



## RAYCHEM

# WinterGard, WinterGard Plus, WinterGard Wet

## Selection Guide (for Pipe Freeze Protection Applications)

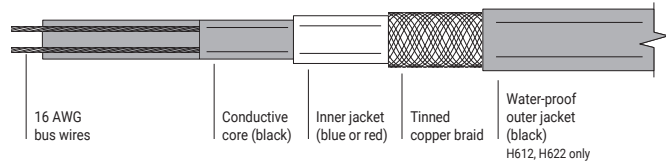
nVent RAYCHEM WinterGard self-regulating heating cables provide convenient, reliable freeze protection for a wide variety of professionally installed residential and commercial water-pipe and roof-and-gutter de-icing applications in nonhazardous areas. This selection guide is designed to assist in cable and accessory selection and basic circuit design of pipe-freeze-prevention applications.

Complete design guidelines, installation instructions, and safety

### Construction

information are provided in the Residential & Light Commercial Self-Regulating Heating Products Application and Design Guide (H53585), the H900 Power Connection Kit (H53665), and the H908 Plug-in Power Connection Kit (H54789).

For detailed information on roof and gutter de-icing applications, please refer to the WinterGard Wet Roof & Gutter De-Icing Design, Installation and Maintenance Guide (H56804).



### Pipe Applications

|   |                |
|---|----------------|
| Water pipes in dry areas:                                     | H311/H611/H621 |
| Water pipes in wet areas and refrigeration condensate drains: | H612/H622      |

### nVent RAYCHEM Product Specifications and Data

|  | WinterGard   | WinterGard Plus | WinterGard Plus | WinterGard Wet      | WinterGard Wet |
|--|--|-----------------|-----------------|---------------------|----------------|
|  | H311100  | H611050         | H621050         | H612050             | H622050        |
|  | H311250  | H611250         | H621250         | H612250             | H622250        |
|  |  |                 |                 | H612500             | H622500        |
|  |  |                 |                 | H6121000            | H6221000       |
| Service voltage  | 120 V  | 120 V           | 240 V           | 120 V               | 240 V          |
| Power output at 40°F (W/ft)                                    | 3  | 6               | 6               | 6                   | 6              |
| Power output in refrigeration condensate drains at 32°F (W/ft) | n/a  | n/a             | n/a             | 8                   | 8              |
| Weight per 100 ft (lb)   | 6  | 6               | 6               | 7                   | 7              |
| Nom. cable width (in)  | 0.380  | 0.380           | 0.380           | 0.415               | 0.415          |
| Nom. cable thickness (in)                                      | 0.180  | 0.180           | 0.180           | 0.215               | 0.215          |
| Bus wire gauge (AWG)   | 16   | 16              | 16              | 16                  | 16             |
| Braid wire gauge equivalent (AWG)                              | 14   | 14              | 14              | 14                  | 14             |
| Insulating jacket type   | Modified polyolefin  |                 |                 |                     |                |
| Outer jacket type  | n/a  | n/a             | n/a             | Modified polyolefin |                |
| Maximum exposure temp. (°F)                                    | 150  | 150             | 150             | 150                 | 150            |
| Environment  | Use only in ordinary (nonhazardous) areas. Do not expose to any chemicals. |                 |                 |                     |                |
| Agency approvals*  | 1, 3   | 1, 3            | 1, 3            | 1, 2, 3             | 1, 2, 3        |

\*1 = UL System Listed 718K Pipe Heating Cable; 2 = UL System Listed 877Z De-Icing and Snow Melting Equipment; 3 = CSA Certified LR21133

### ⚠ WARNING:

WinterGard systems must be installed correctly to ensure proper operation and to prevent shock or fire. Carefully read and follow the Residential & Light Commercial Self-Regulating Heating Products Application and Design Guide and the H900 series connection kit installation instructions.

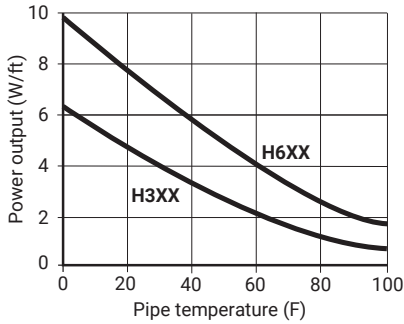
- Use only in ordinary (nonhazardous) areas. Do not expose to any chemicals, oil or grease.
- In wet areas, use only WinterGard Wet.

- To minimize the danger of fire from sustained electrical arcing if the heating cable is damaged or improperly installed, and to comply with the requirements of nVent, agency approvals, and national electrical codes, ground-fault equipment protection must be used on each heating cable branch circuit. Arcing may not be stopped by conventional circuit protection.

- This selection guide does not take the place of the installation instructions included in the Residential & Light Commercial Self-Regulating Heating Products Application and Design Guide and in the H900 series accessory kits.
- System approvals and performance are based on the use of only H900 series accessories with WinterGard heating cables. These accessories must be used. Do not substitute parts.

## Circuit Sizing Guide

### WinterGard Power Temperature Curves

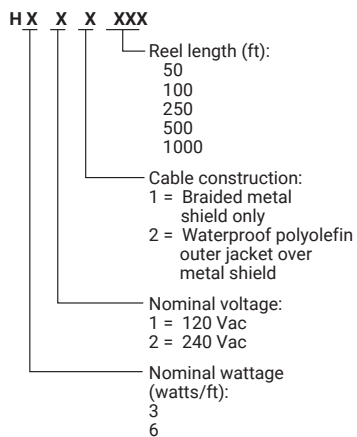


| Heating cable type   | Circuit breaker rating (A) | Maximum heater length (ft) per circuit at start-up temperature |      |      |
|--|----------------------------|--|------|------|
|  |                            | 0°F  | 32°F | 40°F |
| <b>WinterGard 120 V</b><br>H311 on pipe                                | 15                         | 150  |      | 250  |
|  | 20                         | 200  |      | 250  |
|  | 30                         | 250  |      | 250  |
| <b>WinterGard Plus 120 V</b><br>H611 on pipe                           | 15                         | 125  |      | 150  |
|  | 20                         | 140  |      | 195  |
|  | 30                         | 200  |      | 200  |
| <b>WinterGard Plus 240 V</b><br>H621 on pipe                           | 15                         | 200  |      | 255  |
|  | 20                         | 250  |      | 340  |
|  | 30                         | 375  |      | 400  |
| <b>WinterGard Wet 120 V</b><br>H612 on pipe                            | 15                         | 125  |      | 150  |
|  | 20                         | 140  |      | 195  |
|  | 30                         | 200  |      | 200  |
| <b>WinterGard Wet 120 V</b><br>H612 in refrigeration condensate drains | 15                         | 100  | 125  |      |
|  | 20                         | 125  | 165  |      |
|  | 30                         | 150  | 200  |      |
| <b>WinterGard Wet 240 V</b><br>H622 on pipe                            | 15                         | 200  |      | 255  |
|  | 20                         | 250  |      | 340  |
|  | 30                         | 375  |      | 400  |
| <b>WinterGard Wet 240 V</b><br>H622 in refrigeration condensate drains | 15                         | 200  | 250  |      |
|  | 20                         | 250  | 320  |      |
|  | 30                         | 305  | 400  |      |

**Note:** Maximum circuit lengths are based on start-up load. Steady-state amps per foot is dependent upon heating cable temperature.

## Catalog References

### Catalog Numbers



| Cable type           | Catalog number | Cable construction* | Watts/ft (on 40°F metal pipe) | Nominal voltage | Package type**            |
|----------------------|----------------|---------------------|-------------------------------|-----------------|---------------------------|
| WinterGard H311      | H311100        | 1                   | 3                             | 120             | TruckPak <sup>®</sup> box |
|                      | H311250        | 1                   | 3                             | 120             | 250-ft reel               |
| WinterGard Plus H611 | H611050        | 1                   | 6                             | 120             | 50-ft box                 |
|                      | H611100        | 1                   | 6                             | 120             | TruckPak box              |
|                      | H611250        | 1                   | 6                             | 120             | 250-ft reel               |
| WinterGard Plus H621 | H621050        | 1                   | 6                             | 240             | 50-ft box                 |
|                      | H621100        | 1                   | 6                             | 240             | TruckPak box              |
|                      | H621250        | 1                   | 6                             | 240             | 250-ft reel               |
| WinterGard Wet H612  | H612050        | 2                   | 6                             | 120             | 50-ft box                 |
|                      | H612100        | 2                   | 6                             | 120             | TruckPak box              |
|                      | H612250        | 2                   | 6                             | 120             | 250-ft reel               |
|                      | H612500        | 2                   | 6                             | 120             | 500-ft reel               |
|                      | H6121000       | 2                   | 6                             | 120             | 1000-ft reel              |
| WinterGard Wet H622  | H622050        | 2                   | 6                             | 240             | 50-ft box                 |
|                      | H622100        | 2                   | 6                             | 240             | TruckPak box              |
|                      | H622250        | 2                   | 6                             | 240             | 250-ft reel               |
|                      | H622500        | 2                   | 6                             | 240             | 500-ft reel               |
|                      | H6221000       | 2                   | 6                             | 240             | 1000-ft reel              |

\* Construction: 1 = braided metal shield only; 2 = waterproof polyolefin outer jacket over braid.

