PRELIMINARY COPY

TEST PROCEDURE TO QUALIFY A PROTECTIVE ENVELOPE SYSTEM TO PROTECT REDUNDANT ESSENTIAL ELECTRICAL CABLES AT THE COMANCHE PEAK STEAM ELECTRIC STATION

PREPARED BY K.N.Kum

CHECKED BY K.O.Bell

TABLE OF CONTENTS

1.0 SCOPE

This procedure prescribes the methods and guidelines to be utilized for the preparation of test specimens, installation of protective envelope systems, performance of the One Hour Fire Test and documentation of Test Results.

2.0 TEST OBJECTIVES

2.1 PRIMARY OBJECTIVE

The primary objective of this test is to qualify a protective envelope for redundant essential cable separation problems. It will provide documented evidence the envelope will satisfactorily withstand an ASTM E-119-(80) fire exposure and provide a one hour effective barrier per American Nuclear Insurers Acceptance rating by maintaining circuit integrity.

2.2 SECONDARY OBJECTIVE

Another objective of this test is to gather data for further evaluation relative to the thermal insulating effectiveness of the sprayed-on fire-proof coatings as applied to essential instrument sensing lines.

3.0 ACCEPTANCE CRITERIA

3.1 Acceptance will be based on American Nuclear Insurer's criteria for successful passage of the ASTM-E-119(80) Fire and Hose Stream Test as outlined in Section 8.0 of this procedure.

3.2 Criteria for successful passage of these tests are defined by Reference 4.3.2.

4.0 REFERENCES

4.1 DRAWINGS

4.1.1 American Nuclear Insurers Bulletin #5 (79)
Suggested Test Layout Drawing

4.1.2 Gibbs & Hill Drawing 2323-E1-1701

4.1.3 Pictorial Drawing of Cable Tray #SK-012979-D

4.1.4 Pictorial Drawing of 90^{o} Cable Tray Riser #GF-069I-R-CP

4.2 VENDOR MANUALS

4.3 DOCUMENTS

4.3.1 Federal Register/Volume 45, No. 225/Wednesday, November 19, 1980.
Fire Protection Program for operating nuclear power plants
10 CFR Part 50, Appendix R

4.3.2 ANI Bulletin #5(79) July 1979, ANI/MAERP STANDARD Fire Endurance Test Method to Qualify a Protective Envelope for Class 1 E Electrical Circuits.

4.3.3 ASTM-E-119-80 Standard Methods of Fire Tests of Building Construction and Materials.

4.3.4 Appendix A to BTP-9.5-1, NRC Supplemental Guidance-Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance.

4.3.5 Texas Utilities Generating Company Quality Assurance Plan.

4.3.6 Standards and Practices for Instrumentation; 5th Edition, 1977.

4.3.7 Construction Procedure for Cable Installation; Brown & Root #35-1195-33I-7, Revision 3.

4.3.8 Construction Procedure for Installation of "Hilti" Drilled in Bolts; Brown & Root #35-1195-CEI-20, Revision 7.

4.3.9 Construction Procedure for Cable Tray and Hanger Fabrication and Installation; Brown & Root #35-1195-ELP-10, Revision 4.

4.3.10 Construction Procedure for Exposed Conduit and Conduit Hanger Fabrication and Installation; Brown & Root #35-1195-ELP-10, Revision 5.

4.3.11 Gibbs & Hill Specification 2323-ES-100, Revision 1; Electrical Erection Specification.

4.3.12 Gibbs & Hill Specification 2323-ES-19, Revision 1; Cable Tray Specification.

4.3.13 Unistrut - General Engineering Catalog - No. 9; @1980.

4.3.14 Steel Construction Manual (AISC) 8th Edition.

5.0 RESPONSIBILITIES

5.1 COMANCHE PEAK PROJECT ENGINEERING STAFF

5.1.1 Establish the criteria, guidelines, drawings, recommendations, etc. to govern the installation of the test specimen and application of the protective envelope.

5.1.2 Approve the specific application procedures.

5.1.3 Provide materials representative of site installations per the bill of materials, Appendix 1.

5.2 VENDOR

5.2.1 Provide envelope system materials and specific application pro edures.

5.3 APPLICATOR

5.3.1 Provide scheduling of personnel, equipment and material necessary to perform the application of envelope system utilizing the appropriate procedures.

5.3.2 Coordinate all phases of the Fire Test preparation with the testing organization.

5.4 TESTING ORGANIZATION

5.4.1 Prepare the test slab in accordance with approved drawings and applicable procedures.

5.4.2 Conduct the fire test in accordance with references 4.3.2 and 4.3.3.

5.4.3 Document the test parameters and results.

5.5 TEXAS UTILITIES GENERATING COMPANY QUALITY ASSURANCE

5.5.1 Provide assurance that the Vendor, Applicator and Testing Organization have QA/QC programs that are in accordance with the applicable QA requirements of reference 4.3.4 as prescribed in reference 4.3.5.

5.6 VENDOR QUALITY ASSURANCE/QUALITY CONTROL

5.6.1 Provide documentation to assure compliance with the applicable requirements of reference 4.3.4 for the manufacture of the product.

5.7 APPLICATOR QUALITY ASSURANCE/QUALITY CONTROL

5.7.1 Will assure necessary inspection points are included in the application procedures.

5.7.2 Maintain material quality and application inspection documentation of the envelope installation in accordance with the applicable QA requirements of reference 4.3.4, and verify that approved procedures are utilized in the application of the envelope system.

5.7.3 Perform as a liason with the testing organization and provide the testing organization with all applicable procedures, documentation of applicable acceptances and any other necessary items.

5.8 TESTING ORGANIZATION QUALITY ASSURANCE/QUALITY CONTROL

5.8.1 Inspect and document the construction of the test specimen.

5.8.2 Assure the test monitoring instrumentation is properly calibrated.

6.0 SPECIAL PRECAUTIONS

6.1 PRECAUTIONS FOR APPLICATION OF PRODUCT

While spraying products, avoid repeated inhalation due to potential

of lung injuries from components of coatings. Avoid prolonged contact of products with skin. Do not take products internally. Observe special precuations as recommended by product manufacturer.

6.2 PRECAUTIONS FOR CONDUCT OF FIRE TEST

Fire Endurance tests, as outlined in Section 8.1, have potential for producing smoke, combustion products, fumes and toxic vapors. Proper safety precaution shall be exercised to preclude personnel hazard from breathing the above.

7.0 PRE-REQUISITES

7.1 GENERAL TEST CONFIGURATION REQUIREMENTS

Cable tray, conduit, and instrument sensing line construction, support, installation and loading shall be representative of the configurations installed at the Comanche Peak Steam Electric Station, where applicable. Deviations from representative configuretions and procedures shall be approved by Comanche Peak Project Engineering.

7.2 TRACIBILITY REQUIREMENTS

To insure that the materials used in this test are representative of those used in the plant, the materials leaving the site shall be marked with a material identification tag. Prior to shipping the test materials to the testing laboratory, they shall be tagged, and logged for tracibility purposes.

7.3 TEST CONFIGURATION

7.3.1 GENERAL

All test assemblies shall be sufficiently secured to the top of the test slab by the testing laboratory.

7.3.2 CABLE TRAY TEST ASSEMBLIES

Two types of cable trays shall be utilized in the test assembly.

(a) Solid back

(b) Ladder back

One typical cable tray support shall be installed in each cable tray test assembly. Refer to drawings FDSG-D2, and FDSG-D3 contained in Appendix 2 (Support Installation), for support type and locations. Supports shall be installed in accordance with Appendix 2.

Cable tray test assemblies shall be fabricated and installed in accordance with Appendix 3. Refer to drawings FDSG-D08 and FDSG-D9, contained in Appendix 3, for details of fabrication and installation.

7.3.3 CONDUIT TEST ASSEMBLY

One five (5) inch conduit shall be used in the test assembly.

One typical conduit support shall be installed in the test assembly. Refer to drawing FDSG-D2 and FDSG-04, contained in Appendix 2, showing support type and location.

The conduit test configuration shall be assembled and installed in accordance with Appendix 3. Refer to drawings FDSG-D10 and FDSG-11, contained in Appendix 3 for details.

7.3.4 AIR DROP CABLE TEST ASSMEBLIES

Cables representative of all air drop shall be incorporated into the test assembly. Cables to be air dropped shall be identified in table FDSG-T4, contained in Appendix 4.

These cables shall drop freely through the slab penetrations (singularly, or in groups) and into a cable tray assembly. Four different configurations shall be tested. They are defined as follows:

(1) A 5" conduit shall be embedded in the slab. This conduit shall be flush with the slab on the fire exposed side. Cables through this penetration shall drop into the lightly loaded ladder back tray. Refer to drawing FDSG-D12, contained in Appendix 3, for details of this configuration.

(2) A 5" conduit shall be embedded in the slab. This conduit shall extend down from the bottom of the slab, then bend to the horizontal plane. Cables through this penetration shall drop into the 40% filled solid back tray. Refer to drawing FDSG-D12, contained in Appendix 3, for details of this configuration.

(3) A 5" conduit shall be embedded in the slab. This conduit shall be flush with the slab on the fire exposed side. A single cable shall be dropped into a tray that has been coated and cured. This tray shall be single layer (lightly loaded) solid back tray. This arrangement simulates a repair of the coating system, or the addition of a cable to the already coated system. Refer to drawing FDSG-D12, contained in Appendix 3, for details of this configuration.

(4) A 5" conduit shall be embedded in the slab. This conduit shall enter a junction box mounted on the fire exposed side of the slab. A 5" conduit shall drop out of the junction box. Cables shall drop through junction box and conduit assembly and into the 40% fill ladder back tray. Refer to drawing FDSG-D12, contained in Appendix 3, for details of this configuration.

The conduit assemblies as described above shall be installed in accordance with Appendix 3, of this procedure.

The cables shall be installed in accordance with Appendix 4 of this procedure.

7.3.5 INSTRUMENT SENSING LINE TEST ASSEMBLY

One three-eights (3/8) inch diameter, stainless steel instrument sensing line shall be incorporated into the test assembly. As stated in Section 2.2, this is to gather data for evaluation of the fire-proof coatings thermal insulationg characteristics when exposed to a postulated fire.

Four typical instrument sensing line supports shall be installed in the test assembly. Refer to drawing FDSG-D6 contained in Appendix 2 of this procedure for support type and locations. Supports shall be installed in accordance with Appendix 2.

7.4 CABLE LOADING REQUIREMENTS

Cable loading requirements shall be as specified in the American Nuclear Insurers Bulletin #5 (79). The distribution of cables in the cable tray and conduit test assemblies shall be as follows:

33 1/3% Power Cables
33 1/3% Instrumentation Cables
33 1/3% Control Cables

Test configurations shall be as follows:

(a) Ladder Back Tray
    (i) 100% Design (40% density)
    (ii) Lightly loaded (one layer)

(b) Solid Back Tray
    (i) 100% Design (40% density)
    (ii) Lightly loaded (one layer)

(c) Conduit

    (i) 40% Density

7.5 CABLE INSTALLATION

An itemized listing of cable types and quantities to be routed in the test assemblies is provided in tables FDSG-T1, through FDSG-T4, contained in Appendix 4.

To attach cables to solid back trays, holes shall be drilled in the trays. Specifications for spacing of holes, and intervals for tying cable to the trays are contained in Appendix 4. Cables shall be installed in accordance with Appendix 4. Cable location within tray shall be documented and be included with data to be evaluated by the testing laboratory.

7.6 THERMOCOUPLE INSTALLATION

Thermocouples shall be located in test assemblies in accordance with reference 4.3.2.

Refer to drawing FDSG-14, contained in Appendix 4, for locations of thermocouples in test assemblies.

7.7 FIRE STOP INSTALLATION

Due to the type of coating system used, fire stops shall be required. For testing purposes, one American Nuclear Insurers accepted fire stop shall be installed in each horizontal tray run, and in one of the two vertical runs in each assembly. These shall be installed prior to coating application the type of fire stop that is installed shall be at the discretion of the testing laboratory.

7.8 COATING OF ASSEMBLY

Test assemblies shall be coated with the fire retardant material in accordance with approved procedures contained in Appendix 6 (application of product). There shall be no differences in the application procedures for the test and the actual installation without prior approval.

7.9 FIRE SEAL INSTALLATION

Upon completion of the fabrication, installation and coating of the test configuration, penetrations shall be sealed with an American Nuclear Insurers approved seal.

The conduit openings, where cables drop out shall be sealed with an American Nuclear Insurers approved seal.

As stated in reference 4.3.2, section 3.4.4.6, failure of the fire seal shall not necessarily constitute a failure of the protective envelope. The type of fire seal used shall be at the discretion of the testing laboratory.

7.10 CIRCUIT INTEGRITY MONITORING

Sufficient cables shall be energized to monitor circuit integrity. They shall be energized as required to check for a circuit failure. Circuit failure is defined as circuit to circuit (conductor to conductor short circuits); circuit to system (conductor continuity); and circuit to ground (short circuits, conductors to ground). Monitoring all of the conductors in every cable or even part of the conductors in each cable will be an impossible task, therefore selected cables in each cable tray will be instrumented for each of the three parameters.

a. Two cables, one power and one instrumentation/control in each cable tray will be connected to a short circuit detection circuit as shown in Figure FDSG-F2, contained in Appendix 4.

b. Two cables, as above, will be connected to a continuity monitoring circuit as shown in Figure FDSG-F2, contained in Appendix 4.

c. Two cables, as above, will be connected to a ground short circuit detection circuit as shown in Figure FDSG-F2, contained in Appendix 4. This is a total of six instrumented cables per cable tray.

The monitored cables shall be scanned once each minute. Monitored cables shall be energized until the hose stream test is completed. Refer to reference 4.3.2 for acceptance criteria.

7.11 PRE-BURN INSPECTION

Prior to commencement of the fire endurance test, a thorough check of the entire test assembly and associated equipment (including data recording equipment) shall be performed and documented, by the testing laboratory. Refer to Appendix 7 of this procedure for details.

8.0 PROCEDURE

8.1 FIRE ENDURANCE TEST

8.1.1 The protective envelope shall be exposed to the standard time-temperature curve, found in ASTM E-119 (80), for one hour.

Refer to Appendix 8, contained in this procedure, for detailed test instructions.

8.1.2 The third party testing organization shall strive to adopt their testing procedures to assure the fire test shall comply with the requirements established in reference 4.3.2 standards Any changes, revisions or deviations required to comply with this requirement shall be documented and properly justified and included as a part of the final test report.

8.1.3 Acceptance criteria are contained in reference 4.3.2.

8.2 HOSE STREAM TEST

8.2.1 Immediately following the fire endurance test, accessible surfaces of the protective envelope shall be subjected to the American Nuclear Insurers preferred Hose Stream test, as specified in reference 4.3.2. The Hose Stream shall be applied for a minimum of two and one half (2½) minutes, without de-energizing the circuit. Proper safety precautions shall be exercised.

8.2.2 Refer to Appendix 9, contained in the procedure, for detailed test instructions.

8.2.3 Acceptance criteria are contained in reference 4.3.2.

9.0 DATA SYSTEM

9.1 During the fire exposed period, the thermocouples will be scanned at the rate of twenty channels per seconds, at one minute intervals.

9.2 The monitored cables shall be scanned once each minute. Monitored cables shall be energized until the hose stream test is completed.

10.0 QUALITY CONTROL DOCUMENTATION

10.1 The assigned Quality Control Inspector shall verify installation and document accordingly to assure concurrence with drawings, the bill of Materials, and the appropriate application procedures.

11 0 FIRE TEST REPORT

11.1 Testing organization will submit report on results of test and thermocouple data sheets to CPPE.

11.2 CPPE will assemble the laboratory report, data and required QC documentation into a final report for submittal to American Nuclear Insurers.

APPENDIX 1

BILL OF MATERIALS

APPENDIX 1

BILL OF MATERIALS

ITEM	QUANTITY	DESCRIPTION	MATERIAL SPEC.
A.	4	18" width x 4" depth x 65" length Solid Bottom Cable Tray	ES-19
B.	4	18" width x 4" high 90° inside Riser El. 12" Rad., Solid Bottom Cable Tray	ES-19
C.	4	18" width x 4" depth x 65" length Ladder Back Cable Tray	ES-19
D.	4	18" width x 4" high 90° inside Riser El. 12" Rad., Ladder Back Cable Tray	ES-19
E.	2	18" width x 4" depth x 46" length Solid Bottom Cable Tray (Middle Section)	ES-19
F.	2	18" width x 4" depth 46" length Ladder Back Cable Tray (Middle Section)	ES-19
G.	1	5" Ø Rigid Steel Conduit x 29½" length(threaded on both ends)	ES-23A
H.	1	5" Ø Rigid Steel Conduit x 58" length (threaded on both ends)	ES-23A
I.	2	5" Ø Rigid Steel Conduit x 50 3/4 " length (threaded on both ends)	ES-23A
J.	3	5" Ø 90° Rigid Steel Conduit El. 24" Rad.(threaded on both ends)	ES-23A
K.	1	5" Ø Rigid Steel Conduit x 38 3/4" length (threaded on both ends)	ES-23A
L.	5	5" Ø Rigid Steel Conduit Couplings	ES-23A
M.	1	3/8" Ø Instrumentation Tube x 210" length, Stainless Steel	MS-625
N.	2	5" Ø Rigid Steel Conduit x 24" length (threaded on both ends)	ES-23A
O.	2	Tube Carbon Steel 2x2x0.25x20" Lg.	ASTM A500
P.	2	Carbon Steel Plate 3/8" x 3" x 3" Lg.	ASTM A36
Q.	2	Carbon Steel Plate ½" x 10" x 10" Lg.	ASTM A36
R.	4	One Hold Clamp (Unistrut - P2010)	
S.	4	½" Ø x 2½" Lg. Bolts	A-325
T.	2	½" Ø x 7" Lg. Bolts (Hilti Kwik)	
U.	2	C6 x 8.2 x 44" Lg. (channel)	ASTM A36
V.	1	C6 x 13 x 114" Lg. (channel)	ASTM A36
W.	2	L6 x 6 x 3/4 x 1'-6" Lg. (angle)	ASTM A36

