TEST REPORT

Hemyc (1-Hour) Electrical Raceway Fire Barrier Systems Performance Testing

Conduit and Junction Box Raceways

Project No. 14790-123263

FINAL REPORT

April 11, 2005

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Abstract

This document describes the evaluation of three standard conduit raceway sizes, one junction box and several support systems, all protected with the Hemyc One Hour System, when exposed to the ASTM E119 time-temperature heating curve. Each conduit size was tested empty and heavily loaded with bare #8 AWG copper wire. Results are given in the Conclusion Section of this report.

The details, procedures and observations reported herein are correct and true within the limits of sound engineering practice. All specimens and test sample assemblies were produced, installed and tested under the surveillance of either Sandia National Laboratories, the manufacturer's or the testing laboratory's in-house Quality Assurance Program. This report describes the analysis of a distinct assembly and includes descriptions of the test procedure followed, the assembly tested, and all results obtained.

Deggary N. Priest, President — April 11, 2005 Date

Reviewed and approved:

Constance A. Humphrey
QA Director — April 11, 2005 Date

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ACCREDITED
No. 0689-01

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PURPOSE AND SCOPE

Note: This section has been reproduced in part from the Test Plan contained in Appendix A.

Section 50.48, "Fire Protection," of 10 CFR Part 50 requires that each operating nuclear power plant have a fire protection plan that satisfies General Design Criterion 3 of Appendix A to 10 CFR Part 50. Criterion 3 requires that structures, systems, and components important to safety shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions. Noncombustible and heat resistant materials shall be used wherever practical throughout the unit, particularly in locations such as the containment and control room. Fire detection and fighting systems of appropriate capacity and capability shall be provided and designed to minimize the adverse effects of fires on structures, systems, and components important to safety. Firefighting systems shall be designed to assure that their rupture or inadvertent operation does not significantly impair the safety capability of these structures, systems, and components. Section 50.48 also requires that all plants with operating licenses issued prior to January 1, 1979, satisfy the requirements of Sections III.G, III.J, and III.O of Appendix R to 10 CFR Part 50. (Post 1979 plants (per 10 CFR Part 50.48) have to comply with the provisions of their licenses.)

Section III.G of Appendix R, which addresses fire protection of safe shutdown capability, requires that fire protection features be provided such that one train of systems necessary to achieve hot shutdown conditions remains free of fire damage. One acceptable means of satisfying this requirement is to separate cables and equipment and associated non-safety circuits of redundant systems necessary to achieve and maintain hot shutdown conditions located in the same fire area by a fire barrier having a 3-hour fire rating (Section III.G.2.a). Another means is to enclose cables and equipment and associated non-safety circuits of one redundant train in a fire barrier having a 1-hour fire rating and install fire detectors and an automatic fire suppression system in the fire area (Section III.G.2.c).

The scope of this [project] is to describe the overall plan for investigating the fire resistance rating of [the] Hemyc (1-hour) ... electrical raceway fire barrier system (ERFBS). The primary approach ... [was] to perform [an] ... ASTM E 119 furnace test on a number of cable raceway types that [were] protected by ... the Hemyc ... fire barrier material. The Hemyc test [was] performed for a period of 60-minutes, followed by a hose stream test and post-test visual inspection of the ERFBS. . . .

OBJECTIVE

Note: This section has been reproduced in part from the Test Plan contained in Appendix A.

The objective of this program [was] to assess the fire resistance rating of Hemyc ERFBS by subjecting various test specimens (conduit and junction boxes) to standard temperature-time conditions as specified in ASTM E 119 and criterion stipulated in GL 86-10, Supplement 1. The types and characteristics of the ERFBS enclosing the test specimens [were] intended to simulate as-installed configurations.

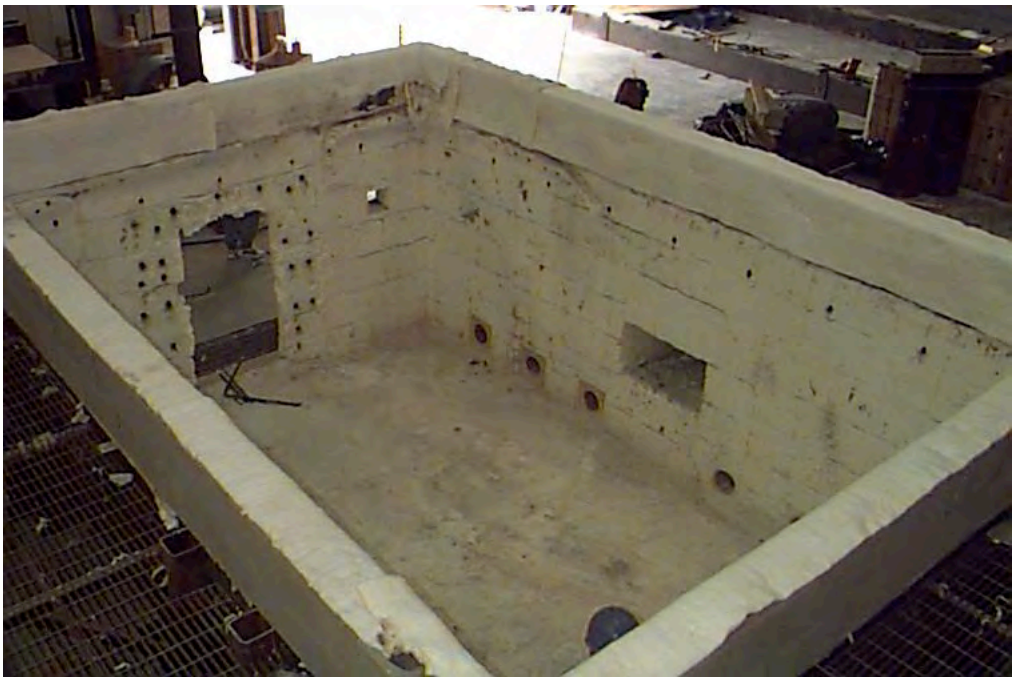
These tests [were intended to] provide additional data in that redundant conduits loaded to their maximum capacities with cables [were] included in the test. Also, [two] support structure analogs partially enclosed in the ERFBS [were] exposed to the one-hour test conditions.

TEST PROCEDURE

Note: Since the Test Plan (Appendix A) includes an accurate and complete description of the test procedure to be followed, much of these details have not been reproduced in the main body of this report.

Horizontal Test Furnace

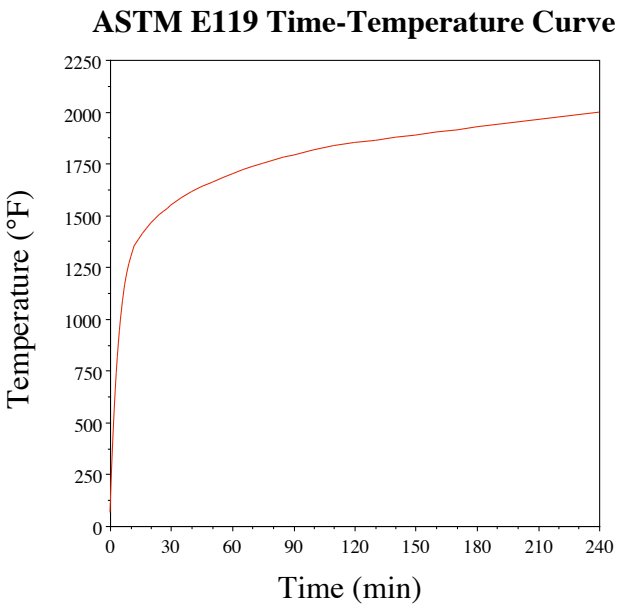
The 12' x 18' x 7' deep horizontal test furnace used in these evaluations was designed to allow the specimen to be uniformly exposed to the specified time-temperature conditions. It is fitted with 12 symmetrically-located premixed air/propane gas burners designed to allow an even heat flux distribution across the exposed surface of a horizontal test specimen. Furnace pressures may be maintained at any value from +0.03" W.C. to -0.05" W.C. The furnace consists of a structural steel frame, lined with sheet metal and insulated with a six inch thick layer of ceramic fiber.



12' x 18' Horizontal Furnace (Overhead View)

The temperature within the furnace is determined to be the mathematical average of thermocouples located symmetrically within the furnace with half positioned twelve inches below the bottom surface of the test deck and the other half located 12" below the bottom of the test specimens. In this manner, an average exposure on the entire assembly can be determined by averaging the readings in real time and adjusting the average temperature to follow the standard time-temperature curve. The materials used in the construction of these thermocouples are those suggested in the E119 test standard. During the performance of a fire exposure test, the furnace temperatures are monitored at least every 15 seconds and displayed for the furnace operator to allow control along the specified time-temperature curve. All data is saved to hard disk at intervals of once per minute unless more often is requested.

The fire exposure is controlled to conform with the standard time-temperature curve shown in Figure 1, as determined by the tables below:



Time (min)	Temperature (°F)
0	68
5	1000
10	1300
20	1462
30	1550
60	1700
90	1792
120	1850
180	1925
240	2000

Figure 1 E119 Temperature Exposure

The furnace interior temperature during a test is controlled such that the area under the time-temperature curve is within 10% of the corresponding area under the standard time-temperature curve for 1 hour or less tests, 7.5% for those less than 2 hours and 5% for those tests of 2 hours or more duration.

Furnace Pressure

The pressure differential between the inside of the furnace (as measured approximately 12" below the exposed surface of the test support slab) and the laboratory ambient air was maintained at 0.00 inches of water column for the duration of the fire exposure test (after the first five minutes, during which furnace stabilization was achieved). This was achieved and controlled by adjusting the inside furnace pressure until slight puffs of intermittent flames extended through unused thermocouple probe holes in the sides of the furnace, indicating a very slight positive pressure at these locations.

Thermocouple Locations

All six conduit systems were instrumented with 24 GA. Type K glass/glass insulated thermocouples (Special Limits of Error: ±1.1°C) purchased with calibration certifications and lot traceability. The thermo-junctions were mechanically attached along the side of each conduit which faced the bottom or sides of the furnace (that is, along the outside and bottoms of the conduit) by clamping them under the heads of #8x32 stainless steel machine bolts placed into holes drilled and threaded to receive them, spaced 6" o.c. Bare #8 AWG, multiple-strand copper conductors were instrumented with similar thermocouples attached every 6 inches along the wire's length. These thermocouples were attached by placing the thermo-junction in direct contact with the surface of the wire and crimping the junction to the copper wire with a copper Buchanan 2011S open end splice cap fastened in place with a Buchanan C-24 "pres-SURE" tool. An instrumented bare #8 AWG conductor was then pulled through the inside of each conduit. In conduits which contained additional bare #8 AWG conductors as thermal mass, the instrumented conductors were placed inside the bundle, to avoid abrasive damage to the thermocouples during installation of the bundle into the conduit. The support systems contained thermocouples installed as indicated in the Test Plan (Appendix A).

The junction box was instrumented with 1/16" diameter Inconel® sheathed, 30 Ga. Type K thermocouples, to allow them to withstand the temperatures which may be experienced by their leads passing between the junction box and outside the heated area. These thermocouples were not purchased with calibration certificates, but instead were numbered and sent to Sandia National Laboratories, which performed a series of multi-temperature point calibrations of them. The results of these calibrations are presented in Appendix D, Quality Assurance.

See Appendix C Thermocouple Locations for exact locations of all test item thermocouples.

Data Acquisition Systems

The outputs of the thermocouples were monitored by 300 channel and 100 channel Yokogawa, Inc., Model Darwin Data Acquisition Units, driven by Macintosh computers. The furnace control thermocouples were monitored by a separate 100 channel Yokogawa, Inc. Model Darwin Data Acquisition Unit and Macintosh computer. The computers were programmed in LabVIEW 5.0 to send the commands to the data acquisition systems to sample the data input lines and to convert the raw data into a usable format (i.e., degrees Fahrenheit) for display on screen and storage as an ASCII tab-delimited text file. Those files were then, after the test, imported into MS Excel for tabular and graphical display.

Correction Factor

In accordance with ASTM E119, when the indicated resistance period is 1/2 h or over, determined by the average or maximum temperature rise on the unexposed surface or within the test sample, or by failure under load, a correction shall be applied for variation of the furnace exposure from that prescribed, where it will affect the classification, by multiplying the indicated period by two thirds of the difference in area between the curve of average furnace temperature and the standard curve for the first three fourths of the period and dividing the product by the area between the standard curve and a base line of 68°F (20°C) for the same part of the indicated period, the latter area increased by 3240°F•min to compensate for the thermal lag of the furnace thermocouples during the first part of the test. For a fire exposure in the test higher than standard, the indicated resistance period shall be increased by the amount of the correction. For a fire exposure in the test lower than standard, the indicated resistance period shall be similarly decreased for fire exposure below standard. The correction is accomplished by mathematically adding the correction factor, C, to the indicated resistance period.

The correction can be expressed by the following equation:

$$C = \frac{2I(A - A_s)}{3(A_s + L)}$$

where:

C = correction in the same units as I,
I = indicated fire-resistance period,
A = area under the curve of indicated average furnace temperature for the first three fourths of the indicated period,
A_s = area under the standard furnace curve for the same part of the indicated period, and
L = lag correction in the same units as A and A_s (54°F•h or 30°C•h (3240°F•min or 1800°C•min))

Hose Stream Test

Immediately following the fire endurance test, a hose stream test was performed in accordance with USNRC Generic Letter 86-10, Supplement 1, Enclosure 1, Section VI. The hose stream was "applied at random to all exposed surfaces of the test specimen through a 1-1/2" fog nozzle set at a discharge angle of 15 degrees with a nozzle pressure of not less than 75 psi and a minimum

discharge rate of 75 gpm with the tip of the nozzle at a maximum of 10 feet from the test specimen. Duration of the hose stream application is 5 minutes." Prior to the hose stream application, the laboratory ensured the correct angle spray pattern, pressure and flow was achieved through calibrated gauges and other equipment as required.

Assessment Criteria

The test specimens were subjected to the ASTM E 119 temperature-time profile in the test furnace. An assessment of the ERFBS performance was based on two principal factors, as stated in Generic Letter 86-10, Supplement 1:

1. *The time at which the average unexposed side temperature of the fire barrier system, as measured on the exterior surface of the raceway or component, exceeds 139°C (250°F) above its initial temperature. Or the time at which a single temperature reading of a test specimen exceeds 30% of the maximum allowable temperature rise (i.e., 180°C [325°F]) above its initial temperature.*
2. *The fire barrier system remains intact during the fire exposure and water hose stream test without developing any openings through which the cable raceway is visible.*

TEST SPECIMEN CONSTRUCTION

Supporting Deck

A 13' x 19' insulated 10 GA. steel deck was designed to accept the test items in this project. The deck was continuously welded and reinforced with 4" structural steel channel, as indicated in the drawings in Appendix B. The placement of all test items in the deck was adjusted to maximize distances between items and between items and furnace walls, and to minimize shadowing effects between items.

Each of the conduits were designed to pass through the test deck, extend 36" below the insulated lower surface of the deck, turn 90° (through a zero radius turn) to horizontal, extend a total of 60", and then turn 90° upwards (through a sweeping radius turn) and pass back up and through the supporting deck. All test items were supported by structural elements on the unexposed side of the test deck at distances of 12" and 30" above the deck.

One specimen of each conduit contained a heavy loading (nominally 30%) of bare #8 multi-strand copper conductor. The length and weight of each bundle was determined, as well as the weight of each assembled conduit system and its weight per unit length.

Raceway	Raceway Weight Per Unit Length* (lb/ft)	No. of Strands of Bare #8 Conductor	Bare #8 Weight per Unit Length (lb/ft)	% Fill by Actual Area	Total Weight per Unit Length (lb/ft)
1A (4" conduit)	9.4	1	n/a	n/a	9.4
1B (4" conduit)	9.4	291	14.84	30.0	24.24
1C (2½" conduit)	5.1	1	n/a	n/a	5.1
1D (2½" conduit)	5.1	113	5.85	29.8	10.95
1E (1" conduit)	1.5	1	n/a	n/a	1.5
1F (1" conduit)	1.5	18	1.02	29.7	2.52
1G (Unistrut)	1.67	n/a	n/a	n/a	1.67
1H (2"x2" steel)	2.76	n/a	n/a	n/a	2.76

* Note: this is the weight of the raceway only, before the bare #8 was installed.

CONDUCT OF TEST

Preburn Inspections

As required in the Test Plan, prior to the commencement of the fire endurance test, a thorough check of the test assembly and associated equipment (including calibration of the data recording equipment) and completion of applicable Laboratory QA/QC checklists were performed and documented by the testing laboratory.

Written approval of the construction, assembly, installation and instrumentation was supplied by OPL and signed by Sandia National Laboratories' representative prior to performance of the fire exposure test (a sign-off sheet for this purpose was supplied by the Laboratory).

The test assembly was then placed on the large scale horizontal fire resistance furnace and the thermocouples connected to the data acquisition system and their outputs verified. The test assembly was inspected one last time before the furnace was close prior to the test. Upon receipt of approval to proceed, the test was initiated. Following the fire exposure test, all data acquisition systems were recalibrated in accordance with the Test Plan.

TEST RESULTS

The thermocouples were connected to the data acquisition systems and their outputs verified on March 10, 2005. The furnace was fired on March 11, 2005, and computer data collection of thermocouple data continued for 60 minutes. The ambient temperature at the start of the test was 54°F, with 60% relative humidity. The furnace was fired at 9:09 AM and the standard time-temperature curve followed for 60 minutes. The pressure differential between the inside of the furnace (as measured 12" below the exposed surface of the test slab) and the laboratory ambient air was maintained at 0.00 inches of water column for the duration of the fire exposure test (after the first five minutes, during which furnace stabilization was achieved).

Persons present to perform or witness the test were as follows:

Deggary Priest	-	Omega Point Laboratories, Inc.
Connie Humphrey	-	Omega Point Laboratories, Inc.
Mike Dey	-	Omega Point Laboratories, Inc.
Cleda Patton	-	Omega Point Laboratories, Inc.
Troy Bronstad	-	Omega Point Laboratories, Inc.
Oscar Estrada	-	Omega Point Laboratories, Inc.
Richard Beasley	-	Omega Point Laboratories, Inc.
Laudencio Castanon	-	Omega Point Laboratories, Inc.
Frank Wyant	-	Sandia National Laboratories
Mark Allen	-	Sandia National Laboratories
Mark Salley	-	US Nuclear Regulatory Commission
Roy Woods	-	US Nuclear Regulatory Commission
Randy Brown	-	Promatec
Mike Jordan	-	Promatec
Frank Haese	-	Promatec

Observations made during the test were as follows:

TIME (h:min:s)	OBSERVATIONS
0:00	Furnace ignited at 9:09 AM.
3:40	Furnace probes #1 and #4 were not functioning. They were fixed or replaced. Working well now.
5:00	Furnace pressure adjusted to neutral 12" below test deck.
10:00	Exterior surfaces of the protected items turning white.
17:00	Furnace pressure re-adjusted to neutral.
21:30	Right side of JB insulation falling away. Soon, the other side fell over also.
25:40	Test Item 1B developed an opening at the patch.
38:00	Junction box cover has fallen to the furnace floor.
50:00	Steam and smoke from unexposed side of 1G and 1D.
58:50	Light steam from 1A.
59:00	Light steam from 1F.
60:00	Furnace extinguished. Specimen thermocouples were disconnected and the test assembly lifted from the furnace, observed, photographed and moved to the hose stream test area.
1:07:36	Hose stream began at a nozzle spray angle of 15°, pressure at 75 psi and from a distance of 10 ft. The entire test assembly was slowly spun and the hose stream operator remained stationary and applied the hose to the test items as they passed in front of him.
1:12:36	Hose stream stopped. The test assembly was then observed, photographed and allowed to drip for several hours before being placed on 8' tall 24" ø pipe stands and undergoing post-test disassembly. There were no significant changes in any of the exterior claddings on the raceways due to the hose stream test.

Test item	Observation
1A	Collar loose (2-1/4" opening) and stitching at corner was opened (1/4" – ½" opening at the LB) – raceway visible at both places.
1B	Same as 1A: Collar loose and stitched seam open (1/2" – 1" at LB) – raceway visible at both places.
1C	½" – 1" opening at the telescoping overlap at the center – raceway visible.
1D	Collar loose and open (3-1/2" – 4" gap with angular opening of 1" – 2") – raceway visible
1E	Slight damage to the stitching holding a patch to the pad at the 90° sweeping elbow. No openings. Some shrinkage at the center overlap, but the joint covering did not leave openings.
1F	Collar loose and open (2") – raceway visible
1G	No damage, no openings
1H	No damage, no openings
JB	Both sides and bottom coverings had fallen off during the fire exposure. Support cladding open ~3/8" on side nearest Item 1A and ¾" – 1" on the other side.

Other than small pieces of the deck insulation falling to the laboratory floor, the test assembly showed no visible effect due to the hose stream test. Later comments indicate that most of the raceways failed the hose stream test, when in fact the openings occurred in the Hemyc system due to the fire exposure. However, regardless of when the openings occurred, it cannot be stated that those test items met the requirements of the hose stream test. Much steam and dripping hot water remained after the hose stream was stopped.

In accordance with the E119 test standard, a calculation for any correction to the indicated fire resistance period was done. The correction factor was then mathematically added to the indicated fire resistance period, yielding the fire resistance period achieved by this specimen:

ITEM	DESCRIPTION	TEST VALUE
C	correction factor	0.23 min (14 seconds)
I	indicated fire-resistance period	60 min
A	area under the curve of indicated average furnace temperature for the first three fourths of the indicated period	58 876°F • min
As	area under the standard furnace curve for the same part of the indicated period	58 516°F • min
L	lag correction	3240°F • min
	FIRE RESISTANCE EXPOSURE RECEIVED BY THIS SPECIMEN ==>	60

Note: The standard specifies that the fire resistance be determined to the nearest integral minute. Consequently, if the correction factor is less than 30 seconds, and the test specimen met the criteria for the full indicated fire resistance period, no correction is deemed necessary. That was the case for this project.

CONCLUSIONS

In accordance with the assessment criteria listed in the Test Plan, all raceway systems failed to meet a 1h fire endurance period. The table below summarizes the results for each item. Note that the instrumented bare #8 copper wires with the thermocouples attached were buried within the bare copper wire bundles to protect the thermocouples from damage while the bundles were being pulled through raceways 1B, 1D and 1F.

Raceway		Time to $\Delta T_{avg} \geq 250°F$ (min)	Time to $\Delta T_{ind} > 325°F$ (min)	Max. Temp Bare #8@1h (°F)	Burn-Through/ Structural Failure Yes/No	Pass Hose Stream Yes/No	Final Grade Pass/ Fail
1E	1" Conduit (empty)	46	42	1013	No	Yes	Fail
1F	1" Conduit (loaded: fill=29.7%, 1.02 lb/ft)	44	34	1177	Yes	No	Fail
1C	2 1/2" Conduit (empty)	48	41	709	Yes	No	Fail
1D	2 1/2" Conduit (loaded: fill=29.8%, 5.85 lb/ft)	51	38	446	Yes	No	Fail
1A	4" Conduit (empty)	49	33	865	Yes	No	Fail
1B	4" Conduit (loaded: fill=30.0%, 14.84 lb/ft)	57	43	199	Yes	No	Fail
1I	Junction Box (empty)	17	15	n/a	Yes	No	Fail

Item #1G: Unistrut Support

The Unistrut support was instrumented with thermocouples located 1" inside the edge of the insulation material, and every 3" away from that point, under the insulation. As the plot contained in Appendix B indicates, at a distance 7" from the edge of the insulation, the temperatures are very nearly the same for the rest of the distance. Definitely at a distance of 10", all temperatures are virtually identical.

Item #1H: 2" x 2" Square Steel Tubing Support

The 2x2 steel tubing support was instrumented with thermocouples located 1" inside the edge of the insulation material, and every 3" away from that point, under the insulation. As the plot contained in Appendix B indicates, up to a distance 7" from the edge of the insulation, the temperatures are rapidly declining. However, at the 90° zero-radius bend, the two thermocouples (TCs #345 & #346) indicate a reduction in thermal insulation at that point. After that, all thermocouples approach a common temperature, indicating that further distances from the exposed end do not affect the steel temperature. The "effective" insulating distance appears to lie between 7 and 10 inches.

Shrinkage of the Hemyc insulation pads

During the fire exposure, shrinkage of the Hemyc insulation pads appeared to be caused by the heating of the surface fabric. The end result, was that as adjacent insulation pads withdrew from each other during the shrinkage process, the gap exceeded the overlap distance and an opening appeared through which the raceway steel could be seen, thus causing a failure of the system. As previously mentioned, the hose stream test did not appear to cause any change in the opening sizes, but the hose stream test cannot be judged as successful if the openings were there prior to the hose stream test.

Loaded Conduits versus Empty Conduits

Due to the significant effects of the shrinkage of the Hemyc system (and the subsequent opening of joints), the effects of the heavy loadings were overshadowed. No useable information could be extracted from these systems concerning the effect of loading.

Appendix A

TEST PLAN

Plan for Hemyc (1-Hour) and M.T. (3-Hour) Electrical Raceway Fire Barrier Systems Performance Testing

Revision M
April 6, 2005

1 PURPOSE AND SCOPE

Section 50.48, "Fire Protection," of 10 CFR Part 50 requires that each operating nuclear power plant have a fire protection plan that satisfies General Design Criterion 3 of Appendix A to 10 CFR Part 50. Criterion 3 requires that structures, systems, and components important to safety shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions. Noncombustible and heat resistant materials shall be used wherever practical throughout the unit, particularly in locations such as the containment and control room. Fire detection and fighting systems of appropriate capacity and capability shall be provided and designed to minimize the adverse effects of fires on structures, systems, and components important to safety. Firefighting systems shall be designed to assure that their rupture or inadvertent operation does not significantly impair the safety capability of these structures, systems, and components. Section 50.48 also requires that all plants with operating licenses issued prior to January 1, 1979, satisfy the requirements of Sections III.G, III.J, and III.O of Appendix R to 10 CFR Part 50. (Post 1979 plants (per 10 CFR Part 50.48) have to comply with the provisions of their licenses.)

Section III.G of Appendix R, which addresses fire protection of safe shutdown capability, requires that fire protection features be provided such that one train of systems necessary to achieve hot shutdown conditions remains free of fire damage. One acceptable means of satisfying this requirement is to separate cables and equipment and associated non-safety circuits of redundant systems necessary to achieve and maintain hot shutdown conditions located in the same fire area by a fire barrier having a 3-hour fire rating (Section III.G.2.a). Another means is to enclose cables and equipment and associated

non-safety circuits of one redundant train in a fire barrier having a 1-hour fire rating and install fire detectors and an automatic fire suppression system in the fire area (Section III.G.2.c).

The scope of this document is to describe the overall plan for investigating the fire resistance rating of Hemyc (1-hour) and M.T. (3-hour) electrical raceway fire barrier systems (ERFBS). The primary approach will be to perform a series of ASTM E 119 furnace tests on a number of cable raceway types that are protected by either the Hemyc (with and without air gaps) or M.T. fire barrier material. The Hemyc tests will be performed for a period of 60-minutes each, followed by a hose stream test and post-test visual inspection of the ERFBS. The M.T. test will be performed in a similar manner with the principal difference being that it will be conducted for a period of 3-hours. Descriptions of these tests and of the overall approach are provided below.

2 OBJECTIVE

The objective of this program is to assess the fire resistance rating of Hemyc and M.T. ERFBS by subjecting various test specimens (conduit, cable trays, cable drops, and junction boxes) to standard temperature-time conditions as specified in ASTM E 119 and criterion stipulated in GL 86-10, Supplement 1. The types and characteristics of the ERFBS enclosing the test specimens are intended to simulate as-installed configurations.

These tests will also provide additional data in that redundant conduits loaded to their maximum capacities with cables will be included in two of the test runs. Also, a few support structure analogs partially enclosed in the ERFBS will be exposed to the one- and three-hour test conditions.

3 APPROACH

The following sections describe the test specimens and the test conditions to be employed for the performance assessments of the Hemyc and M.T. electrical raceway fire barrier systems.

3.1 Test Specimens

The principal test specimens will include a variety of cable raceway types protected by either the Hemyc 1-hour rated ERFBS or M.T. 3-hour rated ERFBS. In one test, the test specimens will be protected with Hemyc fire barrier material directly attached to the raceway (i.e., without air gaps). The test specimens in the second test will include a mix of test specimen enclosure methods: some protected by Hemyc ERFBS framed with structural supports to provide a 5-cm (2 in) air gap between the ERFBS and the raceway and others protected with Hemyc by direct attachment. For the third test, the test specimens (of the same types included in the first test) will be protected with the M.T. ERFBS (directly attached to the raceways) and subjected to a 3-hour ASTM E 119 furnace exposure.

The types of test specimens and the configurations of the ERFBS selected for these tests are based principally on the application usage information provided to the NRC/NRR by industry (Letter: Emerson, NEI, to Frumkin, NRC/NRR, "Promatec Hemyc 1-Hour and M.T. 3-Hour Fire Barrier Systems," December 28, 2001 and via letter: Marion, NEI, to Hannon, NRC/NRR, "Comments on NRC Hemyc Test Plan," December 6, 2002). Additional correspondence addressing specific details about industry practices in Hemyc applications were also taken into account and, where practical, incorporated into the test plan (e.g., Email: Emerson, NEI, to Salley, NRC/RES, "Hemyc – Predominant Industry Practices," January 18, 2005).

The test protocols presented here are intended to provide bounding states of the protective material performance under standard test conditions. Also, this method is per NRC guidance, as stated in Generic Letter 86-10, Supplement 1, and represents current staff positions on bounding test approaches. Additionally, it is also required that the assembly and installation of the Hemyc and M.T. ERFBS shall be done in accordance with the vendor's specifications and meet all required vendor quality standards.

The test specimens will include the following items:

- 27-mm (1 in) Steel rigid metal conduit (RMC) arranged in a modified "U" configuration such that one vertical leg and one end of the horizontal span of the conduit intersect at a condolet LB access fitting, forming a right angle, while the other end of the horizontal span transitions to the second vertical leg via a conduit radius bend or elbow. Tests will be conducted on both "empty" and "loaded"[1] conduit configurations.
- 63-mm (2½ in) Steel rigid metal conduit (RMC) arranged in a modified "U" configuration such that one vertical leg and one end of the horizontal span of the conduit intersect at a condolet LB access fitting, forming a right angle, while the other end of the horizontal span will transition to the second vertical leg by means of a conduit radius bend or elbow. Both "empty" and "loaded" conduit configurations will be tested.
- 103-mm (4 in) Steel rigid metal conduit (RMC) arranged in a modified "U" configuration such that one vertical leg and one end of the horizontal span of the conduit intersect at a condolet LB access fitting, forming a right angle, while the other end of the horizontal span will transition to the second vertical leg through a conduit radius bend or elbow. Again, "empty" and "loaded" conduit configurations will be tested.
- A 305-mm (12 in) wide 16-gage galvanized steel ladder-back cable tray with 10 cm (4 in) high side rails and 23 cm (9 in) rung spacing. The cable tray will be constructed in a modified "U" configuration such that one vertical leg and one end of the horizontal span of the conduit intersect at a right angle, while the other end of the horizontal span will transition to the second vertical leg by means of a tray vertical curve. Only empty cable trays will undergo testing.
- A 914-mm (36 in) wide 16-gage galvanized steel ladder-back cable tray with 10 cm (4 in) high side rails and 23 cm (9 in) rung spacing. The cable tray will be constructed in a modified "U" configuration such that one vertical leg and one end of the horizontal span of the conduit intersect at a right angle, while the other end of the horizontal span will transition to the second vertical leg by means of a tray vertical curve. The cable trays will be tested without cables.
- Short cable drops consisting of a small bundle of No. 8 AWG bare copper wire suspended from the top of the furnace in a "U" loop configuration to simulate air drops.
- 46 cm x 61 cm x 20 cm (18" x 24" x 8") Steel junction boxes. The junction boxes will be suspended using supports protected by the ERFBS through direct attachment.
- Four separate support structure test elements consisting of two different cross sections (Unistrut® and square steel tube) formed into a right angle ("L")

[1] "Loaded" refers to approximately 30% of cross sectional area fill using bare #8 copper wires.

configuration and partially covered by the ERFBS. These structures are being included in the test program to evaluate the magnitude of heat transmission along their wrapped length and the possible thermal coupling effect on any supported assemblies or intervening items.

A bare #8 stranded copper wire, instrumented with thermocouples along its length, will be routed through each of the conduit test specimens and placed along the horizontal center of the cable tray test specimens and attached to the bottom of the rungs. The thermocouples will be mechanically attached to the bare copper conductor at 150-mm (6 in) spacing intervals. Additional thermocouples will be mechanically attached to the outer surfaces of the conduit test specimens and along the length of both side rails of the cable tray test specimens at 150-mm (6 in) intervals. The ends of the test specimens will be insulated with fiber filler inside and around their perimeters at the furnace-ceiling interface in accordance with the vendor's requirements.

The Hemyc ERFBS consists of blankets constructed of 38-mm (1.5 in) or 50-mm (2 in) thick, 128 kg/m^3 (8 lb/cu ft), JM Cerablanket/B&W Kaowool blanket covered with Siltemp 84CH and 84SR fabric mesh on all surfaces exposed to the fire. The materials are sewn together with "Astroquartz" thread. The cable tray and cable drop test specimens framed to support a 50-mm (2 in) air gap will use the 38-mm thick Hemyc covers and all direct attachment configurations will use the 50-mm thick wraps. All installation shall be in accordance with the vendor's requirements.

The M.T. three-hour ERFBS is virtually identical in concept and uses the same basic materials in construction as Hemyc, but the M.T. also has an internal layer of a heat-activated compound.

PCI Promatec, Inc. has been contracted to fabricate and install the Hemyc and M.T. materials on all of the test specimens.

Table 1 presents the test conditions to be investigated in terms of ERFBS type and configuration for each of the test specimens during the three tests. Conduits will not be tested in the air gap framed configuration and no cable trays will be tested with M.T.

Detailed construction drawings of each of the test specimens are provided in the appendix to this plan. The drawings define the specific details of the design and assembly of each test specimen. Promatec will provide separate drawings detailing the installation of the designated ERFBS. Drawings and descriptions of the dimensions and setup configurations in the furnace and instrumentation details are provided. The fabrication and installation of the ERFBS will be performed in accordance with vendor procedures. Provisions will be made to verify that all material/installation quality requirements are met.

Table 1: Test Matrix

	Test #1	**Test #2**	**Test #3**
	Hemyc (1-Hour, Direct Attachment)	Hemyc (1-Hour, Framed for Air Gap and Direct Attachment)	M.T. (3-Hour, Direct Attachment)
27-mm (1-in) Conduit[1]	X	(Not included)	X
63-mm (2½-in) Conduit[1]	X	(Not included)	X
103-mm (4-in) Conduit[1]	X	(Not included)	X
305-mm (12-in) Tray	(Not included)	X	(Not included)
914-mm (36-in) Tray	(Not included)	X	(Not included)
Junction Box[2]	X	X	X
Cable Drop	(Not included)	X	X
Unistrut Support	X	(Not included)	X
Tube Steel Support	X	(Not included)	X

[1] Conduit test specimens will be tested under both “empty” and “loaded-with-cable” conditions.
[2] Only a single junction box will be included in Test #2 that will be enclosed in Hemyc by Direct Attachment secured with metal bands.

Sandia National Laboratories will procure the required materials for the test specimens. The type of material and equipment obtained will include raceways (conduit, trays,

condolets, and junction boxes), metal to fabricate the support structure specimens, and miscellaneous hardware (nuts, bolts, screws, etc.) plus spare parts. Promatec will be responsible for QA of the Hemyc and M.T. materials and ERFBS installation.

The test laboratory will construct the test specimens in accordance with the detailed construction drawings. The process will include the positive mechanical fastening of the thermocouples to the outer surfaces of the test specimens and checkout for proper operation prior to the installation of the ERFBS. The test laboratory will also be responsible for installation of the instrumented bare #8 copper wire and the additional conductors within the raceways. Table 2 indicates the number of bare #8 conductors to be installed in the "loaded" conduit test specimens. The individual weights of the assembled, but empty, test specimens will be recorded prior to attachment to the test deck. Similarly, the weights of the bare #8 copper wire bundles will also be recorded prior to installation in the selected conduits. The resulting mass per unit length will be used as a first-order basis for determining the influence of cable loading on thermal response of the raceways. The test laboratory will be responsible for QA of the furnace temperatures and test operations. The laboratory will provide logs and record instrument data during the tests.

Table 2: Number of No. 8 Bare Conductors Routed in Loaded Conduit.

Loaded Test Specimens	No. bare #8 stranded wires	Approximate mass per unit length of wire
103-mm (4") Conduit	291	21.72 kg/m (14.58 lb/ft)
63-mm (2½") Conduit	113	8.45 kg/m (5.68 lb/ft)
27-mm (1") Conduit	18	1.38 kg/m (0.95 lb/ft)
Cable Drops	7	0.70 kg/m (0.50 lb/ft)

Photographs and documented written logs of the test specimens, both during and after assembly, shall be prepared by the testing laboratory prior to testing and included as part of the test QA documentation for the final test report.

PCI Promatec, Inc., through a contract with Sandia National Laboratories, will be responsible for fabricating and installing the ERFBS materials on the test specimens following construction, instrumentation and mounting on the test deck.

3.2 Assessment Criteria

The test specimens will be subjected to the ASTM E 119 temperature-time profile in the test furnace. An assessment of the ERFBS performance will be based on two principal factors, as stated in Generic Letter 86-10, Supplement 1:

1. *The time at which the average unexposed side temperature of the fire barrier system, as measured on the exterior surface of the raceway or component, exceeds 139 C (250 F) above its initial temperature. Or the time at which a single temperature reading of a test specimen exceeds 30% of the maximum allowable temperature rise (i.e., 181 C [325 F]) above its initial temperature.*
2. *The fire barrier system remains intact during the fire exposure and water hose stream test without developing any openings through which the cable raceway is visible.*

3.3 Test Facilities

The furnace tests will be conducted at Omega Point Laboratories (OPL), located in Elmendorf, Texas. OPL has a full-scale horizontal furnace that fully satisfies the requirements of this test plan. It is 3.7 m (12 ft) wide by 5.5 m (18 ft) long and 2.1 m (7 ft) deep equipped with twelve propane burners. The furnace has been demonstrated to produce the ASTM E 119 standard time-temperature profile.

The test furnace is located in a 18 m (60 ft) by 61 m (200 ft) by 9 m (30 ft) high building. This building has ample room for test specimen assembly and fire barrier installation activities prior to placement inside the furnace.

3.4 Primary Tests

Three separate test runs will be conducted as part of the primary test series. Two of the tests will test the performance of 1-hour rated Hemyc ERFBS and the third test will assess the performance of 3-hour rated M.T. ERFBS. All of the primary tests will be conducted using the ASTM E 119 standard time-temperature curve (Figure 1). The furnace calibration shall be within ASTM E 119 requirements and the calibration documentation included in the final test report. All thermocouples used in the testing (furnace and test specimens) shall be within ASTM E 119 requirements and the calibration documentation included in the final report.

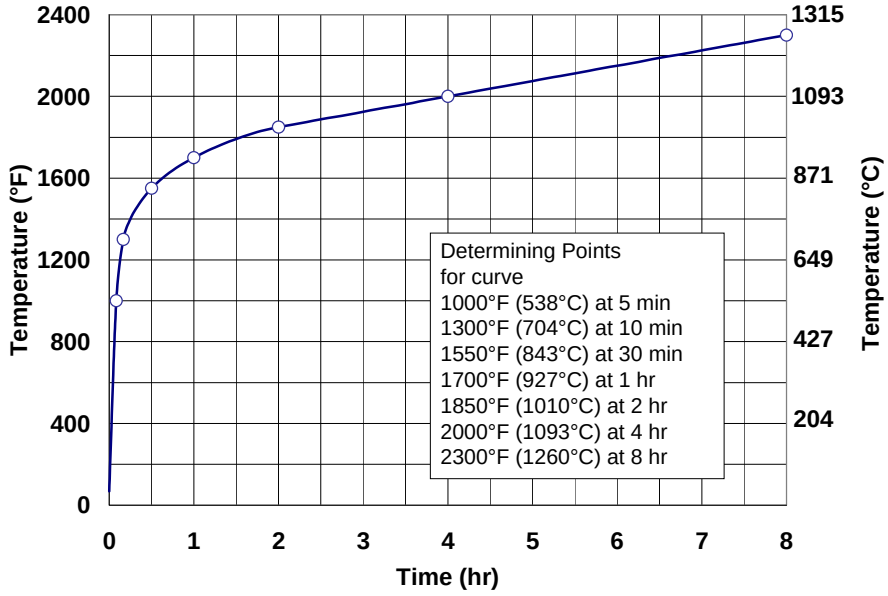


Figure 1. The Standard Time-Temperature Curve (based on data provided in ASTM E 119 – 00a.

As indicated above, these tests will be governed by the conditions provided in this test plan. The test specimens will consist of those items described in Section 3.1. The specific setup and configuration for each test is discussed below.

