EUROPEAN ASSESSMENT DOCUMENT

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FLEXIBLE SPRINKLER HOSE WITH END FITTINGS

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This European Assessment Document (EAD) has been developed taking into account up-to-date technical and scientific knowledge at the time of issue and is published in accordance with the relevant provisions of Regulation (EU) 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

The construction products covered by this EAD are pressure-tight flexible hoses for use in wet and dry automatic sprinkler systems (flexible sprinkler hose).

The flexible sprinkler hose with end fittings comprises a stainless steel or convoluted PTFE inner bellows and stainless steel braided metallic outer jacket with metal end fittings and mounting hardware (e.g., clamps, beams, struts, mounting blocks, screws/bolts) to allow for installation into the appropriate location (e.g., clean room, commercial suspended ceiling, duct). Straight or angled end fittings may be attached to suit sprinkler threads and applications appropriately.

The product is not covered by a harmonised European standard (hEN).

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

Relevant manufacturer's stipulations having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA.

1.2 Information on the intended use(s) of the construction product

1.2.1 Intended use(s)

Flexible sprinkler hose with end fittings are intended to allow the connection of sprinklers in a clean room, commercial suspended ceiling, duct or other location in a land-based building or structure to rigid pipework within a wet or dry automatic sprinkler system.

1.2.2 Working life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of the flexible sprinkler hose with end fittings for the intended use of 25 years when installed in the works provided that they are subject to appropriate installation and maintenance (see 1.1). These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works[1].

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

[1] The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than referred to above.

1.3 Specific terms used in this EAD

1.3.1 Attachment

Method of joining end fittings to a flexible metal hose.

1.3.2 Braid

Tubular woven stocking of metal wires used to provide pressure strength and/or external protection.

1.3.3 Clean Rooms

A clean room is an enclosed space in which airborne particulates, contaminants, and pollutants are kept within strict limits.

1.3.4 Cold Storage

A cold storage is an enclosed thermally insulated space in which the temperature is kept below within strict limits at a temperature normally below 4° C. Such applications are by necessity served by a dry type sprinkler system.

1.3.5 Corrosion Resistant

Flexible sprinkler hose with end fittings may be termed corrosion resistant if its surface exhibits equivalent resistance to aqueous corrosion as steel pipe which is coated with zinc.

1.3.6 Corrugated Metal Hose

Pressure-tight hose with corrugations, helicoidally (formed or arranged in a spiral) or annular (formed in a ring) to the axis of the hose. Made by deforming the metal, the corrugations provide flexibility.

1.3.7 Discharge Coefficient (K-Factor)

The coefficient of discharge as expressed in the equation:

$$K = \frac{Q}{P^{1/2}}$$

Where *Q* is the flow in litres per minute (l/min) and *P* is the pressure in kPa.

1.3.8 End Connection

The fitting or component used to connect a pipe system or an individual sprinkler to the flexible sprinkler hose.

1.3.9 End Fitting

Permanently attached fitting which allows metal hose to be connected to other components.

1.3.10 Flexibility

The capability of a metal hose to be repeatedly bent elastically during operation.

1.3.11 Minimum Bend Radius

The minimum radius, expressed in millimetres (mm), specified by the manufacturer, at which a hose is designed to operate.

1.3.12 Metal Hose Assembly

Assembly of a metal hose with its end fittings.

1.3.13 Pendent Sprinkler

An automatic sprinkler designed such that the water exiting its orifice is directed downward against the deflector.

1.3.14 Rated Working Pressure

The maximum sustained pressure at which the flexible sprinkler hose with any end connection is intended to operate.

1.3.15 Sidewall Sprinkler

An automatic sprinkler intended for installation near a wall and ceiling interface and designed to discharge water horizontally outward and onto adjacent walls.

1.3.16 Suspended Ceiling

A ceiling in which the main runners and cross furring are suspended below the structural members of the building.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

All undated references to standards or to EAD's in this EAD are to be understood as references to the dated versions listed in chapter 4.

2.1 Essential characteristics of the product

Table 2.1.1 shows how the performance of flexible sprinkler hose with end fittings is assessed in relation to the essential characteristics.

Table 2.1.1 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 2: Safety in case of fire			
1	Fatigue	2.2.1	Level/Description
2	Vibration	2.2.2	Level/Description
3	Resistance to Pressure Cycling	2.2.3	Level/Description
4	Resistance to Vacuum Test	2.2.4	Level/Description
5	Friction Loss (Equivalent Length of Pipe)	2.2.5	Level
6	Hydrostatic Strength	2.2.6	Level/Description
7	Seal Integrity	2.2.7	Level/Description
8	High-pressure Flow	2.2.8	Description
9	Elongation	2.2.9	Level
10	Reaction to Fire	2.2.10	Class

2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

This chapter is intended to provide instructions for TABs. Therefore, the use of wordings such as "shall be stated in the ETA" or "it has to be given in the ETA" shall be understood only as such instructions for TABs on how results of assessments shall be presented in the ETA. Such wordings do not impose any obligations for the manufacturer and the TAB shall not carry out the assessment of the performance in relation to a given essential characteristic when the manufacturer does not wish to declare this performance in the Declaration of Performance.

