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UL 3004

Outline of Investigation for Medium Voltage Junction Boxes

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Summary of Topics

This Second Issue of UL 3004, the Outline of Investigation for Medium Voltage Junction Boxes, covers requirements for junction boxes used for termination of medium voltage conductors. This issue includes editorial revisions to the first issue, and does not include any revisions to construction or test requirements.

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INTRODUCTION

1 Scope

1.1 These requirements cover medium voltage junction boxes. Medium voltage junction boxes are rated over 1000 V ac, up to 38,000 V ac, contain insulators, and bus bars or other means, such as separable insulated connector systems, to connect medium voltage conductors. These boxes may also include other associated components necessary for the purpose of connecting medium voltage conductors, such as mechanical cable supports or ground bus for cable shield connections. These junction boxes are intended to be used in accordance with the National Electrical Code, NFPA 70.

1.2 The conductors may be routed through knockouts or openings in the enclosure for cable, conduit, or electrical metallic tubing. These junction boxes may also have special openings to match with similar openings in other equipment such as medium voltage motor controllers, switchgear, switch or circuit breaker enclosures, wireways, and the like.

1.3 Medium voltage junction boxes are not intended to be used as pull boxes, where cables pass through the enclosure without terminating within the enclosure.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this outline shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this outline.

2.2 A component is not required to comply with a specific requirement that:

- a) Involves a feature or characteristic not required in the application of the component in the product covered by this outline, or
- b) Is superseded by a requirement in this outline.

2.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

3 Units of Measurement

3.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

4 Undated References

4.1 Any undated reference to a code or standard appearing in the requirements of this outline shall be interpreted as referring to the latest edition of that code or standard.

5 Glossary

For the purpose of this outline, the following definitions apply.

5.1 General

5.1.1 CLEARANCE – The distance between two conductive parts along a string stretched the shortest way between these conductive parts.

5.1.2 COVER – An unhinged portion of an enclosure that covers an opening.

5.1.3 CREEPAGE DISTANCE – The shortest distance along the surface of an insulating material between two conductive parts.

5.1.4 DISRUPTIVE DISCHARGE – The phenomena associated with the failure of insulation under electric stress; these include a collapse of voltage and the passage of current. The term applies to electrical breakdown in solid, liquid, and gaseous dielectrics, and combinations of these dielectrics.

5.1.5 DOOR – A hinged portion of an enclosure that covers an opening.

5.1.6 ENCLOSURE – A surrounding case constructed to provide a degree of protection to personnel against incidental contact with the enclosed equipment and to provide a degree of protection to the enclosed equipment against specified environmental conditions.

5.1.7 PROSPECTIVE CURRENT – The current that would flow in the circuit if each pole of the circuit were replaced by a conductor of negligible impedance.

NOTE: For testing, the prospective current is determined by calibrating the test circuit with a short circuit placed directly across the test station terminals. During the actual test, the sample is allowed to be wired using a maximum of 8 ft of cable connected to both the line and load side terminals.

5.2 Equipment ratings

5.2.1 RATED CONTINUOUS CURRENT (I_{th}) – The rated continuous current is the maximum current carried on a continuous basis.

5.2.2 RATED DURATION OF SHORT-TIME (t_k) – The rated duration of short-time withstand current is the interval of time for which the equipment can carry a current equal to its rated short-time withstand current (I_k). The preferred rated duration is 2 seconds.

5.2.3 RATED FREQUENCY (f_r) – The rated frequency is the supply frequency for which the junction box is designed and to which the other characteristic values correspond. The standard values of the rated frequency are 50 Hz and 60 Hz. The preferred rated frequency is 60 Hz.

5.2.4 RATED INSULATION LEVEL (U_d), (U_p) – The rated insulation level is the impulse test voltage (BIL) (U_p) and the power-frequency withstand test voltage (U_d) from Table 15.1 that the junction box is expected to withstand.

5.2.5 RATED MAXIMUM VOLTAGE (U_r) – The rated maximum voltage indicates the upper limit of the highest voltage of the system voltage for which the junction box or junction box is intended. Standard values of rated voltages are 2.5 kV, 3.6 kV, 5 kV, 7.2 kV, 12 kV, 15 kV, 27 kV, and 38 kV.

5.2.6 RATED PEAK WITHSTAND CURRENT (I_p) – The rated peak withstand current is the prospective peak current associated with the first major loop of the rated short-time withstand current that the junction box can withstand during the fault interruption test. The prospective peak current value shall be equal to 2.6 times (60 Hz) or 2.5 times (50 Hz or below) the rated short-time withstand current. This may also be referred to as the rated momentary withstand current.

