

1. The FlexHead system is FM approved and UL 2443 listed for use in all types of sprinkler systems including pre-action systems.
2. Product Construction
 - 2.1. The hose section and all of our entire product line is made from 100% type 304 stainless steel. The hose pipe nipples are also 304SS and are fully welded with a proprietary welding process (no o-rings and 100% leak tested to 175psi). It has burst pressure of over 2,000psi and a working pressure of over 1,000psi.
 - 2.2. The bracket section of the FlexHead product is made from 100% galvanized steel.
3. Testing of Product
 - 3.1 Underwriters Laboratory Testing UL 2443*
 - 3.1.1 Hydrostatic Pressure Test

The sample length is to be measured and then the hydrostatic pressure increased to 1.5 times the rated working pressure and held for 1 minute. The sample length is then to be measured again and the length shall not change by more than 0.1 inch/foot of hose length.
 - 3.1.2 Mechanical Strength Test

A flexible sprinkler hose with fittings installed in its intended position using the anchoring components referenced in the installation instructions shall withstand a torque of 60 pound-feet (81 Nm) applied to the outlet without movement of the fitting outlet, deformation, or fracture.
 - 3.1.3 High Temperature Exposure Test

Two samples are to be prepared and subjected to a hydrostatic pressure of twice the rated working pressure. The samples are then to be allowed to dry and then exposed to an ambient temperature in accordance with Table 10.1 for 90 days. Following this exposure, the samples are to be individually subjected to a hydrostatic pressure of twice the rated working pressure for 1 minute.
 - 3.1.4 Vibration Test

Samples are to be vibrated for a period of 30 hours at frequencies ranging from 18 to 37 Hz. During and after being subjected to the required vibration, the samples are to be examined for signs of leakage, rupture, or movement of the outlet fitting affecting the performance of the flexible hose assembly.
 - 3.1.5 Equivalent Length Determination

A sample of each length shall be tested in straight lengths and with the maximum number of minimum radii bends referenced in the installation instructions. The calculated pressure loss from the piezometers, corrected for the inlet and outlet velocities, are to be subtracted from the test sample results to obtain a pressure drop for the fitting. Using the Hazen-Williams coefficient of friction of 120, the equivalent length, in feet (m) of pipe, is to be calculated.
 - 3.1.6 Salt Spray Corrosion Test

Ferrous flexible sprinkler hose with fittings and ferrous anchoring components not protected with a coating shall withstand an exposure to a salt spray atmosphere for 10 days without exhibiting any incipient corrosion.

3.1.7 Stress-Corrosion Cracking of Stainless Steel Parts Test

Austenitic stainless steel parts shall show no evidence of cracking, delamination, or degradation after being subjected to boiling magnesium chloride solution. The exposure is to last for 150 hours. The test samples are to be examined using a microscope having a magnification of 25X for any cracking, delamination, or other degradation as a result of the test exposure.

3.1.8 Low Temperature Test for Dry Pipe Systems

Each sample is to be gradually pressurized with air to a pressure of 40 psig (276 kPa) and then sealed. The pressurized assembly is then to be placed horizontally in air maintained at a temperature of minus 40°F (minus 40°C) for a period of 24 hours. Following the 24 hour low temperature exposure, the assembly is to be place in room ambient temperature of 73 ±5°F (23 ±3°C) for an additional 24 hour period. There shall be no decrease in the pressure in the assembly from the pressure measured before the low temperature exposure.

3.1.9 Pressure Cycling Test

The samples are to be connected to a pressure cycling apparatus, filled with water and vented of all air. The internal pressure is to be cycled 3,000 times from 0 psig (0 kPa) to twice the rated working pressure to 0 psig (0 kPa) at an approximate rate of 10 cycles per minute. During the pressure cycling, observations are to be made for evidence of leakage or physical damage.

3.1.10 Vacuum Test

Flexible sprinkler hose with fittings shall withstand a vacuum of minus 8.84 psi (minus 61 kPa) without collapse, leakage, or other deterioration of the flexible sprinkler hose and fitting performance characteristics.

3.1.11 High Pressure Flow Test

Flexible sprinkler hose with fittings and its anchoring components shall maintain the attached sprinkler in the intended operating position while the sprinkler discharges water at 90 percent of the rated pressure of the flexible sprinkler hose.

3.1.12 Fatigue Test (Limited Flexibility)

Flexible hose with fittings shall withstand without leakage or damage repeated flexing in a direction parallel to the axis of the end fittings. The number of flexing cycles shall be 100 cycles.

* Condensed Summary —Please see approval standard for full testing and approval criteria.

