TENNESSEE VALLEY AUTHORITY

DIVISION OF NUCLEAR ENGINEERING

BROWNS FERRY NUCLEAR PLANT

BFEP-PI 85-02

TITLE: SEISMIC QUALIFICATION OF EXISTING ELECTRICAL CONDUIT AND CONDUIT SUPPORTS

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	BROWNS FERRY NUCLEAR PLANT SEISMIC QUALIFICATION OF EXISTING ELECTRICAL CONDUIT AND CONDUIT SUPPORTS	Project Instruction PI-85-02
Rev. No.	Revision Description	Coordinating Signatures
1	Revised paragraphs 4.1, 4.2, and 6.0 Added Attachment A	*WHD TEH RLH HCR_F
2	Title changed. General and total revision to entire instruction. Attachment A removed and placed in uncontrolled design instruction.	*WHD TEH RLH HCR_F
3	Revised Table of Contents to add "Revision Log", "Table of Contents" "Form 6.6" and "Appendix B" Revised paragraph 1.0, 3.1, 3.3, 3.4, 3.5, 4.1a, 5.1.1, 5.1.3, 5.3.1.2, 5.3.1.3, and 5.3.1.5, 6.0. Added Paragraph 4.1g & 4.1h. Revised Form 6.1. Inserted Form 6.1A and 6.2. Changed number on Form 6.2 to 6.3, 6.3 to 6.4, 6.4 to 6.5, and 6.5 to 6.6. Corrected minor typographical errors.	D771-2/86 JMCKEA 10/2/86 RLH 10-2-86

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PREFACE

The upper tier design input document for this project instruction through revision level 1 was Design Criteria (DC) BFN-50-714. Effective March 28, 1986 DC BFN-50-714 was superseded by DC BFN-50-723. Reinspection of electrical conduit systems evaluated in accordance with the requirements of PI 85-02 through R1 is not required for the singular purpose of determining compliance with the format and requirements of PI 85-02 R2 which incorporates the new design criteria. It has been determined that the number of discrepancies initially written would be less by current criteria; therefore, discrepancies established by PI 85-02 through Revision 1 will be reevaluated against the DC BFN-50-723 requirements to reduce the total number of modifications.

Revision 2 to this PI increases the scope of work to require the inspection and seismic qualification of all electrical conduit in Class I structures as opposed to only Class IE conduit. Reinspection of areas inspected prior to the issue of revision 2 of this PI will be necessary to qualify Non-Class IE conduit.

1.0 PURPOSE

These instructions detail the Division of Nuclear Engineering's (DNE) methods for inspection and seismic qualification of existing electrical conduit and conduit supports in Class I structures at Browns Ferry Nuclear Plant.

2.0 SCOPE

All electrical conduit and conduit supports installed in Class I structures prior to May 1984, will be inspected in accordance with these instructions and shall be seismically qualified to the requirements of Design Criteria (DC) BFN-50-723.

3.0 DEFINITIONS

3.1 DNE Coordinator - The Browns Ferry Engineering Project Principal Civil Engineer (Section Supervisor) or his designated representative.

3.2 Discrepancy - An actual or perceived deviation of the as-installed electrical conduit or conduit support system from seismic design criteria requirements (BFN-50-723) [An unapproved deviation from Design Criteria ordinarily represents a Condition Adverse to Quality (CAQ) requiring a Significant Condition Report (SCR); however, the deviations identified individually as a result of this procedure are tracked by Corrective Action Report, CAR 84-088. Thus no additional reporting is deemed necessary.]

3.3 Common Conduit - All Class 1E conduit outside of the unit considered required for systems which support the operation, shutdown, or maintenance of shutdown for more than one unit.

3.4 Inspection - An engineering evaluation of installed electrical conduit and conduit supports against established structural engineering design benchmarks where no drawings or calculations exist.

3.5 Inspector - A degreed structural engineer trained in the design requirements for the seismic qualification of electrical conduit and conduit supports. On the basis of training, experience, and judgement the inspector identifies installed electrical conduit and/or conduit supports needing documented calculations to demonstrate seismic qualification.

4.0 ORGANIZATIONAL RESPONSIBILITIES

4.1 ELECTRICAL ENGINEERING BRANCH (EEB)

a. Identifies common Class IE conduit necessary to shut down and maintain safe shutdown of Unit 2 in the event of a design basis earthquake. Maintains documentation of all EEB work performed.

