One of the key requirements identified at the outset of this project was the construction of an experimental test rig, the primary functions of which would be;

- To provide a platform on which to practically assess the hydraulic characteristics and performance of prototype sprinkler plumbing systems.
- To assess the practical implications of installing such systems using differing materials or techniques.
- To demonstrate and assess the fire performance of the developed system.

In designing the test rig a secondary (but important nonetheless) was that the rig should provide a means of showcasing both the practical implementation and operation of combined plumbing sprinkler systems.

The experimental test rig constructed at the still air facility at Little Rissington; the use of which was provided by the Fire Experimental Unit – part of the Fire Statistics and Research Division of ODPM.

**Domestic plumbing issues**

During the initial phase of this project a UK plumbing expert was consulted on a variety of issues covering plumbing practices and the supply and distribution of domestic water supplies. Issues of note that were discussed included:

**MAINS CONNECTIONS TO DOMESTIC PROPERTIES**

Until quite recently it was common practice for homes to be connected to the water mains by either 15mm pipe (copper or galvanised). New build properties are now generally connected using 25mm MDPE plastic pipe (although 15mm MDPE is sometimes used).

- Although most existing and new supply pipes will be 15mm copper or 25mm MDPE plastic pipe there is no practical reason why larger pipe sizes could not be accommodated.
- Older houses may be connected to the town’s main by a supply pipe that is shared with adjacent properties. This practice is understood to be no longer used and that newer houses should have a dedicated supply pipe to the main.
Figure C1 illustrates the names used by water companies to describe the various sections of pipe connecting domestic properties to the town water main. This also illustrates which components of the supply chain are the responsibility of the home owner and which belong to the water supplier.

**MAINS WATER METERS**

Relatively few existing dwellings, but all new build houses are fitted with water meters for recording domestic water usage. Domestic water meters are available with a variety of connection sizes (15mm to 40mm). Pressure losses for units above 15mm supply pipe size can be relatively small for normal domestic flows but is device/manufacturer dependent and may impact on the units cost.

**BACKFLOW PREVENTION DEVICES**

Backflow devices are required in instances where there is a risk of non potable water back-siphoning into the drinking water supply (such as might occur if a shower head were able to submerged in a bath of dirty water). Since the proposed sprinkler/plumbing system would only contain potable water and would not introduce any additional risks of back-siphoning, there should be no need for a backflow prevention device in the system. However, it has been suggested that local water authorities are able to impose additional requirements which could include the use of backflow prevention.

**TANKS + BOILERS**

Until relatively recently most new houses were equipped with at least one header tank (located in the loft), used for supplying water to the hot water boiler and in some cases to cold water taps. Most, if not all, new houses that are now built incorporate combination boilers that do not require any type of loft header tank, but are fed directly from the mains water supply.

**WATER QUALITY**

Whilst the risk of Legionella is minimal, the use of increased pipe diameters could lead to additional risk if the design does not allow for regular and efficient flushing.

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22 Based on details of the V100 water meter, supplied by Elster Metering Ltd

23 Whilst it is possible that loft water storage tanks could be used with a pumped supply sprinkler solution, this approach has not been adopted for this study (due to the associated costs and the fact that new build houses don’t incorporate loft header tanks).
CONSTRUCTION METHODS

- Whilst both soldered elbows and swept bends may be used in normal plumbing systems it is recommended that only swept bends (with a radius of at least several times the pipe diameter) are used for the proposed combined system, so as to minimise pressure losses.

- In many new build properties it is apparently not uncommon practice for copper to be used for exposed pipes and for speed-fit plastic pipe to be used in other areas that are not exposed. Whilst plastic pipe and the associated quick connect fittings are slightly more expensive than their copper equivalent this can be offset by savings in installation time.
• To help reduce pressure losses the length of pipe and the number of direction changes (i.e. bends) should be kept to a minimum.

• Any new installation would have to comply with the Water Supply (Water Fittings) regulations 1999 and BS6700.

