Back-pressure valves for faecal sewage pumping stations

Part I. Interpretation of standards and description of the first testing environment for back-pressure knee valves

Mirosław Szuster

Introduction

This article deals with the testing environment for valve examination, compatible with the requirements of valid standards.

Due to the scope and complexity of the matter, the author of the article has concentrated only on the part of testing equipment which handles faecal sewage and produces the biggest difficulties related with interpretation of the PN-EN 12050-4 and PN-EN 12050-1 standards [1].

The difficulties stem from a lack of a laboratory recognized as capable of performing preliminary examinations of products included in the conformity evaluation system 3, as well as the scope of the above mentioned standards. Conformity evaluation of back-pressure valves covered by the PN-EN 12050-4 standard should be performed, according to section 9, after completion of all property tests featured in table Z.1 of attachment Z of the above mentioned standard.

Interpretation of PN-EN 12050-4 and PN-EN 12050-1 standards

In order to perform a correct interpretation of terms of reference of the PN-EN 12050-4 standard (titled 'Sewage pumping stations in buildings and their surroundings. Construction rules and examinations. Part 4: Back-pressure valves for faecal and non-faecal pumping stations) the scope of the following related standards had to be precisely analyzed: PN-EN 1074-3 (Waterworks fittings. Operating requirements and control tests. Part 3: Back-pressure equipment) and PN--EN 12334 (Industrial fittings. Back-pressure cast iron fittings…).

The analysis has evidently proved that all back-pressure valves are excluded from the scope meant for prevention of reverse flow of effluents and used for the purposes of environmental protection which are covered by other standards. Therefore, back-pressure valves meant for surface and underground waterworks transferring drinking water, as well as back-pressure cast iron valves used mainly for general and industrial purposes, can be applied in other systems, if appropriate standards related with their operation are fulfilled.

Due to the fact that complicated and considerably alternating conformity evaluation procedures are, with regard to back-pressure valves for faecal sewage, including type examination, performed by a notified laboratory in terms of these standards, the testing environment has to be specially designed for this purpose.

Correct designing of such an installation was hindered by mistakes made in the translation of the standards. As it occurred, the contents of attachment Z of the PN-EN 12050-4 and 1, 2, 3 standard is not exactly consistent with the contents of EN 12050-4 [2].

The official versions of the corrected attachment Z contents for the above mentioned standards, carrying the status of national standards, should be published in a few weeks. This applies first to the product conformity evaluation procedure Z.2, in particular to point Z.2.1 'Confirmation of conformity'; there the contents of the PN-EN 12050-4 standard currently is translated as follows:

'ATTENTION: as it is stated in attachment III.2(ii) of directive no. (89/106) Building Products, the second option for product declaration of conformity by the producer (this is, conformity confirmation according to system 3), should be based upon the following:

a) ***a preliminary examination performed by an accredited laboratory,***

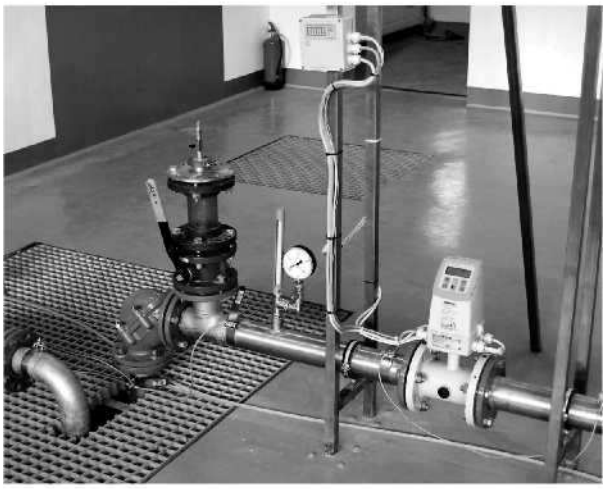
Property in the mandate	Location in the corresponding European Standard	Level(s) recommendation(s) and/or durability class(es)	Notices
Effectiveness	5	N/A	Test according to 8.2.1,8.2.2, 8.2.3, 8.2.6
Noise level	Attachment A	N/A	Badać zgodnie z załącznikiem A
Durability	4.2,5.2,5.9,6	N/A	

Table 1 – Sections in the standard referring to properties determined in the mandate (Polish Standard is its current name).