4.2 CIVIL ENGINEERING BRANCH (CEB)

a. Serves as Lead Engineering discipline responsible for scope of work, budget, and schedule.

b. Performs a detailed inspection of as-constructed conduits and conduit supports for conformance to DC BFN-50-723.

c. Maintains records of inspection findings. Maintains log of discrepancies.

d. Performs analyses, design calculations, and makes drawings as required to show qualification of existing conduits and supports or to provide new supports.

e. Performs rigorous analysis when necessary to show seismic qualification of existing conduit systems.

f. Evaluates and resolves discrepancies.

g. Prepares and maintains Design Criteria and procedures necessary to seismically qualify existing conduit.

h. Maintains documentation of all work performed by CEB within the scope of this document.

i. Prepares and issues a final report to disposition all discrepancies and document the program of seismic qualification of conduit.

j. Prepares and issues interim qualification report to document acceptability of Unit 2 for one cycle of operation.

5.0 QUALIFICATION PROCEDURE

5.1 The first phase of the qualification procedure will consist of detailed inspection.

5.1.1 Inspection Boundaries

All space within Class I structures will be divided into areas with discrete boundaries for inspection purposes. Each area will be assigned to a unique inspection volume and all conduit within the volume will be inspected for conformance to DC BFN-50-723. Typical volumes include:

a. Floor elevation in drywell

b. Floors or segments of floors in each reactor building

c. Individual rooms in the control bay

d. Diesel generator building

e. Intake pumping station

f. RHR Service water tunnel

g. Standby Gas Treatment Building

h. Offgas Treatment Building

5.1.2 Inspection Sequence

In order to support the schedule for Browns Ferry restart, inspection will be performed in the following sequence. All conduits in Unit 2 and conduits in other areas which are common to Unit 2 will be inspected first. Conduits in Unit 1 and Unit 3 will be inspected after completion of Unit 2.

5.1.3 Acceptance Standards

The requirement of this instruction is that all conduit and conduit support systems meet the criteria given in DC BFN-50-723. Since no drawings exist, the inspectors basis of judgment will be on strength and serviceability considerations alone and is primarily determined by the design (i.e. configuration and dimensions). If evidence of poor construction techniques which may adversely affect strength is noted, it will be considered; however, poor construction does not necessarily preclude acceptance of a support. If it could be shown by design principles that the effects of poor workmanship have an insignificant effect on required strength, then the support may be accepted. (For example, a welded joint showing weld defects may be accepted if it could be shown that the quantity of weld greatly exceeds the required amount.) It should also be noted that consideration is given to provide additional supports if the potential exists for a conduit system to interact with a fragile class I component.

Evaluations performed under the DC BFN-50-714 criteria will be re-evaluated per the DC BFN-50-723 criteria. Those discrepancies which were written under the DC BFN-50-714 criteria, but which would not have been identified as a discrepancy under the DC BFN-50-723 criteria will be resolved by the entry of "ACCEPTABLE AS INSTALLED PER BFN-50-723" in the Final Resolution block of Form 6.2. All references to the final resolution of discrepancies which fall into this category will be "ACCEPTABLE AS INSTALLED PER BFN-50-723."

5.1.4 Personnel

Inspection will be performed by teams consisting of a minimum of two trained and experienced structural designers. All potential inspectors will receive on the job training in the requirements of this instruction and will be certified by the responsible CEB principal engineer (section supervisor). The lead inspector on each team must be a degreed civil or mechanical engineer.

5.1.5 Inspection Verification

A review of all inspection areas will be performed by an independent inspection team to verify the judgement and conclusions of the initial inspectors. The verification will consist of reinspection of a portion of the conduit from each area and/or from each inspection team.

The discovery of additional discrepancies during the verification will be brought to the attention of the DNE coordinator who will be responsible for determining the extent of reinspection necessary to assure that all conduit inspected has been seismically qualified. The verification team may not eliminate discrepancies written by the initial inspectors without the concurrence of the DNE coordinator.

5.2 DESIGN

A calculation document shall be developed in accordance with DNE procedures showing resolution of all discrepancies. Design output documents (drawings) will be required for all discrepancies which cannot be shown by calculations or testing to be seismically qualified as presently installed. Existing supports with marginal factors of safety may be accepted for interim use without modification if they meet the requirements for interim qualification as set forth in DC BFN-50-723.

5.3 DOCUMENTATION

5.3.1 The conduit qualification process from inspection through resolution of discrepancies will be documented by the use of forms shown in Appendix A. All completed forms will be maintained as life of plant documents.

