

Ron Fuller, Chief Electrical Inspector

Vol. 15 No. 9

September 2012

Question of the Month

You are installing three 4 AWG THHN conductors in 1 inch EMT conduit on the roof of a building in Yakima with 1 ½ inches between the roof and the bottom of the conduit. What is the ampacity of the conductors after adjustment for ambient temperature and exposure to rooftop sunlight?

Note From The Chief

We will be beginning our Fall stakeholder meetings across the state this month. Check your schedule and do your best to attend a meeting in your area. It is important for you to stay up to date with changes that might affect you.

Meetings will be held from 6 to 8 p.m. in the locations listed below. Meeting dates and addresses will also be posted on the Electrical Program website and distributed on the program email list. If you are not on the email list, you may join by going to this link: <http://www.lni.wa.gov/Main/Listservs/Electrical.asp>.

These meetings have proven to be an important tool in communicating with the electrical industry, and offer an opportunity for our customers to ask questions directly to the Electrical Program and get instant feedback. We encourage all our customers to stay involved and attend these important annual meetings.

Safety Tip of the Month!

Listen to your breaker! A circuit breaker that trips immediately after it is reset is telling you that there is an electrical problem. Sure, sometimes the breaker itself is to blame, and in some cases there may just be too large an electrical load operating on that circuit. But it is more likely that the breaker is tripping because there is a severe electrical problem. Keep resetting that breaker, and you are likely to cause a fire.

Fall 2012 Stakeholder Meetings

September 25 – Tumwater – L&I Auditorium 7273 Linderson Way SW	November 5 – Wenatchee – Chelan County PUD Auditorium 327 N Wenatchee Avenue – Parking in back (east) side of building
September 26 – Aberdeen – L&I Building 415 W Wishkah Street Suite B	November 6 – Yakima – Pacific Power Auditorium 500 Keys Road
October 2 – Tacoma – L&I Building 950 Broadway, Orcas Room, 5 th floor	November 27 – Mount Vernon (5-8 p.m.) – Padilla Bay Interpretive Center, 10441 Bay View-Edison Rd
October 3 – Port Angeles – Elwha Klallam Heritage Center 401 E First Street	November 28 – Everett – Snohomish County PUD Auditorium, 2320 California Street
October 4 – Bremerton – L&I Building basement 500 Pacific Avenue	December 3 – Kennewick – Benton PUD Auditorium 2721 W 10th Avenue
October 16 – Kelso – L&I Building 711 Vine Street	December 4 – Pullman – Gladish Community and Cultural Center, 115 NW State Street
October 17 – Vancouver – L&I Building 312 SE Stonemill Drive	December 5 – Spokane – Spokane Community College Campus Map: 1810 N Greene St – Lair Bldg, # 6 – Sasquatch Room
October 18 – White Salmon – White Salmon Valley Community Library – 77 NE Wauna Avenue	December 6 – Moses Lake – L&I Building 3001 W Broadway Avenue
November 5 – Tukwila – L&I Building 12806 Gateway Dr S	

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Ambient Temperature Adjustment for Conductors in Rooftop Conduits

The interior of conduits exposed to direct sunlight, such as those containing conductors supplying air conditioning units on rooftops, become significantly hotter than the outside air (which is always measured in the shade).

NEC 310.15(B)(2)(c) states: *Where conductors or cables are installed in conduits exposed to direct sunlight on or above rooftops, the adjustments shown in Table 310.15(B)(2)(c) shall be added to the outdoor temperature to determine the applicable ambient temperature for application of the correction factors in Table 310.16 and Table 310.18.*

One source for the average ambient temperatures in various locations is the ASHRAE Handbook of Fundamentals. The table to the right is an excerpt from a [Publication](#) printed with permission of the [Copper Development Association Inc.](#) and gives outdoor temperatures inside rooftop conduits for selected locations in Washington. The 2% design temperature is the appropriate temperature average to be used for determining outdoor ambient temperature. The footnotes at the back of the publication explain how the temperatures are determined.