The Hemyc material will use Siltemp fabric on both the internal and external covering. Stainless steel bands will be used for attachment (i.e., no finger straps will be used). The spacing of the bands will be per Promatec's maximum spacing requirements. Standard 96 – 128 kg/m^3 (6 – 8 lb/ft^3) density ceramic fiber material will be used to construct the Hemyc wraps. The 27-mm (1-in) empty conduit, 63-mm (2½-in) loaded conduit and the 103-mm (4-in) conduit (empty and loaded) will all employ butt joints with 150-mm (6 in) wide collar over wraps. The 27-mm (1-in) loaded conduit and the 63-mm (2½-in) empty conduit will employ 50-mm (2-in) overlap joints. All cable trays will use the overlap joint method. In addition, the cable drop with the 50-mm (2-in) air gap will use the overlap method for sealing the material joints while the cable drop without the air gap will use collars to cover the butt joints.

3.4.1 Test #1

The first test of the series will be conducted on nine test specimens with Hemyc ERFBS directly attached to the raceways (i.e., without framework to provide air gaps between the fire barrier material and raceways). The nominal thickness of the Hemyc will be 50 mm (2 in).

Figure 2 shows one possible configuration of the test specimens inside the furnace. As indicated in the figure, the test specimens include:

- A 103-mm (4 in) conduit without additional cables,
- A 103-mm (4 in) conduit loaded with the maximum (30% of conduit's cross-sectional area) fill of cables,
- A 27-mm (1 in) conduit and condolet LB assembly without cables,
- A 27-mm (1 in) conduit and condolet LB assembly with additional cables (30% fill),
- A 63-mm (2½ in) conduit and condolet LB assembly with no cables,
- A 63-mm (2½ in) conduit and condolet LB assembly with cables (30% fill),
- A 46 cm X 61 cm X 20 cm (18" x 24" x 8") junction box,
- A partially protected Unistrut® support assembly, and
- A partially protected 5 cm x 5 cm (2" x 2") square steel tube support assembly

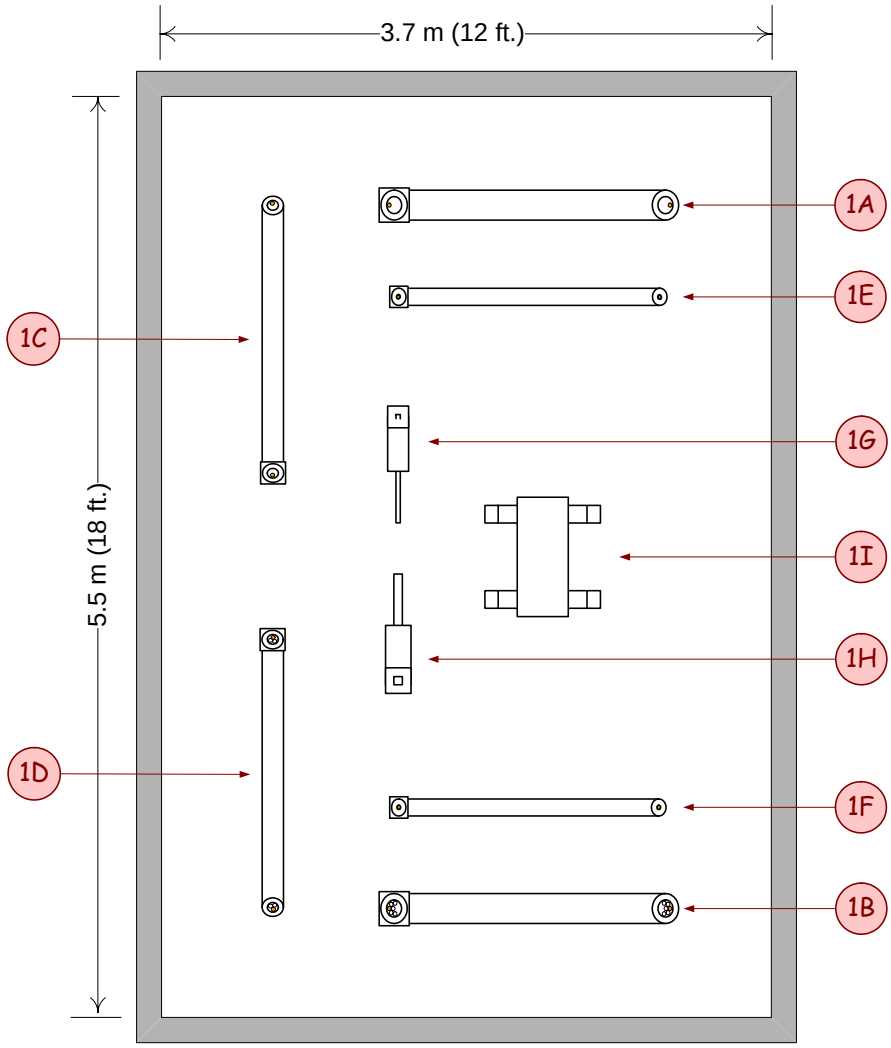


Figure 2. Example of Test Specimen Layout during Test #1 (Hemyc, Direct Attachment Configurations).

This arrangement of the test specimens is intended to maximize thermal exposures and minimize the potential for one specimen to influence the response of another specimen to the thermal environment (i.e., minimize shadowing).

The conduit will be supported from the furnace ceiling in a modified "U" configuration. The metal test deck will be adequately insulated to prevent interaction with the portion of the test specimens located outside the furnace and to protect the metal deck from structural failure during the 1-hour test. Each conduit will include one sharp 90-degree transition from the horizontal span to one of the vertical legs; a condolet fitting will be employed to provide the right angle transition from horizontal to vertical. At the other transition point a radius bend will be used. The two vertical runs of these test articles will be approximately 0.9 m (36 in) along each leg and the horizontal span will be approximately 1.5 m (60 in) (See Figures A1, A2, and A3 in Appendix A). The ERFBS will completely cover the test specimens within the furnace and extend through the test deck for a distance of 15 to 30 cm (6 – 12 in) above the test deck (See Figure A19 in Appendix A). All raceway supports shall be outside the furnace and shall not interfere with the ERFBS during testing.

A Hemyc ERFBS will be directly attached to the support structure analogs such that 30 cm (12 in) of their horizontal sections are exposed to the furnace environment. The junction box will be suspended from the test deck by Unistrut support members and protected with Hemyc through direct attachment (See figure A6 in Appendix A).

The vertical run of the Unistrut will be approximately 0.9 m (36 in) inside the furnace and the horizontal run will be 0.6 m (24 in) (See figure A8 in Appendix A).

The vertical run of the 5 cm x 5 cm (2 in. x 2 in) tube steel will be approximately 0.9 m (36 in) below the test deck and the horizontal run will be 0.6 m (24 in) (See figure A7 in Appendix A).

3.4.2 Test #2

The second test will be conducted on seven test specimens, which will be protected with Hemyc ERFBS. Two of the cable trays and one cable drop will incorporate the necessary framework to provide a minimum of 50-mm (2 in) air gaps between the ERFBS and item. The nominal thickness of the Hemyc ERFBS enclosing the framed components will be 38 mm (1½ in). The remaining two cable trays, cable drop and junction box will be protected with directly attached (i.e., without air gap framework) Hemyc with a nominal wrap thickness of 50-mm (2 in).

One possible arrangement of the test specimens in the furnace during Test #2 is shown in Figure 3. The seven test specimens will include:

- A 914-mm (36 in) cable tray framed for 50-mm (2”) air gap,
- A 914-mm (36 in) cable tray employing direct attachment of the Hemyc,
- A 305-mm (12 in) cable tray framed for 50-mm air gap,
- A 305-mm (12 in) cable tray employing direct attachment of the Hemyc,
- A small cable drop loop employing direct attachment of the Hemyc,
- A 46 cm x 61 cm x 20 cm (18" x 24" x 8") junction box employing direct attachment of the Hemyc suspended from the top of the furnace with separately protected (direct attachment, ceramic fiber blanket) supports, and
- A small cable drop loop framed for 50-mm air gap.

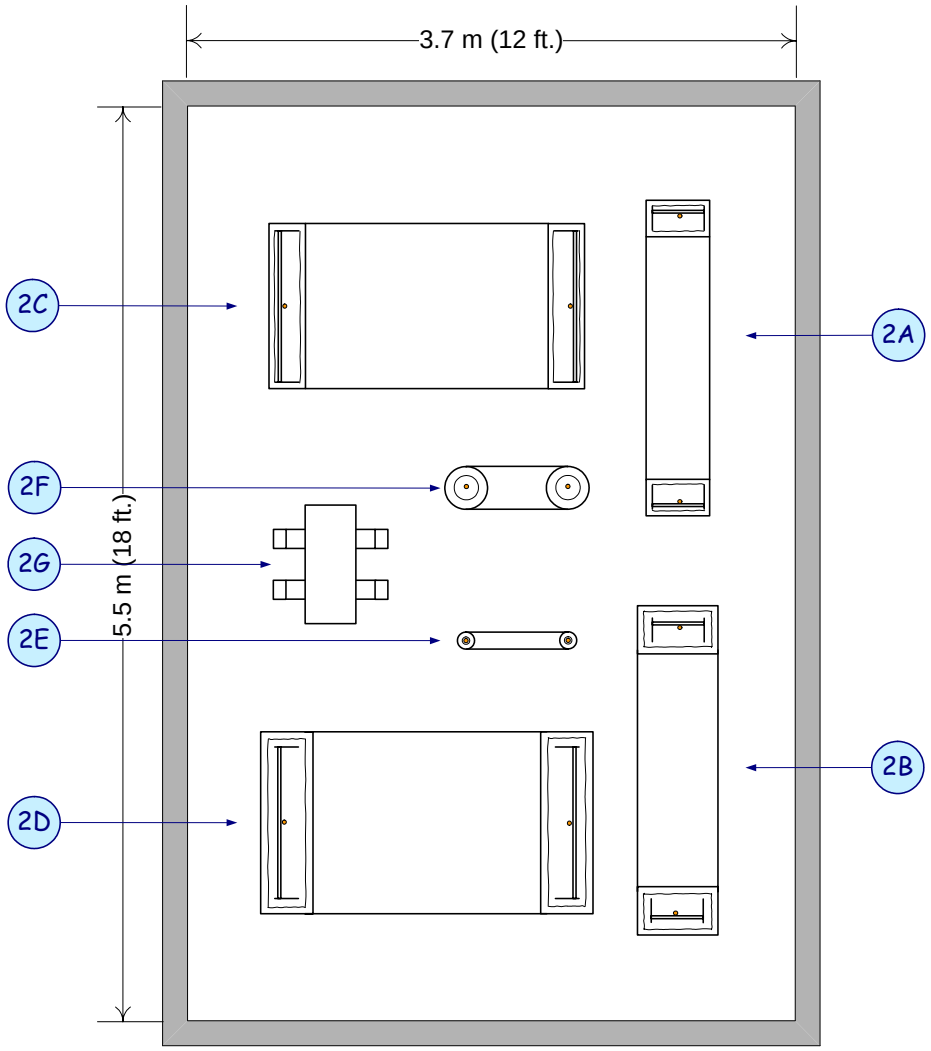


Figure 3. Example of Test Specimen Layout during Test #2 (Hemyc, Framed for 50-mm (2”) Air Gap and Direct Attachment Configurations).

The cable trays will be supported from the furnace ceiling in a modified "U" configuration. The metal test deck of the test specimens will be adequately insulated to prevent interaction with the portion of the test specimens located outside the furnace and to protect the metal deck from structural failure during the 1-hour test. Each tray will include one sharp 90-degree transition from the horizontal span to one of the vertical legs. At the other transition a radius bend will be used. The cable trays will be modified and assembled to accommodate the right angle turn. The two vertical runs of these test articles will be approximately 0.9 m (36 in) along each leg inside the furnace and the horizontal span will be approximately 1.5 m (60 in) (See Figures A4 and A5 in Appendix A). The ERFBS will completely cover the test specimens within the furnace and extend through the test deck for a distance of 15 to 30 cm (6 – 12 in) above the test deck (See Figure A20 in Appendix A). All raceway supports shall be outside the furnace and shall not interfere with the ERFBS during testing.

The junction box will be supported from the furnace ceiling by Unistrut® channels (See Figure A6 in Appendix A). The junction box supports will be directly protected with a ceramic fiber blanket separately from the box.[2] (Note: The junction box supports are not considered as part of this test and will not be instrumented; however any failure in their performance during the test will be noted and investigated as deemed appropriate.) Two wrapped cable bundles (one with air gap, the other without) will be dropped through the top of the furnace and looped in the furnace and routed back up through the test deck (See figure A9 in Appendix A).

3.4.3 Test #3

The final test will be conducted on ten test specimens, all of which will be wrapped with the M.T. 3-hour rated ERFBS without any framework to provide air gaps between the wrap and raceway. The nominal thickness of the M.T. ERFBS will be approximately

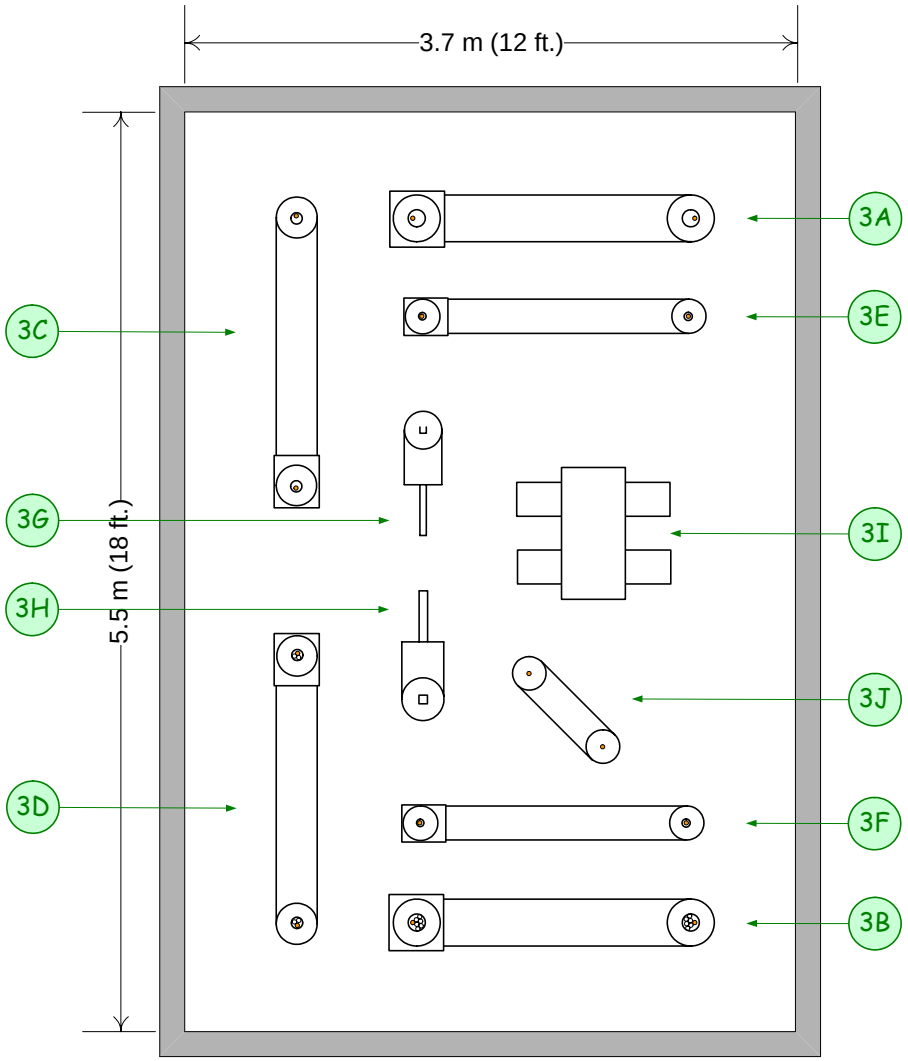
[2] The junction box supports were protected with 50-mm (2") thick raw ceramic fiber blankets (not Hemyc) in Test #2 and kept thermally isolated from the box.

133 mm (5¼ in) for the cable drop. The nominal M.T. thickness for conduits and junction boxes will be 95 mm (3¾ in).

Figure 4 shows a possible configuration of the test specimens in the furnace during Test 3. The test specimens protected with M.T. during Test #3 will include:

- A 103-mm (4 in) conduit without additional cables,
- A 103-mm (4 in) conduit loaded with the maximum fill (30%) of cables,
- A 27-mm (1 in) conduit and condolet LB assembly without cables,
- A 27-mm (1 in) conduit and condolet LB assembly with additional cables (30% fill),
- A 63-mm (2½ in) conduit and condolet LB assembly with no cables,
- A 63-mm (2½ in) conduit and condolet LB assembly with cables (30% fill),
- A small cable drop loop,
- A partially protected Unistrut® support assembly,
- A partially protected 5 cm x 5 cm (2” x 2”) square steel tube support assembly, and
- A 46 cm X 61 cm X 20 cm (18" x 24" x 8") junction box

As in the other two tests, the conduit assemblies will be supported from the furnace ceiling in a modified “U” configuration. The metal deck of the test specimens will be adequately insulated to prevent interaction with the portion of the test specimens located outside the furnace and to protect the metal deck from structural failure during the 3-hour test. Each conduit will include one sharp 90-degree transition from the horizontal span to one of the vertical legs and a radius bend will be used for the other transition. A condolet fitting will be employed to provide the right angle turn. The two vertical runs of these test articles will be approximately 0.9 m (36 in) along each leg inside the furnace and the horizontal run will be approximately 1.5 m (60 in) (See Figures A1, A2, and A3 in Appendix A). The ERFBS will completely cover the test specimens within the furnace and extend through the test deck for a distance of 15 to 30 cm (6 – 12 in) above the test deck (See Figure A19 in Appendix A). All raceway supports shall be outside the furnace and shall not interfere with the ERFBS during testing.



Plan View

Test #3 Configuration Layout
Test Specimens Direct Wrap with M.T.

3A – 103 mm (4") Conduit (0% Fill)
3B – 103 mm (4") Conduit (30% Fill)
3C – 63 mm (2½") Conduit (0% Fill)
3D – 63 mm (2½") Conduit (30% Fill)
3E – 27 mm (1") Conduit (0% Fill)
3F – 27 mm (1") Conduit (30% Fill)
3G – Unistrut Support Structure
3H – 5 cm X 5 cm (2" X 2") Steel Support Structure
3I – 46 cm X 61 cm X 20 cm (18" X 24" X 8") J-Box
3J - #8 AWG Bare Copper Wire Drop

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Figure 4. Example of Test Specimen Layout during Test #3 (M.T., Direct Wrap Configurations).

An M.T. ERFBS will be directly attached to the support structure analogs such that 30 cm (12 in) of their horizontal sections are exposed to the furnace environment. The junction box will be suspended from the test deck by Unistrut support members and protected with M.T. through direct attachment (See figure A6 in Appendix A).

The vertical run of the Unistrut will be approximately 0.9 m (36 in) within the furnace and the horizontal run will be 0.6 m (24 in) (See figure A8 in Appendix A).

The vertical run of the 5 cm x 5 cm (2 in. x 2 in) tube steel will be 0.9 m (36 in) in the furnace and the horizontal run will be 0.6 m (24 in) (See figure A7 in Appendix A).

One wrapped cable bundle will be dropped through the top of the furnace and looped in the furnace and routed back up through the test deck (See figure A9 in Appendix A).

3.5 Conduct of Tests

Each of the primary test runs will be conducted by exposing the test specimens to the time-temperature curve (Fig. 1) as specified in ASTM E 119, Standard Test Methods for Fire Tests of Building Construction and Materials. By this method, the temperature inside the furnace should reach 927 C (1700 F) at the end of the one-hour tests and 1052 C (1925 F) at the end of the 3-hour test. Figure 1 shows the desired temperature profile as a function of time. The time-temperature curve shall be maintained within the limits established in ASTM E 119.

Upon completion of each ASTM E 119 temperature run (one-hour and three-hours), the complete test assembly will be removed from the furnace and a hose stream will be applied to all of the test articles. The hose stream test will consist of a water stream applied at random to all exposed surfaces of the test specimens through a 38-mm (1½ in) fog nozzle set at a discharge angle of 15 degrees with a nozzle pressure of 517 kPa (75 psi) at a minimum discharge rate of 284 lpm (75 gpm) with the tip of the nozzle at a

maximum distance of 3 m (10 ft) from the test specimen. The hose stream application will be continued for at least 5 minutes upon completion of the test.

A visual inspection of all test articles will be conducted following the hose stream test. The purpose of the inspection will be to ascertain whether the ERFBS remained intact during the fire exposure and the cooling and mechanical impact of the hose stream test without developing any openings or breaches. Visible indications of an opening will include obvious tears or displacement of a barrier section or a view of the covered raceway through the fire barrier.

Photographs and video of the test specimens, both prior to and after disassembly, will be taken during the post-test inspection and recorded as part of the test documentation.

3.6 Instrumentation and Data Collection

The primary data to be generated in these tests will be component temperatures as indicated by insulated 24-gage Type-K thermocouples (Special Limit 32 to 2282^{o}F range and 2^{o}F or 0.4% tolerance value per ASTM E230-ANSI MC 96.1). The junction box temperatures will be monitored using Type-K thermocouples sheathed in Inconel. These thermocouples have been calibrated and certified to accuracies within 4^{o}F of the comparison standard over a temperature range of 70^{o}F to 1000^{o}F. Test #1 will require the use of approximately 380 thermocouples to monitor the test specimen temperatures. Test #2 will require about 335 thermocouples. Approximately 400 thermocouples will be needed for Test #3. The outputs of the thermocouples will be sent to a computerized data collection unit for recording and storage. Each thermocouple's output will be recorded at least once per minute. It is expected that Teflon-coated thermocouples will be used during Test #3 to ensure that there will not be interference from any gases evolving from the M.T. ERFBS.

Figures A10 through A18 in Appendix A show the preferred attachment locations of the thermocouples on the test specimens. Routing the thermocouples for monitoring the tray temperatures will be by laying the bundles in the tray at the entry point and branching the

thermocouples off for mechanical attachment to the tray rails and bare copper conductor at the appropriate locations (See figures A13 and A14 in Appendix A). Similarly, for the cable drop thermocouples, the thermocouples will be bundled with the cable drop cables at the points of entrance and exit at the ceiling of the furnace and branching off the thermocouples for attachment to the bare copper conductor wire at 150-mm (6 in) spacing intervals (See figure A18 in Appendix A).

Each conduit will have thermocouples mechanically fastened to the side or bottom surface located along the outside perimeter of the "U" shape (See Figures A10, A11, and A12, in Appendix A). The routing of thermocouples for monitoring the temperature of the conduit will require that a series of small thermocouple bundles be placed around the circumference of the conduit and run to their individual attachment locations between the conduit and ERFBS. In order to minimize the effect of these small bundles on the test results, the conduit thermocouples will be run in underneath the ERFBS from both ends of the test specimen. The bare copper wire routed through the interior of each conduit test specimen will be instrumented with thermocouples installed with a maximum spacing of 150-mm (6 in) along its length. The junction boxes and condolet fittings will have at least one thermocouple attached to each side located at or as closely as possible to the geometric center of the side walls.

Note that the thermocouple locations indicated in these figures are for information purposes only. The thermocouples will be installed, except as noted, at 150-mm (6 in) intervals along the conduits, cable tray rails, and bare #8 copper wires in accordance with the guidance provided in Supplement 1 to Generic Letter (GL) 86-10. The instrumented bare #8 copper wire will be embedded within the copper wire bundles of the "loaded" raceways to protect the thermocouples from physical damage when the bundles are pulled through the raceways. Thermocouples will be attached to the raceway vertical legs located 25-mm (1 in) above the top of the test deck and 25-mm (1 in) below the exposed surface of the insulation on the bottom of the test deck.

3.7 Follow-on Tests

The decision to plan and conduct follow-on tests will be made by NRC (RES) on the basis of the primary test results.

4 REPORTING AND DOCUMENTATION

For each test conducted, the testing laboratory shall produce a draft report within two weeks of completion of the test. Each draft report (including electronic data and color photographs) will be submitted to SNL for a one-week comment period. The draft report will contain a summary of the thermocouple data and a simple analysis on the effects of cable mass on ERFBS performance. Upon receipt of comments, the test laboratory shall issue the final test report within two weeks to SNL. The final report shall contain all thermocouple data (including plots and location maps), QA documentation and construction drawings and ERFBS installation details. Thermocouple data plots will include graphs of (1) each individual temperature monitored during the test, (2) graphs of the average and maximum temperatures recorded for each test specimen exterior surface as a function of time, and (3) graphs of the average and maximum temperatures recorded for each test specimen instrumented bare #8 conductor as a function of time. SNL shall review the final report for accuracy and transmit the complete laboratory report to NRC (RES) within one week.

The test data will be analyzed and the fire barrier performance will be evaluated based on the acceptance criteria.

It should be recognized that the possibility exists that these test results may form the technical basis for broad acceptance of these fire protection systems by NRC, or provided the basis for enforcement action or backfit requirements, as deemed appropriate.

5 REFERENCES

10 CFR, Part 50, Appendix R, Fire Protection Program for Operating Nuclear Power Plants.

Supplement 1 to Generic Letter 86-10, Fire Endurance Test Acceptance Criteria for Fire Barrier Systems used to Separate Redundant Safe Shutdown Trains within the Same Fire Area, March 25, 1994.

ASTM E 119 – 00a, Standard Test Methods for Fire Tests of Building Construction and Materials.

A Test Specimen Configuration Details and Thermocouple Location Plan

These diagrams are not to scale and indicate test specimens assembly and thermocouple installation details for illustrative purposes only.

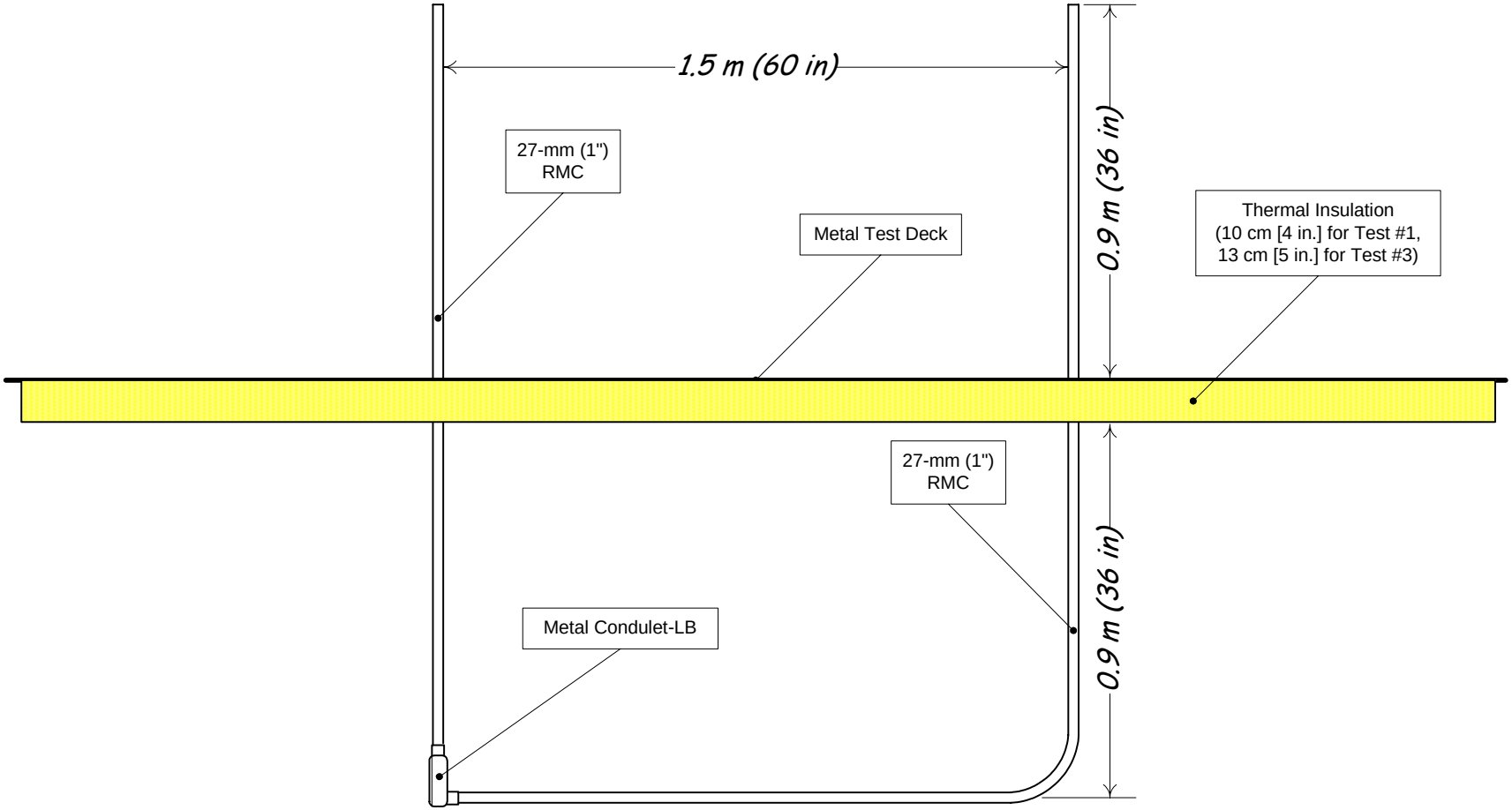


Figure A1: 27-mm (1-in) rigid metal conduit test specimens (side view with dimensions).

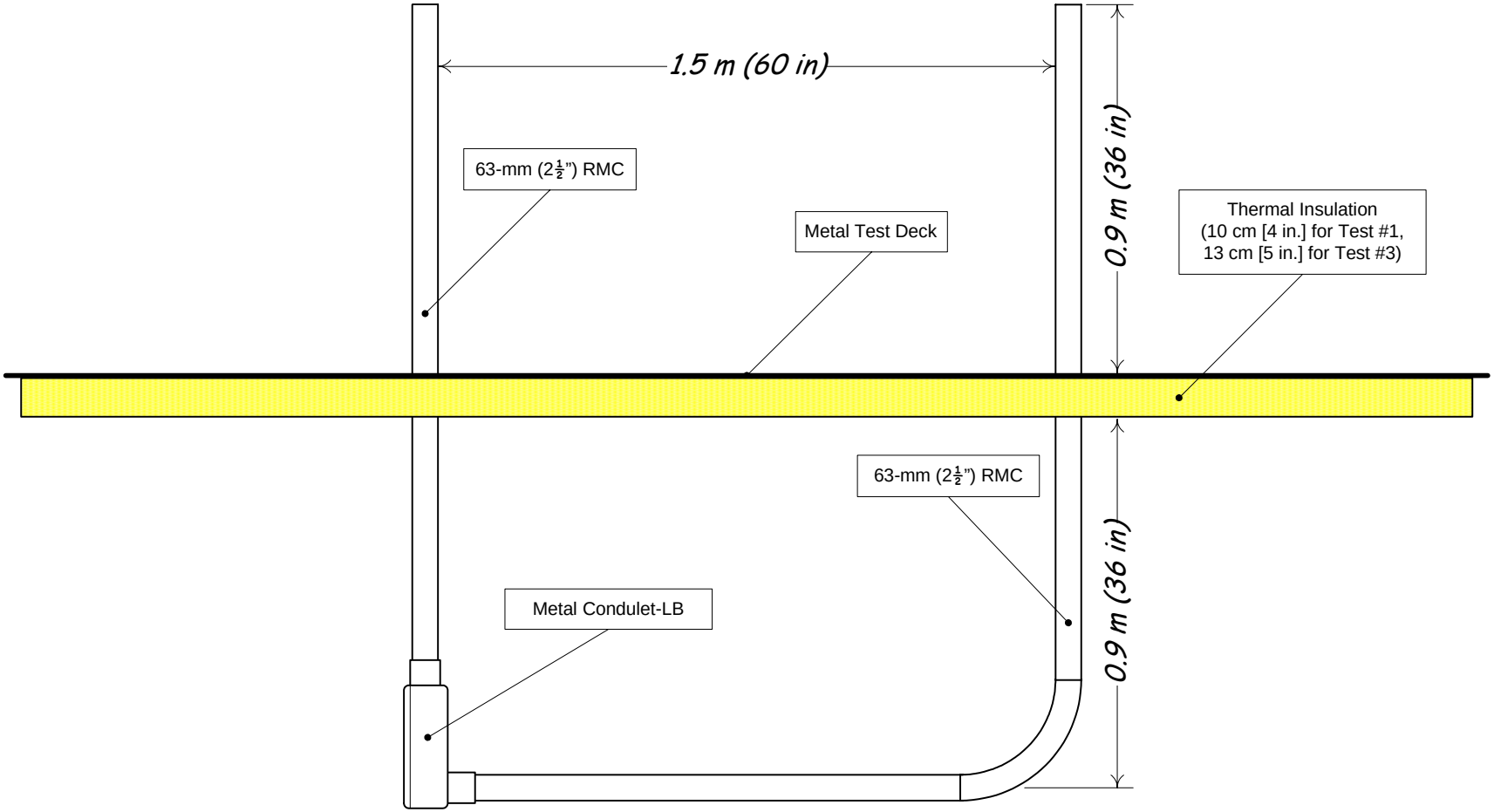


Figure A2: 63-mm (2½-in) rigid metal conduit test specimens (side view with dimensions).

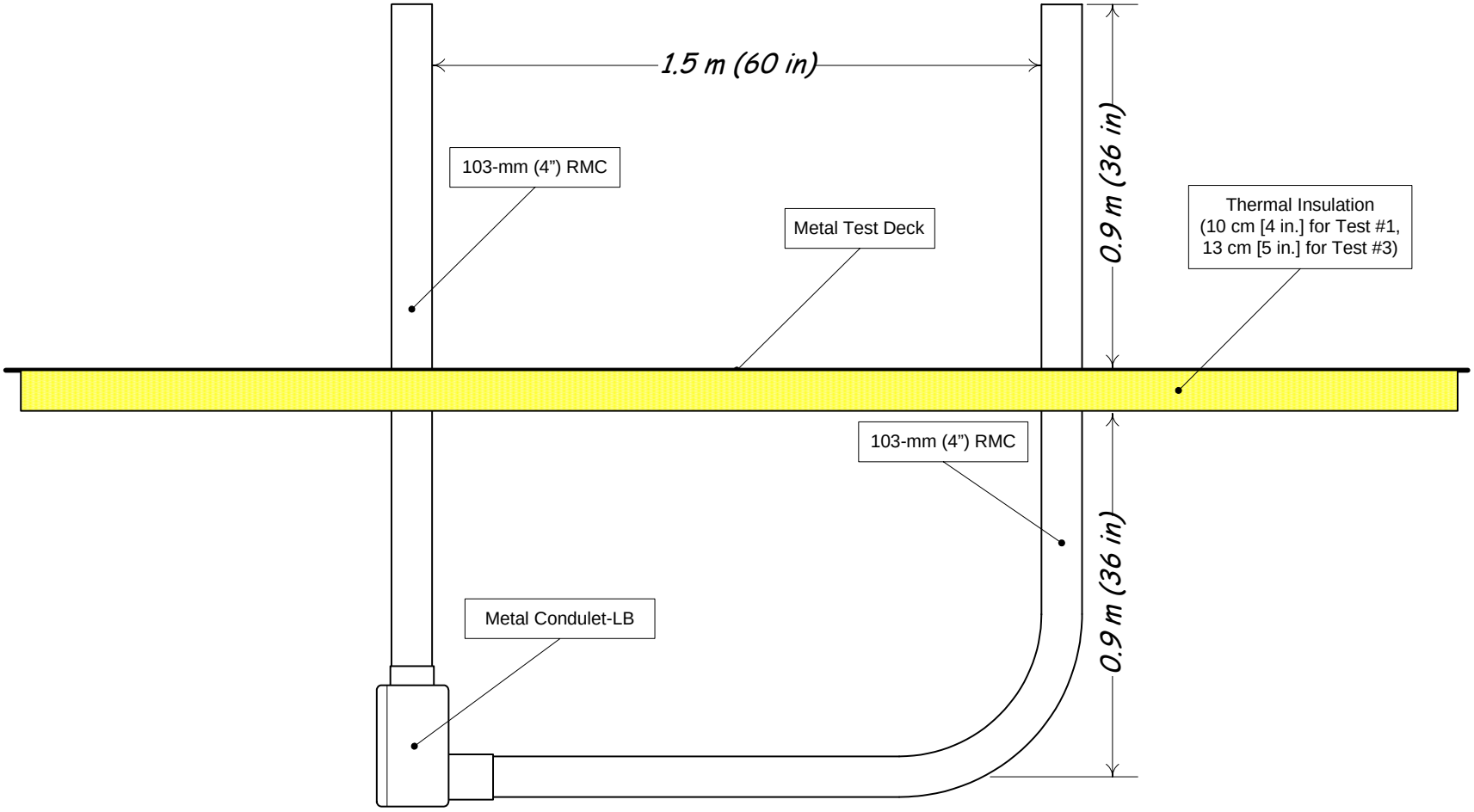


Figure A3: 103-mm (4-in) rigid metal conduit test specimens (side view with dimensions).

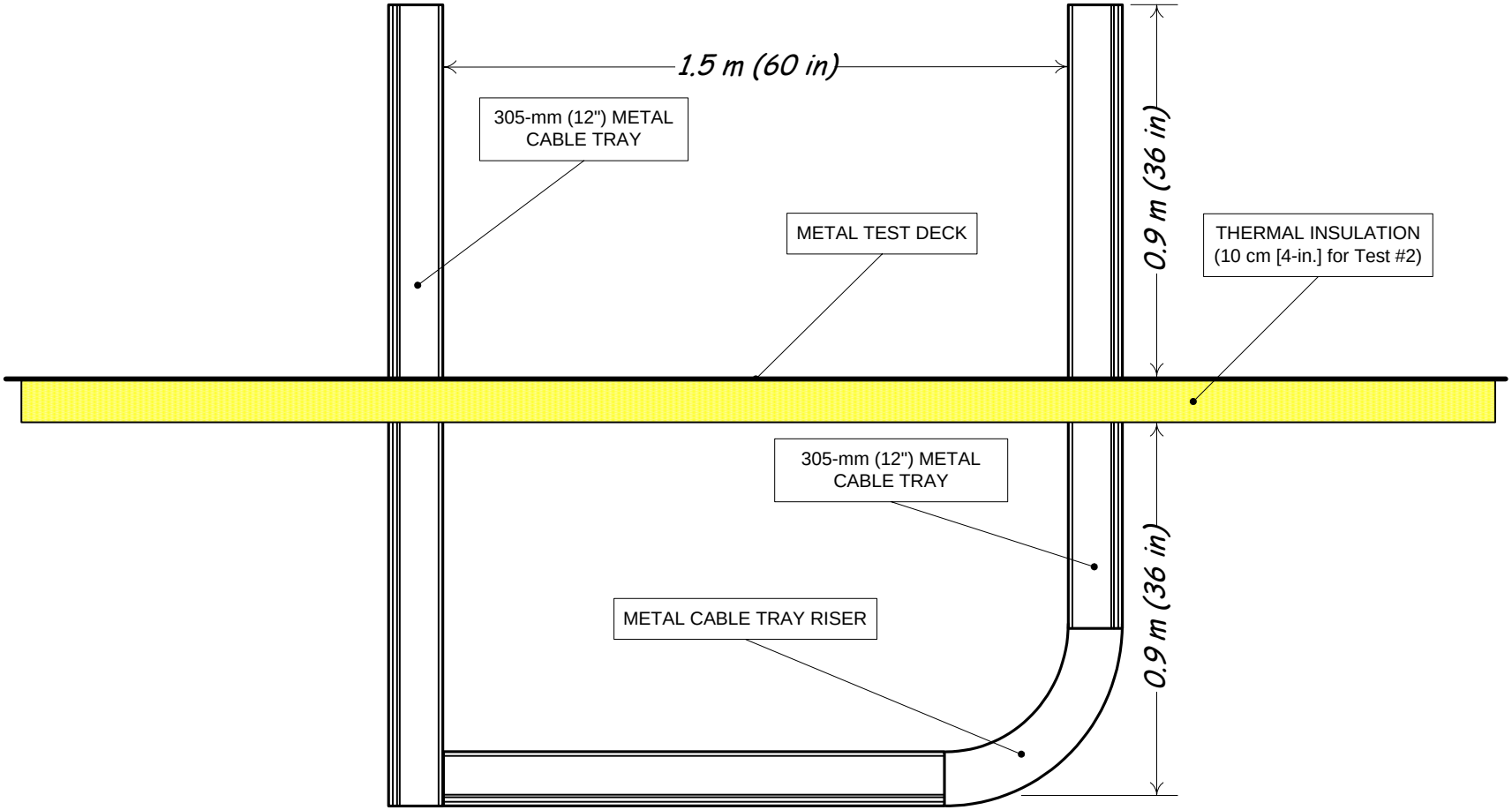


Figure A4: 305-mm (12-in) cable tray test specimens (side view with dimensions). Cable trays will be ladder type, 18-gage galvanized steel with 10 cm (4 in) high side rails and 23 cm (9 in) rung spacing.

