

JATC NEWS

September - December 2005

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Training Director's Report

By Jim

The Eastern Idaho Electrical JATC,s summer has been active but the work situation is the slowest it has been for years. The work picture appears to be weak for the winter also. Consequently we have only indentured ten new apprentices this year with possibility of indenturing two more in the Twin Falls area. The new apprentices include; Dustin Chandler, Wayne Harris, Tyrone Korb, and Johsua Wiggins in the Twin Falls – SunValley area and Chet Cawley, Brandon Eldredge, James Smith, Russell Smythe, David Taufu'i, and Daniel Ternus in the Eastern area. We will continue our quarterly interviews and have an active ranking list to put to work next summer when the work breaks.

Our Journeyman upgrade classes will continue in September through spring 2006. Some of the classes we will be scheduling include; Codeology, Fire Alarm, Code Calculations, Grounding, Motor Control, and NICET Preparation which will meet the continuing education requirement for the 8 hour industry related class. Also, the 16 hour Significant Changes to the 2005 Code will be covered in four different settings (quarterly) from now until summer of 2006. Journeymen and Master electricians remember before you can renew your State of Idaho license you must have 16 hours of 2005 Code Update if your license expires between July 1, 2005 and July 1, 2008. Also you need an 8 hour Industry Related class which could include any Industry Related class taken after July 1, 2002. Please check the class schedule in this publication. We can only schedule and teach the classes, the responsibility to attend and renew your license is left to each individual.

From the Front Desk

By Cory

APPRENTICE INFORMATION

I just wanted to take a minute to remind you of your Idaho State Apprentice Registration Renewal. Your license expired on 7/31/2005. If you have not sent in your renewal, the fee is now \$20.00, and when you renew next year, they will penalize your hours. Your notarized certificate for your OJT hours and

Related Training has already been sent to the Electrical Bureau. All you need to send them is a Money Order for the renewal, and the bottom of the letter they sent you that has your name, address, and license number on it. If you did not receive the notice from them, you can write the information on a piece of paper and sent it in to them. Also, be advised that if you are not registered by September 1, 2005, the committee can remove you from your contractor until you are licensed. It is a requirement that all apprentices indentured with the Eastern Idaho Electrical JATC be registered with the Idaho Electrical Bureau at all times.

If you have any questions, or if you need more information, contact the JATC Office.

Instructor's Soap Box

By Steve

The theme of my last newsletter article was trying to show how field names of tools, methods, and materials make it difficult to find NEC rules that apply. I thought I would narrow the scope to just one subject at a time. I will also try to include a little history along with it like before. The subject this time will be raceways and in particular metal and round. More types to follow in the next newsletter.

When you think about the fact that local 449 is going to celebrate 100 years this November and realize that electricity has been in use for only 126 years it brings into focus how fast our trade changes. It started with the ideas of great minds and inventors such as Thomas Edison, Nikola Tesla, William Merrell, George Westinghouse, and others. Thomas Edison's lighting system was announced in December of 1879 and the first commercial installation was put in service in May of 1880. Within just five years there were over 500 plants in operation, serving 100,000 lamps.

With arcing and sparking and resultant fires occurring almost daily, a group met in 1881 to discuss safer electricity use. The National Association of Fire Engineers met in Richmond, Virginia. That meeting resulted in a proposal that served as the basis for the first national electrical code. The first published NEC was in 1897.

Ordinary electrical conductors strung without protection soon proved dangerous. The earliest designers recognized what was clearly needed was some means by which

Instructor's Soap Box Cont'd

the conductors could be enclosed and protected permanently against mechanical and electrical damage. Harry Greenfield introduced the first known conduit system in 1888: zinc tubes with copper elbows. In 1889 Gus Johnson and Harry Greenfield introduced insulated paper tube conduit. The wire could be pulled after the conduit was in place and the building construction complete. Although other materials were introduced in similar conduits they were not accepted and Greenfield and Johnson enjoyed a near monopoly for the next decade on interior conduit. Greenfield also produced in 1899 the first flexible metal conduit.