\*\* TruckPak consists of 100-foot cable reel, 2 power connections, 1 splice/tee kit, 1 roll application tape, 10 "Electric Traced" labels.

## Selection Tables

Use one of the tables below to help select the correct WinterGard heating cable for your application. (Consult the Residential & Light Commercial Application and Design Guide or H900/H908 Installation Instructions for complete system design information.)

Use Table 1 to select heating cables for insulated metal pipes. Use Table 2 for insulated plastic pipes.

Read across the table to find your pipe diameter, then drop down to the line corresponding to the lowest air temperature for that application and the correct insulation thickness. The cell at that intersection has a particular shade and may have a number.

The shade indicates which heating cable to use (key to the shades appears to the left of Table 1). A number in the cell represents the spiraling ratio (feet of heating cable per foot

of pipe). If no number appears in the cell, straight trace the pipe. If a number does appear in the cell, spiral trace the pipe. If your spiraling ratio is 2.0, multiple-trace the pipe using two straight traces at the 4 o'clock and 8 o'clock positions.

If your spiraling ratio is 3.0, multiple-trace the pipe using three straight traces at the 11 o'clock or 1 o'clock position and at the 4 o'clock and 8 o'clock positions.

### Key to Tables 1 and 2

- H311 WinterGard
- H611/621 WinterGard Plus  
H612/H622 WinterGard Wet
- Increase insulation thickness.

**Table 1. For metal pipes with fiberglass insulation or equivalent** (based on 40°F maintain)

| Lowest air temp. | Insulation thickness | Pipe diameter (inches) |      |      |      |      |      |      |      |      |      |     |
|------------------|----------------------|------------------------|------|------|------|------|------|------|------|------|------|-----|
|                  |                      | 0.50                   | 0.75 | 1.00 | 1.25 | 1.50 | 2.00 | 2.50 | 3.00 | 4.00 | 6.00 |     |
| 0°F              | 0.5 in               |                        |      |      |      |      |      |      |      |      | 1.3  | 1.8 |
|                  | 1.0 in               |                        |      |      |      |      |      |      |      |      |      |     |
|                  | 1.5 in               |                        |      |      |      |      |      |      |      |      |      |     |
| -20°F            | 0.5 in               |                        |      |      |      |      |      | 1.1  | 1.3  | 1.5  | 1.8  | 3.0 |
|                  | 1.0 in               |                        |      |      |      |      |      |      |      |      | 1.1  | 1.5 |
|                  | 1.5 in               |                        |      |      |      |      |      |      |      |      |      | 1.1 |
|                  | 2.0 in               |                        |      |      |      |      |      |      |      |      |      |     |
| -40°F            | 0.5 in               |                        |      |      | 1.1  | 1.2  | 1.4  | 1.7  | 2.0  | 3.0  |      |     |
|                  | 1.0 in               |                        |      |      |      |      |      |      | 1.1  | 1.4  | 1.9  |     |
|                  | 1.5 in               |                        |      |      |      |      |      |      |      |      | 1.4  |     |
|                  | 2.0 in               |                        |      |      |      |      |      |      |      |      |      | 1.1 |

**Table 2. For plastic pipes with fiberglass insulation or equivalent** (based on 40°F maintain)

| Lowest air temp. | Insulation thickness | Pipe diameter (inches) |      |      |      |      |      |      |      |      |      |     |
|------------------|----------------------|------------------------|------|------|------|------|------|------|------|------|------|-----|
|                  |                      | 0.50                   | 0.75 | 1.00 | 1.25 | 1.50 | 2.00 | 2.50 | 3.00 | 4.00 | 6.00 |     |
| 0°F              | 0.5 in               |                        |      |      |      |      | 1.2  | 1.4  | 1.7  | 2.0  | 3.0  |     |
|                  | 1.0 in               |                        |      |      |      |      |      |      |      | 1.2  | 1.6  |     |
|                  | 1.5 in               |                        |      |      |      |      |      |      |      |      | 1.2  |     |
| -20°F            | 0.5 in               |                        |      | 1.1  | 1.3  | 1.5  | 1.8  | 2.0  | 3.0  |      |      |     |
|                  | 1.0 in               |                        |      |      |      |      | 1.1  | 1.2  | 1.4  | 1.8  | 3.0  |     |
|                  | 1.5 in               |                        |      |      |      |      |      |      | 1.1  | 1.3  | 1.7  |     |
|                  | 2.0 in               |                        |      |      |      |      |      |      |      |      |      | 1.4 |
| -40°F            | 0.5 in               | 1.1                    | 1.1  | 1.5  | 1.8  | 2.0  | 3.0  | 3.0  |      |      |      |     |
|                  | 1.0 in               |                        |      |      | 1.1  | 1.2  | 1.4  | 1.6  | 1.9  | 3.0  |      |     |
|                  | 1.5 in               |                        |      |      |      |      | 1.1  | 1.2  | 1.4  | 1.7  | 3.0  |     |
|                  | 2.0 in               |                        |      |      |      |      |      |      | 1.1  | 1.3  | 1.8  |     |

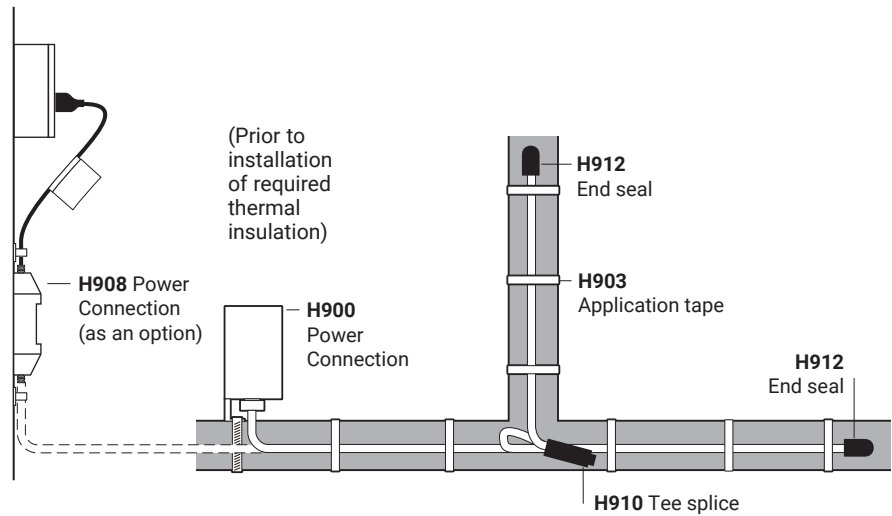
### Example 1

Pipe = 2-inch-diameter metal  
 Lowest air temperature = 0°F  
 Insulation thickness = 1 inch  
 Cable length and type = 1 foot of WinterGard H311 per foot of pipe

### Example 2

Pipe = 2.5-inch-diameter plastic  
 Lowest air temperature = -20°F  
 Insulation thickness = 1 inch  
 Cable length = 1.2 feet of WinterGard Plus H611, H621 or WinterGard Wet H612, H622

## Typical Assembled System



## nVent RAYCHEM WinterGard Accessories (for Pipe Applications)

|               |  |
|---------------|--|
| <b>H900</b>   | Power Connection (Hardwire)                    |
| <b>H903</b>   | Application Tape                               |
| <b>H908</b>   | Plug-in Power Connection Kit with ground fault |
| <b>H910</b>   | Splice and Tee Kit (wet or dry)                |
| <b>H912</b>   | Gel-filled End Seal Kit (includes 2 seals)     |
| <b>AMC-F5</b> | Fixed Set Point Thermostat                     |
| <b>AMC-1A</b> | Adjustable Mechanical Thermostat 15F - 140F    |
| <b>EC-TS</b>  | Adjustable Electronic Thermostat 30F - 110F    |



