Commonly Found Electrical Licensing Concerns and Installation Deficiencies

The Electricians' Licensing Board in conjunction with the State Electrical Inspectors, municipal electrical and building inspectors and other representatives of the electrical industry in the State of New Hampshire have put together this list of common installation deficiencies and problems encountered by the Board's office staff relative to the State's licensing law RSA 319-C and the administrative rules.
The Board welcomes any input from instructors, inspectors, licensees and other concerned parties relative to this list or any other items of concern. The Board would like to remind all concerned parties that the 2005 NEC becomes effective July 1, 2005 as part of the Board's administrative rules. Some local municipalities may adopt the 2005 NEC at an earlier date therefore, it is advisable to check with the local authority before starting an installation. However, no matter what edition of the NEC the local municipality is under, installations in the State of New Hampshire must be performed to the current edition of the NEC as adopted by the Electricians' Board.

Licensing Concerns

1.) Licensees should notify the Board office if you have a change of address and/or telephone number.
2.) Journeyman licensees and registered apprentices should be aware that in order to perform electrical installations for heat, light and power purposes they must be employed by a master electrician. You can not perform installations on your own.
3.) Master licensees should be aware that they are responsible for; periodically inspecting the work of the journeyman licensees in their employ and performing a final inspection of the journeyman's completed installation; verifying that the licenses of the master and journeyman electricians are current; verifying that their apprentices are properly registered with the Electricians' Licensing Board and the Bureau of Apprentice and Training/State Apprentice Council and that the ratio of licenses to apprentices on the job site is proper.
4.) All licensees and apprentices should be aware that when paying fees for licensure, licensure renewal, apprentice registration or renewal the payment must be made in the form of a check or money order. The Board's office can not accept cash. The office sends out renewal forms as a courtesy but you are responsible for renewing your license or apprentice card on time. Apprentices must renew before the expiration date on the apprentice card. If you haven't received a renewal form in the mail you should contact the office.
5.) Master and journeyman electricians should be advised that the proof of the 15 hour update course is not due until their renewal in the year 2006. Please do not send in proof of completion certificate until that time. You must renew by the last day of your birthday month each year. Currently, if you renew within 30 days there is no penalty and you may renew for up to one year with a late fee. However, the license is not valid the day after it expires. If you fail to renew within one year you must be examined.
6.) Apprentices should be aware that when filing an application for apprenticeship or apprenticeship renewal, the application must be signed by the master. Each apprentice must be under the direct supervision of a licensed master or journeyman electrician when performing electrical installations. (One to one supervision ratio)

Most Common Installation Deficiencies

ELECTRICIAN BOARD

Most Common Installation Deficiencies in the State of New Hampshire

The following is a list of the most common deficiencies found with electrical installations in the State of New Hampshire. The list is in random order and it has been formatted to the 2005 edition of the National Electrical Code (NFPA 70-2005).

To view the deficiencies and examples for each deficiency, please click on the light bulb for the appropriate deficiency.

1) **A grounding electrode conductor that is attached to the grounded conductor or equipment grounding terminal bar of a remote panelboard.**

Note: This item has been part of the most common deficiencies since 1999. Although this is not found as often as it was prior to 1999, it still is an issue that is misunderstood and therefore bares consideration.

"250.24(A) System Grounding Connections. A premises wiring system supplied by a grounded ac service shall have a grounding electrode conductor connected to the grounded service conductor, at each service, in accordance with **250.24(A)(1)** through **(A)(5).**

(1) General. The connection shall be made at any accessible point from the load end of the service drop or service lateral to and including the terminal or bus to which the grounded service conductor is connected at the service disconnecting means."

