

QUALITY CONTROL PROGRAM & PROCEDURES  
TRANSMITTAL FORM

Bechtel

Post Office Box 607  
15740 Shady Grove Road  
Gaithersburg, Maryland 20760

TO: Mr. N. H. Miller  
BISCo, Inc.  
630 Bonnie Lane

Elk Grove, Ill. 60007

VIA: Mr. J. D. Lenardson  
TECo QA MANAGER

DATE: January 12, 1977  
FILE NO: 1535, M-255-C  
TECo P.O. NO.: N/A

COPIES TO:  TECo QA MANAGER 1W/A  
 PROJ. CONST. MGR. 1W/A  
 SHOP INSP. SUPV. 1W/A

- 1 APPROVAL WITHOUT COMMENTS.
- 2 APPROVAL WITH COMMENTS, RELEASED FOR INTERIM USE, RESUBMIT WITHIN 20 DAYS PER ED 6058.
- 3 NOT APPROVED. SEE COMMENTS MARKED ON PROCEDURES. RESUBMIT FOR APPROVAL WITHIN 30 DAYS PER ED 6058. NO WORK PERMITTED.

PROCEDURE NO.      REV.      TITLE      APPROVAL STATUS

4835-02-1

12-14-76

Hose Stream  
Testing Report  
(7749-M-255Q-33-1)

1

FILE	PAIM	MJN	TWH	DLR	CJS	KMC	JCR	EMW	DAP	CTD	GWE	JDL	ROUF	QUALITY ASS. MGR. TOLEDO EDISON
	/	/	/	/	/	/	/	/	/	/	/	/	/	/

TOLEDO EDISON  
JAN 14 1977  
Q. A. MGR.

PPA/ASD/pbm  
Attachment (all without)  
cc: R. W. Jackson  
R. V. Manney  
W. E. Wilson  
P. B. Kunjeer  
A. S. Dunstan  
G. P. Schwartz

OR VERY TRULY YOURS,

*P. P. Anas* 1/12/77  
P. P. ANAS, PROJECT ENGINEER      DATE

*J. D. Lenardson* 1-14-77  
J. D. LENARDSON      APPROVAL DATE  
TECo QA MANAGER



Exhibit G

8002124008

bisco



7749-M255Q-33-1

REPORT  
 HOSE STREAM TESTING  
 of  
 BISCO SF-20 SILICONE FOAM,  
 BISCO SF-150L HIGH DENSITY SILICONE,  
 and BISCO FLEXIBLE BOOT  
 PENETRATION SEALS

VENDOR'S QA PROGRAM REVIEW	
Approved with comments	
<input checked="" type="checkbox"/>	Approved with comments requested for
<input checked="" type="checkbox"/>	approval by customer within 20 days
<input checked="" type="checkbox"/>	per EG 1.02
<input type="checkbox"/>	Not approved. Comments marked on
<input type="checkbox"/>	program. Request for approval within
<input type="checkbox"/>	30 days per EG 1.02
Approved by QA program control office	
Supervisor/Inspector will inspect all	
product and materials	
Date of Review: 12/17/77	
By: [Signature]	
Title: [Signature]	
7749	JEFFREY CUSHMAN Power & Industrial Control P.O. Box 1000, Elk Grove Village, IL 60007

PROJECT NO. 4835-02-1

DECEMBER 14, 1976

brand industrial services, inc.  
 630 bonnie lane, elk grove village, illinois 60007, (312) 640-1200, telex 28-0566



PENETRATION SEALS

PROJECT 4835-02-1

DECEMBER 14, 1976

ABSTRACT

A concrete test assembly containing a cable tray with cables, four electrical conduits (two with cables), and a pipe and pipe sleeve assembly was subjected to a one hour fire exposure after which the assembly was subjected to a water stream from a fire hose/nozzle, as described in ASTM Standard E 119, Section 8. The cable tray and area surrounding it, and two conduits containing electrical cables were sealed with BISCO SF-20 Silicone Foam. Two empty conduits were sealed with BISCO SF-150L High Density Silicone, and the pipe and sleeve assembly was sealed with a BISCO Flexible Boot seal. No water was observed to have penetrated the seals during application of the hose stream.

TEST OBJECTIVE

The objective of the testing was to demonstrate the ability of BISCO Penetration Seal Systems to withstand the hose stream phase of the ASTM E 119 Standard Fire Test Method. Successful performance of the hose stream phase when applied to the data obtained in a large scale E 119 fire test conducted by Factory Mutual Research Corporation in March 1975 provide the basis for certifying that the BISCO Penetration Seal Systems will perform as three hour fire barriers, as specified in Bechtel Company Specification 7749-M-255.

CONSTRUCTION OF TEST ASSEMBLY

Testing was performed on a concrete slab fitted with penetrating items, as described in BISCO Procedure 4835-02. Attached drawing 4835-02-1 details the configuration of the test assembly.

A 6" by 24" solid bottom cable tray equipped with ladder type rungs approximately 18" on center was loaded with EPR Neoprene jacketed cables to approximately 46% of the tray area. The cables were tied into the tray and the assembly was anchored to the test slab.

