Sequoyah Nuclear Plant

MODIFICATIONS AND ADDITIONS INSTRUCTION

M&AI-6

INSTALLATION OF CONDUIT AND JUNCTION BOXES

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PORC Review: 8-17-83
Date

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Date Approved: 8-17-83

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1C	Project Manager, DCRM, Construction

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The last page of this instruction is Number 21.

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History of Revisions

MODIFICATIONS AND ADDITIONS INSTRUCTION
MAI-6

Rev. No.	Date	Revised Pages	Rev. No.	Date	Revised Pages
0	11/8/79	All			
1	11/19/81	18			
2	07/08/82	Revised 12,13,16,17, Added 19,20,21			
3	11/29/82	11			
4	AUG 17 1983	15,17,& 18			

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1.0 GENERAL

1.1 Scope

This instruction covers field installation of all electrical conduit systems for Sequoyah Nuclear Plant. Procedures provided by the contractor shall be followed for those portions of the design under separate contract.

1.2 Drawings

The latest revision of the documents listed below in effect at the time of installation shall be followed.

DS-E1.2.2 - Electrical Equipment Nameplates - Sequoyah and Subsequent Nuclear Plants

SD-E13.1.1 - Expansion/Contraction Joint for Embedded Aluminum, Intermediate Metal, and Steel Conduit

SD-E13.1.2 - Expansion and Deflection Fitting for Embedded Aluminum, Intermediate Metal, and Steel Conduit

SD-E13.6.3 - Conduit Boxes, Frames, and Covers

SD-E13.6.5 - Conduit Box Connection (Watertight)

SD-E15.3.4 - Conduit, Cable, and Wire Identification Tags (Sequoyah Nuclear Plant and All Subsequent Nuclear Projects)

Where specific instructions are lacking on design documents, EN DES shall be requested to provide the necessary information on a case-by-case basis.

1.3 Definitions

Class 1E. The safety classification of the electric equipment and systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or otherwise are essential in preventing significant release of radioactive material to the environment.

CATEGORY I STRUCTURES

The Category I structures other than the primary containment structures are listed as follows:

1. Auxiliary-Control Building
   a. Control Bay Portion
   b. Auxiliary Building Portion
   c. Waste Packaging Area
   d. Condensate Demineralizer Waste Evaporator Building Portion
2. Condenser Cooling Water Pumping Station and Retaining Walls
3. Auxiliary Essential Raw Cooling Water Structures
4. Diesel-Generator Building
5. CO_2 Storage Building
6. Refueling Water Tanks and Pipe Tunnels
7. Class 1E Electrical Systems Structures
8. East Steam Valve Room
9. Essential Raw Cooling Water Pumping Station and Access Cells
10. ERCW Discharge Box

2.0 MATERIALS

2.1 General

Materials used in the original installation of the electrical conduit systems and conduit boxes shall be new; shall meet the requirements of an approved recognized standard; and shall be of kind, composition, and physical properties best adapted to their several purposes in accordance with best engineering practices.

2.2 Major or Special Materials

Major materials and those of a special nature used in the installation shall be designated on EN DES detailed design drawings or standard drawings, described in the electrical bill of material, and requisitioned by personnel in the EEB Equipment Requisition Group.

2.3 Miscellaneous Materials

These materials are of a standard nature and shall be purchased directly by the field. Included are conduit bodies and covers, conduit fittings, joints and terminations, flexible conduit, and other minor materials necessary for installation but not requisitioned by EM DES personnel.

Metallic conduit bodies, fittings, joints, couplings, and terminations (except for slip joints as permitted in section 3.2.3.7) shall be of the threaded type and approved for use with conduit systems which serve as the equipment grounding conductor.

Liquid-tight flexible metal conduit with a synthetic jacket (similar to the Anaconda Company, Brass Division, "Sealtite type UA") and connectors (similar to Ideal Industries, Incorporated, "Vap-Oil-Tight" series) shall be used for flexible conduit applications.

It shall be permissible to use the following as an alternative. Pressure-tight stainless steel flexible conduit with a convolute core structure (similar to Servicair Company type SS60 series or American Boa, Incorporated, type NB1-0 series) and connector fittings of compatible materials (available from the respective supplier) may be used for flexible conduit applications inside primary containment and may be used for applications outside containment. Radiation-resistant elastomer seals, such as silicon rubber, ethylene-propylene rubber, or other TVA approved material, shall be used with the connector fittings inside containment to maintain leak-tightness. Either the above type conduit or the type with a closed weave single braid stainless steel jacket (similar to Servicair Company type SS63 series or American Boa, Incorporated, type NB1-a series) may be used. The stainless steel flexible conduit and appropriate connector fittings shall be installed in accordance with the manufacturer's instructions.

Copper-silicon alloy, brass, or plastic conduit plugs shall be used where spare conduits are terminated in wet places.