Example: a single family dwelling that has an attached garage. There is a 200 ampere main disconnect located in the garage and a 4/0 aluminum SER Cable has been run to a panelboard located in the basement. A grounding electrode conductor has been attached to the metal water pipe feeding the dwelling and run to the panelboard located in the basement. The grounding electrode conductor has been terminated on the grounded conductor (neutral) terminal or equipment grounding bus of the panelboard. This panelboard, being a remote panelboard, has been supplied by a feeder and is not part of the service. Therefore, the grounding electrode conductor should have been run to the 200 ampere service disconnect in the garage.

2.) The bonding of metal water piping in the vicinity of separately derived systems.

250.104 Bonding of Piping Systems and Exposed Structural Steel.

(A) Metal Water Piping.

(4) Separately Derived Systems. The grounded conductor of each separately derived system shall be bonded to the nearest available point of the interior metal water piping system(s) in the area served by each separately derived system. This connection shall be made at the same point on the separately derived system where the grounding electrode conductor is connected. Each bonding jumper shall be sized in accordance with Table **250.66**.

Exception: A separate water piping bonding jumper shall not be required where the effectively grounded metal frame of a building or structure is used as the grounding electrode for a separately derived system and is bonded to the metallic water piping in the area served by the separately derived system.

Example: Any metallic water pipe located in the vicinity served by the separately derived system must be bonded to the grounded conductor connection of the separately derived source. The metal water piping serving an office kitchenette with 120-volt power provided from a nearby transformer must be bonded to the transformer grounded connection.

3.) The non-use of expansion fittings in Rigid Non-Metallic (PVC) conduits that are subject to thermal expansion and contraction.

Sections **300.7(B**) and **352.44** require the use of an expansion fitting in exposed straight runs between securely mounted items such as boxes, conduit bodies and elbows of non-metallic raceways that are subject to large temperature variations. The expansion fitting is required when the length change, in accordance with Table **352.44(A)** is 0.25" or greater.

Example: in a 100' run of Rigid Non-Metallic Conduit, that is exposed to a 100 degree difference in temperature, the computed expansion is 4.1". With a 100 degree difference of temperature and in an area not exposed to direct sunlight the length change in a 6' 1" section of Non-Metallic conduit will be more than 0.25".

4.) The non-use of expansion fittings on conduits emerging from the earth where attached to fixed equipment and are installed in locations that are subject to ground movement.

Section **300-5(J)** requires that conduits in these locations be arranged to prevent damage to the enclosed conductors. The Fine Print Note below **(J)** recognizes the use of expansion fittings in conduits to achieve this purpose.

Example: An underground service (lateral) to a dwelling unit installed in 2" Rigid Non-Metallic Conduit that is directly attached to a meter enclosure mounted, outside, on the dwelling unit wall. The issue of areas that are subject to ground movement has always been and will continue to be difficult to define due to varying conditions.

There are many factors that come into play when you consider whether or not the conductors enclosed in the raceway are subject to damage by ground movement. Some of the things that come to mind are; how deep the frost penetration is, has the earth around the conduit been backfilled and compacted or just backfilled and how deep the conduits are buried in the earth. Depending on where you are located in the State of New Hampshire the conditions will vary. Many times this issue is left to the local authority. He/she would be most familiar with the conditions in their area.

5.) The improper installation and securing of expansion fittings in runs of Rigid Non-Metallic (PVC) Conduit.

Section **110.3 (B)** requires that listed or labeled products be installed in accordance with their listing or labeling. Quite often when the expansion fitting mentioned in items # 3 & 5 is installed; it is secured on the wrong end. The manufacturer's listing requires that the expansion fitting be secured on the "bell" (fixed) end. Notice should be taken when mounting the fitting in a vertical position. The fitting must be installed with the "bell" end up and the sliding or expanding end below. On one final note, the conduit must meet the securing requirements of the applicable raceway article.

6.) Use of electrical equipment without following the manufacturer's instructions.

All too often the information provided on or with electrical equipment is overlooked by the installers. If specific installation requirements are provided by the manufacturer they must be adhered to by the installer. Section **110.3(B)** requires that electrical equipment be installed in accordance with any installation instructions that may be included in the listing or labeling. It would be a Code violation to not follow these instructions so don't throw them away until you have read them.

