

Road bridge waterproofing

No. F AT AND 02-09

Parafor Ponts – Siplast-Icopal

Product name
Parafor Ponts

Company:
Siplast-Icopal

Parafor Ponts (Parafor bridges) is a waterproofing membrane, consisting of a prefabricated asphalt base membrane, modified by an SBS polymer (Styrene Butadiene Styrene) with a polyester non-woven reinforcement. It contains a ceramic granule surface protection.

It is welded (with a heat welding gun or by heating cylinders) onto the cement concrete substrate, prepared in advance and having received a Cold Insulation Mastic (CIM): Siplast Primer.

It directly receives the bituminous concrete pavement, laid at about 160°C.

Contents

I	Identification sheet	page 2
II	Characterisation tests	page 4
III	The Commission's Assessment	page 6
	Information concerning the publication	page 12

CHAPTER I – IDENTIFICATION SHEET

I.1 – Commercial information

Parafor Ponts waterproofing membrane is sold by:

SIPLAST-ICOPAL

12 Rue Cabanis 75014 – PARIS

Tél. : 01.40.78.35.00

Fax : 01.45.88.56.87

Siplast-Icopal manufactures the Parafor Ponts membrane on the production sites of Mondoubleau (41) and Lorient (53).

Patent rights holder and licensor.

Parafor Ponts is a trademark registered by Siplast-Icopal, which has full ownership of the product.

I.2 – Definition, constitution and composition

The waterproofing system is part of the family of waterproofing products by prefabricated single-ply membrane as defined in Leaflet (Fascicule or Fas. in French) 67, Chapter I, of the CCTG¹ (Fas. 67-I), Article 7.3.1. The system includes:

a) A cold insulation mastic (CIM), **Siplast Primer**, with a base of bitumen, fluidised by light solvents. The quantity to be applied is 250 to 300 g/m² (100 to 120 g/m² of residual bitumen).

b) A **prefabricated membrane**.

The prefabricated membrane has a bitumen binder base, modified by a polymer (SBS elastomer) with a polyester non-woven reinforcement, and self-protected on the surface by ceramic granules. On the underface, it receives a fusible plastic film. The standard packing is a roll of 1 x 8 m (other packings, 1 m wide are possible). The membrane is welded to the substrate to obtain full-surface bonding. The average thickness (without granules, on regular surface) is 4 mm.

The product's composition is summarised in Table I.

Table I

	NVDM*	Variation range				
		Production specifications			Values obtained by extraction according to NF P 84350***	
			RVR 95**			Tolerances as a %
Weight per unit of surface area (in g/m ²)	6250	5750	± 8	6750	5840	± 10
of the reinforcement	180	162	± 10	198	210	± 15
of the binder	3050	2745	± 10	3355	3100	± 10
of the mineral materials < 0.1 mm	1650	1403	± 15	1898	1215	± 20
of the mineral materials ≥ 0.1 mm	1350	1148	± 15	1553	1300	± 20
Underface protection (fusible film)	9	6	± 30	12	8	± 30

*NVDM: Nominal Value Declared by the Manufacturer.

**RVR 95: Relative Variation Range, as a %.

***Values declared by the manufacturer, as an indication.

¹ CCTG - Cahier des Clauses Techniques Générales (General Technical Clause Book)

I.3 – Application field. Utilisation limits and precautions

This waterproofing system is suitable to structures, the waterproofing substrate of which is concrete (reinforced or pre-stressed), particularly when the purpose is to minimise the weight of the superstructures.

The application can be manual or mechanised according to the desired working rates. Whatever the application method, the smoothing down shall be mandatory and meticulous. When applying, the concrete must have been laid at least two weeks before and any curing compound must have been eliminated. The substrate shall be clean and dry with no trace of hydrocarbons or soiling.

The nature of the ways and means for application does not mandatorily require road vehicle access.

In compliance with Fas. 67 (Chapter I, § 6.5), application while raining is prohibited. Application when ambient temperature is lower than 0°C is prohibited; if the ambient temperature is from +1°C to +5°C, the application will be possible if the substrate temperature is higher than +2°C.

The system shall be covered either by a protection (gravel or similar layer of material), or by wearing courses, within the shortest possible time.

Preferably, the embedded aggregate coat will have a minimal thickness of 7 cm.

I.4 – Special transport and storage conditions

For the storage and application of Siplast Primer, it is necessary to scrupulously comply with the safety information sheet (valid at that moment): ventilated room (in case of works inside structures) and appropriate distance from any source of fire near the stock and during the application. This information sheet is available on request from Siplast-Icopal.

Parafor Ponts is to be stored as instructed in detail on the roll packing (to be stored vertically).

I.5 – Taking essential requirements into account

During its whole service life, the Parafor Ponts system, complies with the requirements of Edict No. 92.647 of July 8, 1992 concerning “suitability of building products for the application”.