Testing will be limited only to the essential characteristics which the manufacturer intends to declare. If for any components covered by harmonised standards or European Technical Assessments the manufacturer of the component has included the performance regarding the relevant characteristic in the Declaration of Performance, retesting of that component for issuing the ETA under the current EAD is not required.

2.2.1 Fatigue

Prior to the fatigue test, the test assembly shall be filled with water and subjected to a hydrostatic strength test equal to the rated working pressure or 1205 kPa whichever is the higher. The test shall be conducted for a duration of five minutes. The test shall be ceased if the sample exhibits leakage or rupture at this time.

The fatigue test shall be conducted in general accordance with the EN ISO 10380 “U-Bend” test method for Type 1-50 hoses of hose sizes up to and including DN 100. A minimum of two samples of flexible sprinkler hose with fittings, of the longest size submitted for assessment, shall be subjected to 50,000 cycles of repeated flexing at a rate of 5 cycles/minute to 15 cycles/minute in a direction parallel with the axis of the end fittings while pressurized to their rated working pressure, as shown in Figure A1. The sample hose shall be mounted in a U shape with the end fittings at a horizontal distance from each other of twice the minimum bend radius stated in EN ISO 10380 Table 8 unless the manufacturer states a smaller bend radius in which case a distance of twice the minimum bend radius, r, of the hose, stated by the manufacturer shall be used. One end of the sample shall be held in a fixed position and the other end shall be flexed in the vertical plane a distance of 4 times the nominal hose diameter above and below the position of the fixed end for a total vertical movement of 8 times the nominal diameter.

After completion of 50,000 cycles, the samples shall be subjected to the hydrostatic post-test as detailed in Clause 2.2.6 (Hydrostatic Strength).

The ETA shall report any deterioration of the flexible sprinkler hose with end fittings or its performance characteristics following fatigue testing and any leakage, rupture, cracking, permanent distortion or deterioration of the Flexible sprinkler hose with end fittings when subsequently tested in accordance with Clause 2.2.6 (Hydrostatic Strength) and the manufacturers specified bend radius if it is smaller than that stated in EN ISO 10380.

2.2.2 Vibration

A flexible sprinkler hose with end fittings, depending on intended installation application, shall be secured to a vibration table with the outlet end fitting in a vertical plane and the hose bent in a 90° angle, at its minimum bend radius, as defined in EN ISO 10380 Table 8 for Type 1-50 hoses unless the manufacturer states a smaller bend radius in which case the bend radius stated by the manufacturer shall be used. The inlet of the flexible sprinkler hose with end fittings shall be securely fixed in a horizontal plane, as shown in Figure A4. The flexible hose shall be filled with water and pressurized to 620 kPa while being subjected to the vibration conditions in Table 2.2.1 applied in the vertical axis only.

Table 2.2.1 Vibration Conditions

Total Table Stroke *Millimetres (mm)*	Frequency *Hertz (Hz)*	Time *Hours (H)*
0.51	28	5
1.04	28	5
3.81	28	5
1.04	18 to 37 variable	5
1.78	18 to 37 variable	5

- If the flexible sprinkler hose with end fittings to be assessed is for use in ducts, the test assembly shall consist of the complete flexible hose, end fittings and all mounting hardware fitted to a 300 mm long, 300 mm diameter example of the intended duct. The duct system assembly under assessment shall be secured to the vibration table. The outlet end of the flexible hose is secured to the duct and is placed in a vertical plane. The inlet end of the hose is bent in a 90° angle at its minimum bend radius while the inlet is securely fixed in the horizontal plane and vibration tested.

- If the flexible sprinkler hose with end fittings to be assessed is for use in a cleanroom ceiling grid, the test assembly shall consist of the complete flexible hose, end fittings and all mounting hardware fitted to a 300-380 mm x 300-380 mm example of the cleanroom ceiling grid. The cleanroom ceiling grid under assessment shall be secured to the vibration table. The outlet end of the flexible hose is secured in the ceiling grid. With the outlet end fitting in a vertical plane, the hose is bent in a 90° angle at its minimum bend radius and vibration tested.

