

GROUNDING FRAMEWORKS AND ASSOCIATED PARTS

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1. GENERAL

1.1 Scope

1.1.1 This section contains requirements and information for the grounding of frameworks and associated parts.

1.2 Associated Information

1.2.1 This section is not intended to include all grounding information. For specific and more detailed information on grounding see Handbook 18 or Handbook 261, Section 700, 702, and 703 for Electronic offices.

1.2.2 The requirements covered in this section shall be followed except as modified by applicable specification and drawings.

1.3 Installing Equipment

1.3.1 The tools and equipment required to perform the operations covered in this section are in the general tool kits and, are normally available on the job.

1.4 Precautions

1.4.1 General safety precautions against personal injury and equipment damage are outlined in Handbook 0 and Section 1A of this handbook and are to be observed at all times as they apply to the operations being performed. Specific precautions to be taken are covered in this section.

2. FRAMEWORK GROUNDS

2.1 Preparation and Installation

2.1.1 Frames are usually grounded through superstructure, cable rack, and circuit. When provided, frames may also be grounded by way of ground bars, lugs, etc., connected to circuit ground conductors. Isolated frames containing commercial AC service, such as AC service, receptacles and outlets, must be grounded. The metallic enclosures containing the AC service or an additional conductor with the AC service, provides this ground. Otherwise, unless called for in job papers, isolated frames need not be grounded. (See Paragraph 3.1.5.)

2.1.1.1 Where frames and racks are furnished with a ground bus bar, the main ground lead and the individual bay ground leads should each be terminated in a separate terminal lug bolted to the ground bus bar. KS-15977 Compression Type Terminal Lugs are used.

2.1.2 The following surfaces shall be treated as current carrying connections and require preparation.

2.1.2.1 Where a lead is furnished specifically for grounding purposes, as in the case of a frame isolated from ground, the iron surface under the bus bar or lug should be scraped and cleaned so that metal to metal connection is certain. Requirements for the use of NO-OX-ID "A" SPECIAL and the preparation of the current surfaces of current-carrying connections are

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covered in Handbook 18. (See Paragraph 3.1.5.2.)

2.1.2.2 At the top of MDF and CDF frames, the junction of the ground bar and each protector vertical is a current carrying connection and must have the surfaces prepared.

2.1.2.2.1 For an ultimate maximum of three verticals, the ground bar at the top is omitted and a connection requiring surface preparation is made to the main ground bar at the bottom.

2.1.3 The following surfaces need not be treated as current carrying connections.

2.1.3.1 In the case of frames which are adequately grounded through the main auxiliary framing, cable rack, and conduit structure, the surfaces between bus bars and the iron framework should be clean but need not be scraped, regardless of whether metallic or nonmetallic finish is used on the framework. The use of NO OX ID "A" SPECIAL is unnecessary. (See Paragraph 2.1.1.)

2.1.3.2 The principal equipment room ground bar, usually located at the bottom of MDF and CDF frames, need not have the surfaces between the bar and the iron work prepared unless the frame is isolated from ground. (See Paragraph 2.1.2.2.1 for exception.)

2.1.4 A framework ground bar becomes a potential current carrier when a ground wire is placed between it and a circuit ground lead within the lineup.

2.1.4.1 Bus bar junctions between the circuit ground wire attachment and the office ground feeder must be considered current carrying connections and treated accordingly.

2.1.4.2 When such conditions exist, or are forthcoming with lineup additions, it is advantageous to treat all bus bar connections in the lineup as current carriers.

2.2 Bay Ground Leads

2.2.1 Attach the No. 6 ground lead to the bay ground bar while it is still in the coiled state in which it is received on the job. Straighten the wire by running it through the closed hands protected by pads of folded canvas.

2.2.2 Where the coded mounting plate includes a bay ground lead support, the ground lead should be soldered to the support as covered in Handbook 9.

2.3 Support of Bay Ground Leads

2.3.1 Bay ground leads should be supported at intervals of approximately 1'-6" with not more than 4" of the unattached end of the ground lead extending beyond the last support. For unequipped portions of the bay, or for portions where the supports, separate supports (P-401965) should be used. The No. 6 ground

lead is attached to these supports by crimping the end of the support. Soldering is not necessary. When a mounting plate contains a ground lead support having a terminal for a ground strap, the ground strap shall be soldered to the terminal; otherwise, the ground strap shall be attached to the No. 6 ground lead with wire of the same gauge as the strap, wrapped around the ground lead with two or three turns, and soldered to it. Where units are mounted after the supports are installed, insert only one mounting screw, (P-35354 or P-148634) in supports which support No. 6 ground leads. This is to be done on those supports where the unit will be mounted on top of the clips on the same order number.

3. CURRENT CARRYING BUS BARS AND TERMINAL LUGS

NOTE: See Handbook 18 for information on taping bus bars at battery distributing fuse boards and power boards.