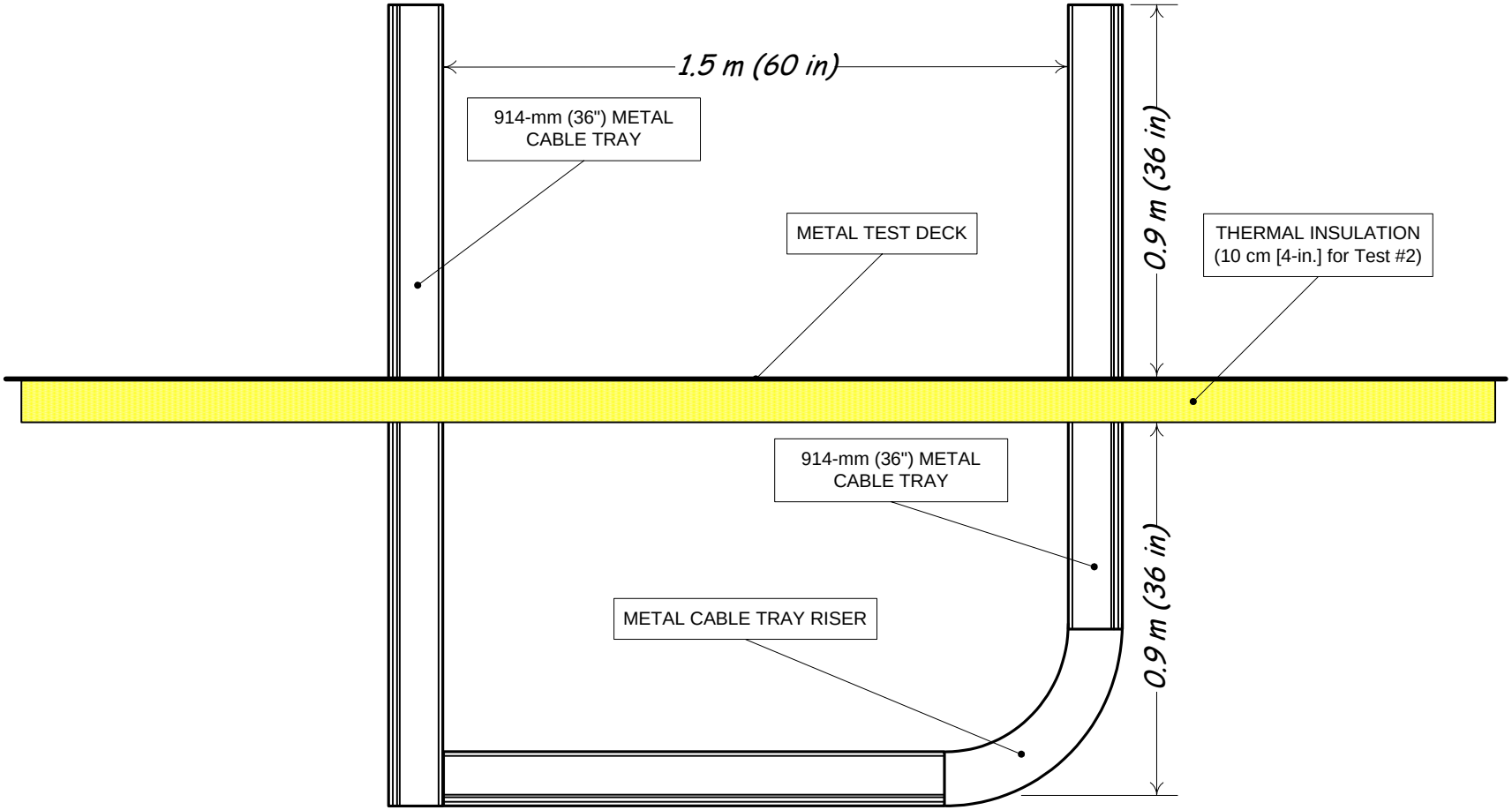


Figure A5: 914-mm (36-in) cable tray test specimens (side view with dimensions). Cable trays will be ladder type, 18-gage galvanized steel with 10 cm (4 in) high side rails and 23 cm (9 in) rung spacing.

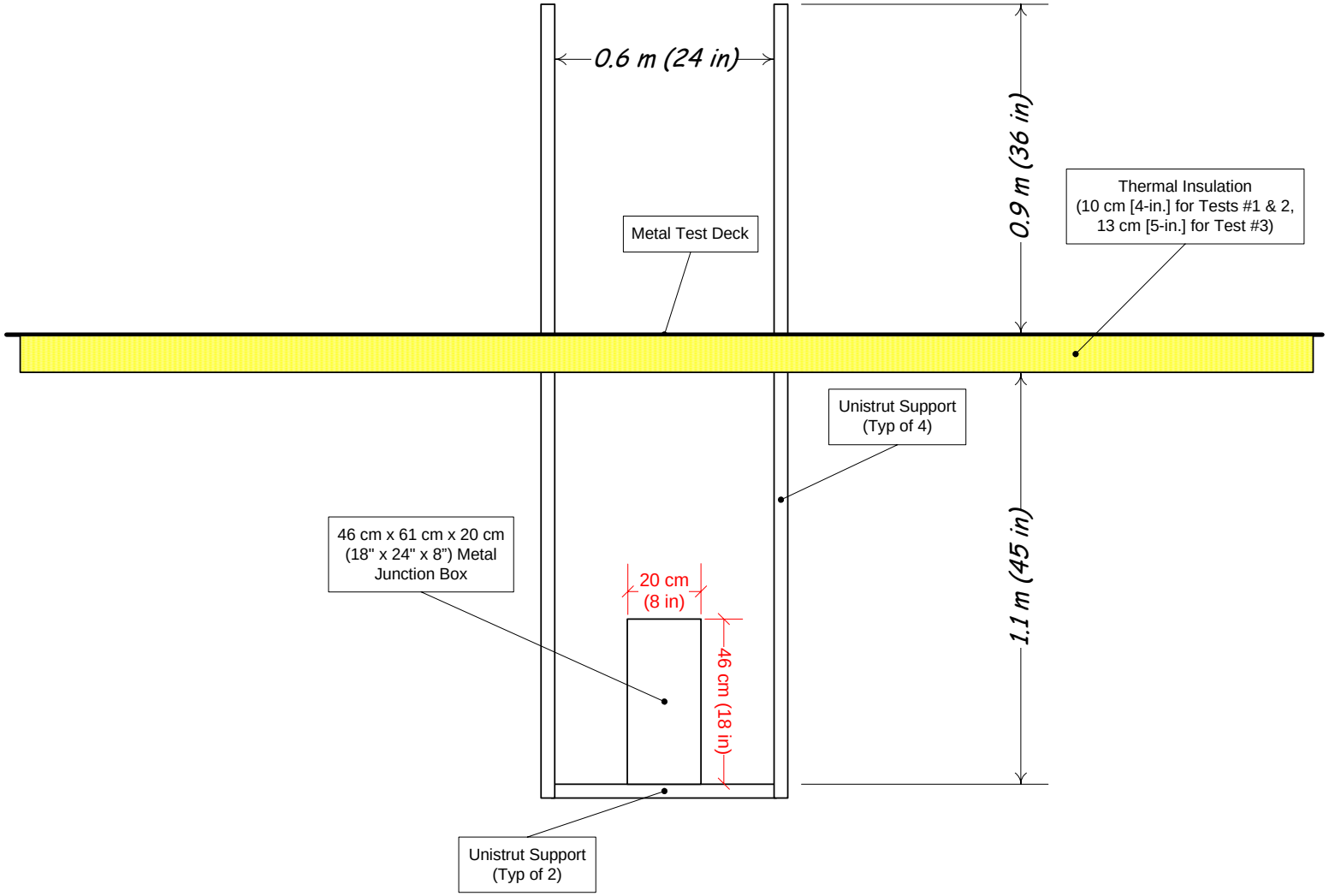


Figure A6 (a): Junction box test specimens (front elevation view with dimensions).

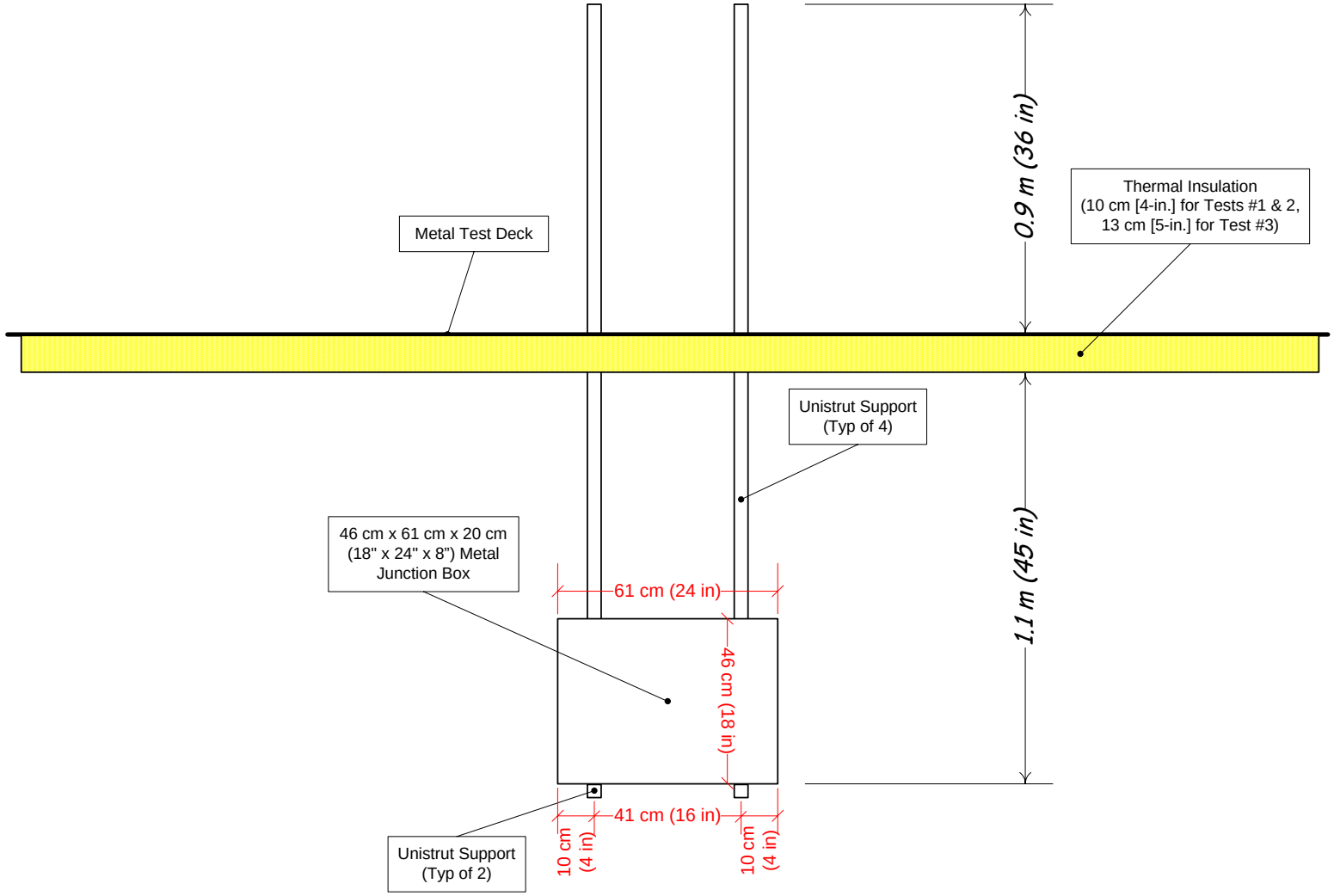


Figure A6 (b): Junction box test specimens (side elevation view with dimensions).

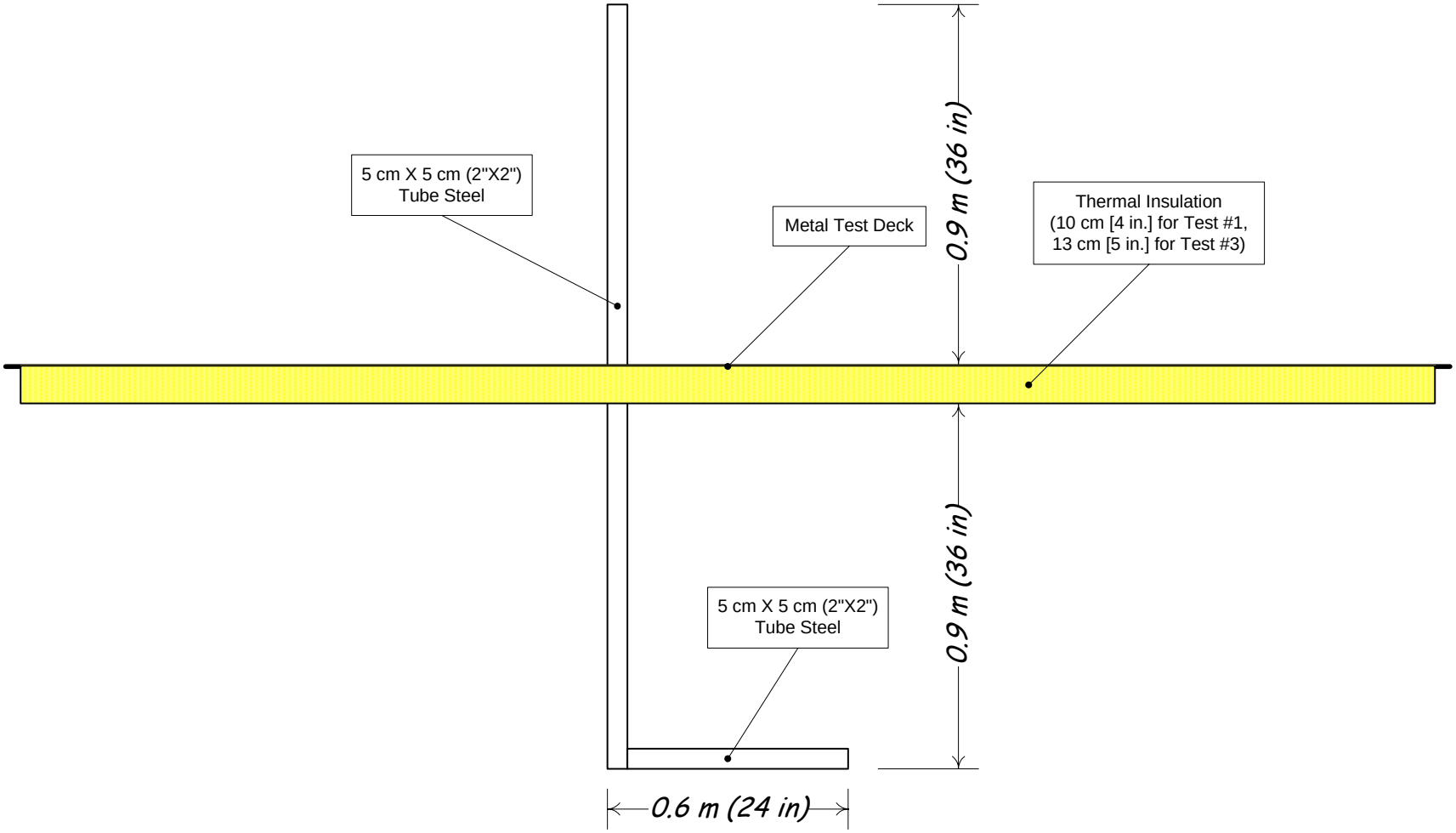


Figure A7: Tube steel support structure test specimens (side view with dimensions).

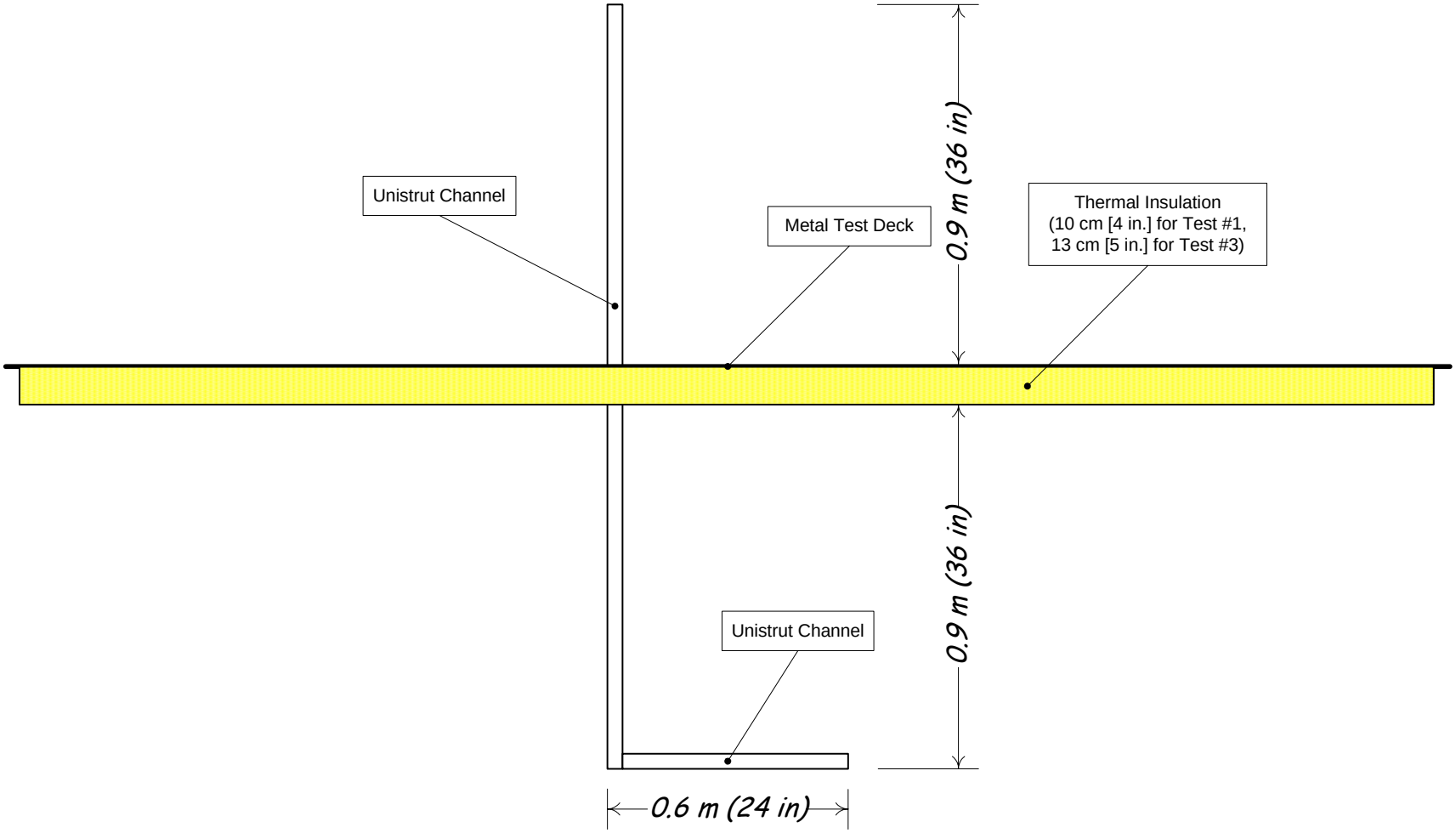


Figure A8: Unistrut® support structure test specimens (side view with dimensions).

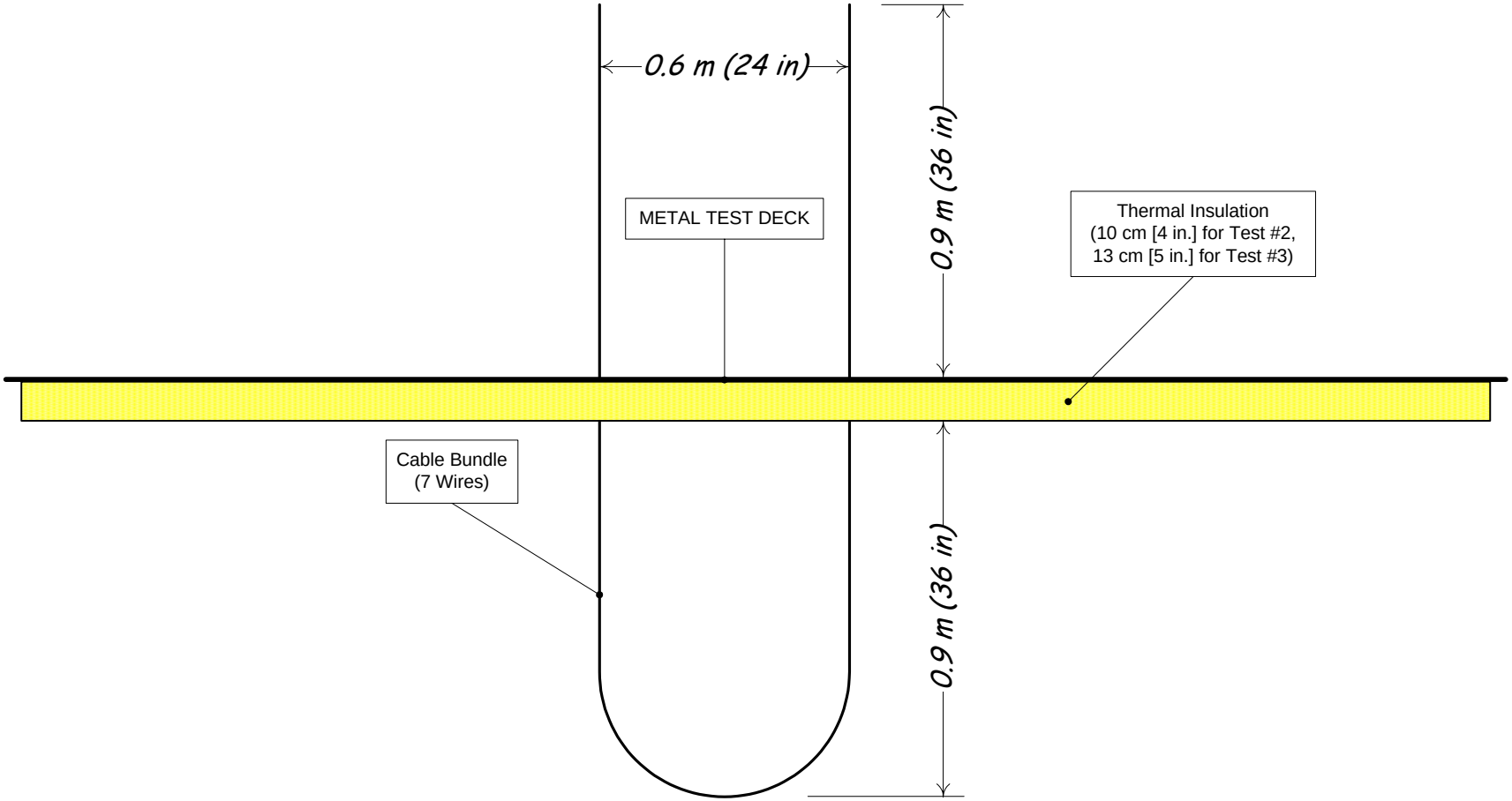


Figure A9: Unsupported cable-drop test specimens (side view with dimensions).

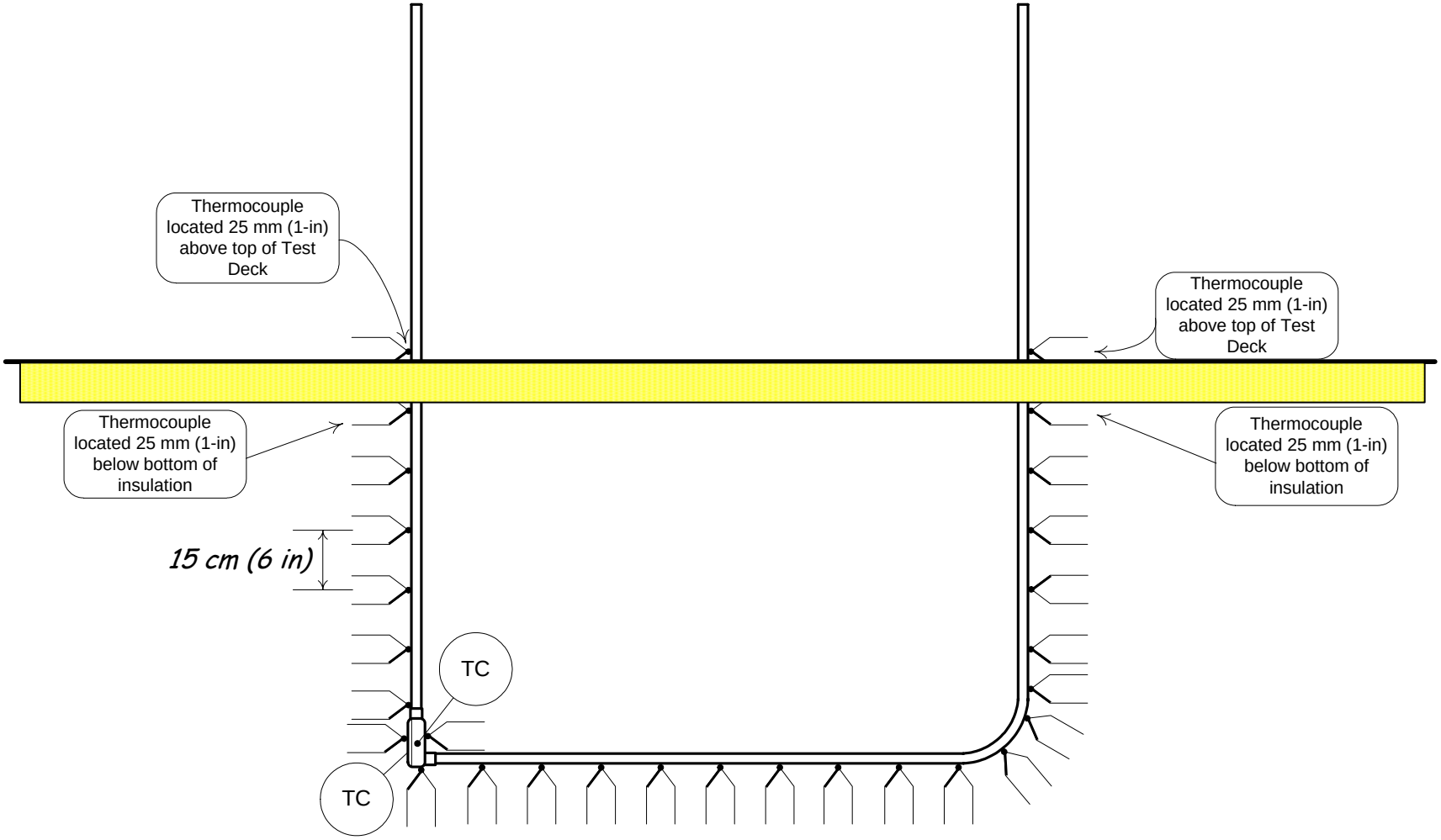


Figure A10: Thermocouple placement on 27-mm (1-in) conduit test specimens (additional thermocouples to be attached—at 150-mm [6-in] spacing intervals—to a bare #8 copper wire routed through conduit).

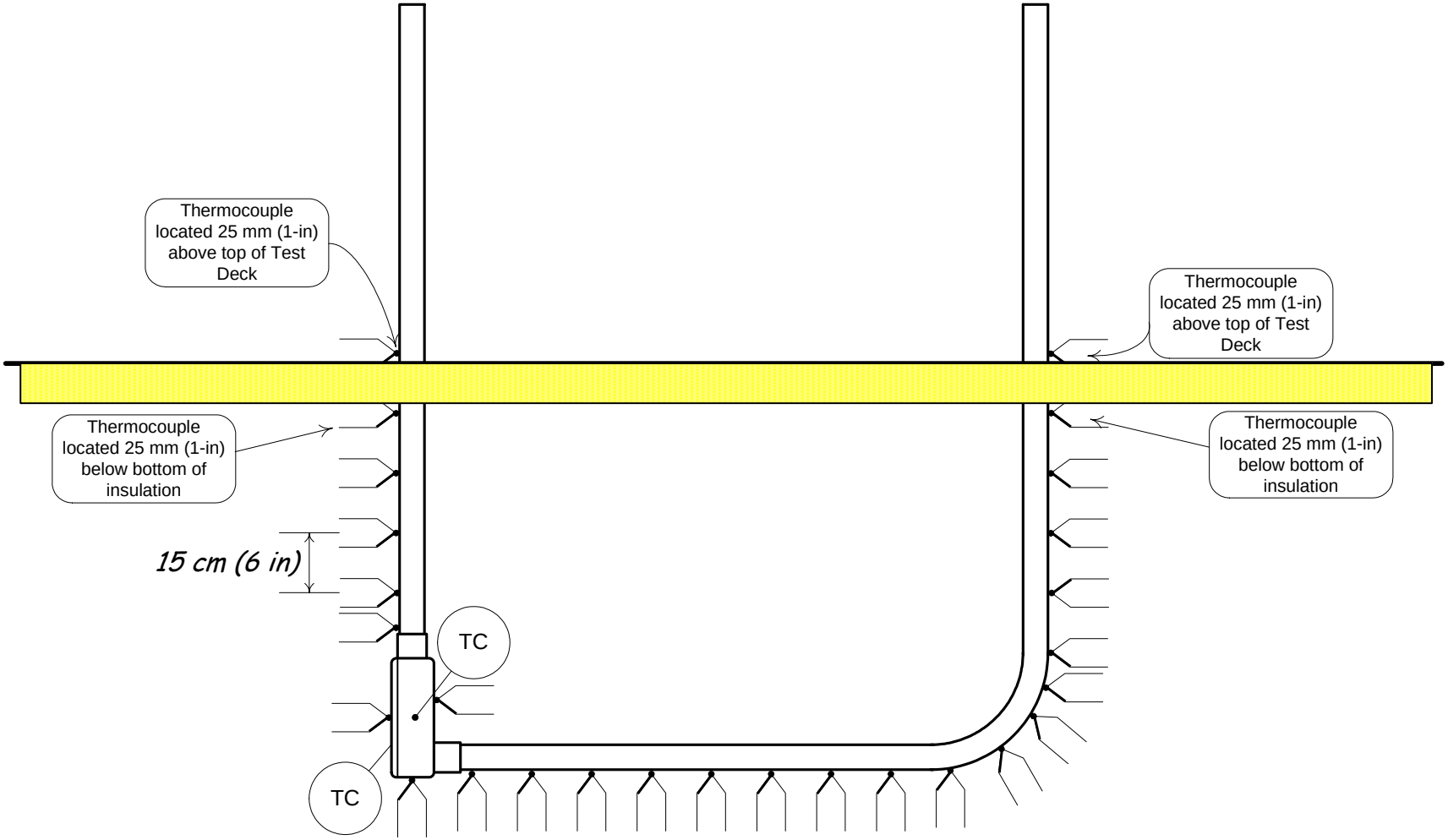


Figure A11: Thermocouple placement on 63-mm (2½-in) conduit test specimens (additional thermocouples to be attached—at 150-mm [6-in] spacing intervals—to a bare #8 copper wire routed through conduit).

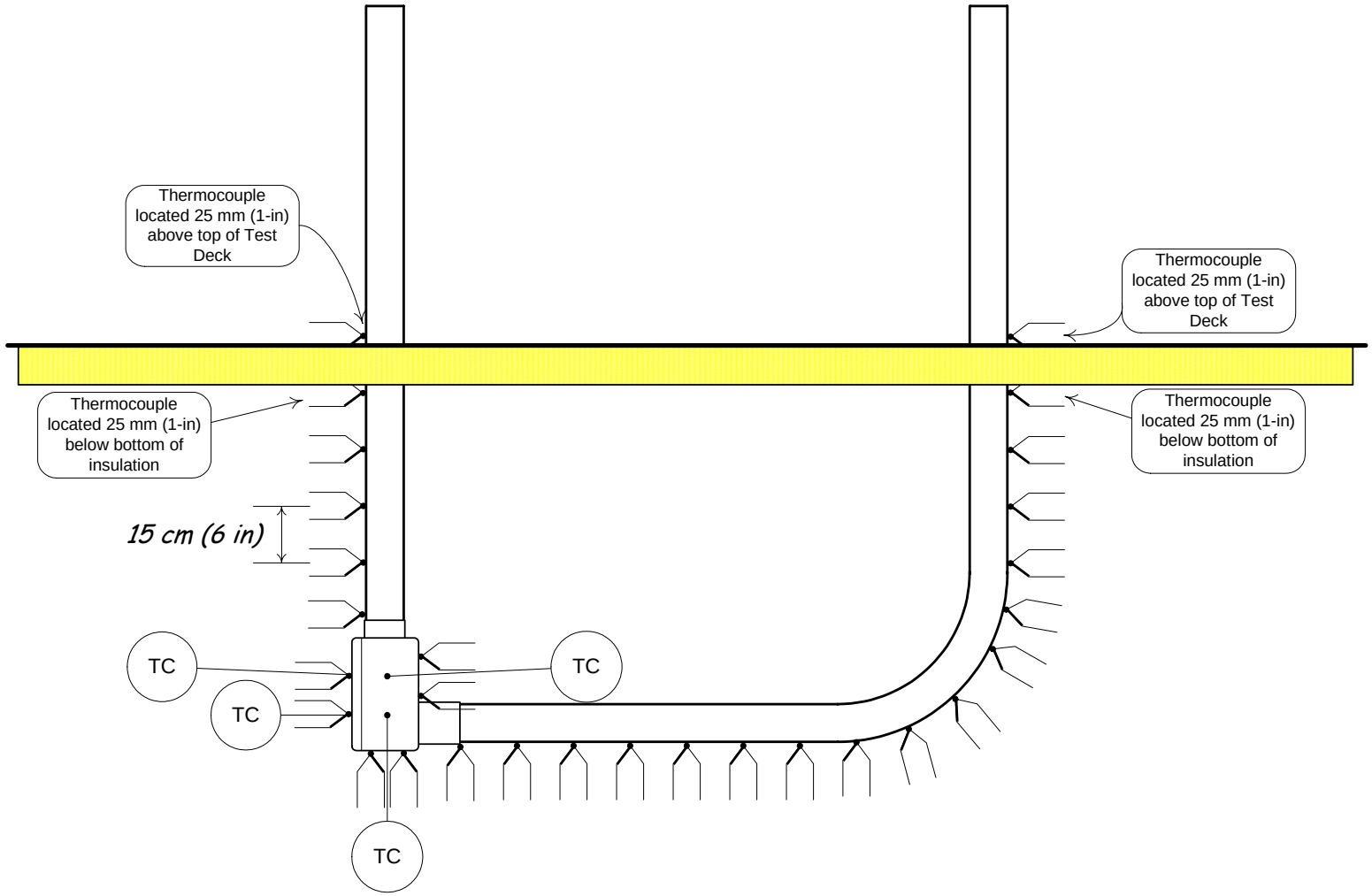


Figure A12: Thermocouple placement on 103-mm (4-in) conduit test specimens (additional thermocouples to be attached—at 150-mm [6-in] spacing intervals—to a bare #8 copper wire routed through conduit).

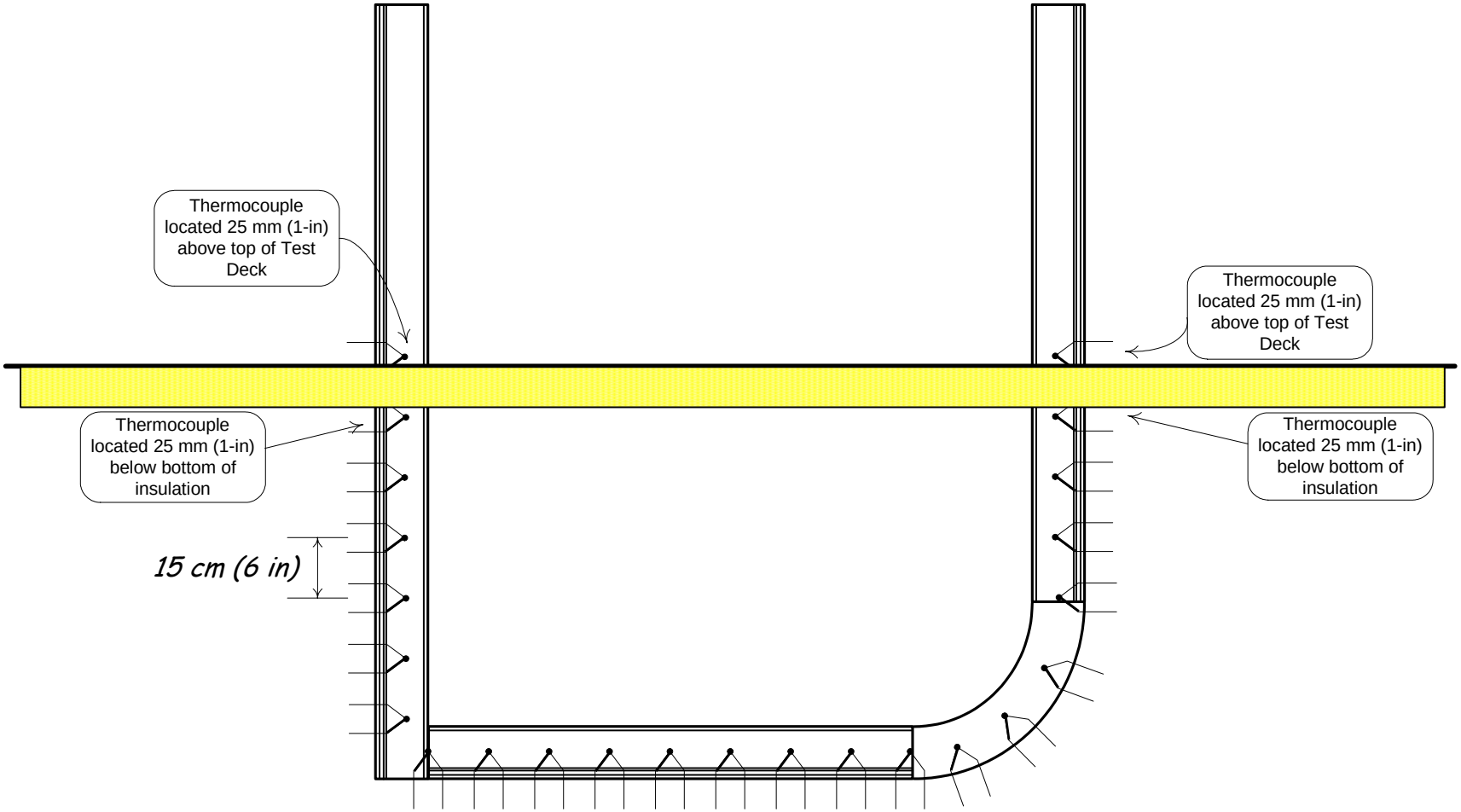


Figure A13: Thermocouple placement on 305-mm (12-in) cable tray test specimens (side view only, additional thermocouples to be attached at 150-mm [6-in] spacing intervals on other side rail and to a bare #8 copper wire routed along the mid-axis of the tray on the bottom of the rungs).

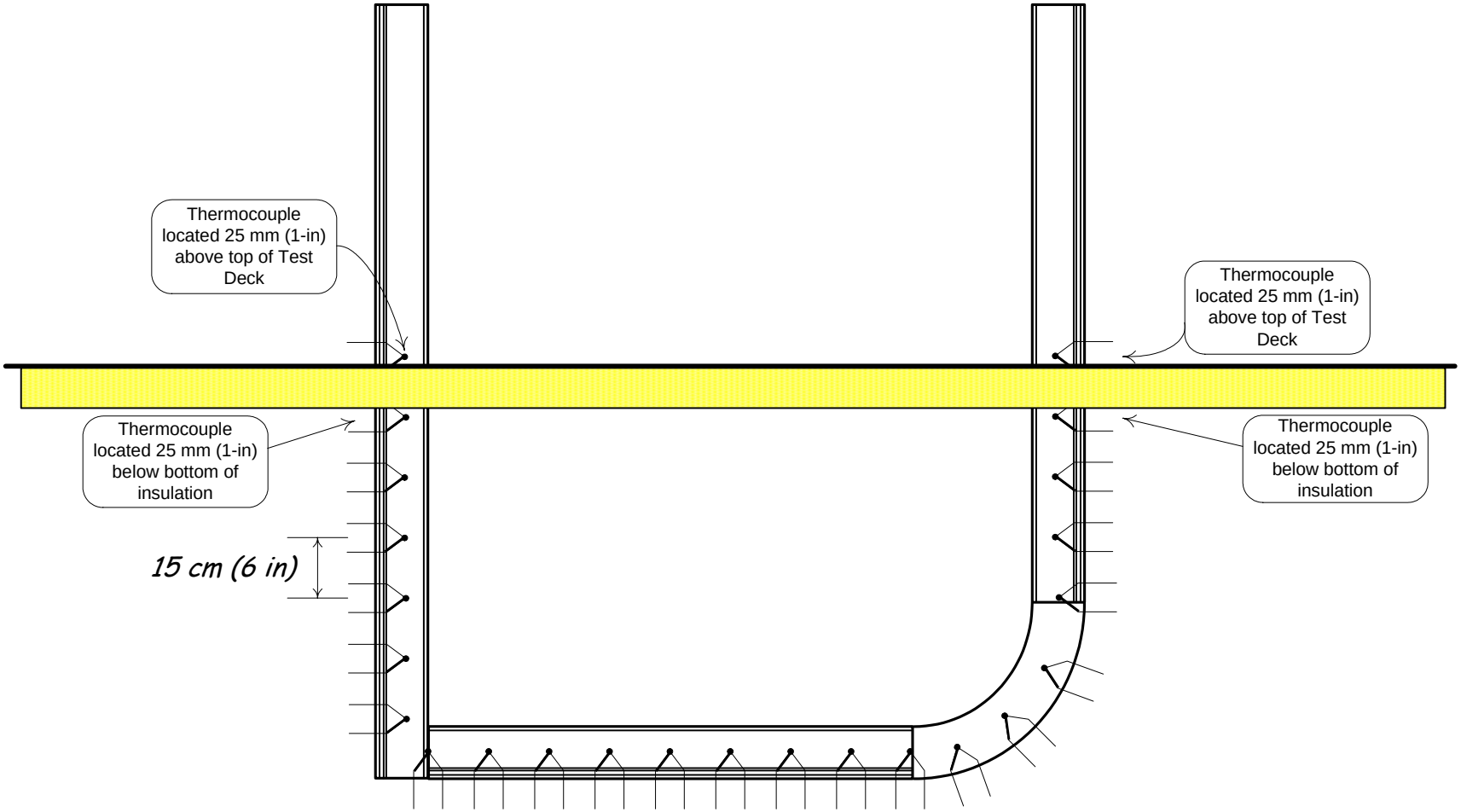


Figure A14: Thermocouple placement on 914-mm (36-in) cable tray test specimens (side view only, additional thermocouples to be attached at 150-mm [6-in] spacing intervals on other side rail and to a bare #8 copper wire routed along the mid-axis of the tray on the bottom of the rungs).

