



Test Report

**Determination of resistance to root penetration
according to EN 13948**

Product name

Gemini Garden P 4 mm

Principal/Manufacturer

**GENERAL MEMBRANE S.p.A.
Via Venezia 28
I-30022 Ceggia (VE)
Italy**

Date: 09-07-2012

The report comprises 9 pages.

Information given by GENERAL MEMBRANE SpA concerning data and characteristics of the flexible sheet Gemini Garden P 4 mm

- **Product name:** Gemini Garden P 4 mm
- **Intended use:** waterproofing of roof garden, avoiding roots penetration
- **Material code/type of material:** Polymer modified bitumen (APP)
- **Thickness of the sheeting (without lamination):** 4 mm
- **Product design/structure:** polyester nonwoven impregnated on both sides with polymer modified bitumen; finished on upper surface with talc and on the lower surface with polymeric film.
- **Supply form:** rolls having length of 5, 7.5 or 10 m
- **Manufacturing technique:** modified bitumen impregnation on both sides of polyester felt
- **Material standards / norms:** EN 13948 /EN 13707
- **Test certificates:** None
- **Year of manufacture:** 2010
- **Installation method at the test site:**
 - Overlap: approx. 80 mm
 - Jointing technique: welding by torch flame (propane gas)
 - Jointing agent: None
 - Type of joint seal: None
 - Wall corner joint reinforcing: None
- **Addition of root inhibition agents with details of concentration:**
0.5% Preventol B5

1 Problem task

In order to prevent damage protection sheets against root perforation are required to perform permanent resistance against penetration or perforation by plant roots. In this test the resistance to root damage of the flexible sheet Gemini Garden P 4 mm manufactured by GENERAL MEMBRANE S.p.A., Via Venezia 28, I-30022 Ceggia (VE), Italy, was determined.

2 Test facility and procedure

The 2 years lasting test was carried out in accordance with EN 13948 "Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing - Determination of resistance to root penetration". The test was carried out between June 2010 and June 2012 comprising 6 containers equipped with the flexible sheet to be tested. Another 2 containers without sheet were serving as control that allows to compare the plant development in the different containers. The flexible sheet was cut, jointed and installed in the containers at the test site of the Institute of Horticulture, University of Applied Sciences Weihenstephan-Triesdorf by GENERAL MEMBRANE S.p.A.. A check sample of the flexible sheet was taken and stored at the test institute. The containers were filled with growing substrate and installed in a climate-controlled glass house. Four test plants (*Pyracantha coccinea* 'Orange Charmer', a Firethorn variety) per container were planted. The final inspection included the noting of any root penetration into and through the flexible sheet.

3 Data given by the manufacturer of the sheet

The test of resistance against root perforation refers to the data and material characteristics of the tested flexible sheet and to the applied jointing and manufacturing technique. The data given by GENERAL MEMBRANE S.p.A. concerning the flexible sheet Gemini Garden P 4 mm are listed on page 2 of this report.

4 Results

4.1 Plant development

The plants performed well during the whole test period. Growth of the test plants in the control containers (without sheet) was only slightly differing from plant growth in the test containers covered by the flexible sheet Gemini Garden P 4 mm. The required minimum vigorousness of Firethorn in the test containers (80 % of the average vigorousness of growth in the control containers) was clearly exceeded (97 to 100 %). Detailed information concerning the plant growth is given in annex 2.

4.2 Penetration and perforation of roots an rhizomes

4.2.1 During testing period

The tested flexible sheet did not show any sign of root perforation during the testing period when checked through the transparent bottom of the containers.

4.2.2 At the end of test period

At the end of the test period (June 2012) the containers were emptied for a detailed check of the flexible sheet Gemini Garden P 4 mm for root penetration and perforation.

The surface and the joints of the flexible sheet did not show any penetrations or perforations caused by roots after the two-year test period.

