

TEST REPORT: P09182-T01

Gelsenkirchen, 10 January 2025

Client: Italiana Corrugati Spa
Loc. Fonte del Doglio, 22/E
61026 Piandimeleto (PU)

Test Order No.: P09182

Description of assignment: Abrasion tests on corrugated pipe

Client's Order No.: -

Date of order: 27 September 2024

This test report consists of five pages.

The test results relate solely to the objects tested. This test report may be copied or reproduced in part only with the express written approval of IKT - Institute for Underground Infrastructure gGmbH.



Dipl. Ing. Dieter Homann
(Director Materials Testing)

Specimens

Specimen designation	Received on	Specimen prepared by	Description of the test specimen according to the client's specifications
IKT			
L8761-2	15.10.2024	Manufacturer	Polyethylene (PE) pipe DN/OD 315, SN 8, UNI EN 13476-3 Product name: Magnum Black

Tests performed

	Type of test	Test standard	IKT Specimen No.
1	Abrasion test in the Darmstadt tilting apparatus with 200.000 load cycles and with an additional evaluation after 100,000 load cycles	With reference to DIN EN 295, Part 3	L8761-2

1. Inducement

The IKT - Institut für Unterirdische Infrastruktur, was assigned by the company Italiana Corrugati Spa on 27 September 2024 with the abrasion test on a Magnum Black PE-Pipe DN/OD 315, SN8. The test was carried out in the time from 12 December 2024 to 03 January 2025 in accordance with DIN EN 295-3 with the Darmstadt tilting apparatus with 200,000 load cycles.

2. Abrasion test in the Darmstadt tilting apparatus (With reference to DIN EN 295, Part 3)

Abrasion resistance is tested in the Darmstadt tilting apparatus according to DIN EN 295, Part 3 on a 1 m long DN/OD 315 half shell.

The base line inside the pipe is usually measured at seventy-one points along a length of 700 mm for determination of depth of abrasion. 150 mm in the boundary area at the ends of the specimen are not included in the evaluation, since practically no abrasion occurs here, due to the nature of the test procedure. The measured abrasion data are recorded using an indicating gauge.

As polyethylene half-shells are very flexible and can deform during the test and thus influence the measurement results, they are stiffened at two points with cross beams/struts. In the case of small diameters, such as DN/OD 315, the abrasion cannot be measured at these points.

With reference to DIN EN 295, Part 3, a 5,0 kg quantity of a mixture of sand and gravel (natural, non-crushed round-particled quartz gravel) is put into the pipe half-shell. Water is then added up to a depth of 38 ± 2 mm.

In accordance with DIN EN 295, Part 3, the grading curve of the sand/gravel mixture meets the following requirements:

$$M_p = d_{50} = 6 \text{ mm}$$

$$U = d_{80} / d_{20} = 8.4 \text{ mm} / 4.2 \text{ mm} = 2$$

in which:

M_p Mean particle size [mm]

U Coefficient of uniformity

$d_{80} / d_{50} / d_{20}$ Particle size than which 80, 50, 20 % (parts by mass) of the gravel are smaller, in [mm].

The specimen is alternately tilted by $\pm 22.5^\circ$ in its longitudinal direction (20 cycles per minute), causing the movement of the mixture of sand, gravel and water to generate an abrasive action. The specimen is removed from the apparatus after 100,000 load cycles and the abrasion on the base line is measured. The test specimen is then reinstalled in the tilting apparatus and a further 100,000 load cycles are carried out. After a total of 200,000 load cycles, the test specimen is then removed and measured again.



Figure 1: Sand/gravel/water mixture in the half shell before testing



Figure 2: Testing in the Darmstadt tilting apparatus

3. Test results

Measuring the abrasion in the base of the half-shell with a measuring gauge (accuracy better than $\pm 0.03 \text{ mm}$) using a measuring bridge shows a slight abrasion of the base. The measured values after 100,000 and 200,000 load cycles are shown in the graph in Figure 3 for the measuring points over the length of the pipe. The analysis of the measured values resulted in an average abrasion of 0.30 mm after 100,000 cycles and of 0.62 mm after 200,000 cycles (s.a. Table 1).

Table 1: Results of the abrasion test

IKT Sample No.	Specimen designation	Mean abrasion after 100,000 load cycles [mm]	Mean abrasion after 200,000 load cycles [mm]
L8761-2	PE-Pipe Magnum Black DN/OD 315, SN8	0,30	0,62