**IMPORTANT:** H900 series accessories must be used with WinterGard heating cables. Do not substitute parts.

### North America

Tel +1.800.545.6258  
Fax +1.800.527.5703  
thermal.info@nVent.com



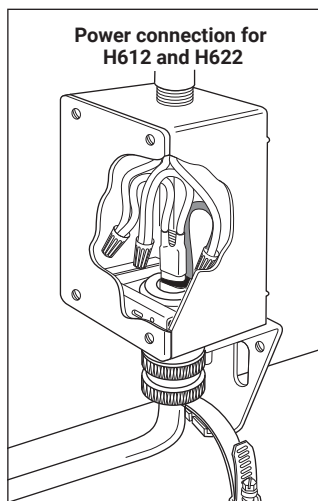
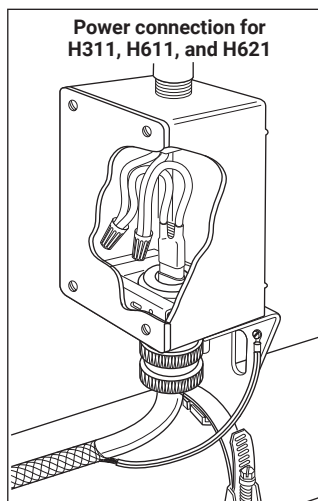
nVent.com



## RAYCHEM

# H900

## WinterGard Power Connection Kit with End Seal Installation Instructions



### DESCRIPTION

The nVent RAYCHEM WinterGard power connection kit is for use only with the following WinterGard heating cables: H311, H611, H612, H621, and H622.

Materials for one power connection and one end seal are included. All nVent RAYCHEM WinterGard heating cables are designed for water-pipe freeze protection applications. Only the H612 and H622 cables can be used for both pipe freeze protection and roof and gutter de-icing applications. Do not use this kit with aluminum feed wires. For additional technical support call nVent at (800) 545-6258.

**Note:** For WinterGard heating cables in pipe heating applications, refer to pages 3–5. For nVent RAYCHEM WinterGard Wet heating cables H612 and H622 in roof and gutter de-icing applications, refer to pages 6–8.

### TOOLS REQUIRED

- Needle nose pliers
- Propane torch or heat gun
- Utility knife
- Adjustable wrench
- Pen
- Diagonal cutters
- Panduit CT100 crimp tool
- Screwdriver

### ADDITIONAL MATERIALS REQUIRED

- UL Listed or CSA Certified junction box suitable for the location, with a clearance hole for 1/2-inch conduit or 1/2-inch NPT threaded hub.
- For H311, H611, and H621, you must use a metallic junction box to ensure proper grounding.
- Your application may require additional WinterGard accessories; for example, H903 application tape for pipe applications; H913/H914 roof clips and/or H915 downspout hangers for roof and gutter de-icing applications.

### APPROVALS

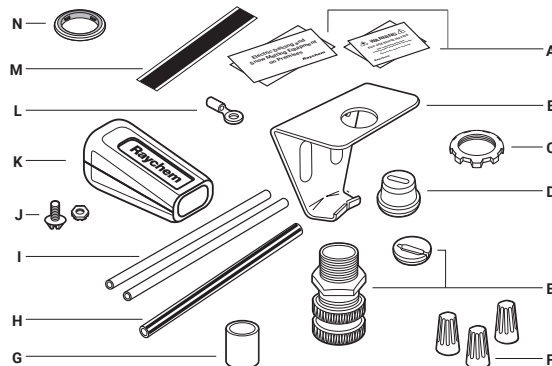


718K Pipe Heating Cable,  
Also Listed as De-Icing and  
Snow Melting Equipment



### KIT CONTENTS

| Item | Qty | Description                                   |
|------|-----|---|
| A    | 4   | Labels  |
| B    | 1   | Pipe mounting bracket                         |
| C    | 1   | Lock nut                                      |
| D    | 1   | Blue grommet                                  |
| E    | 1   | Sealing fitting with black grommet            |
| F    | 3   | Wire nuts                                     |
| G    | 1   | Black heat-shrinkable tube (1/2" x 1")        |
| H    | 1   | Green/yellow heat-shrinkable tube (1/4" x 6") |
| I    | 2   | Black heat-shrinkable tubes (1/8" x 5 1/2")   |
| J    | 1   | Green grounding screw and kep nut             |
| K    | 1   | Gel-filled end seal                           |
| L    | 1   | Ring terminal                                 |
| M    | 1   | Black cloth tape (6" long)                    |
| N    | 1   | Sealing gasket                                |



**WARNING:**

These components are electrical devices. They must be installed correctly to ensure proper operation and to prevent shock or fire. Carefully follow all of the installation instructions and read these important warnings.

- To minimize the danger of fire from sustained electrical arcing if the heating cable is damaged or improperly installed, and to comply with the requirements of nVent and national electrical codes, ground-fault equipment protection must be used on each heating cable branch circuit. Arcing may not be stopped by conventional circuit protection.
- Component approvals and performance are based on the use of specified parts only. Do not substitute parts or use vinyl electrical tape.

- The black heating-cable core is conductive and can short. It must be properly insulated and kept dry.
- Keep components and heating cable ends dry before and during installation.
- Damaged bus wires can overheat or short. Do not break braid or bus wire strands when scoring the jacket or core.
- Bus wires will short if they contact each other. Keep bus wires separated.
- Heat-damaged components can short. Use a heat gun or a torch with a soft, yellow, low-heat flame, not a blue focused flame. Keep the flame moving to avoid overheating, blistering, or charring the heat-shrinkable tubes. Avoid heating other components. Replace any damaged parts.

- Use only fire-resistant insulation materials such as fiberglass wrap.
- Leave these installation instructions with the user for future reference.

**CAUTION:**

Charring or burning the heat-shrinkable tubes in this kit will produce fumes that may cause eye, skin, nose, and throat irritation. Consult Material Safety Data Sheet RAY3122.

CHEMTREC 24-hour emergency telephone:  
(800) 424-9300

Non-emergency health and safety information:  
(800) 545-6258.

**H900 DESIGN AND INSTALLATION INFORMATION FOR HEATING CABLE ON PIPES ONLY (WINTERGARD H311, H611, H621, H612, AND H622 HEATING CABLES).**

**Important:** For the nVent warranty to be valid, you must comply with all the requirements outlined in these guidelines.

All thermal and design information provided here is based upon a "standard" installation with heating cable fastened to an insulated pipe. For any other application or method of installation, consult nVent at (800) 545-6258.

**HEATING CABLE SELECTION AND DESIGN**

Make sure that the heating cable being used is suitable for your application. Refer to the Commercial and Residential Application and Design Guide (H53585) for heating cable application information.

**1. Determine the heating cable type.**



Use Table 1 to select heating cables for insulated metal pipes. Use Table 2 to select heating cables for insulated plastic pipes. Read across the table to find your pipe size, then drop down to the line corresponding to the lowest air temperature for that application and the correct insulation thickness. The cell at that intersection has a particular shading and may have a number. The shading indicates which heating cable to use (key to the shading appears above the table headings). A number represents the spiraling ratio (feet of heating cable per foot of pipe).

If no number appears in the cell, straight trace the pipe. If a number does appear in the cell, spiral trace the pipe.


If your spiraling ratio is 2.0, multiple trace the pipe using two straight traces at the 4 o'clock and 8 o'clock positions.


If your spiraling ratio is 3.0, multiple trace the pipe using three straight traces at the 11 o'clock or 1 o'clock position, and at the 4 o'clock and 8 o'clock positions.

**Example 1:**




- Pipe size: 1 in
- Lowest air temp.: 0°F
- Insulation thickness: 1/2 in
- Metal pipe:  WinterGard H311
- Plastic pipe:  WinterGard Plus H611, H621  
WinterGard Wet H612, H622

**Example 2:**

- Pipe size: 2 1/2 in
- Lowest air temp.: -20°F
- Insulation thickness: 1/2 in
- Metal pipe:  1.3 WinterGard Plus H611, H621  
WinterGard Wet H612, H622  
(Use 1.3 feet of heating cable per foot of pipe.)




- Plastic pipe:  2.0 WinterGard Plus H611, H621  
WinterGard Wet H612, H622  
(Use two straight traces at the 4 o'clock and 8 o'clock positions.)