7.) The non-bonding of service raceways and equipment.

Note: This item has been part of the most common deficiencies since 1999. Although this is not found as often as it was prior to 1999, it still is an issue that is misunderstood and therefore bares consideration.

Section **250.92(A)** requires the non-current carrying metal parts of service equipment, indicated in Section **250-92(A)(1)**, **(2)** and **(3)**, to be effectively bonded together. Section **250.92(A)(1)** speaks to service raceways and Section **250.92(A)(2)** speaks to all service equipment enclosures containing service conductors, including meter fittings, boxes, and the like interposed in the service raceway. Section **250.92(B)** describes the methods that will ensure the electrical continuity of the service equipment. As described in Section **250.92(B)** standard locknuts or bushings are not an acceptable means for the bonding required by this section.

*Example: a structure that has an overhead service. The service entrance conductors splice to the service drop and run down an EMT raceway to the meter enclosure. The EMT raceway is secured to the hub on top of the meter enclosure with a compression connector. The EMT raceway runs from the back of the meter enclosure directly through the wall and attaches to the service disconnect enclosure with standard connectors, locknuts and plastic bushings on both ends. The problem here is a bonding fitting should have been used on one end of the EMT raceway running from the meter enclosure to the service disconnect enclosure to bond the raceway. The EMT riser is effectively bonded by the threaded hub on the top of the meter enclosure. If there were any wireways or boxes installed in the raceway system they would be required to be bonded as well. Section **250.102(C)** requires equipment bonding conductors on the supply side of the service to not be smaller than the sizes shown in Table **250.66**.*

8.) The non-use of a locking type disconnect for submersible well pump motors.

Section **430.102(A)** requires the installation of a disconnecting means in sight from the motor controller location that disconnects the controller. In the case of the typical residential submersible well pump installation the controller would be the pressure switch on the water storage tank. Section **430.102(B)** requires a disconnecting means to be in sight from the motor location to disconnect the motor. Article **100** defines "in sight from" to be visible and within 50'so there should be a disconnecting means that is visible and located no more than 50' from the pump motor. Normally it is impracticable to accomplish this so under the Exception to **430.102(B)** you are permitted to eliminate the motor disconnect if the location is impracticable and the controller disconnect is capable of being locked in the open position. The provisions for locking or adding a lock to the disconnecting means shall be installed at the switch or circuit breaker used as the disconnecting means and shall remain in place with or without the lock installed.

*Example: a submersible well pump has been installed to supply the domestic water for a dwelling unit. The pump cable runs from the well head to the dwelling unit basement where it connects to the load side terminals of the pressure switch located on the water storage tank. A branch-circuit has been run about 35' from a panelboard that is not visible from the water storage tank location, to a snap switch located next to the water storage tank. The conductors on the load side of the snap switch run to the line side terminals of the pressure switch. In this case the snap switch would be the controller disconnect switch required by **430.102(A).** If the panelboard were visible for the entire 35' from the water storage tank location the circuit breaker could also serve as the controller disconnect. There is no disconnect within sight from the well head, in the installation described, so in order to meet the exception to **430.102(B)** a device capable of locking the snap switch in the open position would be required. There are products available on the market that will allow a lock to be placed on a standard snap switch assembly or circuit breaker.*

9.) The improper connection of septic pumps.

There are several different problems that can stem from septic pump installations. First, Section **430.102(A)** requires the installation of a disconnecting means in sight from a motor controller location that disconnects the controller. In the case of the typical residential septic pump installation the controller would be the float switch in the pump tank. Section **430.102(B)** requires a disconnecting means in sight from a motor location to disconnect the motor. In this case it is possible to satisfy both requirements with one disconnecting means located at the tank as the controller and the motor are both within site of the disconnecting means. Article **100** defines "in sight from" to be visible and within 50'. So there must be a disconnecting means that is visible and located no more than 50' from the pump tank. In most residential cases the pump and controller (float switch) are inserted into a receptacle located near the tank so the attachment cap for the controller and pump cord can serve as the disconnecting means.