Order No.: P09182
Sample-Id.: L8761-2

Client: Italiana Corrugati Spa
Material: Magnum Black

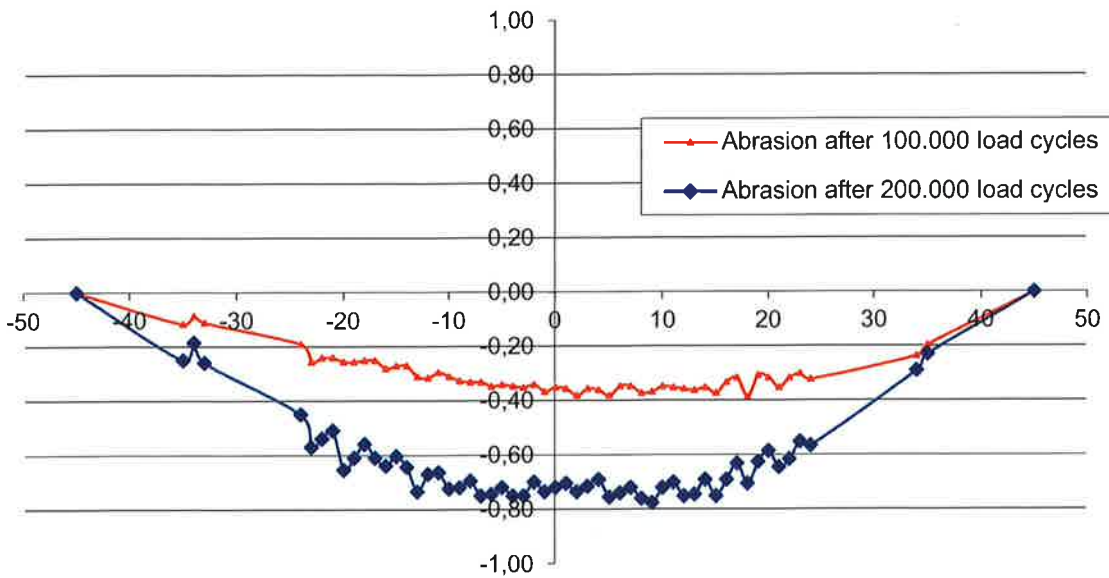


Figure 3: Abrasion after 100,000 and 200,000 load cycles

The following figures 4 and 5 show the half-shell after completion of the test.

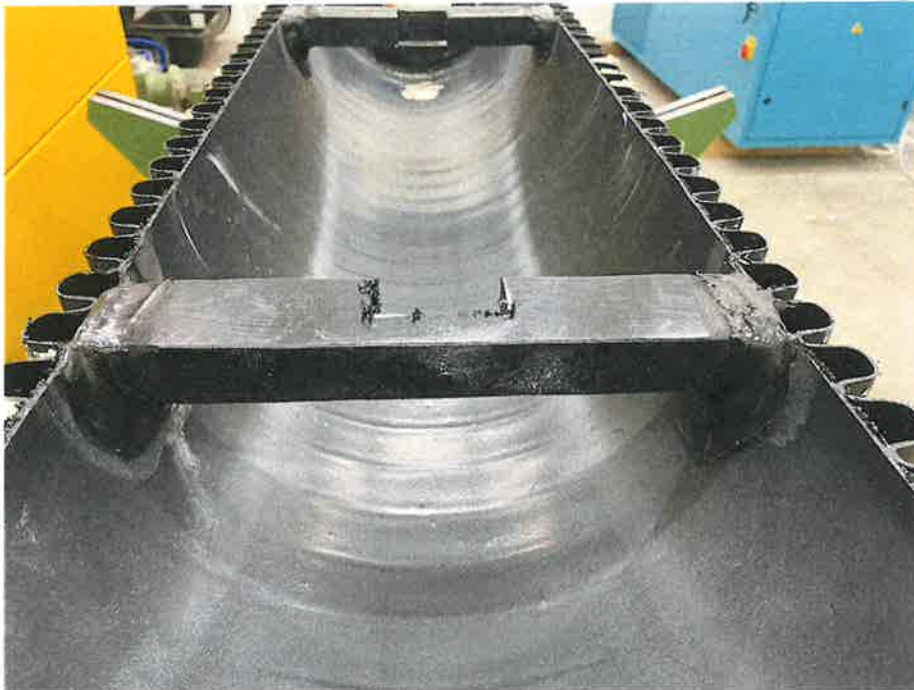


Figure 4: View into the half shell after 100,000 load cycles

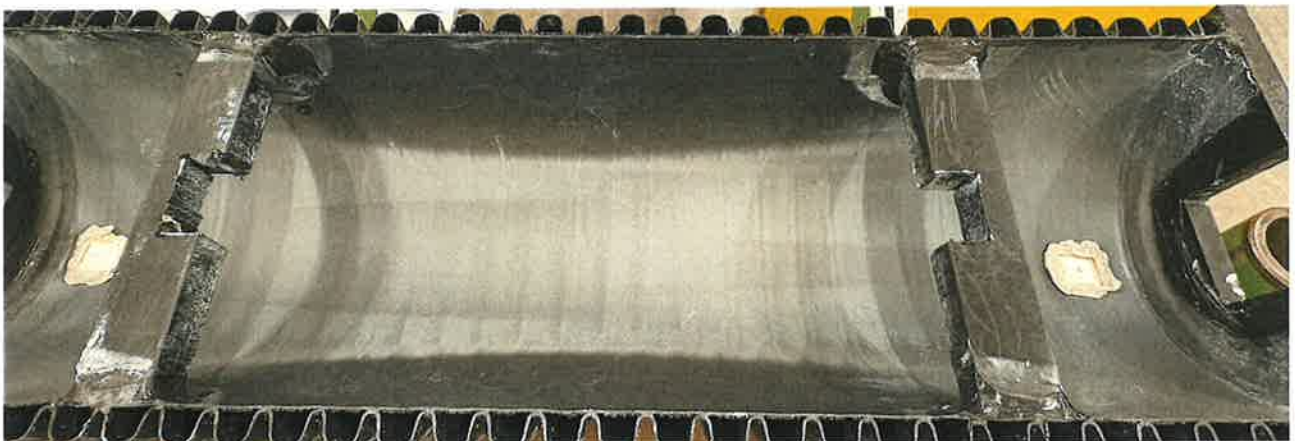


Figure 5: View into the half shell after 200,000 load cycles