**Table 1. For METAL pipes with fiberglass insulation or equivalent (based on 40°F maintain temperature)**

Key to Table 1:  = H311  = H611, H612, H621, H622  = Use a thicker insulation

| Lowest air temp. (°F) | Insulation thickness | Nominal pipe size |        |      |          |          |      |          |      |      |      |     |
|-----------------------|----------------------|-------------------|--------|------|----------|----------|------|----------|------|------|------|-----|
|                       |                      | 1/2 in            | 3/4 in | 1 in | 1 1/4 in | 1 1/2 in | 2 in | 2 1/2 in | 3 in | 4 in | 6 in |     |
| 0                     | 1/2 in               |                   |        |      |          |          |      |          |      |      | 1.3  | 1.8 |
|                       | 1 in                 |                   |        |      |          |          |      |          |      |      |      |     |
|                       | 1 1/2 in             |                   |        |      |          |          |      |          |      |      |      |     |
| -20                   | 1/2 in               |                   |        |      |          |          | 1.1  | 1.3      | 1.5  | 1.8  | 3.0  |     |
|                       | 1 in                 |                   |        |      |          |          |      |          |      | 1.1  | 1.5  |     |
|                       | 1 1/2 in             |                   |        |      |          |          |      |          |      |      | 1.1  |     |
|                       | 2 in                 |                   |        |      |          |          |      |          |      |      |      |     |
| -40                   | 1/2 in               |                   |        |      | 1.1      | 1.2      | 1.4  | 1.7      | 2.0  | 3.0  |      |     |
|                       | 1 in                 |                   |        |      |          |          |      |          | 1.1  | 1.4  | 1.9  |     |
|                       | 1 1/2 in             |                   |        |      |          |          |      |          |      |      | 1.4  |     |
|                       | 2 in                 |                   |        |      |          |          |      |          |      |      | 1.1  |     |

**Table 2. For PLASTIC pipes with fiberglass insulation or equivalent (based on 40°F maintain temperature)**

Key to Table 2:  = H311  = H611, H612, H621, H622  = Use a thicker insulation

| Lowest air temp. (°F) | Insulation thickness | Nominal pipe size |        |      |          |          |      |          |      |      |      |
|-----------------------|----------------------|-------------------|--------|------|----------|----------|------|----------|------|------|------|
|                       |                      | 1/2 in            | 3/4 in | 1 in | 1 1/4 in | 1 1/2 in | 2 in | 2 1/2 in | 3 in | 4 in | 6 in |
| 0                     | 1/2 in               |                   |        |      |          |          | 1.2  | 1.4      | 1.7  | 2.0  | 3.0  |
|                       | 1 in                 |                   |        |      |          |          |      |          |      | 1.2  | 1.6  |
|                       | 1 1/2 in             |                   |        |      |          |          |      |          |      |      | 1.2  |
| -20                   | 1/2 in               |                   |        | 1.1  | 1.3      | 1.5      | 1.8  | 2.0      | 3.0  |      |      |
|                       | 1 in                 |                   |        |      |          |          | 1.1  | 1.2      | 1.4  | 1.8  | 3.0  |
|                       | 1 1/2 in             |                   |        |      |          |          |      |          | 1.1  | 1.3  | 1.7  |
|                       | 2 in                 |                   |        |      |          |          |      |          |      |      | 1.4  |
| -40                   | 1/2 in               | 1.1               | 1.1    | 1.5  | 1.8      | 2.0      | 3.0  | 3.0      |      |      |      |
|                       | 1 in                 |                   |        |      | 1.1      | 1.2      | 1.4  | 1.6      | 1.9  | 3.0  |      |
|                       | 1 1/2 in             |                   |        |      |          |          | 1.1  | 1.2      | 1.4  | 1.7  | 3.0  |
|                       | 2 in                 |                   |        |      |          |          |      |          | 1.1  | 1.3  | 1.8  |

## 2. Calculate the total heating cable length required

$$\text{Length} = A + B + C + D + E + F + G + H$$

- A Pipe length x spiraling ratio
- B 4 ft x # gate/globe valves x valve length (ft) x spiraling ratio
- C 2 ft x # ball/butterfly valves x valve length (ft) x spiraling ratio
- D 2 ft x # flanges x pipe diameter (ft) x spiraling ratio
- E 2 ft x # pipe supports v pipe diameter (ft) x spiraling ratio
- F 1 ft for each power connection
- G 2 ft for each splice connection
- H 3 ft for each tee connection

= Total heating cable length (ft)

## 3. Determine the maximum heating cable circuit length allowed.

See Table 3 on the next page. Ensure that your circuits do not exceed the maximum circuit length listed in Table 3. If necessary, use additional shorter circuits.

**Example** (taken from Example 2 [on metal pipe], page 3):

|                     |                            |
|---------------------|----------------------------|
| Pipe length:        | 50 ft                      |
| Spiral ratio:       | 1.3 (from Table 1, page 3) |
| Globe valves:       | 3 (each 0.5 ft long)       |
| Pipe supports:      | 10 supports for 1 in pipe  |
| Power connections:  | 1                          |
| Splice connections: | 1                          |

### WinterGard heating cable required:

|   |                              |                            |           |
|---|------------------------------|----------------------------|-----------|
| A | Pipe length x spiral ratio   | = 50 ft x 1.3              | = 65.0 ft |
| B | 3 globe valves (0.5 ft each) | = 4 ft x 3 x 0.5 x 1.3     | = 7.8 ft  |
| C | 0 ball/butterfly valves      | = 0 =                      | 0         |
| D | 0 flanges                    | = 0 =                      | 0         |
| E | 10 pipe supports             | = 2 ft x 10 x 0.085* x 1.3 | = 2.2 ft  |
| F | 1 power connection           | = 1 ft x 1                 | = 1.0 ft  |
| G | 1 splice connection          | = 2 ft x 1                 | = 2.0 ft  |
| H | 0 tee connection             | = 0 =                      | 0         |

**Total heating cable length required = 78.0 ft**

\*1 in pipe diameter / 12 in per foot = 0.085 foot

## HEATING CABLE INSTALLATION

### 1. Prepare for installation.

- Store the heating cable in a clean, dry place.
- Complete piping pressure test.
- Review the WinterGard heating cable design and compare to materials received to verify that the proper WinterGard heating cable and accessories are available. The WinterGard heating cable will have the heating cable type printed on the outer jacket.
- Walk the system and plan the routing of the WinterGard heating cable on the pipe.

### 2. Cut the heating cable to length.

- Cut the heating cable to the length required. This can be done before or after the cable is attached to the pipe. Leave a minimum of 1 foot extra heating cable for connection to power. For splice and tee connections, leave a minimum of 1 foot for each section of heating cable. WinterGard heating cable can be cut to length without affecting its heat output per foot.
- Protect the heating cable ends from moisture or mechanical damage if they will be left exposed before connection.

### 3. Position and attach heating cable to pipe.

- Be sure all piping to be traced is dry.
- Install heating cable, using straight tracing, spiraling, or multiple tracing according to the "Heating cable selection and design" section on page 3.
- For straight tracing, install the heating cable on a lower half of the pipe; for example, in the 4 o'clock or 8 o'clock position.
- Be sure to install the additional heating cable required for valves, flanges, etc. as indicated in Step 2 of the "Heating cable selection and design" section.
- When the design calls for spiraling, begin by suspending a loop every 10 feet as shown in Figure 1. To determine the loop length, obtain the spiral factor from Table 1 or 2 and multiply by 10. For example, if a spiral factor of 1.3 is called for, leave a 13-foot loop of heating cable at every 10-foot section of pipe. Grasp the loop in its center and wrap it around the pipe. Even out the distance between spirals by sliding the wraps along the pipe. Use glass tape to secure the center of the loop to the pipe to obtain good contact.
- Tape WinterGard heating cable to the pipe at 2-foot intervals using RAYCHEM H903 fiberglass application tape or nylon cable ties. Do not use vinyl electrical tape, duct tape, metal bands, or wire.

### 4. Install heating cable end seals, splices, tees, and power connection.

- Install all end seals, splices, tees, and power connection prior to plugging in.
- If splicing or teeing, use only the H910 WinterGard Splice and Tee Kit to satisfy code and agency requirements.
- H900 kit assembly instructions begin on page 9.

### 5. Check the installation.

- Prior to installing thermal insulation, make sure the heating cable is free of mechanical damage (from cuts, clamps, etc.) and thermal damage (from solder, overheating, etc.).
- Visually check all power connections, end seals, splices, and tees.
- Using a megohmmeter, test each circuit according to the instructions in the "Heating cable testing and maintenance" section (page 5) both before and after installing the thermal insulation.