5.3.1.1 Each inspection team is responsible for inspecting all conduits and supports in their assigned volume for conformance to DC BFN-50-723 and recording discrepancies on Form 6.1. Form 6.1, Inspection Certification, will be signed by each inspector upon completion of the volume.

5.3.1.2 A Conduit Inspection Log, Form 6.1-A (designated Form 6.1 prior to issue of PI 85-02, R2), will be maintained to document the conduit inspected in Unit 1 and Unit 3 which are required for Unit 2 Interim operation. The conduit tag numbers, diameter, qualification for span and support, verification sign-off and date, and discrepancy number (where applicable) will be entered.

5.3.1.3 A Discrepancy Number (DN) Log, Form 6.2, will be generated for each volume as it is evaluated. Information recorded on this form will include the assigned Discrepancy Number, the Conduit Identifier, The Conduit Diameter, the Conduit Material, Comments, and the Final Resolution for each discrepancy. The field team will fill in all information with the exception of the Final Resolution. The Final Resolution will be provided by the DNE Coordinator. THIS FORM IS FOR INFORMATION ONLY AND IS TO BE USED FOR CONVENIENCE IN TRACKING DISCREPANCY RESOLUTIONS.

5.3.1.4 A Discrepancy Resolution Form, Form 6.3, will be initiated by completing Part A immediately after a discrepancy number has been assigned. Part A of the Discrepancy Resolution Form will provide a detailed description of the discrepancy supplemented by support sketches and/or isometric sketches as necessary to provide sufficient information for rigorous analysis and/or detailed design. Part B of the Discrepancy Resolution Form will be completed after final checking of calculations and design output documents have been issued.

5.3.1.5 Forms 6.4 and 6.5 will be completed and filed to verify adequate training and qualifications of inspectors and lead inspectors respectively.

5.3.1.6 An Inspection Verification Form, Form 6.6, will be completed prior to final certification for seismic qualification of the conduit within a volume. Any exceptions must be resolved.

6.0 FINAL REPORT

A final report will be prepared by CEB to document the seismic qualification of all electrical conduit and conduit supports installed before May 1984 in Class I structures. The report will be prepared after all inspection has been performed, discrepancies resolved, and necessary drawings have been issued. The final report will include, as a minimum, the following material:

a. Program Document
b. A Listing of discrepancies, resolutions, calculation packages, and drawings issued
c. Copies of all forms generated as a result of BFNP-PI 85-02
d. Actions taken to assure that the qualification will not be altered and to prevent recurrence of the problem.
e. Listing of all correspondence, reports, criteria, specifications, and similar documents written as a result of the decision to provide seismic qualification for existing conduit.
f. Interim Qualification Report for one cycle of operation of Unit 2.

APPENDIX A

FORMS FOR DOCUMENTATION

INSPECTION CERTIFICATION
(FORM RETROACTIVE TO R0 ISSUE OF PI 85-02)

UNIT _____ AREA _____ VOLUME NUMBER _____

To the best of my knowledge, we have inspected all electrical conduit in the above volume and have initiated discrepancy resolution forms for the following discrepancies. There are no additional deviations from the requirements of this instruction in our judgment.

(List all discrepancies below)

Yellow Tagged

_____ _____
_____ _____
_____ _____
Inspector Date

Untagged

_____ _____
_____ _____
_____ _____
Inspector Date

White Tagged

_____ _____
_____ _____
_____ _____
Inspector Date

FORM 6.1-A LOG SH____OF____

BFEP CLASS IE CONDUIT INSPECTION LOG

VOLUME LOCATION_____ TEAM MEMBERS_____

UNIT_____ AREA_____ FLOOR ELEVATION_____

CONDUIT TAG NO	CONDUIT DIA	QUALIFICATION Y/N CND SPAN	SUPPORT	VERIFICATION SIGN-OFF AND DATE	DISCREPANCY NUMBER (DN) (SEE DN LOG)

(10/87)

FORM 6.2

SHT_____ OF_____

DISCREPANCY NUMBER (DN) LOG

(FOR INFORMATION ONLY)

DISCREPANCY NUMBER	CONDUIT IDENTIFICATION	DIA.	MAT.	COMMENTS	FINAL RESOLUTION (FOR DNE COORDINATOR USE ONLY)

PI 85-02 R3

DISCREPANCY RESOLUTION
(EFFECTIVE FOR WORK INITIATED AFTER
ISSUE OF PI 85-02 R2)

DISCREPANCY NO. _____

LOCATION _____

PART A - DESCRIPTION OF DISCREPANCY: (INCLUDING RECOMMENDED ACTION)

Attachments: Yes____ No____ Inspector _____ Date _____

Inspector _____ Date _____

PART B - FINAL ACTION:

DESIGNER _____ Date _____

CHECKER _____ Date _____

DNE COORDINATOR _____ Date _____

The following individual has been trained by a lead engineer/inspector and has met the qualifications for the engineer/inspector requirements and may continue the inspection and evaluations.