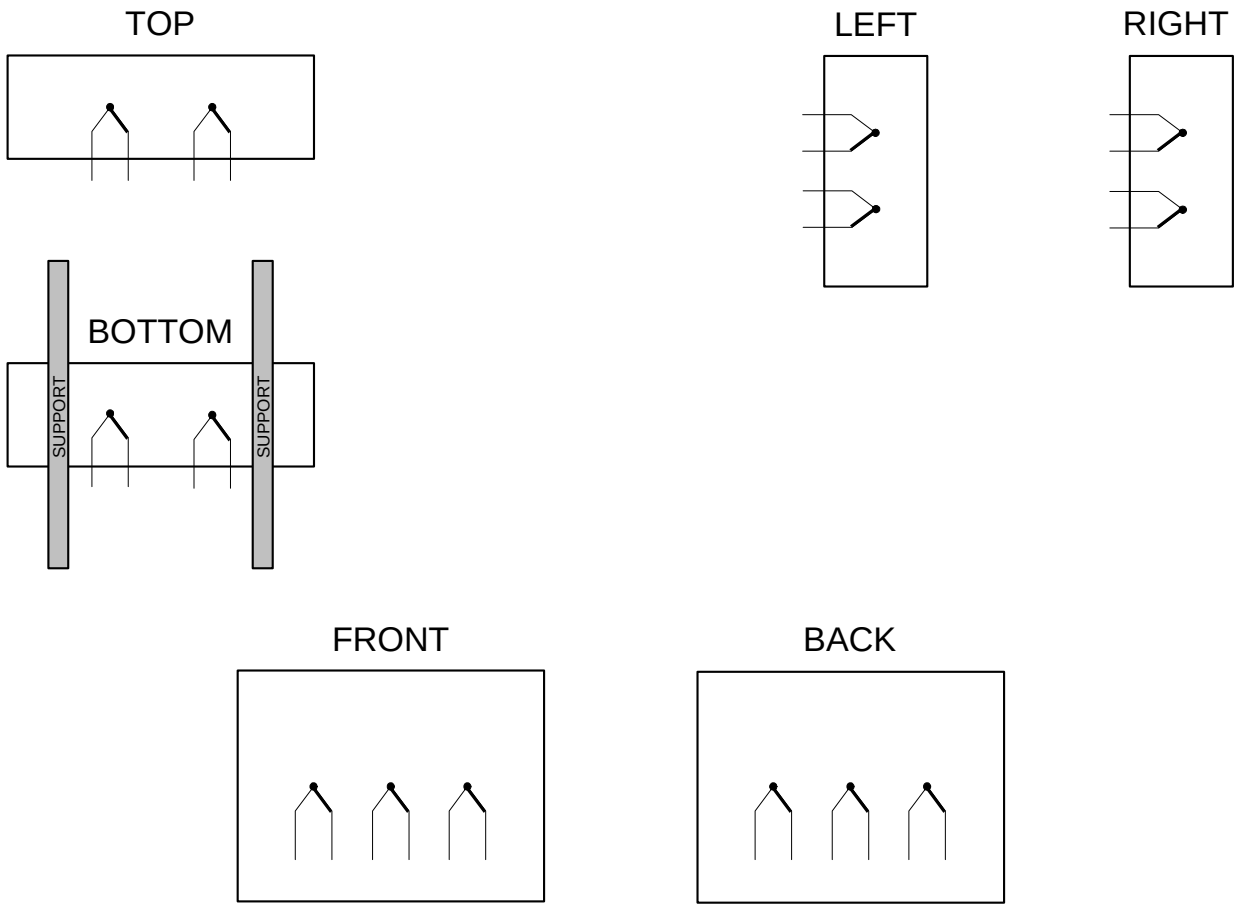


Figure A15: Thermocouple placement on junction box test specimen surfaces (no bare #8 copper conductor wire will be located inside the box and no thermocouples will be used to monitor the status of the junction box supports).

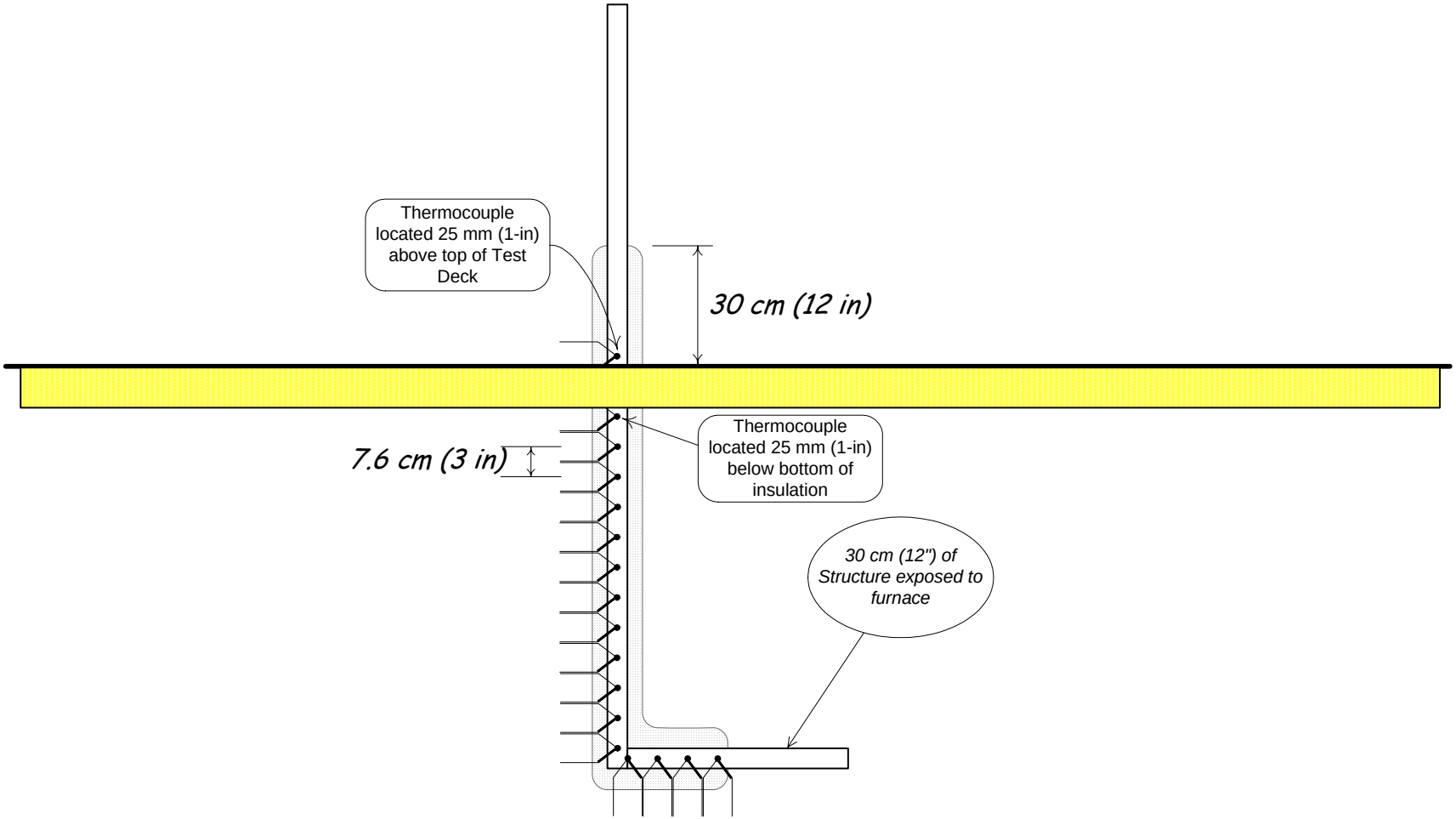


Figure A16: Thermocouple placement on tube steel support structure test specimens. (Note: ERFBS silhouette shown for reference only.)

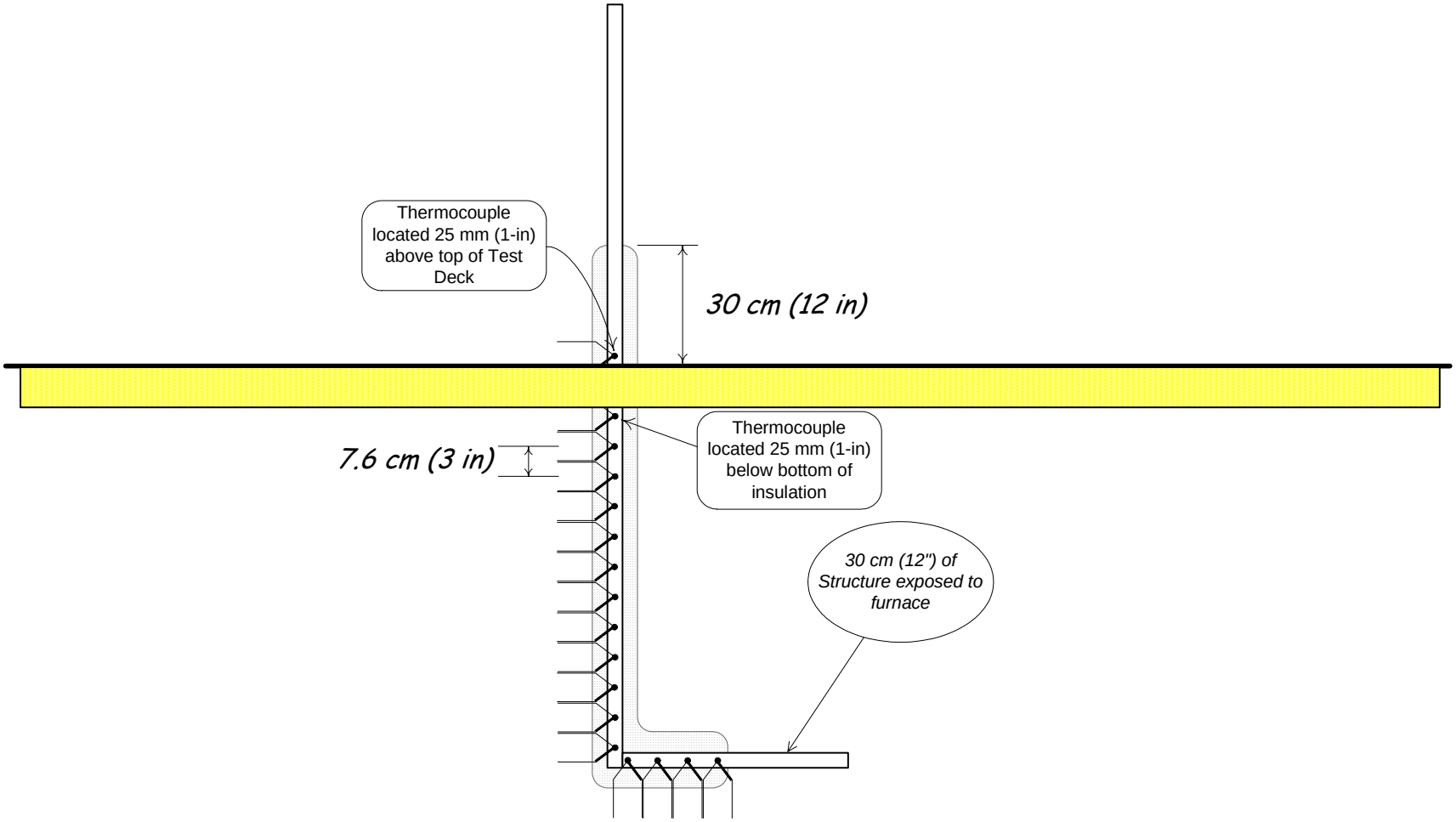


Figure A17: Thermocouple placement on Unistrut® channel support structure test specimens. (Note: ERFBS silhouette shown for reference only.)

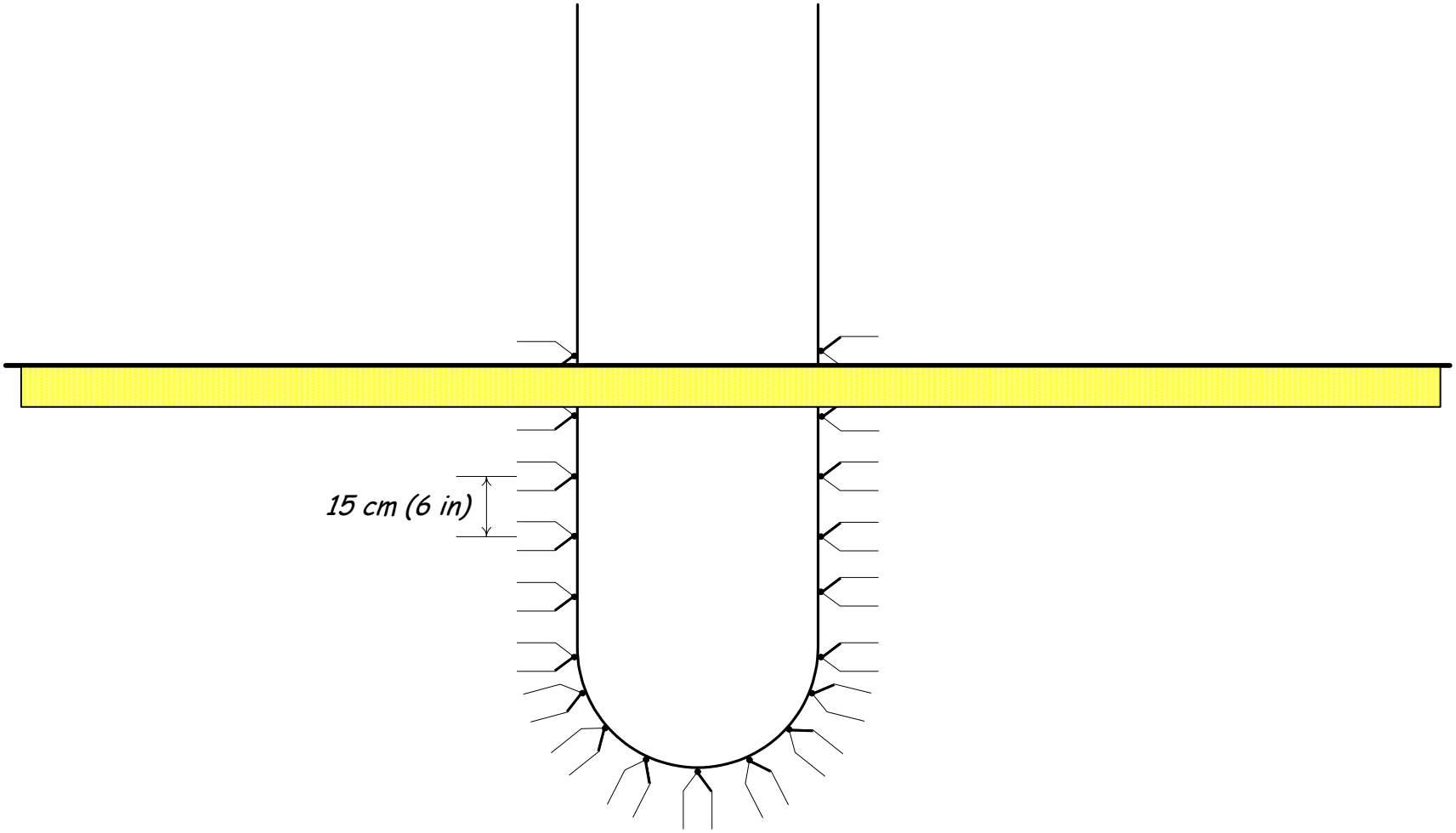


Figure A18: Thermocouple placement on unsupported cable drop test specimens.

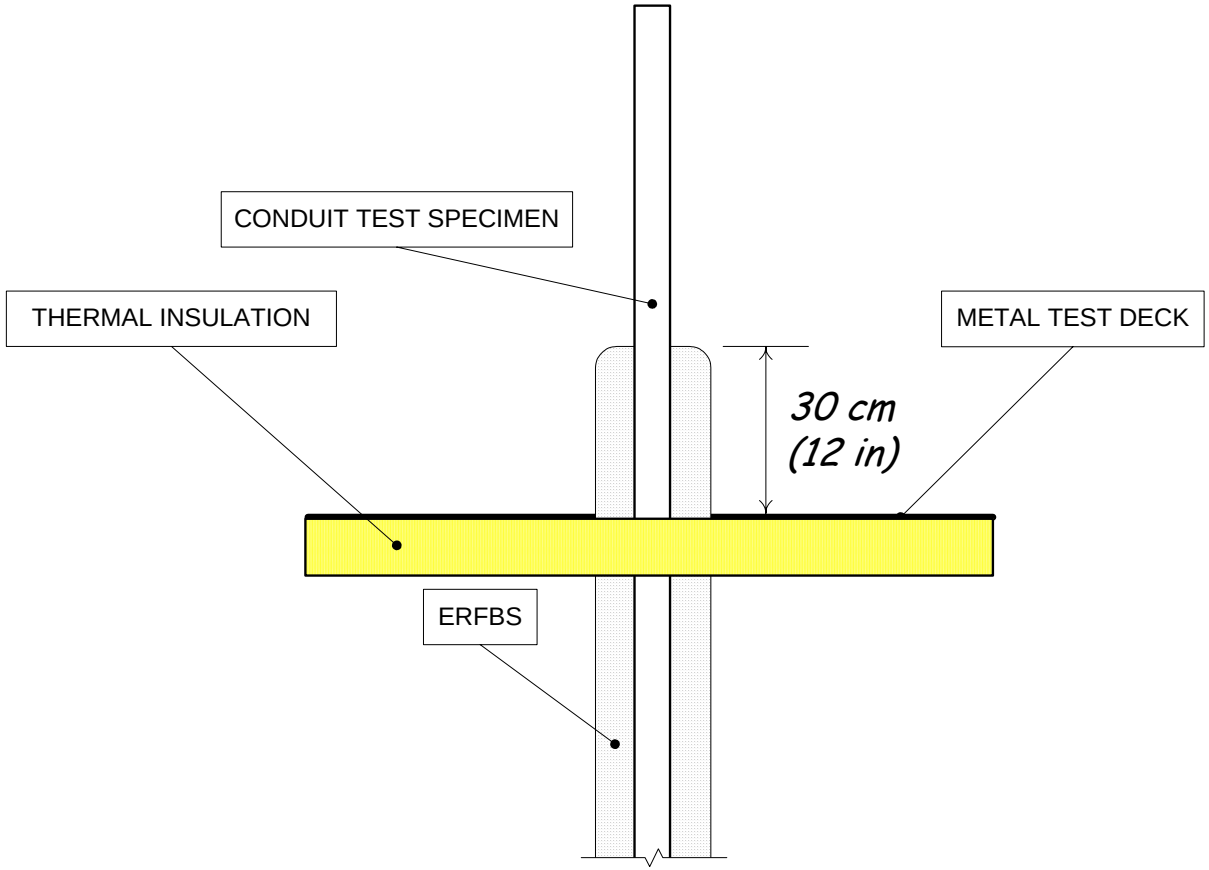


Figure A19: Detail of conduit test specimen direct attachment ERFBS extension through the test deck.

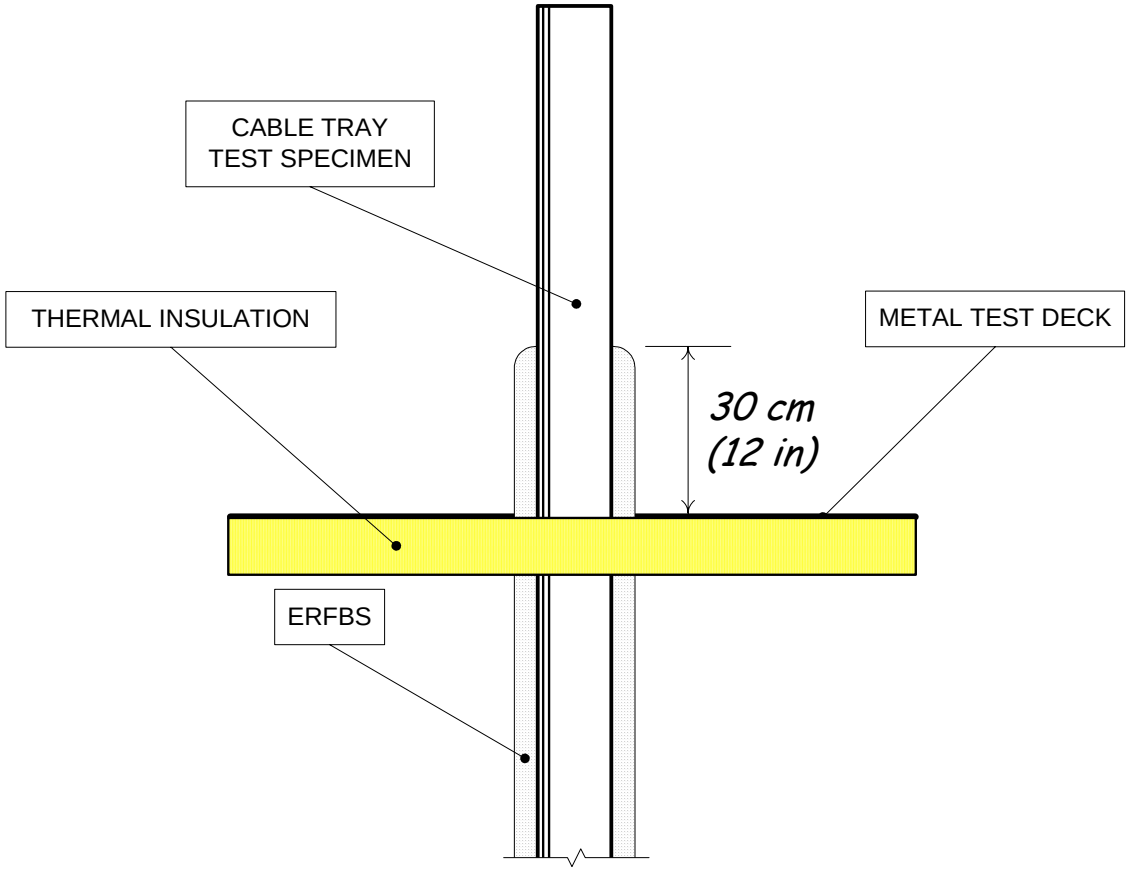
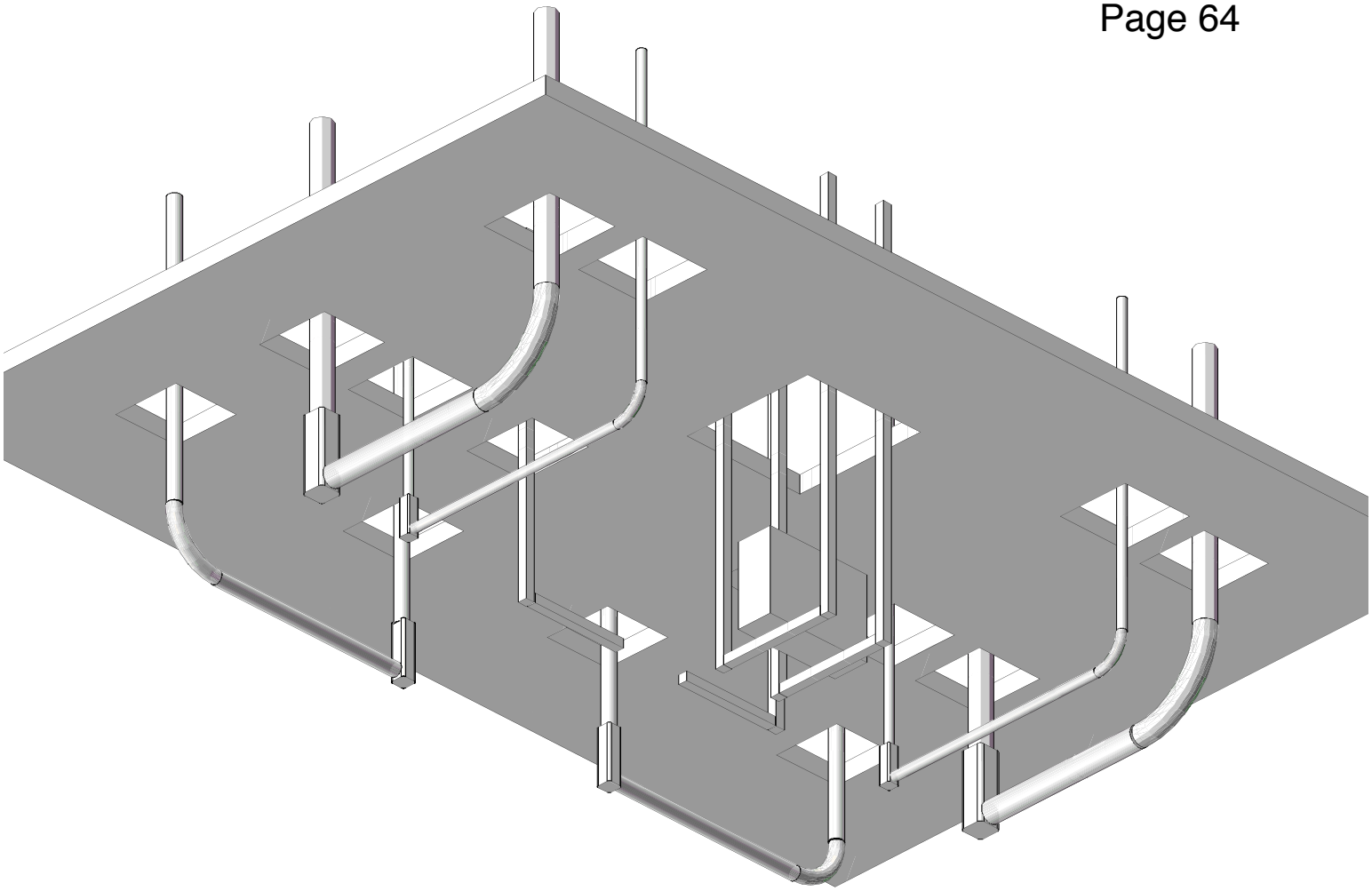


Figure A20: Detail of cable tray test specimen direct attachment ERFBS extension through the test deck.

Appendix B

CONSTRUCTION DRAWINGS

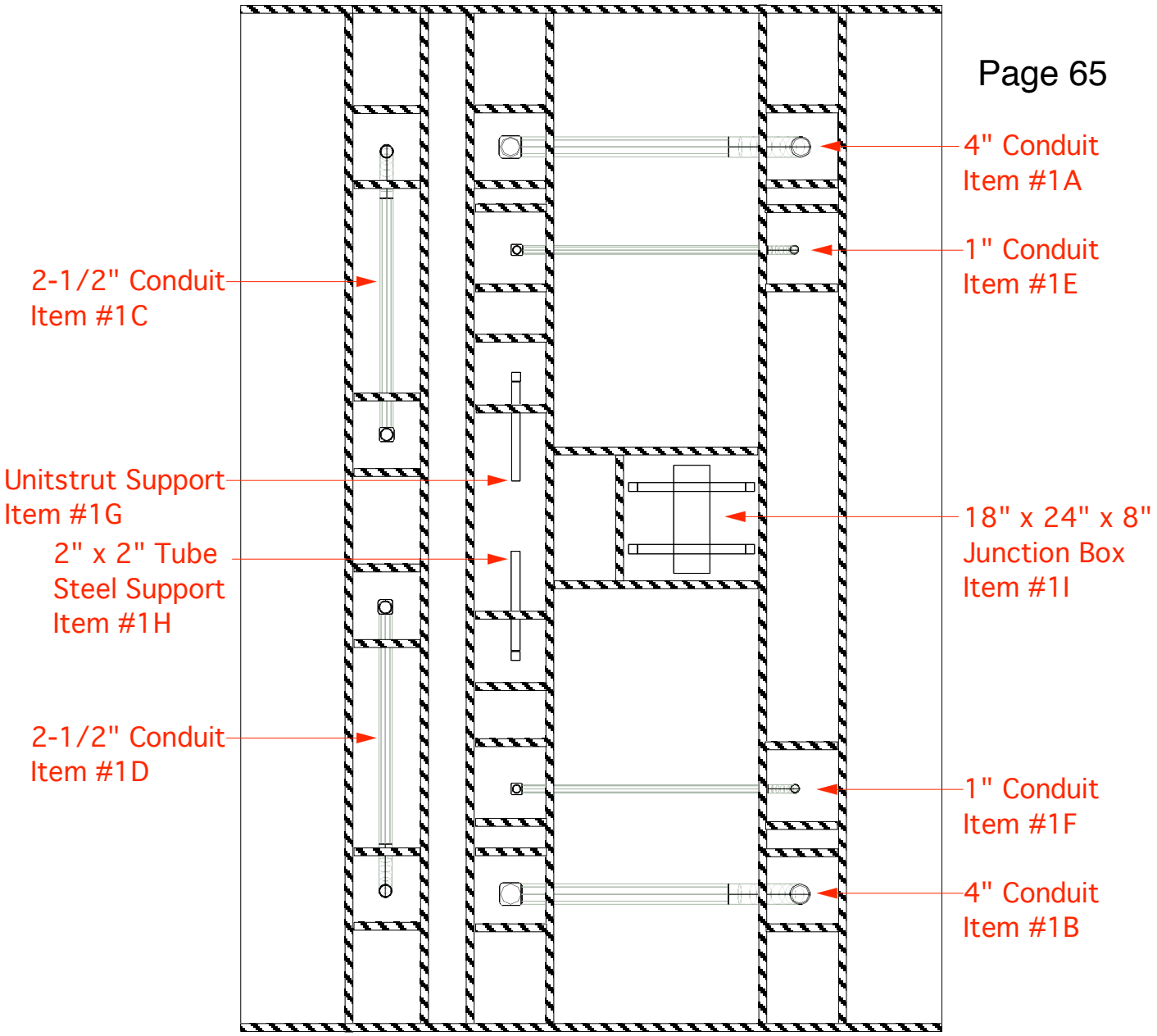


3D ISOMETRIC VIEW FROM BELOW

Note:
This view shows the separation and placement of all raceways in Test #1. Support members on the unexposed side of the deck are not shown.

OMEGA POINT LABORATORIES, INC. Project No. 14790-123263
SANDIA NATIONAL LABORATORIES
Fig. 1 Test 1 Assembly Isometric View
Drwn by:D.N.Priest Date: 12/30/04 OPL App'l: C Humphrey Date: 12/30/04 Sandia App'l: Date:

Scale=1:30

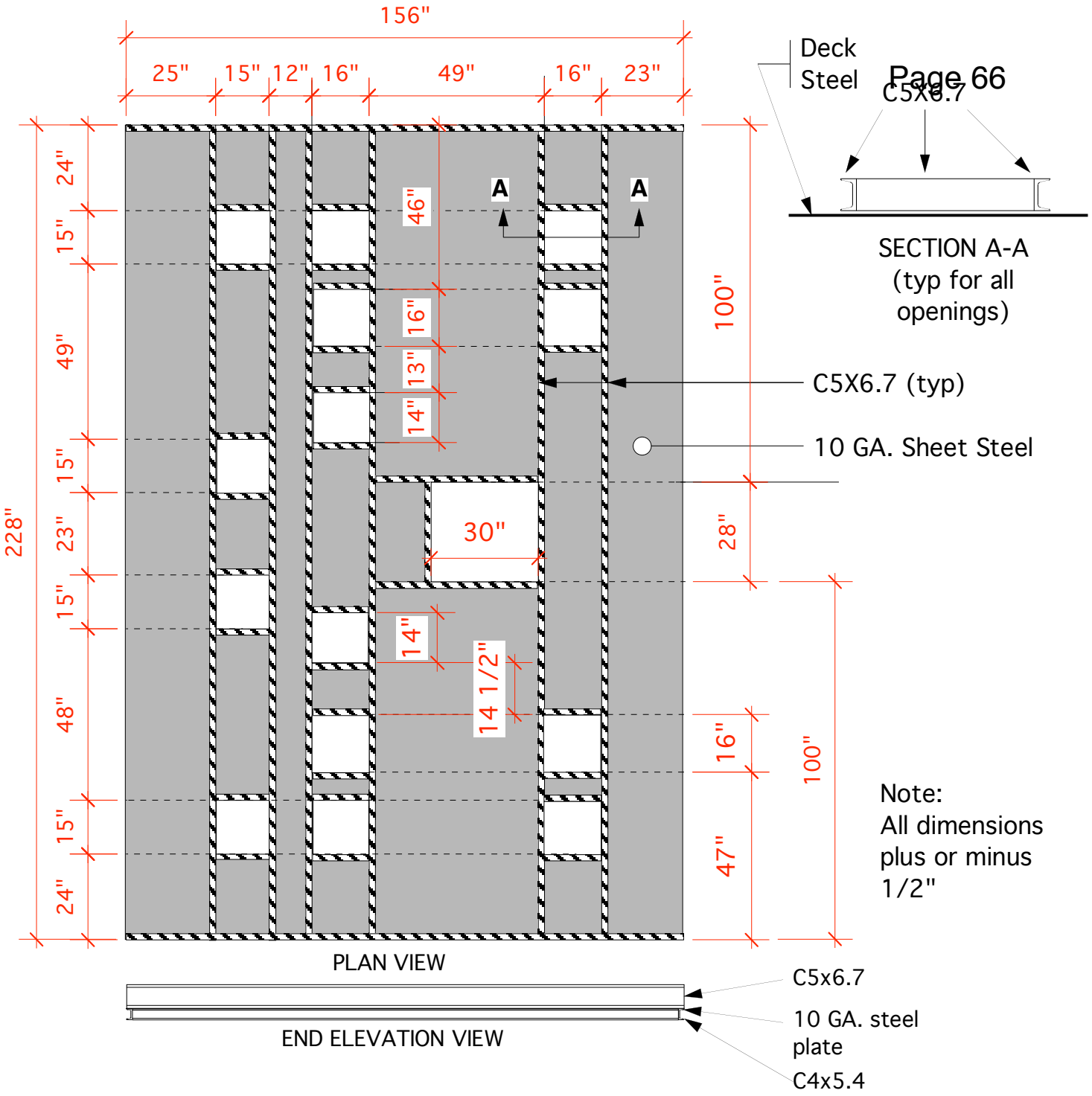


PLAN VIEW

Note:
All raceway items have been placed in the furnace in symmetric locations, to give as uniform exposure as possible between two of the same items. In this drawing, the structural channel above the deck steel is shown cross-hatched, and the deck steel and 4" channel below it are transparent, to indicate the placement of the raceways. See Fig. 3 for deck and opening dimensions.

OMEGA POINT LABORATORIES, INC. Project No. 14790-123263
SANDIA NATIONAL LABORATORIES
Fig. 2, Rev.1 Test 1 Assembly Raceway Layout
Drwn by:D.N.Priest Date: 1/25/05 OPL App'l: C Humphrey Date: 1/25/05 Sandia App'l: Date:

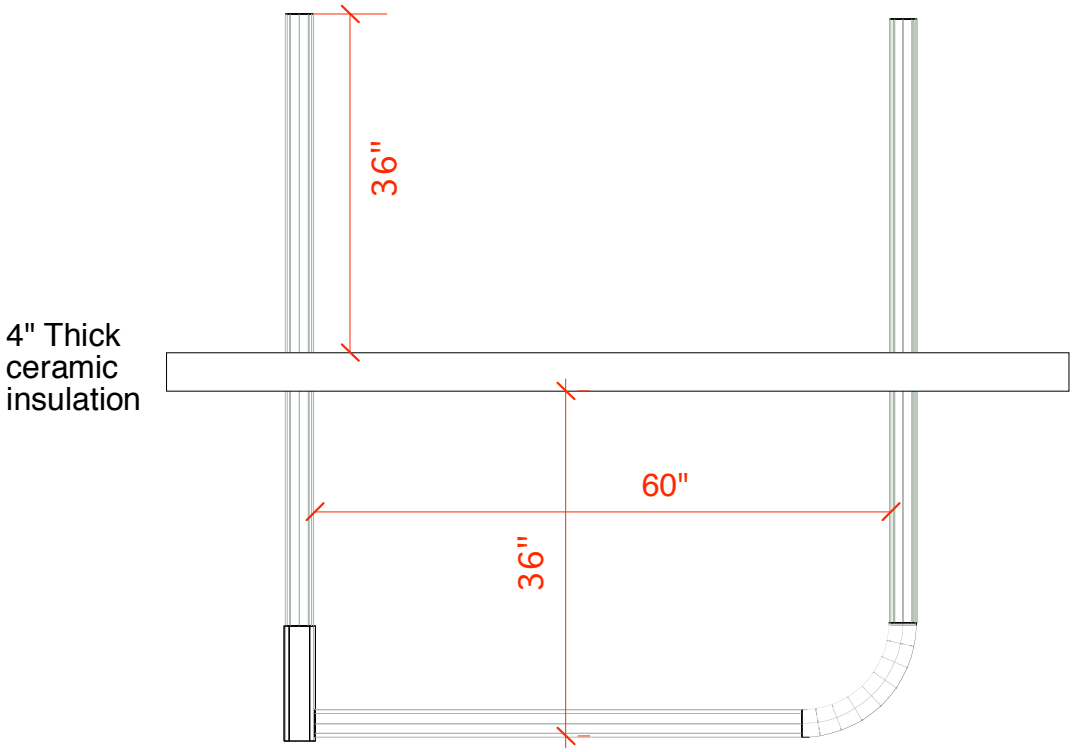
Scale=1:35



Note:
The lower perimeter steel consisted of C4x5.4 channel, positioned with flanges outwards, completely around the deck. Over the channel was placed a continuously-welded layer of 10 GA. hot-rolled steel plate. Over the steel plate was placed C5x6.7 channel, mounted with the flanges outwards from the shorter ends, and with flanges away from the interior of each opening (indicated by cross-hatching).

OMEGA POINT LABORATORIES, INC. Project No. 14790-123263
SANDIA NATIONAL LABORATORIES
Fig. 3, Rev.1 Test 1 Assembly Deck Construction Details
Drwn by:D.N.Priest — Date: 1/4/05 OPL App'l: C Humphrey — Date: 1/4/05 Sandia App'l: — Date:

Scale=1:35

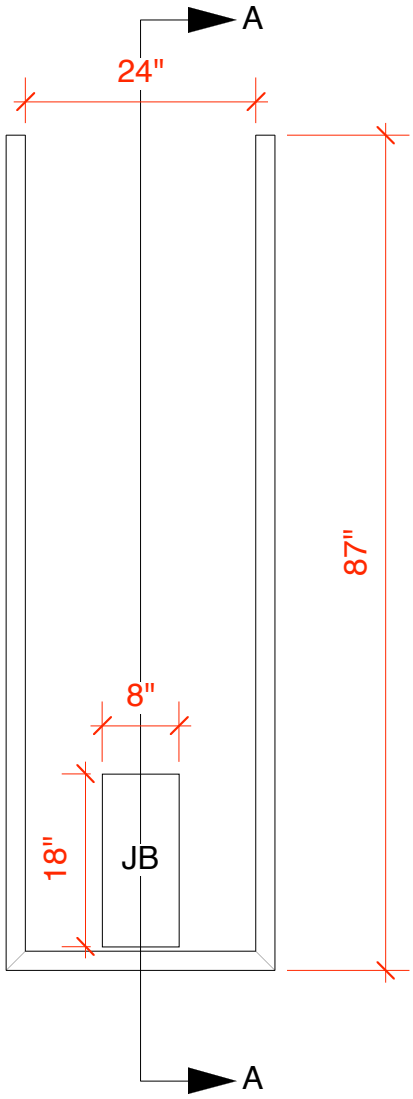


SIDE ELEVATION VIEW

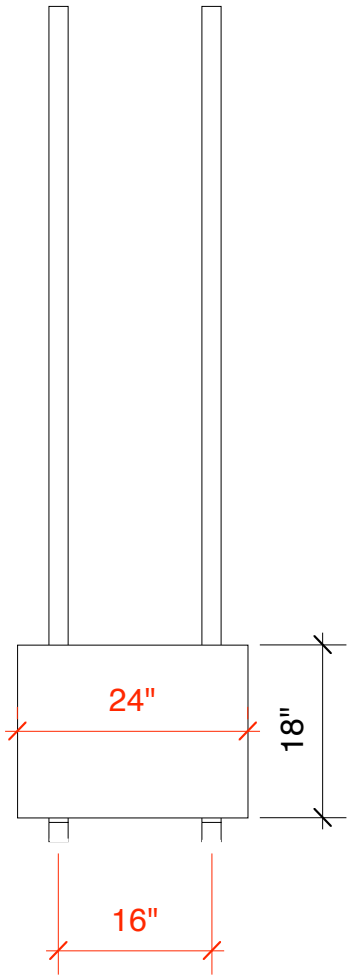
Note:
This view shows the dimensions of each conduit system, regardless of diameter.