APPENDIX 1

BILL OF MATERIALS

ITEM	QUANTITY	DESCRIPTION	MATERIAL SPEC.
X.	14	1" Ø x 12" Lg. Bolts (Hilti Kwik)	
Y.	1	Conduit Clamp (Unistrut - P2558-50)	
Z.	1	Carbon Steel Plate ½" x 6" x 6" Lg.	ASTM A36
AA.	1	C4 x 7.25 x 3'-6" Lg. (channel)	ASTM A36
BB.	1	Channel Combination 50" Long cut to suit(Unistrut - P1001C3)	
CC.	2	Adjustable Brace Fitting (Unistrut -P2815)	
DD.	4	½" Ø CPL Studs w/Hex. nuts x 1½" Lg. (Nelson)	
EE.	2	¼" x 2 1/8" x 6" Lg. Filler Plate, Carbon Steel	ASTM A36
FF.	6	Carbon Steel Plate 3/16" x 2" x 4" Lg.	ASTM A36
GG.	6	5/8" Ø Bolts x 2½" Lg. w/nut & std. Hardened Washer	A-325
HH.	12	½" Ø RD. HD.Bolts w/Hex. nut & std. washer x 2" Lg.	A-325
JJ.	6	Bevel Washers for 5/8" Ø Bolts Carbon Steel	A-325
KK.	1	Junction Box 24" x 10" x 10", Nema Four w/mounting lugs	ES-23A
LL.	2	Channel Conbinations 28" Long (Unistrut - P1001)	
MM.	2	Tube Steel 2x2x0.25x3'-2" Lg.	A-500, GR.B
NN.	6	3/8" Ø x 1" Lg. Bolts (Unistrut)	
OO.	4	3/8" Ø x 5" Lg. Bolts (Hilti Kwik)	
PP.	2	½" Ø x 1½ Lg. Hex HD. Bolts w/Hex nut & Bevel Washers	A-325
QQ.	1	5" Ø Rigid Steel Conduit x 8" Length (threaded on both ends)	ES-23A
RR.	256	3/8" - 16 x 3/4" Lg. Spline Bolt w/Oval Type Phillips Slotted Heads w/Nuts and Locking Devices	A-307
SS.	As Required	Cables (Refer to following page for itemized listing)	IEEE-383
TT.	As Required	Cable Ties	
UU.	32	Splice plates	ES-19

APPENDIX 1

BILL OF MATERIALS

TOTAL CABLES REQUIRED

CABLE FUNCTION	CABLE TYPE	CABLE SIZE	QUANTITY	LENGTH
Power	W-008	1/C 750 MCM	3	30 ft.
Power	W-709	1/C 500 MCM	3	30 ft.
Power	W-710	1/C 350 MCM	4	30 ft.
Power	W-211	1/C 4/0 AWG	4	30 ft.
Power	W-012	4/0 TRIPLEX	4	30 ft.
Power	W-713	2/0 TRIPLEX	4	30 ft.
Power	W-715	# 2 TRIPLEX	2	30 ft.
Power	W-115	2/C # 2 AWG	4	30 ft.
Power	W-017	3/C # 4 AWG	2	30 ft.
Power	W-220	3/C # 6 AWG	4	30 ft.
Power	W-221	2/C # 6 AWG	2	30 ft.
Power	W-123	3/C # 8 AWG	4	30 ft.
Power	W-124	2/C # 8 AWG	3	30 ft.
Control	W-141	4/C #10 AWG	14	30 ft.
Control	W-045	12/C #12 AWG	19	30 ft.
Control	W-046	9/C #12 AWG	16	30 ft.
Control	W-047	7/C #12 AWG	15	30 ft.
Control	W-048	5/C #12 AWG	15	30 ft.
Control	W-850	3/C #12 AWG	16	30 ft.
Instrumentation	W-061	12 Shielded Twisted Pairs # 16 AWG	9	30 ft.
Instrumentation	W-062	6 Shielded Twisted Pairs # 16 AWG	7	30 ft.
Instrumentation	W-263	4 Shielded Twisted Pairs # 16 AWG	7	30 ft.
Instrumentation	W-264	2 Shielded Twisted Pairs # 16 AWG	8	30 ft.
Instrumentation	W-069	22/C # 16 AWG with overall shield	6	30 ft.
Instrumentation	W-071	5/C # 16 AWG with overall shield	6	30 ft.
Instrumentation	W-076	6 Twisted Pair # 16; 1 Twisted Pair # 14; 2 # 16 Drain Wire	6	30 ft.
Instrumentation	W-081	7 Shielded Triads	6	30 ft.

Note: All vendors supplying IEEE383 cables to CPSES shall be represented in the fire test.

APPENDIX 2

SUPPORT INSTALLATION

APPENDIX 2
SUPPORT INSTALLATION

1.0 CABLE TRAY SUPPORTS

1) Attach cable tray supports to the underside of the slab as shown in drawings FDSG-D2 and FDSG-D3, contained in this Appendix.

2.0 CONDUIT SUPPORTS

1) Attach conduit support to the underside of the slab as shown in drawing FDSG-D2 and FDSG-D4 contained in this Appendix.

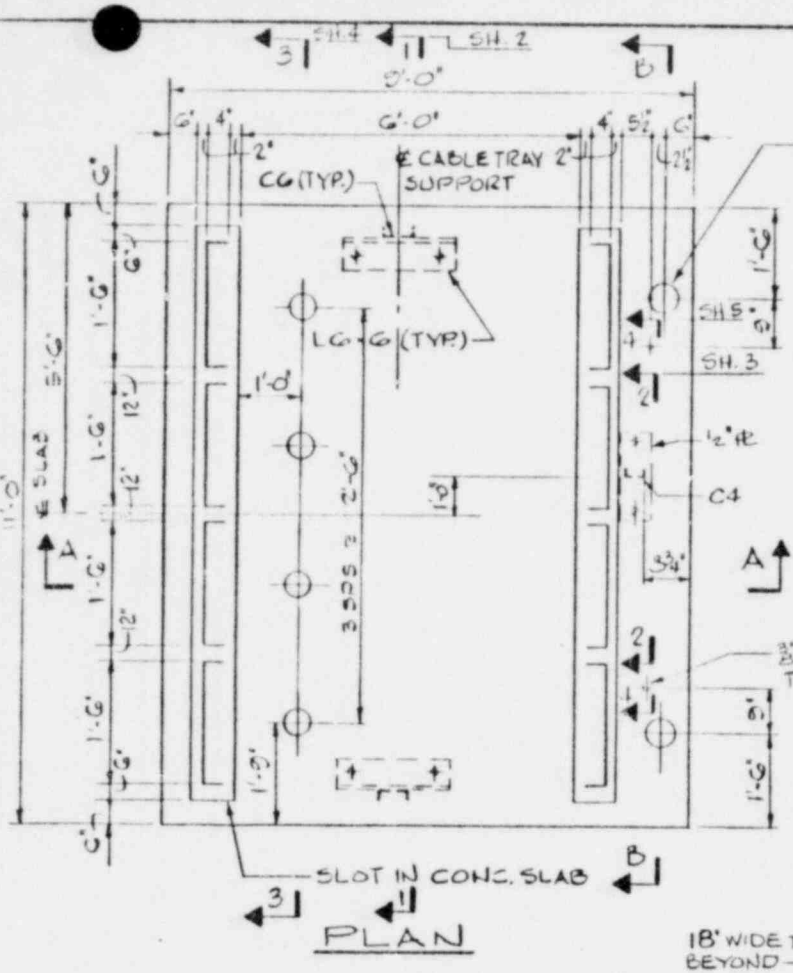
3.0 INSTRUMENT SENSING LINE SUPPORTS

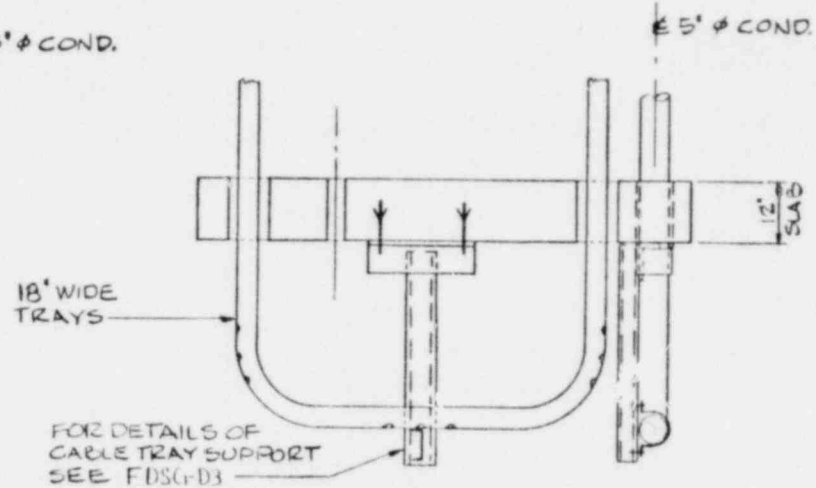
1) Attach instrument sensing line supports to the underside of the slab, as shown in drawing FDSG-6, contained in this Appendix.

4.0 JUNCTION BOX SUPPORT FOR AIR DROP CABLE

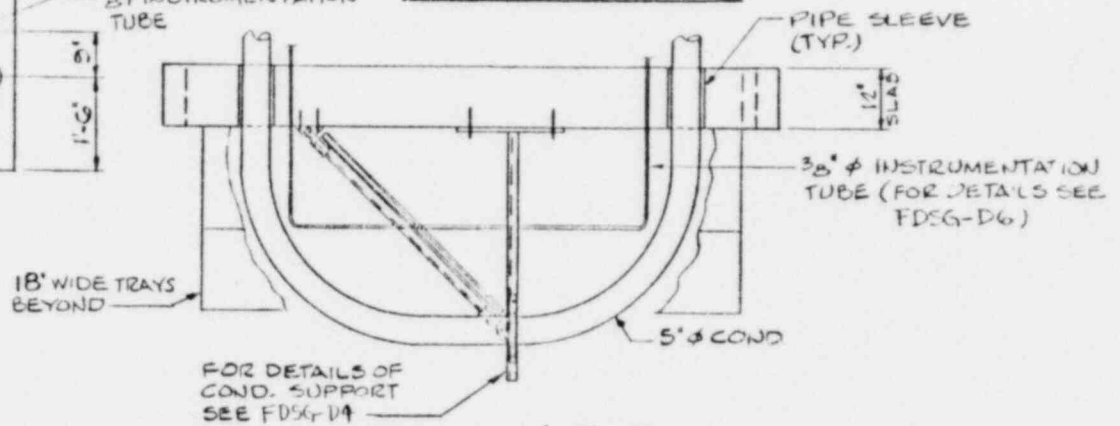
1) Attach junction box support to the underside of the slab as shown in drawing FDSG-D5, contained in this Appendix.

NOTE: Procedure for installation of Hilti Bolts in Brown & Root Construction procedure # CEI-20 Revision 7.





SECTION A-A



SECTION B-B

TEXAS UTILITIES SERVICES, INC. C.P.S.E.S. GLEN ROSE, TEXAS						
FIRE PROTECTION TEST FOR CONDUITS, CABLE TRAYS, INSTRUMENTATION TUBING, & SUPPORTS						
DWG TITLE: SUPPORT DETAILS				SCALE: NONE		
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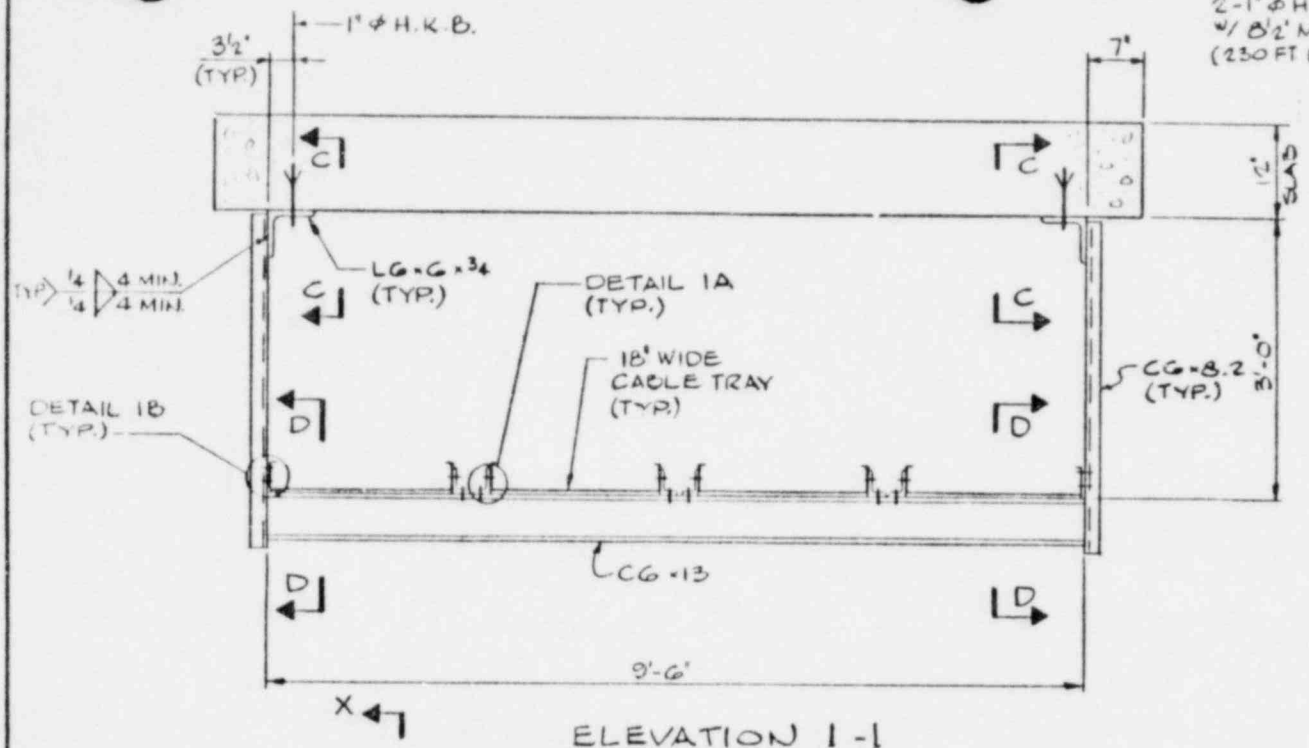
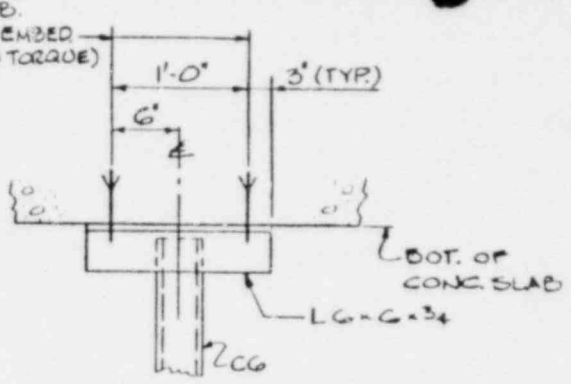


ELEVATION 1-1



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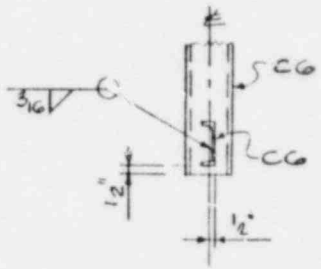

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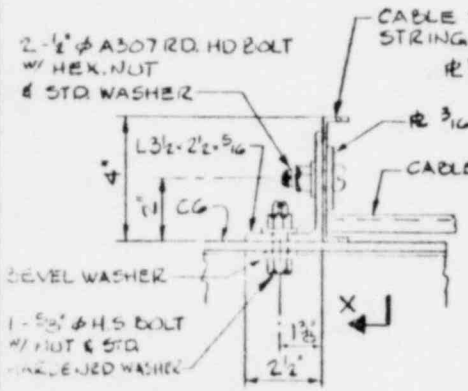
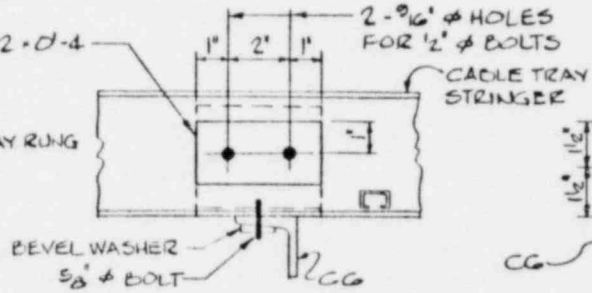


DETAIL 1A



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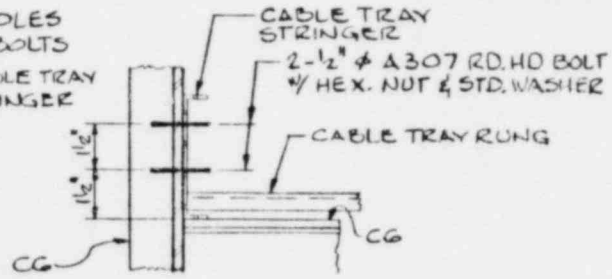

DETAIL 1B

TEXAS UTILITIES SERVICES, INC.	
C.P.S.E.S.	GLEN ROSE, TEXAS
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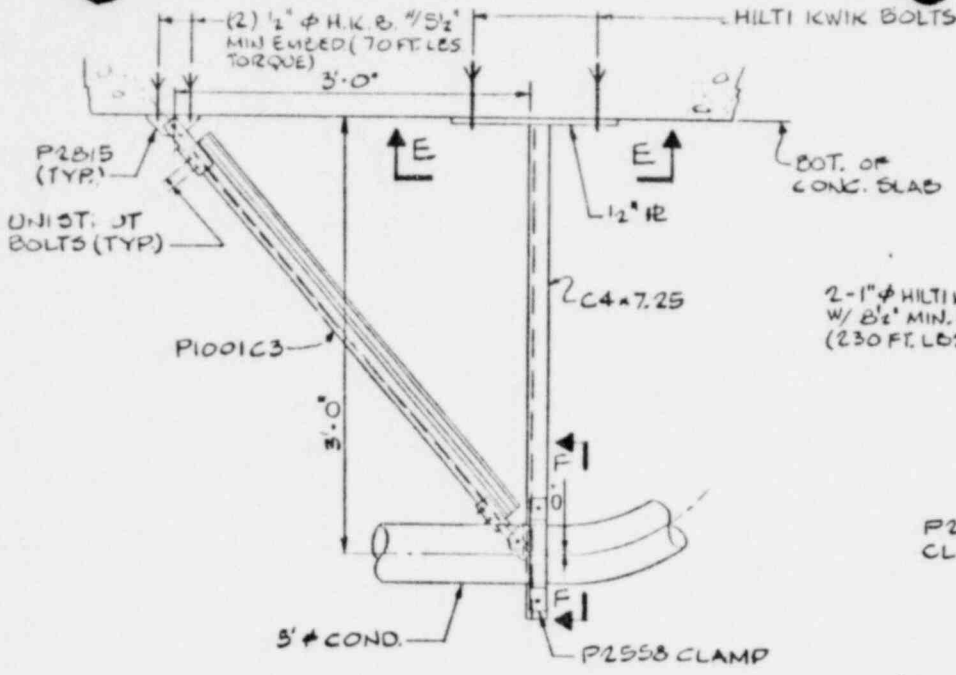
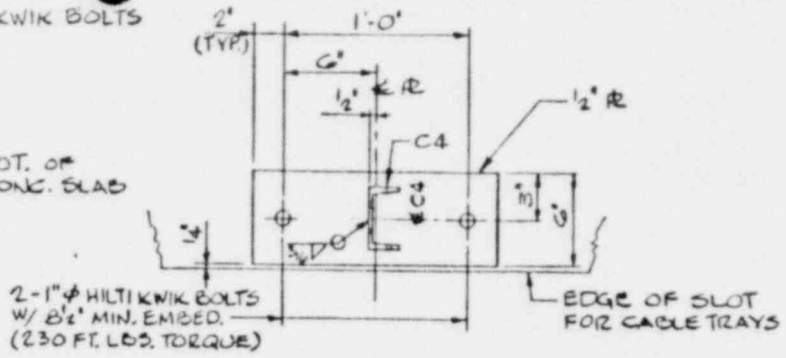
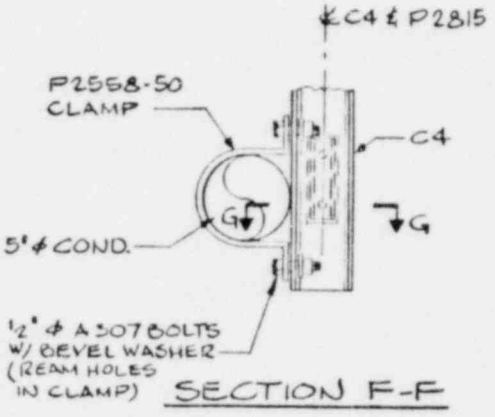