If additional restrictions or limitations are required on miscellaneous materials to be purchased, these shall be so stated on the design drawings.

3.0 INSTALLATION

3.1 General

3.1.1 Installation of conduit, boxes, fittings, and accessories shall conform to the latest edition of the National Electric Code (NEC) and the drawings and standards described in section 1.2. In the event of a conflict between design drawings and NEC, the drawings shall govern.

3.1.2 If interferences occur, the cognizant engineer shall be notified for resolution by established procedures, with EN DES.

3.1.3 If it should become necessary to make a field change every precaution shall be taken to ensure that the change is coordinated with other conduit work, structural work, plumbing work, piping, and architectural features; and information shall be obtained regarding the completed conduit run to ensure there will be no interferences when the conduit run is extended. A complete record of any such change shall be sent to EN DES per AI-19.

3.1.4 Unless specifically called for on the detailed design drawings, structural steel or reinforcing bars shall not be cut or drilled in seismic structures.

3.1.5 Materials shall be properly protected while in storage.

3.2 Conduit

3.2.1 General

3.2.1.1 Conduit exposed to the weather, embedded in concrete, or in wet locations shall be sloped for drainage, if possible. Embedded conduit systems shall be rigidly supported and braced in position to avoid settling and to prevent the formation of pockets if heavy batches of concrete are placed on the conduit.

3.2.1.2 To terminate a conduit beneath a switchboard or at an apparatus, a bushing, chase nipple, or conduLet shall be used unless otherwise defined on design drawings. In certain instances where it may be impossible to install a conduit bushing or chase nipple at each termination point of a conduit because of limited space, the conduit end should be smoothed of all burrs and obstructions (beveled or rounded to approximately a 1/16" radius) so that cables will not be damaged.

3.2.1.3 After a conduit run is completed, it shall be inspected and cleaned out. Compressed air shall be used in blowing out any accumulation of trapped liquid.

3.2.1.4 Conduit identification tagging shall accompany the conduit installation. The tag shall be as designated on the conduit design drawings and/or conduit schedule and in accordance with electrical standard drawing SD-E15.3.4 (except it shall be permissible to use black lettering on termination tags for all but black background colors and to use rectangular polystyrene tags for conduit identification), or it shall be permissible to use self-sticking Mylar conduit markers (e.g., AMP Special Instries or LEM Products,

3.2.1.4 (Cont'd)

Incorporated), self-adhesive Polyester conduit markers (e.g., W. H. Brady Company) or ¼-inch minimum-width stainless steel ribbon material with the designation made using a Dymo tapewriter (or equivalent).

In yard areas where conduits are exposed to the natural environment, the conduit tag may be of 1/2-inch minimum-width stainless steel ribbon material.

3.2.2 Exposed Conduit

3.2.2.1 Exposed conduits shall be run in straight lines parallel to column lines, walls, or beams. Where conduits are grouped, the bends and fittings shall be installed to present an orderly appearance. Unnecessary bending or crossing shall be avoided.

3.2.2.2 Supports for straight runs of exposed rigid metal conduit shall not exceed the maximum distances listed in the NEC for systems made up with threaded couplings.

In seismic Category I structures, exposed conduits shall be supported as defined on design documents. (Ref 47A056 series drawings).

3.2.2.3 Malleable iron 1-hole pipe straps, clamps, U-bolts, hangers, or close bracket-type pipe supports may be used. Pipe backspacers should be used for the 1-hole malleable iron pipe supports where it is desired to hold a conduit run away from the surface to eliminate offsetting the conduit at the fittings.

3.2.2.4 In nonseismic structures, galvanized steel members may be drilled or punched for conduit supporting bolts provided the holes are immediately coated with zinc-dust zinc-oxide paint (Federal Specification TT-P-641d) and galvanized or rust-resisting bolts are used. Threaded stud bolts, Nelson stud anchors, or equivalent, may be used instead of drilling or punching steel members.

3.2.2.5 In moist locations and in locations where appearance is of importance, precautions shall be taken, such as by use of strap-type wrenches or equivalent means, to avoid injuring the galvanized coating or surface of stainless steel conduit.

3.2.3 Embedded Conduit

3.2.3.1 A minimum 2-inch clearance shall be maintained between conduits embedded in poured concrete walls or floor slabs, except that detailed design dimensions shall be adhered to adjacent to conduit terminations, etc., where area is restricted.

Conduits and conduit sleeves, when located in a bank or group form in a wall pour, may be adjusted as required to line up the bottom outside edge of the smaller sized conduit with the bottom outside edge of the largest conduit in the group in order to continue the group run on a common exposed support.

Likewise, grouped conduits in a floor or ceiling slab may be shifted enough to take advantage of a common exposed wall or column support. Embedded conduit runs shall terminate within ±1/2 the nominal diameter of the conduit being installed, unless the above exceptions apply.