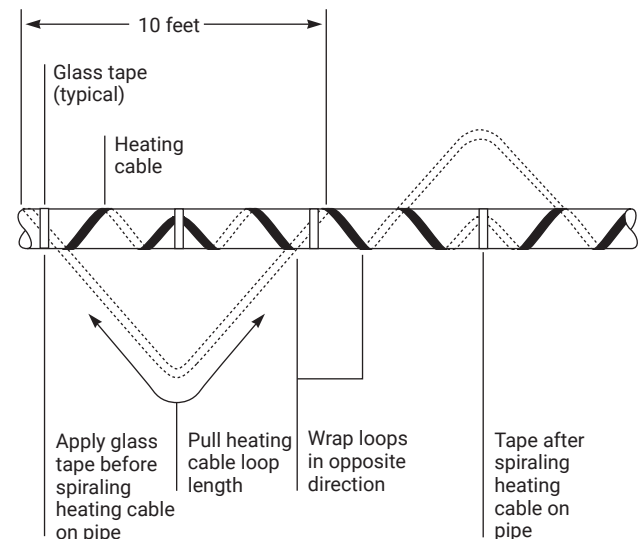


Figure 1. Spiraled heat tracing



## 6. Install thermal insulation.

- A reliable WinterGard system depends on properly installed and weather-proofed thermal insulation.
- Ensure that type and thickness of the insulation are in accordance with the information in the heating cable selection tables on page 3 and that all pipe work—including valves, joints, wall penetrations, and other elements—has been fully insulated.
- Minimize the potential for mechanical damage to the heating cable after installation by installing the insulation as soon as you have checked the cable installation.

## 7. Mark the installation.

- Place “Warning” labels for pipe trace applications on the outer surface of the insulation at 10-foot intervals (on alternating sides of the pipe) to indicate the presence of WinterGard electric heating cable. Additional labels and application tape are contained in the H903 kit.

## 8. Check the installation

- Prior to powering, check to be sure the heating cable is free of mechanical damage (cuts, clamps, etc.).
- Visually check all power connections, end seals, splices, and tees for proper installation.
- Using a Megohmmeter, test each circuit according to the instructions in the “Heating cable testing and maintenance” section below.

## ELECTRICAL PROTECTION

### Voltage rating

|                      |             |
|----------------------|-------------|
| H311, H611, and H612 | 110–120 Vac |
| H621                 | 208–240 Vac |
| H622                 | 208–240 Vac |

For the maximum heating cable circuit length permitted for a given circuit breaker rating, refer to Table 3. Limit your circuit length based on your lowest anticipated start-up temperature.

### Ground fault protection:

nVent and national electrical codes require ground-fault equipment protection on each heating cable branch circuit. To reduce the risk of fire caused by damage or improper installation, circuit breakers such as Square D QO-EPD and QOB-EPD or equivalent, with a 30-mA trip level, should be used. Alternative designs providing comparable levels of ground-fault protection may also be acceptable. For technical assistance, call nVent at (800) 545-6258.

**Table 3. Maximum heating cable circuit length on pipe**

| Heating cable type                    | Circuit breaker rating (A) | Maximum heater length (ft) per circuit at start-up temperature |      |
|---------------------------------------|----------------------------|--|------|
|                                       |                            | 0°F  | 40°F |
| WinterGard 120 V<br>H311 on pipe      | 15                         | 150  | 250  |
|                                       | 20                         | 200  | 250  |
|                                       | 30                         | 250  | 250  |
| WinterGard Plus 120 V<br>H611 on pipe | 15                         | 125  | 150  |
|                                       | 20                         | 140  | 195  |
|                                       | 30                         | 200  | 200  |
| WinterGard Plus 240 V<br>H621 on pipe | 15                         | 200  | 255  |
|                                       | 20                         | 250  | 340  |
|                                       | 30                         | 375  | 400  |
| WinterGard Wet 120 V<br>H612 on pipe  | 15                         | 125  | 150  |
|                                       | 20                         | 140  | 195  |
|                                       | 30                         | 200  | 200  |
| WinterGard Wet 240 V<br>H622 on pipe  | 15                         | 200  | 255  |
|                                       | 20                         | 250  | 340  |
|                                       | 30                         | 375  | 400  |

**Note:** Maximum circuit lengths are based on start-up load. Steady-state amps per foot is dependent upon heating cable temperature.

## HEATING CABLE TESTING AND MAINTENANCE

nVent recommends that the insulation resistance between the bus wires and the heater grounding braid or metal pipe should be checked during installation using a 2500-Vdc megohmmeter. Minimum reading should be 1000 megohms, regardless of length.

Record the original values for each circuit. Take additional readings during regularly scheduled maintenance and compare to the original value. If the readings fall below 1000 megohms, inspect cables and insulation for signs of damage.

If physical damage is found, the entire damaged section must be removed and a new section of heating cable spliced in using only approved WinterGard H910 splice kits. Do not repair the damaged heating cable section.

If physical damage cannot be found, the complete circuit should be removed and replaced with new WinterGard heating cable.



**WARNING: Shock and Fire Hazard. Damaged heating cable or components can cause electrical shock, arcing, and fire. Do not attempt to energize damaged cable or components. Replace them immediately using a new length of heating cable and the appropriate WinterGard accessories.**

**Table 4. Product data—WinterGard products on pipe only**

| Heating cable type              | WinterGard                                     |      | WinterGard Plus                                |      | WinterGard Wet  |      |
|---------------------------------|--|------|--|------|---|------|
|                                 | H311   | H611 | H621   | H612 | H622  |      |
| Service voltage (V)             | 120  | 120  | 240  | 120  | 240   |      |
| Thermal output at 40°F (W/ft)   | 3  | 6    | 6  | 6    | 6   |      |
| Weight per 100 ft (lb)          | 6  | 6    | 6  | 9    | 9   |      |
| Minimum installation temp. (°F) | 0  | 0    | 0  | 0    | 0   |      |
| Maximum exposure temp. (°F)     | 150  | 150  | 150  | 150  | 150   |      |
| Exposure to chemicals           | None   | None | None   | None | None  | None |
| Environment                     | Use only in dry ordinary (nonhazardous) areas. |      | Use only in dry ordinary (nonhazardous) areas. |      | Use only in wet or dry ordinary (nonhazardous) areas. |      |



## H900 DESIGN AND INSTALLATION INFORMATION FOR ROOF AND GUTTER DE-ICING ONLY (WinterGard Wet H612, and H622 Heating Cables)

**Important:** For the nVent warranty to be valid, you must comply with all the requirements outlined in these guidelines.

All design information provided here is based on a “standard” shake or shingle roof application. For any other application or method of installation, consult nVent at (800) 545-6258.

### HEATING CABLE DESIGN

Only WinterGard Wet H612 120-V and H622 240-V heating cables are suitable for use with the H900 power connection kit for roof and gutter de-icing applications.

#### 1. Calculate the heating cable length required.

$$\text{Length} = A + B + C + D + E + F + G$$

- A** Roof edge length (ft) x feet of heating cable per foot of roof edge (From Table 5)
- B** Roof edge length (ft) x 0.5\*
- C** Total gutter length (ft)
- D** Total downspout length (ft) + 1 (ft)
- E** 1 ft for each power connection
- F** 2 ft for each splice connection
- G** 3 ft for each tee connection

**= Total heating cable length (ft)**

\* Roof extension: This length allows the heating cable to extend into the gutter to provide a continuous drain path, or where no gutters are present, extends beyond the roof edge to form a drip loop.

**Note:** nVent recommends a gutter and downspouts to provide a continuous path for melted water.

**Table 5. WinterGard Wet cable length for roof de-icing**

| Eave overhang | Shingle roof | Standing seam metal roof: |              |
|---------------|--------------|---------------------------|--------------|
|               |              | 18 inch seam              | 24 inch seam |
| 0             | 2.0 ft       | 2.5 ft                    | 2.0 ft       |
| 12"           | 2.8 ft       | 2.8 ft                    | 2.4 ft       |
| 24"           | 3.8 ft       | 3.6 ft                    | 2.9 ft       |
| 36"           | 4.8 ft       | 4.3 ft                    | 3.6 ft       |

**Note:** nVent recommends a gutter and downspouts to provide a continuous path for melted water.

#### Example:

|                       |       |
|-----------------------|-------|
| Roof edge:            | 40 ft |
| Roof overhang:        | 1 ft  |
| Roof gutter:          | 40 ft |
| Downspout:            | 15 ft |
| Power connection:     | 2 ea  |
| Tee connection:       | 1 ea  |
| Voltage available:    | 120 V |
| CB Size Available:    | 15 A  |
| Start-up temperature: | 0 °F  |

#### WinterGard Wet heating cable required:

|                              |                |                |         |
|------------------------------|----------------|----------------|---------|
| <b>A</b> Roof edge:          | 40 ft x 2.0    | (from Table 5) | = 80 ft |
| <b>B</b> Roof extension:     | = 40 ft x 0.5  |                | = 20 ft |
| <b>C</b> Roof gutter:        | = 40 ft        |                |         |
| <b>D</b> Downspout:          | = 15 ft + 1 ft |                | = 16 ft |
| <b>E</b> Power connection:   | 1 ft x 2 ea    |                | = 2 ft  |
| <b>F</b> Splice Connections: | = 0            |                |         |
| <b>G</b> Tee connection:     | 3 ft x 1 ea    |                | = 3 ft  |

#### Total WinterGard Wet heating cable

**required: = 161 ft\*\***

\*\* This total exceeds 100-ft maximum circuit length (see Table 6), therefore two separate circuits are required.