Table 310.15(B)(2)(c) gives the temperature adder for conduits exposed to sunlight on or above rooftops. The closer the conduits are installed to the rooftop, the higher the temperature adder that must be applied.

Distance above roof to bottom of conduit	0 – ½"	> ½" – 3 ½"	> 3 ½" – 12"	> 12"
Temperature adder °F	60°	40°	30°	25°

	2% Design Temp.	Temperature inside conduit in direct sunlight				Max Temp.
		Distance above roof. Up to:				
		1/2"	3 1/2"	12"	36"	
WA	Washington					
WA	ARLINGTON MUNI	81	141	121	111	106
WA	BELLINGHAM INTL AP	78	138	118	108	103
WA	BREMERTON NTNL AWOS	84	144	124	114	109
WA	DESTRUCTION ISLAND	63	123	103	93	88
WA	FAIRCHILD AFB	90	150	130	120	115
WA	FELTS FLD SPOKANE+D935	93	153	133	123	118
WA	FRIDAY HARBOR	77	137	117	107	102
WA	GRAY AAF	84	144	124	114	109
WA	HANFORD	99	159	139	129	124
WA	HOQUIAM AP	73	133	113	103	98
WA	KELSO WB AP	85	145	125	115	110
WA	OLYMPIA	85	145	125	115	110
WA	OMAK	96	156	136	126	121
WA	PASCO	97	157	137	127	122
WA	PEARSON FLD	89	149	129	119	114
WA	PULLMAN/MOSCOW RGNL	90	150	130	120	115
WA	QUILLAYUTE	77	137	117	107	102
WA	SEATTLE BOEING FIELD	84	144	124	114	109
WA	SEATTLE/TACOMA	83	143	123	113	108
WA	SPOKANE	91	151	131	121	116
WA	STAMPEDE PASS	77	137	117	107	102
WA	TACOMA MCCHORD AFB	84	144	124	114	109
WA	TACOME NARROWS	82	142	122	112	107
WA	TATOOSH ISLAND	62	122	102	92	87
WA	WALLA WALLA	96	156	136	126	121
WA	WENATCHEE/PANGBORN	94	154	134	124	119
WA	WEST POINT (LS)	69	129	109	99	94
WA	WHIDBEY ISLAND NAS	71	131	111	101	96
WA	WILLIAM R FAIRCHILD	77	137	117	107	102
WA	YAKIMA	94	154	134	124	119

Once the total ambient temperature is determined, you must adjust the ampacity of the conductor. Remember that NEC 110.14(C) allows the use of the full temperature rating of the conductor for ampacity adjustment, correction, or both, as long as the temperature rating of the termination is not exceeded. Multiply the ampacity of the conductor taken from table 310.16 or 310.18 by correction factor found in the lower portion of the ampacity table.

Example: What is the ampacity of three 2 AWG THHN copper conductors in conduit 3 ½ inches above a rooftop in Olympia?

Olympia 2% design temperature = 85°; Table 310.15(B)(2)(c) adder for 3 ½ inches above rooftop = 40°; Total ambient temperature = 125°; 2 AWG (90° temperature rating) ampacity = 130 amperes; Table 310.16 correction factor for 125° ambient temperature = .76; 130 amperes X .76 = 98.8 amperes adjusted ampacity.

After the ambient temperature correction factor has been applied, an additional adjustment factor may be required in accordance with NEC 310.15(B)(2)(a) if more than three current-carrying conductors are installed in the raceway.

Ugly Installations

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Violations: NEC 250.52(A)(5) Ground rods shall not be less than 8 ft. in length; WAC 296-46B-990 Serious non-compliance (Installing a shortened rod/pipe grounding electrode). Possible suspension or revocation of license/certificate of installer may result.

Answer to Question of the Month: ASHRAE 2% design temperature for Yakima = 94°; Table 310.15(B)(2)(c) adder for 1 ½" above rooftop = 40°; Total ambient temperature = 134°; 4 AWG (90° temperature rating) ampacity = 95 amperes; Table 310.16 correction factor (134° ambient temperature) = .71; 95 amperes X .71 = 67 amperes adjusted ampacity.



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