

**INTERNAL FIRE ENDURANCE TEST L3 IN
ACCORDANCE WITH IMO RESOLUTION A.753
(18) FOR DISCONTINUOUS FILAMENT WOUND
FIBERGLASS PIPE ND350**

Manufacturer: TECNOPLAST SRL

July 2016

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Fire Poly FPCC Coating Technical Data Sheet

ANNEX B

IMO L3 Test Report issued by Southwest Research Institute San Antonio Texas

1.0 Generality

1.1 Standards

Test was carried out according to IMO Resolution A.753(18), 22 November 1993, *"Guidelines for the Application of plastic Pipes on Ships"* Appendix 2, *"Test Method for Fire Endurance Testing of Water-filled plastic piping"*.

The test is intended to ensure that piping systems meet the fire endurance requirements of the level 3. This lowest level is considered to provide the fire endurance necessary for a water filled piping system to survive a local fire of short duration. The piping systems essential to the safe operation of the ship have to meet level 3 fire endurance standard (Fire endurance requirements matrix is presented in Appendix 4 of IMO A.753(18)).

For plastic piping systems three levels (1, 2 and 3) of fire endurance are given, level 1 being the highest and level 3 the lowest one.

Test was supervised by the representative of Consorzio Polo Tecnologico Magona Cecina (LI) Dott. Ing. Alberto Niccolini. Consorzio Polo Tecnologico Magona (CPTM <http://www.polomagona.it>) was founded in 1997, creating a research centre of excellence in the ex-industrial Magona area in the city of Cecina (LI) with the cooperation/support of Pisa University.

1.2 Description of Specimen

Pipe ND350 closed at both the ends (cap on one side and a flange connection on the other side) with a length of $1500 \text{ mm} \pm 100 \text{ mm}$, is mounted freely in a horizontal position on two V-shaped supports.

The free length of the pipe between the supports is $800 \text{ mm} \pm 50 \text{ mm}$.

The actual pipe dimensions, as measured before to start the testing, are shown in Table 1 below:

Nominal diameter	mm	350
Resistant internal diameter	mm	350
Average measured outside diameter	mm	363.8
Nominal wall thickness	mm	6.9
Measured average thickness	mm	6.95
Liner thickness	mm	1.5
Mechanical resistant thickness	mm	4.6
Outer layer thickness (Gel Coat + Fire Poly FPCC coating)	mm	0.8

Table no. 1: Table with pipe data

The ends of the pipe are closed and at one of the ends pressurized water is connected. The water inside the pipe is stagnant and the pressure is maintained at $3 \pm 0,5$ bar during the test. A relief valve is connected to one of the end closures of the specimen and the water inside the pipe is deaerated. The water temperature measured at the beginning of the test was about 20°C.



Picture no. 1: Specimen and test device

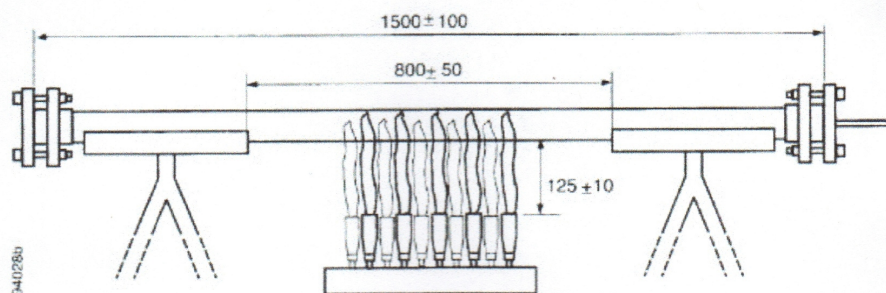
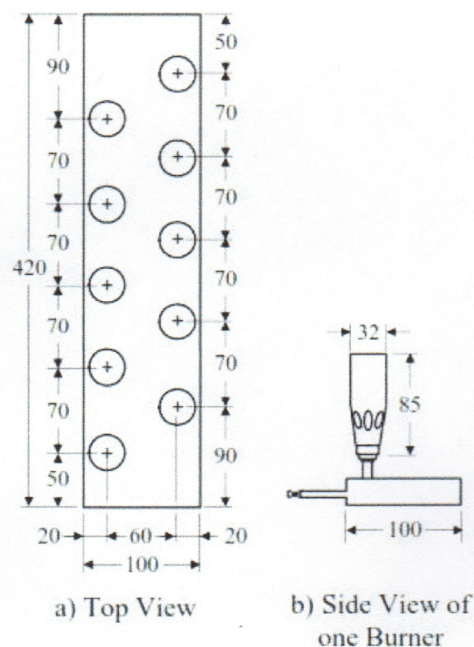


Fig no. 1: Fire Endurance Test: Stand with mounted sample (from Resolution A753 (18))

The fire source consists of 6 rows of burners (for ND350 pipe) mounted centrally below the test pipe parallel to the pipe's axis. The distance between the burner heads and the pipe is 125 ± 10 mm. A constant heat flux averaging $113,6 \text{ kW/m}^2$ ($\pm 10\%$) is maintained at the level of the bottom surface of the pipe. The gas consumption is measured at the end of the test.