- If the flexible sprinkler hose with end fittings to be assessed is for use in a commercial suspended ceiling application, the test assembly shall consist of the complete flexible hose, end fittings and all mounting hardware fitted to a 600 x 600 mm commercial ceiling frame assembly. The commercial suspended ceilings system under assessment shall be secured to the vibration table. The outlet end of the flexible hose is secured in the ceiling assembly, and with the outlet end fitting in a vertical plane, the hose is bent in a 90° angle at its minimum bend radius and vibration tested.

- If the flexible sprinkler hose with end fittings to be assessed is for use in a cold storage application, the test assembly shall consist of the complete flexible hose, end fittings and all mounting hardware fitted to an example of a 300 x 300 mm wide, 100 mm thick foam/urethane cold storage ceiling panel with metal sheathing on both sides. The cold storage assembly under assessment shall be secured to the vibration table. The outlet end of the flexible hose is secured in the ceiling assembly, and with the outlet end fitting in a vertical plane, the hose is bent in a 90° angle at its minimum bend radius and vibration tested.

As vibration testing determines the integrity of the flexible sprinkler hose as it is connected with the associated hardware (brackets, clamps, screws, washers, lock washers etc) which the manufacturer supplies for their specific application, loose fitting acoustical lay-in ceiling panels may be omitted from being fitted into the metal framing assembly.

After completion of the vibration test, the samples shall be examined for leakage or other failure when subjected to the hydrostatic post-test as detailed in 2.2.6 (Hydrostatic Strength).

The ETA shall report any deterioration of the flexible sprinkler hose, its fittings or its attachment hardware. Following exposure to the vibration test, any leakage, rupture, cracking, permanent distortion or deterioration of the Flexible sprinkler hose with end fittings when subsequently tested in accordance with Clause 2.2.6 (Hydrostatic Strength) and the manufacturers specified bend radius if it is smaller than that stated in EN ISO 10380.

2.2.3 Resistance to Pressure Cycling Test

Prior to cycling, the test assembly shall be filled with water and subjected to a hydrostatic strength test equal to the rated working pressure or 1205 kPa whichever is the higher. The test shall be conducted for a duration of one minute. The test shall be ceased if the sample exhibits leakage or rupture at this time.

The test sample shall be bent at a 90º angle, with the end fittings restrained and the hose unrestrained on a flat surface, at its minimum bend radius, as defined in EN ISO 10380 Table 8 for Type 1-50 hoses unless the manufacturer states a smaller bend radius in which case the bend radius stated by the manufacturer shall be used (See figure A.5). The hose assembly shall then be subjected to 20,000 cycles of hydrostatic pressure varying from 0 to 1205 kPa or its rated working pressure, whichever is greater, at a rate of approximately 6 cycles per minute.

After completion of 20,000 cycles, the samples shall be examined for leakage or other failure when subjected to the hydrostatic post-test as detailed in Clause 2.2.6 (Hydrostatic Strength).

The ETA shall report any deterioration of the flexible sprinkler hose performance noted during the 20,000 - cycle test and any leakage, rupture, cracking, permanent distortion or deterioration of the Flexible sprinkler hose with end fittings when subsequently tested in accordance with Clause 2.2.6 (Hydrostatic Strength).

2.2.4 Resistance to Vacuum Test

One previously untested hose sample shall be subjected to a vacuum of 0.88 bar for a period of one minute, the sample shall be observed for any sign of collapse or leakage. After completion of the vacuum test, the sample shall be subjected to the hydrostatic post-test as detailed in Clause 2.2.6 (Hydrostatic Strength).

The ETA shall report any deterioration of the flexible sprinkler hose performance characteristics following the vacuum test detailed above and any leakage, rupture, cracking, permanent distortion or deterioration of the Flexible sprinkler hose with end fittings when subsequently tested in accordance with Clause 2.2.6 (Hydrostatic Strength).

2.2.5 Friction Loss (Equivalent Length of Pipe)

To determine the friction loss of flexible sprinkler hose, flow measurements shall be taken at 19 L/min. increments from 95 L/min. to 246 L/min, measured flows shall be subject to a tolerance of ±5% on each hose length with a sprinkler head threaded into the outlet of the test assembly and Piezometer Rings, as defined in ISO 4006 Clause 7.6, shall be used to provide pressure equalization at each pressure measurement point. The sprinklers used for this test shall have nominal discharge coefficients (K-factors) as listed in Table 2.2.2. The flexible hose length shall be tested with a requested nominal K-Factor sprinkler listed in Table 2.2.2. The sprinkler shall be attached to the hose, and the hose shall be tested with its maximum number of bends, as shown in Table 2.2.3, but not to exceed the minimum radius, as defined in EN ISO 10380 Table 8 for Type 1-50 hoses unless the manufacturer states a smaller bend radius in which case the bend radius stated by the manufacturer shall be used (see Figures A2 and A3). All bends shall be made in a horizontal axis in order that the pressure measurements are taken at the same height.

