

POLYPLASTIC RESEARCH INSTITUTE

HAS IMPLEMENTED ISO 9080:2012 METHOD OF DETERMINATION OF THE LONG-TERM HYDROSTATIC STRENGTH OF PIPE GRADES OF POLYMERS

POLYPLASTIC Research Institute together with accredited laboratories of Klimovsk Pipe Plant and AND Gaztrubplast Plant has mastered and implemented a method of evaluation and the long-term strength forecast for thermoplastics used for pipes production, including pipes reinforced with high-tensile yarns.

The method is based on a number of international and Russian stan-

dards [1–5] which specify the requirements for materials and pipes and methods of determination of the long-term strength and of operational properties of pipelines by testing pipe sample pieces for internal hydrostatic pressure.

ISO 9080-2012 “Plastics piping and ducting systems – Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form

by extrapolation” is a basic standard specifying the test method and statistical treatment of test results. According to this standard, tests are carried out on samples in pipe form made of material under consideration to determine the value of the long-term hydrostatic strength. This International Standard provides a definite procedure incorporating an extrapolation method using test data (time to samples failure) at three or four different test temperatures. For example, tests of HDPE pipe test pieces should be carried out at 20°C, 60°C and 80°C.

For each temperature selected, a minimum of 30 observations shall be obtained, spread over the testing time 10–7000 hours. Internal pressure levels shall be selected such that at least four observations will occur above 7,000 hours and at least one above 9,000 hours.

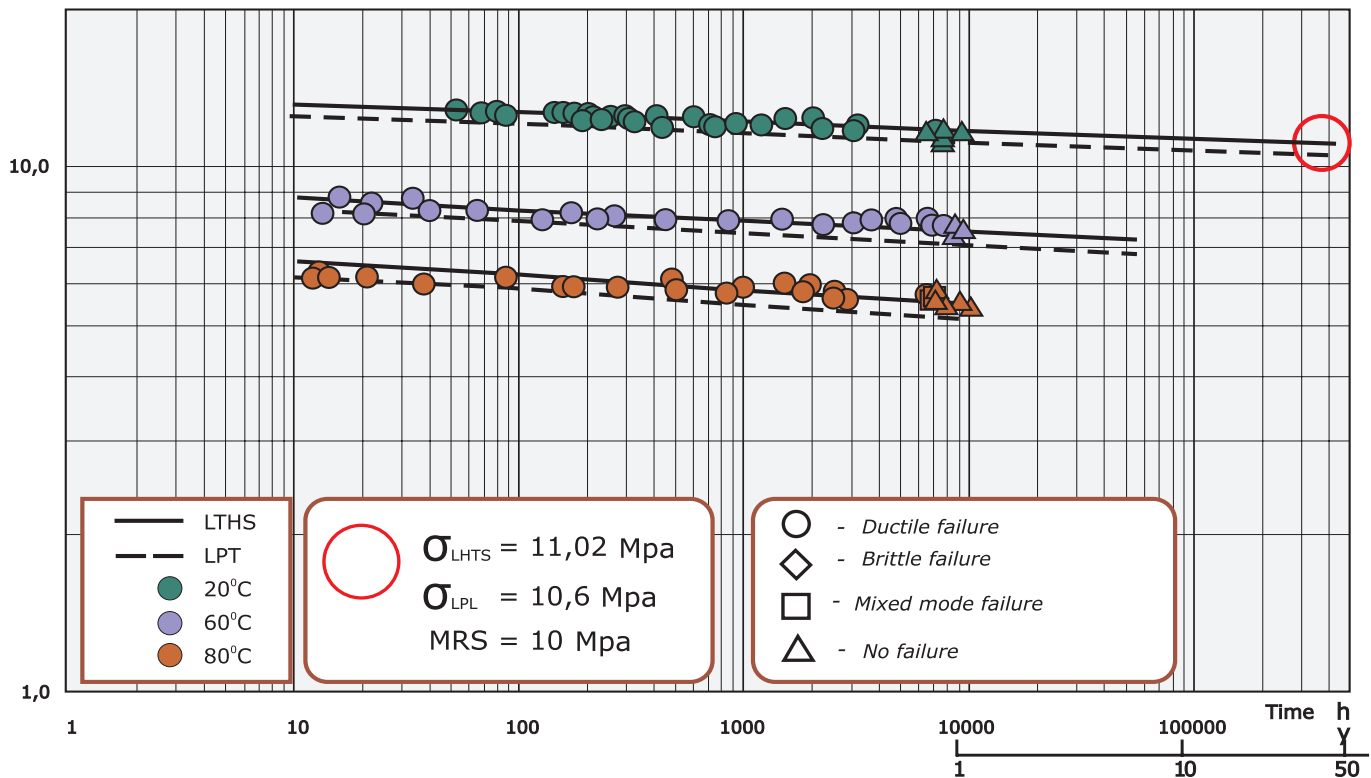
It should be noted, that test equipment should ensure $\pm 1^\circ\text{C}$ the water temperature maintenance accuracy and $-1...+2\%$ of the pressure maintenance accuracy constantly up to the time of failure. Besides, each pipe sample piece should be pressurized individually with internal pressure generating a strictly definite stress in the pipe wall.

Accredited laboratories of POLYPLASTIC Group have all necessary



Tension, Mpa

Minimum required strength of PE 6949C produced by Nizhnekamskneftekhim OJSC



test equipment meeting entire requirements in accuracy and precision of measurements.

Test data are analysed by regression analysis according to standard [1] or a similar current home standard [5]. The results of this analysis are expressed in equations of the temperature- and time-dependence of the average value of the long-term hydrostatic strength σ_{LHTS} and lower limit of long-term strength confidence interval σ_{LPL} .

The derived equation of the temperature- and time-dependence of strength is used for determination of the minimum residual strength defined as MRS, which serves for classification of material under consideration according to standard [3] or for calculation of operational properties of the pipeline including variable operational conditions according to standard [6].

Strict observance of test precision conditions (temperature and pressure maintenance accuracy) and of statistical treatment of test results, using software packages for the stress-rupture calculations, recommended by

standard [1] allows determination of strength properties of the pipe materials with 97,5% probability by extrapolating them to given operating life, for example for 50 years.

The described above test method was used for classification and further certification of the following HDPE pipe grades that are widely used at present:

- PE 4PP25B – produced by Stavrolen LLC as PE80 grade;
- PE 6949C – produced by Nizhnekamskneftekhim OJSC as PE100 grade;
- PE 2HT11-9 – produced by Kazanorgsintez OJSC as PE100 grade.

The monitoring tests for hydraulic strength carried out during the outgoing inspection of pipes from each production-run confirm the reliability of the standard extrapolation method (SEM) and accuracy of control test parameters and equipment settings.

The below figure is a graphical presentation of the results of the SEM analysis for PE 6949C.

References:

1. Plastics piping and ducting systems – Determination of long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation // ISO 9080:2012.
2. Plastics pipes and fittings – Reinforced thermoplastics pipe systems for the supply of gaseous fuels for pressures up to 4 MPa (40 bar) // ISO/TS 18226:2006.
3. Multilayer piping systems for hot and cold water installations inside buildings // ISO 21003:2008.
4. Thermoplastics materials for pipes and fittings for pressure applications – Classification, design coefficient, and designation // ISO 12162:2009.
5. Plastic pipes. Determination of long-term hydrostatic strength of the samples by extrapolation//GOST R 54866-2011 (ISO 9080:2003).
6. Plastics pipes for conveyance of fluids under pressure. Miner’s rule. Calculation method for cumulative damage. EN ISO 13760:1998.