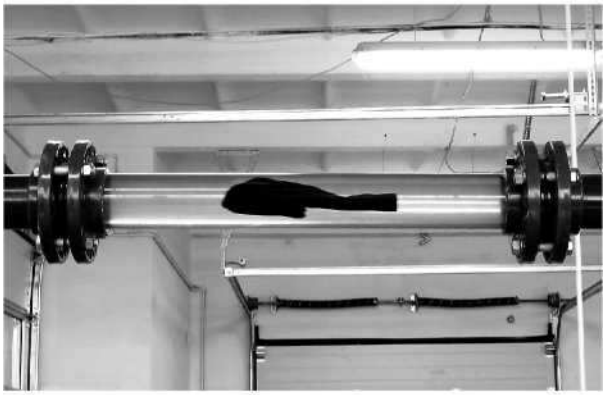
Właściwość podana w mandacie	Rozdział w niniejszej normie europejskiej	Poziom(-y) i/lub klasa(-y) wytrzymałości w mandacie	Notices
Water tightness	4	N/A	Test according to 8.2.4, 8.2.5
Effectiveness	5	N/A	Test according to 8.2.1,8.2.2, 8.2.3, 8.2.6
Noise level	attachment A	N/A	Test according to attachment A
Durability	4,6	N/A	

Table 2 – Sections in the standard referring to properties determined in the mandate (correct translation of the European standard).

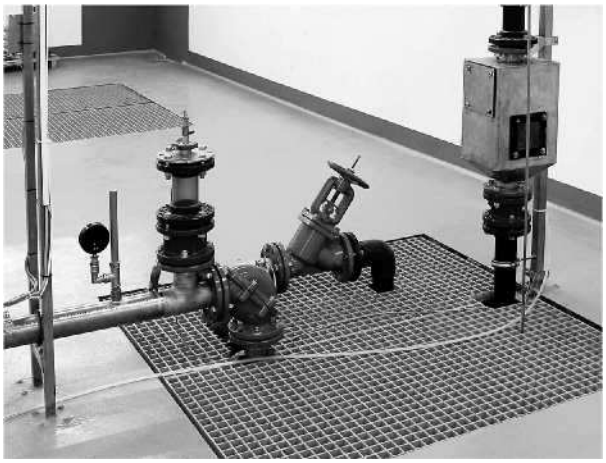
Fot. 1



Fot. 2



Fot. 3



Fot. 4

b) local production quality control.

In the preliminary examinations of products included in system 3, the task of an authorized laboratory is to examine all the properties defined in table Z.1. Conformity evaluation of a ***pumping station,*** *covered by the standard, should be performed according to chapter 9'.*

ATTENTION: as it is stated in attachment III.2(ii) of directive no. (89/106) Building Products, the second option for product declaration of conformity by the producer (this is, conformity confirmation according to system 3), should be based upon the following:

a) a preliminary examination performed by an officially recognized laboratory,

b) Local production quality control.

In the preliminary type examinations of products included in system 3, the task of an authorized laboratory is to examine all the properties defined in table Z.1. Conformity evaluation of a ***back-pressure valve,*** *covered by the standard, should be performed according to chapter 9'.*

Attention: according to EU regulations introduced into national legal systems, a notified laboratory in terms of a given standard is mentioned in the conformity evaluation system 3.

The relevant discrepancies in both translations have been marked with bold font.

Furthermore, it occurred that there are serious translation mistakes in Table Z.1 of attachment Z of the PN-EN 12050-4 standard and one of the examined properties has been overlooked, namely 'Water tightness', according to section 4 and points 8.2.4, 8.2.5 of this standard.

The contents of table Z.1 from the Polish Standard (PN-EN 12050-4) [1] in its current form is presented in table 1, while the contents of the European standard (EN 12050-4) [2], after their appropriate translation are specified in table 2.

Laboratory

Finding a laboratory suitable for the performance of a preliminary examination, notified in terms of EN 12050 1, 2, 3 and 4 standards, is not an easy task.

As it occurred, such a facility is not to be found in Poland; neither does any national laboratory want to be notified in this scope.

The only solution for national producers is to perform the tests at foreign laboratories.

The author of this article was genuinely surprised that as many as four such labs can be found in the Czech Republic, a country which is few times smaller than Poland with respect to area and population.

A certain barrier and obstacle in co-operation with a foreign notified laboratory is the translation of all documents related to the product conformity evaluation procedure.

As a language of communication between the parties, being commonly known in Europe, English can be used. This can subsequently facilitate possible declaration of conformity translations (Z.2.2 Declaration of conformity – 'Declaration should be issued in the language of the countries using the product' - PN-EN 12050-1, 2, 3, 4) and the product user guide for the purpose of its distribution in other member countries and outside the unified EU market.

