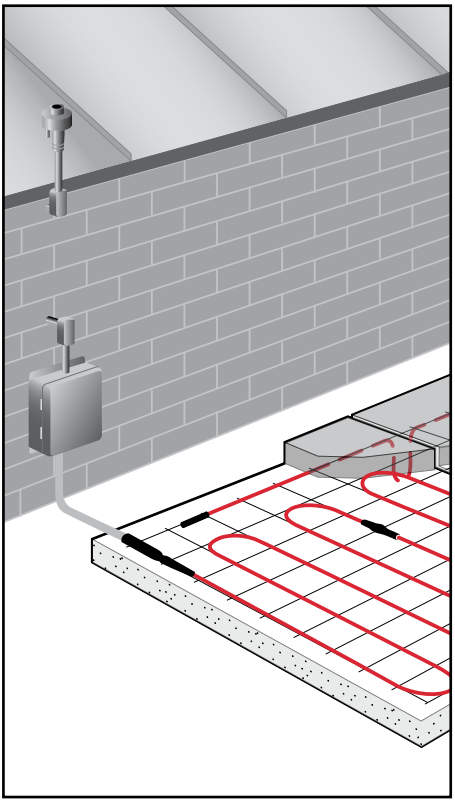
nVent

RAYCHEM

ElectroMelt System

Installation and Operation Manual for Surface Snow Melting and Anti-Icing Systems



Important Safeguards and Warnings

⚠ WARNING: FIRE AND SHOCK HAZARD.

nVent RAYCHEM heat-tracing systems must be installed correctly to ensure proper operation and to prevent shock and fire. Read these important warnings and carefully follow all the installation instructions.

- **To minimize the risk of fire from sustained electrical arcing if the heating cable is damaged or improperly installed and to comply with nVent requirements, agency certifications, 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 breakers.**
- **Approvals and performance are based on the use of nVent parts only. Do not substitute parts or use vinyl electrical tape.**
- **Bus wires will short if they contact each other. Keep bus wires separated.**
- **Connection kits and heating cable ends must be kept dry before and during installation.**
- **The black heating cable core is conductive and can short. It must be properly insulated and kept dry.**
- **Damaged bus wires can overheat or short. Do not break bus wire strands when scoring the jacket or core.**
- **Damaged heating cable can cause electrical arcing or fire. Use only plastic cable ties to secure the heating cable to the reinforcement. Do not use metal attachments such as tie wire.**
- **Do not attempt to repair or energize damaged heating cable. Remove damaged sections at once and replace them with new lengths using the appropriate nVent RAYCHEM splice kit. Replace damaged connection kits.**
- **Megohmmeters operate at high voltage. This voltage is hazardous and possibly lethal. Read and follow all instructions included with the instrument you are using.**

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1 General Information

1.1 Use of the Manual

This manual covers the installation of nVent RAYCHEM ElectroMelt self-regulating heating cables and connection kits for commercial surface snow melting for concrete pavement or in concrete under paving stones; and for anti-icing in concrete pavement. The manual covers general heating cable installation procedures and specific installation details and provides information on available connection kits and accessories. The manual also provides information on controls, testing, and periodic maintenance.

This manual assumes that the proper snow melting or anti-icing design has been completed according to the Surface Snow Melting and Anti-Icing–ElectroMelt Design Guide (H53393). Only the applications described in Section 1.2 of this manual are approved by nVent for ElectroMelt Surface Snow Melting and Anti-Icing systems when used with approved nVent RAYCHEM connection kits. The instructions in this manual and the installation instructions included with the connection kits, control systems, power distribution systems, and accessories must be followed for the nVent warranty to apply. Contact your nVent representative for other applications and products.

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Important: For the nVent warranty and agency approvals to apply, the instructions that are included in this manual and with associated products must be followed.

1 General Information

1.2 ElectroMelt Applications

Surface Snow Melting

Surface snow melting systems prevent the accumulation of snow on ramps, slabs, driveways, sidewalks, platform scales, and stairs under most snow conditions.

Anti-icing

Anti-icing systems keep the surface temperature above freezing at all times to prevent ice formation. Anti-icing applications require a higher watt density and longer hours of operation than a surface snow melting system.

1.3 Safety Guidelines

The safety and reliability of any heat-tracing system depends on the quality of the products selected and the manner in which they are installed and maintained. Incorrect design, handling, installation, or maintenance of any of the system components could damage the system and may result in inadequate snow melting, de-icing, electric shock, or fire. To minimize these risks and to ensure that the system performs reliably, read and carefully follow the information, warnings, and instructions in this guide.

Pay special attention to the following:

- Important instructions are marked **Important**
- Warnings are marked ⚠ **WARNING**

1.4 Approvals

The ElectroMelt surface snow melting and anti-icing system is UL Listed and CSA Certified for use in nonhazardous locations.

1 General Information

1.5 Warranty



nVent standard limited warranty applies to all products. An extension of the limited warranty period to ten (10) years from the date of installation is available if a properly completed online warranty form is submitted within thirty (30) days from the date of installation. You can access the complete warranty on our web site at nVent.com/RAYCHEM.

2 Pre-Installation Checks

2.1 Before You Start

The ElectroMelt surface snow-melting and anti-icing system is an engineered system that has been designed for your application. To ensure an efficient installation and startup, obtain all of the relevant engineering information before you start. Contact the general contractor, owner, or owner's representative to obtain a statement of the project design basis, project specifications, and the heating cable layout drawings.

2.2 Check Materials

Before beginning installation work, verify that all material required for the installation is on hand or on order. It is especially important to have the proper megohmmeter, propane torch and crimp tool available.

Heating cable

- Review the heating cable design and compare the list of materials to the catalog numbers of the heating cables and connection kits received to confirm that the proper materials are on site. The heating cable catalog number is printed on its jacket.
- Ensure that the service voltage available is correct for the ElectroMelt heating cable selection (see Table 1). Inspect the heating cable and connection kits to ensure there is no in-transit damage.
- Verify that the heating cable jackets are not damaged by conducting the insulation resistance test (refer to Section 7) on each reel of cable. Do not power the heating cable when it's on the reel.

TABLE 1: ELECTROMELT SELF-REGULATING HEATING CABLE

Supply voltage	Catalog number
208 V, 240 V, 277 V	EM2-XR

2 Pre-Installation Checks

The following tools are recommended to perform the various installation tasks. ElectroMelt connection kit and accessories instructions include a more detailed description of the tools required to assemble each kit.