A series of flow versus pressure drop measurements shall be conducted with and without the flexible sprinkler hose installed, the pressure loss of the test assembly without the flexible sprinkler hose installed shall be subtracted from the figure obtained with the flexible sprinkler hose installed to obtain the net friction loss across the flexible sprinkler hose.

The average C_v coefficient shall then be calculated using the formula $C_v = Q/\Delta P^{1/2}$ where Q is the flow rate in dm^3/min and $\Delta P^{1/2}$ is the square root of the net friction loss in kPa across the hose.

Table 2.2.2 Nominal Discharge Coefficients (K-factors)

Nominal K-Factor *$dm^3/min/(kPa)^{1/2}$*	Nominal Thread Size, *DN (in.)*
8.0	DN15 (½)
11.5	DN15 or DN20 (½ or ¾)
16.0	DN15 or DN20 (½ or ¾)
20.0	DN20 (¾)
24	DN20 (¾)
27	DN25 (1)
31.7	DN25 (1)
36.0	DN25 (1)

The testing of flexible sprinkler hose for Friction Loss determination shall be conducted to produce reproducible and comparable test data according to the arrangements detailed in Table 2.2.3.

Table 2.2.3 Number of Bends

Flexible Sprinkler Hose Lengths *Metres (m)*	Number of Bends
Up to 0.61 m	1
From 0.61 m to 0.91 m	2
From 0.91 m to 1.21 m	3
From 1.21 m to 1.81 m	4

The ETA shall report the average friction loss through the flexible sprinkler hose with end fittings, equated to the theoretical length of nominal DN 25 EN 10255 Medium sprinkler pipe, with a C-factor of 120, which would produce the same amount of friction loss.

2.2.6 Hydrostatic Strength

Flexible sprinkler hose with end fittings shall withstand a hydrostatic pressure of four times the rated working pressure conducted in general accordance with EN 12259-5, Clause 4.4.3.1, for a period of five minutes.

The ETA shall report any leakage, rupture, cracking, permanent distortion or deterioration that would impact the performance characteristics of the Flexible sprinkler hose with end fittings.

2.2.7 Seal Integrity

Flexible sprinkler hoses which incorporate a sealing mechanism, such as O-rings or gaskets, shall withstand an exposure to low and high temperatures as stated by the manufacturer. Where the manufacturer does not state a low or high temperature these tests shall be conducted at temperatures of 135ºC [high temperature] and -40ºC [low temperature].

- High Temperature Exposure

One sample of the flexible sprinkler hose with end fittings and sealing mechanism, for each sealing mechanism material under examination, shall be hydrostatically tested for a period of one minute to confirm that there is no leakage at the rated working pressure. Then the hose shall be drained and subjected to a high temperature oven-air exposure at the manufacturers stated highest temperature for 45 days. If no temperature is stated by the manufacturer an exposure temperature of 135°C shall be used. After exposure, the hose shall be allowed to cool to ambient air temperature (20°C ± 5°C). It shall then be pneumatically pressurized to 345 kPa, submerged in water and examined for leakage. The sealing mechanism, after removal from the hose, shall be examined for cracking when squeezed together from any two diametrically opposite points.

- Low Temperature Exposure

One sample of the flexible sprinkler hose with end fittings and sealing mechanism, for each sealing mechanism material under examination, shall be hydrostatically tested for a period of one minute to confirm that there is no leakage at the rated working pressure. The hose shall then be drained and subjected to a low temperature exposure of at the manufacturers stated lowest temperature for 4 days. If no temperature is stated by the manufacturer an exposure temperature of -40°C shall be used. Immediately after exposure, the hose shall be submerged in an antifreeze solution which is at the same temperature as the exposure temperature used, pneumatically pressurized to 345 kPa and examined for leakage. The depressurized hose shall then be allowed to warm to ambient temperature (20°C ± 5°C) and disassembled. The sealing mechanism, after removal from the hose, shall be examined for cracking when squeezed together from any two diametrically opposite points.

The ETA shall report any leakage of the hose assembly observed and any cracking, permanent deformation or deterioration of the performance characteristics of the seal.

2.2.8 High-pressure Flow

A flexible sprinkler hose with end fittings shall be fitted with a sprinkler head and secured in a commercial ceiling assembly. The sprinkler shall be operated using a suitable heat source and allowed to discharge for a period of one minute. Five tests shall be conducted with nominal pressures ranging from 300 kPa to the rated working pressure of the flexible sprinkler hose with end fittings in roughly equal increments.