### HEATING CABLE INSTALLATION

#### 1. Prepare for installation.

- Store the heating cable in a clean, dry place.
- Use only the following nVent accessories to satisfy code and agency requirements:
  - H900 WinterGard Plug-in Power Connection Kit (with end seal)
  - H910 WinterGard Splice and Tee Kit (if splicing or teeing)
  - H915 Downspout Hangers
  - H913/H914 Roof Clips
- Carefully plan the routing of the heating cable for roof and gutter de-icing.
- Make certain gutters and downspouts are free of leaves and other debris.

#### 2. Cut the heating cable to length.

- Cut the heating cable to the length required. This can be done before or after it is installed. Leave a minimum of 1 foot extra heating cable for connection to power. For splice and tee connections leave a minimum of 1 foot for each section of heating cable. WinterGard heating cable can be cut to length without affecting its heat output per foot.
- Protect the heating cable ends from moisture and mechanical damage if they will be left exposed before connection.

#### 3. Position and attach the heating cable.

##### On roofs

- Loop the heating cable on the overhang area of the roof. This is the part that extends past the building wall. Extend the bottom of each heating cable loop over the roof edge and, using a UV-resistant cable tie, connect the bottom of each loop to the cable running in the gutter to ensure a drainage channel off the roof and into the gutter and downspout. The cable running in the gutter should remain against the bottom of the gutter. Extend the top of each heating cable loop beyond where the wall joins the roof. nVent recommends 2-foot clip-spacing along the roof edge. See the “Heating cable design” section (Table 5) for spacing and layout information.

- Use WinterGard H913/H914 roof clips to attach heating cable to the roof surface. One kit contains ten double roof clips for approximately 7 linear feet of roof edge. One H914 kit contains 50 roof clips for approximately 35 linear feet of roof edge. For flat roofs, the heating cable can be spaced as needed to create runoff paths for melting ice and snow. Use single-ended clips located at 3-foot intervals to secure the cable to the roof. Roof clips may be attached to a shake or shingle roof with nails or screws. Reseal the nail or screw holes if necessary before installing heating cable in the clips. Roof clips may be attached to a metal roof using screw, nail or adhesive. (See H56723 installation instruction for more details.)
- A barrier (snow fence) can be placed on the roof above the heating cable. This prevents damage to the cable and keeps the installation from coming loose due to ice slides. If desired, the heating cable can be attached to the barrier with UV-resistant cable ties, instead of using roof clips. Do not use wire or other materials because they may damage the heating cable.

##### In gutters and downspouts

- Run heating cable along gutters and into downspouts, ending below the freezing level. Permanent attachment of the cable to the gutter bottom is not necessary. Loop the heating cable in downspouts if convenient, such as when the downspout is not at the end of the run, or use the H910 splice and tee kit to tee down the downspout.
- Use WinterGard H915 downspout hangers to protect the heating cable from fraying and from damage from sharp edges and to provide strain relief. Refer to the H915 kit instructions for installation details.
- Use WinterGard H913/H914 roof clips to route heating cable into and out of the gutter in such a way as to prevent abrasion to the cable. Protect all cable that protrudes past the lower opening of the downspout.

**4. Install heating cable end seals, splices, tees, and power connection.**

- Install all end seals, splices, tees, and power connection prior to plugging in.
- Follow the nVent RAYCHEM H900 kit installation instructions beginning on page 9.
- Use only weatherproof junction boxes approved for wet locations when installing WinterGard H612 and H622 heating cable with the H900 Power Connection Kit for roof and gutter applications.

**5. Mark the installation.**

A label indicating the presence of electric de-icing and snow-melting equipment on the premises is included with this unit. The label must be posted at the electrical outlet cover. The label must be clearly visible.

**6. Check the installation.**

- Prior to powering, check to be sure the heating cable is free of mechanical damage (cuts, clamps, etc.).
- Visually check all power connections, end seals, splices, and tees for proper installation.
- Using a megohmmeter, test each circuit according to the instructions in the “Heating cable testing and maintenance” section below.

**ELECTRICAL PROTECTION**

**Voltage rating**

|      |             |
|------|-------------|
| H612 | 110–120 Vac |
| H622 | 208–240 Vac |

**Ground fault protection:**

nVent and national electrical codes require ground-fault equipment protection on each heating cable branch circuit. To reduce the risk of fire caused by damage or improper installation, circuit breakers such as Square D QO-EPD and QOB-EDPD or equivalent, with a 30-mA trip level, should be used. Alternative designs providing comparable levels of ground-fault protection may also be acceptable. For technical assistance, call nVent at (800) 545-6258.

**Table 6. Maximum heating cable circuit length for roof and gutter de-icing, downspouts and refrigeration condensate drains**

| Heating cable type   | Circuit breaker rating (A) | Maximum heater length (ft) per circuit at start-up temperature |      |
|--|----------------------------|--|------|
|  |                            | 0°F  | 32°F |
| WinterGard Wet 120 V H612 in downspout and refrigeration condensate drains | 15                         | 100  | 125  |
|  | 20                         | 125  | 165  |
|  | 30                         | 150  | 200  |
| WinterGard Wet 240 V H622 in downspout and refrigeration condensate drains | 15                         | 200  | 250  |
|  | 20                         | 250  | 320  |
|  | 30                         | 305  | 400  |

**Note:** Maximum circuit lengths are based on start-up load. Steady-state amps per foot is dependent upon heating cable temperature.

**HEATING CABLE TESTING AND MAINTENANCE**

Make sure that gutter and downspouts are free of leaves and other debris prior to the winter season.

nVent recommends that the insulation resistance between the bus wires and the heating cable grounding braid or metal pipe should be checked during installation using a 2500-Vdc megohmmeter. Minimum reading should be 1000 megohms, regardless of circuit length.

Record the original values for each circuit. Take additional readings during regularly scheduled maintenance and compare to the original value. If the readings fall below 1000 megohms, inspect heating cables and insulation for signs of damage.

If physical damage is found, the entire damaged section must be removed and a new section of heating cable spliced in using only

approved WinterGard H910 splice kits. Do not repair the damaged heating cable section.

If physical damage cannot be found, the complete circuit should be removed and replaced with new WinterGard heating cable.

**⚠ WARNING: Shock and Fire Hazard. Damaged heating cable or components can cause electrical shock, arcing, and fire. Do not attempt to energize damaged cable or components. Replace them immediately using a new length of heating cable and the appropriate WinterGard accessories.**

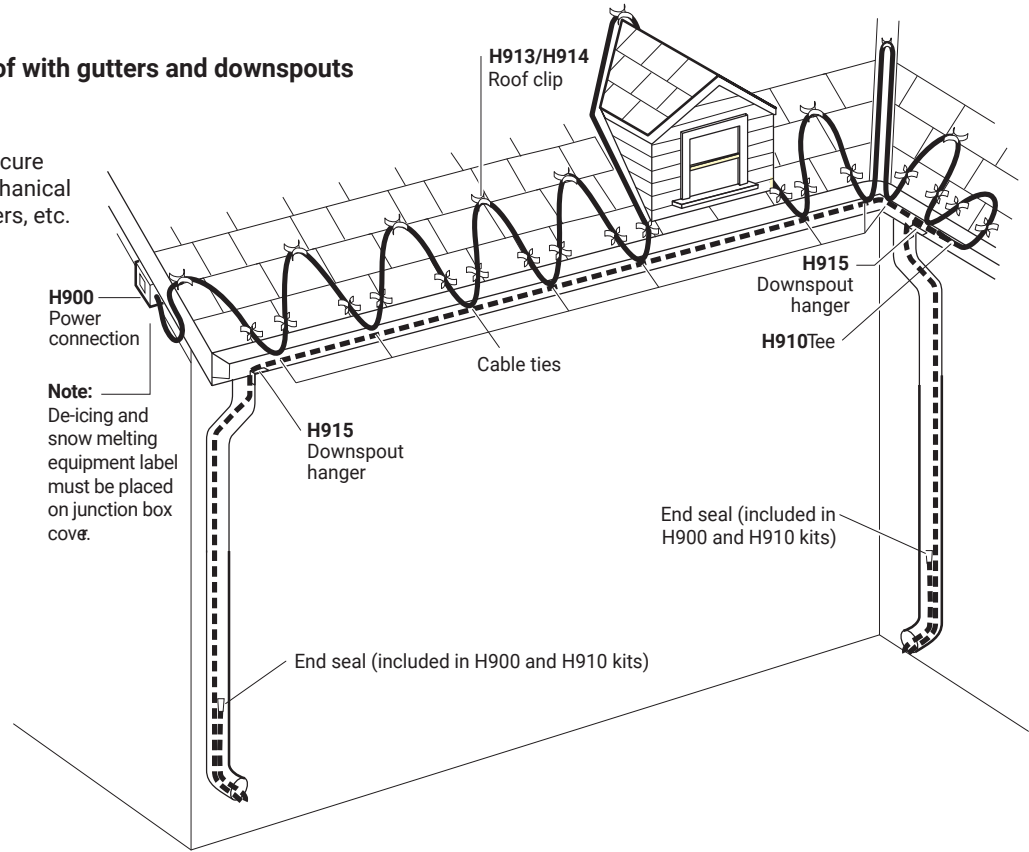
**Table 7. Product data—WinterGard Wet H612 and H622 for roof and gutter de-icing only**