Stripping ElectroMelt heating cable

- Utility knife
- Diagonal cutters
- Pliers (long-nosed)
- Ruler
- Wire cutters
- Small flat blade screwdriver
- Blunt nose pliers, such as slip-joint pliers

Shrinking tubing

- Propane torch or electric heat gun
- Metallic flame shield

Assembling power connection and splice

- All tools listed above
- Appropriate crimp tool
- See individual component Installation Manuals

Testing heating cable

- 2500 Vdc Megohmmeter
- Voltmeter

2.3 Review the Design

To ensure that the installation progresses smoothly and meets the design objectives, answer the following questions:

- What is the exact area to be heated?
- How is the concrete reinforced? How will the reinforcement be supported?
- Where are the concrete construction joints, expansion joints, and crack control joints located?
- What is the heating cable spacing?
- What is the depth of burial of the heating cable?
- Where are the heating cable power connections and end seal terminations located?

2 Pre-Installation Checks

2.4 Project Coordination Meeting

Hold a project coordination meeting. At this meeting review the design. During the meeting discuss the role of each trade and contractor.

Heating cable installation starts after the concrete reinforcement has been installed. The heating cable will be attached to the reinforcement using plastic cable ties to maintain the design spacing. The reinforcement is necessary to ensure that the pavement is structurally sound. Paver applications also use reinforcements such as rebar and wire mesh to secure the heating cable. It is important that the design heating cable depth and spacing in the concrete be maintained for proper operation of the system.

2.5 Heating Cable and Connection Kit Storage

To prevent damage to the ElectroMelt system before installation, the following precautions should be observed:

1. Store the heating cable in a clean dry place.
2. Storage temperature range: –40°F (–40°C) to 140°F (60°C).
3. Protect the heating cable and connection kits, accessories, and controllers from mechanical damage; keep them out of high traffic areas where they may be walked on or accidentally damaged.

2.6 General Installation Guidelines

These guidelines are provided to assist the installer throughout the installation process and should be reviewed before the installation begins.

Avoid damage to the ElectroMelt heating cable as follows:

- Do not energize cables before installation is complete.
- Do not repeatedly bend and straighten the cable.

2 Pre-Installation Checks

- Ensure heating cable is not in contact with an insulating material.
- Install heating cable at the designed spacing to ensure correct watt density.
- For sloping ramps, such as to an underground parking garage, lay the heating cable across the width of the ramp.
- Use a plank to tip wheelbarrow on.
- The heating cable does not bend easily in the flat plane. Do not force such a bend, as the heating cable may be damaged.
- Do not use sharp objects such as rakes, shovels, etc. when installing cable, or walk on the cable with hard boots.



- Make all connections to cables other than nVent RAYCHEM power connection, end seal, and splice kits in above grade junction boxes and keep covers on junction boxes when not working on them.

3 Heating Cable Installation

This section provides instructions for installing the heating cables in pavement or slabs. Read and follow these instructions to ensure that the ElectroMelt system performs reliably and as intended.

3.1 Protect the Heating Cable

On many projects there is a delay between installation of the heating cable and placement of the concrete. If there is any delay at all, take the following precautions to protect the installation until concrete can be poured:

- Prevent traffic from crossing the area where the heating cable is installed.
- Install temporary end seals such as vinyl electrical tape, heat shrink tubing, or other suitable materials on all exposed heating cable ends to prevent water entry. All temporary end seals must be removed before installation.
- Mechanically protect the heating cable so that it cannot be damaged by being walked on, run over, painted, sandblasted, welded, cut, or otherwise cut, abraded, burned, or contaminated.



3.2 Heating Cable Installation

1. Locate Structural Features

Elevate the reinforcement from the ground, measure and mark the designed heating cable spacing on the reinforcement and mark the location of all pavement joints. The reinforcement should be elevated from the ground so that the heating cable attached to it will be 1 1/2 to 2 inches (4 to 6 cm) from the surface of the finished concrete. For paver applications, concrete should be 2 inches (6 cm) thick to allow 1 1/2 inches (4 cm) between heating cable and surface of concrete. Note the planned location of structures such as flagpoles, rail posts, benches or parking meters. These are typically installed after concrete cures and their installation requires cutting

3 Heating Cable Installation

into the concrete. Heating cable should be laid out to avoid areas where follow on construction will be completed.

Types of Concrete Joints

Crack control joints are intended to control where the slab will crack. Their locations is determined by the concrete installers before the concrete is poured. Because of the reinforcement in the base slab, there is rarely a shearing action caused by differential vertical movement between the concrete on either side of the crack. When installing cables using the twopour method, control joints must be placed in both the base slab and the surface slab.

Expansion joints are placed where a concrete slab is above some structures, such as a building, a slab, or a foundation etc. Because the reinforcement does not cross expansion joints, differential movement will occur between the slab and the adjoining structure.

Crossing expansion or crack control joints with the heating cable should be avoided. If this is not possible, an nVent RAYCHEM EMK-XEJ must be used to cross an expansion joint as shown in Figure 1. The kit includes an expansion tube that must be slipped over the heating cable as it is paid out from the reel. The numbers of crack control joints crossed should be minimized per circuit. The heating cable needs to be secured to an 18” or longer, #5 or larger rebar with plastic tie wrap or protected with an nVent RAYCHEM EMK-XCJ as shown in Figure 2 to provide protection against shearing.

⚠ WARNING: Failure to provide adequate reinforcement and protection could result in damage to the heating cable.