3.1 Preparation and Installation

3.1.1 Ferrous bolts, screws, nuts, washers, bus bar supports, and clips used in fastening aluminum to aluminum, copper to copper, or combinations of metals shall be zinc or cadmium plated plus a chromate treatment. Zinc or cadmium finished parts are standard; however, copper finished parts may be used when furnished.

3.1.2 When the ground bus bars in switchboards are made of aluminum, the No. 6 terminal punchings or the P-403926 Terminal Strips should be mounted with through screws, nuts, and washers. The head of the mounting screws should bear against the terminal punching or terminal strip and the washer should be placed under the nut.

3.1.3 Surfaces of aluminum or copper bus bars, terminal lugs, etc., shall be protected from marring. Use washers under the heads of bolts, machine screws, cap screws, and nuts which would otherwise contact a bus bar when such parts are fastened together or to framework. No washers are required under the nuts of stud connections of under the heads of round head machine screws used to mount terminal lugs except where lugs are mounted in slotted holes. Wherever practicable, two screws or bolts should be used for fastening a terminal lug to a bus bar.

3.1.4 Contact surfaces of current carrying connections should be thoroughly cleaned so that metal-to-metal contacts are maintained. Where a coating of NO-OX-ID "A" SPECIAL is required, it shall be applied per Handbook 18.

3.1.4.1 All contact surfaces such as brass, copper, and iron should be cleaned with abrasive paper, and immediately (within 5 to 10 minutes) a thin coating of NO-OX-ID "A" SPECIAL should be applied and the connection

securely tightened.

3.1.4.2 Aluminum contact surfaces should be cleaned (dry) with R-3163 Abrasive Paper in the R-3162 Holder to remove dirt, grease, etc., and to breakdown hard oxide. When using the holder and paper on any contact surface to be cleaned, make sure it is parallel with the surface to be cleaned in order to avoid gouging which reduces the area of the contact surface. Then apply a coat of NO-OX-ID "A" SPECIAL and use an R-2628 Wire Brush to break up any soft oxide that has reformed. Clamp the connection together (within 5 minutes if possible) without removing the NO-OX-ID "A" SPECIAL.

3.1.4.3 Contact Nuts which form a part of the electrical circuit (e.g., nuts, studs) are current carrying parts.

3.1.4.4 Contact surfaces of contact nuts, if 1/2" or more across the flat, shall be cleaned and NO-OX-ID "A" SPECIAL applied.

3.1.4.5 Threads of studs or nuts need not be cleaned unless corroded or excessively dirty.

3.1.4.6 Parts having an added metallic coating shall be cleaned to grease, but coating should not be scratched. Coat with NO-OX-ID "A" SPECIAL.

3.1.4.7 Terminal lugs or punchings for wires smaller than No. 8 do not require the application of NO-OX-ID "A" SPECIAL to the lugs, bolts, screws, or nuts after cleaning, since such lugs are sufficiently pliable to permit them to be drawn into close contact with the surface to which they are connected. Also, NO-OX-ID "A" SPECIAL may be omitted in the case of other thin pliable terminals, such as the ground terminal strip on the ground bar of fuse panels.

3.1.5 Ground contact surfaces, that is, surfaces between bus bars or lugs and iron frameworks, for grounding the frame only, shall be treated as follows:

3.1.5.1 Surfaces between bus bars and the iron framework should be clean but need not be scrapped, regardless of whether metallic or nonmetallic finish is used on the framework. The use of NO-OX-ID "A" SPECIAL is unnecessary.

3.1.5.2 Where a lead is furnished specifically for ground purposes, as in the case of an isolated frame that requires a ground and has no other ground path, the iron surface under the bus bar or lug should be scrapped and cleaned so that a metal-to-metal connection is certain. Requirements for the use of NO-OX-ID "A" SPECIAL are the same as covered in Paragraphs 3.1.4 for current carrying connections.

3.2 Finish of Bus Bars

3.2.1 Bus bars, terminal lugs, and other copper parts on the rear of fuse bays should not be lacquered or otherwise finished, but the surface should be clean and free of conspicuous dirt and grease.

3.2.2 The lacquer finish of bus bars on the front of fuse panels, heat coil panels, and similar panels, should be free of conspicuous defects. The contact surfaces of fuse mounting bus bars (i.e., the surfaces under the fuse mounting screw heads) and the entire face of fuse alarm bus bars should be clean and free of finish materials.

4. INTERFERENCE OF GROUND LEADS OR BUS BARS WITH FRAMES

4.1 Where a ground jumper lead or bus bar interferes with installing a frame in a unequipped space in a lineup of working frames, it will be necessary to provide a temporary ground, to that side of the lineup which would be isolated, before the ground jumper is removed. This can be done by connecting one end of a "00" lead of suitable length to a ground bar of any frame in the group and the other end to either a frame of the same lineup on the opposite side of the unequipped space, or to a frame in an adjacent lineup and then removing the interfering ground lead.