In the early 1890's other companies began to produce gas pipe conduit with wood, fiber, or clay base liners. In 1894, iron-armored conduit was produced consisting of 10-ft lengths of standard-weight, wrought-iron gas pipe, with paper lining and threaded couplings and nipples. Installations using black painted steel pipe, which originally ran through buildings to provide gas for lighting, was being used with some success and was relatively inexpensive. The first approved unlined pipe appeared in 1897 and was enameled inside and out. This improvement was brought about by the introduction of good rubber-insulated electrical conductors. From that evolved today's galvanized rigid steel conduit. Here at last was a conduit that provided full mechanical and electrical protection for conductors and it could be bent without damage to the linings. The first exterior coating to prevent oxidation was enamel, followed in 1902 by electrogalvanized rigid steel conduit. In 1908 sherardized (covered with zinc dust and then baked) steel conduit appeared, followed by hot-dip galvanizing in 1912. In 1931, the Empire State Building was completed with over 1,200,000 feet of Rigid Metal Conduit (RMC) that is still in service today.

The 2005 NEC defines a raceway as "An enclosed channel of metal or nonmetallic materials designed expressly for holding wires, cables, or busbars, with additional functions as permitted in this code." It goes on to list examples of raceways accepted by the code. The metallic round ones are RMC, IMC, EMT, LFMC, FMC, and FMT. How many do you recognize?

When we say "rigid" or "heavy wall" in the field we are talking about the first one. RMC means "Rigid Metal Conduit". It is also called GRC (galvanized rigid conduit). ARC is aluminum rigid conduit. Rigid is also made out of stainless steel and silicone bronze. All are covered by the NEC Article 344. GRC is

the heaviest-weight tubular conduit and the most common.

I haven't heard any field names for the next one other than to just call it IMC. If you have heard of one, let me know and I will pass it on. It was developed in the early 70's by Allied Tube & Conduit and included in the NEC in 1975. It has now evolved to the point of being interchangeable with GRC and uses the same couplings. IMC is covered by the NEC in Article 342. IMC has a thinner wall thickness than GRC making it much lighter than GRC, but its method of manufacture and steel chemistry provide it with a mechanical strength equal to or greater than GRC. Its resultant larger inside diameter allows for easier pulls and/or more conductors.

What are we talking about when we say "ROBROY"? When the conditions of the job require more corrosion protection and to maintain a high physical protection, then we use what is called a coated metallic raceway. It is available in GRC or IMC and installed per NEC 344 or 342 respectively. "PVC-coated" rigid conduit was first introduced in 1961 by Robroy Industries, hence the field name. The other major manufacturer today is Thomas & Betts OCAL Inc.

"Thinwall" or "Steel tube" is of course referring to EMT. Electrical Metallic Tubing is the lightest-weight tubular metal raceway manufactured. EMT is commonly produced as galvanized steel but can be produced in aluminum and is covered in NEC Art. 358. EMT was developed in 1928, but did not gain popularity until the start of WWII, when the entire nation was trying to conserve steel. Soon after the use of EMT began and tradesmen learned how to bend and install it, it gained the massive popularity it enjoys today.

When you decide to use "Greenfield" on the job you are really dating yourself, so I would just call it "flex". It was invented in 1902 by Harry Greenfield and Gus Johnson and when it was listed by Sprague Electric Co. it was called "Greenfield flexible steel conduit". Today the term "Greenfield" is commonly used for all FMC (flexible metal conduit-NEC Art. 348). FMC is also manufactured in both aluminum and steel. The NEC defines FMC as "A raceway of circular cross section made of helically wound, formed, interlocked metal strip."

If you compare the definition of FMC with this next one you will be able to decide which code article applies. "A raceway that is circular in cross section, flexible, metallic, and liquidtight without a nonmetallic jacket." This is NEC FMT from Art. 360. Flexible Metallic Tubing is not common on general construction jobs and I do not believe that I have ever seen any but I envision it like the rolls of bendable copper tubing that plumbers often use. It is only allowed to be generally 1/2 or 3/4 trade size and on systems up to 1000 volts by the NEC. It is also inexplicably only

for use in dry locations, not subject to physical damage, up to 6 feet in length.