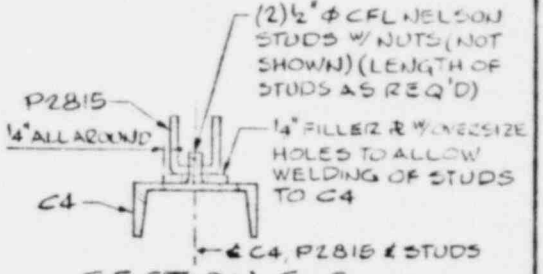
ELEVATION 2-2



SECTION E-E

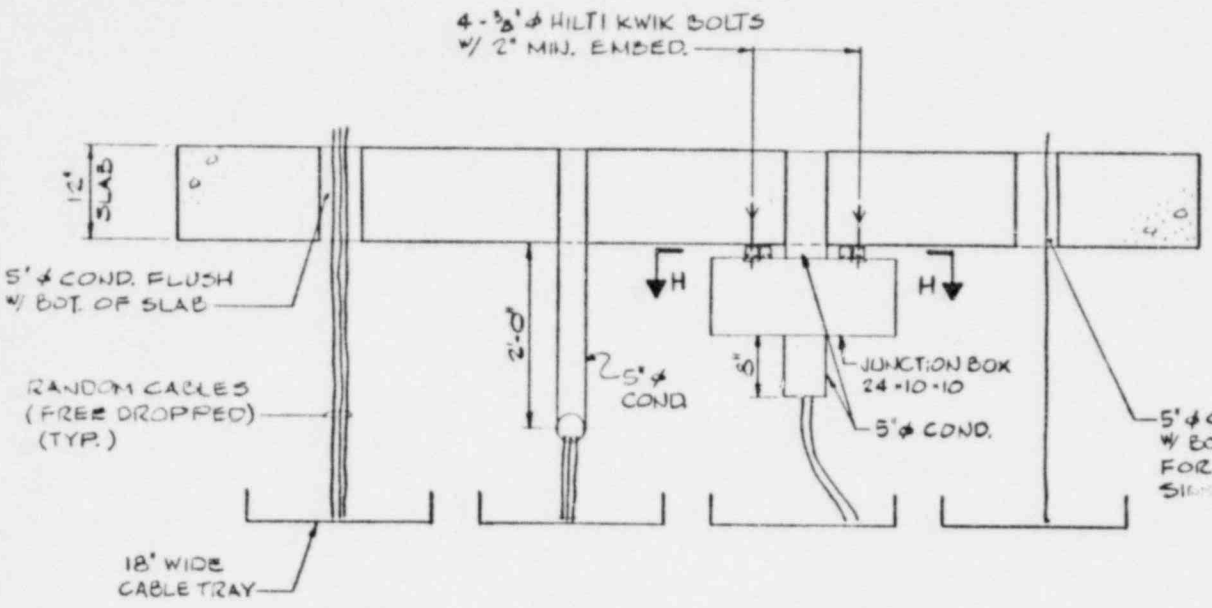


SECTION F-F

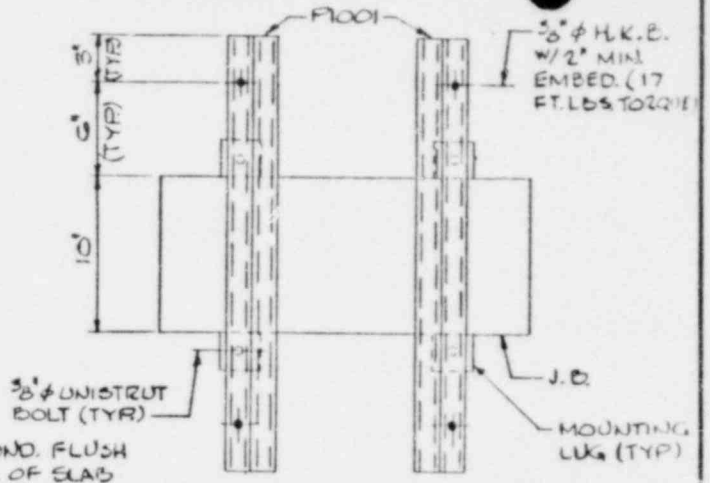


SECTION G-G

TEXAS UTILITIES SERVICES, INC.						
C.P.S.E.S. GLEN ROSE, TEXAS						
FIRE PROTECTION TEST FOR CONDUITS, CABLE TRAYS, INSTRUMENTATION TUBING, & SUPPORTS						
DWG TITLE: SUPPORT DETAILS					SCALE: NONE	
0	DATE 5-22-81	DWN. RAD	CK'D MJP	APP'D [illegible]	ISSUED FOR CONSTRUCTION	DWG NO. [illegible]-D4

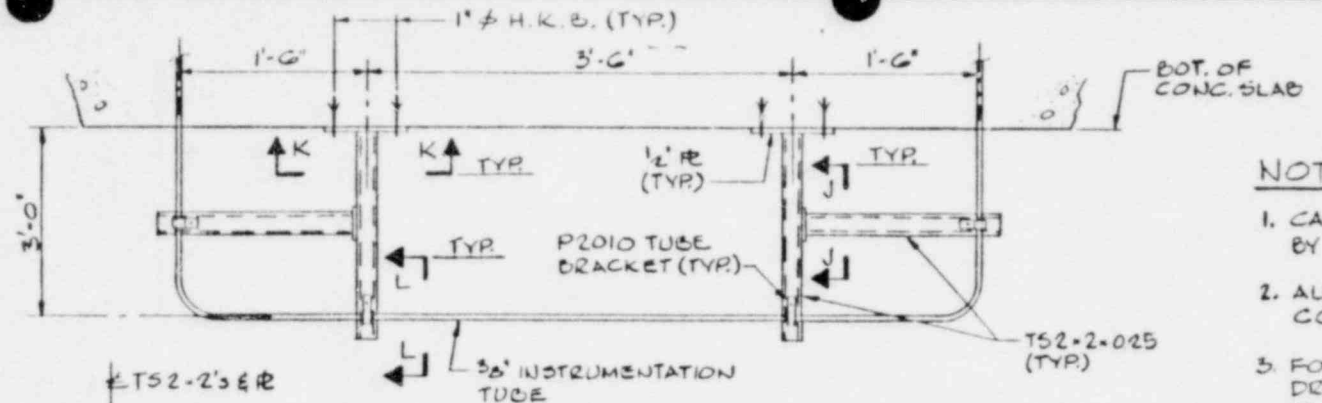


ELEVATION 3-3

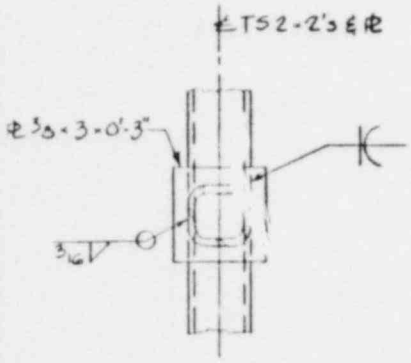


SECTION H-H

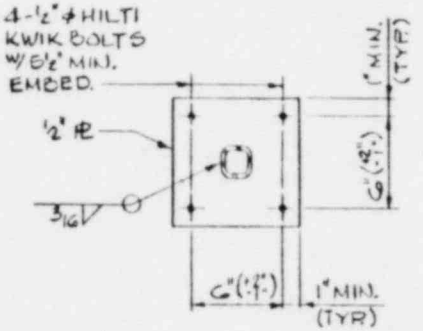
TEXAS UTILITIES SERVICES, INC.						
C.P.S.E.S. GLEN ROSE, TEXAS						
FIRE PROTECTION TEST FOR CONDUITS, CABLE TRAYS, INSTRUMENTATION TUBING, & SUPPORTS						
DWG TITLE: SUPPORT DETAILS				SCALE: NONE		
1	DATE: 5/26/81	DWN. PAD	CKD. MJP	APPD. MJR	ISSUED FOR CONSTRUCTION	DWG NO. FDSS-05



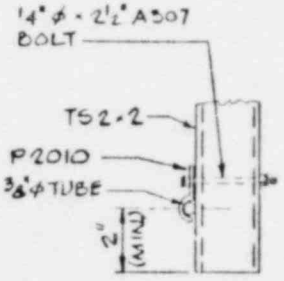
ELEVATION 4-4



SECTION J-J



SECTION K-K



SECTION L-L

NOTES

1. CABLE TRAYS ARE TO BE AS MANUFACTURED BY T.J. COPE &/OR BURNDY & HUSKY.
2. ALL STRUCTURAL STEEL MEMBERS SHALL CONFORM TO ASTM A36.
3. FOR ITEMS REFERED TO IN THESE DRAWINGS WITH A PREFIX "P" (FOR EXAMPLE P1001C3) SEE "UNISTRUT GENERAL CATALOG N° 9A". THESE ITEMS, AS WELL AS UNISTRUT BOLTS, SHALL BE AS MANUFACTURED BY UNISTRUT CORP. AND FURNISHED HOT DIP GALVANIZED. THREADED PARTS SHALL BE ELECTRO-GALVANIZED.
4. ALL WELDING SHALL CONFORM TO THE REQUIREMENTS OF THE AMERICAN WELDING SOCIETY. WELDING ELECTRODES SHALL BE ASTM A233 CLASS E70.
5. FABRICATION AND ERECTION OF ALL STRUCTURAL STEEL SHALL CONFORM TO THE A.I.S.C. "MANUAL OF STEEL CONSTRUCTION", SEVENTH EDITION.

TEXAS UTILITIES SERVICES, INC.						
C.P.S.E.S. GLEN ROSE, TEXAS						
FIRE PROTECTION TEST FOR CONDUITS, CABLE TRAYS, INSTRUMENTATION TUBING, & SUPPORTS						
DWG TITLE: SUPPORT DETAILS				SCALE: NONE		
DATE: 5-22-91	DWN RAD	CHKD MJP	APPD ENK	ISSUED FOR CONSTRUCTION	DWG NO. FD57-26	

APPENDIX 3

TEST CONFIGURATION INSTALLATION

APPENDIX 3
TEST CONFIGURATION INSTALLATION

1.0 INSTALLATION OF CABLE TRAY SEGMENTS

1) Fabricate cable tray test assemblies as shown in drawings FDSG-D3 and FDSG-D9 contained in this Appendix.

2) Secure assemblies with typical cable tray support as shown in drawings FDSG-D2 and FDSG-D3 contained in Appendix 2.

2.0 INSTALLATION OF CONDUIT

1) Fabricate conduit assembly as shown in drawings FDSG-D10 and FDSG-D11, contained in this Appendix.

2) Secure assembly with typical conduit support as shown in drawings FDSG-D2 and FDSG-D4 contained in Appendix 2.

3.0 INSTALLATION OF INSTRUMENT SENSING LINES

1) Bend instrument tubing as shown in drawing FDSG-D13, contained in this Appendix.

2) Secure instrument sensing line with four typical supports as shown in drawing FDSG-D6, contained in Appendix 2.

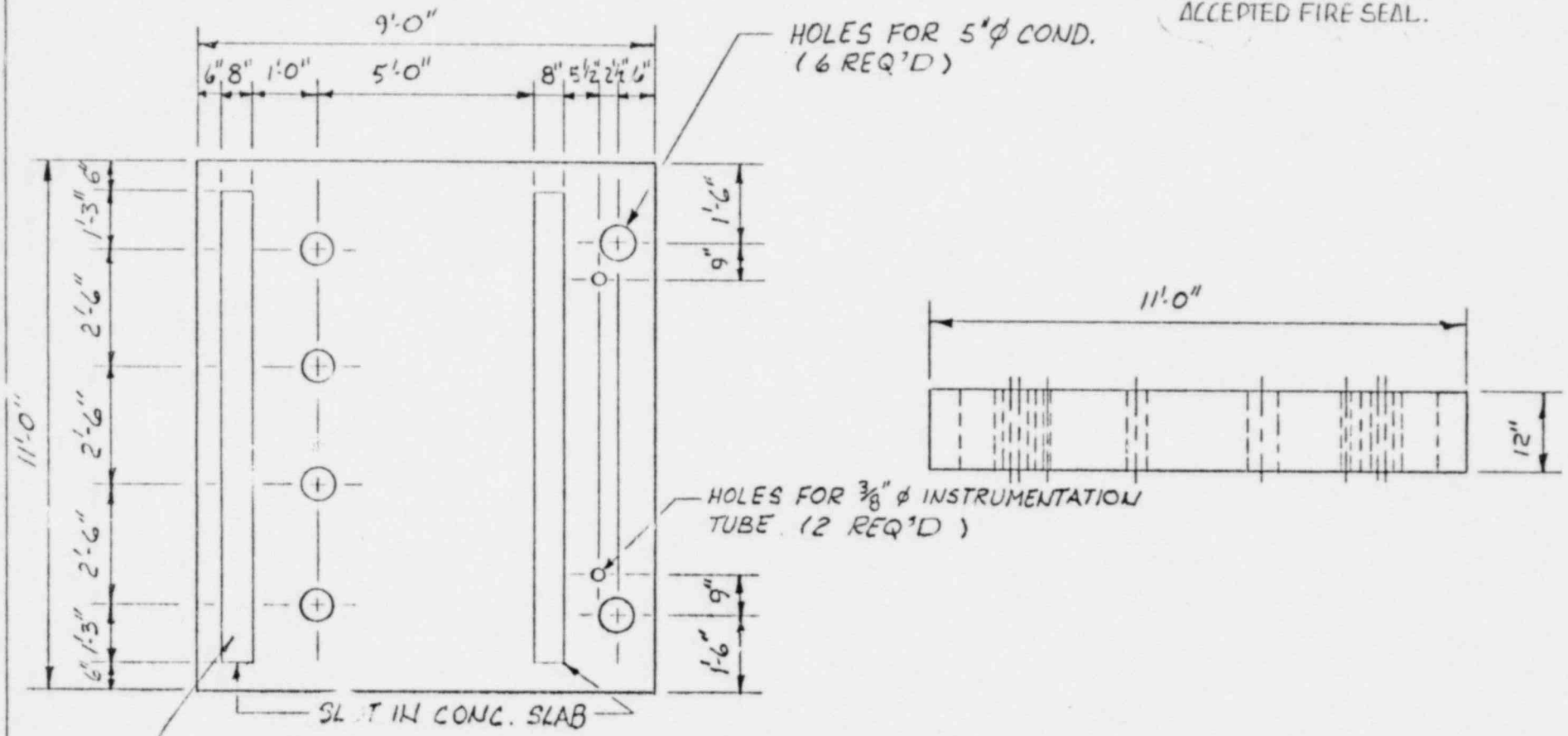
4.0 INSTALLATION OF JUNCTION BOX ASSEMBLY

1) Install junction box and conduit assembly as shown on drawing FDSG-D12 contained in this Appendix.

5.0 Test assembly shall be sufficiently secured to the top of the slab. The system used for this shall be at the discretion of the testing laboratory.

NOTE:

ALL SLAB PENTRATIONS SHALL BE SEALED WITH AN ANI ACCEPTED FIRE SEAL.



REFER TO DRAWING FDSG-D2 FOR TRAY SPACING DETAIL BOTH SLOTS.

