This is an nVent RAYCHEM specification. A qualified design professional should review and edit the document to suit project requirements.

For more information, contact RAYCHEM, a brand of nVent, 899 Broadway St., Redwood City, CA 94025-1146; Phone: 800-545-6258; Website: www.nvent.com/RAYCHEM

Retain relevant Sections title.

SECTION 238313 - RADIANT-HEATING ELECTRIC CABLES
FOR ROOF ICE MELT CONCEALED ROOF DE-ICING (RIM)

or

SECTION 077000 - ROOF AND WALL SPECIALTIES AND ACCESSORIES
FOR ROOF ICE MELT CONCEALED ROOF DE-ICING (RIM)

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes electric heating cables for roof and gutter de-icing with the following electric heating cables:
   1. Roof Ice Melt Concealed Roof De-Icing: Self-regulating, parallel resistance.

B. Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

   1. Section 210533 "Heat Tracing for Fire-Suppression Piping."
   2. Section 220533 "Heat Tracing for Plumbing Piping."
   3. Section 230533 "Heat Tracing for HVAC Piping."

4. Section 238323 "Radiant-Heating Electric Panels."
5. Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
6. Section 260526 "Grounding and Bonding for Electrical Systems."

Retain subparagraphs below for SECTION 238313 to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

1. Section 025800 – “Snow Control”
2. Section 072000 – “Thermal Protection”
3. Section 073000 – “Steep Slope Roofing”
4. Section 074000 – “Roofing and Siding Panels”
5. Section 075000 – “Membrane Roofing”
6. Section 076000 – “Flashing and Sheet Metal”
7. Section 077123 – “Manufactured Gutters and Downspouts”
8. Section 251216 – “Direct-Protocol Integration Network Gateways”
9. Section 255100 – “Integrated Automation Control of Facility Equipment”
10. Section 260000 – “Electrical”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include the following:
      a. Heating product data sheet.
      b. UL-listed certificates for heating product.
      c. System installation and operation manual.
      d. System installation details.
      e. Connection kits and accessories data sheet.
      f. Controller/thermostat data sheet.
      g. Controller/thermostat wiring diagram.
   2. Include rated capacities, operating characteristics, and furnished specialties and accessories.
   3. Schedule heating capacity, length of cable, and electrical power requirement for each electric heating cable required.
   4. Include design calculations for each application.

B. Shop Drawings: For electric heating cable.
   1. Include plans, sections, and attachment details.
   2. Include diagrams for power, signal, and control wiring.
   3. Manufacturer to produce detailed design as described below.

RAYCHEM offers detailed design services. For information contact local representative, visit www.nvent.com/RAYCHEM, or contact RAYCHEM Technical Support at (800) 545-6258.

With this service, RAYCHEM provides: Circuit Layout Drawings, Isometric Drawings, Detail Drawings, Control Panel Drawings, System Wiring Diagram, and Controller Set-Point Schedule.

"Delegated Design Submittal" Paragraph below is defined in Section 013300 "Submittal Procedures" as a "Delegated Design Submittal." Retain below if design services have been delegated to Contractor. Retain only if applicable to your region.

C. Delegated Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Delegated design submittals include the following:

Retain "Roof De-Icing Layout Drawings" and "Roof De-Icing Installation Detail Drawings" subparagraphs below for roof and gutter applications.

1. Roof De-Icing Layout Drawings: Drawings to be provided, including the following:
   a. Location/identification of area to be traced.
   b. Area dimensions.
   c. Heater circuit number.
   d. Electrical load.
   e. Heater catalog numbers.
   f. Heater termination points.
   g. Startup temperature.
   h. Location of all components.
   i. Material list and quantities of all components.
   j. Heating cable layout.
2. Roof De-Icing Installation Detail Drawings: Project-specific Detail Drawings including details showing the following:
   a. Downspout details.
   b. Cable layout details.
   c. Installation details.
   d. Junction box.
   e. Sensor.