Lastly if you ask your partner to find "Seal-Tite" in the NEC, where would he/she look? LFMC (Liquidtight Flexible Metal Conduit) is found in Art. 350. It is a raceway of circular cross section, having an outer liquidtight, nonmetallic, sun-resistant jacket over an inner flexible metal core. (Compare to FMT) LFMC has very few restrictions to its use. The two major ones are for equipment grounding and physical damage. It is available in sizes 1/2 to 4 inch trade sizes.

That covers the metal conduits. I'll do the nonmetal ones next time. As just a side note, whenever you see the word conduit in the codebook instead of the general term of raceway, then the NEC is referring to only those raceways that have the word conduit in its name.

Did You Know?

By Jim

Normally I write this column to inform you of things not usually known about how the JATC functions. However I have seen some things that concern me for the future. I, Jim Weimer, have been a Local Union 449 member for thirty-seven years and have some personal thoughts to share with you. I have experienced many things in thirty-seven years seeing good and bad times. For the past four years I have observed a deterioration in working together to get things done and commitment, with a **me** only attitude. A common goal cannot be reached by thinking only of you. What goal am I talking about – obtaining and keeping work. We need to strive to do and look our best when working for our contractor's customers. We have to look and act professional also be prepared to carry out our work the most expedient way. After all the customer is the one we work for.

The contractor has the responsibility of attaining the work from various customers so ultimately the contractor and their employees work for the customer. The contractor should make sure the supervision they assign to the site is capable of taking care of the job, that is, will he/she work well with the general and other sub-contractors? Is the supervision capable when assigning tasks and can they receive both constructive and destructive input without becoming angry? Can they think of what needs to be done ahead of time and keep the job stocked in both material and tools? Do they have the personality that is needed in order for the crew to respect them? If you are in a supervisory role, such as a General Foreman or Foreman, make sure you have your thoughts and the job organized so the job progresses smoothly, efficiently, and on time. Think ahead and be sure the journeymen understand their task and are

Did You Know? Cont'd

capable of completing it. Ask yourself if the proper and sufficient amount of material and tools are on the job? If you are a journeyman and supervising an apprentice, do you understand your task and does the apprentice understand their role? The journeyman is responsible for getting their task and the apprentice's task completed correctly, expediently, and in a workman like manner while giving the apprentice on-the-job training. The apprentice should make sure they understand his/her work task and ask their journeyman questions if the instructions are not clear. Journeymen, if you cannot answer the apprentices question take the initiative to find out, or maybe between the two of you it can be figured out. Everyone should be aware of the Labor/Management Collective Bargaining Agreement and what rights that Labor and Management have. If a job Steward is assigned to a job, he or she should listen to the crew member's complaint, tell the worker to continue working, and talk to supervision about the situation. Between the steward and supervision the complaint should be resolved and ideally no man hours should be lost over the complaint. Remember with everyone working together and doing their assigned job the contractor will make money, the employees will have work, and the customer will be satisfied. If the contractor cannot make a profit they will ultimately discontinue business, the employees will not have work, and there will be no customers to worry about.

The other subject I would like to touch on is **commitment**. What are you committed to? Is it your family, employer, union, religion, yourself, or if you are a contractor – your business. Personally I am committed to my family first as should everyone. However, without work, your union, your employer or the employer's customer you would have no income to feed your family. Consequently all the items mentioned are tied together to support your family. Religion is a personal matter, I understand that is important to many of you and your family but it should in no way enter the workplace. Apprentices, are you committed enough to complete your apprenticeship? That means being to work and school on time and every day. Journeymen, are you committed to getting the job done efficiently and on time while giving the apprentice the proper on-the-job training? This also means being to work on time, setting a good example for the apprentice, and showing up to continuing education class when you enroll in them. Contractors, is your business structured to flow smoothly and efficiently? Your office staff needs to keep the proper records, pay bills, payroll and benefits timely, also bill the customer as fast as possible. The estimator

should be well prepared to bid all work. National Labor and Management organizations, are you preparing for the future? In both organizations I see no direction for the future. I keep hearing what is wrong right now and we must fix it but I see no recommendations how to help solve the problems. We all need good leadership. Finally, this pertains to all, when we accept a position, on a committee, board or working for a Labor or Management organization, we should have the commitment to attend the meetings and serve to the best of our ability. All meetings are scheduled for the same day and times monthly, so why are there so many conflicts? Both Local Labor and Management organizations meetings have very poor turnouts. Everyone is expected to show up to work and on time, what is the difference when you commit to serve on a committee or board? If we work together, have commitment, and look at the big picture rather than just ourselves, surely we will have a future.