PENETRATION SEALS

PROJECT 4835-02-1

DECEMBER 14, 1976

Two 3" diameter conduits were grouted into the concrete assembly, and were filled with BISCO SF-150L High Density Silicone as described below.

A 3" diameter conduit containing EPR Neoprene jacketed cables (approximately 45% loaded) and a 4" diameter conduit containing EPR Hypalon jacketed cables (approximately 21% loaded) were grouted into the concrete assembly and were filled with BISCO SF-20 Silicone Foam. The cable tray and area surrounding the tray was also sealed with SF-20 Silicone Foam as described below.

A 6" ID pipe sleeve was grouted into the concrete assembly. A 3" ID pipe was centered inside the 6" sleeve and the sleeve/pipe construction was sealed with a BISCO Flexible Boot Penetration Seal. The Boot Seal included Inconel wire mesh and ceramic fiber fill which were placed around the 3" pipe within the concrete slab to effect a fire barrier.

INSTALLATION OF PENETRATION SEALS

Damming materials to contain the liquid SF-20 and SF-150L components were placed flush with the bottom surface of the test assembly to provide a seal the full 12" thickness of the concrete slab. Major areas around the cable tray were dammed with Ethafpam. Voids between the cables in the tray were dammed with BISCO CFR-2300 ceramic fibers. Ceramic fibers were also used to dam around cables in the two conduits and to provide the fire barrier within the sleeve/pipe construction.

Damming was performed in accordance with BISCO Procedure DMI-1.

BISCO SF-20 Silicone Foam was foamed-in-place in the two conduits containing cables and around the cable tray using automatic dispensing equipment. BISCO SF-150L High Density Silicone was poured-in-place into the remaining two conduits by hand. The formulation and blending of the SF-20 was as described in BISCO Procedure 207-M, and the formulation and blending of the SF-150L was as described in BISCO Procedure 209-M.

Installation of the penetration seals was performed in accordance with BISCO Procedures 207-IP, 209-IP, and 204-IP.

The SF-20 and SF-150L seals were allowed to cure for approximately 88 hours prior to fire testing.

TEST METHOD and FACILITIES

The concrete test assembly fitted with penetrating items and sealed as previously described was subjected to a controlled temperature fire. The Portland Cement Association small scale floor furnace was used to provide the necessary time-temperature exposure defined by ASTM E 119. This furnace subjects a 48" by 48" assembly to a fire exposure uniformly distributed to a central area of the assembly 30" by 30", where all of the seals were located.

Standard Test Method ASTM E 119 describes the time-temperature relationship required for the fire exposure. The relationship is commonly known as the "time-temperature curve". The furnace is equipped with thermocouples which measure the furnace atmosphere temperature and transmit this information to a multipoint chart recorder, which displays individual temperatures vs. time, and to an integrating recorder which averages the temperature measurements and prints the average vs. time on a circular chart. Prior to the start of the test the time-temperature curve is hand drawn on the chart papers for ready visual reference. Figures 1 and 2 are reproductions of these furnace atmosphere temperature records.

Because the hose stream phase of the E 119 test does not require it, no information is presented which indicates the unexposed surface temperatures encountered during the test. This data was, however, accumulated.

As directed by the Standard, the test assembly is removed from the furnace after a one hour fire exposure, and subjected to a stream of water from a fire hose equipped with a National Standard Playpipe having a 1-1/8" standard-taper, smooth-bore, shoulderless orifice discharge tip. The distance from the nozzle orifice to the center of the test assembly is to be 20'.

Table I of ASTM E 119 provides the requirements for water pressure and duration of application of the stream, which is dependent on the desired rating of the tested assembly. To obtain a 3 hour rating, as required by the Specification, a pressure of 30 psi and a duration of 150 seconds per 100 square feet of assembly is required. The overall size of the test assembly was four feet by four feet, or 16 square feet. A 24 second hose stream application at 30 psi was called for.

As defined by the E 119 Standard (copyright- ASTM) "The assembly shall be considered to have failed the hose stream test if an opening develops that permits a projection of water from the stream beyond the unexposed surface during the time of the hose stream test".

PROJECT 4835-10

DECEMBER 14, 1976

PROGRESS of TEST

Testing was performed on December 14, 1976 at Portland Cement Assoc., Skokie, IL.

The concrete assembly was subjected to a 1 hour - 3 minute fire exposure consistent with the time-temperature curve defined in ASTM Standard E 119.

Almost immediately after the start of the fire test smoke was observed coming from the area close to the cable tray. It is believed that the smoke was the result of the Neoprene jacketing on the cables melting within the silicone foam seal. Since the furnace operates at a negative pressure, smoke below the seal would be drawn downward and exhausted. The presence of smoke above the test specimen indicates that a seal was present around the cables, and also that the temperature of the cables above the bottom of the seal was sufficient to cause the insulation to decompose.

During the last half hour of the fire test water was observed around several of the grouted-in conduits. Grouting of this specific test assembly was performed in July 1976, and the water was due to the dehydration of the grouted portions.