Retain "Control Panel Drawings," "System Wiring Diagram," and "Controller Set-Point Schedule" subparagraphs below for all applications.

3. Control Panel Drawings: Drawings for each control panel to include the following:
   a. Physical arrangement and structural Detail Drawings.
   b. Complete power and control wiring diagrams showing all internal wiring connections for electrical and instrument components in each control panel. All wires, terminals, and devices are numbered and tagged in accordance with system elementary diagrams.
4. System Wiring Diagram: Project-specific Drawings (if applicable) including the following:
   a. Interconnect of all major components.
   b. Assignment of circuiting.
   c. Connection of circuit wiring in terminal blocks.
   d. Connection of sensor wiring.
   e. Connection of external alarm wiring.
5. Controller Set-Point Schedule (If applicable) showing the following:
   a. Circuit addresses.
   b. Circuit set points.
   c. Circuit alarms and settings.
6. Power Distribution Panel Board Schedules (If applicable) showing the following:
   a. Heat tracing circuit allocation.
   b. Breaker size.
   c. Voltage and wattage.

d. Operating load amperes.

D. Testing Instructions and Reporting Form: Provide documentation for use in preinstallation testing of heat tracing system.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

B. Testing: Completed system test report.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. ISO-09001 registered.
2. Provide products consistent with UL 515 and/or UL 1683, UL 1588, CSA 22.2 No 130, and IEEE 515.1 requirements.

B. Installer Qualifications:
1. System Installer to have complete understanding of product and product literature from manufacturer or authorized representative prior to installation.
2. Electrical connections to be performed by licensed electrician.

C. Certification: System (Heating Cable, Connection Kits, and Controller): UL-listed, CSA-certified roof and gutter de-icing, surface snow melting, and/or floor-heating systems.

D. Testing: Heating cable for roof and gutter de-icing, surface snow melting, and floor-heating systems to be qualified and tested to demonstrate a useful lifetime in excess of 20 years.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in original, unopened containers or packages with intact and legible manufacturers' labels identifying the following:
1. Product and /manufacturer.
2. Length/quantity.
3. Lot number.
4. Installation and operation manual.
5. Material safety data sheet (MSDS) (if applicable).

B. Store heating cable in clean, dry location with a temperature range of 0 to 140 deg F (-18 to 60 deg C).

C. Protect heating cable or heating mats from mechanical damage.

D. Protect heating cable ends from moisture ingress until final termination of heating cable is complete.

1.8 WARRANTY

When warranties are required, verify with Owner's counsel that warranties stated in this article are not less than remedies available to Owner under prevailing local laws.

For more detailed information on RAYCHEM's Limited Product Warranty, see www.nvent.com/RAYCHEM.

Retain first "Manufacturer's Limited Warranty" and "Manufacturer's Extended Warranty" paragraphs below for roof and gutter de-icing applications.

A. Manufacturer's Limited Warranty: Manufacturer agrees to repair or replace electric heating products listed below that fail in materials or workmanship within specified warranty period, when such goods are properly installed, operated, and maintained in accordance with product documents.
   1. Covered products include the following:
      a. Heating cables, connection kits, and accessories.
      b. Thermostats, controllers, panels, contactors, sensors, and accessories.

Verify available warranties and warranty periods for electric heating cable and retain "Warranty Period for Heating Cable" Subparagraph below as required.

   2. Warranty Period for Heating Cable: Two years from date of Substantial Completion.

As a demonstration of quality, RAYCHEM offers an extended warranty on all heating cable and components manufactured. The extended warranty is free to the Owner. Contractor (or RAYCHEM field technician) must perform a system test as outlined in RAYCHEM's installation manual. Although some manufacturers do not offer an extended warranty due to variations in product quality, they may make an exception on certain projects to meet specification. Hence, require that the extended warranty being offered is published on manufacturer's website.