**INSTALLER COMPETENCE**

To ensure the installer possesses the skill-sets required to correctly implement the system design an accessible accreditation scheme may be required. A number of bodies that provide approvals schemes for plumbing engineers, which might be able to provide suitable additional training, include:

• WRAS (the Water Regulations Advisory Scheme), which manages an approvals scheme for plumbing engineers and is funded by the water supply industry.

• GORGI, which runs a certification scheme for registered gas installers.

• BPEC Certification Ltd. This company has many approved assessment centres around the country that carry out a range certification schemes for gas installers and plumbers.

**Design and layout of test rig**

The scaffold structure, a schematic of which is illustrated in Figure C2, has been designed and constructed to simulate an average family home with:

• A lounge, diner/study, toilet and kitchen on the ground floor.

• One small and two medium size and bedrooms and a bathroom on the first floor.

• A loft space.

The test rig is positioned at the far (south) end of the Rissington hanger in close proximity to both an existing 30,000 L cold water storage tank and an existing fire test compartment, see Figure C3. Fire tests were conducted in the brick built compartment indicated in Figure C4; this is situated beneath a 10 m² smoke collection hood for the removal of gaseous fire products during live fire tests. Figure C4 also shows the bare scaffold framework for the test ‘house’ prior to installation of any domestic plumbing or sprinkler systems.

**Test rig dimensions**

The test rig is intended to be representative of a typical 3 bedroom family home and consequently the dimensions and internal layout of the structure have been
chosen to reflect this. The overall footprint of the test rig is 6.0 m x 6.0 m and the floor to ceiling height of both ground floor and first floor is 2.4 m.

The floor area is based on data used for the CLEA model (a model used by DEFRA that details various parameters relating to commercial and domestic premises, including calculated average values for those parameters) and the BRE test house used in their study of domestic sprinklers.

The ceiling height on both floors follows that indicated in the CLEA model data and that of the fire test rooms used in BRE study. The only other initially specified dimensions are those of the lounge. For consistency with historical tests conducted by BRE, the dimensions of the main lounge have been set to 4m x 3m; which is also close to the maximum allowable size for protection from a single sprinkler.

The dimensions and floor areas for each of the notional house compartments are detailed in the table below. The layout of these rooms and the locations for domestic utilities are illustrated in Figure C5.
### Test rig compartment sizes

<table>
<thead>
<tr>
<th>Name</th>
<th>Floor</th>
<th>Dimensions (m) (width x depth)*</th>
<th>Area (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main lounge</td>
<td>Ground floor</td>
<td>3.0 x 4.0</td>
<td>12.0</td>
</tr>
<tr>
<td>Diner/study</td>
<td>Ground floor</td>
<td>4.0 x 2.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Kitchen</td>
<td>Ground floor</td>
<td>2.0 x 3.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Lavatory</td>
<td>Ground floor</td>
<td>1.0 x 2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Hallway + lower staircase</td>
<td>Ground floor</td>
<td>—</td>
<td>6.0</td>
</tr>
<tr>
<td>Bedroom 1</td>
<td>First floor</td>
<td>3.0 x 3.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Bedroom 2</td>
<td>First floor</td>
<td>3.0 x 3.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Bedroom 3</td>
<td>First floor</td>
<td>3.0(max)/2.0(min) x 2.2</td>
<td>5.4</td>
</tr>
<tr>
<td>Bathroom</td>
<td>First floor</td>
<td>2.0 x 2.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Cupboard</td>
<td>First floor</td>
<td>1.0 x 1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Landing + upper staircase</td>
<td>First floor</td>
<td>—</td>
<td>5.6</td>
</tr>
<tr>
<td>Loft space</td>
<td>Second floor</td>
<td>6.0 x 6.0</td>
<td>36.0</td>
</tr>
</tbody>
</table>

* Width – side to side of the house, Depth – front to back of the house

---

**Figure C3** – Location of scaffold test rig inside hanger 97
**Figure C4** – Scaffold test rig at south end of Rissington hanger
Figure C5 – Compartment boundaries and dimensions
Test rig details and utilities

The test rig has been fitted with a selection of typical domestic utilities intended to provide a means of;

- Demonstrating how domestic and sprinkler system plumbing networks might be integrated.
- Assessing the impact of the normal domestic utilities on sprinkler system performance.