After 1 hr. 3 min. the test assembly was removed from its vertical position on the furnace and moved by crane to a mobile platform. The test assembly was moved to a horizontal position and transported to an area adjacent to the research laboratory to receive the hose stream. The total time taken in removing the slab from the furnace and positioning it was 3 min. 4 sec.

With the test assembly 20' from the discharge tip of the fire hose, and normal to the stream of water, the application of the water stream began. The stream was directed first at the middle of the assembly and then at all parts of the specimen.

Observations were made during the hose stream application from behind and slightly to the left of the assembly, as viewed from the front. For added insurance the water stream was continued for a total duration of slightly over 30 seconds. No water was seen to penetrate the assembly.

Observations of the unexposed face of the assembly after test revealed that no openings had developed in any of the penetration seals.

PROJECT 4835-02-1

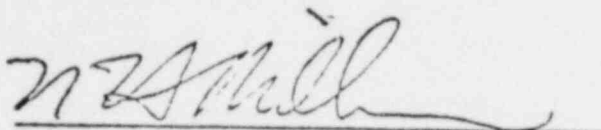
DECEMBER 14, 1976

GENERAL

Testing was monitored by Mr. L. A. Haigh of The Toledo Edison Company.

All areas defined in this report were monitored by the undersigned, and it is hereby certified that the information presented herein is accurate in all respects, to the extent of the knowledge of the undersigned. It is additionally certified that the materials and formulations used in this testing are the same as the materials and formulations used by BISCO in previous testing of these materials, and are the same as the materials and formulations used at the Davis-Besse Project.

Original temperature data (charts and graphs) are maintained at the Portland Cement Association Fire Research Department.