Conduits embedded in switchyards and transformer yards shall maintain a 1-inch minimum clearance between conduits.

3.2.3.2 In switchyards and transformer yards all single conduit or groups of conduits shall be encased in concrete with the outer coverage a minimum of 2-1/2 inches.

3.2.3.3 Where aluminum or nonmetallic plastic conduits are embedded in concrete, extreme care shall be taken to anchor this conduit so that it will not be floated when the concrete is placed.

3.2.3.4 Embedded conduit shall be rigidly supported to withstand concrete vibrators or batches of mass concrete placements.

3.2.3.5 In supporting embedded steel, aluminum or plastic conduit, extreme care shall be taken to avoid damage to the surface of the conduit if welding or brazing is used near the conduit. In no case shall the conduit be welded or brazed to the support. Nonmetallic plastic conduit in duct runs shall not be supported by reinforcing steel forming closed magentic loops; preformed plastic spacers shall be used.

3.2.3.6 Concrete curbs shall be provided where specified on design project drawings.

3.2.3.7 Slip joints shall be installed where embedded conduits cross expansion or contraction joints in accordance with electrical standard drawing SD-E1.3.1, as defined and located on design drawings of the respective deisgn project.

3.2.3.8 Wherever slip joints are used, suitable bonding in accordance with electrical standard drawing SD-E13.1.1 shall be provided around the joint to ensure a continuous ground circuit. Where use of expansion and deflection-type fittings (see SD-E13.1.1) are defined in design drawings, the manufacturer's instructions shall be followed in making ground connections.

3.2.3.9 All embedded conduits turning out of poured concrete shall terminate with a standard coupling flush with the surface of concrete unless otherwise specified on design drawings. Couplings shall be plugged pending exposed extension.

3.2.3.10 In duct runs the metallic conduit shall be grounded at each manhole or handhole by brazing the ground wire to the top of the conduit coupling or by using grounding bushings.

3.2.4 Rigid Metal Conduit

3.2.4.1 General

a. Metallic conduit systems, whether embedded or exposed, shall be installed in accordance with those portions of the NEC ensuring that the systems will be adequately grounded and electrically continuous to function as the equipment grounding conductor. When boxes do not have threaded hubs or bosses (or as in section 3.3.1.3), conduits shall be securely fastened to boxes and cabinets, each with a locknut and a bushing inside the box and a locknut outside. The conduits shall be of such length that when the bushings are screwed tight against the ends of the conduits, no appreciable space will be left between the bushings and the locknuts. The locknuts shall be sufficiently tightened against the box to avoid hotspots or sparking during fault conditions, but without deforming the box.

3.2.4.1 Continued

b. Running threads shall not be used on rigid metal conduit for connection at couplings.

c. Welded or brazed grounds on conduit runs shall be done on the top of couplings only, and extreme care shall be taken to avoid injury to the inner surface of the conduit by excessive heating. The welded or brazed joint shall be coated with asphaltum (e.g., Koppers Bitumastic Jet-Set Primer), or equivalent.

d. Standard-radius field bends or manufacturer's elbows are generally to be used for metal conduits, but special long-radius bends shall be used wherever specifically called for on the design drawings. The long-radius bends shall have radii as large as physical conditions will permit, but never less than seven times the nominal diameter of the conduit. Short radius elbows shall be used only where specifically called for on the drawings.

e. Field bends for rigid metal conduit shall be made such that the internal diameter of the conduit is not materially changed and the protective coating on the inside and the outside of the conduit is not injured. The bends shall be free of kinks, indentations, or flattened surfaces. Heat shall not be applied in making any metallic conduit bend. (See section 3.2.5.4 for field bends for nonmetallic conduit.)

f. Rigid conduits that are 3 feet or less in length and that are installed vertically without bends between the top of motor control centers and cable trays in Class I buildings may be supported in the following manner:

1. Conduits shall be attached to the top of the board with locknuts.

2. P-1001A Unistrut shall be run the length of the board beside the conduits and shall be bolted to strucutral members of the board at each end and at each panel joint with 3/8-inch bolts (length as required). Spacers shall be used to raise the Unistrut above the top of the board sufficiently to clear the locknuts allowing the Unistrut to fit flush against the conduit.

3.2.4.1 Continued f.

3. Each conduit shall be attached to the Unistrut with Unistrut pipe straps. If conduit alignment is such that the Unistrut and conduit are not in contact then spacers shall be used to make a rigid connection.

4. Conduits shall not be attached to cable trays. Sufficient slack shall be left in cables to allow 1-inch movement in all directions between conduits and trays.

g. Motor control centers with conduits that are greater than 3 feet in length require conduit supports as shown on mechanical seismic support drawings (47A series) for conduit or as specified on structural steel drawings. For these longer runs, a length of flexible conduit is required as noted on conduit drawings.