Picture No. 2: Burner assembly

The duration of fire endurance test in the wet condition is 30 minutes.

After termination of the burner regulation test, the specimen is allowed to cool down to ambient temperature. Then it is tested with internal pressure of 18 barg.

The test time in the pressure tests is 15 min.

2.0 Pipe characteristics

The pipe is produced by discontinuous/reciprocal filament winding according to ASTM D3517-96 and accordingly the designation is:

Type	2	Glass fiber reinforced thermosetting polyester resin (RTRP)
Liner	1	Reinforced thermosetting internal liner
Grade	2	Vinylester resin surface liner – non reinforced
Class	C250	Pressure class (250 psi – 16 bar)
Stiffness	D	72 psi – 5000 Pa

The nominal characteristics of the pipe are the following:

- The innermost part of the liner is reinforced with 1 "C" glass surfacing veil (33 g/m²) with a glass to resin ratio 10/90 by weight and a thickness of 0.2 mm
- The second layer of the liner is reinforced with no. 2 chopped "E" glass roving mat (375 g/m²) with a glass to resin ratio of 30/70 and a thickness of 1.3 mm for a total thickness of the internal liner of 1.5 mm.
- The mechanical resistant wall is made of approximately (percentages are by weight):
 - 27% vinylester resin
 - 73% continuous glass fiber roving
- The outer coat is made by not reinforced resin + Fire Poly FPCC coating with a thickness of 0.8 mm.

3.0 Performance criteria

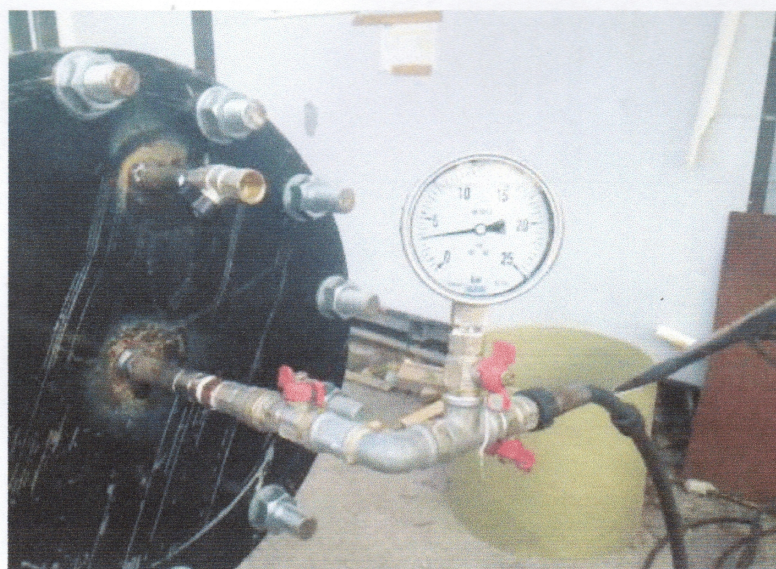
During the test, no leakage from the specimen should occur except that slight weeping through the pipe wall may be accepted.

In the hydrostatic test (after the fire test) the pressure should be held for a minimum of 15 minutes without significant leakages, i.e. not exceeding 0,2 l/minute

4.0 Observations during the fire endurance test

Time/min:s	Observation
00:00	Fire endurance test was started.
00:05	The exposed surface began to darken
00:10	Water pressure measurement: 3.2 bar
30:00	The test was terminated.

No leakage was observed during the test



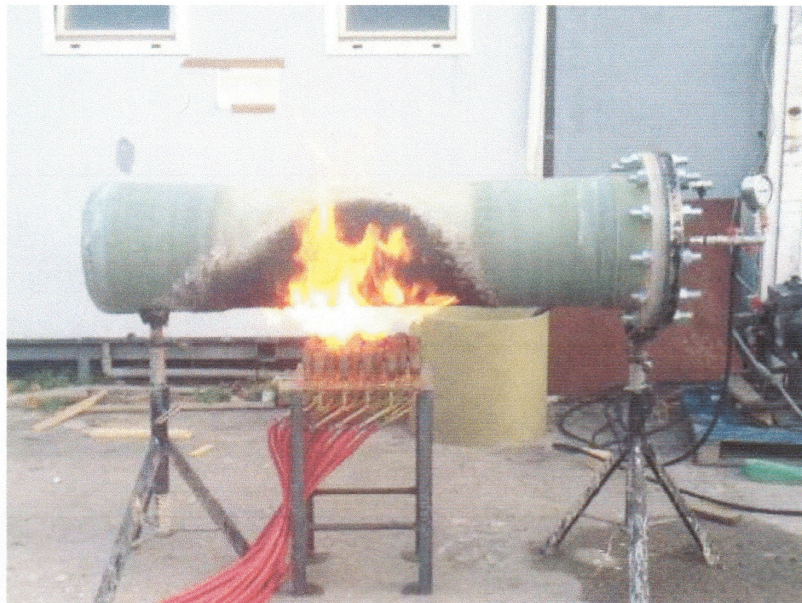
Picture No. 3: Pressure at start of the test



