INSTITUT FÜR WASSERBAU UND WASSERWIRTSCHAFT
VERSUCHSANSTALT FÜR WASSERBAU

Technische Universität Darmstadt, Rundeturmstrasse 1, D-64283 Darmstadt

ABRASION TEST ACCORDING TO EN 295 - 3

Report No.:	**666Z / 04 (Pipe1)**
Pipe material:	**Polyethylene**
Type of pipe:	**SLOW FLOW, corrugated**
Nominal width:	**DN 280**
Manufacturer:	**ITALIANA CORRUGATI**
Request of:	**Italiana Corrugati, Ms. Gasparotto, asked for an abrasion test by Email, dated 14th September 2004. The pipe to be tested was made of PE. The inner pipe diameter was 280mm.**

Result:

The test was made according to EN 295 part 3. The test method had been developed by our laboratory and is well known as "Darmstadt method". This corresponds to the tests which are required by national regulations for several kinds of plastic pipes, e.g. polyester, PVC or glass reinforced plastic pipes. The half pipe, supplied by ITALIANA CORRUGATI, was tested during 400.000 cycles to ensure reliable results. Each test was interrupted at 25-, 50-, 75-, 100-, 150-, 200-, 300-, and 400-thousand cycles and the abrasion was measured (see annex).

Photos of the pipe at the beginning, in the course and at the end of the abrasion test are given in the annexes 2.1, 2.2 and 2.3. An abrasion effect is not visible on the pictures.

Annex 3 shows a plot of the average abrasion a_m, measured during the tests, versus the number of cycles. For the tested pipe the average abrasion value was determined in three different ways. First the average abrasion value was determined from abrasion values which were taken in intervals of 10mm along the inside of the pipe (method A, standard). Secondly the average abrasion value was determined by analysing the minimum and maximum values of the corrugation of the pipe inside wall (method B). Finally the average abrasion value was determined from measurements that were taken in intervals of 1mm along the inside of the pipe (method C: for method C the measurement was carried out only after 100-, 200-, 300-, and 400-thousand cycles). The measurements can be described by quadratic functions.

Method A: $a_{m\,(10mm)} = -3.4*10^{-7}*(cycles/1000)^2 + 0.00015*(cycles/1000)$.

Method B : $a_{m\,(min\text{-}max)} = -2*10^{-7}*(cycles/1000)^2 + 0.0001*(cycles/1000)$.

Method C : $a_{m\,(1mm)} = -2*10^{-7}*(cycles/1000)^2 + 0.00009*(cycles/1000)$.

From this the abrasion after 100.000 load cycles can be calculated to

Method A: $a_{m\,(10mm)}^{100} =$ 0.01mm,

Method B: $a_{m\,(min\text{-}max)}^{100} =$ 0.01mm,

Method C: $a_{m\,(1mm)}^{100} =$ 0.01mm.

The measured value of abrasion after 100.000 load cycles were

Method A: $a_{m,\,measured\,(10mm)}^{100} =$ 0.01mm,

Method B: $a_{m,\,measured\,(min\text{-}max)}^{100} =$ 0.01mm,

Method C: $a_{m,\,measured\,(1mm)}^{100} =$ 0.01mm.

In addition to the average abrasion value the maximum and minimum abrasion value at the corresponding load cycle could be used to find a statement about the condition of the inner layer. Such an interpretation is not required by the standard. Because of the higher dependency of minimum and maximum values on the kind of strain compared to the dependency of the average values, these values yield only limited information about the pipe material and the type of pipe.

In annex 3.2 a table with the maximum, minimum and average abrasion values is given, that are nearly proportional to each other.

The tested pipe did not show an explicit abrasion value after 400.000 cycles. This may be caused by the deposition of finer material in both end-zones of the tested pipe (see annex 2.2 and 2.3). The finer material deposits in the depressions of the wall structure. The gravel-sand-water mixture as well as the wall structure is modified. Therefore the test conditions are not exactly the same as the conditions for abrasion tests of pipes with a smooth inner layer.

Darmstadt, 15th of March 2005

P. Mewis

(Dr.-Ing. P. Mewis)

Annex:

1. Extract from EN 295 part 3, Measurement device
2. Pictures of the new pipe, after 50.000 cycles and after 400.000 cycles
3. Diagrams, abrasion and wall thickness as a function of cycles