3 Heating Cable Installation

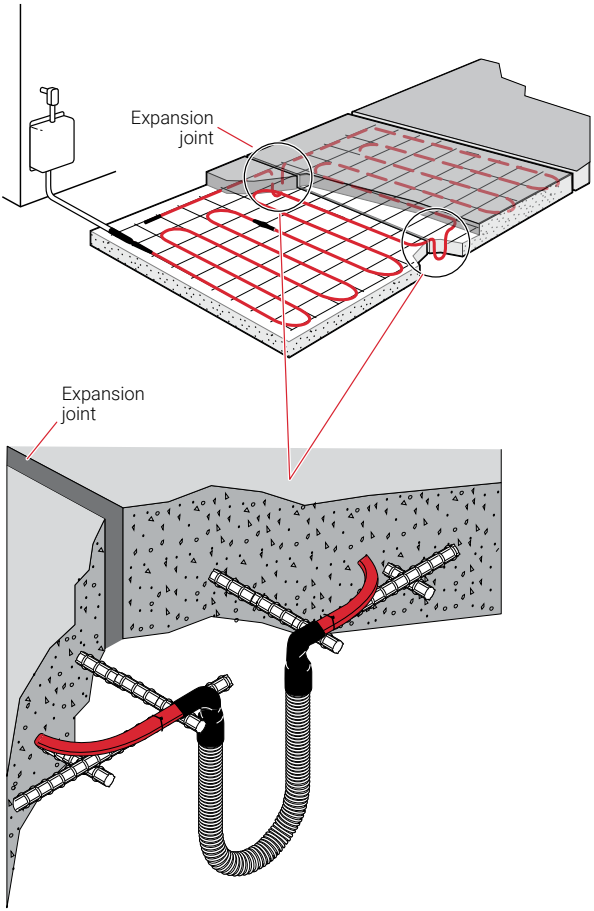
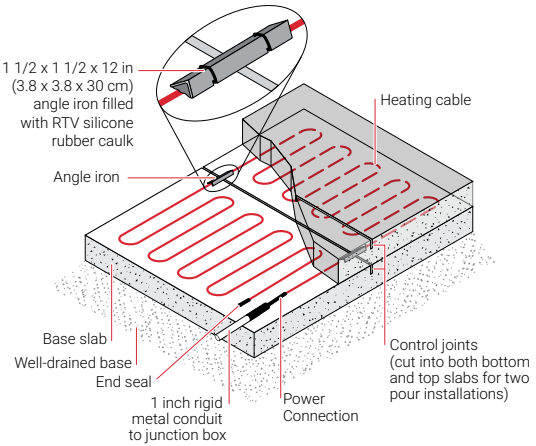


Figure 1: Expansion joint

3 Heating Cable Installation



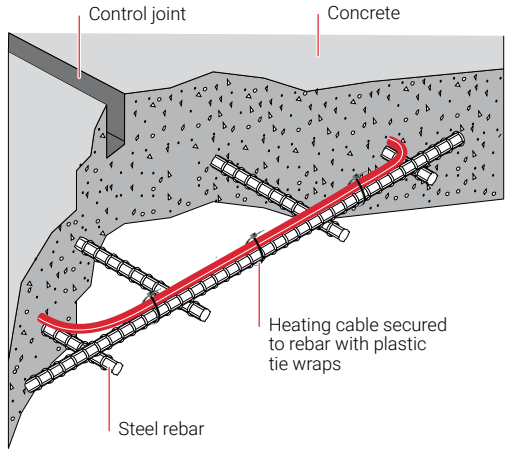


Figure 2: Control joint

3 Heating Cable Installation

Important: Only use UL Listed or CSA Certified weatherproof metal junction box and conduit.

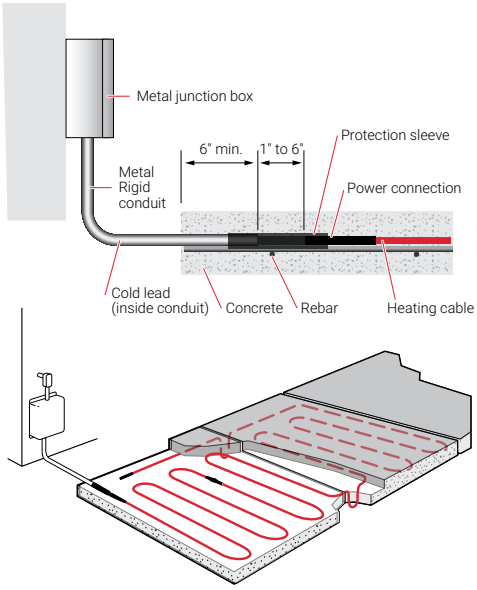


Figure 3: ElectroMelt installation

2. Layout Heating Cable

Mount the heating cable reel on a holder and place it near the junction box where the circuit will be terminated. Plan for one end of the heating cable circuit to reside near the 1 inch rigid metal conduit opening where the non-heating cable enters. Use a reel holder that pays out smoothly with little tension and avoid jerking the cable while pulling. Ensure the correct number of expansion joint kits for the circuit you are installing are slipped over the heating cable before paying out the cable.

Lay the heating cable on the reinforcement in a serpentine pattern at the design spacing previously marked. Ensure heating cable is at least 4 inches (10 cm) from the edge of the pavement and from obstacles such as pipes, drains, and anchors.

3 Heating Cable Installation

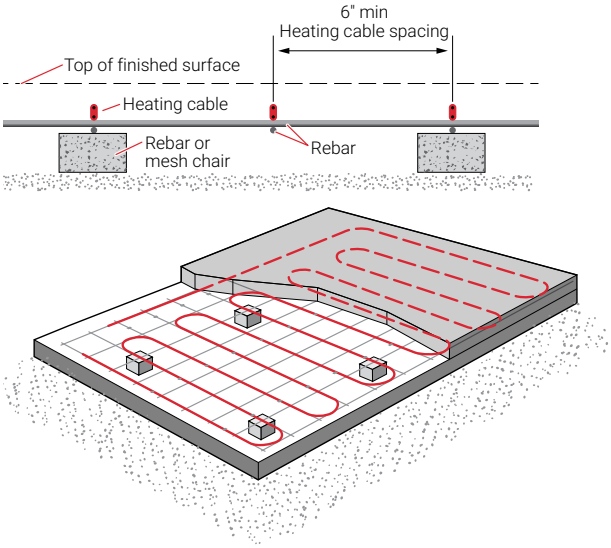


Figure 4: ElectroMelt installed on rebar

An nVent RAYCHEM EMK-XS splice kit may be required to connect lengths of heating cable into a designed circuit length. Protect the ends of the heating cable against water damage with temporary end seals until the termination kits are installed.

The non-heating cable must be installed between the pavement and junction box in a 1 inch rigid metal conduit (Figure 3). The conduit must not penetrate building walls or floors and must not be insulated. Extend the conduit at least 6 inches into the concrete of the application area protective bushings may be installed at each end of the conduit.

The nVent RAYCHEM EMK-XC power connection kit must be installed in the concrete slab 1 inch to 6 inches from the end of the conduit.

⚠ WARNING: The heating cable must not be traced inside the rigid conduit and into the junction box. Only the non-heating lead shall be traced through the conduit to the junction box.