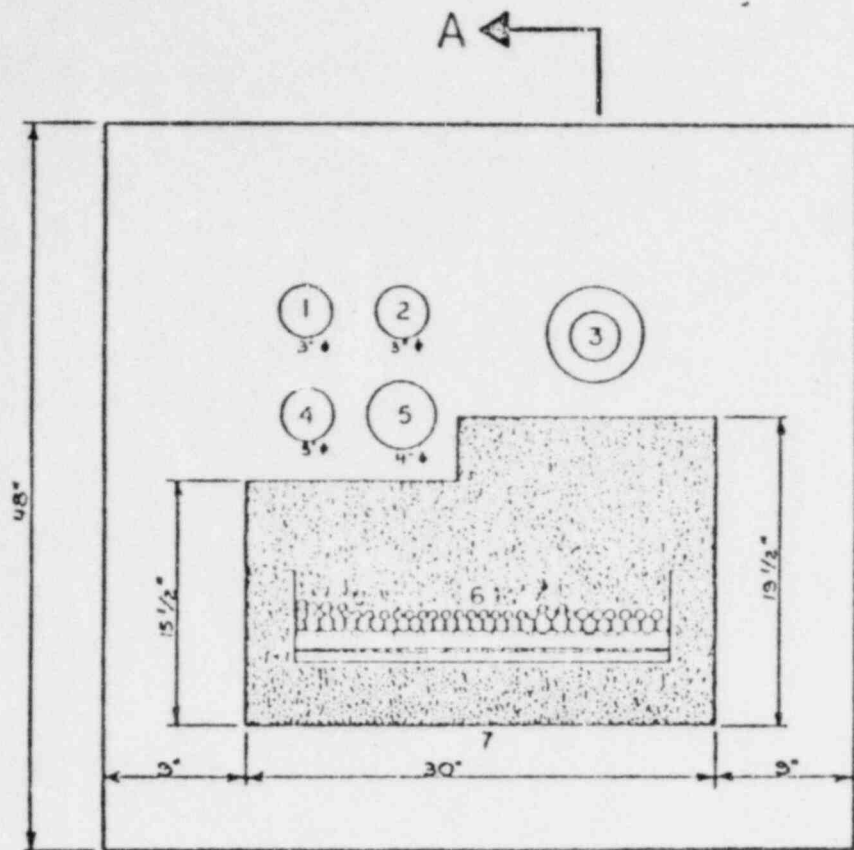


Brand Industrial Services, Inc.  
N. H. Miller  
Quality Assurance Manager

\_\_\_\_\_  
Notary

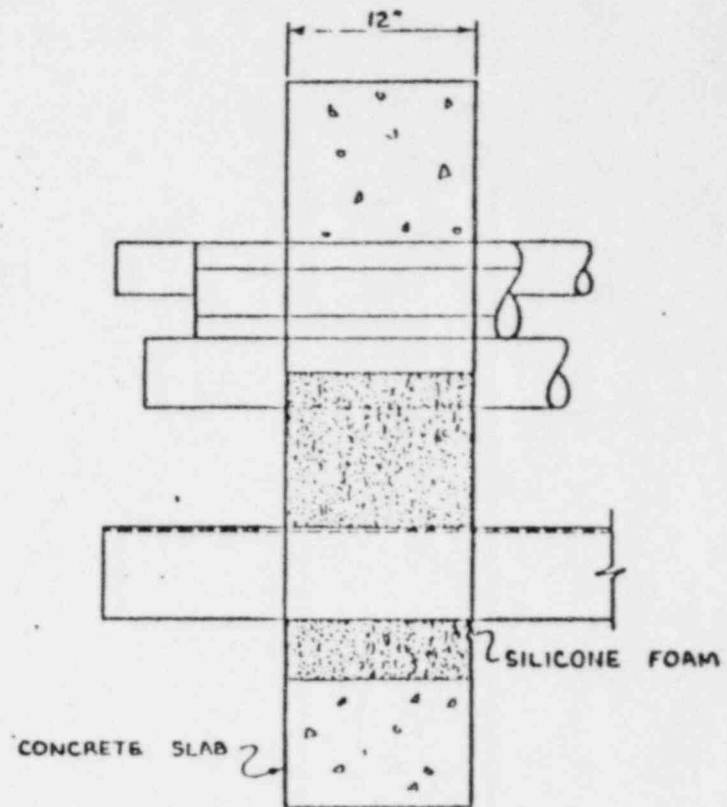
/bms

- Attachments: Pages 6 through 8 - Furnace Temperatures (Individual)
- Page 9 - Furnace Temperature (Averaged)
- Page 10 - Drawing 4835-02-1, Test Assembly



FIRE TEST SLAB

NOTE  
1. FOR IDENTIFICATION OF PENETRATING ITEMS,  
SEE PROCEDURE 4835-02 APPENDIX A.



SECTION 'A-A'

DAVIS BESSE QUALIFICATION TESTING:  
ONE HOUR FIRE W/HOSE STREAM

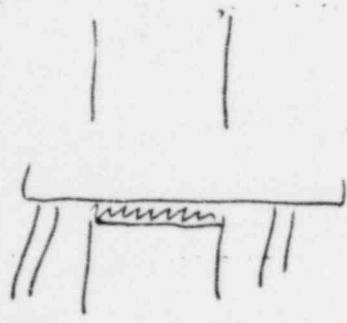
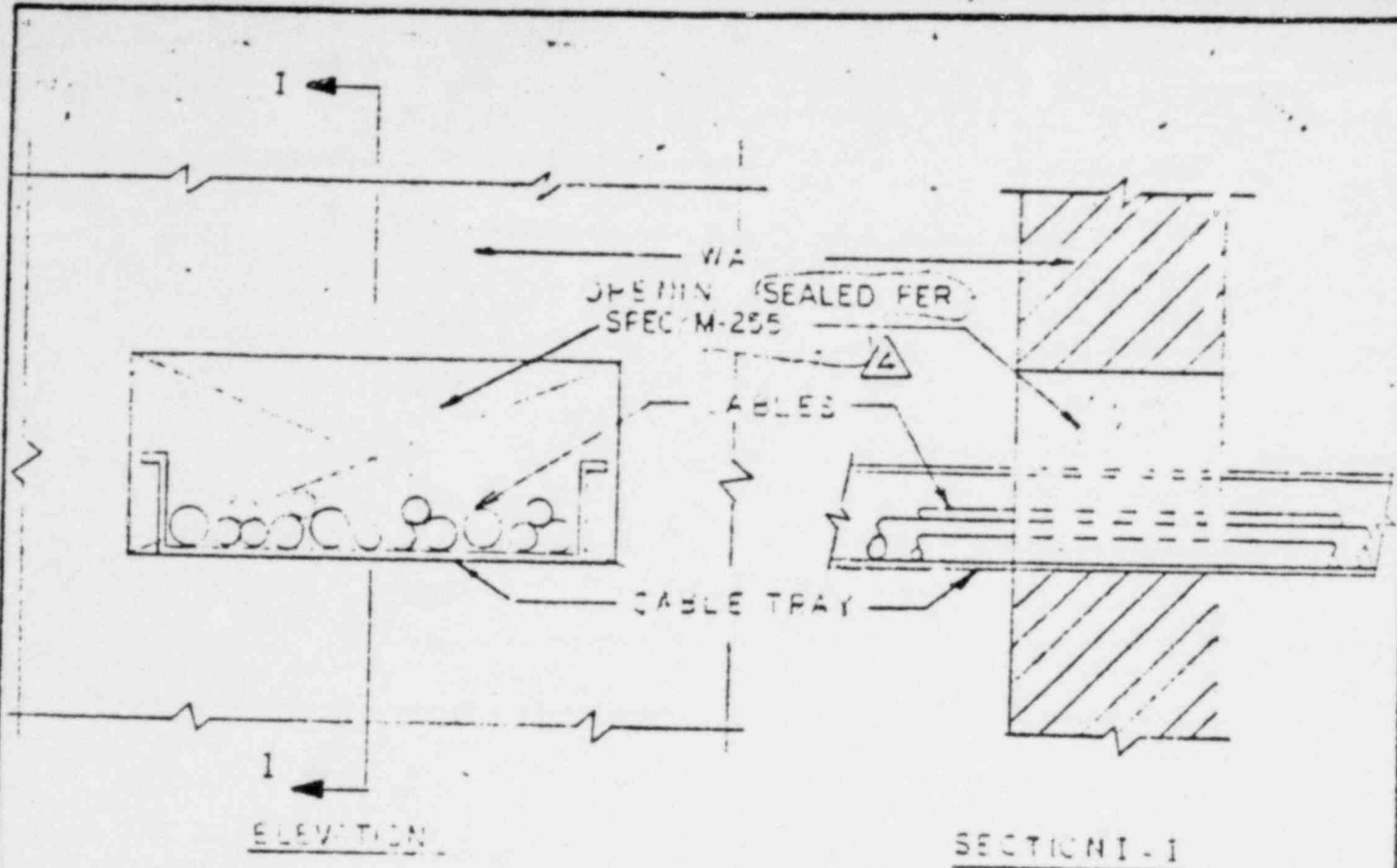
scale 1 1/2" = 1'-0"	designed by	SIGNATURE:	drawn by DAK
date 6-11-76	PROJ	<i>[Signature]</i>	PROC. 4835-02
	Q.N.	<i>[Signature]</i>	
	MOBT.	<i>[Signature]</i>	
			Rev. no. 4835-02-1