NAME SOC SEC NO

Lead Eng/Insp	Date
Section Supervisor	Date

The following individual has been trained by a lead engineer/inspector and has met the qualifications for the lead engineer/inspector requirements and may continue the inspection and begin training of additional engineers/inspectors.

NAME SOC SEC NO

Lead Engineer/Insp.	Date
Section Supervisor	Date

INSPECTION VERIFICATION
(FORM RETROACTIVE TO R0 ISSUE CF PI 85-02)

Unit _____ Area _____ Volume Number _____
Inspector _____
Inspector _____

We have reviewed a portion of all conduit in the area represented by the above volume and concur with the findings of the initial inspection team with the following exceptions:

Exceptions: (Enter none if applicable)

Auditors: _____ Date _____

_____ _____

Additional Action Required To Resolve Above Exceptions:

DNE Coordinator _____ Date _____

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APPENDIX B

GENERAL INSPECTION INSTRUCTIONS

INSPECTION GUIDELINES

B.1 The following requirements will be given to the constructing organization in the form of notes on 48B810-1. Inspectors may assume that discrepancies meeting the descriptions below will be corrected.

B.1.1 Oversize, undersize, and missing clamps will be replaced with the correct clamp size.

B.1.2 Clamp bolts will be torqued to manufacturer's requirements or other values determined adequate by tests.

B.1.3 Clamp bolts on supports attached directly to vibrating equipment or piping, plus the next support will have a jam nut added after torquing.

B.1.4 Clamps that have one side tapped for bolting will be replaced by a new clamp with a through bolt and nut.

B.1.5 Any clamp bolt that is not fully threaded and is torqued against the thread runout will be replaced by a bolt with more thread length.

B.2 The basic inspection of conduit and supports should consider the following parameters.

B.2.1 All conduit and conduit supports shall be evaluated for conformance to DC BFN-50-723 and the results documented.

B.2.2 The support spacing shall be measured along the conduit longitudinal axis and support spacings which exceed the maximum spacing in DC BFN-50-723 shall be identified with a discrepancy number as described in PI 85-02. The discrepancy may be resolved through rigorous analysis which considers the location and weight of fittings and other discontinuities. The location of threaded connections, splices, elbows, tees, and other fittings has been enveloped in the design criteria and need not be considered for those spans which meet criteria limits.

B.2.3 Unsupported junction boxes shall be evaluated in accordance with the requirements of Section 3.0 of DC BFN-50-723.

B.2.4 Axial restraint for conduit shall be provided in accordance with Section 4.3 of DC BFN-50-723.

B.2.5 Conduit supported by duct work or duct supports may not be seismically qualified and should be noted on discrepancy logs.

INSPECTION GUIDELINES (Continued)

B.2.6 Seismic deflections shall be considered in accordance with Section 4.2 of DC BFN-50-723. As a general rule, conduit may impact with each other without damage during a seismic event.

B.2.7 Loads transmitted by spacers and ties to other conduit shall be evaluated for their effect on the total conduit system.

B.2.8 Supports shall be evaluated for their load carrying capability and for adequate stiffness to qualify the conduit analysis.

B.2.9 Structural members shall be carefully measured so that correct section properties will be used for qualification.

B.2.10 Weld configuration shall be evaluated for its ability to transmit loads between the members connected. The effects of obvious weld defects such as excessive undercut and cracks shall be considered. Weld quality of conduit supports are included in the BFNP Weld Quality Evaluation conducted by the TVA Welding Project.

B.2.11 The support connection to the building structure (concrete or structural steel) shall be examined for the following items:

- Obvious anchor deficiencies such as exposed shells, excessive shell projection, inclined anchors, etc. Anchor deficiencies in general will be sampled in accordance with BFEP PI 86-01 and check for the requirements of BFN 50-795 (Existing Anchor Bolt Sampling Program).

- Baseplate deficiencies such as oversized bolt holes and excessive gaps beneath baseplates.

- Unusual fasteners such as Phillips head machine screws, slotted machine bolts, brass bolts, etc.

Any potential deficiencies noted above shall be documented with a discrepancy as described in BFEP PI 85-02 unless it can be shown that the deficiency does not impair the strength or serviceability of the support.