3.2 FM Global Testing Class Number 1637 (Factory Mutual)

3.2.1 Hydrostatic Strength Test

A sample FlexHead was subjected to a hydrostatic pressure of four (4) times the rated working pressure of 175 psi (1205 kpa) to 700 psi (4825 kpa) for a period of five minutes. The assembly showed no signs of rupture, cracking, permanent distortion, or deterioration of performance characteristics. *The FlexHead successfully passed this test.*

3.2.2 Vibration Test

A sample FlexHead was secured to a vibration table. The FlexHead hose was bent in a 90° angle and pressurized to 90 psi (620 kpa) and the mounting bracket and hose were then subjected to a total of 25 hours of severe vibration conditions. After the successful completion of the vibration tests the sample was subjected to the hydrostatic pressure test at 700 psi and showed no signs of deterioration. *The FlexHead successfully passed this test.*

3.2.3 Friction Loss (Equivalent length of pipe)

To determine the effect of the FlexHead to the discharge coefficient of the sprinkler, the average friction loss through the FlexHead shall be equated to the theoretical length of nominal 1" diameter schedule 40 sprinkler pipe which would produce the same amount of friction loss. *Please see friction loss table.*

3.2.4 Vacuum Test

A sample FlexHead was subjected to a vacuum of 25 inHG for a period of five minutes. After the successful completion of the Vacuum Test the sample was subjected to the hydrostatic pressure test at 700 psi and showed no signs of deterioration. *The FlexHead successfully passed this test.*

3.2.5 Pressure Cycling Test

A sample FlexHead was filled with water and bent at a 90° angle and subjected to 20,000 cycles of pressure varying from 0 psi (0 kpa) to 175 psi (1205 kpa) at a rate of approximately 6 cycles per minute. After the successful completion of the pressure cycling tests the sample was subjected to the hydrostatic pressure test at 700 psi and showed no signs of deterioration. *The FlexHead successfully passed this test.*

3.2.6 Fatigue Test

A sample FlexHead was subjected to 50,000 cycles of repeated flexing at a rate of 5 to 30 cycles per minute per section 8.3 of ISO standard 10380. After the successful completion of the fatigue test the sample was subjected to the hydrostatic pressure test at 700 psi and showed no signs of deterioration. *The FlexHead successfully passed this test.*

3.2.7 Head Deployment

A sample FlexHead installed in a suspended ceiling was fitted with a sprinkler head and pressurized to 26–175 psi. The sprinkler head was then activated by a heat source at various pressures, and the sprinkler head deployed. The assembly showed no signs of distortion or deterioration of performance on the assembly or sprinkler head. *The FlexHead successfully passed this test.*

* Condensed Summary —Please see approval standard for full testing and approval criteria.

4. Suspended Ceiling grid construction

- 4.1. ASTM C635 is the standard specification for the manufacture; performance and testing of metal suspension systems for acoustical tile and lay in panel ceilings.
- 4.2. Virtually all ceiling grid systems are manufactured to ASTM C635 and installed per ASTM C636 per building codes.
- 4.3. Per ASTM C635, all ceiling grids are rated as light duty, medium duty, or heavy duty grid systems.
- 4.4. The FlexHead system is listed and approved for use in all grid duty designations (light duty, medium duty, or heavy duty grid systems).
- 4.5. The following tests were performed on the FlexHead product while attached to a light duty ceiling grid. The sole purpose of this testing was to test the interaction between the FlexHead system and the ceiling grid system. The intent of the testing to specifically insure that the attachment method would be safe and secure, that no stress or damage would occur to the grid system or the FlexHead product as a result of the interaction between the two, and that the structural integrity of the ceiling and FlexHead systems would remain in tact.

- 4.5.1. Vibration tests: A FlexHead Commercial Ceiling Sprinkler System assembled on a suspended ceiling grid is secured to a vibration table with the end fitting in a vertical plane and the hose bent at 90 degrees at its minimum bend radius. The test sample will be filled with water and pressurized to 90 psi while being subjected to the vibration conditions from 0.020 in. to 0.070 in. total table stroke at 18 to 37 Hz for a 25 hour period. The assembly shall show no signs of deterioration and be subject to the Hydrostatic Strength Test.
- 4.5.2. High Pressure Flow (Head Deployment)
An assembly shall be fitted with a sprinkler and secured in a commercial ceiling frame assembly. The sprinkler shall be operated using a suitable heat source. A minimum of seven tests shall be conducted with pressures ranging from 10 psi to 175 psi (69 to 1206 kPa) in approximately 30 psi (210 kPa) increments. The test sample shall show no signs of deterioration or its attachment.