2	DAK	12/10	DIMENSIONS CHANGED
REV.	CHK.	DATE	DESCRIPTION

Page 10  
Report 4835-02-1  
Hose Stream Test  
December 14, 1976



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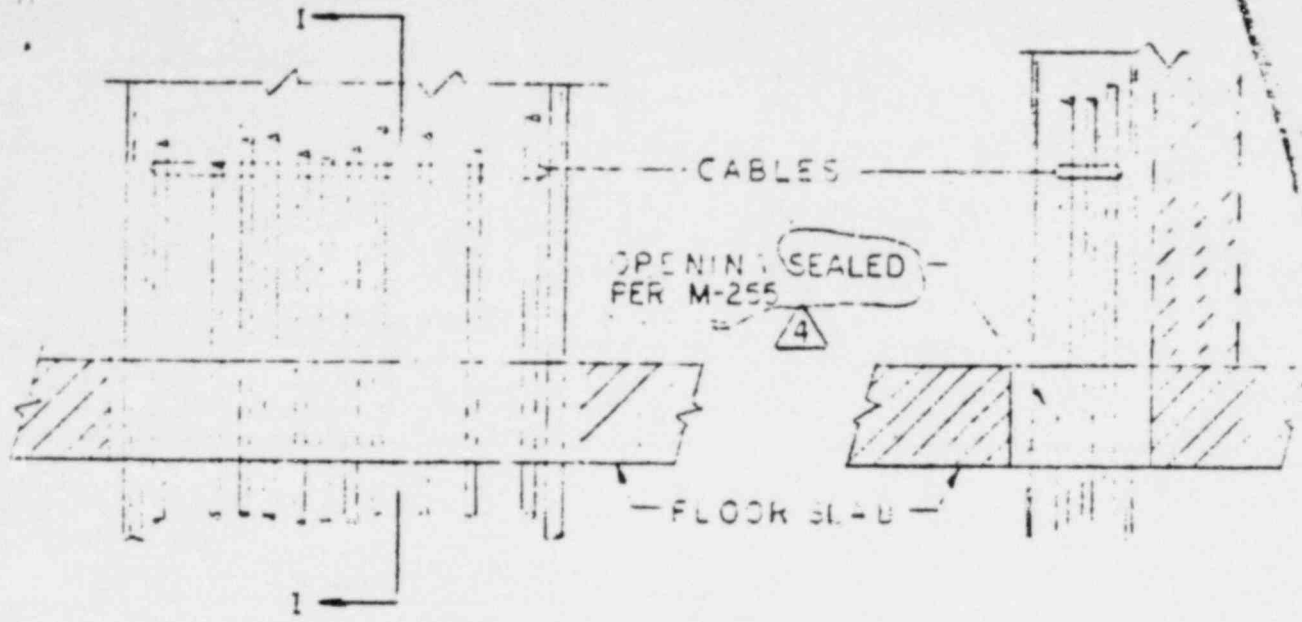
FIRE STOP AND AIR SEAL FOR CABLE TRAYS  
WALL PENETRATIONS  
CLASS-I-E / NON-CLASS-I-E

Exhibit H

1	3-25-73	REVISED AS NOTED	RMR	RCW	SHE	—
2		ADDED AS NOTED	CRS	INT	SHE	—
3		REVISED AS NOTED	ELB	SEN	APP	—
No.	DATE	REVISIONS	BY	CHE	CHKD	APPD
SCALE		DESIGNED	DRAWN			
ORIGIN		<b>DAVIS-BESSE NUCLEAR POWER STATION</b> THE TRUSSO EDISON COMPANY THE CLEVELAND ELECTRIC ILLUMINATING COMPANY				JOB No. 774 DRAWING No. 401-200- -123
						REV. 4