Most often the homeowner does not want to see a pedestal with a receptacle and cords so the attachment caps are cut off and the cords are wired directly (hard wired) into a junction box that is located in the tank. If the pump and controller have been hard wired many times there is no disconnect at all located within site from the motor or controller. In some cases the manufacturer prohibits the removal of the cord cap and float assembly end and this would be a violation of the manufacturer's requirements. In other cases the receptacle has been installed inside the pump tank. Before making this kind of installation, consideration should be given to the issues of accessibility and corrosion. Also, depending on the size of the system there may be sufficient hazardous vapor in the pump chamber to classify the location. The classified locations are more common in commercial and industrial applications.

10.) Clearances working clearances, headroom, dedicated space.

A number of concerns relating to the clearance issues **of Section 110.26** are often overlooked in the field. This section requires that sufficient access and working space be provided about electrical equipment to provide ready and safe operation and maintenance of the equipment.

The depth of working space described in Section **110.26(A)(1)** is required about equipment operating at 600 volts or less to ground that may require examination, adjustment, servicing, or maintenance while energized. The depth of the space must be determined in accordance with **Table 110.26(A)(1)** which is based on the conditions described in the table notes.

Section 110.26(A)(2) "Width of Working Space" requires the working space to be at least 30 inches in width or the width of the equipment whichever is greater. This section further requires that the space permit the door or hinged panel of the equipment to open at least 90 degrees.

Section 110-26(A)(3) "Height of Working Space" requires the height of the working space to be at least 6 feet 6 inches, measured from the floor, grade, or platform, or the actual height of the equipment itself which ever is greater. Associated equipment that is located within the working space is not permitted to extend more than 6 inches beyond the front of the electrical equipment.

Section 110.26(B) "Clear Spaces" requires that space about electrical equipment be kept clear and to not allow the space to be used for storage.

Section 110.26(F) "Dedicated Equipment Space" requires that switchboards, panelboards, distribution boards, and motor control centers be located in dedicated spaces and be protected from damage. **Section 110.26(F)(1)(a)** mandates a clear space that is the depth and width of the equipment that extends to height of 6 feet above the equipment or the structural ceiling which ever is lower. Only equipment associated with the electrical installation is permitted in this space. Where the structural ceiling height is greater than 6 feet, **100.26 (F)(1)(b)** permits foreign systems above the six foot space where protection from leaks, breaks or condensation has been provided.

11.) Failure to re-identify the white conductor in cables installed for the purpose of switching, employing the white conductor as an ungrounded conductor.

200.7 Use of Insulation of a White or Gray Color or with Three Continuous White Stripes.

(C) Circuits of 50 Volts or More. The use of insulation that is white or gray or that has three continuous white stripes for other than a grounded conductor for circuits of 50 volts or more shall be permitted only as in **(1)** through **(3)**.

(1) If part of a cable assembly and where the insulation is permanently re-identified to indicate its use as an ungrounded conductor, by painting or other effective means at its termination, and at each location where the conductor is visible and accessible. Where used in the manner the identification shall encircle the insulation and be a color other than white, gray or green.

(2) Where a cable assembly contains an insulated conductor for single-pole, 3-way or 4-way switch loops and the conductor with white or gray insulation or a marking of three continuous white stripes is used for the supply to the switch but not as a return conductor from the switch to the switched outlet. In these applications, the conductor with white or gray insulation or with three continuous white stripes shall be permanently re-identified to indicate its use by painting or other effective means at its terminations and at each location where the conductor is visible and accessible.

12.) The terminating of more than one grounded conductor under a single terminal.