During and after the high-pressure flow tests, the flexible sprinkler hose, fittings and attachment hardware shall be examined for leakage, rupture and movement.

The ETA shall report any leakage, rupture and movement of the sprinkler hose, its fittings or its attachment hardware following a high-pressure flow.

2.2.9 Elongation

One sample of a flexible sprinkler hose with end fittings of the maximum length submitted for assessment shall be placed in a straight assembly then measured. The flexible sprinkler hose shall then be subjected to a hydrostatic pressure of 1.5 times the rated working pressure and held for 1 minute. After the 1 minute exposure, the test pressure shall be released and the sample length shall be measured again.

The ETA shall report the extension in length of the flexible sprinkler hose following pressurization as a percentage of its original unstressed length.

2.2.10 Reaction to fire

The product shall be classified in accordance with Commission Delegated Regulation (EU) No 2016/364. The flexible sprinkler hoses with end fittings are considered to satisfy the requirements for performance class A1 of the characteristic reaction to fire in accordance with the Commission Decision 96/603/EC, as amended by Commission Decisions 2000/605/EC and 2003/424/EC, without the need for testing on the basis of it fulfilling the conditions set out in that decision and its intended use being covered by that decision.

Therefore, the performance of the product is A1.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System(s) of assessment and verification of constancy of performance to be applied

For the products covered by this EAD the applicable European legal acts is Commission Decision 96/577/EC, as amended by 2002/592/EC.

The system is **1.**

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 3.2.1.

For kits: The manufacturer (regarding the components he buys from the market with DoP) shall take into account the Declaration of Performance issued by the manufacturer of that component. No retesting is necessary.

Table 3.2.1 Control plan for the manufacturer; cornerstones

No	Subject / type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [**including testing of samples taken at the factory in accordance with a prescribed test plan**]					
1	Pressure Test	Examination for leakage when pressurised	As defined in control plan	As defined in control plan	100% of production
2	Elongation	2.2.9	As defined in control plan	As defined in control plan	1/daily
3	Length	Check of dimensions per manufacturers technical file.	As defined in control plan	As defined in control plan	1/daily
4	Visual Inspection	Visual	As defined in control plan	As defined in control plan	100% of production

3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 3.3.1.

Table 3.3.1 Control plan for the notified body; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control					
1	The notified product certification body shall verify the ability of the manufacturer to maintain continuous and orderly manufacturing of the product according to the Control Plan.	Verification of the complete FPC, to be implemented by the manufacturer	As defined in control plan	As defined in control plan	When starting the production or opening of a new production line
Continuous surveillance, assessment and evaluation of factory production control					
2	The notified product certification body shall verify that the manufacturing process and the system of Factory Production Control is maintained.	Verification of the controls carried out by the manufacturer on the raw materials, on the process and on the product as indicated in Table 3.2.1	As defined in control plan	As defined in control plan	1 / year

4 REFERENCE DOCUMENTS

EN ISO 10380: 2012	Pipework - Corrugated metal hoses and hose assemblies
EN 12259-5: 2002	Fixed firefighting systems - Components for sprinkler and water spray systems - Part 5: Water flow detectors
EN 10255:2004+A1:2007	Non-Alloy steel tubes suitable for welding and threading - Technical delivery conditions
ISO 4006:1991	Measurement of fluid flow in closed conduits — Vocabulary and symbols