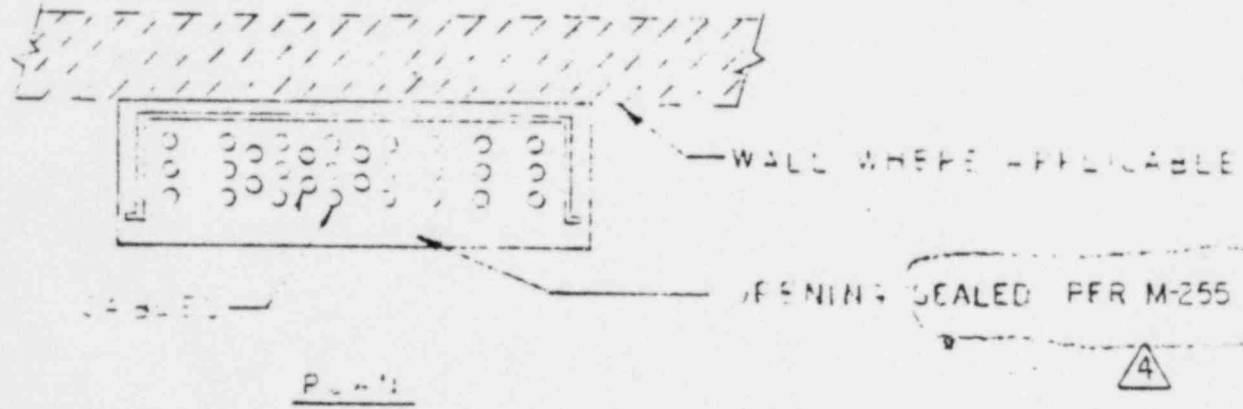
G. 731 E  
4 19 71

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ELEVATION

SECTION I-I



PLAN

FIRE STOP AND AIR SEAL FOR CABLE TRAYS  
 FLOOR OPENINGS  
 CLASS-I-E / NON CLASS-I-E

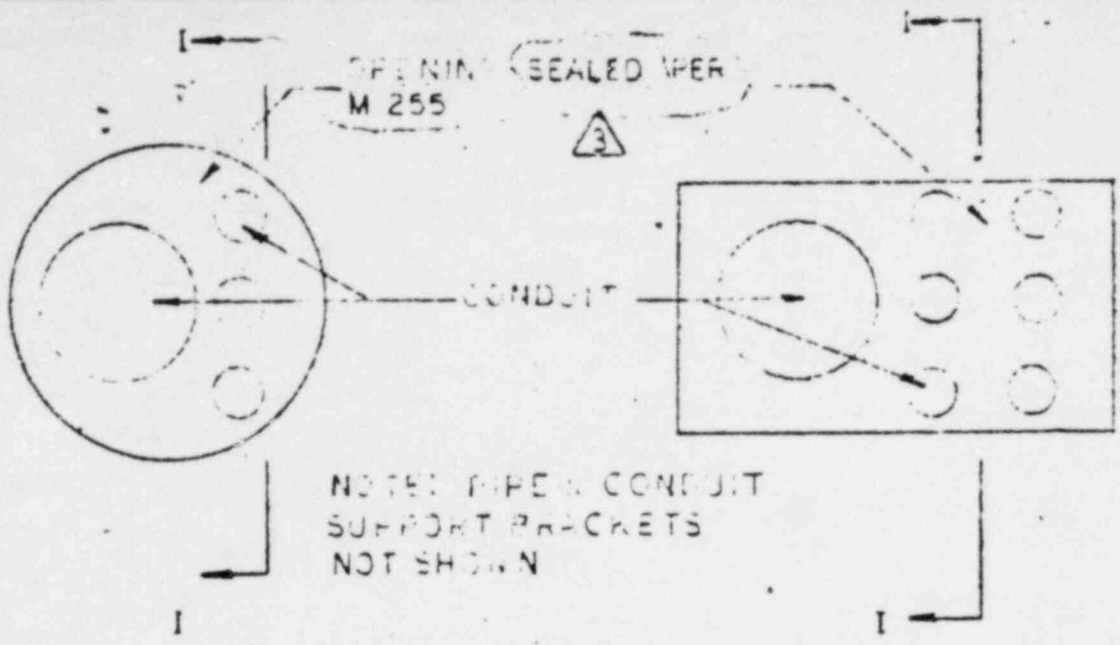
NO.	DATE	REVISIONS	BY	CHK	ENGR	DRG ENGR	APP
1	3-25-76	REVISED AS NOTED	PMR	YCW	WJL	SNC	SAS
2	4-15-76	ADDED OPENING	CHS	WJL	WJL	SNC	SAS
3	1-27-77	EDUCATIONAL IDENTIFICATION	A-	GEN	WJL	WJL	WJL

SCALE	DESIGNED	DRAWN	NO. NO.	DRAWING NO.	REV.
ORIGIN	<b>BECHTEL</b> DAVIS-BESSE NUCLEAR POWER STATION THE TOLEDO EDISON COMPANY THE CLEVELAND ELECTRIC ILLUMINATING COMPANY		77-1-E-3-1-2	4	