TEXAS UTILITIES SERVICES, INC. C.P.S.E.S. GLEN ROSE, TEXAS							
FIRE PROTECTION TEST FOR CONDUITS, CABLE TRAYS, INSTRUMENTATION TUBING, & SUPPORTS							
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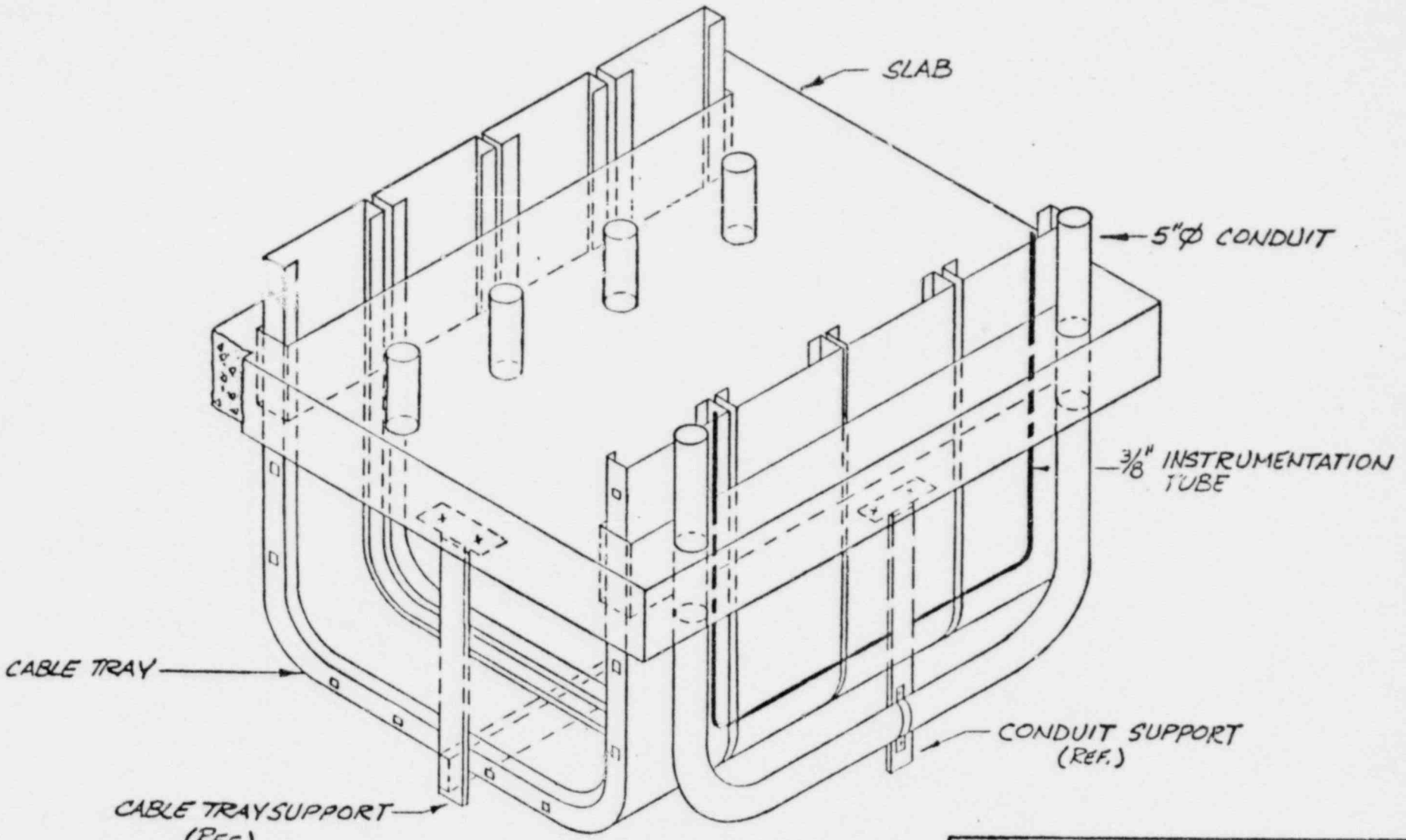
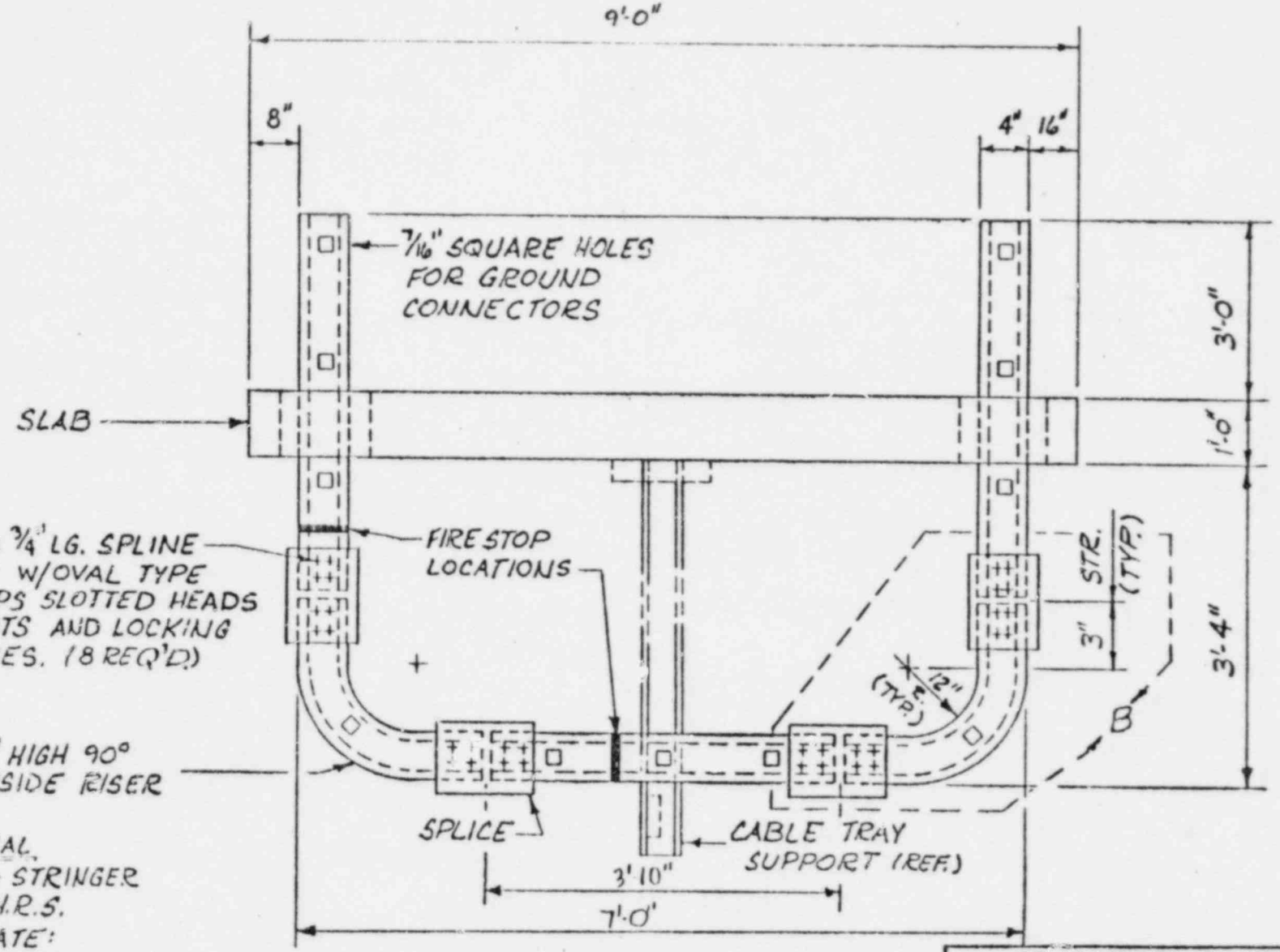
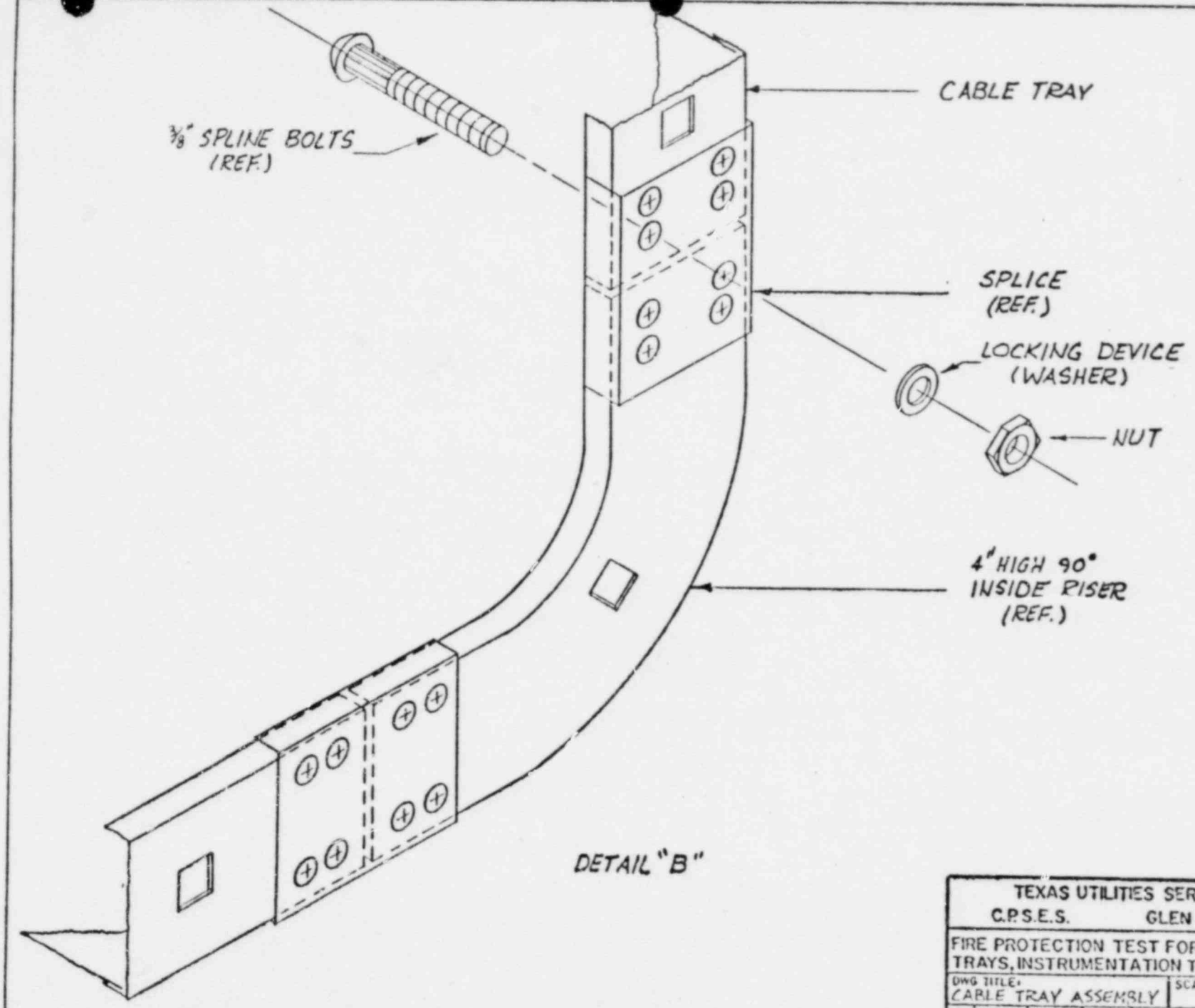


TEXAS UTILITIES SERVICES, INC.						
C.P.S.E.S. GLEN ROSE, TEXAS						
FIRE PROTECTION TEST FOR CONDUITS, CABLE TRAYS, INSTRUMENTATION TUBING, & SUPPORTS						
DWG TITLE: TEST ASSEMBLY				SCALE: NONE		
Δ	DATE: 5-2-78	DWN: RAD	CKD: MJP	APPD: [illegible]	ISSUED FOR CONSTRUCTION	DWG NO. FDSG-D7



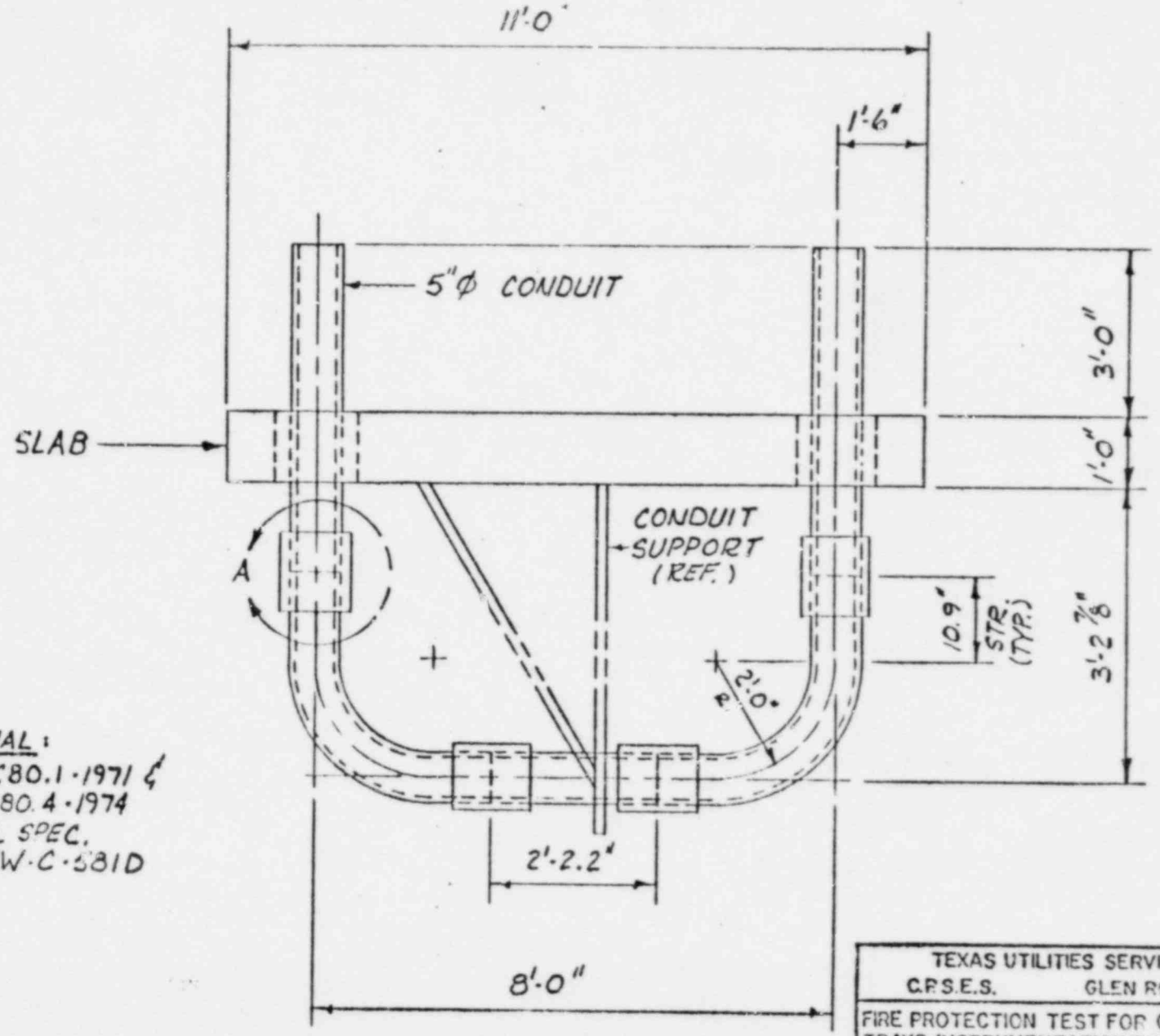
MATERIAL,
ELBOW - STRINGER
#14 GA. H.R.S.
BED PLATE:
18 CR #22 GA
STRAIGHT LENGTH:
STRINGER #16 GA. CRS,
BEDPLATE: #22 GA. CRS.

TEXAS UTILITIES SERVICES, INC. C.P.S.E.S. GLEN ROSE, TEXAS						
FIRE PROTECTION TEST FOR CONDUITS, CABLE TRAYS, INSTRUMENTATION TUBING, & SUPPORTS						
DWG TITLE: CABLE TRAY ASSEMBLY				SCALE: NONE		
6	DATE: 5-26-81	DWN RAD	CKD MJP	APPD	ISSUED FOR CONSTRUCTION	DWG NO. FD-SG-08



DETAIL "B"

TEXAS UTILITIES SERVICES, INC: C.P.S.E.S. GLEN ROSE, TEXAS							
FIRE PROTECTION TEST FOR CONDUITS, CABLE TRAYS, INSTRUMENTATION TUBING, & SUPPORTS							
DWG TITLE: CABLE TRAY ASSEMBLY					SCALE: NONE		
0	DATE: 5-24-81	DWN RAD	CKD MJP	APP'D VT	ISSUED FOR CONSTRUCTION	DWG NO. FDSG-D9	



MATERIAL:

1. ANSI C80.1-1971 & C80.4-1974
2. FEDERAL SPEC. WW-C-581D

TEXAS UTILITIES SERVICES, INC. C.P.S.E.S. GLEN ROSE, TEXAS							
FIRE PROTECTION TEST FOR CONDUITS, CABLE TRAYS, INSTRUMENTATION TUBING, & SUPPORTS							
DWG TITLE: CONDUIT + CPLING ASSEMBLY					SCALE: NONE		
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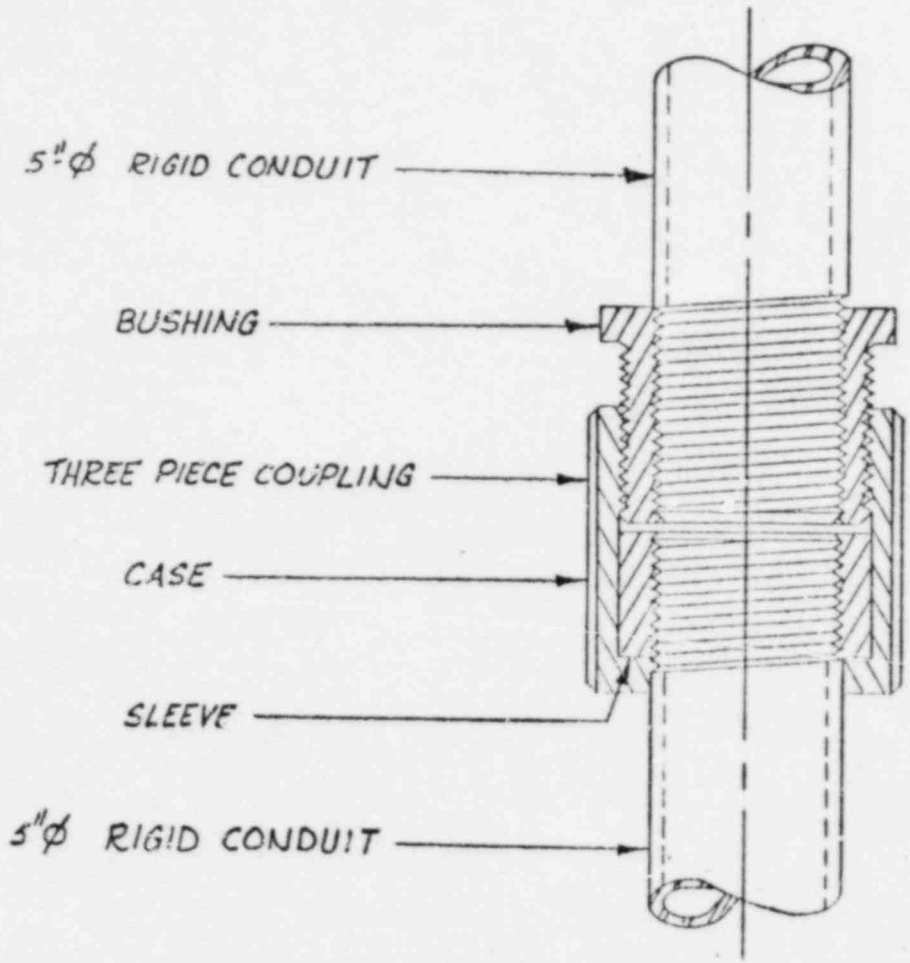
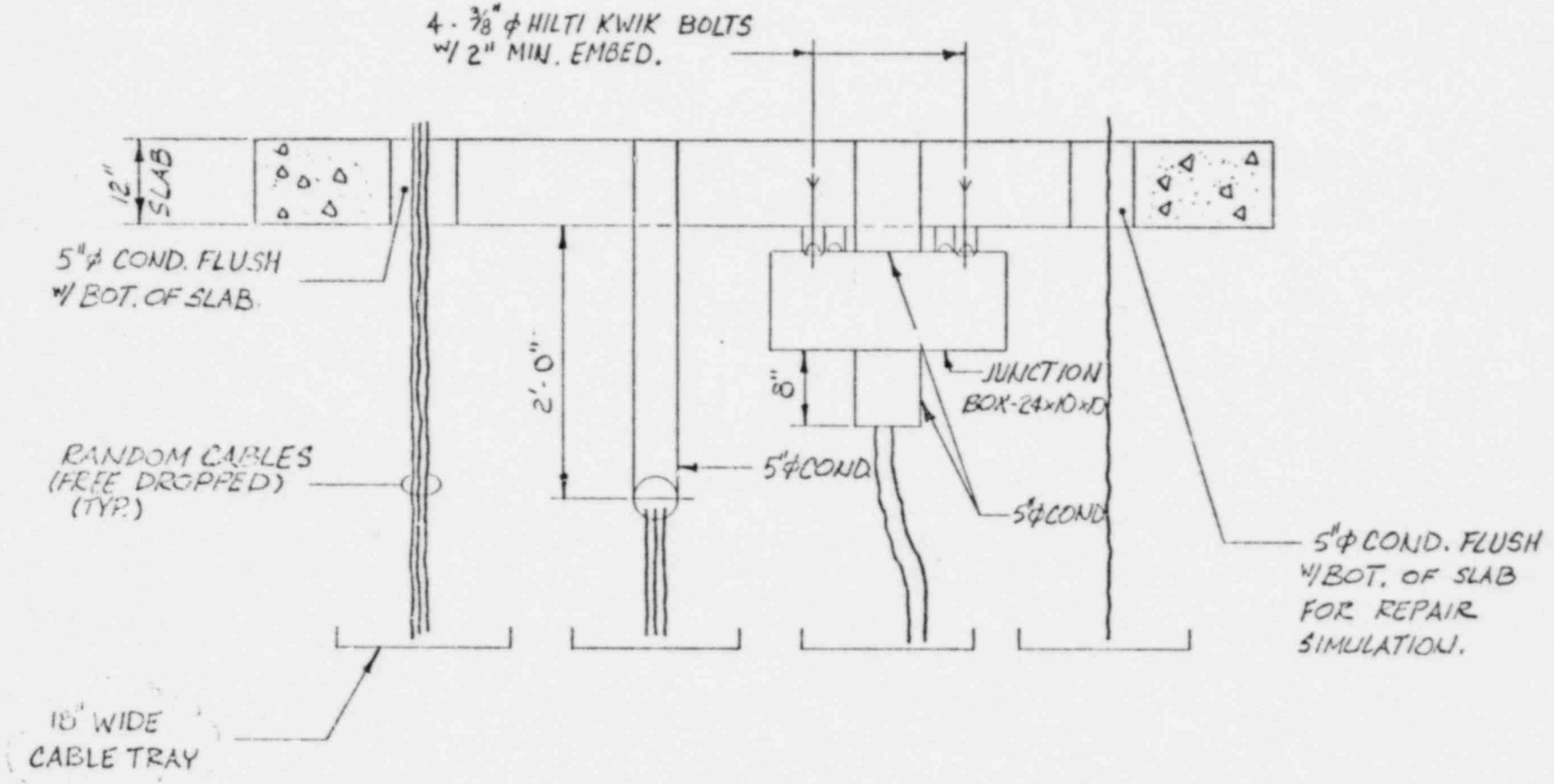