The requirements relative to mechanical stability and to durability are taken into account in this Technical Assessment.

The constituents of the waterproofing have no harmful effects on hygiene, health and the environment.

I.6 – References

Approximately 600,000 m² of surface of bridges have received waterproofing, using this system (in France) during the period of validity of the Technical Assessment (from 1996 to 2001).

I.7 – Measures taken by the company to ensure quality

The Siplast-Icopal company is ISO 9001 certified by BVQI for all its activities and for all its sites.

On the packing, the rolls contain the identification of the production factory (M for Mondoubleau et L for Loriol), the date, the hour and the minute of production.

Siplast-Icopal keeps available a product installation Specification Book (date: January 1994, 3rd edition). Moreover, it proposes training either at its training centre or on the jobsite at start-up.

CHAPTER II – CHARACTERISATION TESTS

II.1 – Characterisation elements

NB: To use the data contained in this Chapter, see § III.5.

II.1.1 - Varnish

Chemical family: **Bitumen and volatile petroleum solvents.**

TABLE III

Characteristics	Unit	Standard	NVDM	RVR (as a %)
Density	Kg/m ²	NF T 30.020	920	± 1
Dry matter	%	NF EN ISO 3251	41	± 1
Drying time	Hour		2	-

Measurements at 23°C.

The reference (P 18.809) infrared (IR) spectrum on the dry varnish was recorded. The record is the property of Siplast-Icopal. A copy in an envelope was deposited at the Commission's Secretariat.

II.1.2 – Aggregate embedment binder

Family of polymers: **Styrene Butadiene Styrene (SBS) elastomer.**

TABLE III

Characteristics	Unit	Standard	NVDM	RVR 95**
Density			1.29	± 3.8
Softening temperature in ring and ball test (TBA in French)	°C	NF EN 1427	120	± 8
Needle penetration at 25°C	0.1mm	NF EN 1426	35	± 30
Breaking strength	MPa	XP T 66.038	0.4*	-
Elongation to break	%	XP T 66.038	≥800*	-
Elastic limit at 24 h	%	XP P 84.360	≥100*	-
Modulus at 100%	MPa	-	0.15*	-
Temperature of brittleness when bending on mandrel Ø20 mm	°C	-	-20*	-

*Values are indications only

** as a %

The reference (P 18.809) infrared (IR) spectrum on the dry varnish was recorded. The record is the property of Siplast-Icopal. A copy in an envelope was deposited at the Commission's Secretariat.

II.1.3 – Finished product

The tests are performed in compliance either with Standard NF G 07.001 or with Standard NF P 98.283. The results are recorded in Table III.

TABLE IV

Test conditions		Packaging: Thermal stress	Elongation as a %			Force in daN/cm		
			NVDM	RVR 95*	PV**	NVDM*	RVR 95*	PV**
20°C 100 mm/min	Lengthwise	Without	40	± 20	37.7 (1.2)	19	± 15	21.6 (1.5)
20°C 100 mm/min	Crosswise	Without	44	± 20	39.9 (2.3)	12.5	± 15	14.6 (2.3)
20°C 100 mm/min	Lengthwise	With	42	± 20	40.4 (4.6)	20	± 15	16.1 (2.6)
-10°C 10 mm/min	Lengthwise	With	31	± 20	26.1 (4.8)	33	± 15	22.1 (0.8)

*As a %

**This check is prior to the tests of § 11.2 (the standard deviation values are given in parentheses).

Note: The breaking strength test on a weld 5 cm wide after thermal stress gives results comparable to those of the control test specimen. However, the breaking method during the elongation test at -10°C justifies the jobsite precaution bringing the width of the welding strip to 10 cm.

II.2 – Test for the assessment of the suitability for the application

For this assessment, the Siplast-Icopal company has carried out a certain number of tests in compliance with the instructions in the standards, of Fas. 67, Chapter I, of the CCTG and of the Guide for investigating a Technical Assessment request. At the Commission’s request, the tests performed according to the instructions in the guide are as follows:

Test method	Reference of the Test Report
Waterproofing (NF P 98.281.1 or Test Method No. 1*).	LCPC** Test Report (T.R.) No. 322144 A of January 25, 1985, No. 328028 of March 3, 1988 and LRPC*** T.R. of Aix No. 5947/91 C0019 of April 5, 1991
Single cracking and cracking with fatigue (Test method No. 6*)	LCPC T.R. No. 322144 A of January 25, 1985, No. 328028 of March 3, 1988 and of LRPC T.R. of Aix No. 5947/91 C0019 of April 5, 1991
Cracking resistance of the wearing course (Test method No. 4*)	Test not operational
Bond to the substrate (NF P 98.282, Speed 1.65 mm/min).	LRPC T.R. of Aix No. 10863 95 C0040 of November 9, 1995
Water absorption	LCPC T.R. No. 322144 A of January 25, 1985, No. 328028 of March 3, 1988 and LRPC T.R. of Aix No. 5947/91 C0019 of April 5, 1991
Interface shear (Test method No. 5*)	LRPC T.R. of Aix No. 10863 95 C0040 of November 9, 1995
Bond on wet substrate (NF P 98.282, Speed 1.65 mm/min).	LRPC T.R. of Aix No. 10863 95 C0040 of November 9, 1995
Rut formation test (NF P 98.2531, T ^{re} ; 45°C, total thickness of the test specimen: 10 cm, 30,000 cycles).	SIPLAST T.R. of July 15, 1981
Puncturing under concentrated static load (Test method No. 7*)	LCPC T.R. No. 322144 A of January 25, 1985, No. 328028 of March 3, 1988 and LRPC T.R. of Aix No. 5947/91 C0019 of April 5, 1991
Puncturing under concentrated dynamic load (NF P 84.506, special conditions).	Test not operational
Plate bearing (Test method No. 3*).	LRPC T.R. of Aix No. 10863 95 C0040 of November 9, 1995
Renewal tests	LRPC T.R. of Aix No. 17514 01 C0078/01 of April 25, 2002 and No. 17514 03 C0078/02 of June 21, 2002

*References to Appendix 3 of the Guide. These methods will be covered by standards at the appropriate time.

**LCPC – Laboratoire Central des Ponts et Chaussées (Central Bridge and Road Laboratory).

***LRPC – Laboratoire Régional des Ponts et Chaussées (Regional Bridge and Road Laboratory).

II.3 – Classes, Levels

Not applicable

The undersigned Head of the requesting Company or his authorised representative attest to the exactness of the information supplied in this Assessment, Chapters I and II.

Date: December 20, 2002

CHAPTER III – THE COMMISSION’S ASSESSMENT

The system presented in the previous chapters was examined by the “Waterproofing of road bridges” Commission, including representatives of the Contracting Authorities and of the Main Contractors [Road Division, Egis-Scetauroute, SNCF (French National Railroad,...)], of the Bridge and Road laboratories, of the SETRA² and of the Profession; the Profession was represented by the following Associations: Office des Asphalts, CSFE, USIRF and SN FORES.

III.1 - SUITABILITY FOR THE APPLICATION

Reference documents: Fas. 67 (Chapter I), Guide for the investigation of a request for a Technical Assessment, Technical File supporting the Assessment request.

Note: The Assessment is carried out in the context of use in continental France. For use at other locations, for example, Overseas Departments and Overseas Territories, consult the Secretariat.

III.1.1 - Waterproofing

The waterproofing is satisfactory under the conditions of the test carried out in compliance with Standard NF 98.281.1 at a pressure of 0.5 MPa.

III.1.2 - Substrate cracking resistance (Single cracking and after fatigue at -10°C)

In single cracking, it is necessary to reach a crack opening of 10 mm to note a detachment of each side of the lips of the crack.

This is an excellent result.

After the cracking test with fatigue, an incipient detachment is noted on each side of the lips at 5 mm, then at 10 mm, a detachment of 5 to 10 mm on each side of the lips.

The result is satisfactory and considerably better than the value required by Fas. 67, which request that the material “withstand a crack of 2 mm opening without break”.

III.1.3 - Cracking resistance of the wearing course

Test not operational at the moment when the request was investigated.

III.1.4 - Substrate bond

In the laboratory, the average tensile stress to break of the bonded material on a concrete substrate was 0.53 MPa with a standard deviation of 0.02 (test performed at +20°C).

This result complies with the specification of Fas. 67 (Chapter I): 0.4 MPa at 20°C.

The bond variation curve as a function of the temperature was established in the laboratory. The values obtained at substrate temperatures higher than 30°C render the precautions indicated in § III.2 mandatory.

The Siplast-Icopal company has this curve available (LRPC T.R. of Aix No. 10863 95 C0040 of November 9, 1995), which makes it possible to interpret adhesive strength tests on site.

III.1.5 - Shear at interface

In the present state of knowledge, the maximal values measured attest to a good link between the covering and the waterproofing membrane; furthermore, after the maximal shear stress, the curve shows no sudden drop in shear, which is very satisfactory.

² SETRA - Service d'Etude Technique des Routes et Autoroutes (Road and Highway Technical Study and Design Department).

III.1.6 - Assessment of the adaptability to the condition of the substrate

The application on a substrate kept at 5°C and with a relative humidity of 95%, entailed a drop of about 15% from the adherence value at 20°C (See § III.1.4). On the other hand, the adherence after an application at 0°C drops by about 32%. This explains the application field limitations detailed in § I.3.