The individual panels in some boards have large openings on the top that do not permit the use of locknuts for attaching conduits to the panel. P1001A or P1000 Unistrut bolted to panel structural members may be used as a point of attachment for conduits.

Conduits entering the top of electrical boards in Class I buildings shall not be installed in a manner that results in a rigid tie between the top of the board and the cable trays or the building. The materials, bolts, etc., used shall conform to the requirements listed on mechanical drawings 47A056-1.

3.2.4.2 Steel Conduit and Intermediate Metal Conduit (IMC)

Steel and IMC conduit joints and connections shall be made water-tight and rustproof by means of the application of a thread compound which will not insulate the joint. Each field-cut thread shall be cleaned to remove the cutting oil before the compound is applied. An electrically conductive and antiseize compound for metal surfaces such as Kopr-Shield (available from Thomas and Betts Company), SS-30 (available from Jet-Lube, Incorporated), or equivalent, shall be applied to only the male conduit threads to prevent the obstruction of the raceway.

3.2.4.3 Aluminum Conduit

a. Rigid aluminum conduit installed outdoors or in wet locations shall preferably be provided with aluminum fittings and supports. Galvanized fittings and supports may be used in special cases. Care must be taken to prevent the contact of aluminum conduit with corrosive materials in places where moisture can accumulate.

b. Strap-type wrenches or equivalent shall be used to avoid scratching and gouging the aluminum conduit.

c. Aluminum conduit joints at couplings or fittings tend to seize unless treated. Use a commerical compound such as Aloca Thread Lubricant. Satisfactory mixtures such as zinc dust and vaseline (50-60 by weight), or a heavy cup grease containing 25 percent graphite may be used. Aluminum threads shall not be coated with red lead or other lead compounds.

d. Standard benders may be used for aluminum conduit except that EMT benders shall be used for conduit 1 inch and below. Use an EMT bender 1/4-inch larger than the conduit size, i.e., 1-1/4 inches for 1-inch rigid, 1 inch for 3/4-inch rigid.

e. Aluminum conduit shall be grounded by inserting a galvanized steel coupling in the run, brazing the ground wire to the top of the coupling, and carefully coating the joint with asphaltum. The design drawings will show grounding when used for a single phase of a 3-phase circuit.

f. Rigid steel conduit and associated fittings may be used as a substitute for aluminum conduit and fittings.

g. Aluminum conduit, conduit fittings, or components shall not be used inside the reactor building primary containment.

3.2.5 Plastic Conduit

NOTE: Plastic conduit containing chlorides is not allowed in the powerhouse.

3.2.5.1 To prevent warping during storage, plastic conduit shall be stacked on a smooth, flat surface in an area not directly exposed to the rays of the sun. Spacers of 1-inch soft wood, approximately 2 feet apart, should be used between layers of conduit. Manufacturer's shipping bundles may also be used for direct storage.

3.2.5.2 Where Plastic conduits are encased in concrete (such as in duct banks between buildings), the conduits shall be anchored with preformed plastic spacers prior to concrete placement. The conduits and spacers shall be located as shown on design drawings.

3.2.5.3 Plastic conduit may be cut with a hacksaw. After cutting, ends shall be trimmed and rough edges smoothed. Area to be solvent welded (outside of conduit and inside of coupling or fitting) shall be free from dust, dirt, grease, and moisture. Use methyl ethyl ketone (MEK) for cleaning. Polyvinyl chloride (PVC) solvent shall be brushed liberally on the end of the conduit and inside the fitting or coupling when making a joint. After fitting has been pushed on, it should be twisted one-fourth turn to spread the solvent evenly. Continue to hold joint for 15 seconds so that conduit does not push out of fitting.

3.2.5.4 Bends for nonmetallic conduit are usually purchased as required for the conduit system, but for special cases may be made in the field. Extreme caution should be observed when any source of heat is near plastic conduit. Field bending can be accomplished by the use of a "hot air-cold air" blower; a hand-type dryer is recommended by the manufacturers.

3.2.6 Flexible Conduit

Flexible conduit shall allow for relative displacement of Class 1E equipment or components and a rigid conduit system. After installation, the flexible conduit should not be tight or stretched between couplings or fittings. Fittings used on flexible conduit shall be installed per the manufacturers instructions.

3.2.6.1 Flexible conduit connected to floor mounted equipment shall be installed in accordance with the requirements stated in Figure 1.

3.2.6.2 Flexible conduit connected to mechanical systems subject to thermal or similar movement shall be installed in accordance with the requirements stated in Figure 2.

3.2.6.3 Follow dimensions given in Table A for determining the bend radius for flexible conduit for equipment in par. 3.2.6.1 above and drawing 47A056-89 for equipment in par. 3.2.6.2 above.

3.2.6.4 Install flexible conduit between flush and recessed lighting fixtures to rigid conduit systems when so indicated on design drawings.