The domestic items used are illustrated in Figures C6 to C8. Although the test rig could effectively simulate either an old or new build property, with regards to the plumbing it is assumed to be a new build and consequently allowance has been made for a connection to a combination boiler on the ground floor, rather than a loft tank and first floor hot water tank that might be found in an older property.

<table>
<thead>
<tr>
<th>Domestic plumbing utilities installed in the test rig</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Floor</strong></td>
</tr>
<tr>
<td>Ground floor</td>
</tr>
<tr>
<td>“ “ “ Kitchen</td>
</tr>
<tr>
<td>“ “ “</td>
</tr>
<tr>
<td>“ “ “</td>
</tr>
<tr>
<td>First floor</td>
</tr>
<tr>
<td>“ “ “</td>
</tr>
<tr>
<td>“ “ “</td>
</tr>
<tr>
<td>“ “ “</td>
</tr>
</tbody>
</table>

Figure C6 – Downstairs toilet detail and test ‘house’ entrance
The items located in each of the rooms (kitchen, toilet and bathroom) are connected to sections of 15mm copper pipe, as illustrated in Figures C9 and C10, that can be connected to the main plumbing system via a short flexible hose. This flexible connection is only used for experimental reasons (to enable the domestic items to be connected to a variety of different sprinkler plumbing networks with minimal effort) and would not need to form part of an actual installation.
**Figure C9** – Schematic of domestic plumbing arrangements

- **Kitchen domestic plumbing arrangement**
  - Flexible connection to combined sprinkler plumbing
  - Outside tap
  - Sink tap
  - Dish washer connection
  - Washing machine connection
  - Hot water boiler connection

- **Bathroom domestic plumbing arrangement**
  - Flexible connection to combined sprinkler plumbing
  - Shower head
  - Bath tap
  - Sink tap
  - Toilet cistern

- **Downstairs toilet plumbing arrangement**
  - Toilet cistern
  - Sink tap

**Figure C10** – Domestic supply connection to sprinkler 22mm supply pipe

- Flexible connection between sprinkler supply pipe and domestic supply
Sprinkler water supply

Consultation with the relevant experts indicated that it would be reasonable to assume an overall range of mains water pressures from 1 bar to 6 bars. With no locally available mains source able to cover this range it was necessary to implement a pumped water supply that could be accurately controlled to provide the test rig with a suitable range of pressures and flow rates.

Figure C11 – Mains water supply pump control/viewing ‘pod’

Water is supplied to the test facility by means of an EBARA EVM8-6N22 single phase high pressure multistage centrifugal pump, drawing water from a 30,000L storage tank. Figures C11 and C12 illustrate the water control arrangement used. The pump operates at a constant speed and water flow to the test rig is controlled by adjusting the proportion of pumped water that is recycled back to the storage tank using control valves CV1 and CV2.

The instrumentation used for measuring water flow and pressure is monitored inside the control pod shown in Figure C11.

Figure C12 – Water supply and control to test rig
Instrumentation

For the purpose of the initial hydraulic assessment tests only flow and pressure were recorded using electronic transducers as detailed below;

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Instrument type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow</td>
<td></td>
<td>After pump, before MDPE mains supply pipe</td>
</tr>
<tr>
<td>Pressure</td>
<td>Gems 2200 series 0-10bar transducer</td>
<td>House inlet pressure, just before main stop valve</td>
</tr>
<tr>
<td>Pressure</td>
<td>Gems 2200 series 0-10bar transducer</td>
<td>Sprinkler supply pressure</td>
</tr>
<tr>
<td>Pressure</td>
<td>Gems 2200 series 0-10bar transducer</td>
<td>Various locations around pipe network</td>
</tr>
</tbody>
</table>

Data from all of the sensors and transducers were monitored, displayed and recorded electronically using an Adept Scientific USB Datashuttle data logger that is controlled by a desktop computer running DasyLab data acquisition software.
ANNEX D