III.1.7 – Resistance to the rutter

The behaviour of the waterproofing membrane under the action of the rutter, under the test conditions (See § II.2), is satisfactory.

III.1.8 – Puncturing under concentrated static load and under concentrated dynamic load

The force necessary for the static puncturing is 8.8 daN at 20°C on the average.

The product is capable of supporting light jobsite traffic and traffic related to laying the wearing courses.

III.1.9 – Resistance during application of overlaying courses

After the plate bearing test, the waterproofing membrane contains no puncturing detrimental to the waterproofing.

III.1.10 – Water absorption test

During the test, the percentage of water absorbed after 30 days of immersion is 1.15% as an average on 3 test specimens. This complies with the specification in Fas. 67.

III.1.11 - Conclusions

a) The tests to assess the suitability for the application indicate that the system meets the specifications set by Fas. 67 and by the Guide. The system has excellent resistance to cracking and an excellent link with the wearing courses.

b) Special conditions necessary for obtaining the declared results.

Respect the temperature and humidity conditions when applying.

III.2 – ASSESSMENT WITH RELATION TO THE APPLICATION FIELD

The ambient high temperature adherence limit values imply that the system has risks of swelling, particularly during periods when there are sudden temperature variations (de-aerating the concrete). This is why it is recommended to lay the wearing courses as soon as possible (15 days in normal period, 8 days maximum in risk period). It is also possible to apply a temporary protection (See STER 81, S/Dos E, Ch IV, § 10).

III.3 - DURABILITY

With the information available to the Commission, the behaviour in service has not brought out any particular problems of efficiency on the structures waterproofed with this system;

In case of unsatisfactory durability, the Main Contractor is invited to report this to the Commission's Secretariat.

III.4 – ADAPTING TO THE SUBSTRATE'S STATE AND GEOMETRY

a) Texture of the concrete, slope, etc...

Applying on vertical surfaces contains no particular difficulties, as long as the raised part of the membrane is held and protected (by a mesh-reinforced coating or by a strip of metal or similar flashing).

The concrete surface is to receive a surface preparation in compliance with the specifications of Fas.67 and of Guide STER 81 (ss/dossier ST).

b) Re-profiling (the formulation of this course is to be studied and designed for this specific application field)

Re-profiling “in black” above the membrane causes no particular problem if the lengthwise profile lends itself to it (absence of concavity forming a water trap).

Re-profiling “in white” under the membrane is possible but with disadvantages linked to this type of technique (of re-profiling).

Re-profiling “in black” under the membrane can be possible with this technique (in the case of waterproofing renovation work). As for the systems of this family, this technique is expected to be advantageous and the system quite suitable to this context.

III. 5 - CHECKING COMPLIANCE

It should be remembered that the Technical Assessment is a document made available to Main Contractors to enlighten them in their choice or acceptance of a technique and, in particular, the correct adapting of the product to the desired application field so the Technical Assessment concerns a perfectly identified product, upon which standard tests are performed.

The Assessment is limited to that evaluation and the procedure does not provide for subsequent scrutiny of the manufacturer during the Assessment validity period. So it is up to the Main Contractor to perform the compliance verifications of the product procured, when compared with the product identified in Chapters I & II. Thus the compliance checks of the products on the jobsite are to be carried out in compliance with the specifications of Fas. 67, Chapter I (Art. 8.3.3.1) and the § I.2 and II.1 (as related to Tables I to IV).

The § II.1 gives the characteristics that have been recorded with the Commission at the time of the Technical Assessment request.

In case of non-compliance of the results with the elements given § II.1, it is requested that the entity concerned transmit the file for complementary analysis (IR spectrum, for example) to the Secretariat of the Commission.

III. 6 - APPLYING AND LAYING

*The Siplast-Icopal company makes the products but does not apply them. It is recommended that the applying firm **on the jobsite, possess the Application and Laying Specification Book**, prepared by Siplast-Icopal and that it provide a jobsite Quality Assurance Plan (QAP) to its customer.*

*Particularly, to avoid risk of swelling, **the thickness of the embedded aggregate coat shall be 7 cm minimum** and it is recommended to not leave the membrane without protection for more than two weeks, and for even a shorter period when the sun is strong (see § III.2).*

Furthermore, Siplast-Icopal has a Technical Department, specialised in the field of Civil Engineering to provide counselling and its assistance.

III. 7 - OTHER EVALUATION ELEMENTS

The elements concerning the Quality System made available to the Commission elicit no observations on this point (see § I.7 concerning the existence of an ISO 9000 Certification).

The data concerning the subsequent scrutiny of the manufacture, of the quality assurance operations in particular, and of the behaviour in service of the system applied, elicit no observations from the Commission.