DETAIL - "A"

TEXAS UTILITIES SERVICES, INC. C.P.S.E.S. GLEN ROSE, TEXAS	
FIRE PROTECTION TEST FOR CONDUITS, CABLE TRAYS, INSTRUMENTATION TUBING, & SUPPORTS	
DWG TITLE: CONDUIT + CPLING ASSEMBLY	SCALE: NONE
A DATE: 2/6/81 DWN: PAD CHD: MJP APPD: [illegible] ISSUED FOR CONSTRUCTION	DWG NO. FDSG-011



TEXAS UTILITIES SERVICES, INC. C.P.S.E.S. GLEN ROSE, TEXAS						
FIRE PROTECTION TEST FOR CONDUITS, CABLE TRAYS, INSTRUMENTATION TUBING, & SUPPORTS						
DWG TITLE: AIR DROP CABLE ASSEMBLY				SCALE: NONE		
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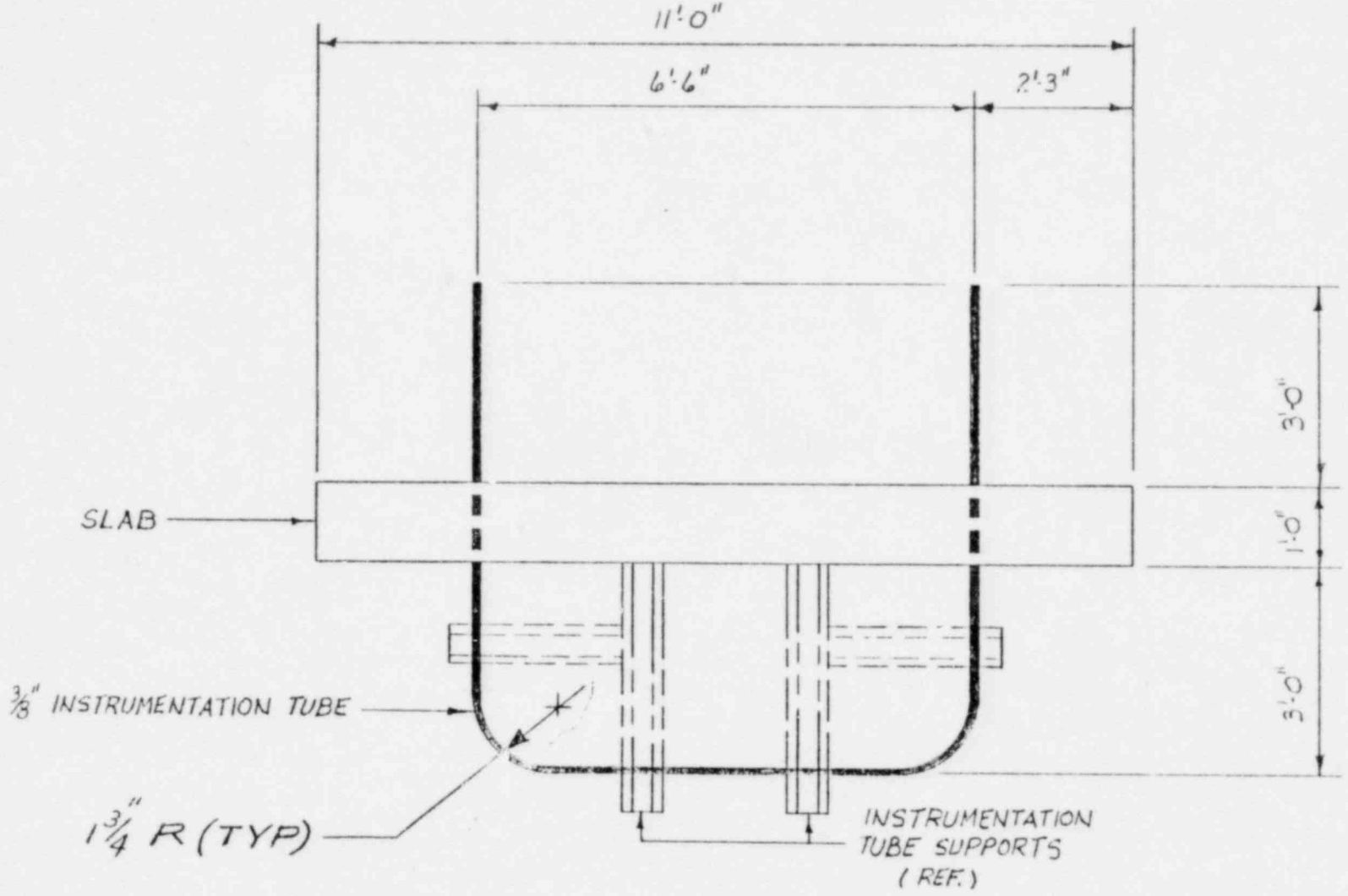


TEXAS UTILITIES SERVICES, INC. C.P.S.E.S. GLEN ROSE, TEXAS						
FIRE PROTECTION TEST FOR CONDUITS, CABLE TRAYS, INSTRUMENTATION TUBING, & SUPPORTS						
DWG TITLE: INST. TUBING ASSEMBLY				SCALE: NONE		
1	DATE: 7-7-81	DWN: KAD	CK'D: MJP	APP'D: [illegible]	ISSUED FOR CONSTRUCTION	DWG NO. FDS-D-P

APPENDIX 4

CABLE INSTALLATION

APPENDIX 4
CABLE INSTALLATION

1.0 PRECAUTIONS FOR CABLE INSTALLATION

(a) Cables shall be handled with care during installation and protected from abrasion or other damage due to pulling over rough surfaces or obstruction with sharp edges.

(b) Select proper cable type and quantity as specified in Tables FDSG-T1 thru FDSG-T4, contained in this appendix.

(c) Quality Control personnel shall be present for cable installation.

(d) Raceway shall be free of debris, oil and sharp edges.

(e) Raceway shall be adequately supported for cable pulling activity.

1.1 CABLE INSTALLATION PROCEDURES

1) Refer to Tables FDSG-T1 through FDSG-T4 contained in this Appendix, for types and quantities of cable to be routed.

2) Drill holes in solid back cable tray segments to permit securing cables to tray. Drill holes subject to the following limitations:

   (a) Holes shall be ¼" diameter.
   (b) Holes shall be at a minimum spacing of 2".
   (c) Holes drilled shall be minimized.

   Drill holes at the following intervals:

   Six to eight foot intervals in horizontal trays not more than four feet in vertical trays.

3) Cables shall be tied in convenient sized bundles, randomly placed in cable trays and secured at the above specified intervals. Cable ties shall be nylon ties, representative of those used at CPSES.

4) Pull cables through conduit assembly in bundles of convenient size. Cables shall be pulled through conduit randomly.

5) Air drop cables to be tested shall be pulled through slab penetration, rather than be tied to the vertical run as detailed in drawing FDSG-D12, contained in Appendix 3.

6) Document locations of all cables within test configurations to be included with data to be evaluated by testing laboratories.

APPENDIX 4
TABLE FDSG-TI
CABLE DISTRIBUTION FOR 40% FILL OF
A CABLE TRAY

CABLE FUNCTION	CABLE TYPE	CABLE SIZE	QUANTITY	LENGTH
Power	W-008	1/C 750 MCM	1	30 ft.
Power	W-709	1/C 500 MCM	1	30 ft.
Power	W-710	1/C 350 MCM	1	30 ft.
Power	W-211	1/C 4/0 AWG	1	30 ft.
Power	W-012	4/0 Triplex	1	30 ft.
Power	W-713	2/0 Triplex	1	30 ft.
Power	W-715	# 2 Triplex	1	30 ft.
Power	W-116	2/C # 2 AWG	1	30 ft.
Power	W-017	3/C # 4 AWG	1	30 ft.
Power	W-220	3/C # 6 AWG	1	30 ft.
Power	W-221	2/C # 6 AWG	1	30 ft.
Power	W-123	3/C # 8 AWG	1	30 ft.
Power	W-124	2/C # 8 AWG	1	30 ft.
Control	W-141	4/C # 10 AWG	6	30 ft.
Control	W-045	12/C # 12 AWG	7	30 ft.
Control	W-046	9/C # 12 AWG	6	30 ft.
Control	W-047	7/C # 12 AWG	6	30 ft.
Control	W-048	5/C # 12 AWG	6	30 ft.
Control	W-850	3/C # 13 AWG	7	30 ft.
Instrumentation	W-061	12 Shielded Twisted Pairs # 16 AWG	3	30 ft.
Instrumentation	W-062	6 Shielded Twisted Pairs # 16 AWG	2	30 ft.
Instrumentation	W-263	4 Shielded Twisted Pairs # 16 AWG	2	30 ft.
Instrumentation	W-264	2 Shielded Twisted Pairs # 16 AWG	2	30 ft.

APPENDIX 4
TABLE FDSG -TI
CABLE DISTRIBUTION FOR 40% FILL OF
A CABLE TRAY (con't)

CABLE FUNCTION	CABLE TYPE	CABLE SIZE	QUANTITY	LENGTH
Instrumentation	W-069	22/C # 16 AWG with overall shield	2	30 ft.
Instrumentation	W-071	5/C # 16 AWG with overall shield	2	30 ft.
Instrumentation	W-076	6 Twisted pair # 16; 1 Twisted pair # 14; 2 # 16 drain wire	2	30 ft.
Instrumentation	W-081	7 shielded twisted triads	2	30 ft.

APPENDIX 4
TABLE FDSG-T2
CABLE DISTRIBUTION FOR A LIGHTLY LOADED
(SINGLE LAYER) CABLE TRAY

CABLE FUNCTION	CABLE TYPE	CABLE SIZE	QUANTITY	LENGTH
Power	W-?10	1/c 350 MCM	1	30 ft.
Power	W-211	1/c 4/o AWG	1	30 ft.
Power	W-012	4/o Triplex	1	30 ft.
Power	W-713	2/o Triplex	1	30 ft.
Power	W-116	2/c # 2 AWG	1	30 ft.
Power	W-220	2/c # 6 AWG	1	30 ft.
Power	W-123	3/c # 8 AWG	1	30 ft.
Control	W-141	4/c # 10 AWG	1	30 ft.
Control	W-045	12/c # 12 AWG	1	30 ft.
Control	W-046	9/c # 12 AWG	1	30 ft.
Control	W-047	7/c # 12 AWG	1	30 ft.
Control	W-048	5/c # 12 AWG	1	30 ft.
Control	W-850	3/c # 12 AWG	1	30 ft.
Instrumentation	W-061	12 Shielded twisted pairs # 16 AWG	1	30 ft.
Instrumentation	W-062	6 Shielded twisted pairs # 16 AWG	1	30 ft.
Instrumentation	W-263	4 Shielded twisted pairs # 16 AWG	1	30 ft.
Instrumentation	W-264	2 Shielded twisted pairs # 16 AWG	1	30 ft.
Instrumentation	W-069	22/c # 16 AWG with overall shield	1	30 ft.
Instrumentation	W-071	5/c # 16 AWG with overall shield	1	30 ft.
Instrumentation	W-076	6 twisted pairs # 16; 1 twisted pair # 14; 2 # 16 drain wire	1	30 ft.
Instrumentation	W-081	7 shielded twisted triads	1	30 ft.

APPENDIX 4
FDSG-T3
CABLE DISTRIBUTION FOR 40% FILL
OF A 5" CONDUIT

CABLE FUNCTION	CABLE TYPE	CABLE SIZE	QUANTITY	LENGTH
Power	W-008	1/C 750 MCM	1	30 ft.
Power	W-709	1/C 500 MCM	1	30 ft.
Power	W-124	2/C # 8 AWG	1	30 ft.
Control	W-045	12/C # 12 AWG	3	30 ft.
Control	W-046	9/C # 12 AWG	2	30 ft.
Control	W-047	7/C # 12 AWG	1	30 ft.
Control	W-048	5/C # 12 AWG	1	30 ft.
Instrumentation	W-061	12 Shielded Twisted pairs # 16 AWG	1	30 ft.
Instrumentation	W-062	6 Shielded Twisted pairs # 16 AWG	1	30 ft.
Instrumentation	W-263	4 Shielded Twisted pairs # 16 AWG	1	30 ft.
Instrumentation	W-264	2 Shielded Twisted pairs # 16 AWG	2	30 ft.

APPENDIX C
TABLE FDSG-T4
CABLES TO BE AIR DROPPED*

A) CABLES TO BE AIR DROPPED INTO 40% FILL LADDER BACK TRAY

CABLE FUNCTION	CABLE TYPE	CABLE SIZE	QUANTITY
Power	W-715	#2 Triplex	1
Control	W-046	9/C # 12 AWG	1

B) CABLES TO BE AIR DROPPED INTO 40% FILL SOLID BACK TRAY

CABLE FUNCTION	CABLE TYPE	CABLE SIZE	QUANTITY
Power	W-123	3/C # 8 AWG	1
Control	W-045	12/C # 12 AWG	1
Instrumentation	W-061	12 Shielded twisted pairs, # 16 AWG	1

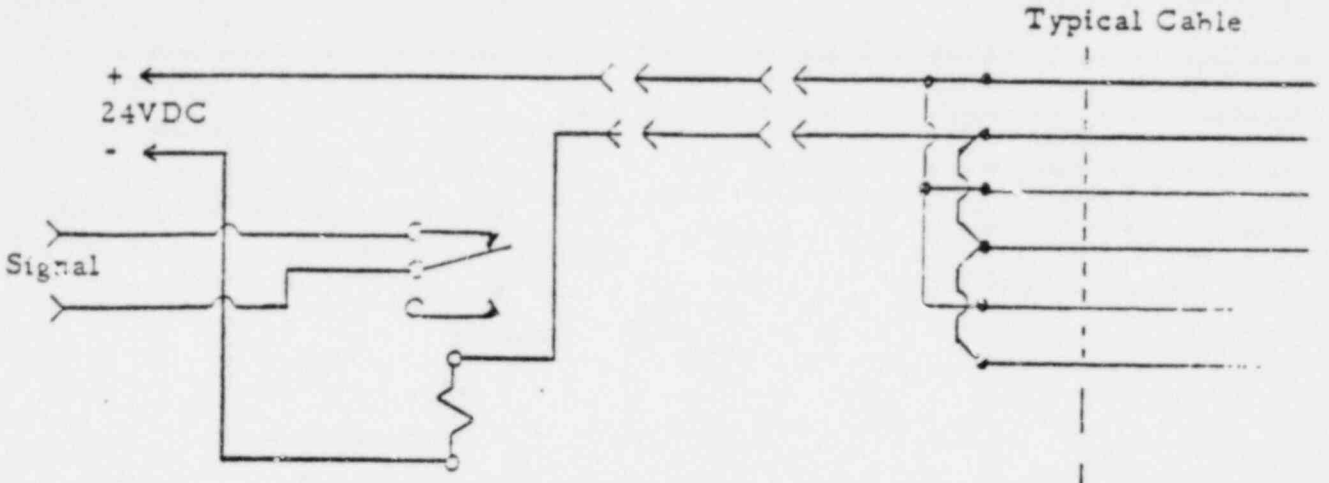
C) CABLES TO BE AIR DROPPED INTO LIGHTLY LOADED LADDER BACK TRAY

CABLE FUNCTION	CABLE TYPE	CABLE SIZE	QUANTITY
Power	W-116	2/C # 2 AWG	1
Control	W-850	3/C # 12 AWG	1
Instrumentation	W-081	Shielded twisted triads	1

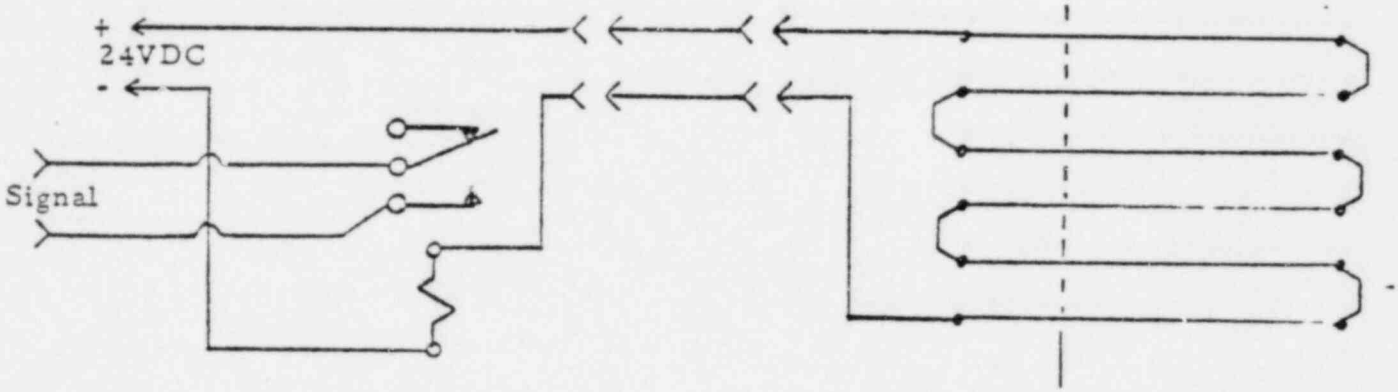
D) CABLES TO BE AIR DROPPED INTO LIGHTLY LOADED SOLID BACK TRAY

CABLE FUNCTION	CABLE TYPE	CABLE SIZE	QUANTITY
Power	W-220	2/C # 6 AWG	1

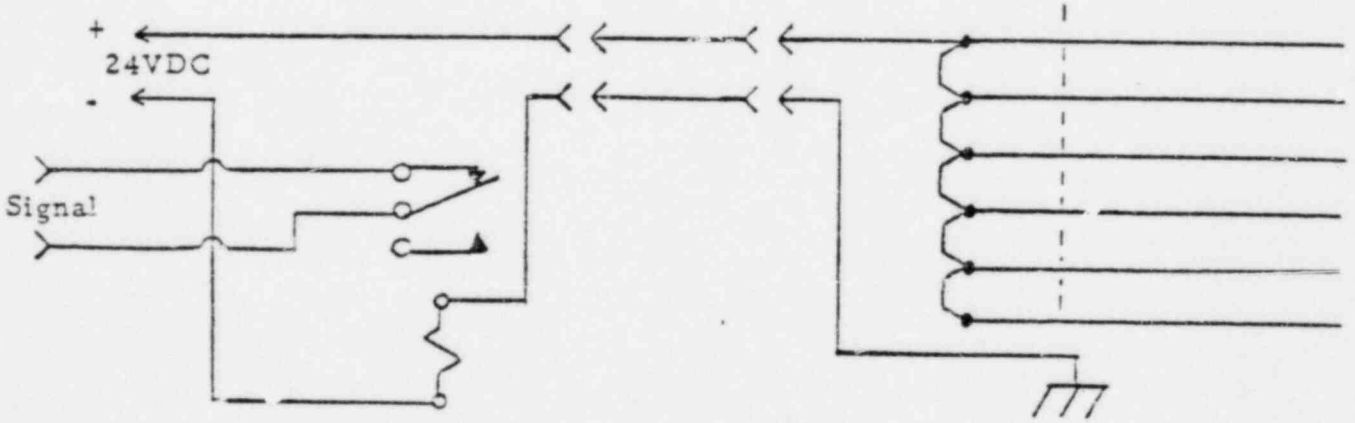
* THESE CABLES SHALL DROP THROUGH THE SLAB PENETRATION AND ENTER THE HORIZONTAL SECTION OF TRAY. THESE CABLES ARE NOT IN ADDITION TO CABLES IDENTIFIED IN TABLES FDSG-T1 and T2. THESE CABLES ARE A PART OF THE REQUIRED FILL FOR THE CABLE TRAYS.