5 Summary

In accordance with EN 13948 "Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing - Determination of resistance to root penetration" a two years lasting test was carried out with the flexible sheet Gemini Garden P 4 mm manufactured by GENERAL MEMBRANE S.p.A., Via Venezia 28, I-30022 Ceggia (VE), Italy.

The surface and joints of the flexible sheet Gemini Garden P 4 mm did not show any penetrations or perforations caused by roots after the two-year test period.

The flexible sheet Gemini Garden P 4 mm is therefore considered to be root resistant according to EN 13948.

The test on root resistance relates to the data and material characteristics as well as the applied jointing technique and manufacturing technique described on page 2 of this report.

Check samples of the tested sheet were taken and are stored at the Institute of Horticulture, University of Applied Science Weihenstephan-Triesdorf.

The test report was compiled in June 2012.

This report comprises 9 pages.

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Annex 1
Photos concerning the tested sheet Gemini Garden P 4 mm
(June 2012)



Figure 1: Sheet surface



Figure 2: Sheet surface with T joint



Figure 3: Sheet surface with wall corner joint



Figure 4: Cross-section of a joint of the membrane

Annex 2

Data on plant development

Table 1: Height and trunk diameter of Firethorn in 6 test containers

Cont. No.	Plant No.	June 2011		June 2012	
		Ø cm ¹⁾	Height cm	Ø cm ¹⁾	Height cm
1	1	1.7	227	2.3	292
	2	1.6	193	1.9	334
	3	1.9	233	2.2	336
	4	1.8	255	2.1	342
2	1	1.7	229	2.0	292
	2	1.5	225	1.9	311
	3	1.5	224	1.9	274
	4	1.8	236	2.2	344
3	1	1.9	262	2.3	284
	2	1.4	231	1.8	319
	3	1.6	211	1.9	348
	4	1.5	195	1.8	298
4	1	1.6	221	1.9	324
	2	1.6	254	2.0	301
	3	1.4	231	1.8	319
	4	1.5	221	1.9	327
5	1	1.6	211	1.9	348
	2	1.5	195	1.8	298
	3	1.6	254	2.0	301
	4	1.7	212	2.2	338
6	1	1.9	230	2.1	298
	2	1.6	205	2.0	354
	3	1.6	247	1.9	308
	4	1.6	227	1.9	299

¹⁾ Trunk diameter measured at 20 cm above substrate surface

Table 2: Average height and trunk diameter of Firethorn in 6 test containers

		June 2011		June 2012	
Cont. No.	Plant No.	Ø cm ¹⁾	Height cm	Ø cm ¹⁾	Height cm
1-6	1-5	1.63	226.2	1.99	316.2

¹⁾ Trunk diameter measured at 20 cm above substrate surface

Table 3: Height and trunk diameter of Firethorn in 2 control containers

		June 2011		June 2012	
Cont. No.	Plant No.	Ø cm ¹⁾	Height cm	Ø cm ¹⁾	Height cm
1	1	1.8	241	2.1	291
	2	1.6	235	1.9	321
	3	1.8	241	2.1	341
	4	1.7	257	2.3	343
2	1	1.6	205	1.9	327
	2	1.7	222	2.2	310
	3	1.7	218	2.1	298
	4	1.5	202	1.9	310

¹⁾ Trunk diameter measured at 20 cm above substrate surface

Table 4: Average height and trunk diameter of Firethorn in 2 control containers

		June 2010		June 2011	
Cont. No.	Plant No.	Ø cm ¹⁾	Height cm	Ø cm ¹⁾	Height cm
1-2	1-5	1.68	227.6	2.06	317.6

¹⁾ Trunk diameter measured at 20 cm above substrate surface

Table 5: Average values of height and trunk diameter of Firethorn in 6 test containers related to the values of the plants in 2 control containers (data in %, nominal value: ≥ 80 %)

		June 2010		June 2011	
Cont. No.	Plant No.	Ø %	Height %	Ø %	Height %
1-6	1-5	97	99	97	100