3.2.6.5 Flexible conduit lengths shall be installed as near Class 1E equipment as practicable.

3.3 Conduit Boxes

3.3.1 General

3.3.1.1 Where large boxes are embedded, they shall be properly braced on the inside so that concrete placement will not deflect them. Threaded holes in box frames shall be protected from injury.

3.3.1.2 Outlet boxes in architectural tile or masonry unit walls shall be installed strictly in accordance with design drawings and for best appearance.

3.3.1.3 Where water-tight conduit connections to junction boxes without threaded hubs or bosses are required (see elect-rical standard drawing SD-E13.6.5), Appleton type HUB conduit hubs, or equivalent, may be used in place of welded hubs.

3.3.1.4 Exposed noncurrent-carrying metal parts of fixed equipment and boxes shall be grounded. Equipment not secured to, and in metallic contact with, grounded structural steel shall be connected to the grounding system, when indicated on the detailed design drawings, by brazing the grounding cable to the equipment and then carefully coating the joint with asphaltum, or equivalent.

3.3.1.5 For general information concerning boxes, see electrical standard drawing SD-E13.6.3.

3.3.2 Painting

Field fabricated surface-mounted boxes shall be painted, inside and outside, immediately after fabrication. Field fabricated flush-mounted boxes shall be painted on the inside and the exposed parts only. Primer paints shall be lead free. Zinc chromate primer (Federal Specification TT-P-57, Type II) is recommended for black sheet steel. Finish coats for exposed parts shall harmonize with the general painting scheme about the plant.

3.3.3 Seismic Mounting

Surface-mounted conduit boxes located in seismic Category I structures shall be seismically mounted. Where the mounting surface is poured concrete, boxes shall be attached to embedded steel plates or mounted to the concrete with bolt anchors as shown on equipment seismic support design drawings of the respective design project. Seismic mounting of flush or surface boxes to masonry walls shall be in accordance with specific design details.

3.3.4 Identification Marking

Junction boxes and/or pull boxes which are assigned junction box numbers and nameplate numbers on design drawings shall be identified by attaching the respective nameplate to its box as described in electrical standard drawing DS-E1.2.2. It shall be permissible to use 3M Scotch pressure-sensitive foam tapes for attaching nameplates.

Junction boxes and/or pull boxes which have assigned box numbers, but no assigned nameplate numbers on design drawings, shall be marked with the applicable color scheme defined for the respective nuclear plant (see electrical design standard DS-E1.2.2). The size lettering shall be determined by the Cognizant Engineer depending on the box size. The use of self-sticking Mynar markers (e.g., AMP Special Industries or LEM Products, Incorporated), self-adhesive Polyester markers (e.g., W.H. Brady Company), or equivalent, is a suitable means for box identification markings.

4.0 INSPECTION REQUIREMENTS

QA has the responsibility to ensure that conduits and conduit boxes designated for Class 1E cables (divisions of separation) have been installed according to the design documents in the workplan and this instruction. All other conduits and boxes may be inspected by the Cognizant Engineer.

Installed conduit systems and conduit boxes shall be inspected for the following:

A. Size, type and location

B. Identification

C. Grounds

D. Conduit fittings

E. Flexible conduit installation

F. Burrs and sharp edges at terminations

G. Physical separation

H. Conduit hangers

I. Conduit terminations

J. Straps properly tightened

NOTE: Conduit box size, type, and location (where applicable) shall be verified and documented when inspection is performed on each conduit which terminates in the box.

Acceptance Criteria

A. Size, type, and location shall conform to the EN DES approved drawing in the workplan.

NOTE: Rigid steel conduit may be substituted for aluminum conduit in the event of a shortage of aluminum conduit, if care is exercised in the selection of supports.

B. Identification

Conduit shall be tagged per TVA STandard Drawing SD-E-15.3.4 of General Construction, Specification G-40. Conduit boxes shall be labeled with the assigned nameplate and junction box (identification number JB) specified on the applicable EN DES drawing. When no nameplate is assigned, the box shall be identified by the specified JB number with mylar self-sticking tape (or equal) in accordance with TVA Standard Drawing DS-E1.2.2.

NOTE: Temporary identification methods for conduit boxes are authorized pending receipt of permanent labels.

C. Grounds

1. Conduit shall be grounded at least once by one of the following:

   a. Securing to building steel of embedded plate;

   b. Securing to a grounded conduit support;

   c. Securing to a grounded junction box;

   d. Use of U-bolt grounding clamps, grounding straps, or grounding bushing secured to a ground conductor.

2. Conduit boxes shall be grounded at least once by one of the following:

   a. Securing to a building steel or embedded plate;

   b. Securing to a grounded conduit (If a conduit is used to ground a conduit box, the box shall not be used as a ground for any of the other conduits terminating in it);

   c. Using a Kearney stud connector or compression lug, and bolting an external ground to the box.