EkoWodrol examination equipment

The testing environment described below is a result of the introduction of many years of the author's experience gained with respect to construction and examination of knee valves according to European harmonized PN-EN 12050- 1, 2, 3, 4 standards, valid in Poland since December 2002.

The testing environment for back-pressure ball valves is presented in pictures 1, 2, 3, 4

after the first stage of construction.

Picture 1 presents the testing equipment in a general view with covered back-pressure knee valves of the SZUSTER system in upper and lower positions.

A part of the testing system is presented in picture 2, together with a knee valve (without a ball) in the role of a joint with an observation cover. There is an **insertion unit for test material** located behind it.

Attention: for testing purposes of back-pressure knee valves, the test material is not inserted via the pump located in the well (under a yellow platform grating), but through the insertion unit located on the pumping line between the pump and the examined back-pressure valve.

Such location of the test material insertion provides reliable results in the case of back-pressure knee valves used in pumping stations equipped with indirect separation of solids, known in Poland as 'sewage presses'.

In this type of test material insertion, it is not subjected to any significant deformation or shredding by the pump rotor, which reflects also the real conditions existing in a sewage press.

Additionally, an installed thermometer and pressure meter unit is visible in picture 2, as well as a flow meter calibrated in m^3/h behind it, connected with a flow speed meter calibrated in m/s.

After stabilizing the flow speed tp the level of 0.7 m/s the test material is inserted through the insertion unit, and after passing through the examined valve it flows through the upper pipe of the pumping pipeline. As an objective of the observation of test material, the upper part of the pipeline was made of transparent pipe, as shown in picture 3. Then the test material is caught on a grating located in the test material trap tank, which is equipped with a removable cover and a transparent observation window, as presented in picture 4.

The examination system is meant also for research of water flow resistance conformity against the PN-EN 1267 standard. Thus, there is the possibility to find the flow resistance coefficient ζ in conditions existing in reality, as the pumping system is made of stainless steel, and the examined valves are connected with loose collars which is commonly applied in practice.

Summary

This article describes only a part of the testing system (its first stage of construction) related to examination of back-pressure ball knee valves meant for faecal sewage pumping stations, and the chosen matters only sketch the complexity of problems encountered by companies applying the above mentioned standards in business practice. This leads to the conclusion that only some companies producing back-pressure valves should specialize in the production of back-pressure valves for faecal sewage pumping stations. This applies especially to back-pressure ball valves, which generally cannot meet the required properties mentioned in section 5 of the PN-EN 12050-4 standard, in particular point 5.3, according to point 8.2.3, 8.4 and 8.5 of the PN-EN 12050-1 standard. Due to this reason, there are no back-pressure ball valves which would pass the test material (made from new floor canvas 0.4 m x 0.25 m = 0.1 m^2, dry weight of 40g +/- 5 g cut on the entire circumference and kept in water for 24 hours) flowing through the valve at a flow speed in the outlet equal 0.7 m/s. In order to prevent rolling of test material around the ball, the valve must be fully open or almost fully and the main current must be passing by the ball only from one side (in the position of full opening or almost full opening of the valve). So far, there is only one such type of a back-pressure ball valve on the market, known as 'back-pressure knee ball valve of the SZUSTER system' described more widely in issue no. 2/2005 (117) of the magazine PUMPS and PUMPING STATIONS. Apart from the mentioned back-pressure knee ball valve, only back-pressure flap valves successfully pass the tests, especially the ones with a rubber disc in its preferred location on a horizontal or inclining pipeline. This is possibly thanks to the fact that the main flowing current in a flap valve passes only from one side.

Clinging of solid fibrous elements is a basic disadvantage of the flap valves (contributing to the creation of so called plaits) in the area of flap hinges fixing to the body of the valve, as well as vulnerability of the flap to mechanical disorders, including its detachment and damage of the rubber insulating edge of the rubber flap disc.

LITERATURE:

1. PN-EN 12050-1, 2, 3, 4 and PN--EN 1267 standards (Industrial fittings, examination of water flow resistance).
2. EN 12050-4
3. M. Szuster. Testing system project – stage one.
4. Pictures of a testing system in the laboratory of *EkoWodrol* Sp. z o. o. Company in Koszalin.

Author:

MA Mirosław Szuster is the owner of THE 'SZUSTER' TECHNICAL WORKSHOP and an engineer for production and development in the EkoWodrol Sp. z o. o. Company in Koszalin.

Contact:

e-mail:mirosław@szuster.pl
or miroslaw. szuster@ekowodrol. pl
mobile 0 607 266 751

In the next article of the series, the author will deal with subject matters related with the examination of back-pressure knee valves, especially with regard to their type and conformity evaluation.