ANNEX A – FIGURES

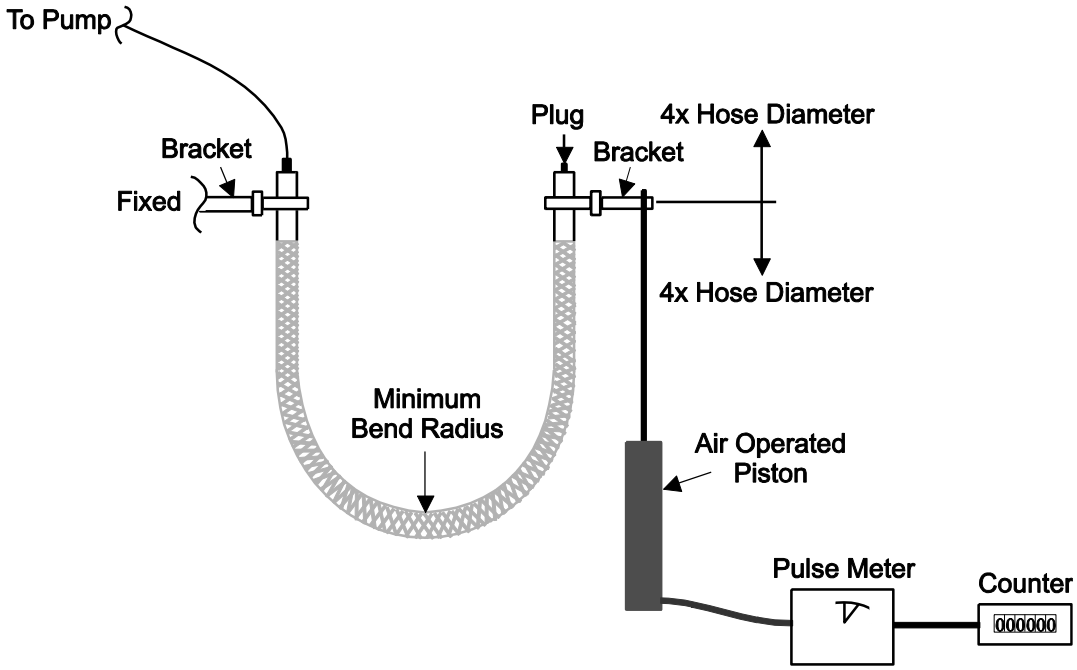

Figure A1. Side view of Test Apparatus for Fatigue Test

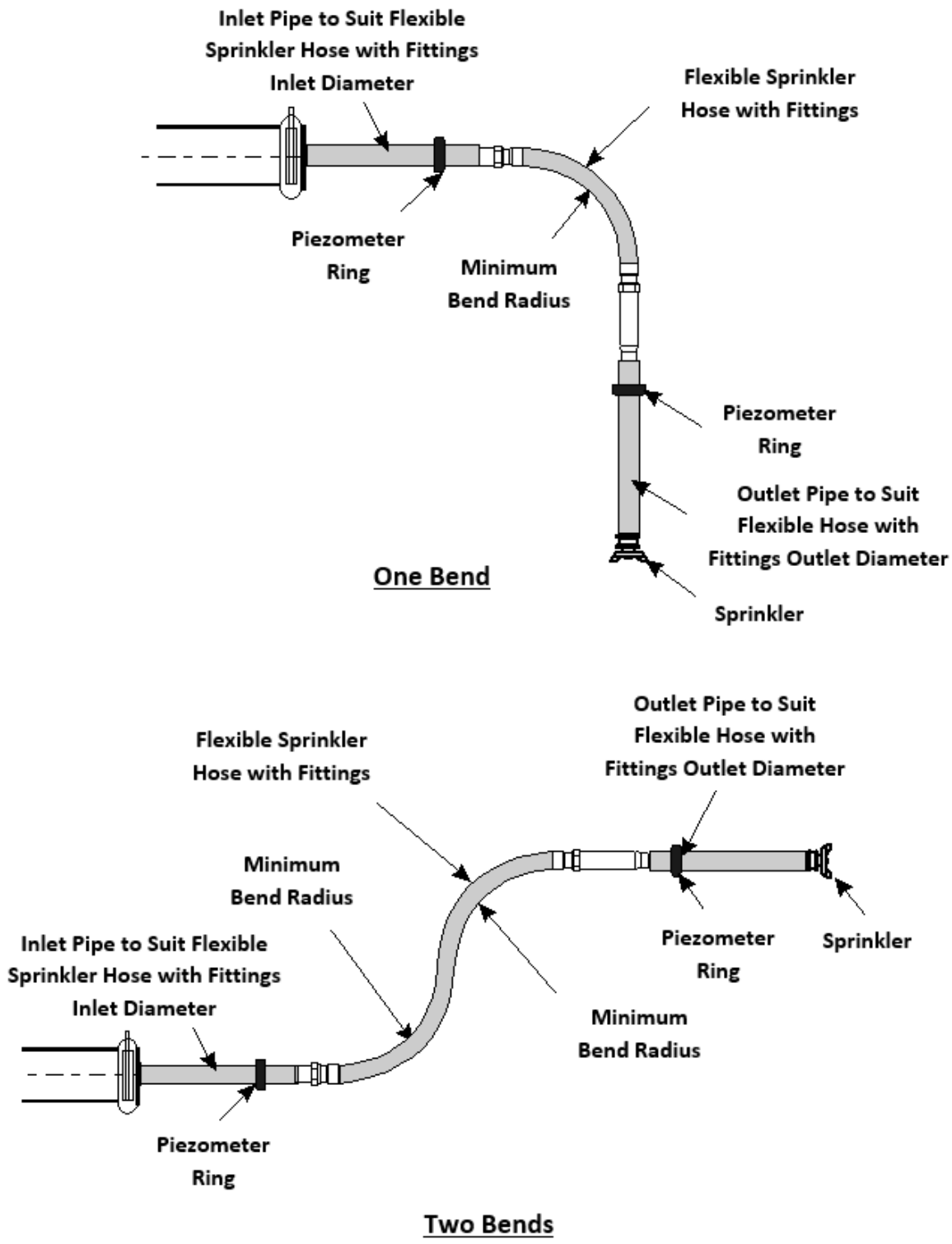

Figure A2. Plan view of Test Apparatus with Flexible Sprinkler Hose with Threaded End Fittings for Measuring Friction Loss (Equivalent Length of Pipe) With One or Two Bends on the Hose