OMEGA POINT LABORATORIES, INC. Project No. 14790-123263
SANDIA NATIONAL LABORATORIES
Fig. 4 Test 1 Assembly Isometric View
Drwn by:D.N.Priest Date: 1/5/05 OPL App'l: C Humphrey Date: 1/5/05 Sandia App'l: Date:

Scale=1:30



SIDE VIEW

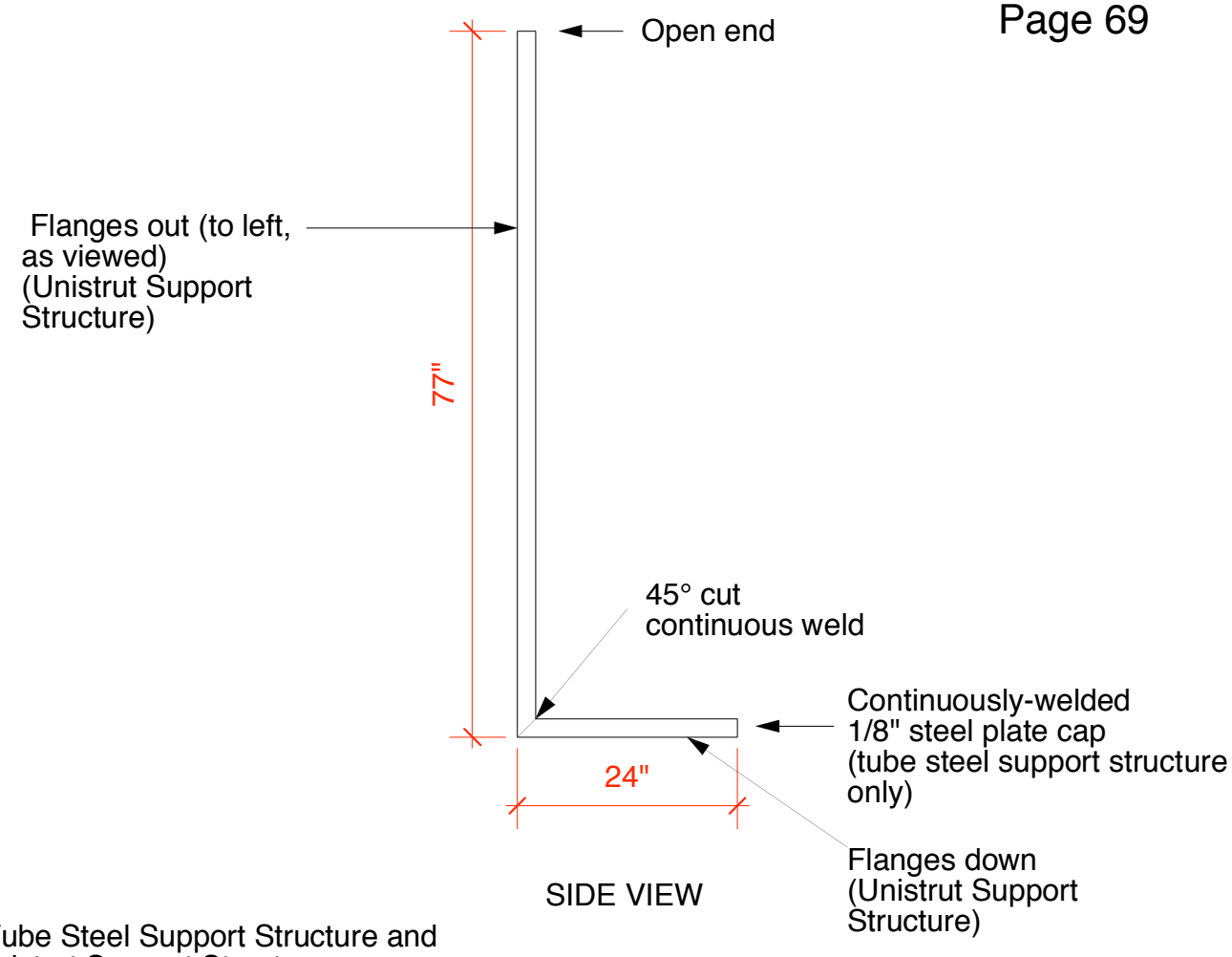


SECTION A-A

Note:
The Unistrut supports for the junction box were constructed to the dimensions indicated. The bottom of the junction box was located 45" below the under side of the insulated deck.

OMEGA POINT LABORATORIES, INC. Project No. 14790-123263
SANDIA NATIONAL LABORATORIES
Fig. 5 Test 1 Assembly Junction Box Supports
Drwn by:D.N.Priest Date: 1/25/05 OPL App'l: C Humphrey te: 1/25/05 Sandia App'l: Date:

Scale=1:20



SIDE VIEW

Note:
The Tube Steel Support Structure and the Unistrut Support Structure were both constucted as shown.

Note:
The Unistrut and 2"x2" tubing support structure test specimens were constructed to the dimensions indicated. The bottom of the specimen was located 36" below the under side of the insulated deck.

OMEGA POINT LABORATORIES, INC. Project No. 14790-123263
SANDIA NATIONAL LABORATORIES
Fig. 6 Test 1 Assembly Steel & Unistrut Support Structures
Drwn by:D.N.Priest Date: 1/27/05 OPL App'l: C Humphrey te: 1/27/05 Sandia App'l: Date:

Scale=1:20

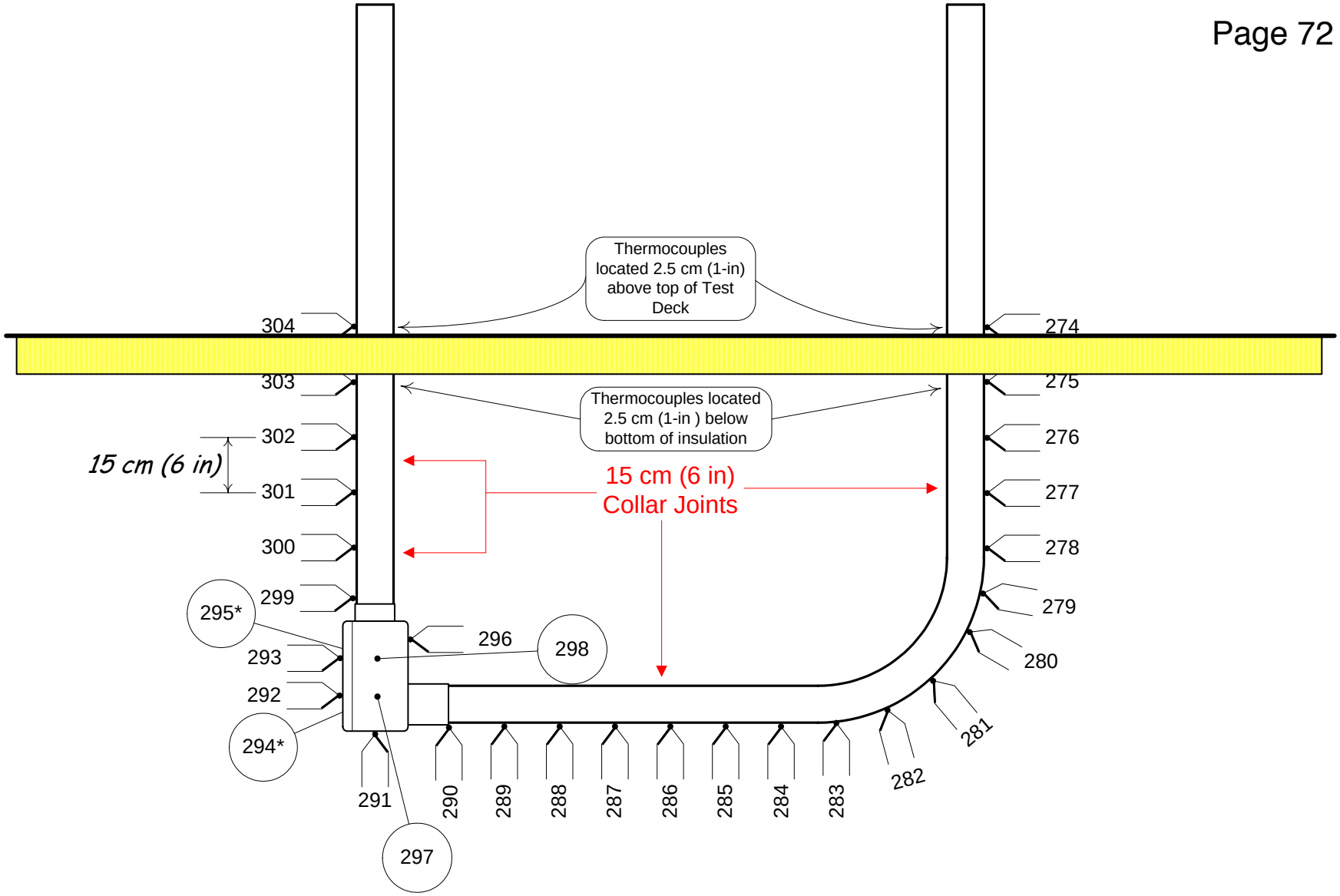
Appendix C

THERMOCOUPLE LOCATIONS

THERMOCOUPLE LOCATION DRAWINGS

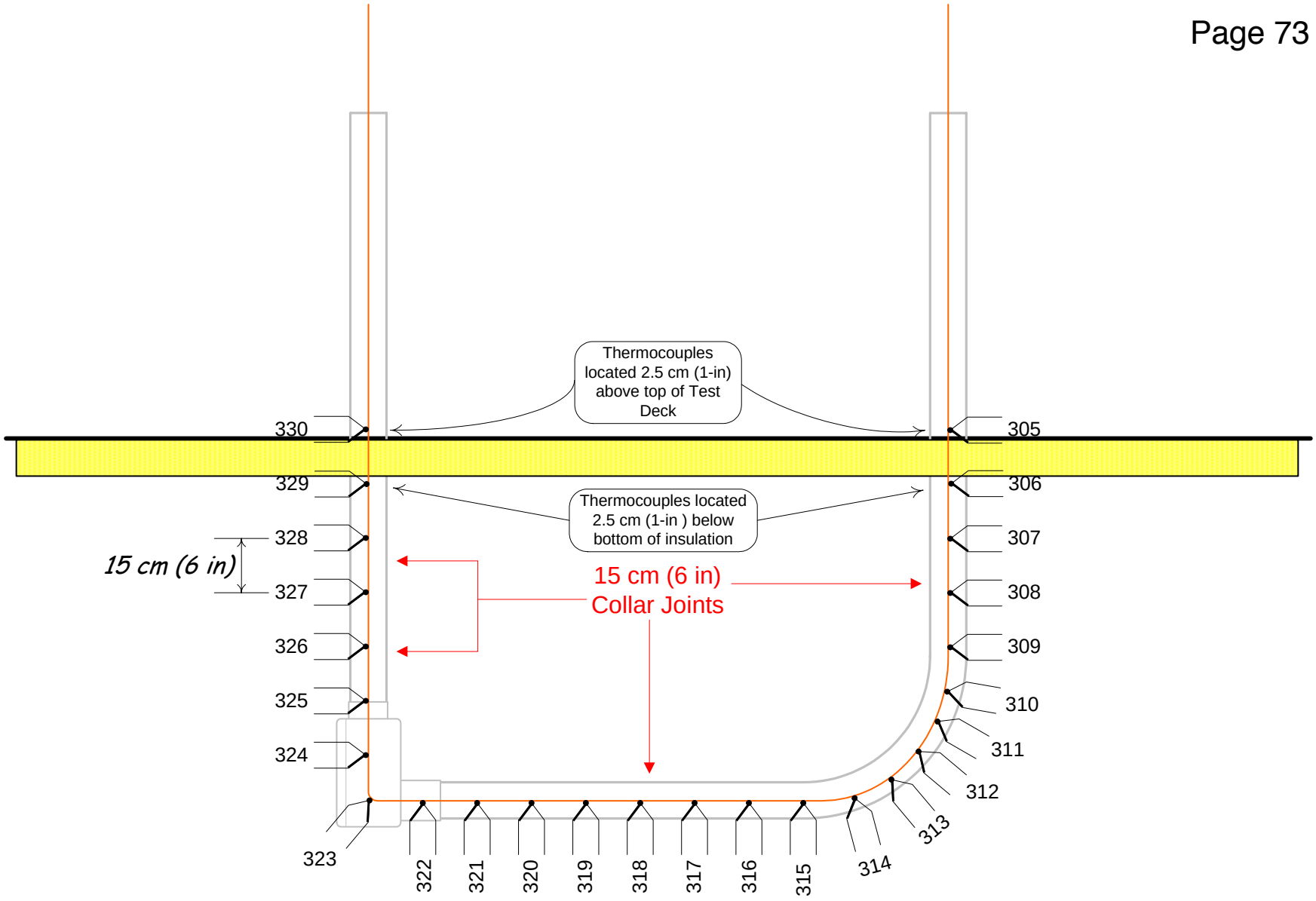
Test #1 – Hemyc, Direct Attachment

Revised 3/16/05

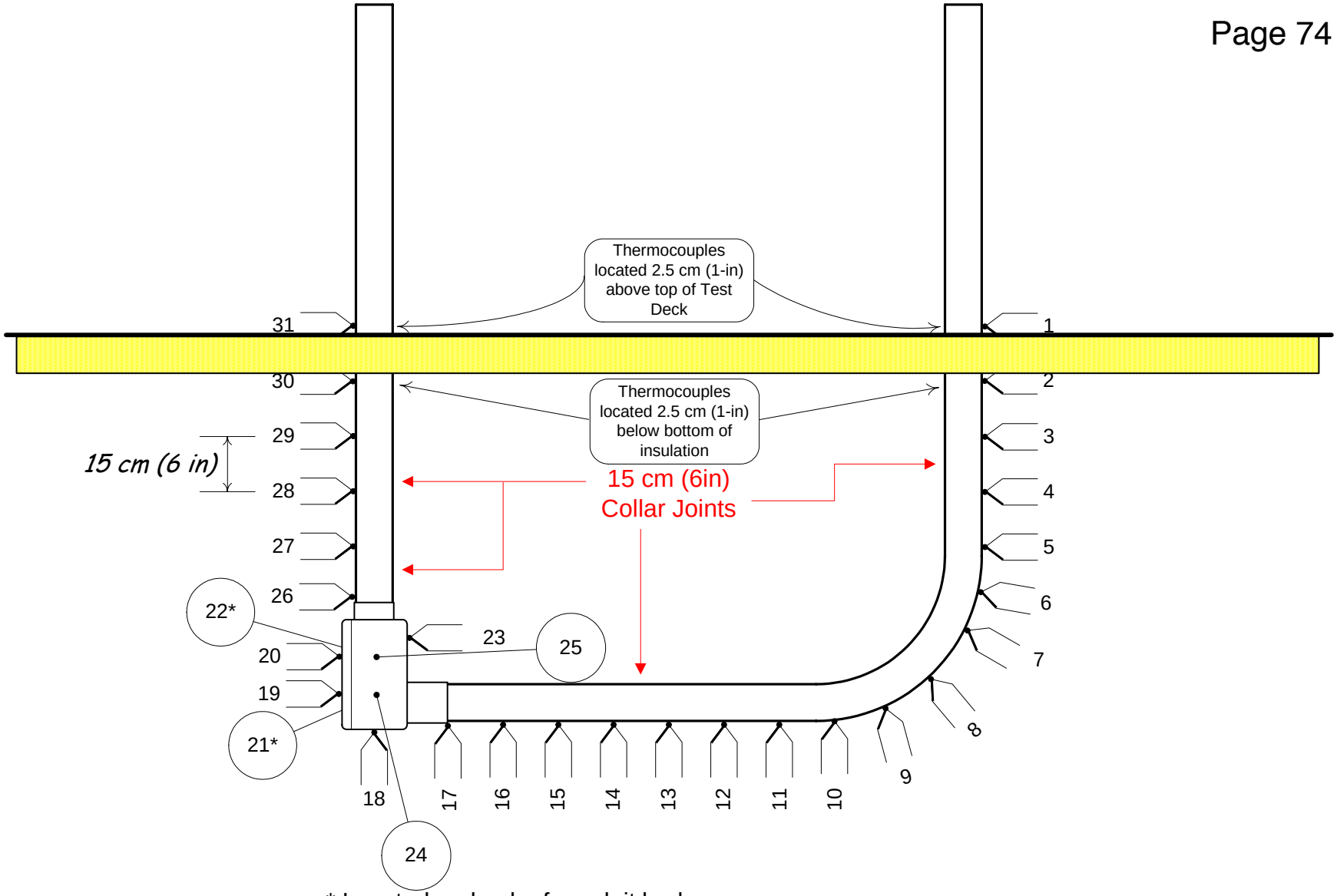


* Located on back of conduit body

Test Specimen 1A – Empty 103-mm (4-inch) conduit thermocouple locations and tag numbers.

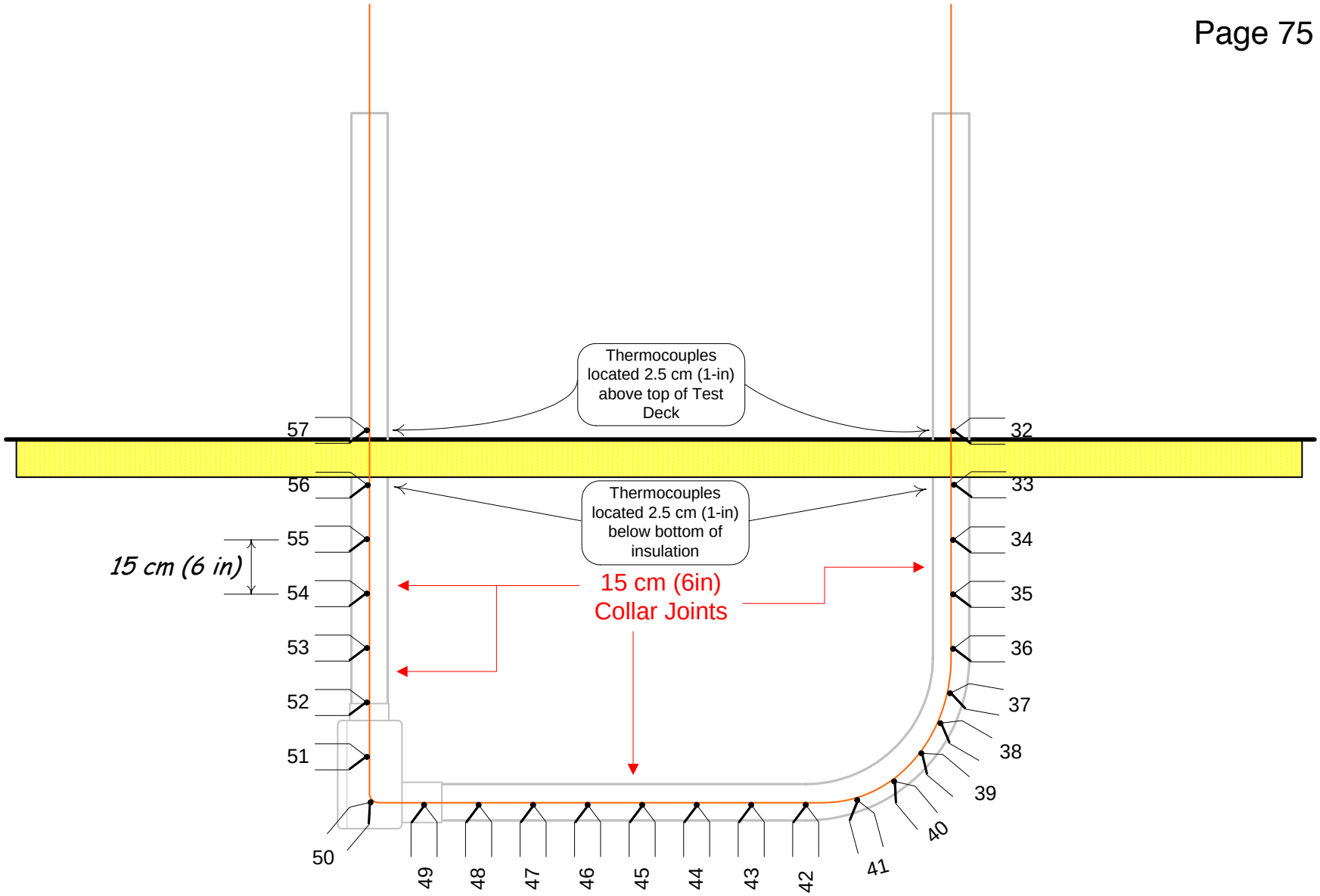


Test Specimen 1A – Empty 103-mm (4-inch) conduit thermocouple locations and tag numbers on bare #8 copper wire. Note: Some uncertainty in exact thermocouple locations exists.

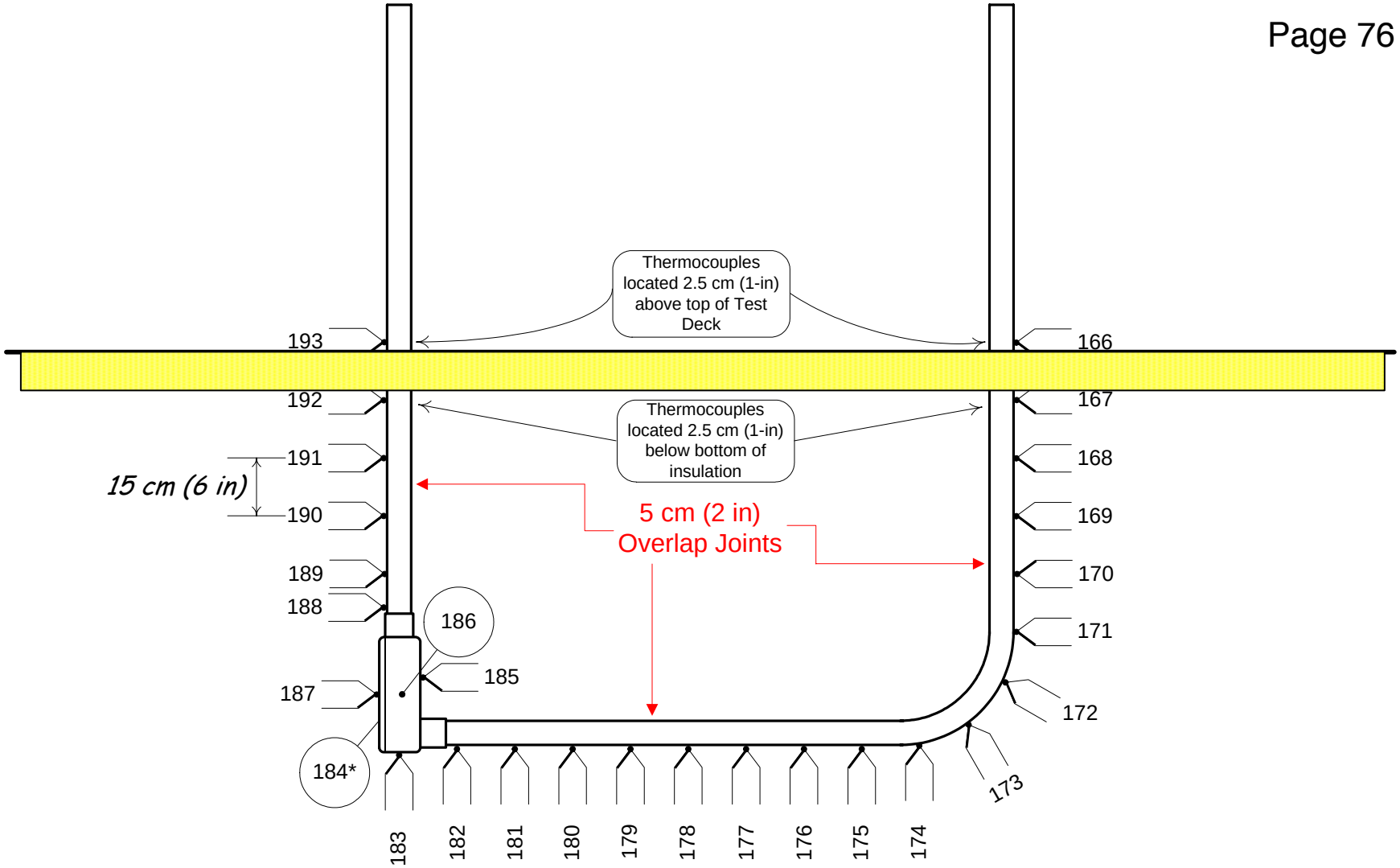


* Located on back of conduit body

Test Specimen 1B – “Loaded” 103-mm (4-inch) conduit thermocouple locations and tag numbers.

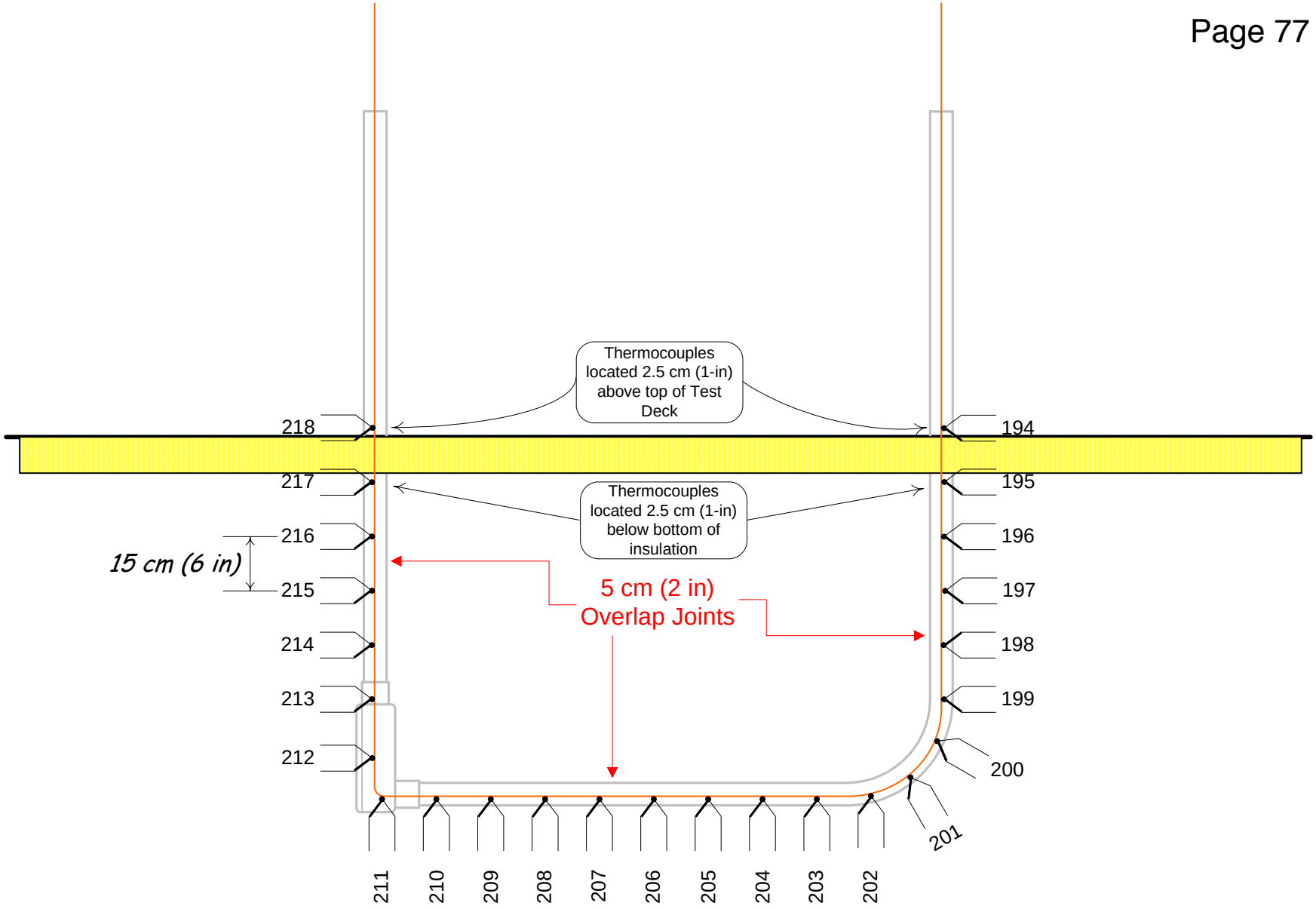


Test Specimen 1B – “Loaded” 103-mm (4-inch) conduit thermocouple locations and tag numbers on bare #8 copper wire. Note: Some uncertainty in exact thermocouple locations exists.

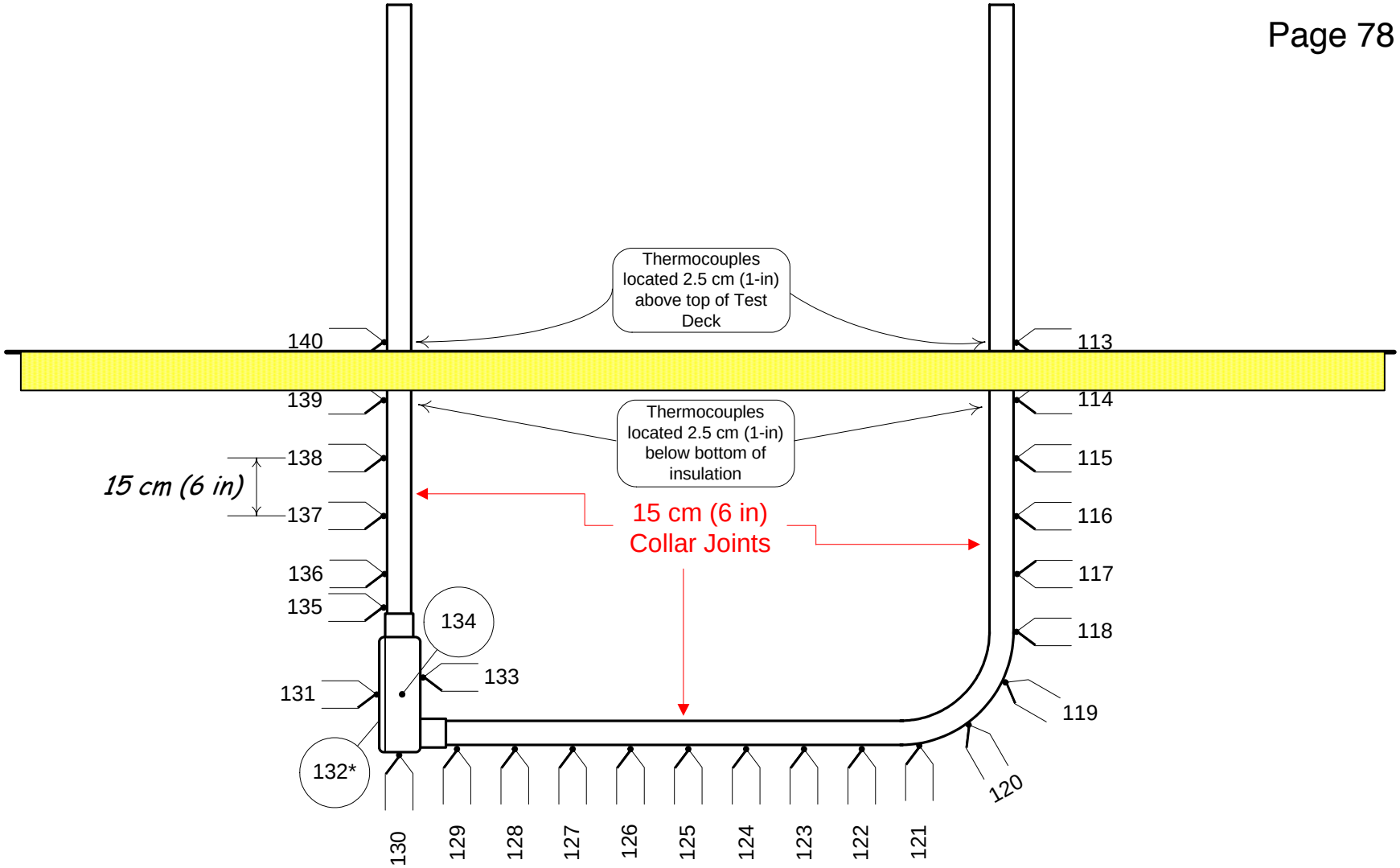


* Located on back of conduit body

Test Specimen 1C – Empty 63-mm (2½-inch) conduit thermocouple locations and tag numbers.

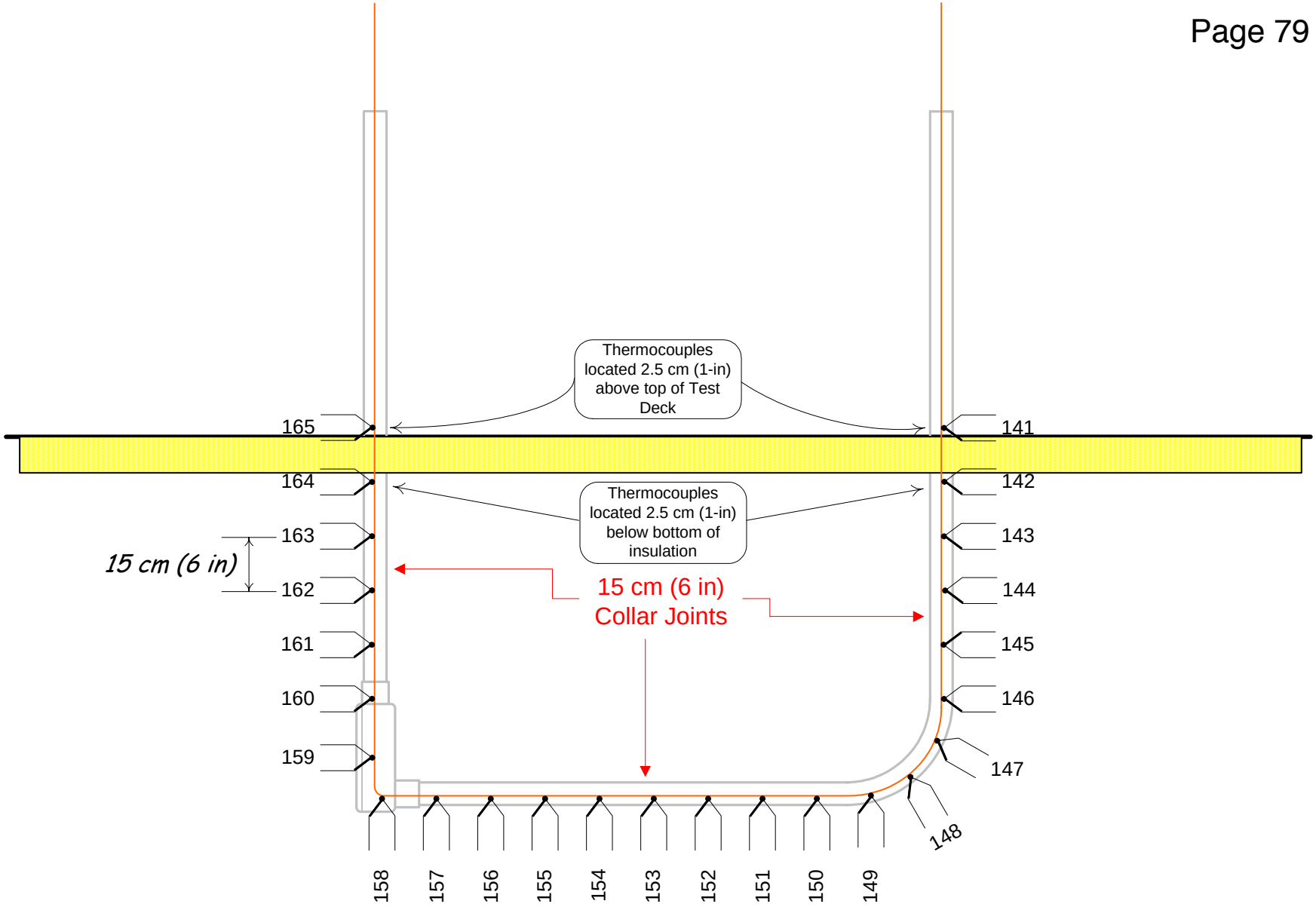


Test Specimen 1C – Empty 63-mm (2½-inch) conduit thermocouple locations and tag numbers on bare #8 copper wire. Note: Some uncertainty in exact thermocouple locations exists.

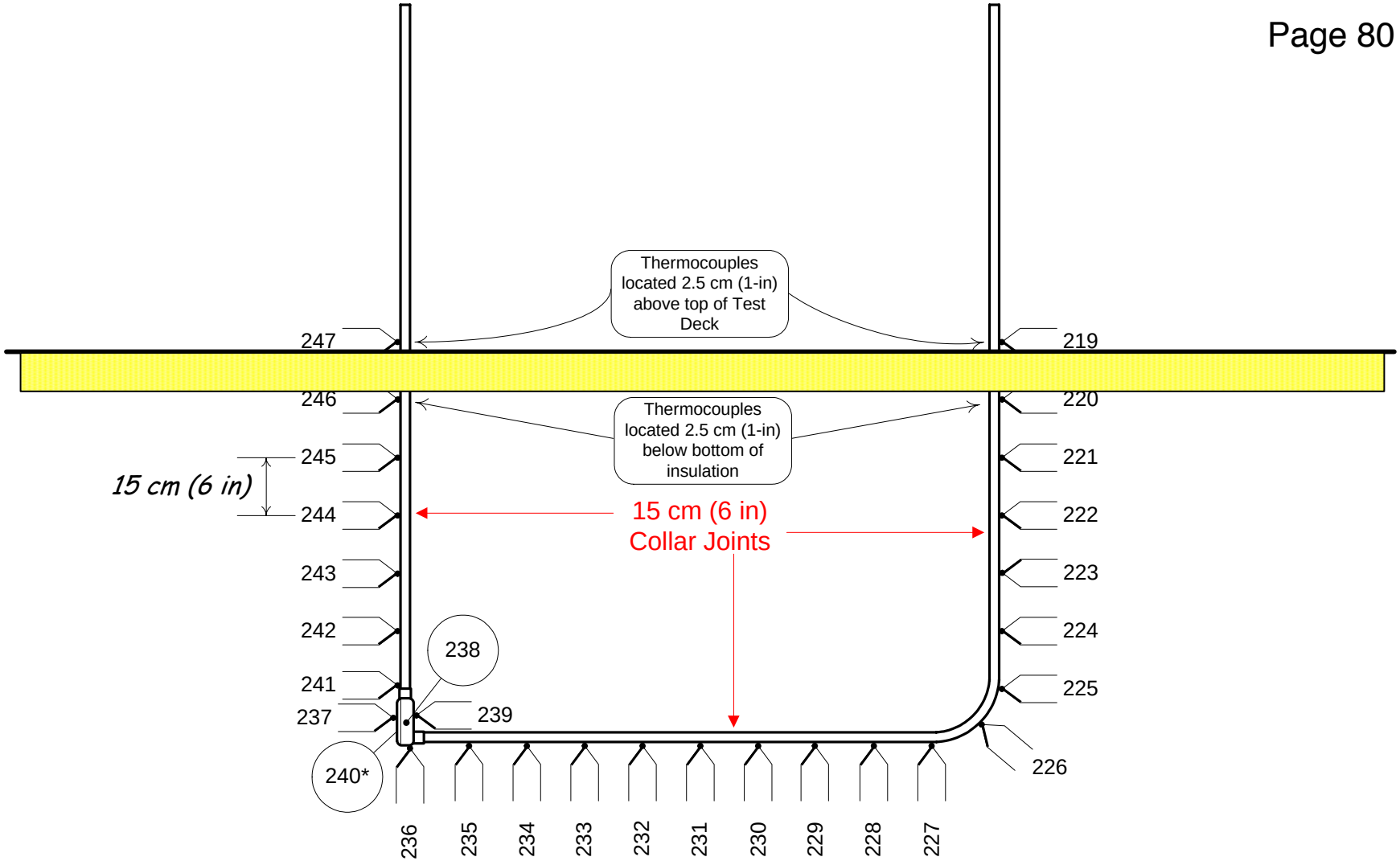


* Located on back of conduit body

Test Specimen 1D – “Loaded” 63-mm (2½-inch) conduit thermocouple locations and tag numbers.