Domestic sprinkler specification details

1. PRODUCT NAME
Viking Freedom™ Model B-3 Residential Concealed Pendant Sprinkler SIN VK425 is a small, high-sensitivity, sledger sprinkler designed for installation on concealed pipe systems where the appearance of a smooth ceiling is desired. The sprinkler is hidden from view by a low-profile, small-diameter cover plate installed flush to the ceiling. The cover plate is available with a painted finish. The two-piece design allows installation and testing of the sprinkler prior to installation of the cover plate. The "push-on", "thread-off" design allows easy installation of the cover plate after the system has been tested and the ceiling finish applied, while also permitting up to 1/2" (12.7 mm) of vertical adjustment. It can be removed and reinstalled to permit temporary removal of ceiling panels without taking the sprinkler system out of service and removing the sprinkler. Inside the body of the Viking Residential Concealed Pendant Sprinkler, the deflector and sealing assembly are held in place by a fast-acting heat-sensitive fusible link that meets the response criteria of fast-response sprinklers. When fire conditions, the temperature around the sprinkler approaches its operating temperature, the cover plate detaches. Continued heating of the exposed sprinkler causes the fusible link to disengage, releasing the deflector and sealing assembly. Water flowing through the sprinkler orifice strikes the deflector, forming a uniform spray pattern over a specific area of coverage determined by the water supply pressure so the sprinkler to extinguish or control the fire.

4. TECHNICAL DATA
Klaxon 175 psi (1207 kPa) water working pressure.
Factory tested pneumatically to 95 psi (655 kPa).
Spring: U.S.A. Patent No. 6,570,720
Requires a 2" (50.8 mm) diameter opening in the ceiling.
Thread size: NPT 1/2" (15 mm)
K-factor: 4.1 U.S. (5.5 metric)
K-factor K-Factor is shown in kPa when pressure is measured in kPa. When pressure is measured in BAR, multiply the meter K-Factor shown by 100.
Available cover plate vertical adjustment:
1/2" (12.7 mm) +/- 1/4" (6.4 mm)
Overall Length: 2-1/4" (57.1 mm)
SPRINKLER MATERIALS
Sprinkler Body: Brass UNS-C84400
Bocap: Brass UNS-C84600
Deflector: Copper UNS-C86000

2. MANUFACTURER
The Viking Corporation
210 N. Industrial Park Road
Hastings, Michigan 49058 U.S.A.
Telephone: (269) 945-9501
Fax: (269) 945-9599
E-mail: techvcs@vikingcorp.com

3. PRODUCT DESCRIPTION

4. COVER PLATE MATERIALS

5. COVER PLATE FINISHES

6. ORDERING INSTRUCTIONS

7. ACCESSORIES

8. Sprinkler Base Part No. 107644

9. Cover Plate Assembly: Part No. 10766

10. Deflector Pin: Stainless steel UNS-32100

11. Button Brass: UNS-C31400

12. Compression Screw: Brass UNS-C36000

13. Fusible Link Assembly: Beryllium Nickel Fusible Link—Stainless steel UNS-S31600

14. Lever Arm: Copper Alloy UNS-C72500

15. Belleville Spring Sealing Assembly: Nickel alloy, coated on both sides with Teflon

Note: Units of measure in parentheses may be approximations.
Form No.: F-0803399
Refer to residential sprinkler data page 6-IV for general care, installation, and maintenance information.

286
Domestic sprinkler specification details

![Figure 2]

NOTE: Upon sprinkler activation, the deflector descends approximately 13/16" (20.6 mm) below the sprinkler body.

### Approval Chart 1

Residential Concealed Pendent Sprinkler VK425

This page applies to system designs using SIN VK425 Sprinklers manufactured after July 12, 2002.

