Fossil Fuels	[MJ]	1.39E+02

LCA RESULTS - USE OF RESOURCES: 1 m² Rhepanol fk 1.5 mm

Parameter	Unit	A1 - A3
Renewable primary energy as energy carrier	[MJ]	9.24E+00
Renewable primary energy as material utilisation	[MJ]	0.00E+00
Total use of renewable primary energy sources	[MJ]	9.24E+00
Non-renewable primary energy as energy carrier	[MJ]	1.07E+02
Non-renewable primary energy as material utilisation	[MJ]	4.29E+01
Total use of non-renewable primary energy sources	[MJ]	1.50E+02
Use of secondary materials	[kg]	0.00E+00
Renewable secondary fuels	[MJ]	2.18E-03
Non-renewable secondary fuels	[MJ]	2.28E-02
Net use of fresh water*	[m³]	1.51E-01

LCA RESULTS - OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² Rhepanol fk 1.5 mm

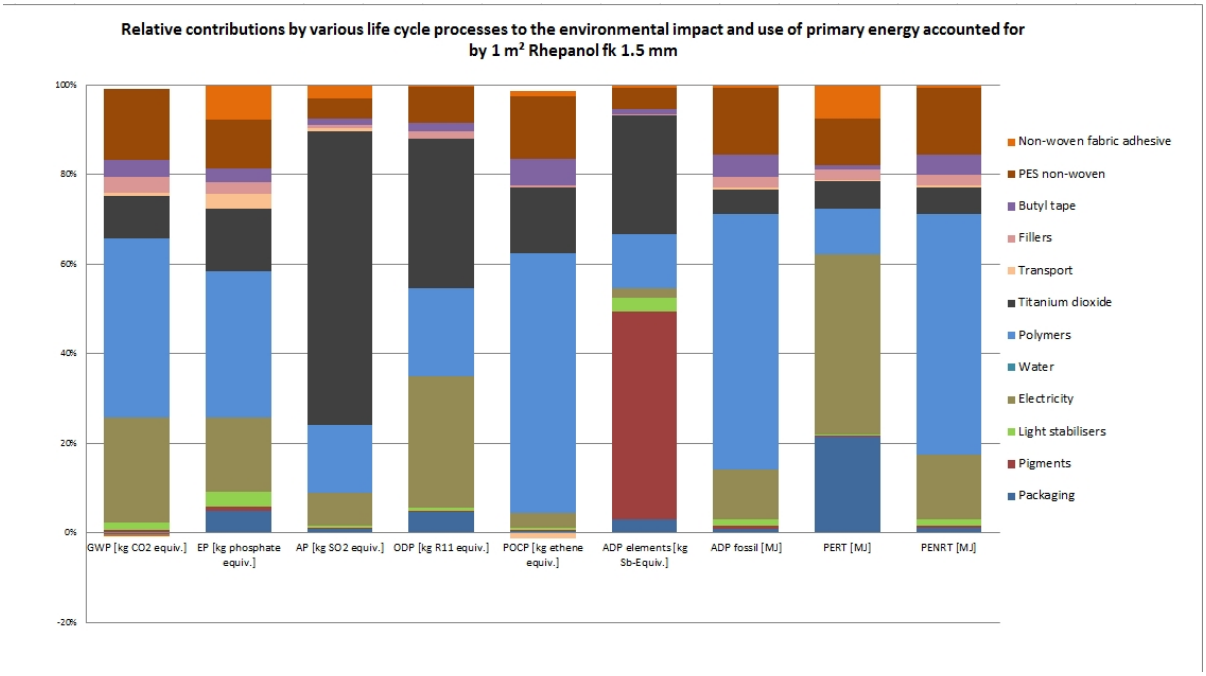
Parameter	Unit	A1 - A3
Hazardous waste for disposal**	[kg]	-
Disposed of, non-hazardous waste**	[kg]	-
Disposed of, radioactive waste**	[kg]	-
Components for re-use	[kg]	-
Materials for recycling	[kg]	-
Materials for energy recovery	[kg]	-
Exported electric energy	[MJ]	-
Exported thermal energy	[MJ]	-

** In accordance with the transition solution approved by the SVA on 4.10.2012, the following applies: LCI information on cardboard packaging does not contain sufficient information for calculating the water volume. This involves a data record in which the data for the "Blue water consumption" method is not available for evaluation. The water value depicted in the table above refers therefore to the system under review but excluding the cardboard packaging. The mass percentage of the overall product accounted for by this packaging is 2.6% for Rhepanol fk 1.5 mm. As this share < 3%, it is not regarded as significant and the parameter can be ignored even if this parameter is associated with increased uncertainty.*
*** The Expert Committee (SVA) at IBU clearly defined the calculation rules for declaration of waste in its last meeting on 4 October 2012. The background data records from the data bases must be revised to that effect. Accordingly, this Environmental Product Declaration follows the transition solution approved by the SVA and is drawn up without a waste declaration.*

6. LCA: Interpretation

The figure below depicts the relative contributions by the individual raw materials and processes to the various environmental impact categories and the use of primary energy in the form of a dominance analysis.

This type of presentation can be used to identify the main influential factors in terms of the product's environmental performance.



Indicators of the life cycle inventory analysis
The absolute value of the use of non-renewable as primary energy carrier (PENRT) is approx. 20 times higher than the use of renewable primary energy carriers (PERT).
For Rhepanol fk 1.5 mm, 54% of the PENRT is accounted for by polymers (41% is attributable to the main polymer PIB while 13% is accounted for by the co-polymers) and 14% by electricity. In terms of the PERT, 40% is accounted for by electricity, 21% by packaging, 10% by the PES non-wovens and 8% each by the PIB and non-woven fabric adhesive.

