Coffee Break Training - Fire Protection Series

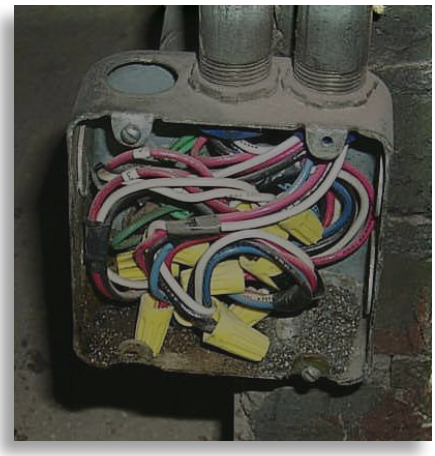
Inspection Techniques: Electrical Conductors in Junction Boxes

No. FP-2010-15 April 13, 2010

Learning Objective: *The student shall be able to identify the maximum number of electrical conductors that may be housed in a single metal junction box.*

Fire inspectors often find themselves checking for electrical hazards in any number of occupancies. While some hazards are obvious, others require some investigation.

In this illustrated example, the number of conductors inside the metal junction box appears to exceed the maximum permitted by National Fire Protection Association (NFPA) 70, *National Electrical Code®*. Metal boxes and conduit bodies must be of sufficient size to provide free space for all enclosed conductors. This arrangement allows access to the connections and heat dissipation.



In addition to missing its required cover, this metal junction box appears to have too many conductors for its volume.

Metal junction boxes must have minimum volumes established by NFPA 70 based on their size and shape. In addition, they must be adequately grounded upon installation. Standard boxes that are not marked with their volume must meet the requirements of the table below.

The volume of a wiring enclosure (box) is the total volume of the assembled sections, and, where used, the space provided by plaster rings, domed covers, extension rings, etc., that are marked with their volume or meet the specification listed below.

Maximum Number of Conductors
4-inch Square Metal Junction Box†

Box Trade Size		Min. Volume		Maximum Number of Conductors (AWG)*						
in.	mm	in^3	cm^3	18	16	14	12	10	8	6
4 x 1- 1/4	100x32	18.0	295	12	10	9	8	7	6	3
4 x 1- 1/2	100x38	21.0	344	14	12	10	9	8	7	4
4 x 2- 1/8	100x54	30.3	497	20	17	15	13	12	10	6
4- 11/16 x 1- 1/4	120x32	25.5	418	17	14	12	11	10	8	5
4- 11/16 x 1- 1/2	120x38	29.5	484	19	16	14	13	11	9	5
4- 11/16 x 2- 1/8	120x54	42.0	689	28	24	21	18	16	14	8

*American Wire Gauge.

†Note that this table does not apply to round, octagonal, or device boxes. Device boxes hold switches, circuit breakers, fuseholders, and similar equipment that carry, but do not use, electricity.

Each conductor that originates outside the box and terminates or is spliced within the box is counted **once**, and each conductor that passes through the box without splice or termination also is counted **once** toward the maximum numbers that are shown.

For additional information, refer to NFPA 70, *National Electrical Code®*.