<table>
<thead>
<tr>
<th>Sprinkler Temperature Classification</th>
<th>Nominal Temperature Rating (Fusing Point)²</th>
<th>Maximum Ambient Ceiling Temperature¹</th>
<th>Required Cover Plate Assembly Temperature Rating</th>
<th>Cover Plate Assembly Base Part No.²⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinary</td>
<td>140 °F (60 °C)</td>
<td>100 °F (38 °C)</td>
<td>135 °F (57 °C)</td>
<td>10786</td>
</tr>
<tr>
<td>NPT Thread Size</td>
<td>Inch mm U.S. metric²</td>
<td>Inch mm U.S. metric²</td>
<td>Sprinkler Base Part Number²⁵</td>
<td>Sprinkler Identification Number (SIN)</td>
</tr>
<tr>
<td>1/2</td>
<td>15 4.1 5.9</td>
<td>2-1/4 55.4</td>
<td>10784A</td>
<td>VK425</td>
</tr>
</tbody>
</table>

**Footnotes**

¹ Based on NFPA-13. Other limits may apply, depending on the loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

² Temperature rating is stamped on the sprinkler.

³ Metric K-Factor shown is for use when pressure is measured in kPa. When pressure is measured in BAR, multiply the metric K-Factor shown by 10.0.

⁴ Base part number shown. For complete part number, refer to Viking’s current price list.


⁶ For areas of coverage smaller than those shown, use the “Minimum Water Supply Requirement” for the next larger listing under “Maximum Areas of Coverage” for the sprinkler used. The distance from sprinklers to walls shall not exceed one-half the sprinkler spacing indicated for the “Minimum Water Supply Requirement” used.

⁷ This chart shows the listings and approvals available at the time of printing. Other approvals may be in process. Check with the manufacturer for any additional approvals.

⁸ Listings are for residential occupancies with smooth, flat, horizontal ceilings, including ceilings with slopes up to and including 2/12 (9°).

⁹ Listed by Underwriters’ Laboratories, Inc. for use in the U.S. and Canada.

¹⁰ Other paint colors are available on request with the same UL and C-UL Listings as the standard finish colors.
## Development of a lower-cost sprinkler system for domestic premises in the UK

### VIKING® TECHNICAL DATA

**FREEDOM™ RESIDENTIAL CONCEALED PENDENT SPRINKLER SIN VK425**

<table>
<thead>
<tr>
<th>Sprinkler Temperature Classification</th>
<th>Nominal Sprinkler Temperature Rating (Fusing Point)</th>
<th>Maximum Ambient Ceiling Temperature</th>
<th>Required Cover Plate Assembly Temperature Rating</th>
<th>Cover Plate Assembly Base Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinary</td>
<td>140 °F (60 °C)</td>
<td>100 °F (38 °C)</td>
<td>135 °F (57 °C)</td>
<td>10786</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NPT Thread Size</th>
<th>Nominal K-Factor</th>
<th>Overall Length</th>
<th>Sprinkler Base Part Number</th>
<th>Sprinkler Identification Number (SN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inch/mm</td>
<td>U.S./metric</td>
<td>Inch/mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2</td>
<td>15</td>
<td>4.1/5.9</td>
<td>2-1/4</td>
<td>57.2</td>
</tr>
</tbody>
</table>

### Approval Chart 2

Residential Concealed Pendent Sprinkler VK425

This page applies to system designs using SIN VK425 Sprinklers manufactured before July 12, 2002.

### Maximum Areas of Coverage

<table>
<thead>
<tr>
<th>Single Sprinkler</th>
<th>Minimum Water Supply Requirements</th>
<th>Two or More Sprinklers</th>
<th>cULus</th>
<th>NYC</th>
<th>FM</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot; x 12&quot; (3.7 m x 3.7 m)</td>
<td>15 gpm @ 13.4 psi (58.8 L/min @ 92.3 kPa)</td>
<td>12 gpm @ 8.6 psi (45.4 L/min @ 91.1 kPa)</td>
<td>A1</td>
<td>A1</td>
<td>–</td>
</tr>
<tr>
<td>14&quot; x 14&quot; (3.6 m x 3.6 m)</td>
<td>16 gpm @ 13.2 psi (60.8 L/min @ 95.9 kPa)</td>
<td>16 gpm @ 8.6 psi (45.4 L/min @ 91.1 kPa)</td>
<td>A1</td>
<td>A1</td>
<td>–</td>
</tr>
<tr>
<td>16&quot; x 16&quot; (5.1 m x 5.1 m)</td>
<td>20 gpm @ 23.8 psi (75.7 L/min @ 164.1 kPa)</td>
<td>19 gpm @ 21.5 psi (71.9 L/min @ 148.3 kPa)</td>
<td>A1</td>
<td>A1</td>
<td>–</td>
</tr>
</tbody>
</table>