Indicators of estimated impacts
In the dominance analysis for Rhepanol fk 1.5 mm, it is apparent that either PIB or titanium dioxide represent the main drivers in the various environmental categories. At 41%, the polymers have the greatest share of GWP (33% is accounted for by PIB alone), EP (polymers make up for a total of 33% while PIB accounts for 27%), POCP (polymers account for a total of 60% with PIB making up for 56%) and ADP Fossil (total polymers account for 58% with PIB accounting for 43%). Titanium dioxide accounts for the greatest share of AP (66%) and ODP (33%). The power mix also makes an extensive contribution to the impact categories: ODP (29%), GWP (24%), EP (17%), AP (7.5%) and ADP Fossil (11%). Pigments account for the largest share in the ADP Elements impact category (478%), followed by titanium dioxide which accounts for 27%.

7. Requisite evidence

No evidence is required.

8. References

Institut Bauen und Umwelt e.V., Königswinter (pub.): General Principles for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2011-06

Product Category Rules for building products Part A: Calculation rules for the Life Cycle Assessment and requirements on the background report, 2012-09

PCR 2012, Part B: PCR instructions for building-related products and services in the building products group pertaining to synthetic and elastomer roofing sheet systems (2012).

DIN EN 495-5:2012-10 Flexible sheets for waterproofing – Determination of foldability at low temperature – Part 5: Plastic and rubber sheets for roof waterproofing

DIN EN 1107-2: 2001-04 Flexible sheets for waterproofing - Determination of dimensional stability – Part 2: Plastic and rubber sheets for roof waterproofing

DIN CEN TS 1187: 2012-03 Test methods for external fire exposure to roofs

SN ENV 1187:2002-09 Test methods for external fire exposure to roofs

DIN EN 1297: 2004-12 Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Method of artificial ageing by long-term exposure to the combination of UV radiation, elevated temperature and water

DIN EN 1548:2007-11 Flexible sheets for waterproofing – Plastic and rubber sheets for roof waterproofing – Method for exposure to bitumen

DIN EN 1847:2010-4 Flexible sheets for waterproofing – Plastics and rubber sheets for roof waterproofing – Methods for exposure to liquid chemicals, including water

DIN EN 1928:2000-07 Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing - Determination of water-tightness

EN 1931:2001-03 Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing – Determination of water-tightness

ISO 9001:2008-12 Quality management systems – Requirements

DIN EN ISO 11925-2:2011-02 Reaction to fire tests – Ignitability of products subjected to direct impingement of flame

DIN EN 12310-2:2000-12 Flexible sheets for waterproofing – Determination of resistance to tearing – Part 2: Plastic and rubber sheets for roof waterproofing

DIN EN 12311-2:2010-12 Flexible sheets for waterproofing – Determination of tensile properties – Part 2: Plastic and rubber sheets for roof waterproofing

DIN EN 12316-2:2012-10 Flexible sheets for waterproofing – Determination of peel resistance of joints – Part 2: Plastic and rubber sheets for roof waterproofing

DIN EN 12317-2:2010-12 Flexible sheets for waterproofing – Determination of shear resistance of joints – Part 2: Plastic and rubber sheets for roof waterproofing

DIN EN 12691:2006-06 Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Determination of resistance to impact

DIN EN 12703:012-06 Adhesives for paper and board, packaging and disposable sanitary products – Determination of low temperature flexibility or cold crack temperature

DIN EN 13501-1:2010-01 Classification of building products and methods by fore performance – Part 1: Classification with the Results of Tests on Fire Performance of Building Products

DIN EN 13501-5:2010-02 Classification of building products and methods by fore performance – Part 5: Classification using data from external fire exposure to roofs tests

DIN EN 13583:2012-10 Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Determination of hail resistance

DIN EN 13948:2008-01 Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Determination of resistance to root penetration

DIN EN 13956:2012-05 Flexible sheets for waterproofing – Plastic and rubber sheets for roof waterproofing – Definitions and characteristics

DIN EN ISO 14025:2009-11 Environmental labels and declarations – Type III environmental declarations – Principles and procedures.

EN 15804:2012-04 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.

DIN V 20000-201:2006-11 Use of building products in construction works – Part 201: Adaptation standard for flexible sheets for waterproofing according to European standards for use as waterproofing of roofs

DIN V 20000-202:2007-12 Use of building products in construction works – Part 202: Adaptation standard for flexible sheets for waterproofing according to European standards for use as waterproofing

DIN EN ISO 50001:2011-12 Energy management systems – Requirements with guidance for use

Institut Bauen
und Umwelt e.V.

Publisher
Institut Bauen und Umwelt e.V.
Rheinufer 108
53639 Königswinter
Germany

Tel. +49 (0)2223 296679-0
Fax +49 (0)2223 296679-0
E-mail info@bau-umwelt.com
Web **www.bau-umwelt.com**

Institut Bauen
und Umwelt e.V.

Programme holder
Institut Bauen und Umwelt e.V.
Rheinufer 108
53639 Königswinter
Germany

Tel. +49 (0)2223 296679-0
Fax +49 (0)2223 296679-0
E-mail info@bau-umwelt.com
Web **www.bau-umwelt.com**

Holder of the Declaration
FDT FlachdachTechnologie GmbH &
Co. KG
Eisenbahnstr. 6-8
68199 Mannheim
Germany

Tel. +49 (0)621 8504-287
Fax +49 (0)621 8504-574
E-mail till.duetzmann@fdt.de
Web **www.fdt.de**

Author of the Life Cycle Assessment
PE INTERNATIONAL
Hauptstrasse 111-113
70771 Leinfelden-Echterdingen
Germany

Tel. +49 (0)711 341817-0
Fax +49 (0)711 341817-25
E-mail info@pe-international.com
Web **www.pe-international.com**