Grounded Conductor Terminations 408.41

It is not uncommon to find the termination of more than one grounded conductor under a single terminal, in a panelboard. The NEC, as well as the manufacturer, limits terminating the grounded conductor in a panelboard to a single conductor per terminal. Unless you are dealing with parallel grounded conductors under a terminal designed for the purpose, each grounded conductor shall terminate within the panelboard in an individual terminal that is not used for another conductor.

13.) The failure to support luminaires to the ceiling grid in suspended ceilings.

Means of Support 410.16

410.16 (C) Suspended Ceilings

Luminaires (fixtures) installed in suspended ceilings that are required to be chained or tied to the structure, either by the local authority or the job specifications, are often not secured to the grid. **Section 410.16 (C)** requires the framing members of suspended ceilings be secured to each other and to the building structure at appropriate intervals. This Section also requires that the luminaires be securely fastened to the ceiling framing members either by bolts, screws, rivets, or listed clips identified for use with the type of ceiling framing members and luminaires (fixtures). Unless the luminaires are completely supported independent of the grid system they must secured to the grid system.

14.) The flexible connection to emergency system equipment in hospitals.

517.30 (C) (3) Mechanical Protection of the Emergency System

Too often there is a failure to recognize and install a compliant wiring method delivering power for emergency system luminaires in locations covered under applications defined in **517.30(A).** The use of unprotected flexible metal raceways or cable methods is only permitted under specific conditions. The failure to recognize this requirement appears to come from a misunderstanding of the language found in Section **517.30(C)(3)(3)d**. The permitted method depends upon the conditions and circumstances related to

the installation and choice of the method. The intent is to protect the integrity of the emergency system from adverse conditions, particularly potential physical damage.

"517.30(C)(3) Mechanical Protection of the Emergency System.
The wiring of the emergency system in hospitals shall be mechanically protected. Where installed as branch circuits in patient care areas, the installation shall comply with the requirements of **517.13(A)** and **517.13(B)**. The following methods shall be permitted:
(3) Listed flexible metal raceways and listed metal sheathed cable assemblies in any of the following:
d. Where necessary for flexible connection to equipment"
*An example of the abuse of the permission to install a flexible cabling method is when luminaires fed from the emergency branch circuits are connected from ceiling outlets using a flexible wiring method. The language specifically indicates: "where necessary for flexible connection." The intent is clear that it is only permitted "**where necessary"** not where convenient, possible, preferred or easier! The option to use a flexible wiring method would have to be "identified" as **"necessary" where it relates to the connection of the equipment and** "approved" by both State and Local Authorities Having Jurisdiction. If the intention to use a flexible wiring method in this application to connect emergency luminaires is for reasons of convenience, preference, ease of installation, or financial, it is not considered "**NECESSARY!"***

15.) The mechanical protection of fire pump wiring and control wiring.
695.6 (E) Pump Wiring & 695.14 (E) Control Wiring
Occasionally fire pump installations present a circumstance where the fire pump and controls connected thereto are in the same room but only a short distance away from the fire pump controller. Because of the distance, the wiring methods being used are not always chosen from the methods indicated in Sections **695.6(E) & 695.14(E).** These wiring methods included in these sections are intended to assure protection of the integrity of the wiring system from adverse conditions. Electrical Metallic Tubing (EMT), often found, is not one of the approved methods.
695.6(E) Pump Wiring.
All wiring from the controllers to the pump motors shall be in rigid metal conduit, intermediate metal conduit, liquidtight flexible metal conduit, or liquidtight flexible nonmetallic conduit Type LFNC-B, listed Type MC cable with an impervious covering, or Type MI cable.
695.14(E) Control Wiring
All electric motor-driven fire pump control wiring shall be in rigid metal conduit, intermediate metal conduit, liquidtight flexible metal conduit, liquidtight flexible nonmetallic conduit Type B (LFNC-B), , listed Type MC cable with an impervious covering, or Type MI cable.