3 Heating Cable Installation

3. Secure Heating Cable

Expansion joint kits should be placed at the planned expansion joint prior to securing heating cable to the reinforcement. Secure heating cable to the reinforcement with plastic tie wraps (not wire) at approximately 12 inch (30 cm) intervals, as shown in Figure 2. Hand tighten plastic tie wraps to prevent damage to the heating cable. Cut off tails of tie wraps.

4. Perform Insulation Resistance Test

After the heating cable has been placed, but before any terminations or splices have been made, test the insulation resistance of each length of heating cable using the electrical resistance testing procedure in Section 7. If the insulation resistance is less than 1000 megohms when tested at 2500 Vdc, consult Section 8, troubleshooting guide.

5. Install Splices

Install any splices that may be required. Mark the location of splices on the heating cable installation drawing for future reference.

Repeat the insulation resistance test procedure in Section 7 at 2500 Vdc.

6. Terminate the Heating Cable

Terminate the heating cable using an EMK-XC power connection and end seal kit before concrete is poured. Work such as drain installation, placement of anchor bolts, and cutting of crack control joints is often done after the initial concrete pour. It is advisable to test the heating cable for damage by performing an insulation resistance test after any construction is performed on the concrete.

⚠ WARNING: Test the heating cable for damage by performing an insulation resistance test after any construction is performed on the concrete.

Install the snow melting and anti-icing equipment labels supplied with the EMK-XC power connection and end seal kit to the cover of the junction box and to the power distribution panel board to comply with UL requirements.

3 Heating Cable Installation

Perform an insulation resistance test of the branch circuit conductors using the procedures in Section 7 before installing the power connection kit. Subsequent testing of the heating cable may be done from the power distribution panel. Testing the power wiring with 2500 Vdc will reveal any wire damage that might later be mistaken for low heating cable insulation resistance.

7. Pour the Concrete

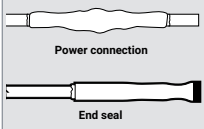
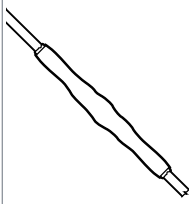
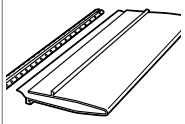
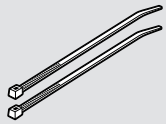
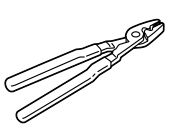
Coordinate placement of the concrete with the contractor. Concrete should be poured so that heating cable is 1 1/2 to 2 inches (4 to 6 cm) from surface. All precautions should be taken during the pour to protect the heating cable. Do not use sharp tools such as shovels and rakes during the pour. Do not strike the heating cable with tools, walk on the heating cable, or do anything else that will damage the cable jacket. Do not energize the heating cables during the concrete curing period. Do not allow traffic on the new completed surface until adequate stability has been attained and the material has cured sufficiently. Set pavers per manufacturers instructions after satisfactory insulation resistance test.

At least one SMCS Snow Melting Caution Sign should be installed with each snow melting system in order to reduce the risk of damage to the embedded heating cable during future alterations or additions to the heated surface. For concrete ramp applications, one SMCS is recommended at the top of the ramp and another at the bottom, installed in the ramp itself. Conduct the insulation resistance test in Section 7 at 2500 Vdc continuously during the concrete pour. If damage to the heating cable is suspected, stop the concrete pour immediately and inspect heating cable for damage. If necessary, replace damaged portions of heating cable by splicing in a new length of heating cable using the EMK-XS splice kit or replace the damaged circuit entirely.

Conduct the insulation resistance test in Section 7 at 2500 Vdc after the concrete pour is complete.

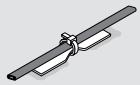
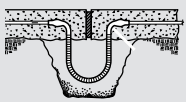
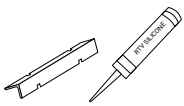
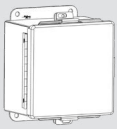
4 Power Supply and Electrical Protection

TABLE 2: ELECTROMELT SELF-REGULATING HEATING CABLE

Catalog number	Description	Heating cable allowance[1]
Connection Kits		
 EMK-XC-USA EMK-XC-CAN	Power connection and end seal kit; use 1 per circuit **Standard pkg:** 1	1ft (30 cm) for power connection and 0.3ft (9 cm) for end seal
 EMK-XS	Splice kit; use as needed **Standard pkg:** 1 **Note:** Heating cable will be delivered without the need to insert a splice. However, repair and installation issues in your specific application may required the use of a splice kit.	1 ft (30 cm)
Accessories		
 EMK-XJR	Jacket repair kit, use as needed **Standard pkg:** 1	NA
 EMK-XCT	Nylon cable ties; 1 per foot of cable used **Standard pkg:** 100 per pack	NA
 EMK-XT	Crimping tool **Standard pkg:** 1	NA

4 Power Supply and Electrical Protection

TABLE 2: ELECTROMELT SELF-REGULATING HEATING CABLE

Catalog number	Description	Heating cable allowance[1]
Continued		
 CT-CABLE-TIE	UV-resistant cable tie; use as needed **Standard pkg:** 100 per box	NA
 SMCS	Snow melt caution sign Dimensions 6 x 4 in (150 x 100 mm); 1 minimum per system **Standard pkg:** 1	NA
 EMK-XEJ	Expansion joint kit; 1 per expansion joint crossing **Standard pkg:** 1	1 1/2 ft (45 cm)
 EMK-XCJ	Crack control joint kit; 1 per crack control joint crossing **Standard pkg:** 1	NA
 EMK-JB	Junction box Dimensions 6 x 6 x 4 in (152 x 152 x 102 mm) **Standard pkg:** 1	Maximum of 2 circuits per EMK-JB

[1] Allow extra heating cable for ease of component installation.

4 Power Supply and Electrical Protection

4.1 Voltage Rating

Verify that the supply voltage is either 208, 240, or 277 volts as specified by the ElectroMelt system design and that the heating cable is appropriately rated (refer to Table 1).

4.2 Circuit Breaker Sizing

Circuit breakers must be sized using the cable lengths shown in Table 3 for automatic snow control system or Table 4 for manual snow control system. Do not exceed the maximum circuit length shown for each breaker size. Use circuit breakers that incorporate 30-mA ground-fault circuit protection, or provide equivalent levels of ground-fault protection.