### Sprinkler Temperature Rating

A - 140 °F (60 °C)

### Footnotes

1. Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.
2. Temperature rating is stamped on the sprinkler.
3. Metric K-Factor shown is for use when pressure is measured in kPa. Use metric K-Factor shown by 10.0.
4. Base part number is shown. For complete part number, refer to Viking’s current price list.
5. Accepted for use, City of New York Department of Buildings, MEA Number 89-92-E, Vol. 15.
6. For areas of coverage smaller than those shown, use the “Minimum Water Supply Requirement” for the next larger listing under “Maximum Areas of Coverage” for the sprinkler used. The distance from sprinklers to walls shall not exceed one-half the sprinkler spacing indicated for the “Minimum Water Supply Requirement” used.
7. This chart shows the listings and approvals available at the time of printing. Other approvals may be in process. Check with the manufacturer for any additional approvals.
8. Listings are for residential occupancies with smooth, flat, horizontal ceilings, including ceilings with slopes up to and including 2/12 (9°).
10. Other paint colors are available on request with the same UL/CSA Listing as the standard finish color.
Domestic sprinkler specification details

Residential Concealed Pendent Sprinkler SIN VK438
NOTE: Must be installed in neutral or negative pressure plenums only.

1. PRODUCT NAME
Viking Freedom™ Residential Concealed Pendent Sprinkler SIN VK438
• Sprinkler Part No. 12224ABX
• Cover Plate Assembly Base Part No. 12207 (push-on, thread-off style)
• Available since 2003.

The Sprinkler Identification Number (SIN) is stamped on the sprinkler deflector.

2. MANUFACTURER
The Viking Corporation
216 N. Industrial Park Road
Hastings, Michigan 49058, USA
Telephone: (269) 945-9501
(877) 984-5464
Fax: (269) 945-9599
e-mail: techsvcs@vikingcorp.com

3. TECHNICAL DATA
Glass-bulb fluid temperature rated to -65 °F (-55 °C).
Rated to 175 psi (1207 kPa) water working pressure.
Factory tested hydrostatically to 600 psi (3448 kPa).
Testing: U.S.A. Patent No. 4,831,870
Thread Size: \( \frac{1}{4} \) (15 mm) NPT
Nominal K-Factor: 4.9 U.S. (7.1 metric)*

Sprinkler and Adapter Assembly: Part No. 12224ABX

Cover Assembly: Base Part No. 12207

4. ACCESSORIES (order separately)
Sprinkler Wrench: Part No. 07380W**
Available since 1990.
Sprinkler Cabinet: Part No. 01731A
Capacity: five (5) sprinklers
Available since 1971.
**A \( \frac{3}{8} \)" ratchet is required (not available from Viking).
Refer to the "Sprinkler Accessories" section of the data book.

5. INSTALLATION
WARNING: Viking residential sprinklers are to be installed in accordance with the latest Viking technical data, the latest edition of applicable standards of the National Fire Protection Association and any other similar Authorities Having Jurisdiction, and also with provisions of governmental codes, ordinances, and standards whenever applicable.
Final approval and acceptance of all residential sprinkler installations must be obtained from the Authorities Having Jurisdiction.

When using Viking Residential Concealed Sprinkler SIN VK438 for systems designed NFPA 13D or NFPA 13R, apply the listed areas of coverage and minimum water supply requirements shown in the approval chart on page 149.
For systems designed to the latest edition of NFPA 13R, the number of design sprinklers is to be the four contiguous most hydraulically demanding sprinklers. The minimum required discharge from each of the four sprinklers is to be the greater of the following:
• The flow rates given in the approval chart on data page 149 for NFPA 13D and NFPA 13R, applications for each listed maximum area of coverage, or
• A minimum discharge of 0.1 gallon per second, ft. over the "design area" consisting of the four contiguous most hydraulically demanding sprinklers for the coverage areas being protected by the four sprinklers. NOTE: This "A = S x L" method must be used to determine the sprinkler protection area of coverage per NFPA 13.