B. Manufacturer's Extended Warranty: Provide Owner an extended product warranty for heat tracing products described below.
   1. Contractor must complete and forward to Owner the Installation, Inspection, or Commissioning Record(s), and complete manufacturer's online warranty registration form within 30 days from date of installation; otherwise, only standard limited warranty applies.
   2. Warranty Period for Heating Cable: 10 years from date of Substantial Completion.
   3. Warranty Period for Concealed Roof Ice Melt Panels and Components: 20 years from date of Substantial Completion.
   4. Heating cables, panels, and components not automatically offered with an extended manufacturer's warranty, as a standard matter of course, will not be allowed.
   5. Warranty information must be published on manufacturer's website.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR ELECTRIC HEATING CABLES

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Source Limitations: All system components to be sourced from a single manufacturer, under no circumstances are any components installed other than those supplied by cable manufacturer, to ensure system integrity and to meet warranty requirements.

2.2 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES – ROOF ICE MELT CONCEALED ROOF DE-ICING

Retain this article for roof ice melt concealed roof de-icing.

Retain "Basis-of-Design Product" Paragraph and list of manufacturers below to require a specific product or a comparable product from manufacturers listed.

A. Basis-of-Design Product: Subject to compliance with requirements, provide RAYCHEM; a brand of nVent; **RIM Roof Ice Melt System** or comparable product by one of the following:
   1. <**Insert manufacturer's name**>.

B. System Description: Complete concealed roof ice melt system that consists of heating cables secured in extruded-aluminum panels in a fixed heat-transfer position specifically designed for eaves, valleys, channels, rakes, and flat roof sections; ambient, surface, and moisture sensing control; and monitoring, with integrated ground-fault circuit protection and Building Management System (BMS) communication capabilities.

C. Compliance: UL 515, UL 1588, CSA 22.2 No 130-16, and IEEE 515.1.

D. Roof Ice Melt Panels:
   1. Roof ice melt panels consist of aluminum extrusions with channels designed to fit the self-regulating heating cables. To prevent roof damage, extrusions do not have any protrusions perpendicular to roof surface.
   2. To ensure maximum output from heating cables, aluminum extrusion and heating cable are manufactured by same manufacturer and specifically for the heating cable being used.
   3. Roof ice melt panels are specifically designed for eaves, valleys, channels, rakes, and low-pitch roof sections.

E. Heating Element: Pair of parallel No. 16 AWG, nickel-coated, stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end watertight. Cable is capable of crossing over itself once without overheating.

F. Electrical Insulating Jacket: Modified polyolefin.

G. Cable Cover: Tinned-copper braid with polyolefin outer jacket.

1. Outer jacket printed with cable model number, agency listings, batch number, and meter marks (for ease of installation within maximum circuit length).

H. Voltage: [**120**] [**208**] [**240**] [**277**] V without use of transformers.

I. Heating cable is part of a UL-listed and CSA-certified system.

J. Heating Cable Connection Kits:
1. Heating cable circuits are connected to power wiring in an approved junction box with approved termination components.
2. Manufacturer provides power connection, splice/tee, and end seal kits compatible with selected heating cable.
3. Connection kits to be UL-listed and CSA-certified.

K. Heating Cable Installation Accessories:
1. Drain Tracing: Use on all flat roof drains to keep roof drains free of ice and snow.

Retain "Basis-of-Design Product" Subparagraph below to require a specific product.

a. Basis-of-Design Product: RAYCHEM; RIM-DRAINTRACE (RIM-DT).

2. Cable cover bracket to be used to enhance the heat transfer from heating cable to the snow and create larger drain paths.

Retain "Basis-of-Design Product" Subparagraph below to require a specific product.

a. Basis-of-Design Product: RAYCHEM; RIM-CABLE COVER BRACKET (RIM-CCB).

3. Clips: Use to secure heating cables to roofs and gutters. Attach clips with mechanical fasteners (screws or nails) on shake roofs or using adhesive on metal, slate, or composite roofing, in locations where RIM panel is not used.