   NOTE: Cable tray grounds may be used as a grounding connection when no other means are available.

D. Conduit Fittings

No threadless fittings shall be used in a conduit run in a seismic Class I building.

E. Flexible Conduit Installation

1. The flexible conduit portion of an exposed conduit run shall be installed and supported in accordance with the requirements of the applicable 47A056 series drawings. The bend radius for flexible conduit to mechanical equipment shall be per drawing 47A056-89 and to floor mounted equipment per Table 1A of this instruction.

2. The end points of flexible conduit may be left free to facilitate cable pulling activities. Proper termination of the flexible conduit shall be verified after the cable is pulled.

3. Flexible conduit to floor mounted equipment shall meet requirements of Figure 1.

4. Flexible conduit to mechanical systems subject to thermal etc. movement shall meet the requirements of Figure 2.

F. Burrs and Sharp Edges

Conduit and conduit boxes shall be free from burrs, cuts, sharp edges, rough surfaces, or any other defects that may be detrimental to the cable jacket.

G. Physical Separation

Conduit and conduit boxes shall conform to the physical spearation requirements specified on EN DES drawings.

H. Conduit Hangers

1. In seismic Class I building, hangers shall be spaced as follows:

   5 ft. (max.) - 1 ft. (min.) for 3/4" and under

   10 ft. (max.) - 1 ft. (min.) for 1" and above

2. Four inch or smaller 1-hole pipe straps and 4-inch or smaller conduit boxes, shall be installed in accordance with the requirements of drawings 47A056-2 and -76 respectively. Inspection shall be accomplished with the related conduit and documented by the inspector's signature and date on the inspection sheet.

3. In non-seismic areas, conduit supports shall be spaced in accordance with the National Electric Code (NEC) and documented by the inspector's signature and date on the inspection sheet.

I. Termination

1. Conduit terminating in a conduit box or cabinet that do not have treaded hubs or bosses shall be secured using a locknut and a bushing on the inside and a locknut on the outside. In wet locations conduit hubs may be used.

   NOTE: If there is insufficient space for bushing installation, conduit ends may be rounded to approximately 1/16 inch radius.

2. A bushing or chase nipple shall be installed when a conduit terminates beneath a cabinet or board.

J. Straps Properly Tightened

1. Bolts without washers shall show no visible evidence of slack and the bolt shall be verified to be, as a minimum, handtight.

2. Bolts with flat washers shall be verified to be, as a minimum, handtight and the washer shall exhibit no ability to be turned by hand twisting.

3. Bolts with lockwashers shall exhibit lockwashers.

Documentation

Conditions encountered that were not anticipated and any NCR's, FCR's, design deviations, etc. shall be recorded in the "Remarks" section of the inspection sheet. This inspection shall be documented on the inspection sheet as shown on Attachment A or by signature in the work instructions of the workplan.

The identification of the conduit boxes included in this inspection shall be recorded in the "Remarks" section of the inspection sheet or near the signoff in the work instructions.

Data Sheet
Work Plan _____/MR _____
Page ____ of ____

(1) QA Inspector required on CSSC equipment only.

EXPOSED CONDUIT AND JUNCTION BOX INSPECTION SHEET

Ref. Drawings: _____

Conduit # or J-Box #						
Acceptable						
Size, Type, Location Routing						
Correct Coupling						
Identified Properly						
Burrs, Sharp Edges Removed						
Separation Requirements Met						
Hanger Spacing Acceptable						
* Straps Properly Tightened						

Remarks: _____

1 added page.

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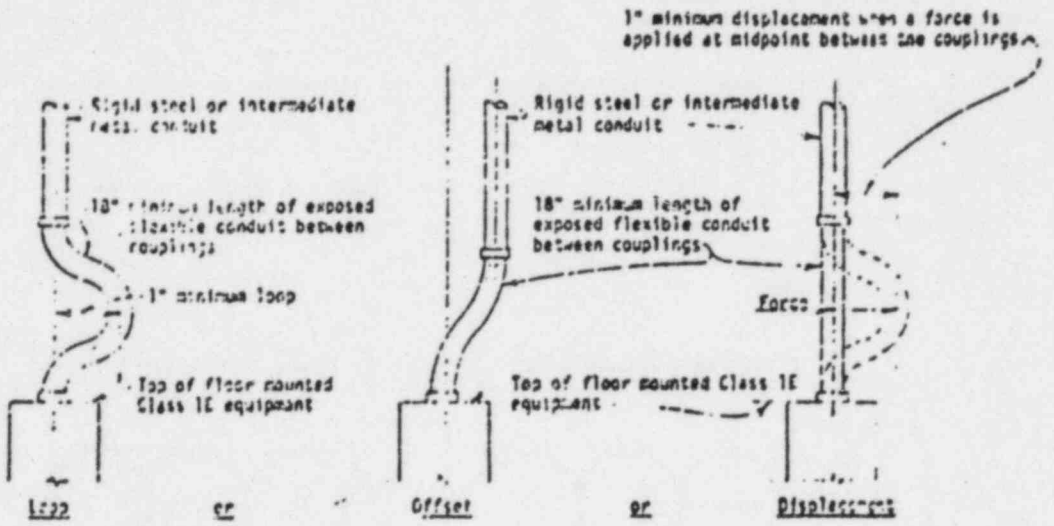
FIGURE 1