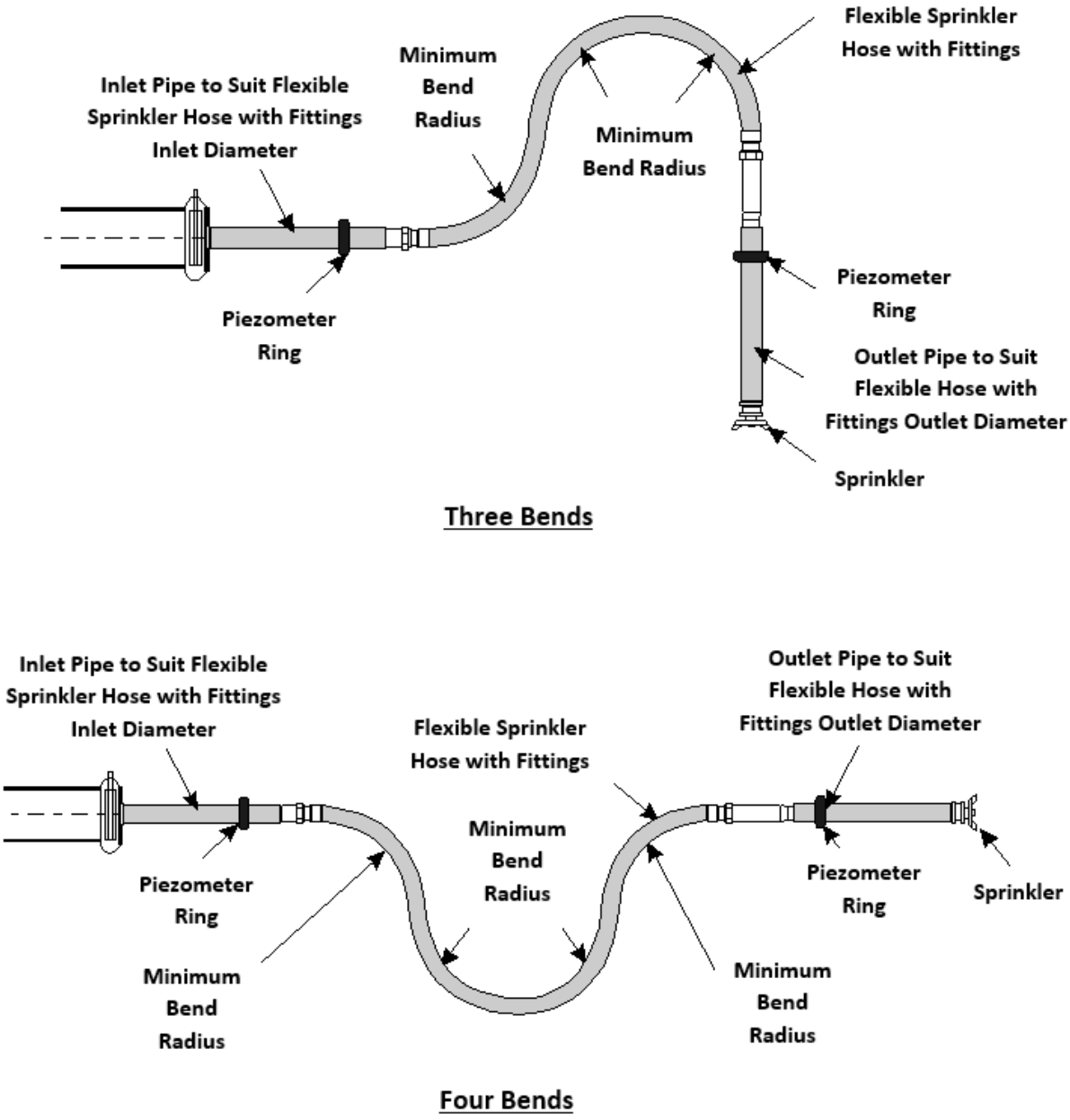

Figure A3. Plan view of Test Apparatus with Flexible Sprinkler Hose with Threaded End Fittings for Measuring Friction Loss (Equivalent Length of Pipe) With Three or Four Bends on the Hose