TABLE 3: MAXIMUM HEATING CABLE CIRCUIT LENGTH FOR STARTUP AT 20°F (–7°C) IN FT (M) USING AN AUTOMATIC SNOW CONTROL SYSTEM

Circuit breaker	Heating cable supply voltage					
	208 V		240 V		277 V	
15 Amp	80	(24)	85	(26)	100	(31)
20 Amp	105	(32)	115	(35)	130	(40)
30 Amp	160	(49)	170	(52)	195	(59)
40 Amp	210	(64)	230	(70)	260	(79)
50 Amp	265	(81)	285	(87)	325	(99)

4 Power Supply and Electrical Protection

TABLE 4: MAXIMUM HEATING CABLE CIRCUIT LENGTH FOR STARTUP AT 0°F (–18°C) IN FT (M) USING A MANUAL CONTROL SYSTEM

	Heating cable supply voltage					
Circuit breaker	**208 V**		**240 V**		**277 V**	
15 Amp	75	(23)	80	(24)	90	(27)
20 Amp	100	(31)	110	(34)	120	(37)
30 Amp	145	(44)	160	(49)	180	(55)
40 Amp	200	(61)	210	(64)	240	(73)
50 Amp	245	(75)	265	(81)	300	(91)

4.3 Ground-Fault Protection

If the heating cable is improperly installed or physically damaged to the point that water contacts the bus wires, sustained arcing or fire could result. If arcing does occur, the fault current may be too low to trip conventional circuit breakers. nVent and national electrical codes require both ground-fault protection of equipment and a grounded metallic covering on all heating cables. Ground-fault protection must be provided by the installer.

⚠ **WARNING: To minimize the danger of fire from sustained electrical arcing if the heating cable is damaged or improperly installed, and to comply with nVent requirements, agency certifications, 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 breakers.**

⚠ **WARNING: Disconnect all power before making connections to the heating cable.**

4 Power Supply and Electrical Protection

4.4 Important Power Supply Safeguards

- Make sure that the heating cable load you are connecting is within the rating of the control system selected. Check the design drawings for the heating cable load.
- The electrical conduit that feeds wiring to the control device must have a low-point drain so condensation will not enter the enclosure.
- Make sure that the line voltage you are connecting to the control system is correct. For proper wiring, follow the installation instructions enclosed with the control device.

5 Control, Monitoring and Power Distribution

Control systems are selected from the following three options. All are effective and approved; however, an automatic snow controller offers the highest system efficiency and the lowest operating cost and is most strongly recommended.

1. Manual on/off control
2. Slab sensing thermostat
3. Automatic snow controller

If the current rating of the control means is exceeded, all three methods will require contactors sized to carry the load. Each method offers a trade-off balancing initial cost versus energy efficiency and ability to provide effective snow melting. If the system is not energized when required, snow will accumulate. If the system is energized when it is not needed, there will be unnecessary power consumption. Choose the control method that best meets the project performance requirements. For additional information, contact your nVent representative.

5.1 Manual On/Off Control

A manually controlled system is operated by a switch that controls the system power contactor. This method requires constant supervision to work effectively. A manual system can be controlled by a building management system.

5.2 Slab Sensing Thermostat

A slab sensing thermostat can be used to energize the system whenever the slab temperature is below freezing, but is not energy efficient when used as the sole means of control. The slab sensing thermostat is recommended for all surface snow melting and anti-icing applications, even when an automatic snow controller is used, and is required for all paver installations.

5 Control, Monitoring and Power Distribution

5.3 Automatic Snow Controller

With an automatic snow controller, the snow melting system is automatically energized when both precipitation and low temperature are detected. When precipitation stops or the ambient temperature rises above freezing, the system is de-energized. In addition, a slab sensor de-energizes the system after the slab reaches the slab sensing set point even if freezing precipitation is still present. Using an automatic snow controller with a slab sensor offers the most energy-efficient control solution. For additional information, refer to Figure 4.

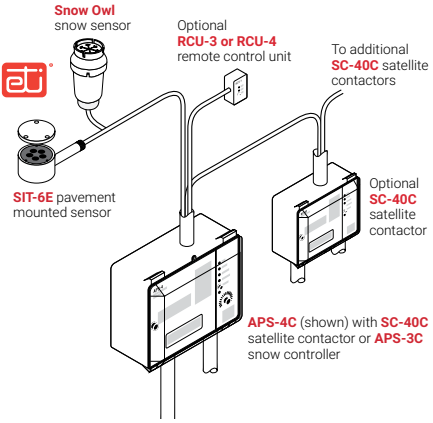


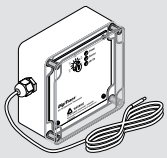
Figure 4: Automatic snow melting control system

Important: Controllers shall be Listed and shall be suitably rated for the snow melting system and anti-icing installation. Contact nVent to determine suitability.

For areas where a large number of circuits are required, the nVent RAYCHEM ACS-30 can be used. The Surface Snow Melting control mode in the ACS-30 includes an External Device control option. This option allows a Snow/Moisture sensing controller (from Table 5) to be integrated into the ACS-30 system. Note that sensors (snow or gutter) cannot be directly connected to the ACS-30 system. Refer to the ACS-30 Programming Guide (H58692) for more information on system setup.

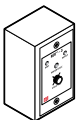
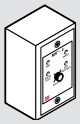
5 Control, Monitoring and Power Distribution

TABLE 5: CONTROL SYSTEMS

Description
Slab sensing thermostat
 EC-TS
Electronic slab sensing thermostat for snow melting applications housed in a NEMA 4X enclosure with 2 x 1/2 in conduit entries for power and 1 gland entry for the sensor. The temperature set point and LED indicators for alarm, power, and heating cable status can be visually checked through the clear lid. Electrical rating is 30 A at 100–277 V, 50–60 Hz, SPST switch. The EC-TS includes a 25 ft (7.6 m) sensor.
Automatic snow melting controllers
 APS-3C
Automatic snow melting controller housed in a NEMA 3R enclosure provides effective, economical automatic control of all snow melting applications. CSA Certified, c-UL-us Listed, available in 120 V and 208-240 V, 50/60 Hz models, 24-Amp DPDT output relay, adjustable hold-on timer, and integral high limit temperature sensor with an adjustable range of 40°F to 90°F (4°C to 32°C). Enclosure dimensions: 11-1/2 in x 9-1/8 in x 6-9/16 in (292 mm x 232 mm x 167 mm)
 APS-4C
Automatic snow melting controller housed in a NEMA 3R enclosure provides effective, economical automatic control of all snow melting applications. The APS-4C operates up to ten SC-40C satellite contactors for larger loads. CSA Certified, c-UL-us Listed, available in 277 V single-phase, and 208/240, 277/480, and 600 V three-phase models, built-in 3-pole 50-Amp contactor (40-Amp contactor for 277 V single phase), integral 30-mA ground-fault circuit interrupter, adjustable hold-on timer, and integral high limit temperature sensor with an adjustable range of 40°F to 90°F (4°C to 32°C). Enclosure dimensions: 11-1/2 in x 9-1/8 in x 6-9/16 in (292 mm x 232 mm x 167 mm)