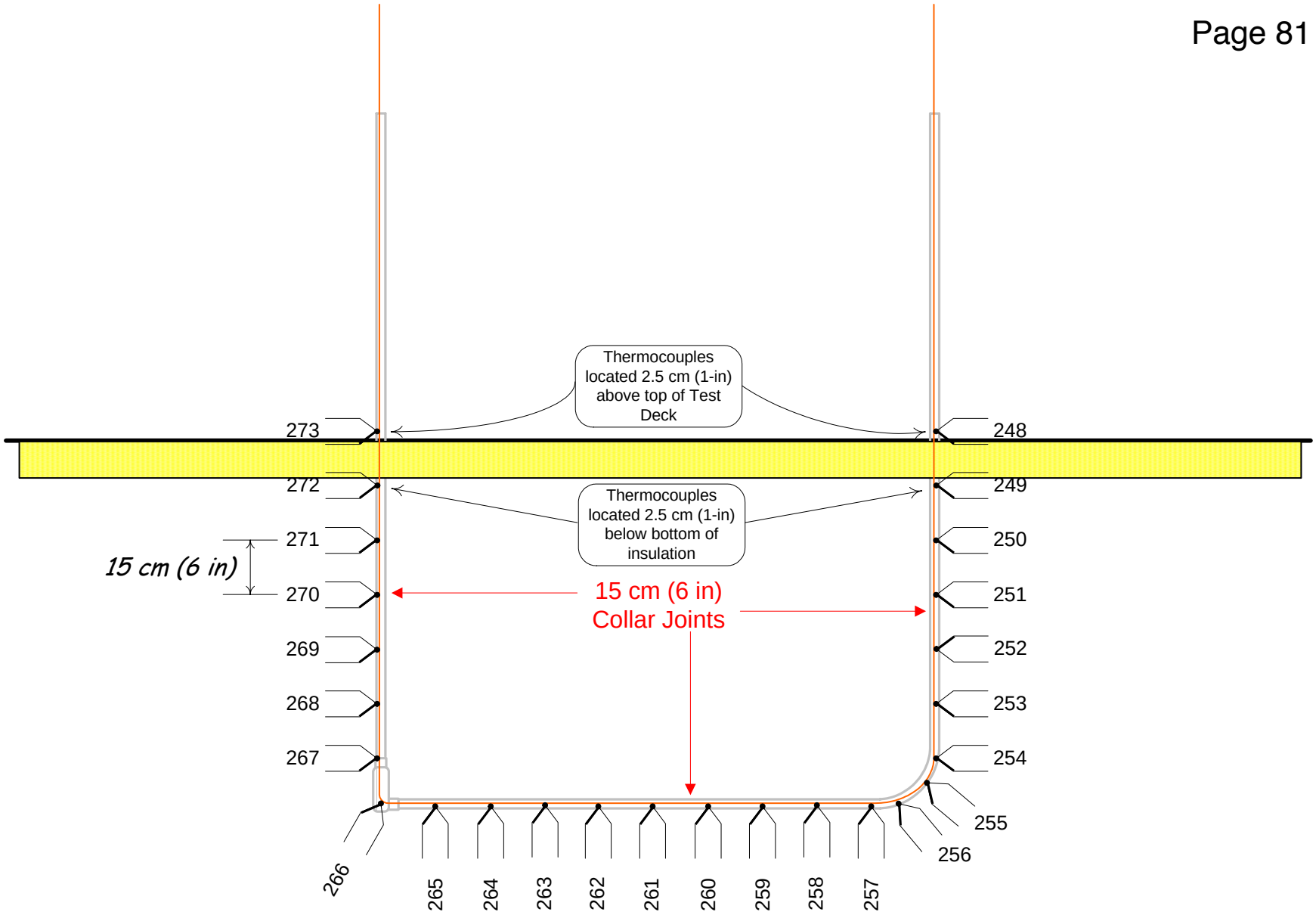


Test Specimen 1D – “Loaded” 63-mm (2½-inch) conduit thermocouple locations and tag numbers on bare #8 copper wire. Note: Some uncertainty in exact thermocouple locations exists.

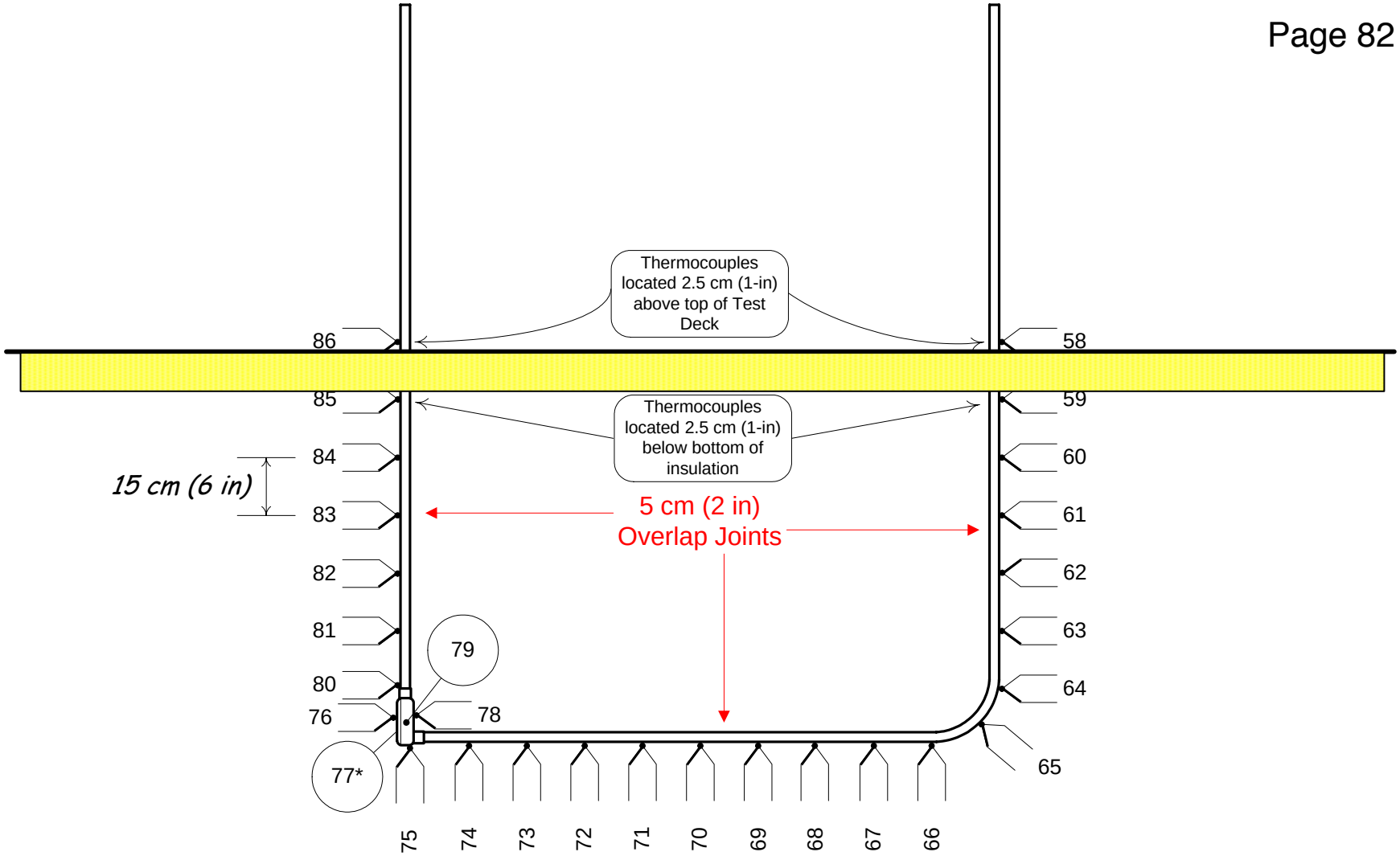


* Located on back of conduit body

Test Specimen 1E – Empty 27-mm (1-inch) conduit thermocouple locations and tag numbers.

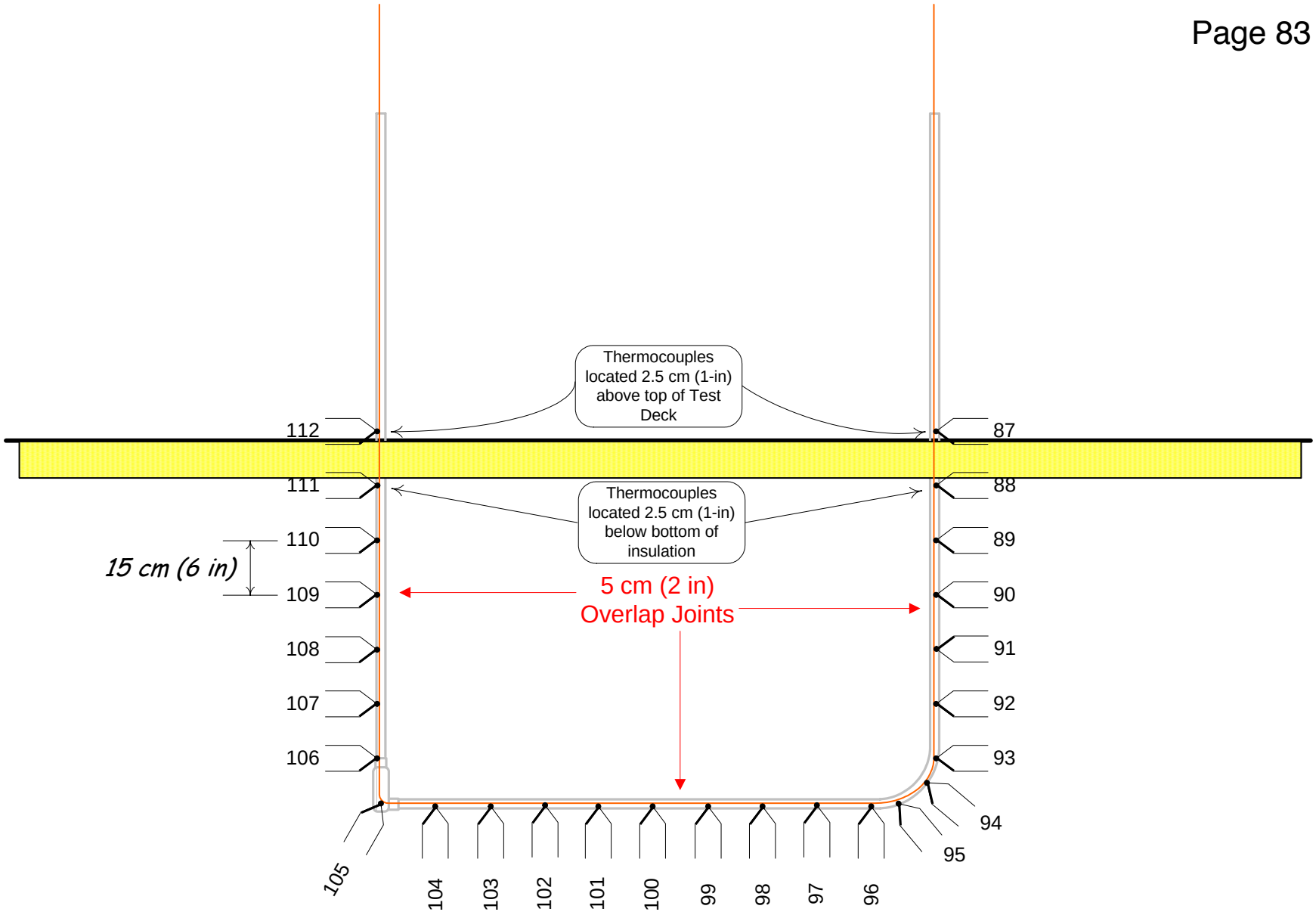


Test Specimen 1E – Empty 27-mm (1-inch) conduit thermocouple locations and tag numbers on bare #8 copper wire. Note: Some uncertainty in exact thermocouple locations exists.

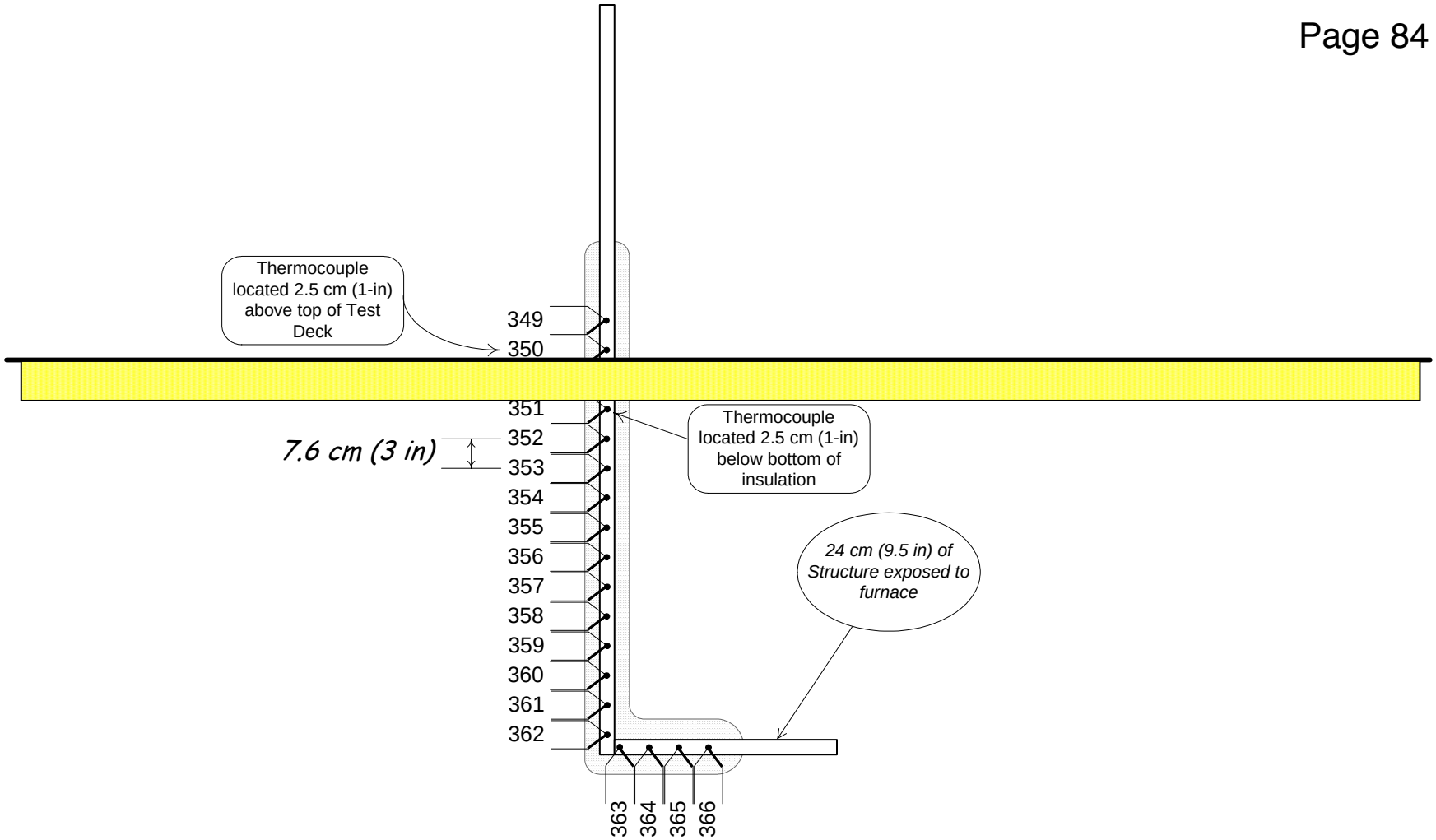


* Located on back of conduit body

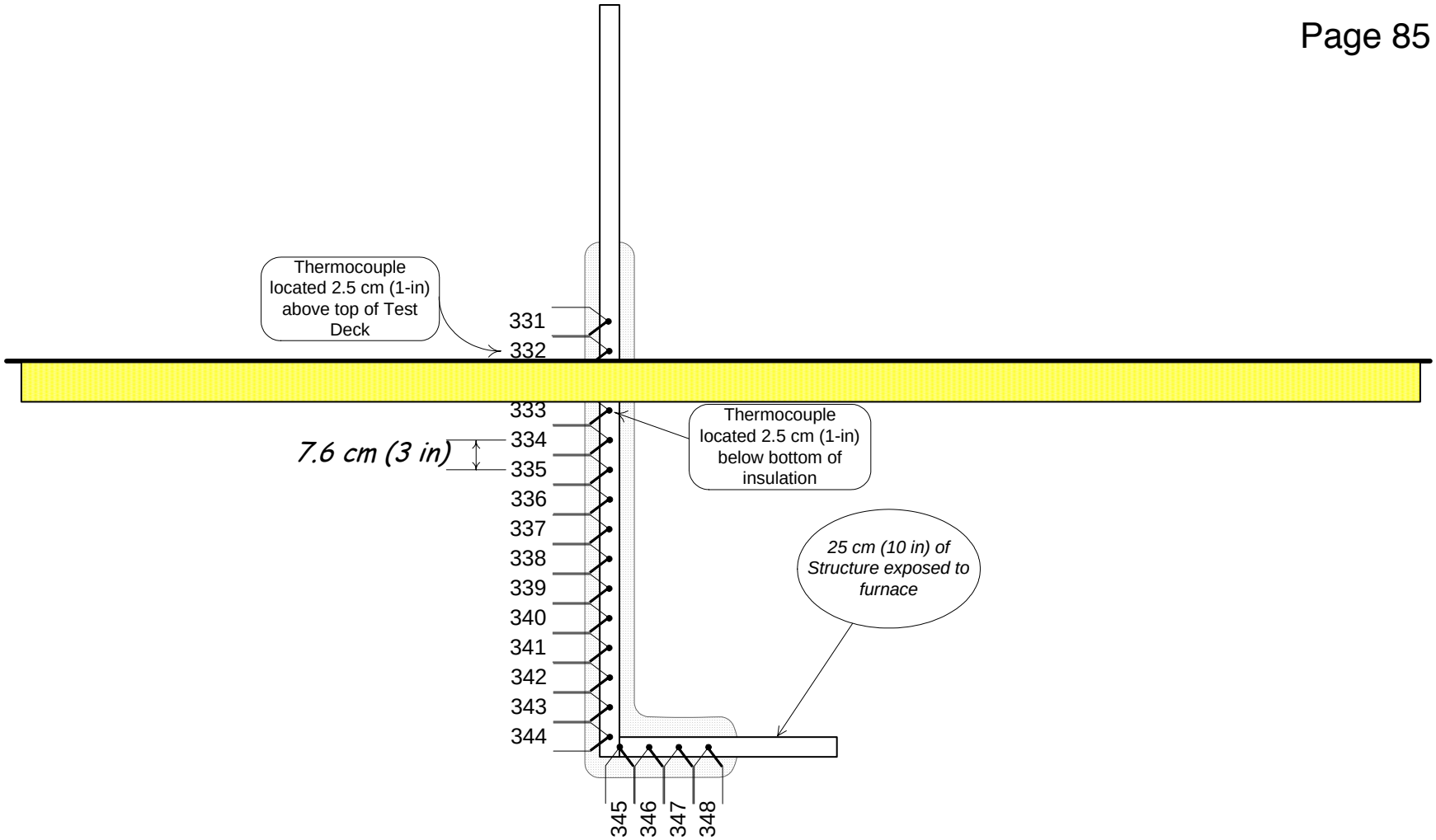
Test Specimen 1F – “Loaded” 27-mm (1-inch) conduit thermocouple locations and tag numbers.



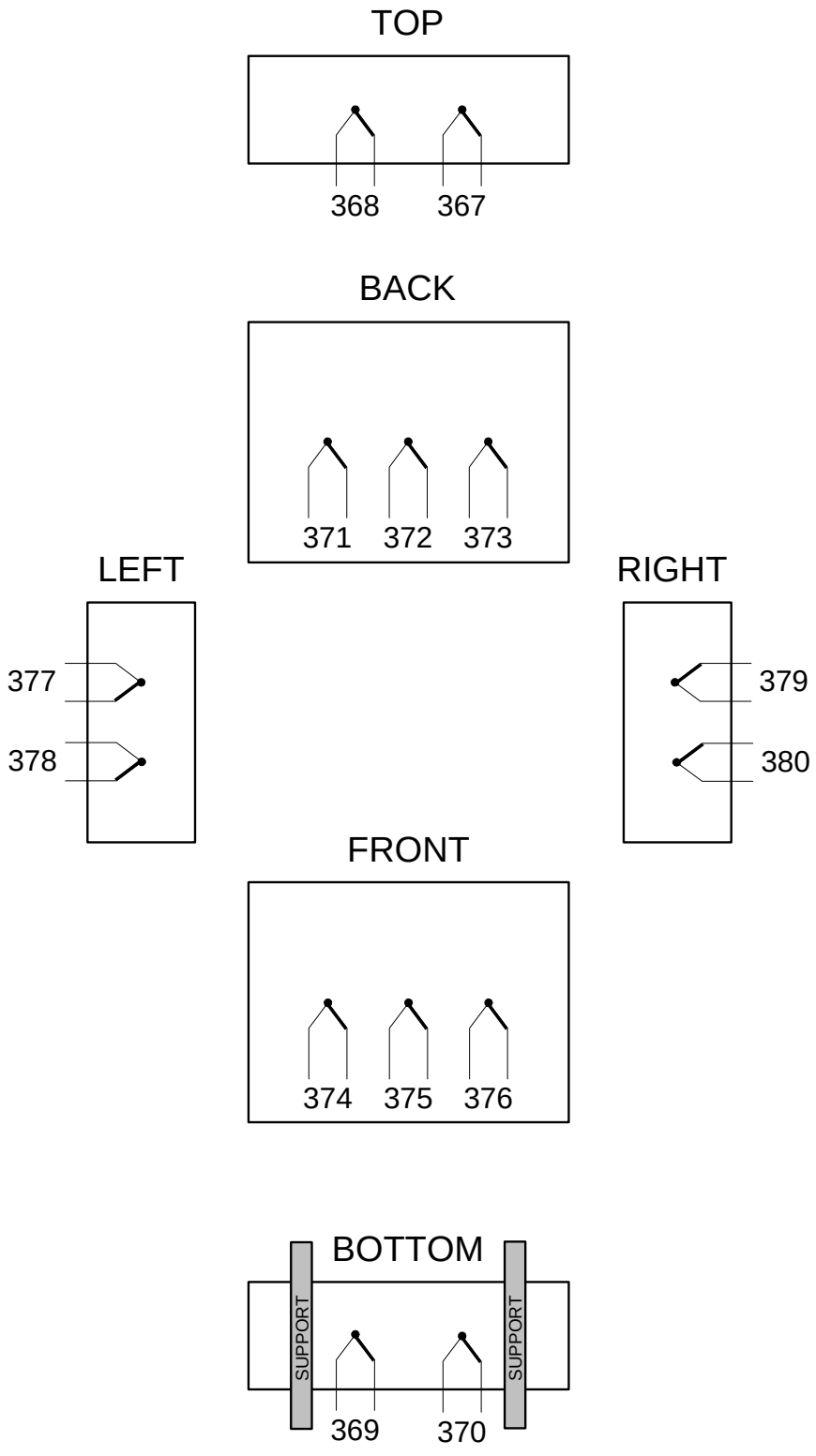
Test Specimen 1F – “Loaded” 27-mm (1-inch) conduit thermocouple locations and tag numbers on bare #8 copper wire. Note: Some uncertainty in exact thermocouple locations exists.



Test Specimen 1G – Unistrut support structure thermocouple locations and tag numbers.



Test Specimen 1H – 50 cm X 50 cm (2 in. X 2 in) tube steel support structure thermocouple locations and tag numbers.

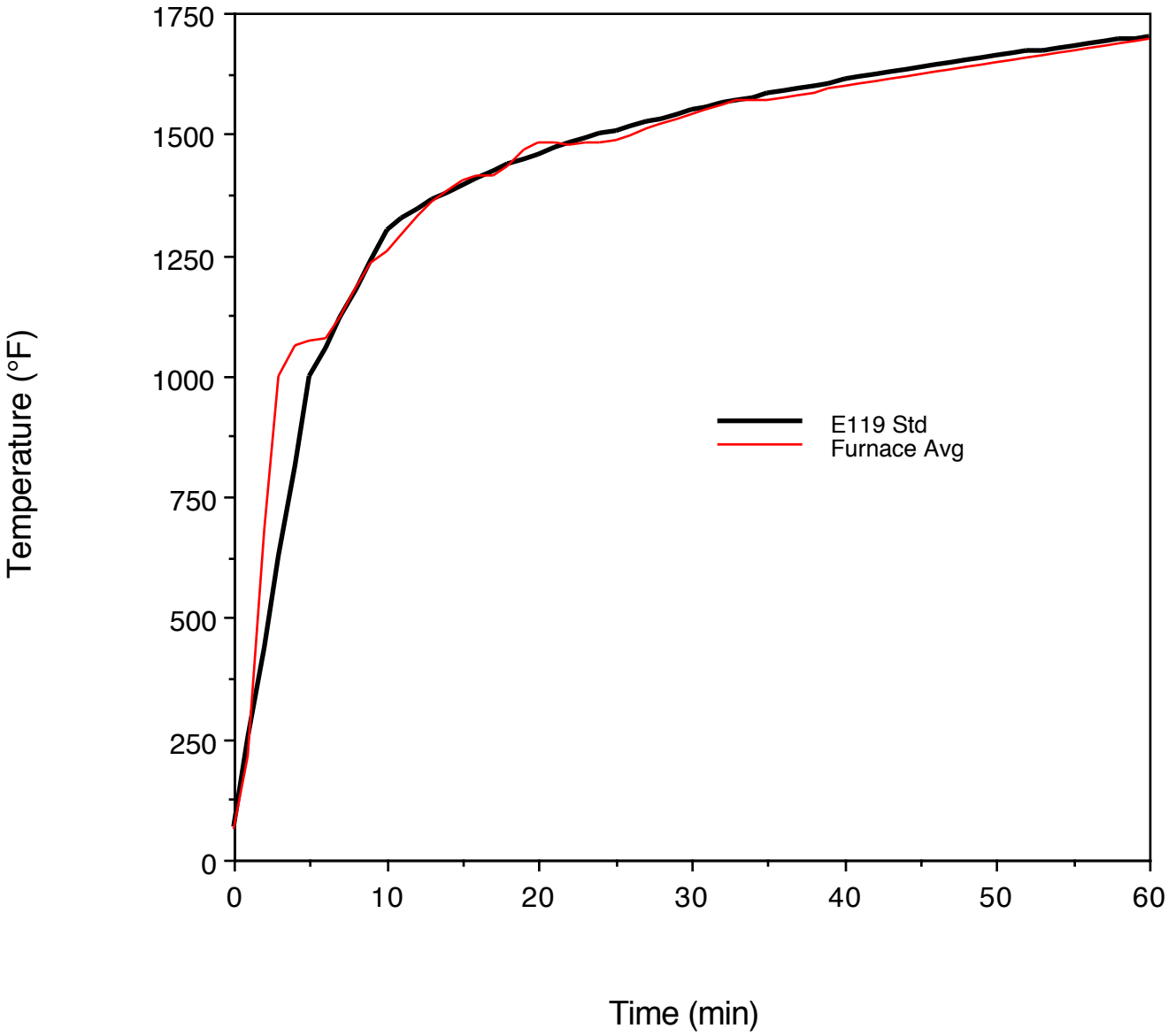


Test Specimen 1I – Junction box thermocouple locations and tag numbers. Note: Back panel is transparent in this figure to show correct orientation of thermocouple locations.

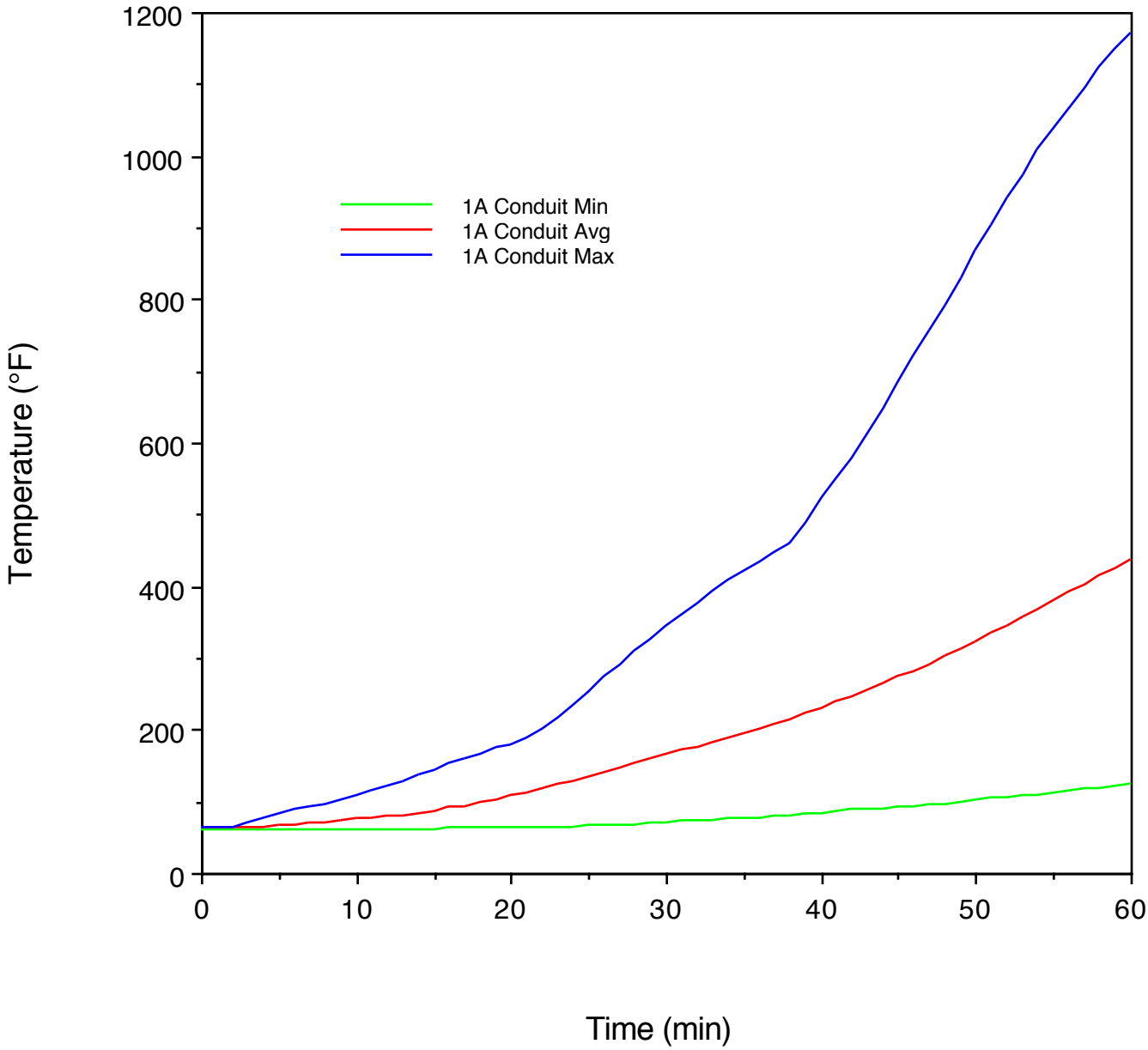
Appendix D

TEST DATA

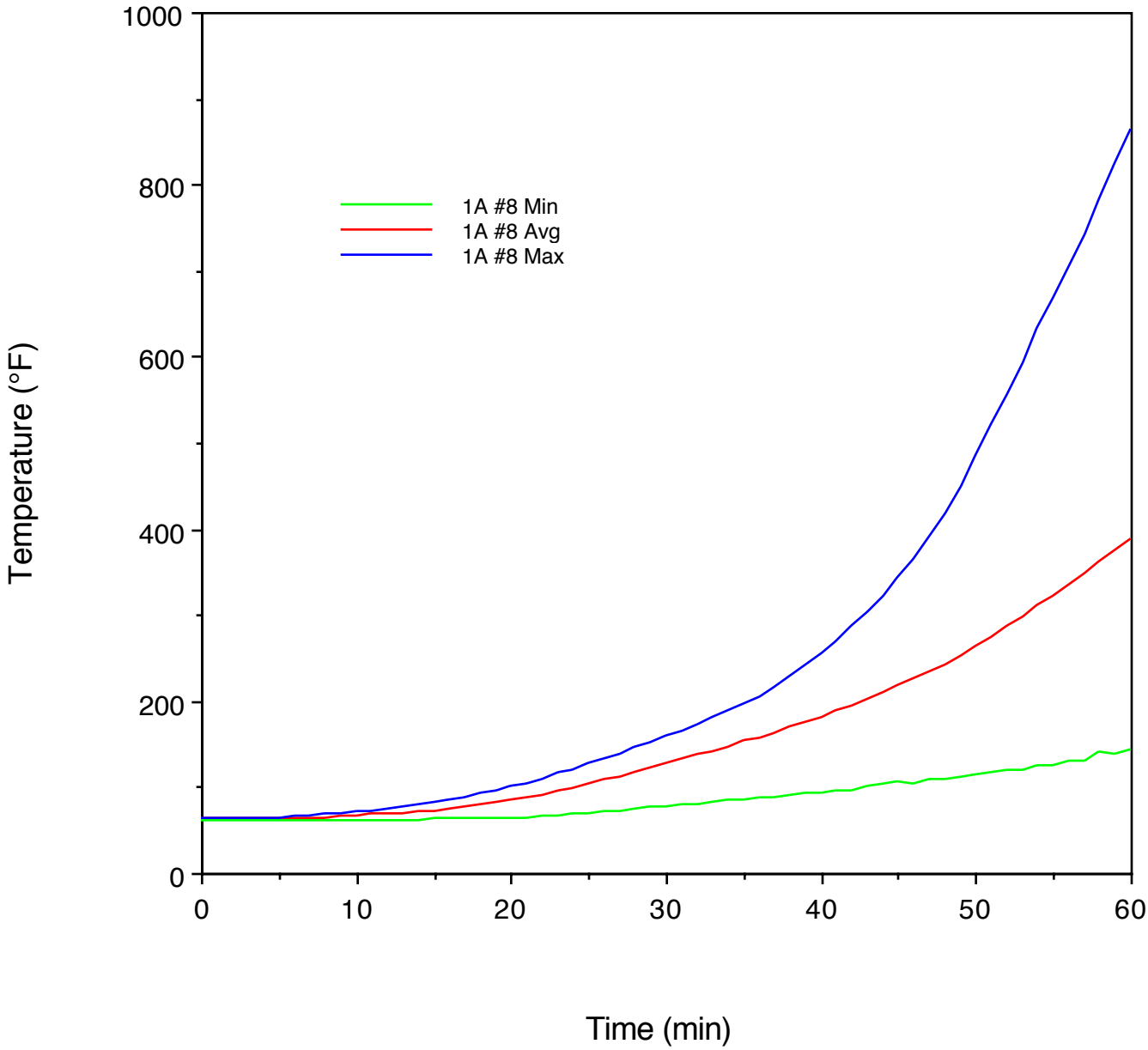
Project No. 14790-123263
Sandia National Laboratories
Furnace Interior Temperatures



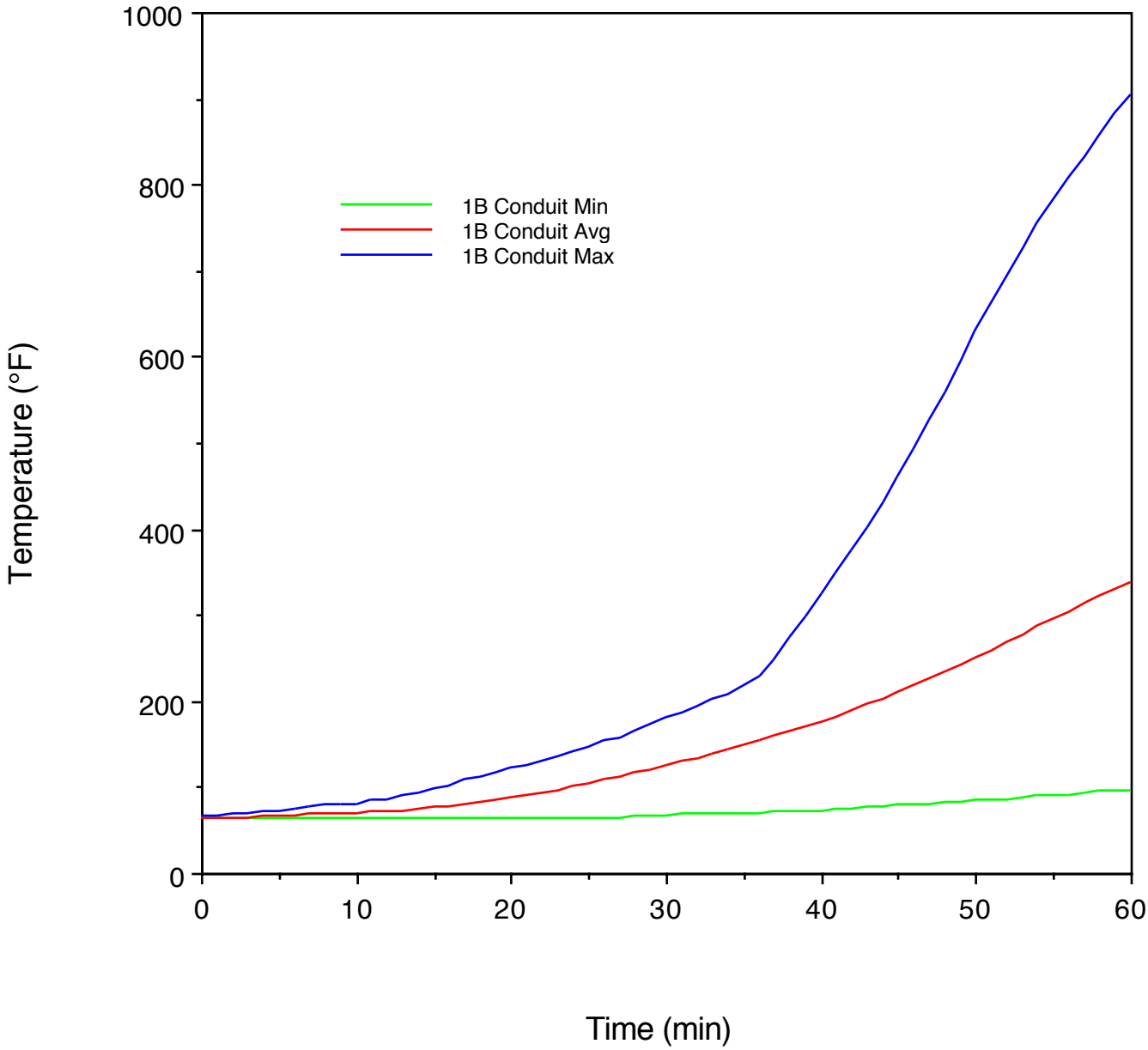
Project No. 14790-123263
Sandia National Laboratories
Test Item #1A Conduit Steel
Minimum, Average & Maximum Temperatures



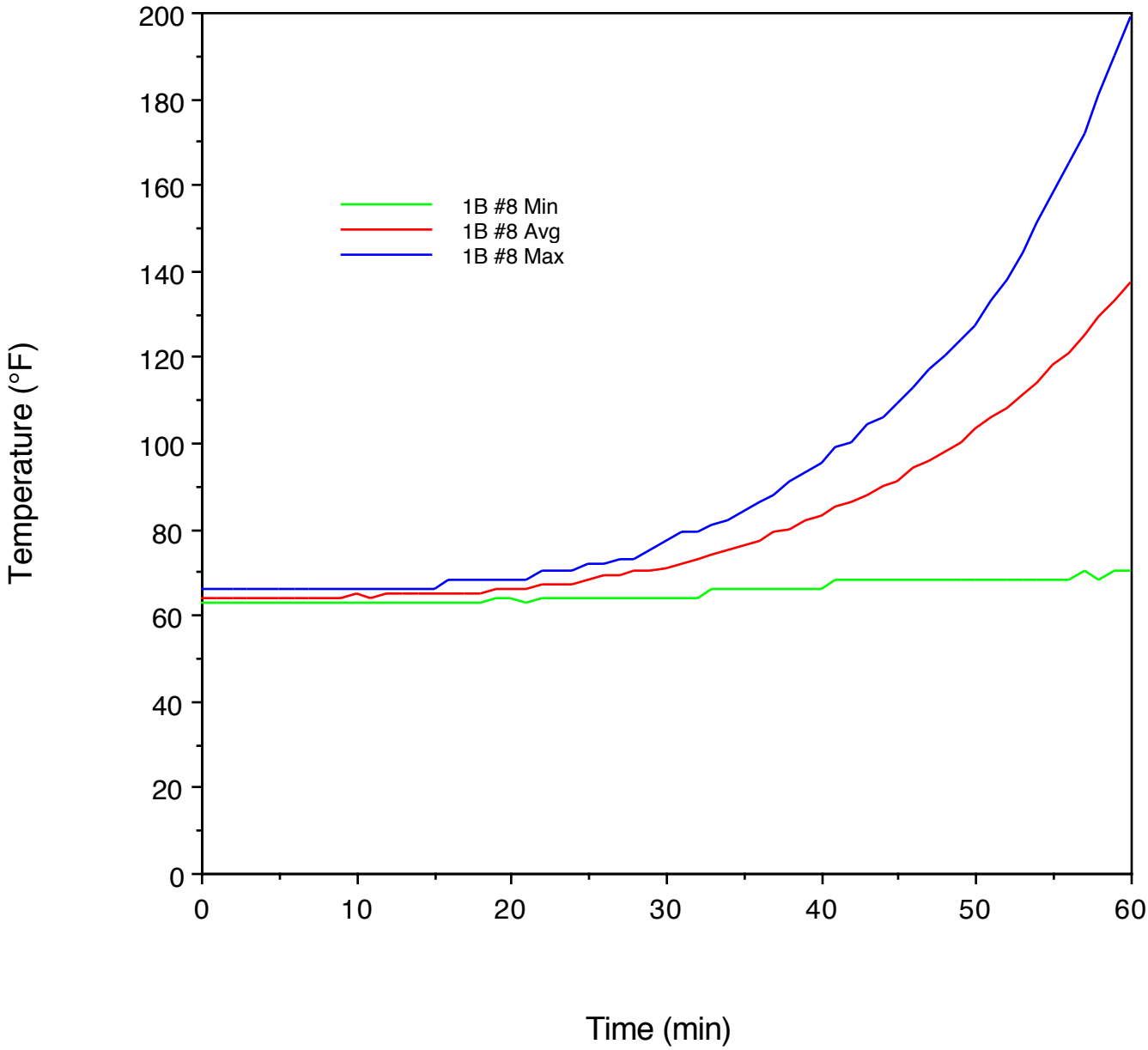
Project No. 14790-123263
Sandia National Laboratories
Test Item #1A Bare #8 Copper Conductor
Minimum, Average & Maximum Temperatures