A - Typical Circuit to Circuit Monitoring Channel



B - Typical Circuit to Systsm Monitoring Channel



C - Typical Circuit to Ground Monitoring Channel

Figure FDSG-F2 Cable Integrity Monitoring Circuits

APPENDIX 5

THERMOCOUPLE INSTALLATION

APPENDIX 5
THERMOCOUPLE INSTALLATION

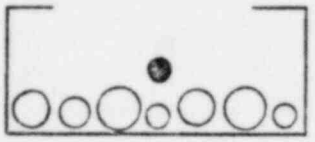
1.0 THERMOCOUPLE INSTALLATION

1.1 GENERAL

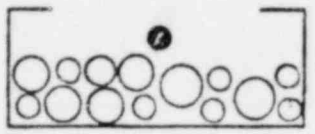
Prior to seal and coating installation, thermocouples will be embedded into the cable bundles and coatings to provide the test engineer with an identification of the conditions during the fire exposure test.

1.2 TEST ASSEMBLIES

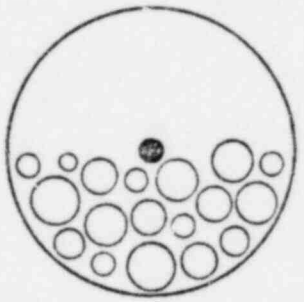
All test assemblies will contain one string of thermocouples located inside the assembly, among the cables at twelve (12) inch intervals.
Refer to drawing FDSG-D14 contained in this appendix for a pictorial representation of thermocouple locations.



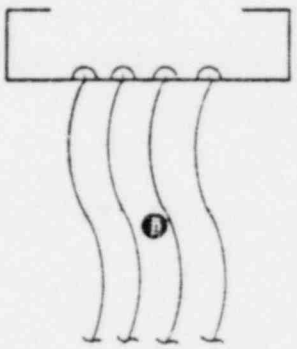
THERMOCOUPLE LOCATION FOR LIGHTLY LOADED TRAY



THERMOCOUPLE LOCATION FOR 40% TRAY FILL.

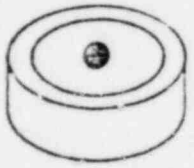


THERMOCOUPLE LOCATION FOR CONDUIT



THERMOCOUPLE LOCATION FOR FREE DROP CABLE

NOTE:
THERMOCOUPLES SHALL BE INSTALLED AT ONE FOOT INTERVALS.



THERMOCOUPLE LOCATION FOR INSTRUMENT TUBING

TEXAS UTILITIES SERVICES, INC.
C.P.S.E.S. GLEN ROSE, TEXAS

FIRE PROTECTION TEST FOR CONDUITS, CABLE TRAYS, INSTRUMENTATION TUBING, & SUPPORTS

DWG TITLE: THERMOCOUPLE LOCATION

DATE	DWN	CKD	APVD	SCALE	ISSUED FOR
6 25 81	EAD	MJP		NONE	CONSTRUCTION

DWG NO. ED53-004

APPENDIX 6
PRODUCT TECHNICAL INFORMATION
AND
PRODUCT APPLICATION AND REPAIR PROCEDURES

SECTION 1: PRODUCT DATA SHEETS

SECTION 2: ASTM-E84 TEST UL DOCUMENTATION

SECTION 3: PRODUCT APPLICATION AND REPAIR PROCEDURES

SECTION 1: PRODUCT DATA SHEETS

APPENDIX 6

TECHNICAL INFORMATION

THERMO-LAG STRESS SKIN TYPE 330-69
DATA SHEET

PRODUCT DESCRIPTION:

THERMO-LAG Stress Skin type 330-69 is comprised of an open weave, self stiffened steel mesh used to provide an enclosure over conduits, cable trays, and air dropped cables and provide an easily accessible refurbishment of surfaces which possess adequate characteristics to receive the THERMO-LAG 330-1 Subliming Material System.

THERMO-LAG Stress Skin Type 330-69 is inherently resistant to differential thermal expansion, thermal stress, flutter, vibration and other type of loading - potentially resultant from earthquake conditions.

PHYSICAL PROPERTIES:

THERMO-LAG Stress Skin Type 330-69 shall be comprised of an open weave, self stiffened steel mesh to meet the following characteristics:

Strand Diameter:	0.019 inches minimum
Mesh Size:	64 Holes/sq. in. minimum
Weight/Sq Yd:	1.75 pounds/Sq. Yd. minimum

Type "V" Stiffeners dimensions:

Height:	.29 $\pm$ 0.04 inches
Base:	.29 $\pm$ 0.04 inches
Distance Between:	6 $\pm$ 1 inches

CHEMICAL PROPERTIES:

THERMO-LAG Stress Skin Type 330-69 is chemically treated to provide reliable long lasting corrosion inhibiting environment.

APPENDIX 6
TECHNICAL INFORMATION

THERMO-LAG STRESS SKIN TYPE 330-69

DATA SHEET CONTINUED

BASIC USE:	THERMO-LAG Stress Skin Type 330-69 shall be installed in such a manner as to provide a complete and continuous wrap over all areas to receive the THERMO-LAG 330-1 Subliming Material System, with the exception of junction boxes and structural support entities.
SURFACE PREPARATION:	Prior to use, the substrate should be clean, free of loose dirt, grease and other contaminants. No special surface preparation is required.
METHOD OF APPLICATION:	Best results are obtained if each individual length of each individual section does not exceed 10 feet. Each section should overlap each preceding section by at least 6 inches or fastened to the preceding and following section by a flange facsimile having a 1 inch lip, minimum. Circumferentially, two sections are preferred. The skin shall be tight and all flanges and butt joints properly fastened. The sections should be secured to each other by using a stapler plier equipped with a reverse clinch. The stapler wire must have a minimum thickness of 0.019 inches and a width of 0.050 inches. The maximum distance between staples should be 6 inches.

APPENDIX 6
TECHNICAL INFORMATION

THERMO-LAG 330-1 SUBLIMING COMPOUND

DATA SHEET

PRODUCT DESCRIPTION:	THERMO-LAG 330-1 is a water based, fireproofing, thermally activated, subliming and insulative coating. When exposed to flame, the material volatizes at fixed temperatures; exhibits a small volume increase through formation of a multi-cellular matrix; absorbs and blocks heat to protect the substrate material.
TYPE:	THERMO-LAG 330-1 Subliming Compound
COLOR:	Antique White
FINISH:	Textured
OUTSTANDING FEATURES:	Ease of Application Excellent exterior and interior durability No flash point or fire hazard Chemical Resistance No asbestos Rugged

COMPOSITION AND PHYSICAL PROPERTIES:

SOLVENT?	WATER
Net Weight/gallon lbs/gal	10.5 ± 0.5
Non volatile	66 Min.
Flash Point	None
Consistency	Semi-solid, paste-like
Warranted Shelf Life	6 Months
Storage Conditions	Above 32°F and Below 100°F

APPENDIX 6
TECHNICAL INFORMATION

THERMO-LAG 330-1 SUBLIMING COMPOUND

DATA SHEET CONTINUED

BASIC USE:

THERMO-LAG 330-1 is applied to cable trays, cable drop and junction box assemblies, structural steel, support structures, containment vessels, tank cars, and other similiar entities. THERMO-LAG 330-1 is applied to protect the substrate against loss of structural stength and accessing temperatures during exposure to fire. One and multiple hour fire ratings can be provided as determined by test utilizing the ASTM E-119 time - temperature environment, hydrocarbon or chemical fire environments.

THERMO-LAG 330-1 Subliming Compound has also been tested per ASTM E84 Standards by an independent testing laboratory and will have a:

Flame Spread	2.9
Fuel Contributed	0
Smoke Developed	12.9

COATING THICKNESS:

The coating thickness is a function of the specific weight of the steel to be protected. The heavier the steel, the thinner the coating required for a given fire endurance rating (Specific film thicknesses are recommended by the architect or owner.)

PACKAGED:

55 gallon drums approximately 500 net lbs. THERMO-LAG 330-1 Subliming Compound is supplied in containers bearing Underwriters Laboratories labels.

STORAGE CONDITIONS:

Store above 32°F and below 100°F.

APPENDIX 6
TECHNICAL INFORMATION

THERMO-LAG 330-1 SUBLIMING COMPOUND

DATA SHEET CONTINUED

SURFACE PREPARATION:	1. Surface must be clean, dry and free from contaminants including oil, grease and scale prior to application. 2. THERMO-LAG 351 Primer should be used as and where required.
MIXING:	Material should be stirred to a homogeneous consistency prior to application.
TEMPERATURE/HUMIDITY:	THERMO-LAG 330-1 Subliming Compound shall be applied in conformance with good painting practices. The surface shall be dry, above 40°F and below the dew point.
METHOD OF APPLICATION:	May be applied by airless spray or by troweling.
RECOMMENDED SPRAY EQUIPMENT:	For spray application direct from the shipping container, air-ram (45:1 compression ratio) extrusion pump, airless spray equipment should be used.
CLEAN UP:	Water

APPENDIX 6
TECHNICAL INFORMATION

THERMO-LAG 330-70 CONFORMABLE CERAMIC INSULATOR

DATA SHEET

PRODUCT DESCRIPTION:

THERMO-LAG 330-70 Conformable Ceramic Insulator is a strong light weight, flexible ceramic blanket. It is manufactured from long ceramic fibers. There are no binders added to the THERMO-LAG 330-70 Conformable Ceramic Insulator. It is a highly efficient material having low specific heat, excellent resistance to thermal and mechanical shock.

PHYSICAL PROPERTIES:

Color:	White
*Continuous Use Limit:	1260°C(2300°F)
Melting Point:	1760°C(3200°F)
Fiber Diameter:	2-3 microns(mean)
Specific Heat at 1093°C(2000°F):	1130 J/kg°C(.27 Btu/lb/°F)
Specific Gravity:	2.73 g/cm3

*The Continuous Use Limit is determined by irreversible linear change criteria not product melting point.

APPENDIX 6
TECHNICAL INFORMATION

THERMO-LAG 330-70 CONFORMABLE CERAMIC INSULATOR

DATA SHEET CONTINUED

CHEMICAL PROPERTIES:

Aluminum Oxide:	48.0%	Silicone Dioxide:	51.8%
Iron Oxide:	0.04%	Titanium Dioxide:	0.002%
Magnesium Oxide:	0.01%	Calcium Oxide:	0.02%
Sodium Oxide:	0.1%		
Leachable Chlorides:	Less Than 10 ppm		

BASIC USE: THERMO-LAG 330-70 Conformable Ceramic Insulator is used for insulation enhancement of temperature sensitive components and is designed to provide equal compatibility, efficiency and greater heat resistance when used in concert with THERMO-LAG 330-1 Subliming Material System.

SURFACE PREPARATION: No special surface preparation is required.

METHOD OF APPLICATION: THERMO-LAG 330-70 Conformable Ceramic Insulator shall be wrapped in such a manner as to be complete and continuous with no gaps or holes. When the application of the THERMO-LAG Stress Skin Type 330-69 and THERMO-LAG 330-70 Conformable Ceramic Insulator is complete, a "cacoon" effect should be present.

STORAGE: THERMO-LAG 330-70 Conformable Ceramic Insulator should be kept in its containers sealed when not in use. Store off the ground.

THERMO-LAG 350

TWO PART WATER BASED SPILL RESISTANT TOPCOAT

DATA SHEET

PRODUCT DESCRIPTION:	THERMO-LAG 350 Water Based Spill Resistant Topcoat is a two component formulation designed to provide chemical and corrosion resistance to protect against abrasion, moisture, corrosive fumes and chemical contact.
PHYSICAL PROPERTIES:	
Color:	White
Finish:	Gloss
Solids by Volume:	34.0 ± 1.0% Mixed
Theoretical Coverage:	50 Sq. Ft Per Gallon
Mixing Ratio By Volume:	Part A - 4 To Part B - 1
Net Weight per Gallon:	10.93 ± 0.20 lbs (Mixed)
Storage Temperature:	Minimum - 35°F Maximum - 120°F Protect from freezing. In cold weather, store materials inside above 60°F until use.
Shelf Life:	6 Months at recommended storage temperatures.
Flash Point (Seta):	Part A - above 200°F Part B - above 135°F
Pot Life:	10 hours at 60°F 8 hours at 77°F 4 hours at 100°F
Surface Temperature:	Minimum - 60°F Maximum - 120°F
Thinning:	Use clean water. For air spray thin up to 10%; airless spray, brush or roller, up to 5%.

APPENDIX 6
TECHNICAL INFORMATION

THERMO-LAG 350

TWO PART WATER BASED SPILL RESISTANT TOPCOAT

DATA SHEET CONTINUED

CHEMICAL RESISTANCE:

FREQUENT CONTACT	OCCASIONAL CONTACT	
Alkali Solutions	Fresh Water	Organic Acids
Alcohols	Waste Water	Mineral Acids
Aliphatic Hydrocarbons	Mineral Oils	Oxidizing Agents
Aromatic Hydrocarbons	Vegetable Oils	Ketones
Salt Solutions		

BASIC USE:

Especially formulated to provide compatibility when used in the THERMO-LAG 330-1 Subliming Material System. THERMO-LAG 350 Two Part Water Based Spill Resistant Topcoat provides excellent protection against water flow, climatic variations, chemical attack and physical abuse. This material has been tested in accord with ASTM E84 Standards by an independent testing laboratory and will provide a:

Flame Spread: 5
Fuel Contributed: 0
Smoke Developed: 0

PACKAGED:

5 Gallon Kits consisting of one short filled 5 gallon pail of Part A and a one gallon can of Part B.

APPENDIX 6
TECHNICAL INFORMATION

THERMO-LAG 350

TWO PART WATER BASED SPILL RESISTANT TOPCOAT

DATA SHEET CONTINUED

SURFACE PREPARATION:

The surface should be clean, free of loose and foreign contaminants and dry: at least 5°F above the dew point. Coating will not cure below minimum surface temperature.

Moisture meter readings, using a Delmhorst Moisture Meter, Model DP must be taken and readings of 20 or less must be obtained prior to the topcoat being applied.

MIXING:

Stir contents of Part A, making sure no pigment remains on the bottom of the pail. Add Part B (1 gallon container) to Part A (5 gallon pail). Mix with a power mixer until the two components are thoroughly blended. Do not use mixed material beyond pot life limits.

METHOD OF APPLICATION:

Application can be made by spray, roller or brushing. A criss/cross application technique is recommended to help achieve pin-hole free coverage.

APPLICATION EQUIPMENT:

Brush:

Use Nylon or synethetic bristle brushes.

Rollers:

Use short nap synthetic rollers for smooth surfaces.
Use long nap synethetic rollers for rough surfaces.

APPENDIX 6
TECHNICAL INFORMATION

THERMO-LAG 350

TWO PART WATER BASED SPILL RESISTANT TOPCOAT

DATA SHEET CONTINUED

APPLICATION EQUIPMENT:

For Air Spray:

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss MBC or JGA or equal	E	2 or 78	5/16" or 3/8"	3/8" or 1/2"	75-100 psi	10-20 psi

NOTE: Low ambient temperature applications or longer hoses require higher pot pressure.

For Airless Spray:

Tip Orifice	Atomizing Pressure	Material Hose ID	Manifold Filter
0.015" to 0.019"	2700-3000 psi	1/4" or 3/8"	60 mesh

NOTE: Use appropriate tip and atomizing pressure for equipment, applicator technique and weather conditions.

DRYING TIME AT 75°F: THERMO-LAG 350 Two Part Water Based Spill Resistant Topcoat dries to touch in approximately 1 hour; to handle in approximately 5 hours. Allow to dry for at least seven days before exposure to immersion service. Drying time will vary on ambient temperatures and relative humidity.

CLEAN UP: Clean all equipment immediately after use with water, followed by a final washing with xylol or No. 8 Thinner.

SECTION 2: ASTM-E84 TEST UL DOCUMENTATION

ASTM-E-84 TEST DOCUMENTATION

CONFORMABLE CERAMIC INSULATOR

UL TESTED AND LISTED SEPT. 1979

UL FILE NO. R8418

PROJECT NO. 79NK1036

FLAME SPREAD	0
FUEL CONTRIBUTED	0
SMOKE DEVELOPED	0

ASTM-E-84 TEST DOCUMENTATION

THERMO LAG 330-1 SUBLIMING COMPOUND

UL TESTED AND LISTED JUNE 16, 1981

UL FILE NO. R6076

PROJECT NO. 81NK3238

FLAME SPREAD	5
FUEL CONTRIBUTED	0
SMOKE DEVELOPED	15

SECTION 3: PRODUCT APPLICATION AND REPAIR PROCEDURES

APPENDIX 6

THERMO-LAG 330-1

SUBLIMING MATERIAL SYSTEM

APPLICATION PROCEDURES

TABLE OF CONTENTS

APPENDIX 6

THERMO-LAG 330-1

SUBLIMING MATERIAL SYSTEM

APPLICATION PROCEDURES

LIST OF FIGURES

INTRODUCTION

This material application guide delineates the minimum acceptable standards for the application of the THERMO-LAG 330-1 Subliming Material System to cable trays, conduits, cable drops, junction box assemblies and other fittings, structural steel, support structures and other similar entities.