Retain "Basis-of-Design Product" Subparagraph below to require a specific product.

a. Basis-of-Design Product: RAYCHEM; GMK-RC.

4. Downspout Hangers: Use to provide mechanical protection and strain relief to heating cable as it goes over sharp edges and to hold the heating cable in place at top of downspouts.

Retain "Basis-of-Design Product" Subparagraph below to require a specific product.

a. Basis-of-Design Product: RAYCHEM; DSH.

L. Controls:

Retain "Single-Circuit Local Digital Control System"; "Highly Efficient Multi-Circuit, Control System"; "Multi-Circuit, Distributed Digital Control System"; or "Multi-Circuit, Group Control System" Subparagraph below.

1. Single-Circuit Local Digital Control System:

a. Self-regulating heating cables are controlled via an energy saving, programmable single-circuit controller to provide adjustable maintained temperatures in the range of -40 to140 deg F (-40 to 60 deg C).

Retain "Basis-of-Design Product" Subparagraph below to require a specific product.

1) Basis-of-Design Product: RAYCHEM; C910-485.

b. Controllers provide 30 mA ground-fault protection as required by code. Ground-fault setting is non-adjustable.
c. Controller is microprocessor-based control system with integrated equipment ground-fault protection.
d. Control user interface includes LED displays and function keys that make it easy to use and program. No additional handheld programming devices are needed.
e. Alarm conditions and programming settings are easy to interpret on the full-text front panel. Settings are stored in nonvolatile memory in the event of power failure.
f. Controller has both an isolated solid-state triac relay and a dry contact relay for alarm annunciation back to BMS.
g. Controller shall include an RS-485 communication module to remotely configure, control, and monitor the heating cable circuits through BMS.
h. Controller includes an auto-cycle tests feature to verify heat trace and roof ice melt system integrity at a user-defined interval.
i. Controller has NO/NC alarm contacts. Controller alarms on the following:
   1) Loss of power.
   2) Ground-fault warning.
   3) Ground-fault trip.
   4) Low current.
j. Digital controller to be UL-listed or CSA-certified.

2. Highly Efficient Multi-Circuit, Control System.
   a. Roof and gutter de-icing circuits are controlled and monitored using a highly efficient, digital control system.
      1) Basis-of-Design Product: RAYCHEM; HECS.
   b. Control system includes controller and power distribution. The power distribution includes distribution blocks and modular, din-rail-mounted branch circuit breakers and 30 mA ground-fault breakers (EPD).
   c. Control system is able to control multiple zones of roof de-icing circuits distributed across multiple areas of the roof.
   d. Control system has timers to delay operation of a group of roof de-icing circuits for the timer's specified interval to manage inrush current load.
   e. Control system uses solid state relays to provide quiet and efficient operation.
   f. Control system uses an ambient sensing controller combined with one or more roof and ice melt panel sensing controllers to provide a highly energy-efficient control system.
   g. Ambient sensing controller allows the roof ice melt panel sensing controllers to feed power to the roof de-icing circuits only when the ambient temperature is below the ambient sensing controller's Ambient-on set point and above its low temperature cut-out set point.
   h. Controller operates the roof de-icing circuits based on the measured roof ice melt panel temperature.
   i. Control system to be UL-listed.
3. Multi-Circuit, Distributed Digital Control System:

a. Roof and gutter de-icing circuits are controlled and monitored using a digital control system.

Retain "Basis-of-Design Product" Subparagraph below to require a specific product.

1) Basis-of-Design Product: RAYCHEM; ACS-30.

b. Multi-Application: Distributed digital control system has pre-programmed parameters to provide concurrent control for heating cables used for pipe freeze protection, flow maintenance, hot-water temperature maintenance, surface snow melting, roof and gutter de-icing, freezer frost heave prevention and floor-heating applications.

c. User Interface Terminal: For all programming

Retain "Basis-of-Design Product" Subparagraph below to require a specific product.