|   | H612                                       | H622                                       |
|---|--|--|
| Service voltage (V)                             | 120  | 240  |
| Thermal output at 32°F (W/ft) (in ice and snow) | 8  | 8  |
| Weight per 100 ft (lb)                          | 9  | 9  |
| Minimum installation temp. (°F)                 | 0  | 0  |
| Maximum exposure temp. (°F)                     | 150  | 150  |
| Exposure to chemicals                           | None                                       | None                                       |
| Environment                                     | Use only in ordinary (nonhazardous) areas. | Use only in ordinary (nonhazardous) areas. |

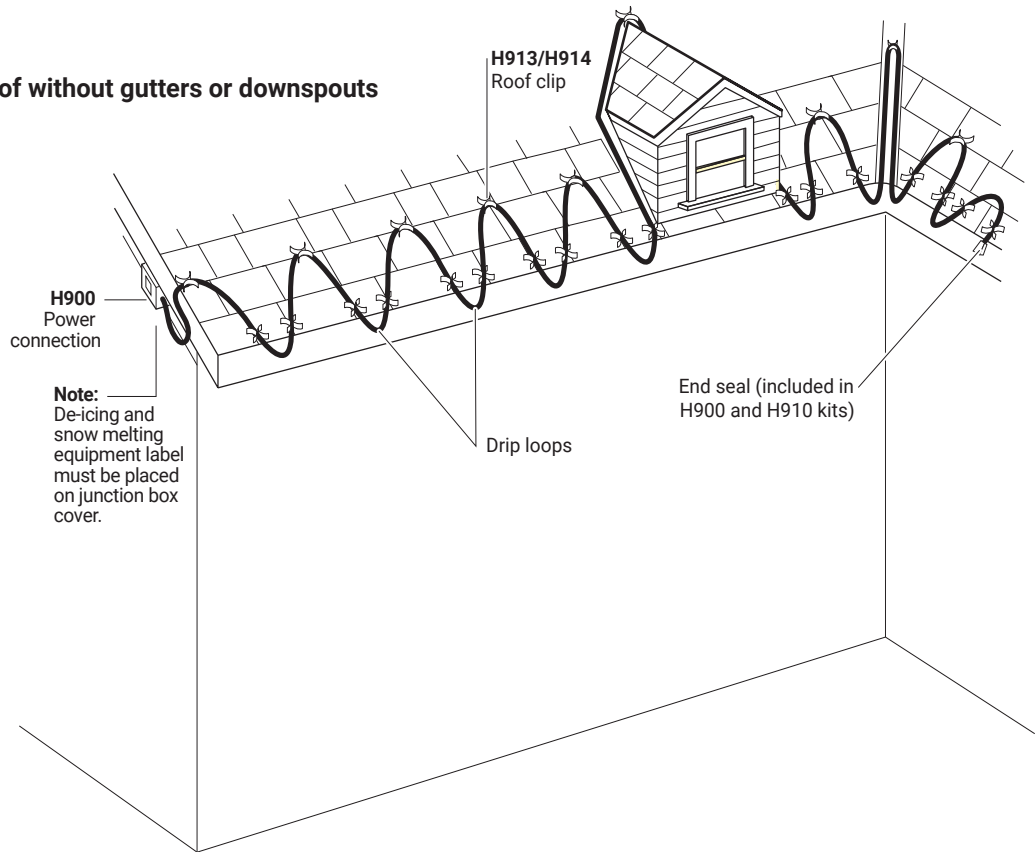
### Roof with gutters and downspouts

**Note:**

- In all locations, route and secure cable to avoid possible mechanical damage, such as from ladders, etc.

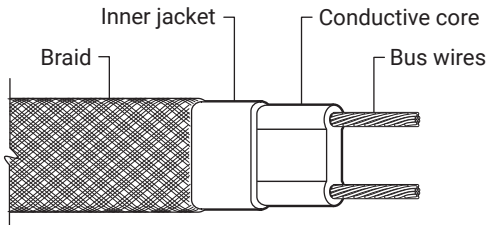


### Roof without gutters or downspouts

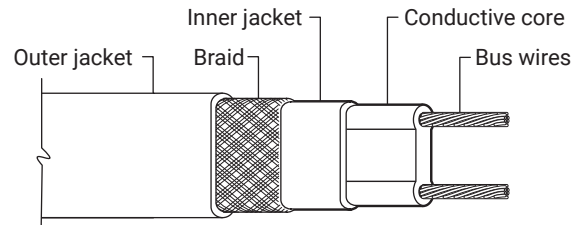


## H900 Power Connection Kit

### Identify heating cable



**WinterGard H311, H611, H621**  
Heating cables with braid and no outer jacket

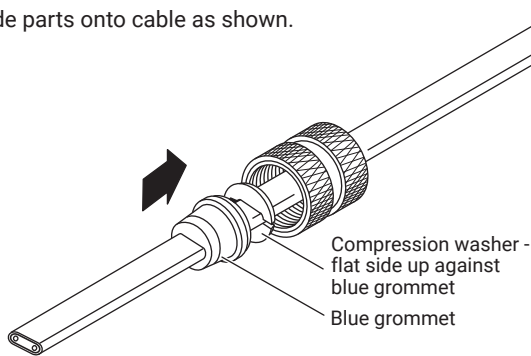


**WinterGard H612, H622**  
Heating cables with braid and outer jacket

**Note:** Instructions generally show heating cable with braid and outer jacket. Cables with no outer jacket look slightly different from those illustrated.

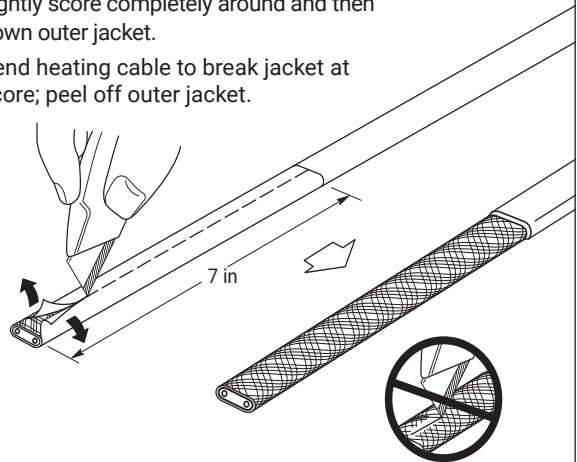
#### 1A For H612 and H622 heating cables only

- Open sealing fitting and discard black grommet.
- Slide parts onto cable as shown.



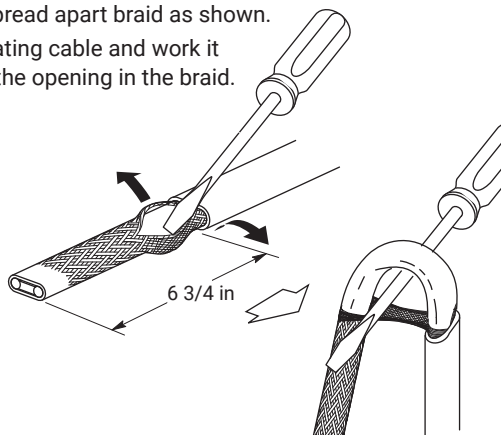
#### 1B For H612 and H622 heating cables only

- Lightly score completely around and then down outer jacket.
- Bend heating cable to break jacket at score; peel off outer jacket.