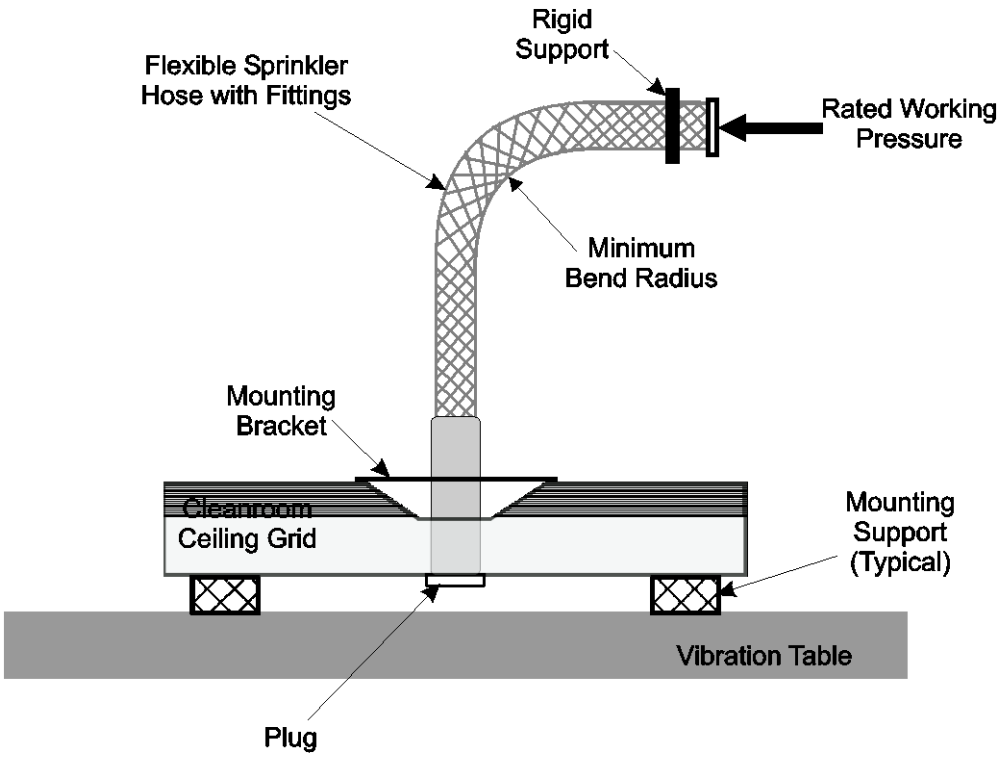

Figure A4. Side view of Test Arrangement for Vibration Test

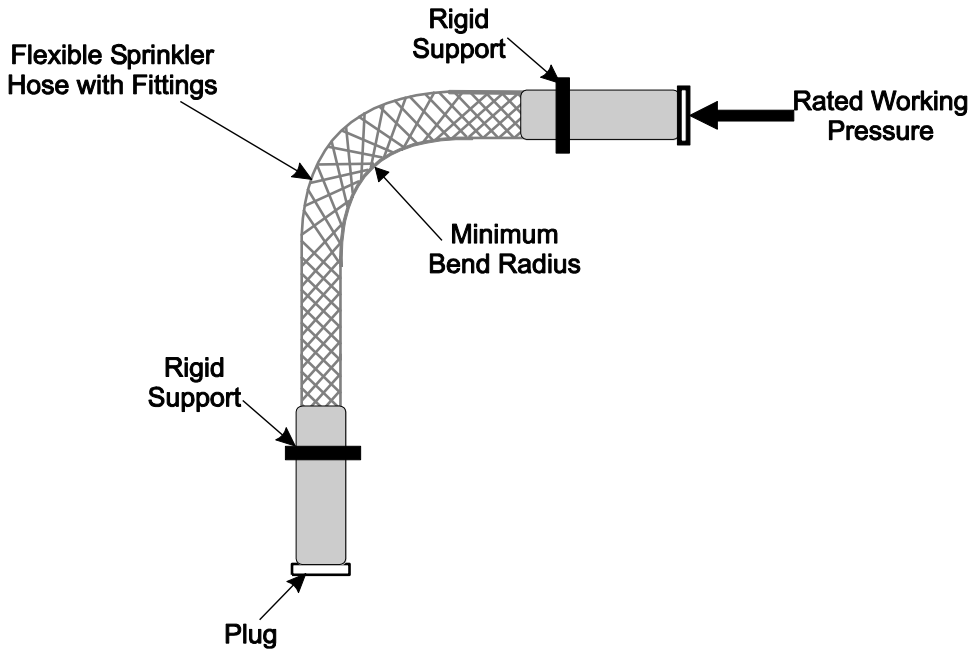

Figure A5. Test Arrangement for Pressure Cycling Test