1) Basis-of Design Product: RAYCHEM; ACS-UIT3.
2) Certification: c-CSA-us Certified.
3) Terminal Display: Color LCD display with password protection to prevent unauthorized system access.
4) Capable of communicating with up to 52 power control panels, where each panel can control up to five circuits and accept up to five temperature inputs.
5) Digital control system shall be capable of assigning up to four temperature inputs per heat-tracing circuit.
6) Capable of communicating with up to 16 remote monitoring modules, where each module can accept up to eight temperature inputs.
7) USB port to allow for quick and easy software update.
8) Programmable Alarm Contacts: Three, including an alarm light on enclosure cover.
9) Provide separate offline software tool to allow users to preprogram digital control system and transfer program via USB drive or Ethernet.
10) Enclosure: NEMA 4 for indoor or outdoor locations.

d. Power Control Panels:

Retain "Basis-of-Design Product" Subparagraph below to require a specific product.

1) Basis-of-Design Products: RAYCHEM; ACS-PCM2-5.
2) Certification: c-UL-us Listed.
3) Enclosure: NEMA 4/12 enclosure approved for nonhazardous indoor and outdoor locations.
4) Provide ground-fault and line current sensing alarming, switching and temperature inputs for five heat-tracing circuits.
5) Contactors: Five 3-pole, 30A contactors, EMR type.
6) Capable of operating at 120 to 277 V.
7) Alarm contact, including alarm light on panel cover.

e. Controllers may be added to the control system for single-circuit extensions.

Retain "Basis-of-Design Product" Subparagraph below to require a specific product.

1) Basis-of-Design Product: RAYCHEM; C910-485.

f. Temperature Inputs: Digital control system is capable of assigning up to four temperature inputs per heat-tracing circuit.

Retain "Basis-of-Design Product" Subparagraph below to require a specific product.

1) Basis-of-Design Product: RAYCHEM; RTD.

g. Remote Monitoring Modules: User Interface Terminal is capable of communicating with up to 16 remote monitoring modules, where each module is capable of accepting up to eight temperature inputs.

Retain "Basis-of-Design Product" Subparagraph below to require a specific product.

1) Basis-of-Design Product: RAYCHEM; RMM2.

h. User interface Terminal has the following:
   1) USB port to allow for quick and easy software updates.
   2) Three programmable alarm contacts, including an alarm light on enclosure cover.

i. Provide separate offline software tool to allow users to pre-program digital control system and transfer program via USB drive or Ethernet.

j. User Interface Terminal Enclosure: NEMA 4 for indoor or outdoor locations.

k. Power Control Panel Enclosures: NEMA 4/12 enclosure approved for nonhazardous indoor and outdoor locations.

l. Power control panel provides ground-fault and line current sensing alarming, switching, and temperature inputs for five heat tracing circuits.

m. Each power control panel has five 3-pole, 30 A contactors (EMR type).

n. Digital Controller:
   1) Integrated adjustable GFPD (10 to 200 mA).
   2) Capable of being configured for On/Off, ambient sensing, PASC, and timed duty cycle control modes based on application. PASC control proportionally energizes power to heating cable to minimize energy based on ambient sensed conditions.
   3) Upon communication loss with user interface terminal, panels shall control with last downloaded set point.
   4) Include built-in self-test feature to verify proper functionality of heating cable system.

If selecting BACnet or Metasys protocol in first subparagraph below, include RAYCHEM ProtoNode RER multi-protocol gateway as an accessory.

5) BMS Communication Protocol: By [**Modbus**] [**BACnet or Metasys N2**].
6) Variables monitored by digital controller and reported back to BMS include:
   a) Temperature.
   b) Ground-fault.
   c) Current draw.
   d) Power consumption.
   e) Associated alarms.

4. Multi-Circuit, Group Control System:
   a. Group Controller: Snow melting and de-icing power distribution and control panel.

Retain "Basis-of-Design Product" Subparagraph below to require a specific product.