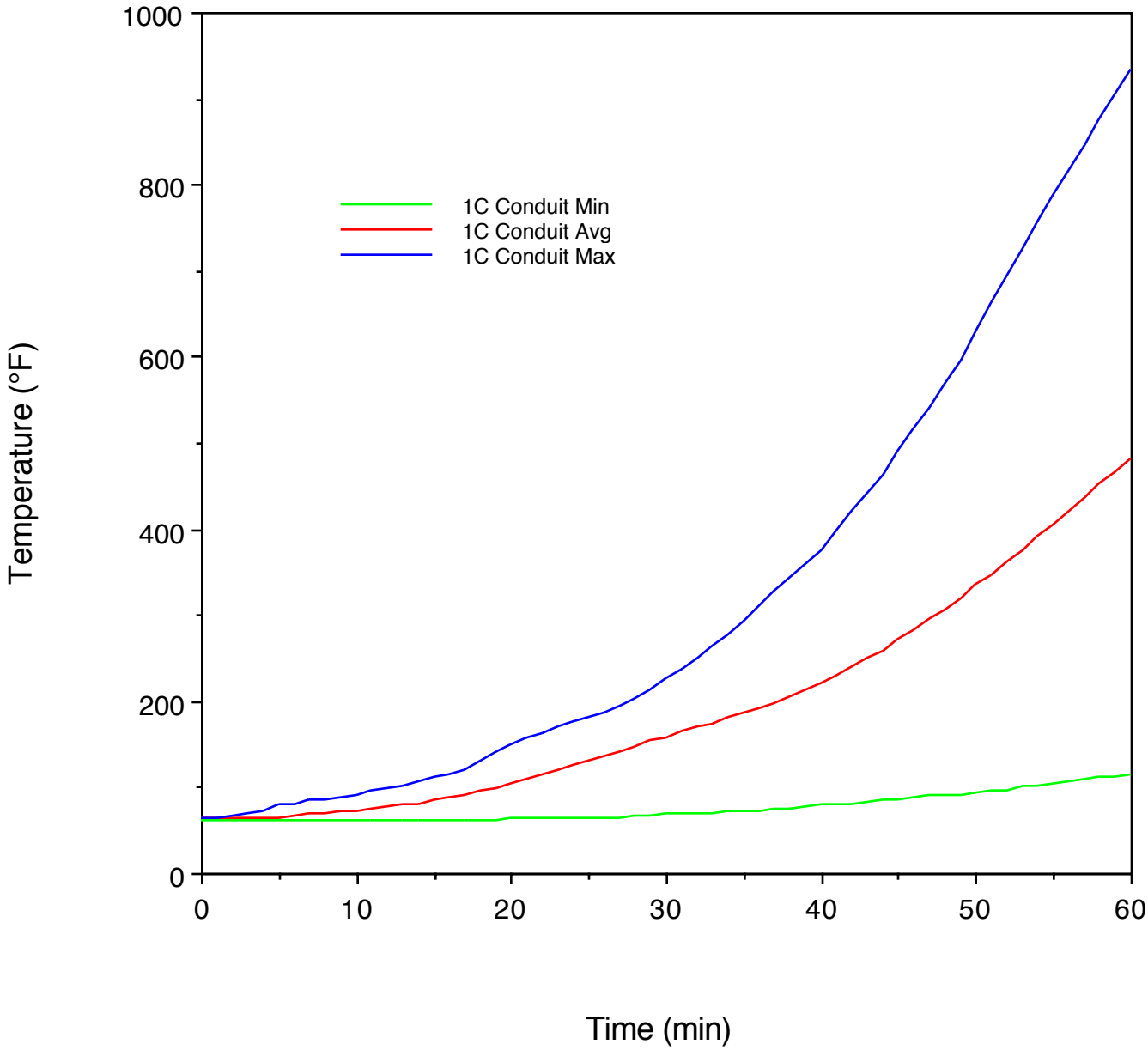
Project No. 14790-123263
Sandia National Laboratories
Test Item #1B Conduit Steel
Minimum, Average & Maximum Temperatures



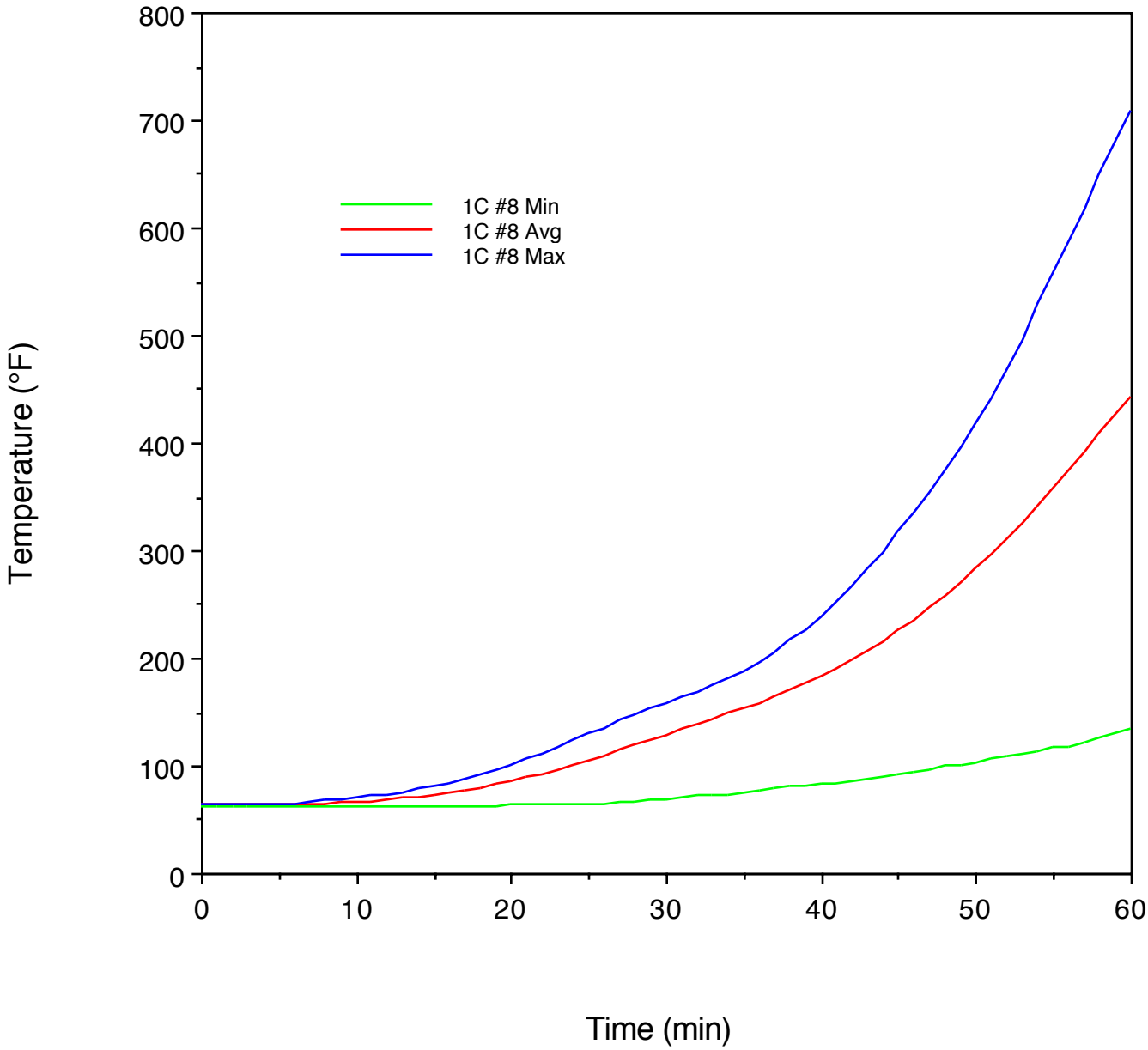
Project No. 14790-123263
Sandia National Laboratories
Test Item #1B Bare #8 Copper Conductor
Minimum, Average & Maximum Temperatures



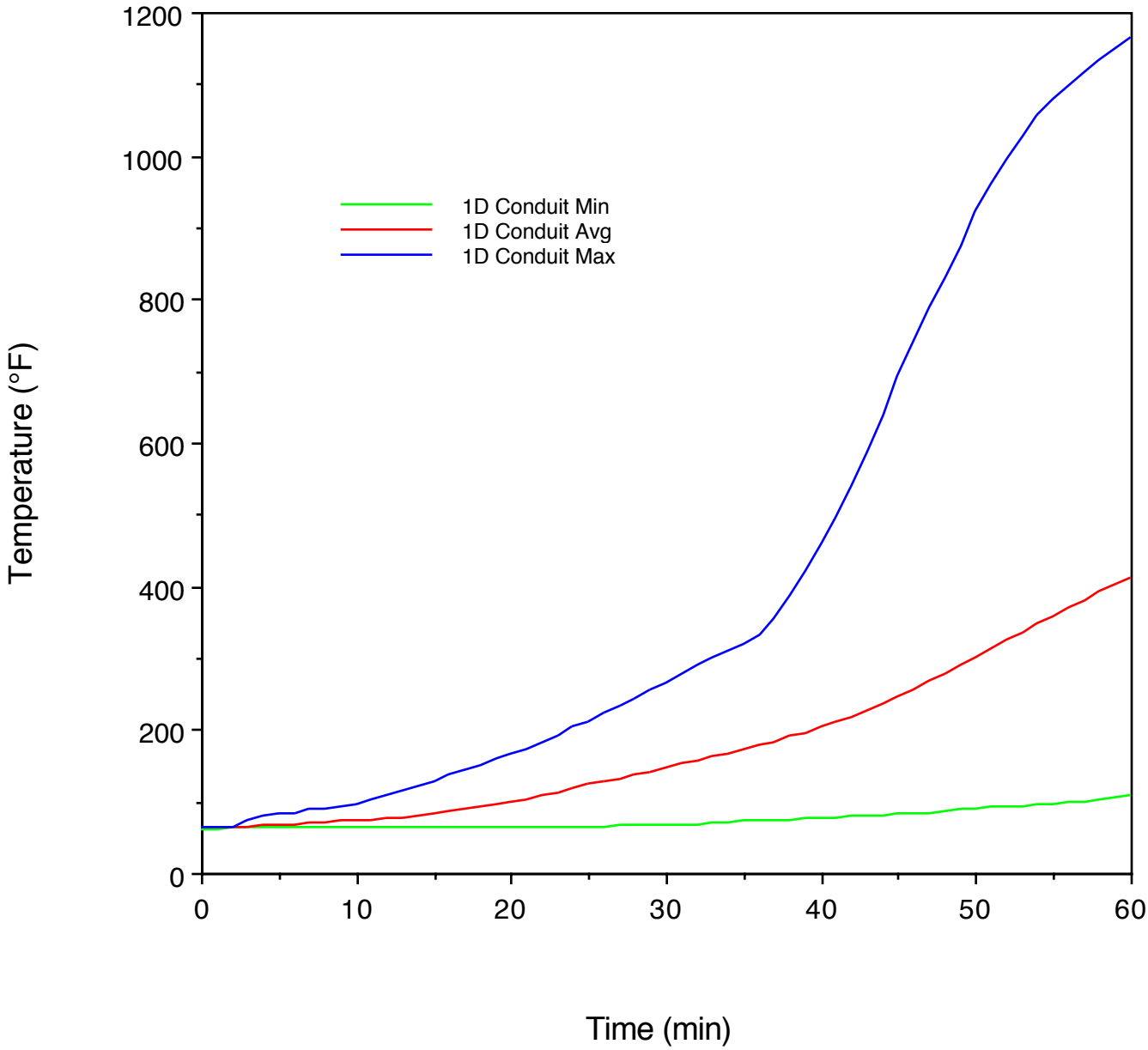
Project No. 14790-123263
Sandia National Laboratories
Test Item #1C Conduit Steel
Minimum, Average & Maximum Temperatures



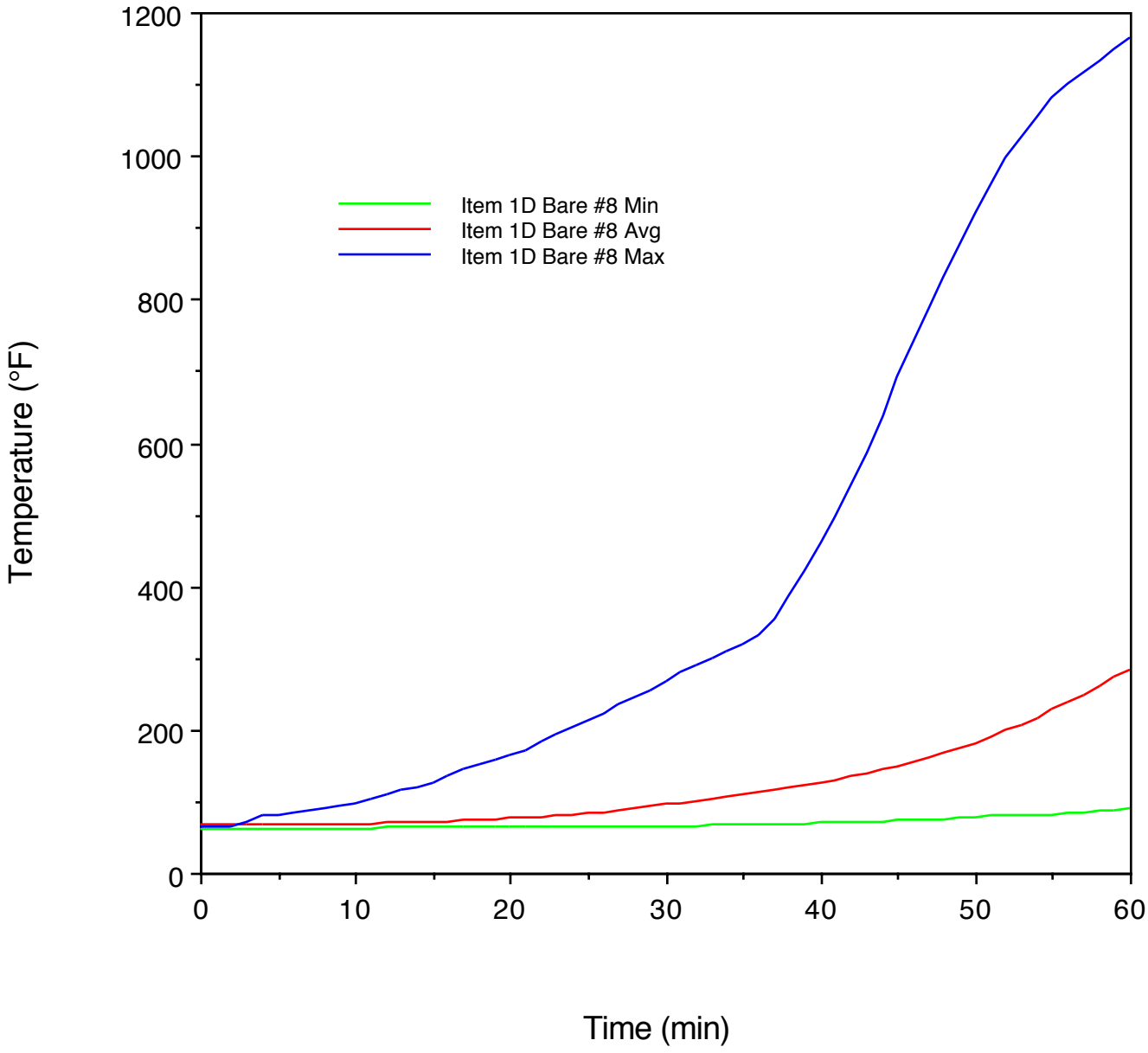
Project No. 14790-123263
Sandia National Laboratories
Test Item #1C Bare #8 Copper Conductor
Minimum, Average & Maximum Temperatures



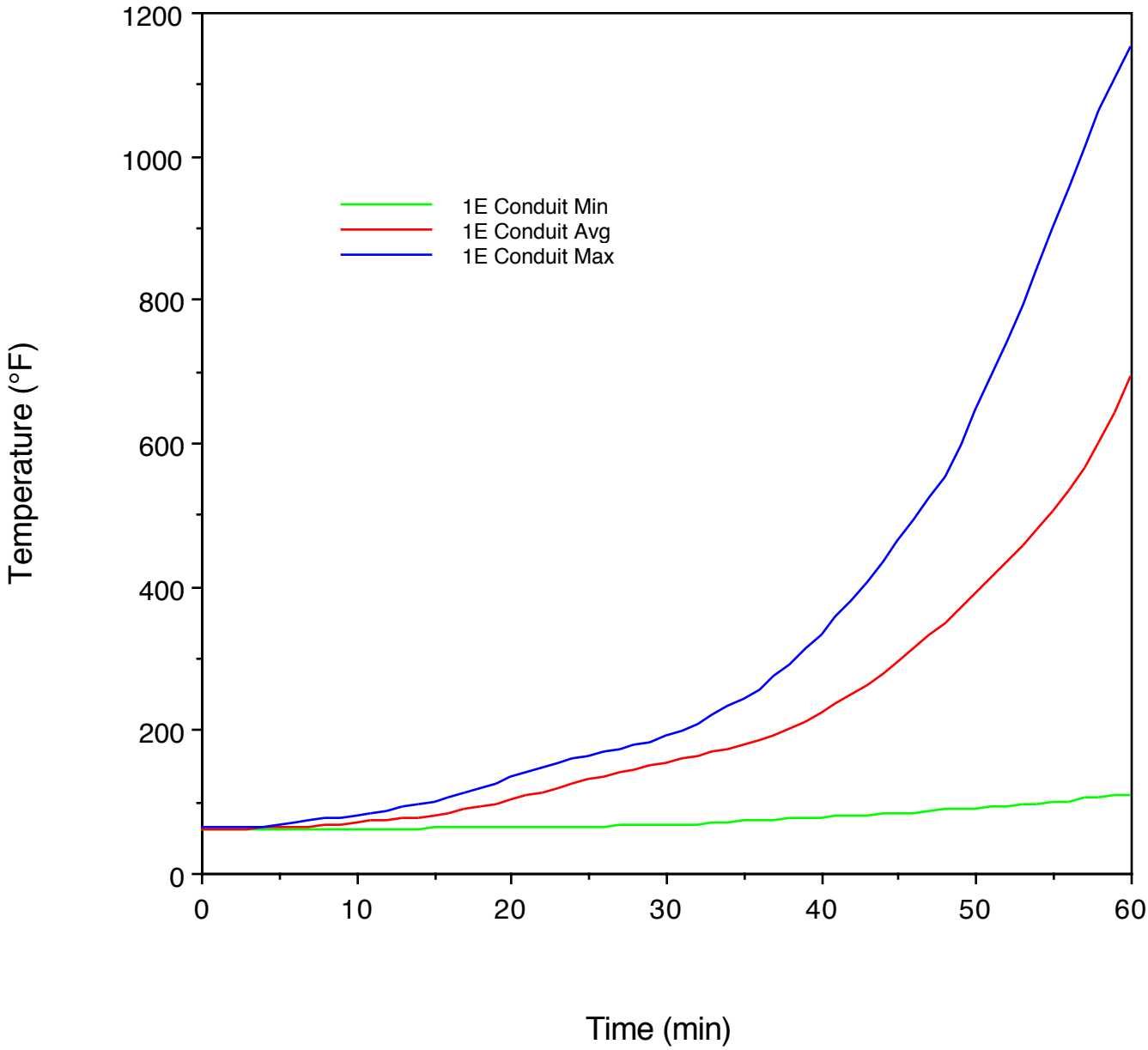
Project No. 14790-123263
Sandia National Laboratories
Test Item #1D Conduit Steel
Minimum, Average & Maximum Temperatures



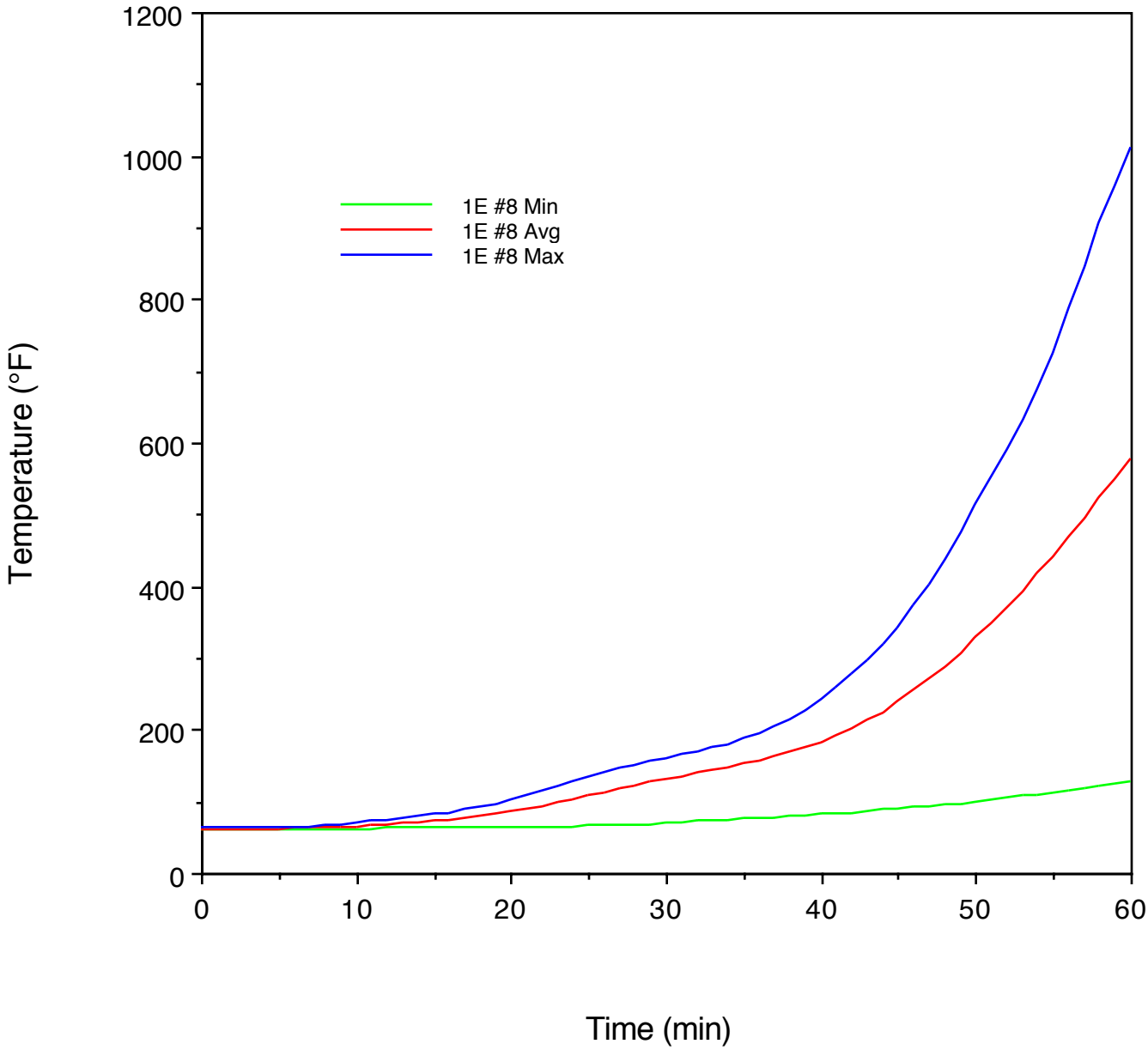
Project No. 14790-123263
Sandia National Laboratories
Item 1D Bare #8 Conductor
Minimum, Average & Maximum Temperatures



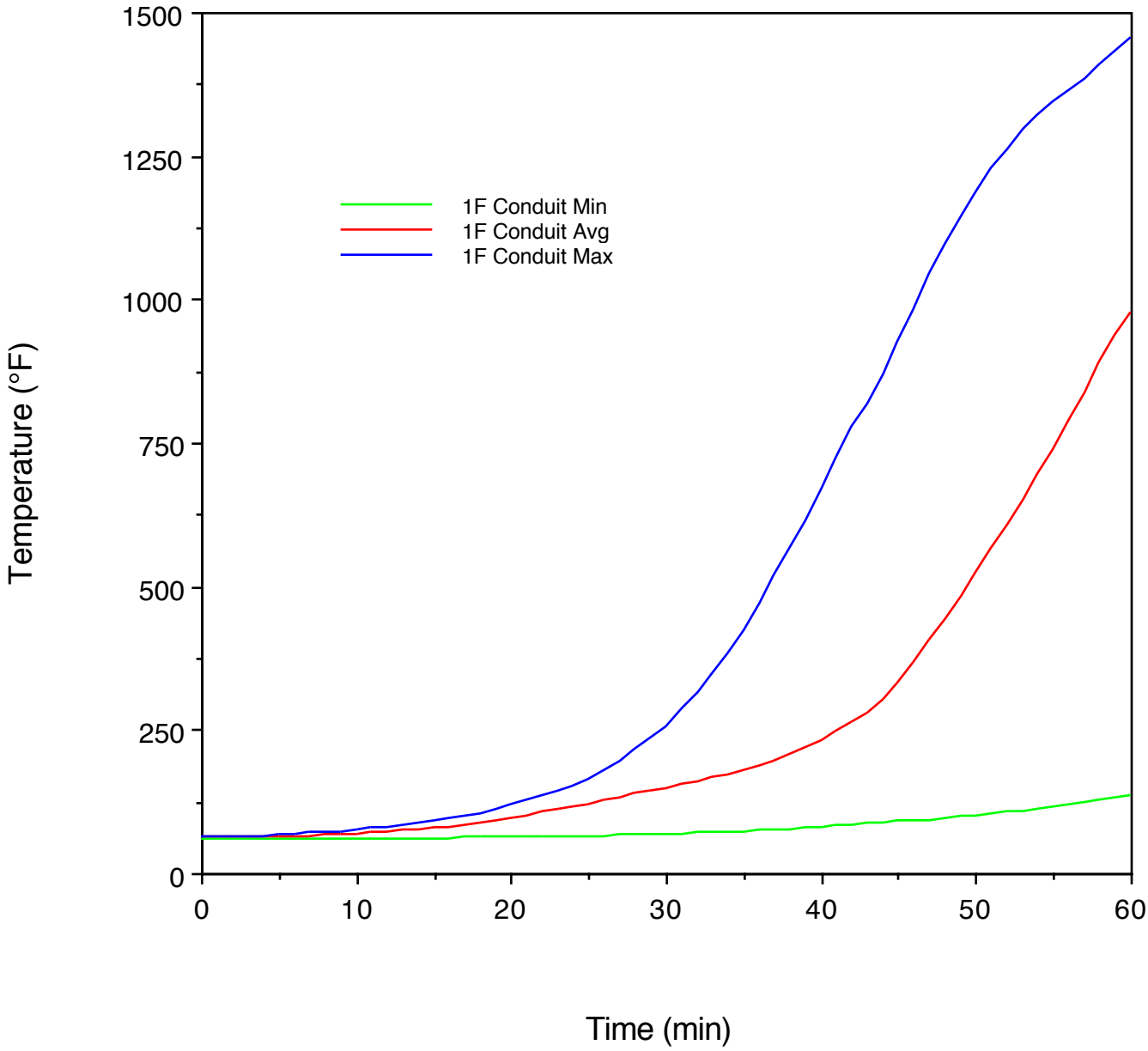
Project No. 14790-123263
Sandia National Laboratories
Test Item #1E Conduit Steel
Minimum, Average & Maximum Temperatures



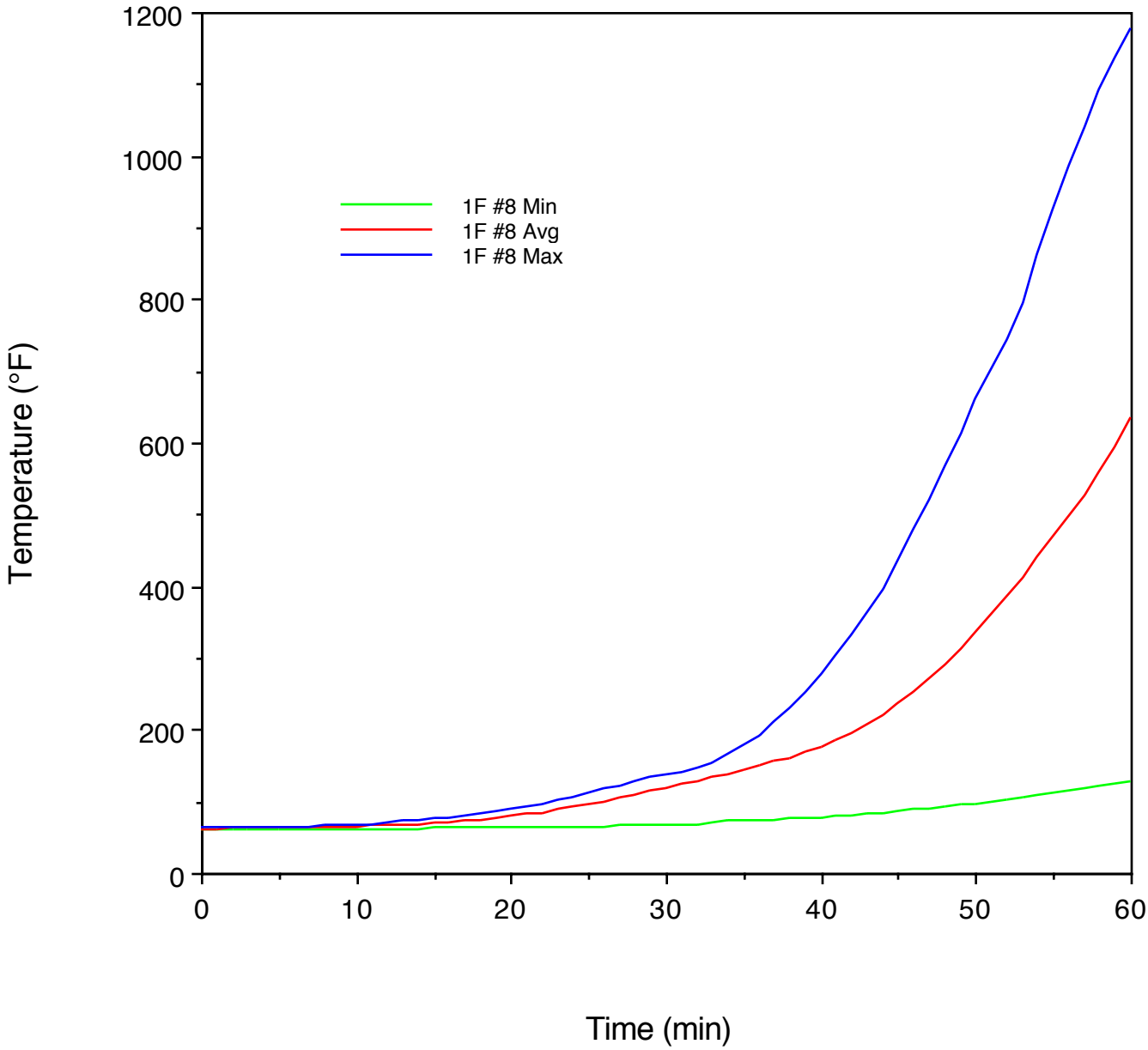
Project No. 14790-123263
Sandia National Laboratories
Test Item #1E Bare #8 Copper Conductor
Minimum, Average & Maximum Temperatures



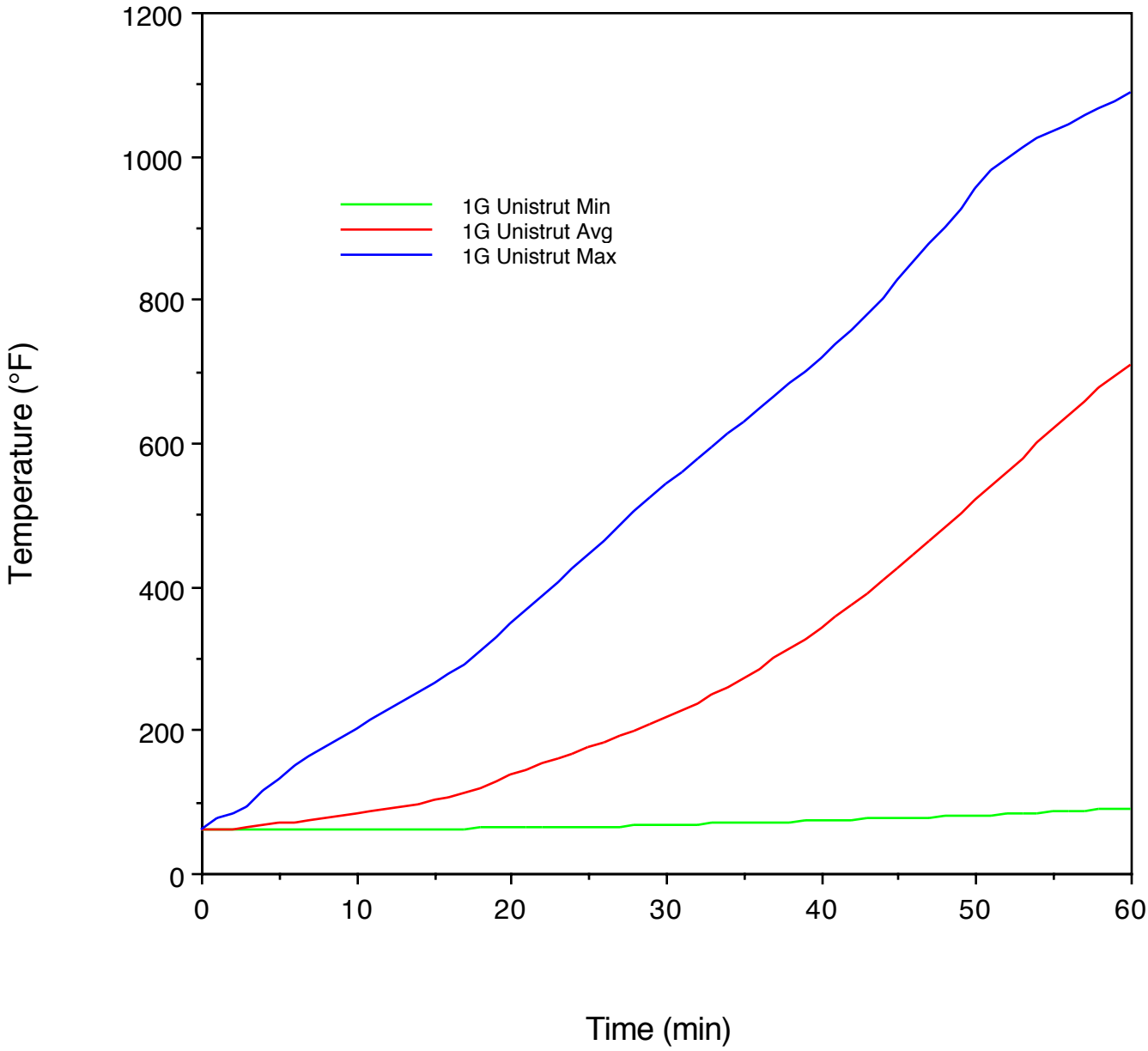
Project No. 14790-123263
Sandia National Laboratories
Test Item #1F Conduit Steel
Minimum, Average & Maximum Temperatures



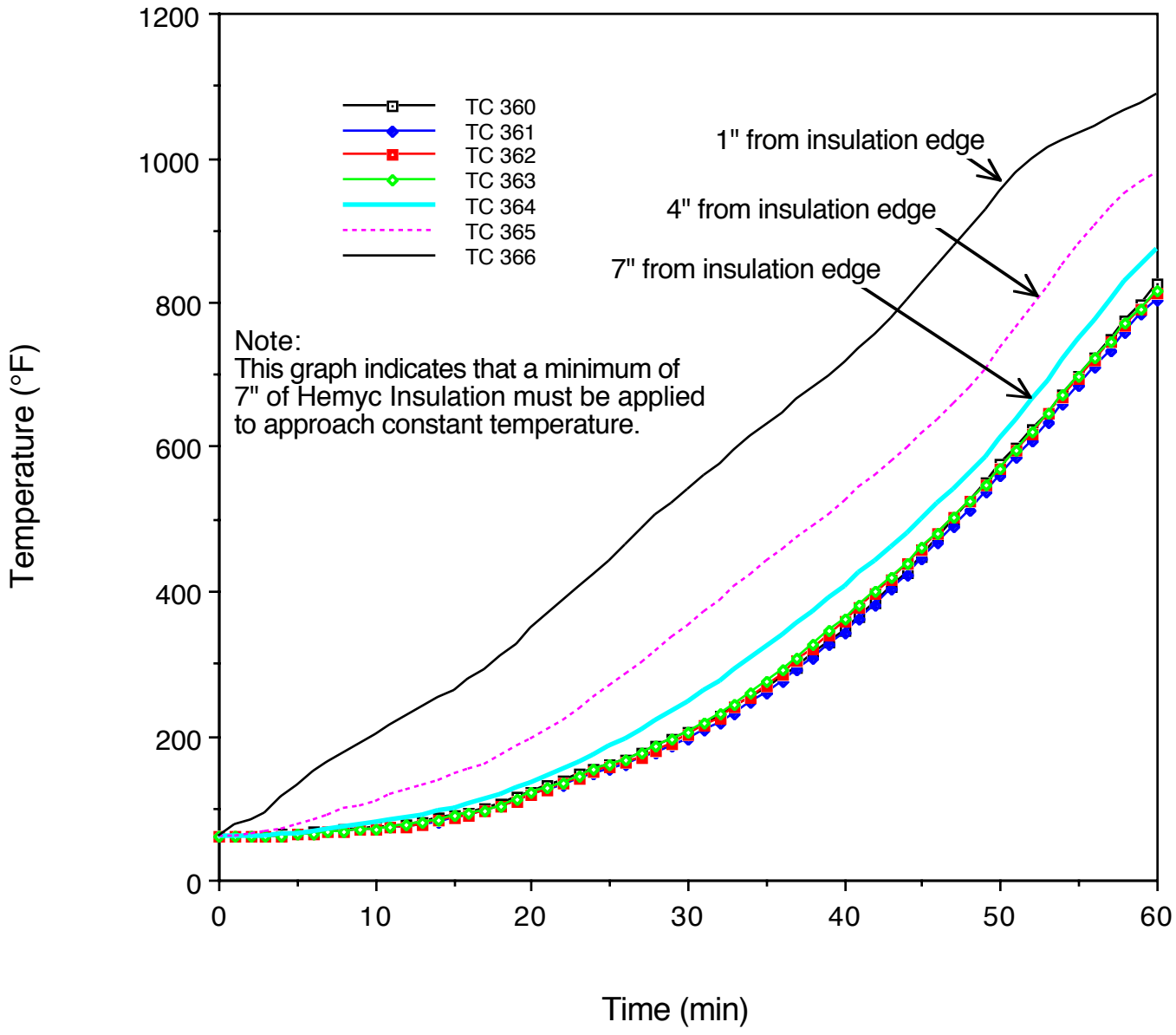
Project No. 14790-123263
Sandia National Laboratories
Test Item #1F Bare #8 Copper Conductor
Minimum, Average & Maximum Temperatures