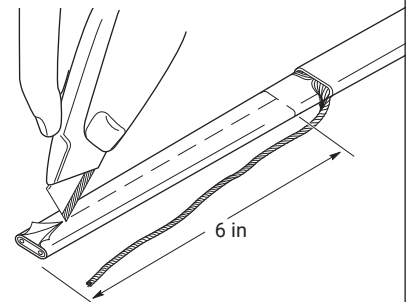
#### 2 For all cables

- Push braid back to loosen slightly.
- Gently spread apart braid as shown.
- Bend heating cable and work it through the opening in the braid.



#### 3

- Position braid on one side of heating cable.
- Straighten the braid and twist into a "pigtail."
- Lightly score completely down and around the inner jacket.
- Bend heating cable to break jacket at score; peel off inner jacket.



**4**

- Notch core at end.
- Twist back and peel bus wires from core.

**5**

- Score between bus wires at base jacket.
- Bend core to break free at base jacket.
- Peel core and any remaining material from bus wires.

**6**

**⚠ CAUTION: Health Hazard. Consult material safety datasheet RAY3122.**

- Slide 5 1/2 in black shrink tubes into place against conductive core.
- Shrink tubing by moving heat source continuously from side to side.

**7**

- Slip green/yellow tube over braid and shrink.

**8**

- Center 1 in black shrink tube over end of heating cable as shown.
- Heat tube evenly until it shrinks and adhesive flows out both ends.
- Immediately pinch with pliers between wires while tube is still hot. Hold for 10 seconds to ensure seal.

**9A For H612 and H622 heating cables only**

- Slide parts into position as shown.

**9B For H311, H611, and H621 heating cables only**

- Trim braid.
- Crimp ring terminal onto braid.
- Discard black grommet supplied with sealing fitting.
- Slide parts onto heating cable as shown.

Position flat side of compression washer against the blue grommet.

**10 For pipe applications**

**Note:** For junction box with clearance hole, use lock nut.

- Insert sealing fitting.

**11A For H311, H611, H621 heating cables only**

- Metallic junction box must be used to ensure proper ground.
- Attach ring terminal to mounting bracket as shown.
- Insert heating cable and tighten fitting.

**11B For H612 and H622 heating cables only**

**Note:** For WinterGard Wet cables, follow instructions provided with junction box to seal against water if used in wet locations.

- Insert heating cable and tighten fitting as shown.

**12A For H311, H611, H621 heating cables only**

- Make connections as shown.
- The wire nuts included are not intended for use with aluminum feed wires.

**12B For H612 and H622 heating cables only**

- Make connections as shown.
- The wire nuts included are not intended for use with aluminum feed wires.

**13 For roof and gutter applications only**

- Apply "Electric De-icing" label to junction box cover.

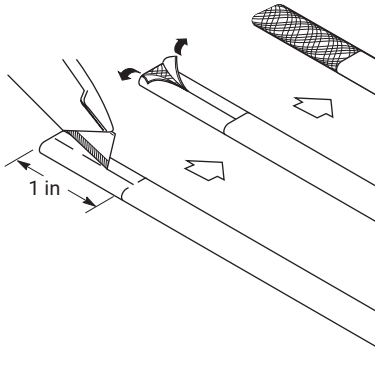


## H900 END SEAL

**Note:** The end seal is designed to be installed only once; it cannot be removed from the heating cable once installed. Do not use until ready for final installation.

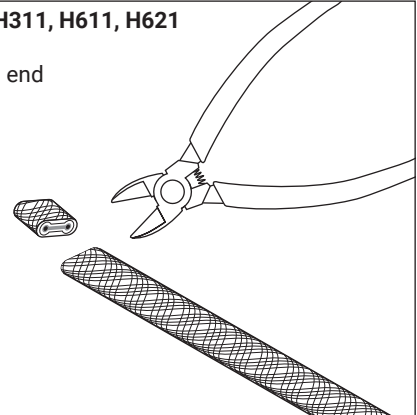
### 1A End Seal for H612 and H622

- Cleanly cut off the end of the cable.
- Score down and around outer jacket 1 inch from the end.
- Remove the outer jacket.
- Do not cut or damage inner jacket.



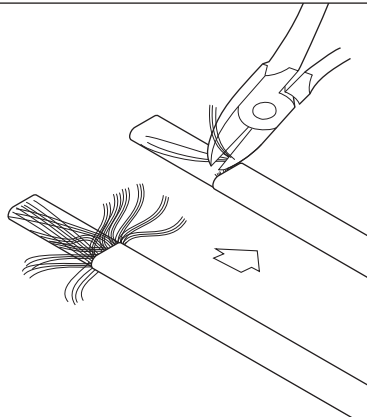
### 1B End Seal for H311, H611, H621

- Cleanly cut off the end of the cable.



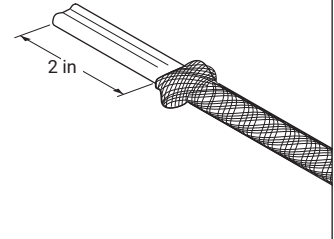
### 2A

- Unravel and remove exposed braid.



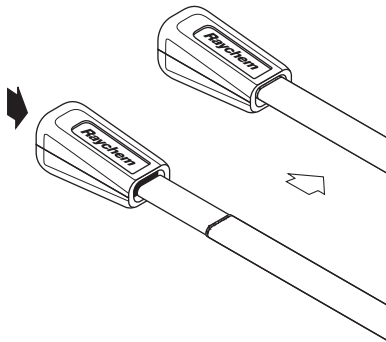
### 2B

- Push the braid back 2 inches from the cable end.



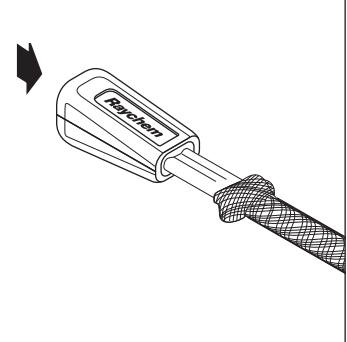
### 3A

- Firmly push end seal onto the cable (at least 1 1/2 inches). Some gel may ooze out.
- Do not twist or try to remove the end seal during or after insertion. Do not reuse an end seal.



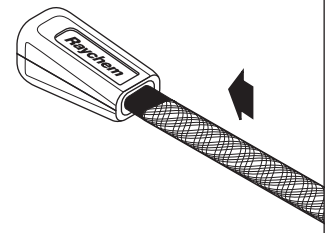
### 3B

- Firmly push end seal onto the cable (at least 1 1/2 inches). Some gel may ooze out.
- Do not twist or try to remove the end seal during or after insertion. Do not reuse an end seal.



### 4B

- Slide the braid up against the end seal and secure with the 6-inch length of tape provided.





## LIMITED WARRANTY

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nVent warrants all RAYCHEM wholesale distribution self-regulating heating cables and components against faulty workmanship and use of defective materials for two (2) years from the date of purchase. This warranty can be amended only by a written instrument signed by a duly authorized officer of nVent. Buyer's exclusive remedy under this warranty shall be to have nVent, within a reasonable time, repair such goods or supply replacement goods or credit Buyer's account for such goods and accept their return whichever nVent may elect at its sole discretion. nVent shall in no event be liable for the cost of removal or installation, for loss or damage to or loss of use of facilities or other property, loss of revenue, loss of use of revenue, loss of anticipated profits, or other damages or costs of any kind whatsoever, whether direct, indirect, incidental, or consequential.

Notwithstanding the foregoing, nVent shall have no liability whatsoever unless: (a) Buyer promptly notifies nVent in writing after discovery of an alleged nonconformity and includes a detailed explanation of the alleged nonconformity; (b) Buyer promptly returns the goods to nVent postage prepaid, at the address obtained by calling Customer Service at 1-800-545-6258 or 650-216-1526; and (c) nVent' examination of such goods establishes to nVent' satisfaction that such alleged nonconformities actually exist and occurred in the cause of proper and normal use and were not caused by accident, misuse, neglect, alteration or improper installation, repair or testing or such other cause outside of the responsibility of nVent under this Limited Warranty.

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If the goods are a consumer product in buyer's jurisdiction, the above exclusion or limitation of incidental or consequential damages and the above disclaimer of implied warranties may not apply. The term of any such implied warranty is limited to the term of this two-year Limited Warranty. Some jurisdictions do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply. This warranty gives consumers specific legal rights, and consumers may also have other rights, which vary by jurisdiction.

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