4.1.1 Equip the lead with a terminal lug for connecting to the ground bars. If the shunt of half-tap is placed across the unequipped space, note that it is long enough to clear the top of the additional frame while it is being pushed into place.

5. CHECKING GROUND CONNECTIONS

5.1 The tightness of the bolts which make the ground connections on job assembled ground leads should be checked.

5.1.1 Ground bar connections on No. 1 crossbar district junctor frames should be tested in accordance with information in the section covering district junctor tests in Handbook 61.

6. ADDING FUSE PANELS

6.1 To prevent possibility of a short circuit when adding a unit fuse panel to the fuse bay, it is advisable to remove the ground bus bar from the fuse panel to be mounted by taking out three screws and one stud.

7. DISTRIBUTING AND PROTECTOR FRAMES

7.1 Distributing frames and protector frames having a circuit ground bus bar attached to the framework do not require separate framework ground. Distributing frames not having a ground bus bar attached to the framework are ordinarily grounded through contact with the auxiliary framing structure and do not require a separate framework ground except in those cases where they are isolated or the auxiliary framing arrangement is such that a good ground is questionable. In these cases,

ground the frame with a No. 6 lead attached to the nearest suitable ground source, such as auxiliary framing, cable rack, conduit, and other building ironwork with a suitable terminal.

7.2 On additions to old type main distributing frames, having a solid copper ground wire at the bottom of the protector mounting details and where no definite method is specified, splice with a sleeve type connector. See Handbook 22. Sweat the wires in the connector. Where the ground wire does not extend beyond the last old vertical, make splice between last and next to last old verticals.

8. IDENTIFICATION OF GROUND LEADS

8.1 Common System Framework Grounds

8.1.1 Grounding leads terminating on the originating end of discharge ground bar of power plant, battery distributing fuse boards, etc., shall be identified with a 145C Number Plate with information in identifying the distant end of ground lead. A 145C Number Plate is not required at the equipment end since office record drawings indicate assignments. In accordance with Handbook 39, the information may be stamped on the bus, bay, panel, etc., to which the connector attaches where room permits. When room does not permit, 145C Number Plates shall be stamped in accordance with Handbook 39 and attached per Handbook 18, Section 6A. When the 145C Number Plates are required and the job engineer failed to order sufficient quantity, it remains the installer's responsibility to requisition, stamp, and install them.

8.1.1.1 145C Number Plates will not be required where the entire run of cable from termination to termination can be visually identified.

8.2 TSPS Ground System

8.2.1 For specific information on the identification of ground leads, refer to standard drawing J-18014A-1. When 145C Number Plates are required and the job engineer failed to order sufficient quantity, it remains the installers responsibility to requisition stamp and install them. The 145C Number Plates shall be stamped in accordance with Handbook 39 and attached per Handbook 18, Section 6A.

8.3 ETS Ground System

8.3.1 For specific information on the identification of ground leads, refer to standard drawing J-67475A-1 or office drawing -311.

8.4 ESS No: 1; 1A; 2; 2B, & 3 Ground System

8.4.1 For specific information on the identification of ground leads, refer to standard drawings ED1A200-10 and J-1A035C-1.

8.4.1.1 As 145C Number Plates are not required, the identification of distribution ground leads at the power distribution ground leads at the power distribution frame is recorded on the office drawing -311.

8.5 ESS No: 4 Ground System

8.5.1 For specific information on the identification of ground leads, refer to job drawings.

8.6 Fuse Panel Ground Bars

8.6.1 For specific information on the identification of fused circuit grounds and other miscellaneous ground leads terminated on fuse panel ground bars, refer to the Sections of Handbook 39 covering Specific Requirements on Fuses and Fuse Panels.

9. VERIFICATION ITEMS

9.1 The numbers in parentheses refer to the associated paragraphs in this section.

9.1.1 Grounds and Bus Bars

9.1.1.1 Framework grounds installed when required (2.1.1 to 2.1.2.1).

9.1.1.2 Grounds properly supported (2.3.1).

9.1.1.3 Check tightness of bolts which make ground connections on job assembled ground leads (5.1).

9.1.1.4 Ground bar connections on No. 1 Crossbar District Junctor Frames tested per Handbook 61 (5.1.1).

9.1.1.5 Proper finish used on bus bars (3.1.1, 3.1.2).

9.1.1.6 Screws, nuts and washers installed as required (3.1.2).

9.1.1.7 Surfaces protected from marring (3.1.3).

9.1.1.8 Ground wires identified (8.1.1 to 8.5.1).

9.1.2 Grounding Distributing and Protector Frames

9.1.2.1 Ground connections installed where framework ground is questionable (7.1).

9.1.2.2 Ground wire on old type frames spliced with sleeve type connector (7.2).

← indicates new or changed information.

] indicates information subject to verification.

Engineering Planning Manager
(Installation)

Reason for Reissue:
To update Paragraph 8.1.1.1 to indicate when
145C Number Plates can be omitted.