G 231 E  
 4 19 71

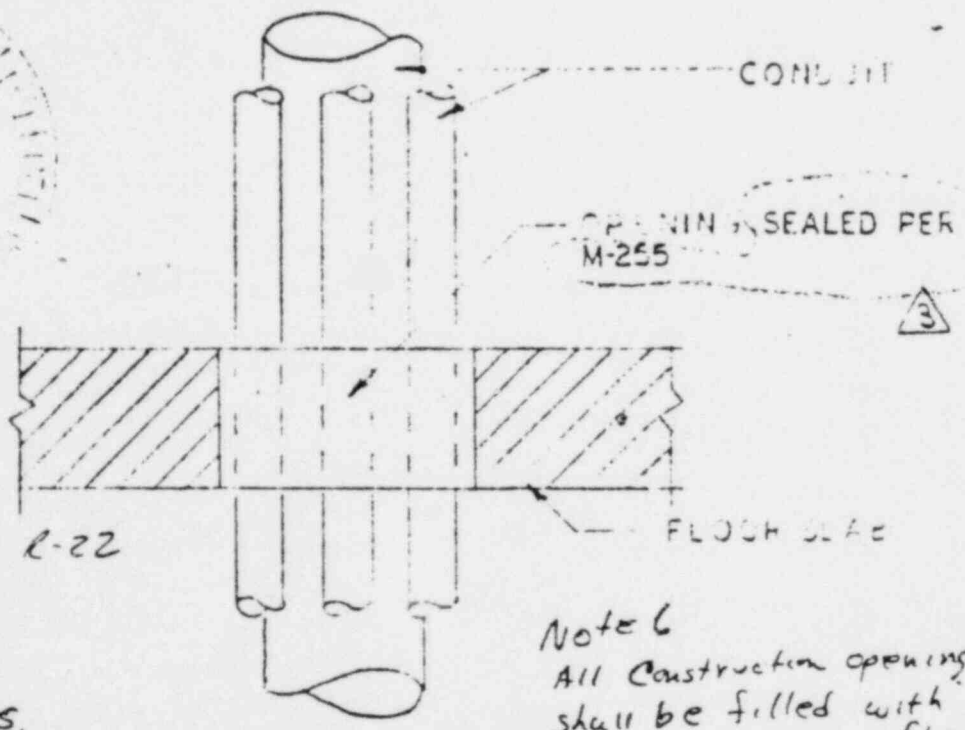
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PLAN OF CIRCULAR OPENING

PLAN OF RECTANGULAR OPENING

NOTE: PIPE & CONDUIT SUPPORT BRACKETS NOT SHOWN



Drawing 240 R-22  
 Det. 7+8  
 PIPE DUCT  
 Negative Press.  
 Or Flood Wall  
 Boundary

Note 6  
 All construction openings shall be filled with reinforced conc. after pipe inst.