16.) The location of the disconnecting means for Emergency Systems.
225.31 Disconnecting Means, 225.32 Location and 700.12 (B) (6) Outdoor Generator Sets
It is not uncommon to find a disconnecting means that has been improperly located for an Emergency System (Article **700**) feeder which has been supplied from an outdoor housed generator. By the definition in Article **100** the conductors supplying an emergency system from a "separately derived system," in this case a generator, are considered as "feeder" conductors. Where the generator is located outdoors, the conductors would be considered as "outdoor feeder conductors" which are subject to the requirements of Article **225**, Outdoor Feeders and Branch Circuits.

The scope of Article **225** (**225.1**) notes that the Article covers the requirements for outside branch circuits and feeders run on or between buildings, structures, or poles on the premises; and electric equipment and wiring for the supply of utilization equipment that is located in or attached to the outside of buildings, structures or poles. **225.31** states that a means shall be provided for disconnecting all ungrounded conductors that supply or pass through the building or structure. The first sentence of **225.32** requires the disconnecting means to be located either inside or outside of the building or structure served or where the conductors pass through the building or structure. The second sentence in this section notes that the disconnecting means must be at a readily accessible location nearest the point of entrance of the conductors.

The confusion typically comes in when the language in **700.12(B)(6)** is applied improperly. This section, by the format of Code in **90.3**, can supplement or amend Chapters One though Four. At first glance, one gets the impression that a disconnecting means that is located under or within the housing of an outdoor generator set can be used as the disconnecting means required by **225.31**.

700.12(A) – (F) provide the general requirements for the acceptable sources of power supplying Emergency Systems. **700.12(B)(6)** is titled "Outdoor generator sets" and states that "where an outdoor housed generator set is equipped with a readily accessible disconnecting means located within sight of the building or structure supplied, an additional disconnecting means shall not be required where ungrounded conductors serve or pass through the building or structure. One must further recognize that Article **100** defines the term "within sight of" and means that the specified equipment is visible and not more than 50' away. In the case of **700.12(B)(6)**, the "specified equipment" is the disconnecting means and it must be visible and not more than 50' away from the building served. The definition of "within sight of" in Article **100** does not preclude the use of a window in a panel of the generator housing. However, the disconnecting must be completely visible through the panel window from the building. On one final important note, **225.36** requires the disconnecting means to be suitable for use as service equipment and this requirement in not amended by Article **700**.

17.) The separation of Emergency System Conductors from other conductors.
700.9 Wiring, Emergency Systems (700.9 (B) Wiring)

Section **700.9(B)** requires that wiring from an emergency source or emergency source distribution overcurrent protection to the loads be kept entirely independent of all other wiring and equipment unless it is otherwise permitted in **700.9(B)(1)–(4)**. These list items permit the emergency system wiring to be combined with: **(1)** the wiring from the normal source in transfer switches; **(2)** the wiring from another source in exit or emergency luminaires (light fixtures); **(3)** the wiring from another source in common junction box, attached to exit or emergency luminaries (light fixtures); **(4)** the wiring from a branch circuit supplying unit equipment in a common junction box where the emergency circuit wiring is supplied by the unit equipment.

There is often confusion related to the phrase "wiring from the emergency source to the loads or source distribution overcurrent protection to the emergency loads…." Although a much debated topic, this phrase means that we must keep the wiring from the emergency source to the emergency loads entirely independent of all other wiring or we must keep the wiring from the emergency source distribution overcurrent protection to the emergency loads entirely independent from all other wiring.

One of the common misapplications is to run a feeder from the source to one distribution panelboard and combining the emergency system overcurrent protection in the same enclosure with the legally required standby and/or optional standby overcurrent protection. Under this circumstance the "wiring" to the emergency loads has been combined in the same enclosure with legally required standby and/or the optional standby wiring. Therefore, the wiring to the emergency loads has not been kept "entirely independent of all other wiring." Note that none of the previously discussed items in **700.9(B)(1)-(4)** permit this application. You would, however, be allowed to run two or more feeders from the source to separate panelboards. The first panelboard would contain strictly emergency system overcurrent protection and wiring and the other panelboard(s) could contain the legally required standby and/or the optional standby system overcurrent protection and wiring. In this case, the wiring to the emergency loads has been kept "entirely independent of all other wiring."