The THERMO-LAG 330-1 Subliming Material System intended for this application consists of THERMO-LAG Stress Skin Type 330-69, THERMO-LAG 330-1 Subliming Coating, THERMO-LAG 330-70 Conformable Ceramic Insulator and THERMO-LAG 350 Two Part Water Based Spill Resistant Topcoat.

The application of the product for the test articles shall be performed by TSI Inc. and/or B&B Insulation Inc. The application of the product at the facility shall be performed by an applicator such as B&B Insulation Inc., or Brown & Root. Training of the applicator shall be performed and documented by TSI Inc.

THERMO-LAG 330-1 SUBLIMING MATERIAL SYSTEM

APPLICATION PROCEDURES

1.0 THERMO-LAG STRESS SKIN TYPE 330-69

THERMO-LAG Stress Skin Type 330-69 shall be used as a base over which THERMO-LAG 330-1 Subliming Coating shall be applied. The Stress Skin shall be installed in such a manner as to provide a complete and contiuous wrap over all areas to receive the THERMO-LAG 330-1 Subliming Coating with the exception of junction boxes and structural support entities.

Best results are obtained if each individual length of each individual section does not exceed 10 feet. Each section should overlap each preceding section by at least 6 inches or fastened to the preceding and following section by a flange facsimile having a 1 inch lip, minimum. Circumferentially, two sections are preferred. The skin shall be tight and all flanges and butt joints properly fastened.

The sections should be secured to each other by using a stapler plier equipped with a reverse clinch. The stapler wire must have a minimum thickness of 0.019 inches and a width of 0.050 inches. The maximum distance between staples shall be 6 inches.

APPLICATION PROCEDURES
CONTINUED

Applicating procedures are as follows:

1.1 Record lot numbers on daily work sheets.

1.2 Solid or ladder back tray.

1.2.1 Measure runs to be applied and record on work order.

1.2.2 Cut sections from a roll not to exceed a maximum of 10 feet in length.

1.2.3 Layout bottom hat section and form 90° bend.

1.2.4 Layout top flat section and cut to size

1.2.5 See Figure 1.0.1

1.2.6 Cut and form butt joint attachments.

1.2.7 See Figure 1.0.2

1.2.8 Matching sections are then applied to tray, fastening flanges a maximum every 6 inches.

1.2.9 Attach sections together by fastening butt joints a maximum every 6 inches.

1.2.10 When precoated sections are to be used, the formed uncoated sections are coated per Section 3.0.

1.2.11 After curing, the sections are removed from the spraying forms and mounted on the trays, fastened together a maximum every 6 inches on the flanges.

1.2.12 After installation of precoated sections, edges of flanges and butt joints should be coated with fresh THERMO-LAG 330-1, using a trowel or stiff bristle brush to fill in any gaps and fastening holes or damage.

FIGURE 1.0.1

THERMO-LAG STRESS SKIN TYPE 330-69
TYPICAL CONFIGURATION FOR CABLE TRAYS
ALL TYPES

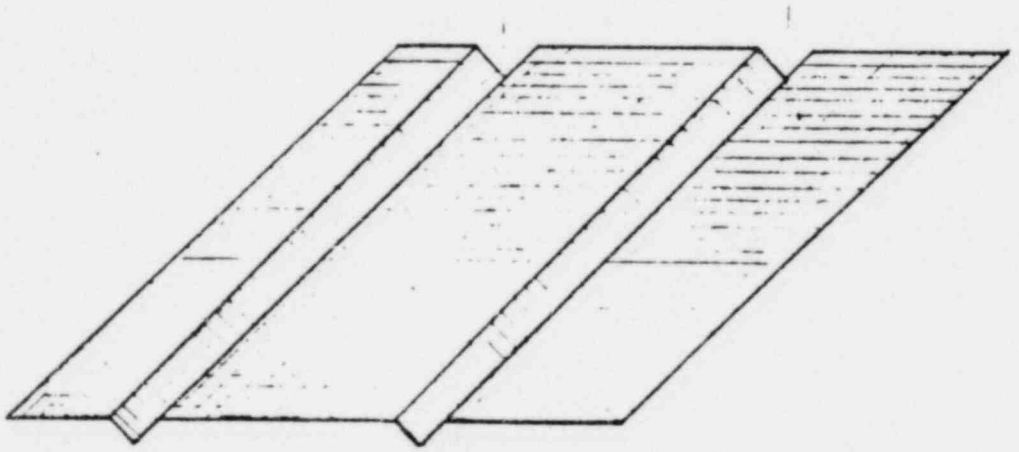
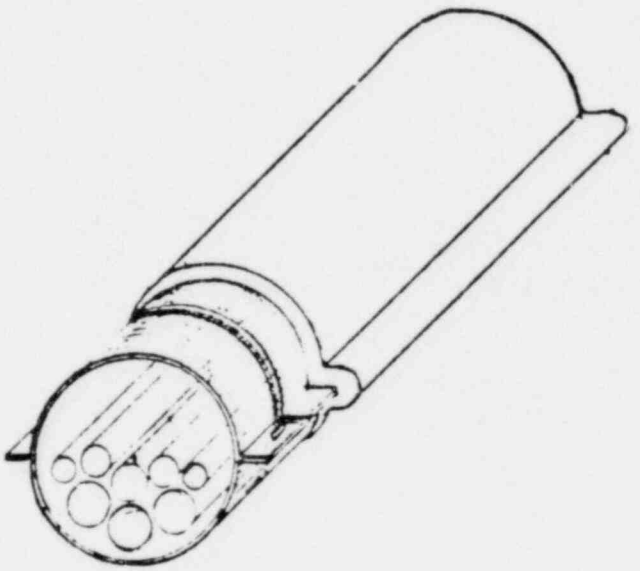


FIGURE 1.0.2

TYPICAL CONFIGURATION FOR

CONDUITS AND CABLE DROPS

ALL TYPES



1.3 Round Conduit

1.3.1 Measure runs to be applied and record on work order.

1.3.2 Cut sections from roll not to exceed a maximum of 10 inch lengths.

1.3.3 Form two "U" Sections with 1 inch 90° flanges.

1.3.4 See Figure 1.0.3

1.3.5 Cut and form butt joints attachments.

1.3.6 See Figure 1.0.4

1.3.7 Matching sections are then applied to tray, fastening flanges a maximum every 6 inches.

1.3.8 Attach sections together by fastening butt joints a maximum every 6 inches.

1.3.9 When precoated sections are to be used, the formed uncoated sections are coated per Section 3.0.

1.3.10 After curing, the sections are removed from the spraying forms and mounted on the trays, fastened together a maximum every six inches on the flanges.

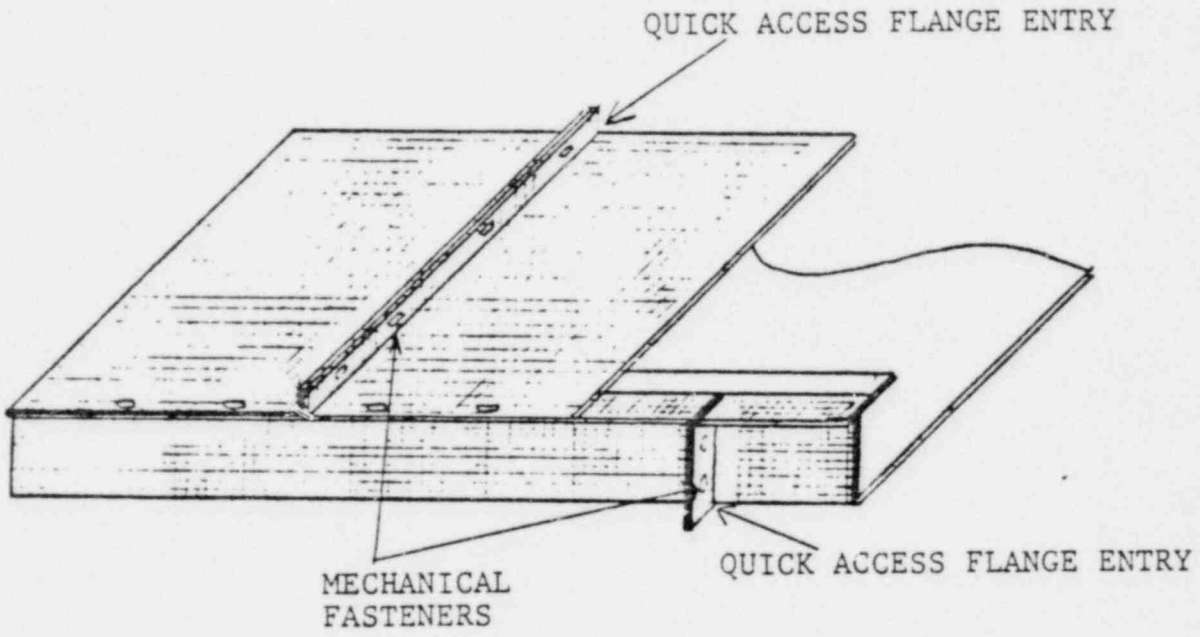
1.3.11 After installation of precoated sections, edges of flanges and butt joints should be coated with fresh THERMO-LAG 330-1, using a trowel or stiff bristle brush to fill in any gaps and fastening holes or damage.

FIGURE 1.0.3

INSTALLATION SCHEMATIC

PRIOR TO THERMO-LAG 330-1

SUBLIMING COATING APPLICATION



2.0 THERMO-LAG 330-70 CONFORMABLE CERAMIC INSULATOR

THERMO-LAG 330-70 Conformable Ceramic Insulator is light weight, flexible ceramic blanket used for insulation enhancement of temperature sensitive components and is designed to provide equal compatibility, efficiency and greater heat resistance when used in concert with THERMO-LAG 330-1 Subliming Material System.

THERMO-LAG 330-70 Conformable Ceramic Insulator shall be wrapped in such a manner as to be complete and continuous with no gaps or holes. When the application of the THERMO-LAG Stress Skin Type 330-69 and THERMO-LAG 330-70 Conformable Ceramic Insulator is complete, a "cacoon" effect should be present.

APPLICATION PROCEDURES

CONTINUED

Applicating procedures are as follows:

2.1 Record lot numbers on daily work sheets.

2.2 Cable drops

2.2.1 Measure drop to be applied and record on work order.

2.2.2 Cut section from roll to length and width.

2.2.3 Layout section and cut to shape.

2.2.4 Apply as a wrap to drop and secure with tape.

2.2.5 Apply THRERMO-LAG Stress Skin Type 330-69 over ceramic insulator.

2.2.6 See Section 1.0.

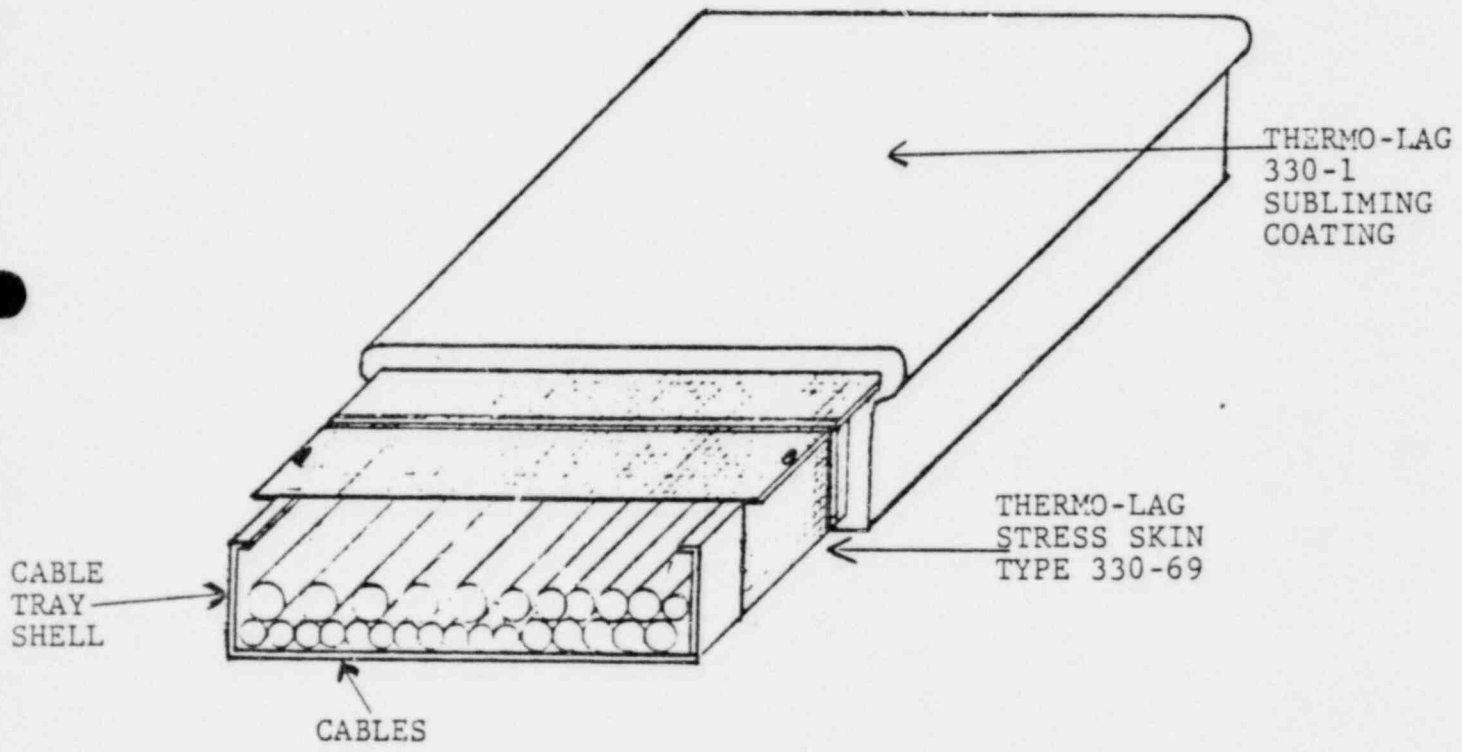
2.3 Cable drops may be protected as single or multiple entities at the discretion of the contractor.

FIGURE 1.0.4

CROSS SECTION

THERMO-LAG 330-1 SUBLIMING MATERIAL SYSTEM

CABLE TYPE



APPLICATION PROCEDURES

CONTINUED

3.0 THERMO-LAG 330-1 SUBLIMING COATING

The contractor shall apply the THERMO-LAG 330-1 Subliming Coating over the properly prepared surface. All surfaces to be coated shall be clean, dry, above 40°F and free from scale, rust and other contaminants, and shall not require insitu priming.

The material shall be applied in as many passes as required to provide the desired build up, taking care to avoid slumping or sagging of the coating. The thickness which can be safely applied in a single stage will depend on the temperature, humidity, applicator technique and similar factors and must be determined on the job. The dry film thickness of the THERMO-LAG 330-1 Subliming Coating after application shall be that specified to provide the required fire resistance rating.

In contaminated atmospheres, application of THERMO-LAG 330-1 shall be completed as soon as possible after the THERMO-LAG Stress Skin Type 330-69 and THERMO-LAG 330-70 Conformable Ceramic Insulator has been installed to avoid atmospheric surface contamination.

The applicator shall take frequent wet thickness measurements of the coating during the application, using a penetrating measuring device (see attached Appendix A) to ensure that the coating is being applied uniformly and at the required wet film thickness. These wet film thickness checks shall be made at least once every twenty (20) sq. ft. of coated surface area. (NOTE: When taking measurements, allow for a shrinkage rate of 25% between wet film and the desired dry film thickness.)

APPLICATION PROCEDURES

CONTINUED

Applicating procedures are as follows:

3.1 Spray Application

3.1.1 Obtain drums from storage area and record batch numbers on daily work sheets. (Appendix B)

3.1.2 Open drum and remove poly seal from top of material.

3.1.3 Insert drum into spray rig.

3.1.4 Insure substrate to be sprayed is free from loose and foreign matter.

3.1.5 Apply material in smooth even passes, taking care to keep the spray gun fan pattern at a 90° angle to the substrate when possible. "Reaching" with the spray gun will cause the fan pattern to vary from 90° and will result in a rough surface. Avoid "over-reaching".

3.1.6 Obtain frequent wet thickness measurements during application, using a penetrating measure device (see Appendix A). Measurements shall be taken at least once every 20 square feet.

3.1.7 Excessive build up of coating material in angle areas such as wet and flange joints may cause some cracking when cured. Excesses can be removed or bevelled by rolling the surface with a damp sponge roller.

3.1.8 All edges should not be sprayed directly with the spray gun in normal spray pattern on the outside and the inside surfaces of the flanges. They should be sprayed from each side causing the material to "wrap" around the edge. If the edge coating is not completely closed, use a wet roller or trowel to seal off the surface.

3.1.8 Where the application of fiberglass armoring is specified, it should be installed between applications of THERMO-LAG 330-1 Subliming Coating, laying the fiberglass armoring into the THERMO-LAG before it has dried. Use a roller to flatten out any wrinkles and to embed fiberglass securely. Then proceed with the application of THERMO-LAG until the required thickness has been installed.

3.1.9 Moisture meter readings, using a Delmhorst Moisture Meter, Model D-P, shall be taken between coats of THERMO-LAG 330-1 Subliming Coating, when multiple coats are applied, and a reading of 90 must be obtained on the first coat before the second coat is applied.

3.1.10 All runs, sags, dips or similar surface imperfections shall be removed before curing and the surface smoothed using prewetted sponge rollers, stiff bristle brushes, or hand trowel.

3.2 Hand Trowel

3.2.1 Trowel material to a uniform thickness using moderate pressure, avoid "overworking". Tools should be wetted with water when smooth finish is required.

3.2.2 Prewet a stiff bristle brush with water and work only a small area, avoid water and work only a small area, avoid continual brushing of same material. Always work to a "wet edge".

3.2.3 Standard painters gloves, work gloves or rubber gloves should be used during hand layup. Work small area and use water to keep gloves wet so that the material will not dry on gloves.

3.2.4 Standard hand or air powered caulking guns, using round, narrow, or wide nozzles should be used where applicable.

3.3 Dry Film Thickness Measurements

3.3.1 After the coating has cured, dry thickness measurements, using a penetrating measuring device, shall be taken every twenty (20) sq. ft. to insure that the minimum thickness measured meets or exceeds dry film thickness requirements. Substandard thickness areas shall be built up to standard thickness by reapplication of coating material to those areas.

3.4 Repairs - Cured Film Imperfections

3.4.1 "Mudcracks" in angle corners should be filled with fresh material using a stiff bristle brush or trowel.

3.4.2 Runs, drips, sags, etc, should be removed and smoothed by sanding (hand or mechanical) or plaining with a sureform plane.

3.4.3 "Blisters" should be removed by cutting back, with a sharp knife, to soundly adhering material. Be sure to undercut around edges to provide an anchor base. Fill patched area with fresh material using spray or hand method. Feather all edges to blend into surrounding surface.

3.4.4 External damage shall be repaired by cutting back edges to provide an anchor base and all loose or damaged material removed using a knife or chisel.