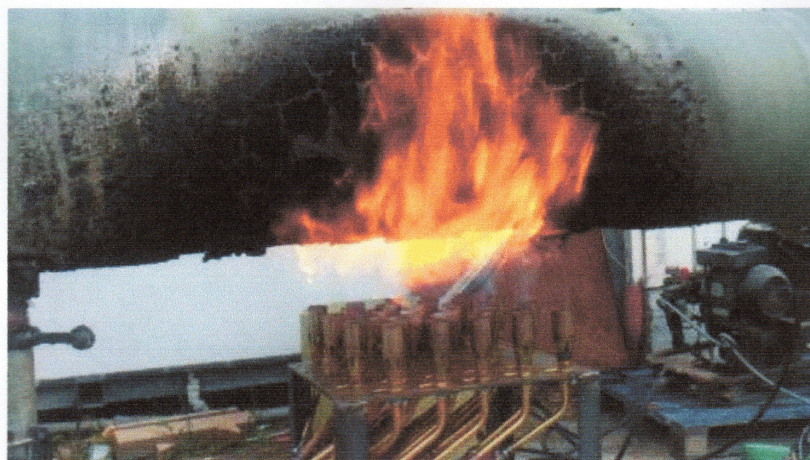
Picture No. 4: Fire endurance test. Test time 5 min.



Picture No. 5: Fire endurance test. Test time 10 min.



Picture no. 6: Fire endurance test. Test time 18 min.



Picture no. 7: Fire endurance test. Detail (Test time 18 min.)



Picture no. 8: Fire endurance test. Test time 25 min.



Picture no. 9: The test specimen after the fire endurance test. The exposed face of the pipe



Picture no. 10: The test specimen after the fire endurance test. The exposed face of the pipe

5.0 Observations during the internal pressure test

Time/min:s	Observation
00:00	Internal pressure test was started.
15:00	The test was terminated.
	No leakage was observed during the test

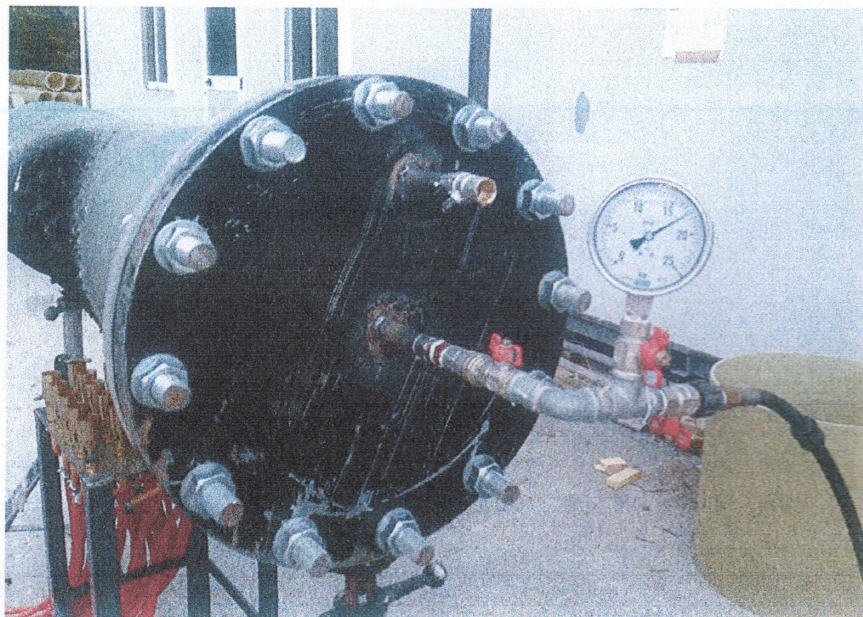
It was also observed that there was not damages or erosion of the mechanical wall of the pipe but only the external coating was damaged as appear from picture no. 10 above.



Picture no. 11: start of pressure test at 18 barg



Picture no. 12: Test Specimen during pressure test (no leakage observed)



Picture no. 13: Test Completed after 15 min (no leakage observed)

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ANNEX A

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