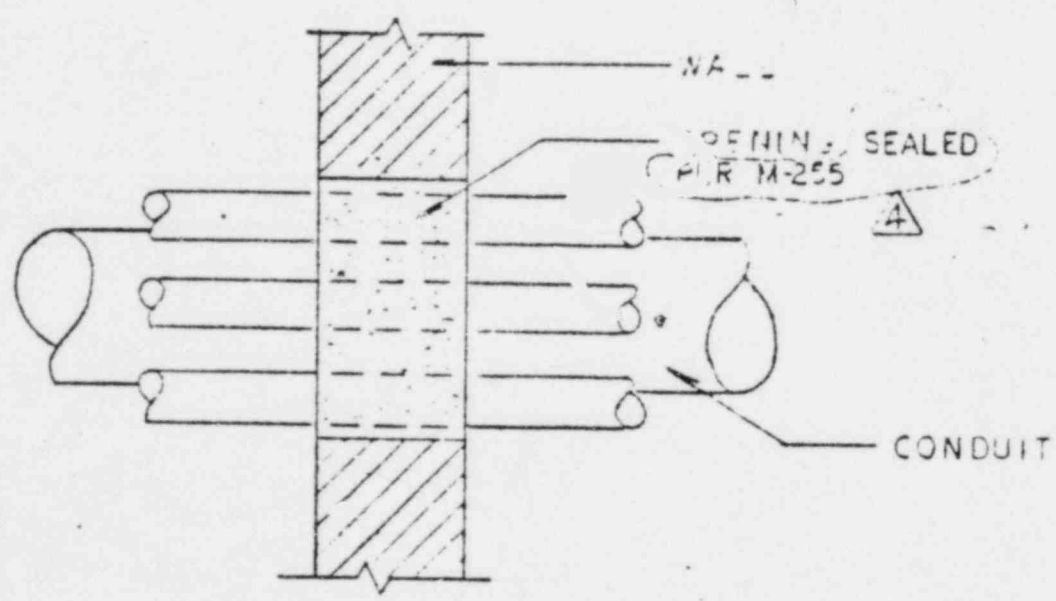
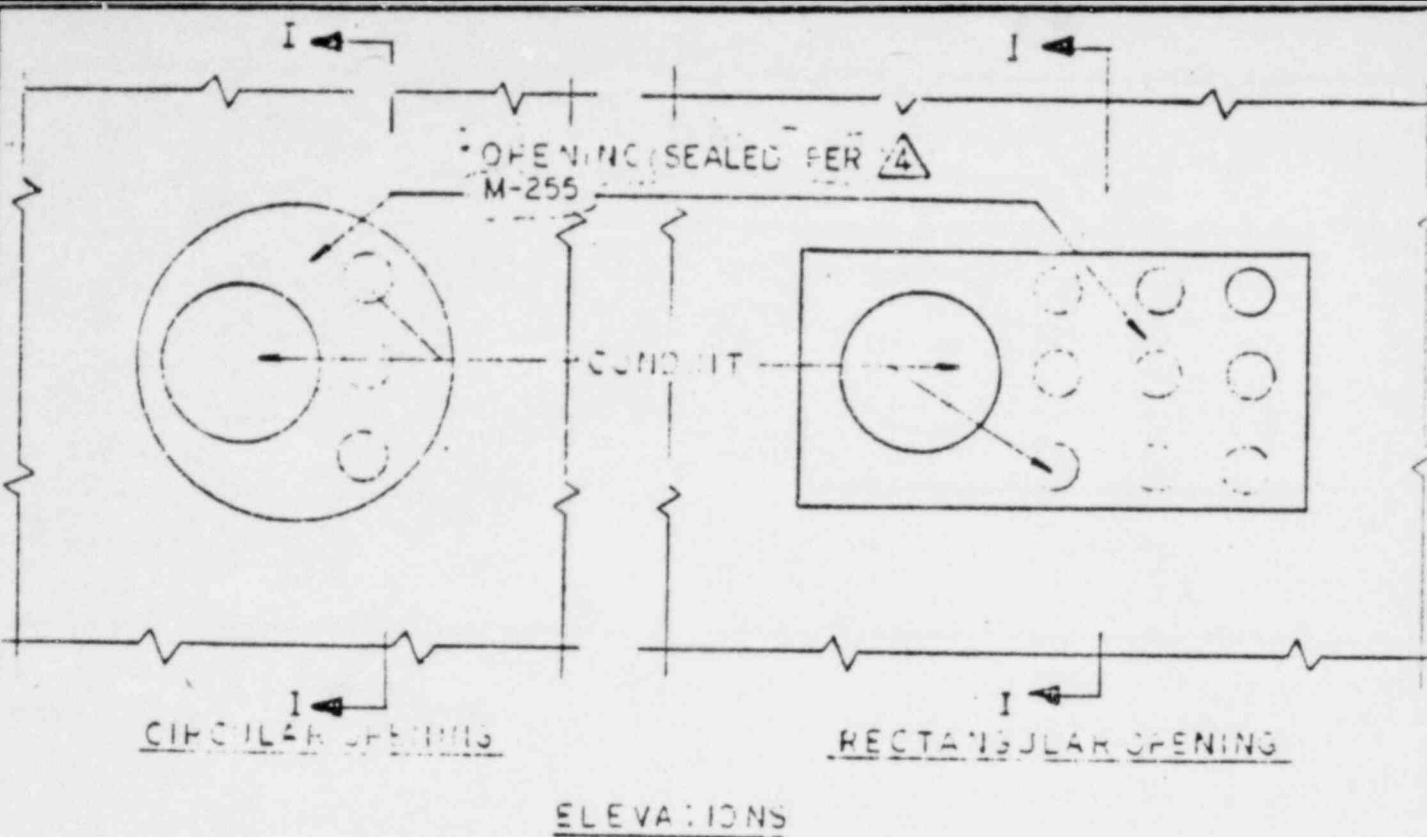
SECTION I-I  
**CONDUIT SEAL THROUGH FLOOR**  
 CLASS-IE / NON-CLASS-IE

1	10-23-74	Q ADDED 3rd 4th 5th	CRS	11/3	100	150	CAS	-
2	10-25-74	REVISED AS NOTED	PMR	new	100	150	SL	-
3	10-25-74	REVISED FOR CONSTRUCTION	J	GEN	MB	OVE	AF	-
NO	DATE	REVISIONS	BY	CHK	DESIGN	ENGR	PROJ	APPN
SCALE		DESIGNED	DRAWN		ENGR	ENGR		
ORIGIN		<b>BECHTEL</b> <b>DAVIS-BESSE NUCLEAR POWER STATION</b> <b>THE TOLEDO EDISON COMPANY</b> <b>THE CLEVELAND ELECTRIC ILLUMINATING COMPANY</b>				JOB NO	771	
						DRAWING NO	771-2-104	REV
								3

G 231 E  
 4 19 71

Exhibit (H)

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SECTION I - I  
CONDUIT SEAL THROUGH WALL  
CLASS-I-E / NON-CLASS-I-E

NO.	DATE	REVISIONS	BY	CHK'D	ENGR	APPR
1	3-28-76	REVISED AS VOTED	KMF	YCW	SMC	SNS
2	4-19-76	Ø ADDED & REVISED	CRS	YCW	SMC	SNS
3	4-22-76	ADDED SECTION	BP	YCW	SMC	SNS

SCALE	DESIGNED	DRAWN	NO. 1745
ORIGIN	<b>BECHTEL</b> <b>DAVIS-BESSE NUCLEAR POWER STATION</b> <b>THE EDISON COMPANY</b> <b>THE CLEVELAND ELECTRIC ILLUMINATING COMPANY</b>		DRAWING NO. <b>7749E302A</b> S-28
G 231 E 4 19 71			REV. <b>4</b>