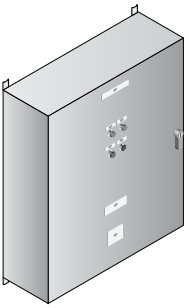
5 Control, Monitoring and Power Distribution

TABLE 5: CONTROL SYSTEMS

Description
Automatic snow melting controllers, continued
 SC-40C — Satellite contactor power control peripheral for an APS-4C snow melting controller, housed in a NEMA 3R enclosure. CSA Certified, c-UL-us Listed, available in 277 V single-phase, and 208/240, 277/480, and 600 V three-phase models, built-in 3-pole 50-Amp contactor (40-Amp contactor for 277 V single phase), integral 30-mA ground-fault circuit interrupter, and integral high limit temperature sensor with an adjustable range of 40°F to 90°F (4°C to 32°C). Enclosure dimensions: 11-1/2 in x 9-1/8 in x 6 in (292 mm x 232 mm x 152 mm)
Snow melting and gutter de-icing sensors and accessories
 Snow Owl — Overhead snow sensor that detects precipitation or blowing snow at ambient temperatures below 38°F (3.3°C). For use with either an APS-3C or APS-4C automatic snow melting controller.
 SIT-6E — Pavement-mounted sensor signals for the heating cable to turn on when the pavement temperature falls below 38°F (3.3°C) and precipitation in any form is present. Microcontroller technology effectively eliminates ice bridging while ensuring accurate temperature measurement. For use with either an APS-3C or APS-4C automatic snow melting controller.
 RCU-3 — The RCU-3 provides control and status display to the APS–3C controller from a remote location. It has a 2, 4, 6 or 8 hour CYCLE TIME adjustment, independent of APS-3C setting.
 RCU-4 — The RCU-4 provides control and status display to the APS-4C controller and SC-40C Satellite Contactor from a remote location. It has a 2, 4, 6 or 8 hour CYCLE TIME adjustment, independent of the APS-4C or SC-40C setting.

5 Control, Monitoring and Power Distribution

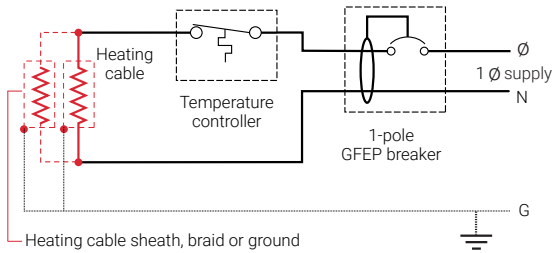
TABLE 5: CONTROL SYSTEMS

Description
 SMPG1
Single-phase power distribution panel that includes ground-fault protection, monitoring, and control for snow melting systems. Single-phase voltages include 208 and 277 V. If standard configurations do not meet your needs, custom SMPG panels are available and processed under the catalog number SMPG-GENERAL, part number P000000763. Please contact your nVent representative for a custom SMPG panel quotation.

5.4 Power Distribution

Figure 5 shows typical wiring schematics for single and group control systems. For large systems with many circuits, a SMPG panel should be used. Refer to Figure 6 for the typical wiring schematic.

Single circuit control



5 Control, Monitoring and Power Distribution

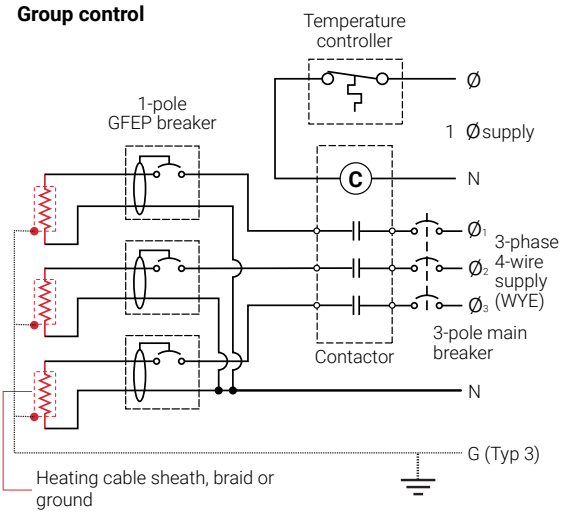


Figure 5: Typical controller wiring—multiple circuits

5 Control, Monitoring and Power Distribution

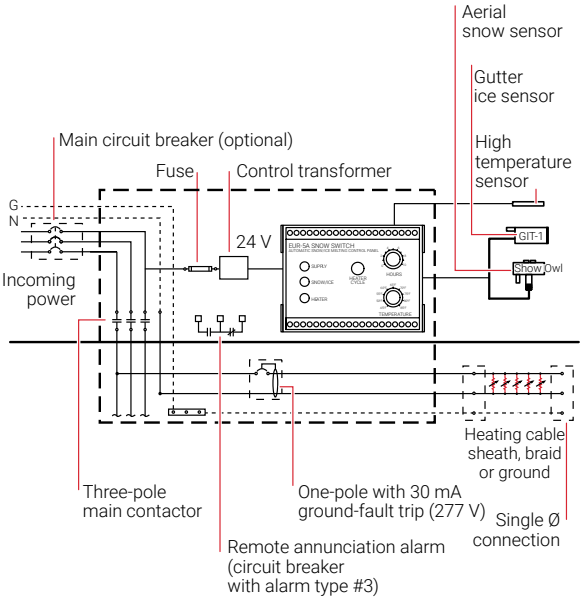


Figure 6: SMPG wiring diagram

6 Commissioning and Preventive Maintenance

6.1 ElectroMelt System Startup

The startup of an ElectroMelt system will be simple if the heating cable has been installed carefully and tested at each step as recommended in Section 3.