FLOOR MOUNTED EQUIPMENT



NOTES:

1. When conduits connect to the top of floor mounted, Class 1E equipment, an 18-inch minimum length of flexible conduit shall be used to connect between the rigid conduit and the equipment. As a general rule, the flexible conduit installation should contain enough slack to form a minimum 1-inch loop at midpoint between couplings, or to permit displacement of a minimum 1-inch between center lines of couplings. Maximum length of flexible conduit is 72" except as noted on design drawings.

2. When conduits connect to the bottom of floor mounted Class 1E equipment, such as control panels, the minimum length of flexible conduit should be 18 inches, but may be less where physical limitations prevent or make it impractical.

3. When conduits connected to the sides of floor mounted, Class 1E equipment such as motors, the flexible conduit shall, as a minimum, be long enough to accomodate its minimum bend radius given in Table 1A.

4. Conduit connections to cable trays should be avoided; however, if conduits are connected to seismic Category I cable trays, an 18-inch minimum length of flexible conduit shall be installed as in Note 1 above.

*Added page 0 0 0 8 3 4 0 5 9 5

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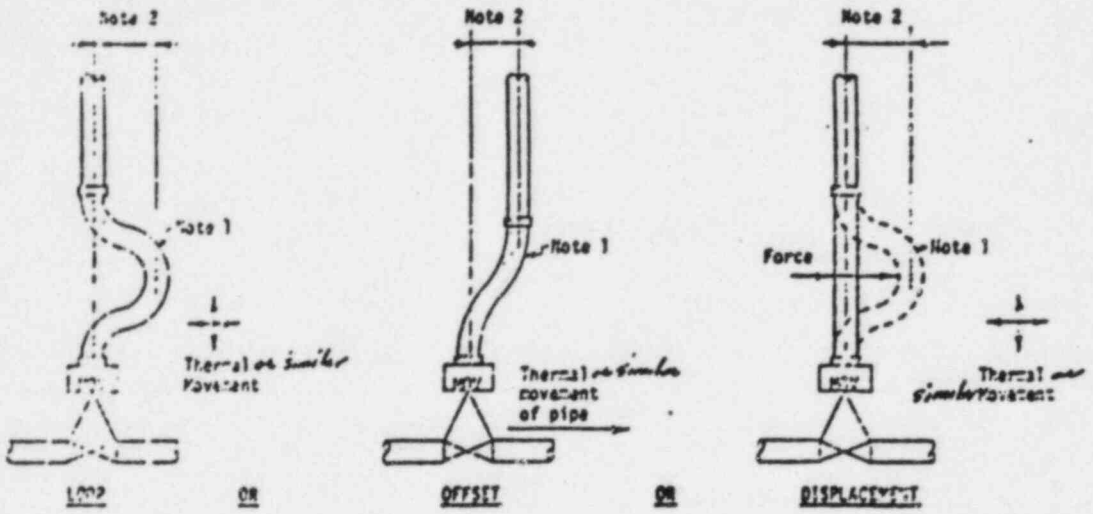
FIGURE 2

MECHANICAL SYSTEMS SUBJECT TO MOVEMENT



NOTES:

1. The minimum length of exposed flexible conduit between couplings shall be as specified in the table below for the size conduit being used.

Flexible Metal Conduit--Nominal ID Size (Inches) (Note 1)	Dimensions	
	Minimum Length (Exposed Between Couplings)	Minimum Offset Loop or Displacement
1/2	18	4.5
3/4	24	6
1	30	7.5
1-1/2	32	8
2	36	9
2-1/2	48	12
3	60	15
4	72 (+2, -0 Tolerance)	18

2. The minimum loop, offset or displacement dimension shall be as specified in the above table.

3. Refer to dwg 47A056-89 for bend radius dimensions.

Table 1

MINIMUM BEND RADIUS FOR FLEXIBLE CONDUIT

A. To floor mounted equipment

	Minimum Bending Radius (Inches)	
Flexible Metal Conduit--Nominal ID Size (Inches)	Liquidtight Flexible With Synthetic Jacket--Minimum Inside Bend Radius (Note 1)	Stainless Steel Flexible -- Minimum Centerline Bend Radius (Note 1)
1/2	3.5	3
3/4	5	5
1	6	6.5
1-1/2	6.5	9.5
2	7	11
2-1/2	9.5	12.5
3	11.5	14.5
4	14	22
5	20	29
6	30	35

Note: 1. Plus allowing for straight run sections needed at the rigid connector(s).