1) Basis-of-Design Product: RAYCHEM; SMPG1.

b. Heating cable manufacturer provides a group snow/ice melting controller with built-in GFPD compatible with selected heating cable.

c. Group snow/ice melting controller has an integrated 30-mA ground-fault circuit breaker.

Custom SMPG panel designs are available if standard configurations are unsuitable. Contact RAYCHEM sales representative for more information and pricing.

d. Group snow/ice melting controller has [**6**] [**12**] [**18**] ground-fault circuit breakers rated up to 50 A.

Retain first subparagraph below if applicable.

e. Group snow/ice melting controller has a main circuit breaker.
f. Group snow/ice melting controller is capable of operating with supply voltages of [**208 V**] [**277 V**]**.**
g. Group snow/ice melting controller shall be capable of supporting up to six aerial or gutter mounted temperature/moisture sensors.
h. Group snow/ice melting controller enclosure to be [**NEMA 1/12**] [**NEMA 3R/4**]**.**
i. Group snow/ice melting controller has an adjustable hold-on timer (0 to 10 hours).
j. Group snow/ice melting controller has an integrated high-limit temperature sensor.
k. Electronic snow/ice melting controller has contacts to interface with Energy Management Computer (EMC).
    1) Inputs: Override On, Override Off.
    2) Outputs: Supply, Snow, Heat, High Temp, Alarm.
l. Digital controller has c-UL-us approvals.

M. Approval:
1. System (heating cable, connection kits, and controller) to be UL-listed, CSA-certified for roof and gutter de-icing.
2. Roof ice melt system has design, installation and operating manual specific to roof ice melting.

2.3 SYSTEM APPROVAL

A. Complete system (heating cable, connection kits, and controller/thermostat) to be listed by a nationally recognized testing laboratory (NRTL).

PART 3 - EXECUTION

3.1 ROOF AND GUTTER DE-ICING

Retain this article for RAYCHEM's "RIM System" applications.

A. Examination:
1. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
    a. Ensure that surfaces in contact with electric heating cables are free of burrs and sharp protrusions.

b. Ensure that surfaces and substrates are level and plumb.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation:
1. Protect all heating cable ends from moisture ingress until cable is terminated with end seals.

C. Installation:

See RAYCHEM's "RIM System Installation and Operation Manual H59380" for roof ice melt. Comply with manufacturer's written instructions in heating cable and connection kit installation and operating manuals.

1. Install electric heating cable and panels in accordance with Drawings and manufacturer's installation and operation manuals.
2. Installer to be responsible for providing complete functional system, installed in accordance with applicable national and local requirements.

D. Connections:
1. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
2. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

E. Field Quality Control:

RAYCHEM offers initial start-up and field testing (commissioning) of the system as a service. For information contact local representative, visit www.nvent.com/RAYCHEM or contact RAYCHEM Technical Support at (800) 545-6258.

1. Manufacturer's Field Service: Initial start-up and field testing (commissioning) of system is performed by factory technician in accordance with Owner's requirements.
2. In the field, all heating cables are meggered with a minimum of 2,500 V dc for self-regulating cable (1000 V dc for mineral insulated cable). Follow all manufacturer's recommended installation tests specific to application printed in installation manual.
3. Final tests must meet manufacturer's specifications and be submitted to Owner.

See Section 014000 "Quality Requirements" for retesting and reinspection requirements and Section 017300 "Execution" for requirements for correcting the Work.

4. Electric heating cables will be considered defective if they do not pass tests and inspections in accordance with manufacturer's requirements.
5. Technician to verify that RAYCHEM's "ACS-30" and "ProtoNode" device server (if applicable) are configured correctly with the BMS.
6. Provide a factory-certified technician or manufacturer's representative for start-up and commissioning of heat tracing system and controller.
7. Prepare test and inspection reports.

F. Protection:
1. Comply with manufacturer's written instructions for maintenance service.

END OF SECTION [**238313**] or [**077000**]