Before Applying Power

Before applying electrical power to the ElectroMelt heating cable, consult the installation test records to verify that the heating cable and the branch circuit wiring insulation resistance have been tested at 2500 Vdc from the distribution panel board. This final insulation resistance test ensures that no ground faults exist in the power wiring or the heating cable due to insulation damage.

⚠ **WARNING: Damaged heating cable can cause arcing or fire. Do not energize damaged heating cable. Repair or replace damaged heating cable prior to applying power.**

Verify Insulation Resistance Test

Verify that the entire branch circuit including the heating cable has an insulation resistance of 1000 megohms minimum when tested with a 2500 Vdc megohmmeter.

Verify Electrical Supply Voltage

Measure the incoming electrical supply to verify that the power to be connected to the heating cable is 208 Vac to 277 Vac.

Visually Inspect Electrical System

Visually inspect all system electrical components.

1. Inspect all wiring for conformance to applicable codes.
2. Inspect all wiring for conformance to design drawings.
3. Verify proper rating on all over current protection devices.
4. Verify that the contactor coil operating voltage is correct for control device used.
5. Verify that all heating cable terminations are closed, and that the snow-melting equipment

label is affixed to the cover of the junction boxes and distribution panel.

Energize the System Controller

Apply power to the control device (manual switch, ambient thermostat or automatic snow controller). Check for proper operation. Do not energize the snow-melting system until the controller is operating properly. Turn the controller off before applying power to the heating cable.

Apply Power to Over Current Protection Devices

Turn on the circuit breakers or other over current protection devices. Test installed ground-fault protection device, following the instructions packaged with the device. If the ground-fault detection feature does not function properly, replace the device before energizing the heating cable.

Energize the Heating Cable

Operate the control device to energize the heating cable. If circuit breakers or other over current protection devices trip, refer to the Troubleshooting Section of this manual. Wait one to three hours for the pavement to warm up. Verify that each heating cable circuit is providing heat by touching the surface of the pavement. If any circuit is not heating, verify that power is present at the branch circuit downstream of the contactor, ring out the branch circuit wiring, then consult the Troubleshooting section of this manual.

Perform Annual Insulation Resistance Test

Your system may be subject to concrete cracking, concrete modifications and rework, or electrical maintenance that might affect the snow-melting and anti-icing system. Perform insulation resistance testing on each ElectroMelt heating cable before the first use of the system each fall to detect changes or damage that might affect the operation of the system. Record the results of the annual test on the forms provided in Section 9. Repair any damage detected during annual test. Refer to the Troubleshooting Guide when the megohmmeter reading is below 1000 megohms at 2500 Vdc.

6 Commissioning and Preventive Maintenance

6.2 Tests

A brief description of each test is found below. Detailed test procedures are found in Section 7.

Visual Inspection

Visually inspect the heating cable, power connections and splices for physical damage. Check that no moisture is present, electrical connections are tight and grounded, and control and monitoring systems are operational and properly set. Damaged heating cable must be replaced.

Insulation Resistance

Insulation Resistance (IR) testing is used to verify the integrity of the heating cable inner and outer jackets.

Power Check

The power check is used in commissioning to confirm that the circuit is functioning correctly.

Ground-Fault Test

Test all ground-fault breakers per manufacturer's instructions.

7 Test Procedures

7.1 System Tests

The following tests must be done after installing the connection kits, but before the concrete is poured:

1. Visual inspection
2. Insulation resistance test

After the concrete is poured:

1. Visual inspection
2. Insulation resistance test
3. Circuit length verification (Capacitance test)
4. Power test

All test procedures are described in this manual. It is the installer's responsibility to perform these tests or have an electrician perform them. Record the results in the Installation and Inspection Record in Section 9.

Visual Inspection Test

- Check all power connections and splice kits for proper installation, overheating, corrosion, moisture, or loose connections.
- Check the electrical connections to ensure that ground and bus wires are insulated over their full length.
- Check the controller for proper setpoint and operation. Refer to its installation and operation manual for details.

Insulation Resistance Test

FREQUENCY

Insulation resistance testing is required during the installation process and as part of regularly scheduled maintenance, as follows:

- Upon receipt of heating cable
- Prior to installation
- After splice kits, terminations or end seals are installed
- Continuously during concrete pour
- After concrete pour is complete

7 Test Procedures

- After any structural work or maintenance is performed on concrete in application area
- As part of scheduled maintenance

PROCEDURE

Insulation resistance testing (using a megohmmeter) should be conducted at three voltages: 500, 1000, and 2500 Vdc. Potential problems may not be detected if testing is done only at 500 and 1000 volts. Measure the resistance between the heating cable bus wires and the braid. Do not allow test leads to touch junction box, which can cause inaccurate readings.

 **Important: System tests and regular maintenance procedures require that insulation resistance testing be performed. Test directly from the controller or the junction box closest to the power connection.**

INSULATION RESISTANCE CRITERIA

A clean, dry, properly installed circuit should measure thousands of megohms, regardless of the heating cable length or measuring voltage (500–2500 Vdc).

All insulation resistance values should be greater than 1000 megohms. If the reading is lower, consult Section 8, Troubleshooting Guide.

7 Test Procedures

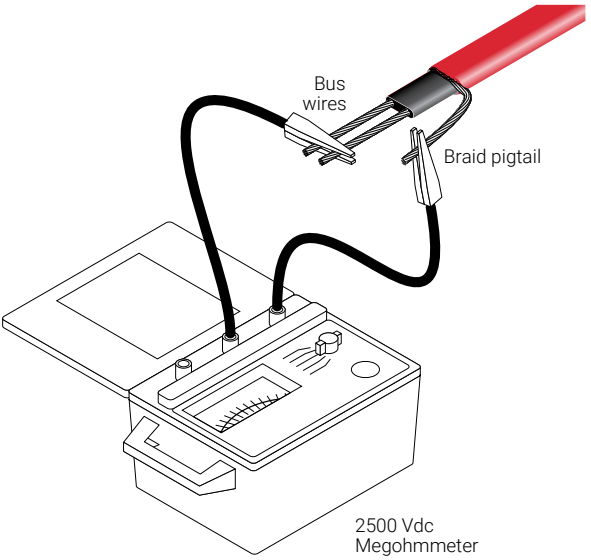


Figure 7: Insulation resistance test

⚠ WARNING: The heating cable can store a large electrical charge after the insulation resistance test is performed. To prevent personal injury from electrical shock, fully discharge the cable prior to disconnecting the megohmmeter. The megohmmeter may discharge automatically. However, it may be necessary to short the cable leads. Contact your supervisor or the instrument manufacturer to verify the safest practice.