5.2.7 RATED SHORT-TIME WITHSTAND CURRENT (I_k) – The rated short-time withstand current is the maximum symmetrical rms value of the short-circuit current that equipment can withstand for the rated duration (t_k). The preferred values are 40 kA and 50 kA.

CONSTRUCTION

6 Enclosure

6.1 General

6.1.1 Unless specified otherwise in this standard, the enclosure shall comply with the Standard for Enclosures for Electrical Equipment, Non-Environmental Considerations, UL 50.

6.1.2 The enclosure may be constructed with a special opening for connection to other equipment if the enclosure is provided with mating surfaces of at least 9.5 mm (3/8 inch) on each side of the special opening and is provided with instructions and markings as specified in Section 22.

6.1.3 Enclosures shall be metallic. Portions of the enclosure may be of insulating material, provided that medium-voltage parts are completely enclosed by grounded metallic covers.

6.1.4 The enclosure shall have no openings that are not closed when mounted as intended.

6.1.5 Enclosures may be evaluated to specific enclosure types as specified in the Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E. Enclosures rated with an outdoor type environmental rating shall be subjected to the driven rain test described in Section 16, in addition to the appropriate tests in UL 50E for the assigned type rating(s).

6.2 Exterior doors, covers, and similar parts of enclosures

6.2.1 A part of the enclosure, such as a door or cover, shall be provided with means, such as latches, bolts or screws, for firmly securing it in place.

6.2.2 Doors or covers shall require the use of a tool to open them and may additionally have provisions for locking. A warning marking shall also be provided in accordance with 19.3.

6.2.3 Doors shall be provided with a latch or with a captive fastener. Such fasteners shall be located or used in multiples so as to hold the cover closed over its entire length. A door more than 1.2 m (4 ft) long on the hinged side shall have at least a two-point latch operated by a single knob or handle, or shall have two or more separate latches or captive fasteners.

6.2.4 Doors and covers shall meet the following conditions:

- a) Doors shall be bolted on all unhinged sides with a minimum of two bolts per side;
- b) Covers shall be bolted with a minimum of two bolts per side;
- c) No bolts are operable by hand, without the use of a tool;
- d) All bolts are captive fasteners.

6.2.5 All doors shall be capable of being opened to a minimum of 90 degrees from the closed position.

6.3 Inspection windows

6.3.1 A transparent material covering an observation opening and forming a part of the enclosure shall:

- a) Be of clear safety-type glass or wire-reinforced glass or another clear material found suitable with respect to flammability and UV resistance in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.
- b) Be secured in such a manner that it cannot be removed without tools; and
- c) Meet the requirements of impact and pressure tests for viewing panes specified in Section 17.

6.4 Enclosure category

6.4.1 All enclosures complying with 6.1 – 6.3 are considered to provide general protection against incidental contact with live parts by unauthorized and untrained personnel. Enclosures intended to provide additional protection may be designated as Category A or B enclosures in accordance with 6.4.2 or 6.4.3.

6.4.2 Category A enclosures are intended for installation in unsupervised areas accessible to the general public where they may be subject to deliberate unauthorized acts to gain access to the interior of the enclosure. Such enclosures may be marked as Category A enclosures in accordance with 20.3, if the enclosure complies with all the requirements for Category A enclosures as detailed in Annex B of IEEE C37.20.2-2015.

6.4.3 Category B enclosures are intended for installation in areas that may be accessible to other than authorized personnel, but not expected to be subjected to deliberate unauthorized acts to gain access to the interior of the enclosure. An enclosure may be marked as a Category B enclosure in accordance with 20.4, if the enclosure complies with all the requirements for Category B enclosures as detailed in Annex B of IEEE C37.20.2-2015.

7 Wire Bending Space

7.1 Wire-bending space for field-installed conductors

7.1.1 Wire bending space shall be such that, during installation, field-installed conductors need not be bent to a radius less than:

- a) 8 times the overall diameter for non-shielded conductors; or
- b) 12 times the overall diameter for shielded or lead-covered conductors.

Construction shall take into account the type and maximum size of wire, optional use of stress cones for field terminations, and other instructions provided in accordance with 21.9.

7.1.2 Junction boxes rated over 5 kV shall always be provided with wire bending space based on the use of shielded conductors. Junction boxes rated 5 kV and below may be provided with wire bending space only for non-shielded conductors when marked in accordance with 21.10.

NOTE: Section 310.10 of NFPA 70 (National Electrical Code) provides details for the use of shielded conductors.

7.1.3 If the construction of the junction box is such that wire-bending space is available only on one side of the termination point of the conductors, this shall be noted in the instructions provided in accordance with 21.9.