Code Corner

By Jim

Problem:
Two sets of 3-phase, 3-wire circuits, each comprised of 2 AWG THW copper motor branch-circuit conductors, are installed in the same conduit with six 14 AWG THHN copper control circuit conductors in an ambient temperature of 30° C (86° F). Also included in the conduit is one 8 AWG THHN copper equipment grounding conductor. What is the allowable ampacity of the 2 AWG THW copper motor branch circuit-conductors?

Conduit Contains:
6 - # 2 AWG THW copper conductors (motor branch-circuit conductors)
6 - # 14 AWG THHN copper conductors (control conductors)
1 - # 8 AWG THHN copper conductor (equipment grounding conductor)

Comment:
The raceway and conductors are installed in an ambient temperature zone of 30° C (86° F) therefore the ampacities selected from Table 310.16 will not be adjusted using the temperature correction factors at the bottom of Table 310.16. Using Section 310.15(B)(2)(a) – Adjustment Factors for more than three current-carrying conductors in a raceway or cable refer to Table 310.15(B)(2)(a). This section tells us that we have to adjust the ampacity of the conductors because more than three current-carrying conductors are installed in the raceway. Which conductors are current-carrying? According to 310.15(B)(2)(a) Exception No. 1, the motor branch-circuit conductors are current-carrying but the control conductors are not. Also, from 310.15(B)(5) the equipment grounding conductor is not current-carrying.

Solution:
2 AWG THW copper conductors – (6) current-carrying
14 AWG THHN copper conductors – (6) non current-carrying
8 AWG THHN copper conductor – (1) non current-carrying

From Table 310.16 # 2 THW copper, 75° C column – 115 amperes
From Table 310.15(B)(2)(a) 4-6 current-carrying conductors adjust ampacity by 80%.
115 amps X .80 = 92 amps.
Therefore, the # 2 AWG THW copper conductor is capable of carrying 92 amperes in this installation.

Answer: 92 amperes

Problem:
What size of Galvanized Rigid Conduit would be required for the above installation?

Comment:
For conduit fill refer to Chapter 9 Table 1 and the Notes to Tables.
All conductors and their insulation need to be considered when calculating conduit fill whether they are current-carrying or not. They still take up space in the raceway. Note 3 does state that the equipment grounding conductors has to be included. Note 6 tells us that for combinations of different sizes installed in a conduit that Table 5 and Table 4 of Chapter 9 shall be used.

Solution:
Conductors to be included in the conduit fill calculation include; the motor branch-circuit conductors, the control conductors, and the equipment grounding conductor.

From Table 5 Chapter 9:
2 AWG THW – (page 631) – Approximate Area (far left column) = .1333 sq. in.
14 AWG THHN – (page 632) – Approximate Area (far left column) = .0097 sq. in.
8 AWG THHN – (page 632) – Approximate Area (far left column) = .0366 sq. in.

Calculate total square inches of conductors:
2's – 6 X .1333 = .7998 sq. in.
14's – 6 X .0097 = .0582 sq. in.
8 – 1 X .0366 = .0366 sq. in.
Total square inches = **.8946 sq. in.**

Refer to Table 4, Chapter 9 (page 628), Article 344 Rigid Metal Conduit (RMC):
Go to Over 2 Wires, 40%, far right column inches squared and find a value that will handle .8946 sq. in. It appears that 1.363 sq. in. will allow the .8946. Index over to the 2nd column from the left of the Table and a 2 inch conduit is needed.

Answer: 2 inch rigid conduit

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