B. To mechanical equipment requiring thermal or similar movement; refer to drawing 47A056-89.

APPENDIX C

INFORMAL PORC REVIEW TRANSMITTAL

Instruction No: M&AI-11 Rev. No: 11

Instruction Title: FABRICATION, INSTALLATION, AND DOCUMENTATION OF SEISMIC SUPPORTS ATTACHED TO SEISMIC CATEGORY I STRUCTURES

PLEASE COMPLETE YOUR REVIEW WITHIN 2 WORKING DAYS.

THIS PROCRDURE SHOULD BE PORC APPROVED BY: _____.

Review must be completed in the time indicated. Attach comments by marking up the instruction or attaching additional sheets. The originator of each comment should be identified by his initials.

	REVIEWER	DATE REVIEWED	SIGNED
1.	Operations Supervisor	6-10-85	
2	Mechanical Mtn Supervisor	6-22-85	
3.	Electrical Mtn Supervisor	6/27/85	TAK
4.	Instrument Mtn Supervisor	7/4/85	
5.	Health Physics Supervisor	7/9/85	
6.	QA Staff Supervisor no comments	8-6-85	
7.	Engineering Group Supervisor	8/6/85	
8.	Safety Engineering Staff	N/A	N/A
9.	Plant Supt. (Oper/Mtn)	8/4	
10.	Plant Manager	8/5	

11. Modifications to resolve PORC comments and return to WPU.

Originating Supervisor _____ Date 8-15-85

12. WPU for incorporating comments. _____ Initials 8-19-85 Date

AUG 23 1985

13. Modifications to review final copy for FORMAL PORC.

Originating Supervisor _____ Date 8-29-85

14. Editorial Clerk review _____ Initials 9-3-85 Date

15. QA Staff to sign coversheet (AIs only) _____ Initials _____ Date

REMARKS/REASON FOR REVISION: _____

(1) Unreviewed Safety Question Determination

A. CHANGE DESCRIPTION (INCLUDE TACF, INSTRUCTION OR SPECIAL TEST NUMBER AND REVISION): REVISE MAAI 11 TO INCORPORATE NEW CONSTRUCTION SPECIFICATIONS CONCERNING ISOLATING ATTACHMENTS ON EMBEDDED PLATES. & MSAI-11 R11

B. CHECK BLOCK(S) BELOW TO DESCRIBE WHAT IS BEING EVALUATED. MORE THAN ONE BLOCK MAY BE CHECKED

			YES	NO
1.	☐ FACILITY CHANGE	FACILITY DESCRIBED IN THE FSAR?	☐	☐
2.	☑ PROCEDURE CHANGE	PROCEDURE DESCRIBED IN THE FSAR?	☐	☑
3.	☐ TEST	SPECIAL TEST/EXPERIMENT (A TEST NOT DESCRIBED IN THE FSAR)	☐	☐
4.	☐ ACTIVITY	SPECIAL ACTIVITY, ABNORMAL CONFIGURATION, ETC., WHICH IS DEEMED TO NEED A USQD	☐	NA

IF ANY BLOCKS CHECKED "YES", THEN COMPLETE SECTION C.

C. UNREVIEWED SAFETY QUESTION DETERMINATION

(1) IS THE PROBABILITY OF AN OCCURRENCE OR THE CONSEQUENCES OF AN ACCIDENT OR MALFUNCTION OF EQUIPMENT IMPORTANT TO SAFETY PREVIOUSLY EVALUATED IN THE SAFETY ANALYSIS REPORT INCREASED? YES ( ) NO ( )

EXPLANATION:

(2) IS THE POSSIBILITY FOR AN ACCIDENT OR MALFUNCTION OF A DIFFERENT TYPE THAN EVALUATED PREVIOUSLY IN THE SAFETY ANALYSIS REPORT CREATED? YES ( ) NO ( )

EXPLANATION:

(3) IS THE MARGIN OF SAFETY AS DEFINED IN THE BASIS OF ANY TECHNICAL SPECIFICATION REDUCED? YES ( ) NO ( )

EXPLANATION:

S.E. FOR NON-CSSC DOCUMENTS/DATE

Modifications
SECTION PREPARED BY

Greg Morris 9/4/85
PREPARER'S SIGNATURE/DATE

D. PORC CONCURS WITH THE ABOVE EVALUATION: * Boyd Patterson SEP 04 1985
PORC CHAIRMAN/DATE

E. PLANT SUPERINTENDENT CONCURS WITH THE ABOVE EVALUATION: * Boyd Patterson SEP 04 1985
PLANT SUPERINTENDENT/DATE

* MARK "N/A" WHEN NOT REQUIRED.

1) THIS FORM IS NOT TO BE USED FOR L-DCR'S. SEE ATTACHMENT 3.