Where there is no overcurrent protection located at the source, it would be permitted to run one feeder to switchgear containing emergency, legally required standby and optional standby system overcurrent protection where the emergency source distribution overcurrent protection and wiring to the emergency load(s) is located in a separate section of the switchgear. Installed in this manner, the wiring from the emergency source distribution overcurrent protection to the emergency loads has been kept entirely independent of all other wiring.

18. Emergency, Legally Required and Optional Standby Signs
700.8, 701.9 and 702.8; Signs

There are two types of signs required when there is an on-site emergency, legally required standby or optional standby source. The first sign is a requirement of "**(A)**" in all three sections. It must be placed at the location of the service entrance equipment and identify the location and type of the onsite power source. Both **700.8(A)** and **701.9(A)** include an exception for the sign where individual unit equipment (battery packs) are the onsite power source.

The second sign is a requirement of "**(B)**" in all three sections and it applies where the grounded circuit conductor connected to the power source is connected to a grounding electrode conductor at a location that is remote from the power source. One common installation where the grounding connection to a grounding electrode conductor that is remote from the power source is where the power source is not installed as a "separately derived system" (see Article **100** definition). In this application the onsite power source grounded conductor has a solid connection to the normal system grounded conductor (not switched by the transfer switch) and the grounding connection to the grounding electrode conductor is typically being made to the normal supply grounded conductor at the service or other normal supply location.

Where the requirement of "**(B)**" applies, the sign must be placed at the grounding location which is where the grounding electrode conductor connects to the grounded conductor. The sign must identify any emergency, legally required standby or optional standby sources as well as any normal sources that are connected at that location.

19. **The sealing of underground raceways or raceways that are exposed to different temperatures.**

Although they are often overlooked, there are specific requirements in the NEC with regard to sealing underground raceways entering buildings or where condensation is created in raceways by the exposure to different temperatures within buildings or where a raceway passes from outdoor to indoor locations.

230.8 requires a service raceway entering a building or structure from an underground distribution system to be sealed in accordance with **300.5(G)** (at either or both ends). Water can enter raceways through couplings or it can build up from condensation resulting from the exposure to different temperatures. How ever the water accumulates within the raceway, the intent of the requirement is to prevent water from entering the service equipment via the underground raceway system. A sealant such as duct seal or other types identified for use with the conductor or cable insulation, shield or other components must be used to seal the ends of raceway and it should not have deteriorating effect on the insulation.

300.5 provides requirements for underground installations and **300.5(G)** states that conduits or raceways through which moisture can contact live parts shall be sealed or plugged at either or both ends. The requirements of this section are specific to where moisture can contact live parts so consideration must be given to how the conduit or raceway is installed. Not all underground conduits or raceways are installed in a manner that moisture would actually contact a live part. An example would be where an underground raceway enters below the equipment and then bends upward to the bottom of the equipment or a conduit body is used and then the raceway attaches the bottom of the equipment enclosure.

300.7(A) applies to raceways that are exposed to different temperatures. This section requires sealing with an approved material to prevent the circulation of warm air to a colder section of a raceway or sleeve where any portion of the raceway or sleeve is subject to different temperatures and where condensation is known to be a problem. Cold storage areas of buildings, passing from the interior to an exterior location and entering a walk-in cooler are examples of where condensation can occur in raceways due to the difference in temperature. A suitable compound at a conduit body or junction box installed in the raceway system just before it enters the colder location can serve as sealing means. As noted above, the compound must not cause deterioration of the conductor insulation.