DEFLECTOR POSITION GUIDELINES
Install Residential Concealed Pendent Sprinkler SIN VK438 with the deflector 3/8" (9.5 mm) to 7/8" (22 mm) below the ceiling. Refer to Figures 1 and 2.
Refer to "Viking Residential Sprinkler Installation Guide" pages (i-v) for general care, installation, and maintenance information.

Replaces page 149 h-l, dated March 12, 2004 (added NSF Certification). Refer to residential sprinkler technical data page (i-v) for general care, installation, and maintenance information.
### Development of a lower-cost sprinkler system for domestic premises in the UK

**February 11, 2005**

#### Viking Technical Data

<table>
<thead>
<tr>
<th>Sprinkler Temperature Classification</th>
<th>Nominal Sprinkler Temperature Rating (Fusing Point)</th>
<th>Maximum Ambient Ceiling Temperature</th>
<th>Temperature Rating of the Required Cover Assembly</th>
<th>Sprinkler Part Number</th>
<th>Sprinkler Identification Number (SIN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinary</td>
<td>155°F (68°C)</td>
<td>100°F (56°C)</td>
<td>155°F (57°C)</td>
<td>12224NX0</td>
<td>12224NX0</td>
</tr>
<tr>
<td>NPT Thread Size</td>
<td>Inch (mm)</td>
<td>Inch (mm)</td>
<td>Inch (mm)</td>
<td>Inch (mm)</td>
<td>Inch (mm)</td>
</tr>
<tr>
<td>U.S. (metric)</td>
<td>1/2 (12.7)</td>
<td>2 (50.8)</td>
<td>2 (50.8)</td>
<td>2 (50.8)</td>
<td>2 (50.8)</td>
</tr>
<tr>
<td>K-Factor</td>
<td>4.0</td>
<td>7.1</td>
<td>95.0</td>
<td>12007</td>
<td>12007</td>
</tr>
</tbody>
</table>

#### Approval Chart

Residential Concealed Pendant Sprinkler SIN VK438 (4.9 K-Factor)

- Installed below smooth, flat, horizontal ceilings only, including ceilings with slopes up to and including 2/12 (9.5°).
- Maximum Areas of Coverage and Minimum Water Supply Requirements.

#### Footnotes

1. Based on NFPA-13. Other limitations may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.
2. The sprinkler temperature rating is stamped on the deflector.
3. This chart shows the listings and approvals available at the time of printing. Other approvals may be in process. Check with the manufacturer for any additional approvals.
4. K-Factor shown is for use when pressure is measured in PSI. When pressure is measured in BAR, multiply the metric K-Factor shown by 10.0.
5. Base part number shown. For complete part number, refer to Viking's current price list.
6. For areas of coverage smaller than those shown, use the “Minimum Water Supply Requirement” for the next larger listing under “Maximum Areas of Coverage” for the sprinkler used. The distance from sprinklers to walls shall not exceed one-half the sprinkler spacing indicated for the “Minimum Water Supply Requirement” used.
7. Listed by Underwriters Laboratories, Inc. for use in the U.S. and Canada.
8. Other paint colors are available on request with the same UL and C-UL Listings as the standard finish colors.
9. Areas under sloped ceilings must be measured along the ceiling slope. Actual floor coverage in the horizontal plane under sloped ceilings will be less than the listed area of coverage.

**NOTE:** Install Residential Concealed Pendant Sprinkler SIN VK438 with the deflector 3/8" (9.5 mm) to 7/8" (22.2 mm) below the ceiling.

#### Diagrams

1. **Figure 2:** Sprinkler SIN VK438, with up to 2" (12.7 mm) cover adjustment.
2. **Figure 3:** Installation Instructions-Sloped Ceilings

Replaces page 149 in, dated March 12, 2004 (added NSF Certification). Refer to residential sprinkler technical data page (i-iv) for general care, installation, and maintenance information.