INSULATION RESISTANCE TEST PROCEDURE

1. De-energize the circuit.
2. Disconnect the controller if installed.
3. Disconnect bus wires from terminal block.
4. Set test voltage at 0 Vdc.
5. Connect the negative (–) lead to the heating cable metallic braid.
6. Connect the positive (+) lead to both heating cable bus wires.

7. Turn on the megohmmeter and set the voltage to 500 Vdc; apply the voltage for one minute. Meter needle should stop moving. Rapid deflection indicates a short. Record the insulation resistance value in the Inspection Record.
8. Repeat Steps 4–7 at 1000 and 2500 Vdc.
9. Turn off the megohmmeter.
10. If the megohmmeter does not self-discharge, discharge phase connection to ground with a suitable grounding rod. Disconnect the megohmmeter.
11. Reconnect bus wires to terminal block.
12. Reconnect the controller.

Circuit length verification (capacitance test)

Connect the capacitance meter negative lead to both bus wires and the positive lead to the braid wire. Set the meter to the 200 nF range. Multiply this reading by the capacitance factor for the correct heating cable shown below to determine the total circuit length.

Length (ft or m) = Capacitance (nF) x Capacitance factor (ft/nF or m/nF)

7 Test Procedures

TABLE 6: CAPACITANCE FACTORS

Capacitance factor		
Heating cable	**ft/nF**	**(m/nF)**
EM2-XR	5.2	(1.6)

Compare the calculated circuit length to the design drawings and circuit breaker sizing tables.



Figure 8: Capacitance test

Power Check

1. Power the heating cable and allow it to stabilize for 30 minutes.
2. Verify input voltage and check for current.
3. Ensure circuit breakers have not tripped.

8 Troubleshooting Guide

Symptom	Probable Cause
Circuit breaker trips	Circuit breaker undersized. Circuit oversized. Start-up at too low a temperature.
	Defective circuit breaker
	Connections and or splices may be shorting out. Physical damage to the heating cable may be causing a short.
	Bus wires connected at the end seal.
	Excessive moisture in connection boxes or splices.
	Nick or cut in heating cable or power feed wire with moisture present.

8 Troubleshooting Guide

	Corrective Action
	Re-establish what the current loads are going to be and resize the breakers. Check to see if existing bus wire sizing is compatible with larger size breaker.
	Replace circuit breaker.
	Locate and repair the incorrect connections. Locate and remove damaged sections of heating cable. Perform insulation resistance test per installation instructions. To locate shorting problems, follow these steps: 1. Visually inspect the power connections and end seals for proper installation. 2. Check for visual indications of damage where there may have been maintenance work. 3. Look for cracked or damaged concrete or any evidence of work on the concrete. 4. If you have not located the problem at this point, contact your nVent representative for suggestions and assistance.
	Remove end seal, disconnect wires, and install a new end seal.
	Dry out and reseal connections and splices. Perform insulation resistance test per installation instructions.
	Locate and replace damaged heating cable or power feed wire.

8 Troubleshooting Guide

Symptom	Probable Cause
Snow and ice not melting.	No power to heating cable.
	Damaged heating cable.
	Weather conditions too severe for design.
Snow and ice slow to melt.	Weather conditions too severe for design.
	Thermal time delay.
Low or inconsistent insulation resistance	Nicks or cuts in the heating cable. Short between the braid and heating cable core
	Arcing due to damaged heating-cable insulation.
	Moisture present in the connection kits.
	Test leads touching the junction box.

8 Troubleshooting Guide

	Corrective Action
	Check branch circuit breaker. Repair if necessary. Check main distribution power and contactor if used. Check system controller-thermostat or automatic snow controller.
	Locate and remove damaged section of heating cable. Perform insulation resistance test per installation instructions.
	Check performance specifications for original design.
	Check performance specifications for original design.
	Heating cable not energized soon enough. Check system controls. Adjust or modify operation.
	Check power, splice, and end connections for cuts, improper stripping distance, and signs of moisture. If heating cable is still accessible, visually inspect the entire length for damage, especially at elbows and flanges and around valves. If the system is insulated, disconnect heating cable section between power kits, splices, etc., and test again to isolate damaged section.
	Replace damaged heating-cable sections.
	If moisture is present, dry out the connections and retest. Be sure all conduit entries are sealed, and that condensate in conduit cannot enter power connection boxes. If heating-cable core or bus wires are exposed to large quantities of water, replace the heating cable. (Drying the heating cable is not sufficient, as the power output of the heating cable can be significantly reduced.)
	Clear the test leads from junction box and restart.

9 Installation and Inspection Records

Installation and Inspection Record

Facility	
Test Date:	
Circuit number:	
Heating cable type:	
Controllers:	
Temperature setting:	
Circuit length:	

Commission

Inspection date:

Visual inspection

- Confirm 30-mA ground-fault device (proper rating/function)
- Visual inspection inside connection boxes for overheating, corrosion, moisture, loose connections, and other problems.
- Proper electrical connection, ground, and bus wires insulated over full length
- Check controllers for moisture, corrosion, setpoint, switch operation.

Insulation resistance test	**M-Ohms**
Bus to braid (Test A)	500 Vdc
	1000 Vdc
	2500 Vdc

Circuit length verification

Capacitance test: Circuit length (ft) =
Capacitance (nF) x Capacitance factor (x 3.28 = m)

Power check

Circuit voltage

Panel	(Vac)
Circuit amps after 30 minutes	(Amps)

9 Installation and Inspection Records

9 Installation and Inspection Records

ElectroMelt Circuit Schedule

Project Name: _____

Electrical Contractor: _____

Completion Date: _____

Circuit Number	Location	Quantity of Splices

9 Installation and Inspection Records

Panel Location	Circuit Breaker Size	Circuit Length

9 Installation and Inspection Records

Periodic Inspection Record

(Photocopy this schedule for future use.)

Project Name: _____

Electrical Contractor: _____

Completion Date: _____

Circuit Number	Location	Megohmmeter Reading

9 Installation and Inspection Records

Circuit Voltage	Circuit Amperage	GFPD Test	Concrete Visual Inspection

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