3.5 Clean Up

3.5.1 All equipment should be cleaned using clean, potable water and stiff scrub brushes.

3.5.2 Before material dries, all spillage, dripping, and overspray should be removed using water wet rags, sponges or scrub brushes.

4.0 THERMO-LAG 350 TWO PART WATER BASED SPILL RESISTANT TOPCOAT

THERMO-LAG 350 Two Part Water Based Spill Resistant Topcoat will be applied only where specified.

The topcoat shall be applied by spray equipment or by roller in two complete coats, at a spread rate of 50 sq. ft. per gallon.

Applicating procedures are as follows:

4.1 Spray Applications

4.1.1 Record batch numbers on daily work sheets.

4.1.2 Pour Part B into Part A and thoroughly mix using a mechanical mixer. Mix a minimum of 5 minutes and allow a "sweat in" period of 20 minutes before commencing the application.

4.1.3 Insure that the area to be topcoated is free from loose and foreign matter.

4.1.4 Moisture meter readings, using a Delmhorst Moisture Meter, Model D-P, shall be taken and readings of 20 or less must be obtained before topcoat is applied.

4.1.5 Place mixed material into spray rig.

4.1.6 Apply topcoat in a smooth even pattern, making sure to criss-cross the area in a continuous film.

4.1 Hand Application

4.2.1 Using a long nap mohair roller, apply a full smooth coat, avoiding excessive build up in corners. Avoid excessive rolling into partially dry material. Always work to a "wet edge".

4.2.2 Using a stiff bristle brush, apply a full coat avoiding excessive "working of material." Always work to a "wet edge".

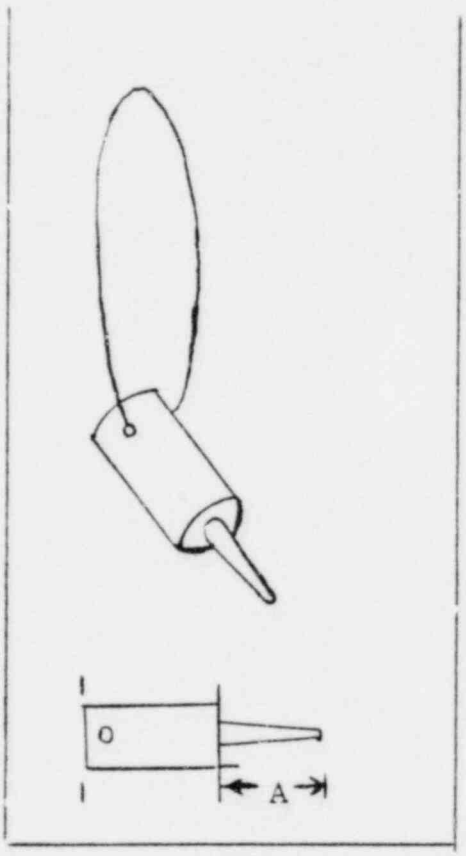
5.0 EQUIPMENT

The most economical and satisfactory method of spraying the THERMO-LAG 330-1 Subliming Material System is by using equipment such as that manufactured by Graco and other companies. Appendix C (6.1) depicts the normal complement of required spray equipment as recommended by TSI for use in the application of THERMO-LAG 330-1 Subliming Material System.

APPENDIX A

SCHEMATIC OF A TYPICAL

PENETRATING MEASURING DEVICE



"A" is equal to the desired thickness of the coating.

On measurement - the pin portion of the gage must sink completely into the dry layer of the applied coating. Take several readings for each thickness. Fill the hole created by the gage after measurement is complete.

APPENDIX B

DAILY WORK SHEET

CONTRACTOR'S NAME: _____

TSI'S REP: _____

DATE: 1 _____

JOB: _____ WEATHER: _____ WORKMEN ON SITE: _____

CONTRACT NO. _____ AIR TEMP: _____ HOURS WORKED: _____

SPEC. NO. _____ SUBSTRATE TEMP. _____

CONTRACTOR: _____

EQUIPMENT USED THIS DATE: (List Type, Description, Tip, Etc.)

_____ _____ _____

_____ _____ _____

PRIMER: _____ SUBLIMING COATING: _____ TOPCOAT: _____

MATERIAL APPLIED THIS DATE:

SECTION	PRODUCT	PRODUCT CODE DATE	EQUIPMENT USED FOR APPLICATION	FT2 AREA COMPLETED	AMOUNT USED	COMMENTS

TESTS CONDUCTED:

SECTION	REQUIRED	DRY THICKNESS MEASURED				ADHESION BOND	MOISTURE	COMMENTS
		1 PASS	2 PASS	3 PASS	FINAL			

APPENDIX C

NORMAL COMPLEMENT OF REQUIRED SPRAY EQUIPMENT

THERMO-LAG 330-1 SUBLIMING MATERIAL SYSTEM

AIRLESS SPRAY EQUIPMENT

QUANTITY	DESCRIPTION OF EQUIPMENT
1 Ea	Hydra Spray Pump 45:1
1 Ea	Air Powered Ram
1 Ea	Hydra Mastic Spray Gun
1 Ea	Special Dump Valve
2 Ea	RAC III with 0.55 Tips
1 Ea	Air Agitator
1 Ea	Air Regulator Kit
1 Ea	Air Regulator Only with Gauge
1 Ea	Air Line Filter
1 Ea	Air Line Lubricator
5 Ea	Pump Repair Parts Kits
6 Ea	Extra Tips with Seals
100 Ft	1" ID Hi Pressure Fluid Hose
75 Ft	1/2" ID Hi Pressure Fluid Hose
25 Ft	3/8" ID Hi Pressure Fluid Hose

APPENDIX C

NORMAL COMPLEMENT OF REQUIRED SPRAY EQUIPMENT

THERMO-LAG 330-1 SUBLIMING MATERIAL SYSTEM

AIR TYPE SPRAY EQUIPMENT

QUANTITY	DESCRIPTION OF EQUIPMENT
1 Ea	10:1 President Spray Pump
1 Ea	Air Powered Ram
1 Ea	Heavy Mastic Spray Gun
1 Ea	Special Dump Valve
2 Ea	1/4" or 1/4" E Spray Tip
1 Ea	Air Agitator
1 Ea	Air Regulator Kit
1 Ea	Air Regulator Only with Gauge
1 Ea	Air Line Filter
1 Ea	Air Line Lubricator
5 Ea	Pump Repair Parts Kits
75 Ft	1/2" ID Hi Pressure Fluid Hose
25 Ft	3/8" ID Hi Pressure Fluid Hose

APPENDIX D

REPAIR PROCEDURES

The following method should be used to repair damaged THERMO-LAG 330-1 Subliming Material System after the system has cured:

A. Remove all loose or debonded THERMO-LAG 330-1 by scraping. Be sure to cut back to sound adhering material.

B. Cut sound edge on a bevel or dovetail in order to form an anchor for the edges.

C. If moisture is present behind damaged area, allow substrate to dry out before proceding with next step.

D. Sand or wire brush substrate. If any signs of rusting are visible, reprime patch area.

E. Apply THERMO-LAG 330-1 into patch area by spraying, for large areas, or by trowel, for small areas. Be sure to slightly dome the patch to allow for shrinkage and blending into adjacent area.

F. After drying, THERMO-LAG Topcoat is applied, overlapping the adjacent area approximately 6 inches to insure a continuous film over the joint between the patch and the adjacent material.

APPENDIX 7

PRE-BURN INSPECTION

APPENDIX 7
PRE-BURN INSPECTION

1.0 FURNACE PREPARATION

1.1 Day before test date:

a. The furnace interior will be cleaned of any residual materials from previous tests. The furnace lining will be checked for cracks, etc.

b. The calibration status of the furnace temperature thermocouples (thermowells) will be checked and recalibrated if the calibration period has expired. This check will include verification of individual continuity and assuring that they are all connected in parallel for recording the furnace average temperature.

c. The burners are always checked to insure that all air regulators are free and unobstructed and that the gas supply and igniters are in order.

1.2 Test date:

a. A final check is made of the burners, gas supply and igniters.

b. The Test Engineer is advised of furnace ready status.

2.0 TEST SLAB SET UP

2.1 Day before test date:

a. The test slab will be moved from the laboratory and placed on top of the furnace. The furnace/slab interface will be sealed with ceramic fiber blanket such as Kaowool.

b. If differential pressure is to be applied, the vacuum enclosure will be installed over the test slab and the slab/enclosure interface sealed. The vacuum blower system procedures outlined in Section VI will then be followed.

c. If differential pressure is not to be applied, the windbreak protective housing will be placed over the test slab and furnace.

d. The scrubber stack will then be attached to the furnace flue.

2.2 Test date (Vacuum system only)

a. The blower is started and the required pressure differential is established and indicated on the manometers.

b. A final check for leaks is made from both inside and outside the furnace.

c. The Test Engineer is advised of the vacuum system ready status.

3.0 DATA SYSTEM SET UP

3.1 Day before test date:

a. The thermocouple leads from the furnace average thermocouples and the test slab and the cable integrity monitoring leads are connected to the data system input panel.

b. The fire exposure data acquisition program loading will be verified.

c. The calibrated thermocouple simulator will be set to 400°F (or any temperature calibration point as required by the sponsor)and the compensation and linearization program verified.

d. At least one scan of all data channels will be performed tc verify proper functioning of all channels.

3.2 Test Date:

a. Steps 3.1b, c, and d above are repeated.

b. The data system clock will be reset and the Test Engineer advised of the data system ready status.

c. Data system will be placed on auto scan upon ignition of the burners and start signal from the Test Engineer.

APPENDIX 8

FIRE ENDURANCE TEST

APPENDIX 8
FIRE ENDURANCE TEST

1.0 REQUIREMENTS

Fire endurance tests shall be performed in compliance with the following standards and guidelines:

1) ASTM E-119(80)
2) American Nuclear Insurers Bulletin #5 (79)

2.0 GENERAL

The fire exposure will be conducted under the supervision of a Senior Research Engineer designated as the Test Engineer Once he has been advised of the ready status of the furnace and the data system, he will make a final check of the test slab and furnace prior to directing the furnace and data system technicians to ignite the burners and initiate the data acquisition.

3.0 TEMPERATURE CONTROL

Furnace temperature is normally controlled by manually adjusting the gas flow to the burners. The furance temperature will be monitored continuously to insure tracking of the ASTM E119(80) time/temperature curve.

4.0 OBSERVATIONS

The unexposed surface of the test slab will be observed for penetration by flame or hot gases and the data, which is updated at one minute intervals will be monitored to keep abreast of the condition of the penetration seals, coatings and cables.

5.0 DOCUMENTATION

In addition to the thermocouple and cable integrity data recorded by the data system, the Test Engineer's observations and record of events as they occur will be doucmented with the use of a miniature tape recorder which the Test Engineer carries throughout the fire exposure period.

APPENDIX 9

HOSE STREAM TEST

APPENDIX 9
HOSE STREAM TEST

1.0 REQUIREMENTS

Hose stream test shall be performed in compliance with the following standards or guidelines:

1) ASTM E-119 80
2) American Nuclear Insurers Bulletin # 5 (79)

2.0 EQUIPMENT

Actual fire fighting equipment will be used to perform the hose stream tests. An International/Howe 500 gpm pumper as shown in Figures IV-5 and IV-6 provides a controlled water stream. A Bourdon tube type pressure gage, installed at the base of the nozzle as shown in Figure IV-7 is used to set the nozzle pressure and a Rockwell Type SR utilities type flowmeter as shown in Figure IV-8 is used to monitor the stream flow rate.

3.0 PROCEDURE

1) Immediately prior to applying the hose stream to the test slab, the water stream will be adjusted for the required nozzle pressure and flow rate. It will then be directed to the exposed side of the test slab which has just been removed from the test furnace. The hose stream is normally directed first at the center of the test slab or test penetration, depending on the number and size of penetrations, then gradually working outwards to uniformly cover the entire test slab. Hose stream application time shall be 2 1/2 minutes per 100 ft. of exposed area as per the Standards. One of the following stream configurations shall be used:

   (1) The stream shall be delivered through a two and one-half (2½) inch national standard playpipe, equipped with one and one-eighth (1 1/8) inch tip, nozzle pressure of thirty (30) pounds per square inch, located twenty (20) feet from the system.

   (2) The stream shall be delivered through a one and one-half (1½) inch nozzle, set at a discharge angle of thirty (30) degrees, with anozzle pressure of seventy-five (75) pounds per square inch, and a minimum discharge of seventy-five (75) gallons per minute with the tip of tag nozzle a maximum of five (5) feet from the system.

   (3) The stream shall be delivered through a one and one-half (1½) inch nozzle set at a discharge angle of fifteen (15) degrees with a nozzle pressure of seventy-five (75) gallons per square inch, and a minimum discharge of seventy-five (75) gallons per minute with the tip of the nozzle a maximum of ten (10) feet from the system.

   NOTE: # 1) is the preferred test per ANI Bulletin # 5 (79)

2) While the hose stream test is being conducted, the test Engineer will monitor the application of the hose stream from a position near the hose nozzle while another engineer will be positioned so that he can observe the top of the test slab for penetration of the water stream through the seals. When the hose stream application has been completed, the test slab will be lowered to allow for a close examination of the penetration seals from below, then lowered further to allow a close view of the unexposed surface to check for any sign of water penetration.

APPENDIX 10

DATA SYSTEM

APPENDIX 10
DATA SYSTEM

1.0 SYSTEM COMPONENTS

1) A 200 channel microcomputer controlled digital data acquisition system as shown in the block diagram FDSG-F1, contained in Appendix 13 will be used to record the thermocouple data from the test penetrations, the furnace temperature, and the cable integrity.

This system is comprised of a B&F Instruments Model SY256 Data Logger integrated with a Cromenco System III Microcomputer, A TEC Model 1440 Terminal, and a Cromenco Model HDD Disc Memory with a 10 megabyte capacity. Redundant data storage is provided by a memodyne Model 3783 Cassette Recorder.

2) A Doric Model 403 A0407E Thermocouple Simulator/Calibrator shall be used to insure accuracy of the data and provide data system calibration traceable to NBS. The calibration unit is connected to the thermocouple input panel and serves to provide a reference temperature of 400° F to the microprocessor during each scan. With this stable reference, the microcomputer can then correct for any drift of the data logger as it processes the data for storage.

2.0 DATA ACQUISITION

1) During the fire exposure period, the thermocouples will be scanned at the rate of 20 channels per second at one minute intervals. The millivolt signals from the SY256 will be linearized and compensated by the microcomputer, displayed on the terminal's CRT, and recorded in disc memory and the cassette recorder for subsequent analysis and plotting.

3.0 DATA PROCESSING

1) Upon completion of testing, the data will be transmitted via a hardwire line to the Testing Laboratory Central Computer Facility where a CDC Cyber 171 will process the data and place it on a CDC 844-41 mass storage hard disc for permanent storage. The data will then be retrieved and transmitted to a Tektronix Model 4054 Graphic Computing System where it will be converted to graphic formatting commands and output to a Tektronix Model 4662 digital X-Y Plotter which will produce an individual graph for each of the test penetrations.

2) The Cyber 171 will also format the data for tabular print listings and transmit it to the Division remote batch facility for printout on a CDC Model 1827-30 line printer. These graphs and tubular data will then be included in the test reports.

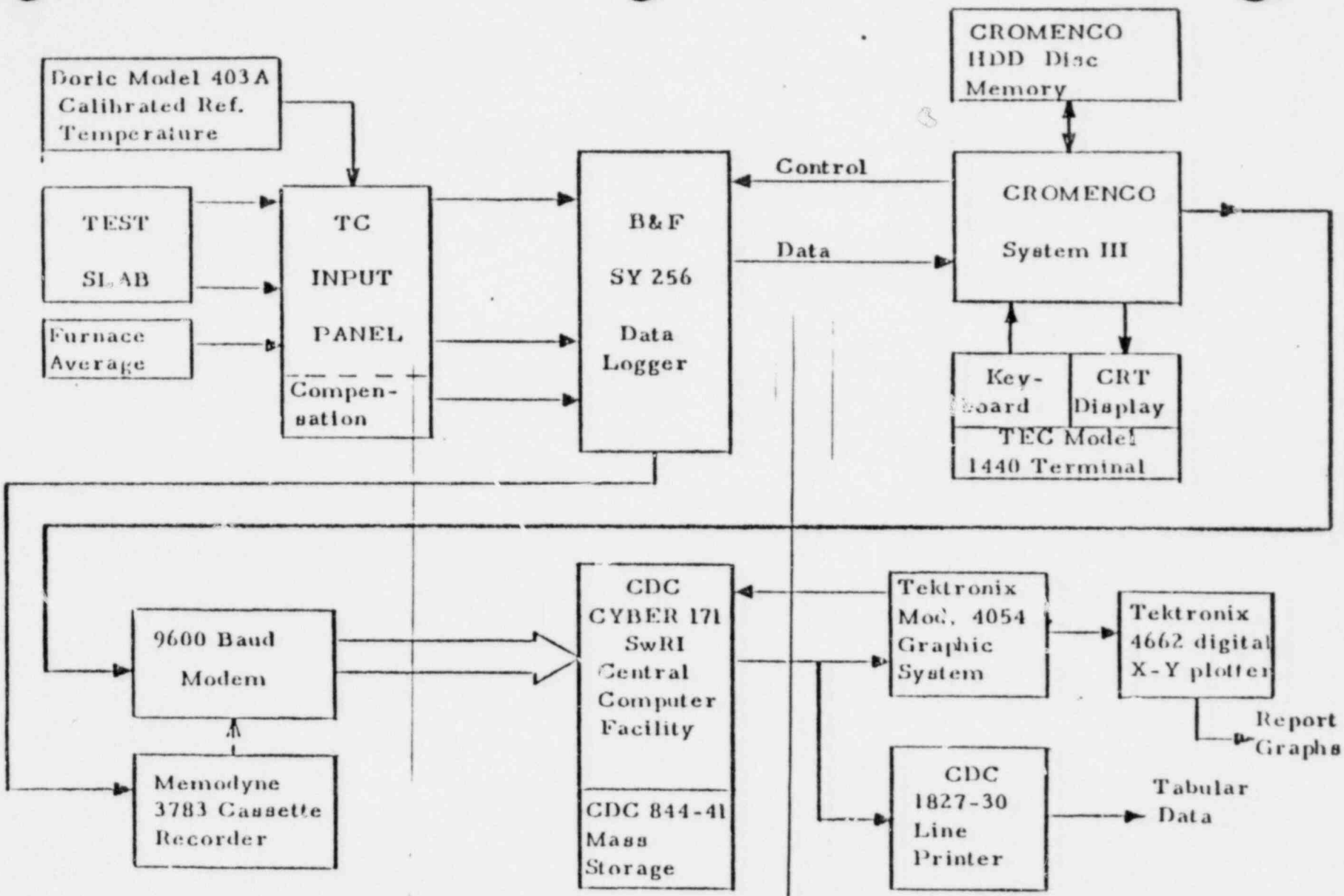


Figure FDSG-F1 **Data System**

APPENDIX 11
QUALITY CONTROL
QUALITY ASSURANCE

PROCEDURES FOR PRODUCT MANUFACTURE
AND PRODUCT APPLICATION FURNISHED
FOR REVIEW UPON REQUEST