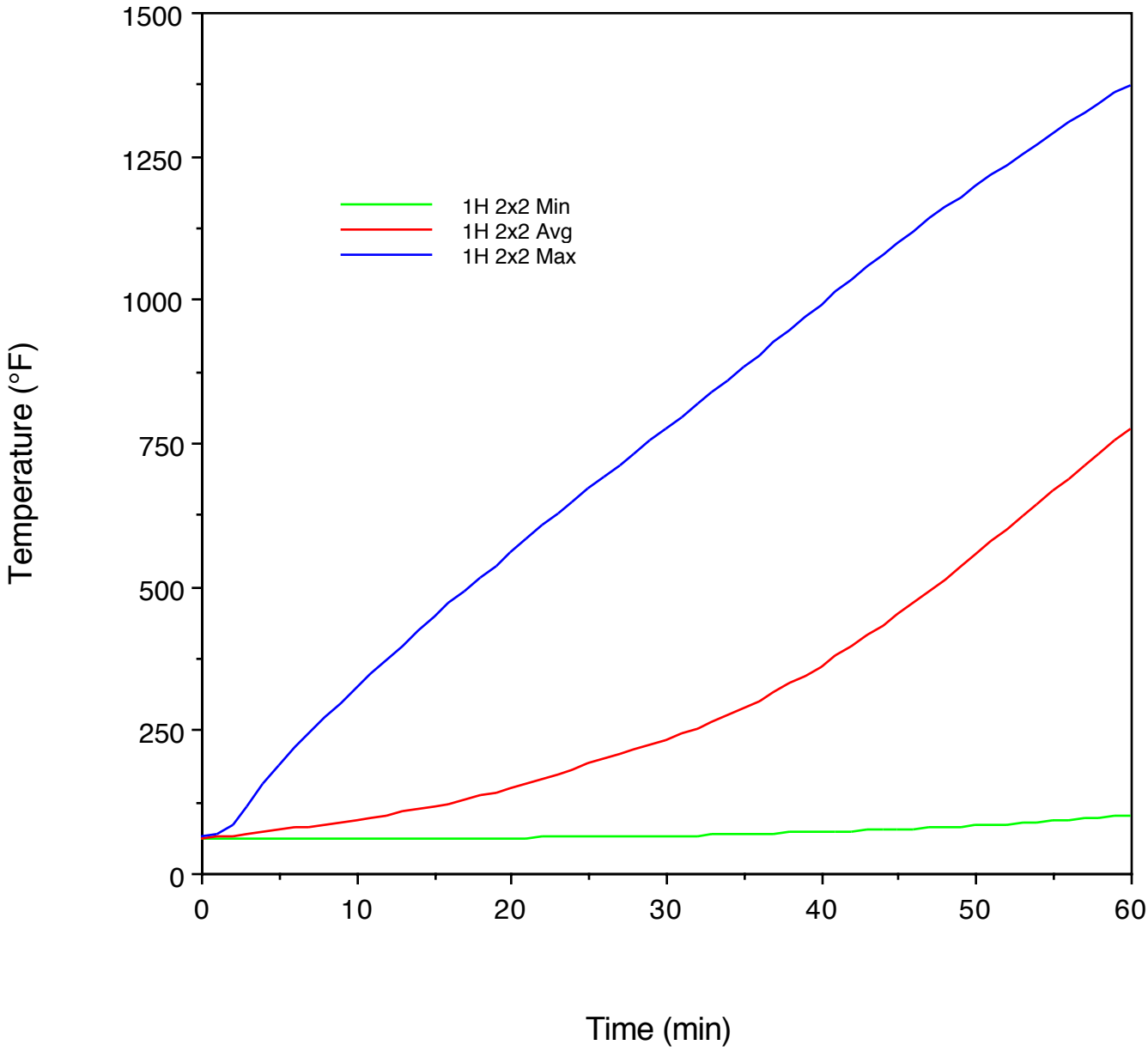
Project No. 14790-123263
Sandia National Laboratories
Test Item #1G Unistrut Steel
Minimum, Average & Maximum Temperatures



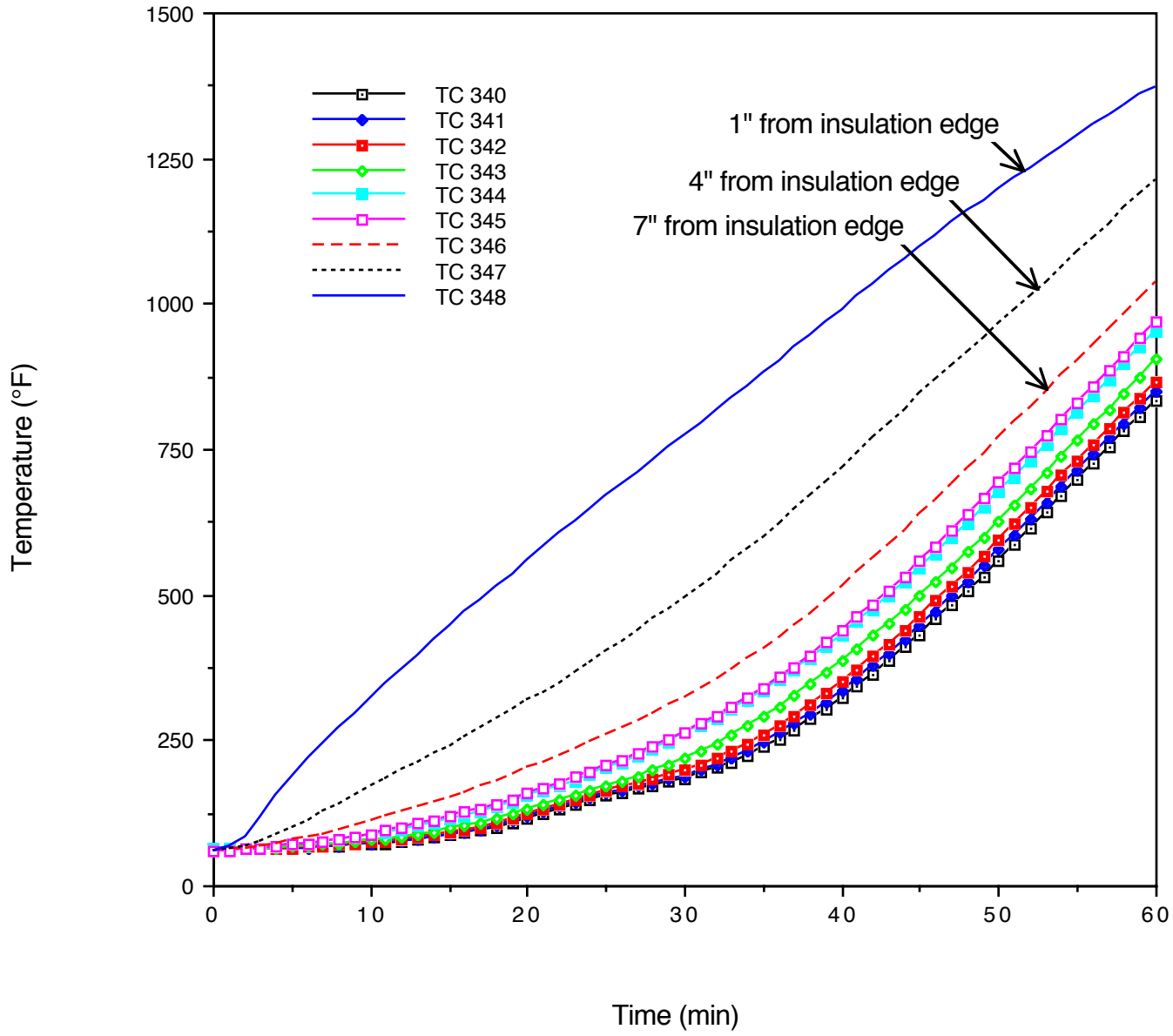
Project No. 14790-123263
Sandia National Laboratories
Thermocouples on Unistrut Support



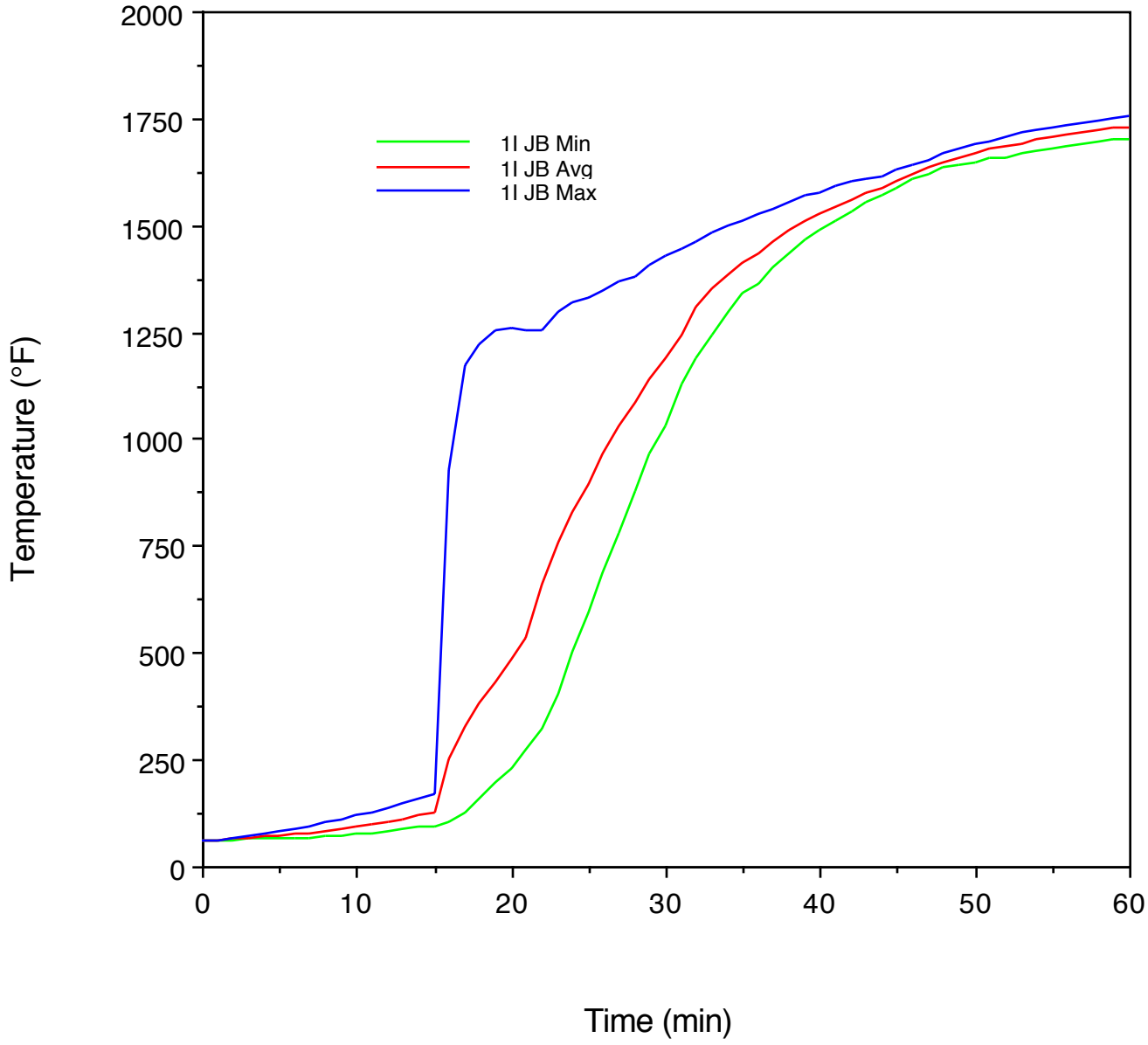
Project No. 14790-123263
Sandia National Laboratories
Test Item #1H 2x2 Steel Support
Minimum, Average & Maximum Temperatures

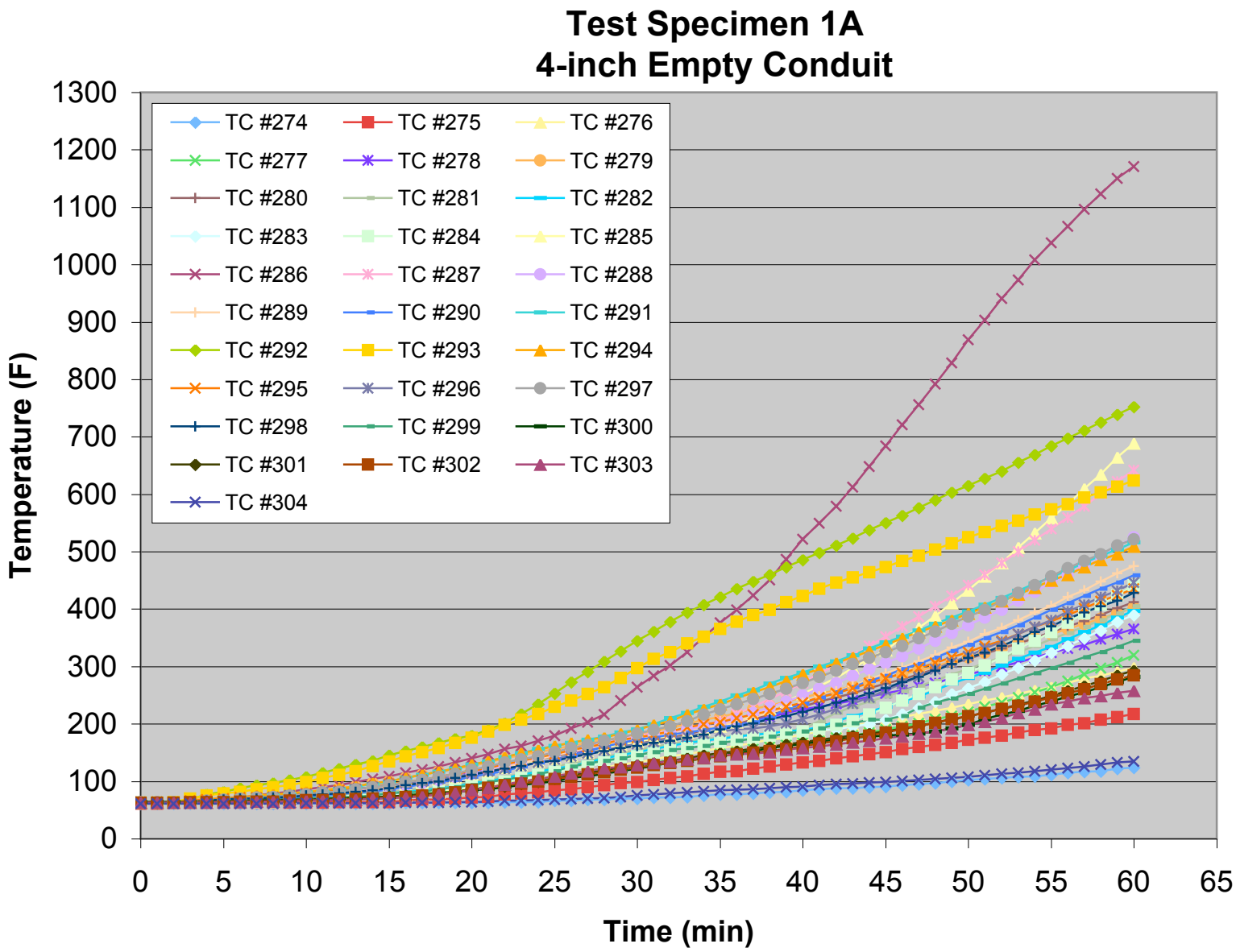


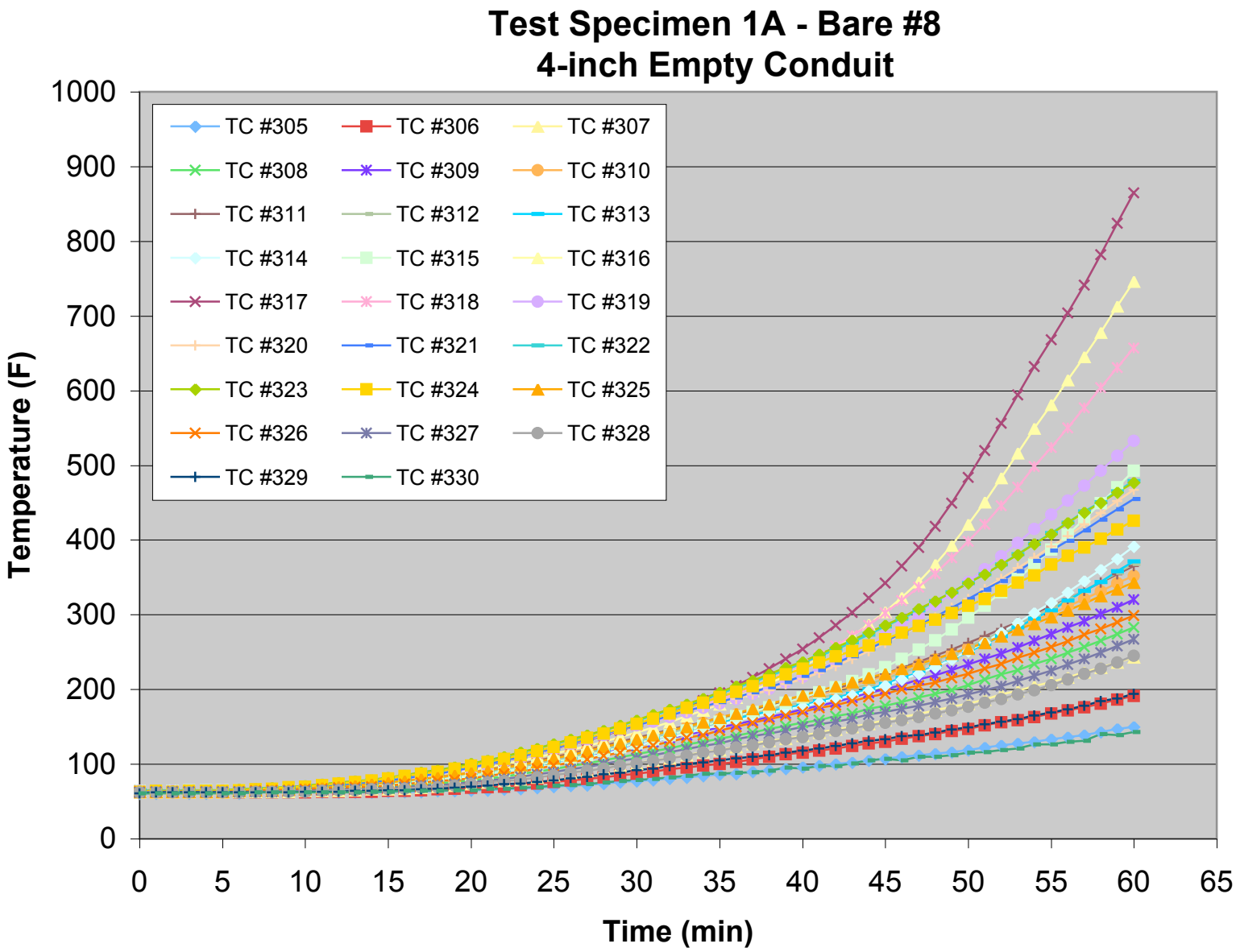
Project No. 14790-123263
Sandia National Laboratories
Item 1H 2x2 Steel Support Temperature Profile

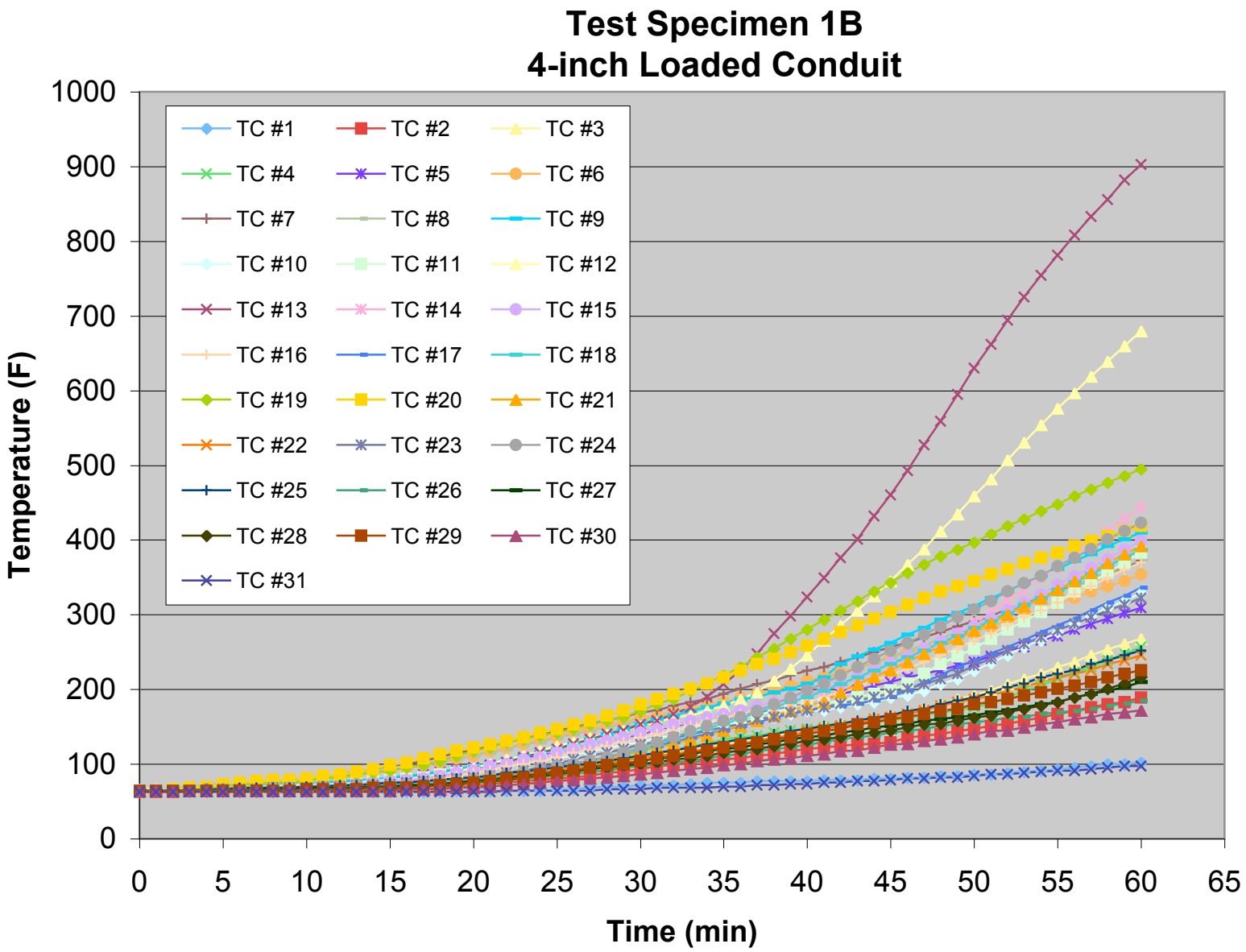


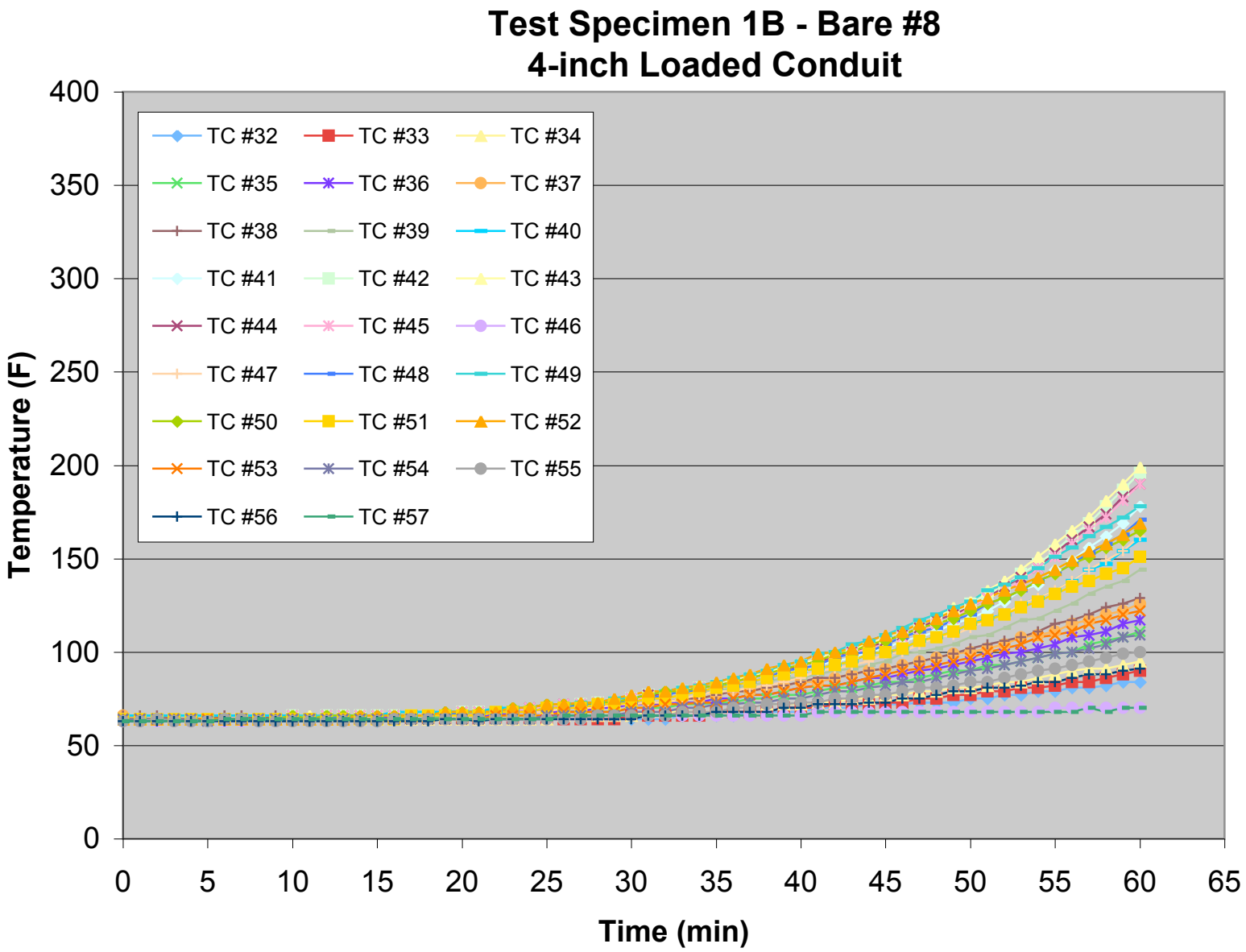
Project No. 14790-123263
Sandia National Laboratories
Test Item #1I Junction Box Steel
Minimum, Average & Maximum Temperatures

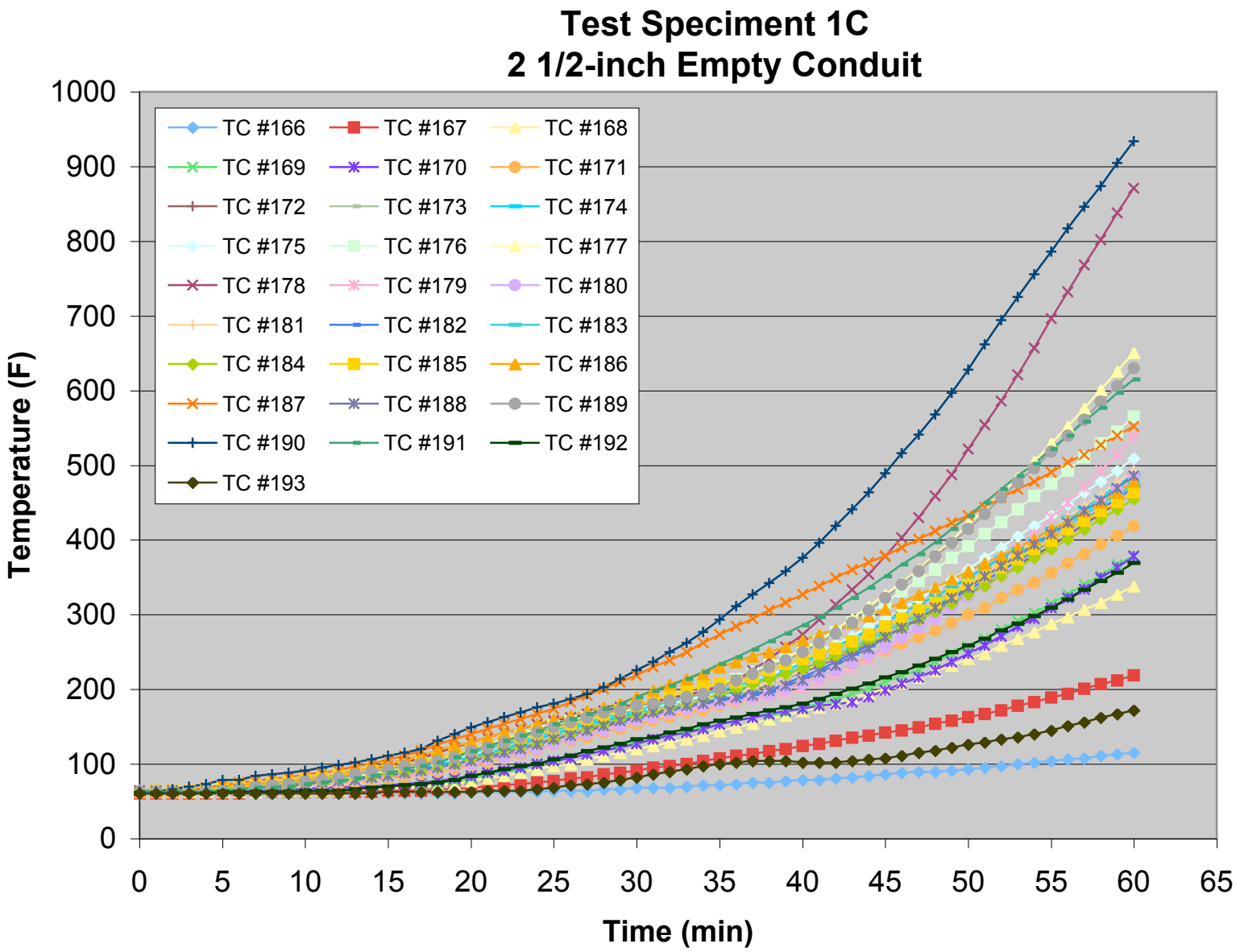


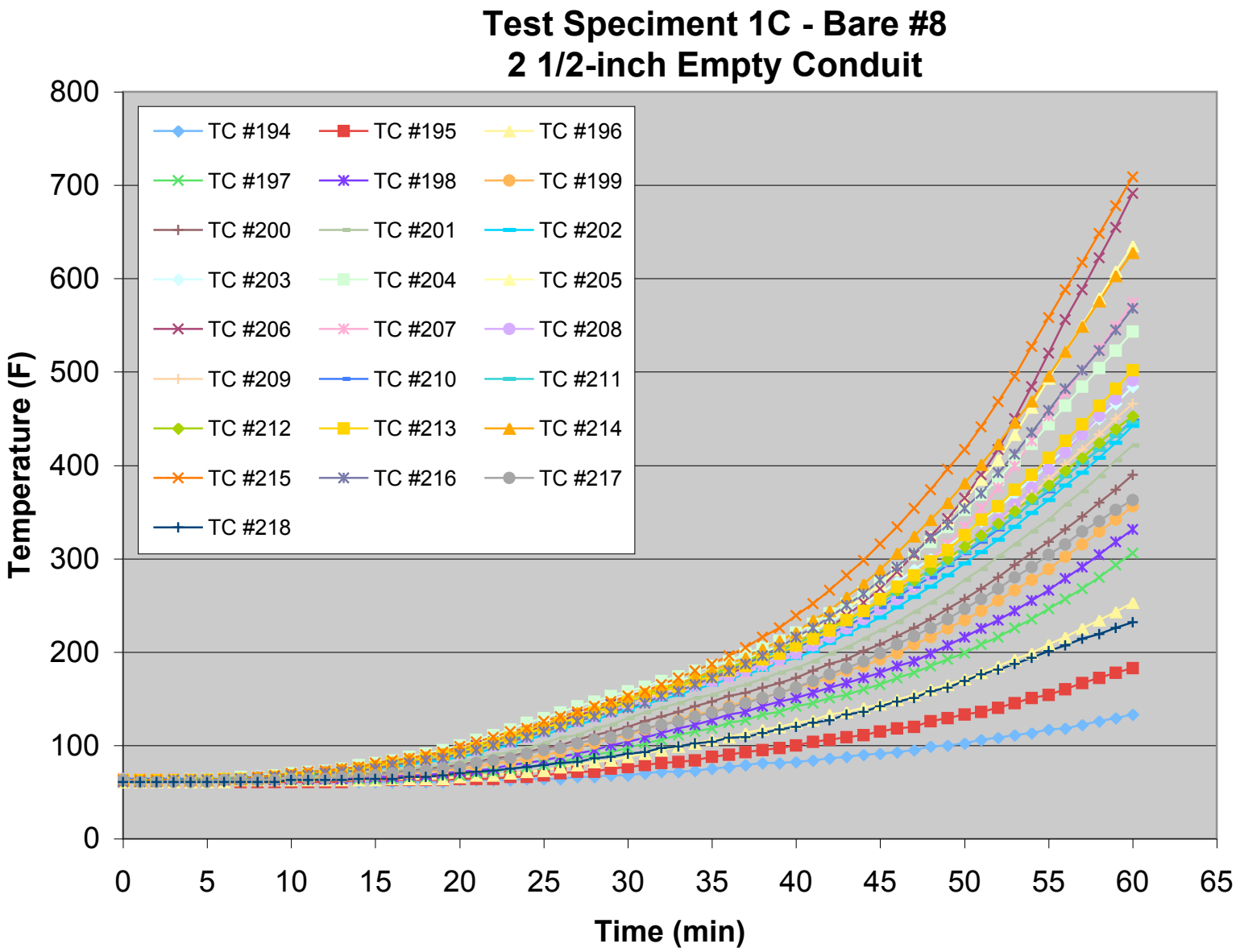

Test Specimen 1A
4-inch Empty Conduit
Temperature (F)
Time (min)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
0
5
10
15
20
25
30
35
40
45
50
55
60
65
TC #274
TC #275
TC #276
TC #277
TC #278
TC #279
TC #280
TC #281
TC #282
TC #283
TC #284
TC #285
TC #286
TC #287
TC #288
TC #289
TC #290
TC #291
TC #292
TC #293
TC #294
TC #295
TC #296
TC #297
TC #298
TC #299
TC #300
TC #301
TC #302
TC #303
TC #304

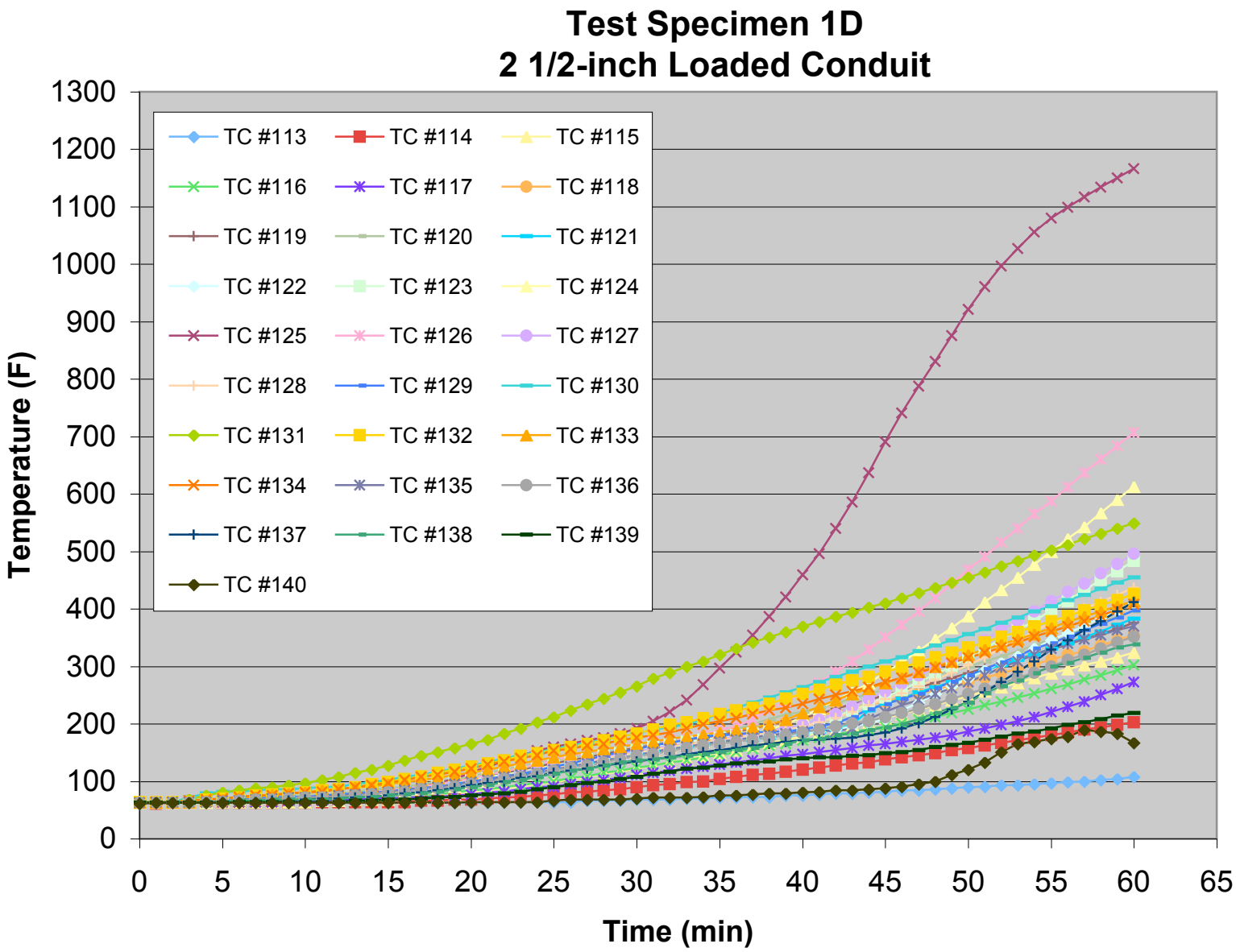

Test Specimen 1A - Bare #8
4-inch Empty Conduit
Temperature (F)
Time (min)
0
100
200
300
400
500
600
700
800
900
1000
0
5
10
15
20
25
30
35
40
45
50
55
60
65
TC #305
TC #306
TC #307
TC #308
TC #309
TC #310
TC #311
TC #312
TC #313
TC #314
TC #315
TC #316
TC #317
TC #318
TC #319
TC #320
TC #321
TC #322
TC #323
TC #324
TC #325
TC #326
TC #327
TC #328
TC #329
TC #330

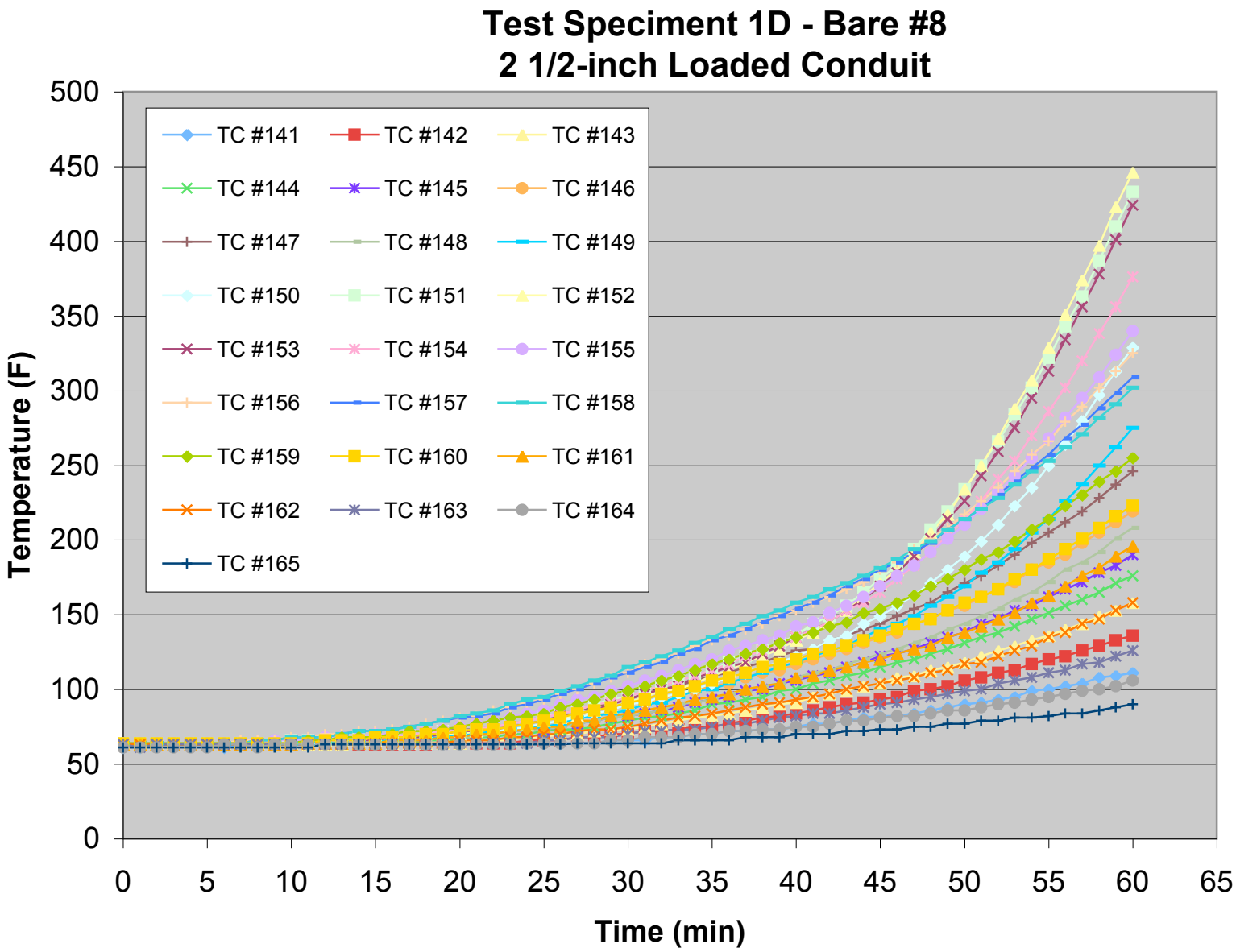

Test Specimen 1B
4-inch Loaded Conduit
Temperature (F)
Time (min)
0
100
200
300
400
500
600
700
800
900
1000
0
5
10
15
20
25
30
35
40
45
50
55
60
65
TC #1
TC #2
TC #3
TC #4
TC #5
TC #6
TC #7
TC #8
TC #9
TC #10
TC #11
TC #12
TC #13
TC #14
TC #15
TC #16
TC #17
TC #18
TC #19
TC #20
TC #21
TC #22
TC #23
TC #24
TC #25
TC #26
TC #27
TC #28
TC #29
TC #30
TC #31

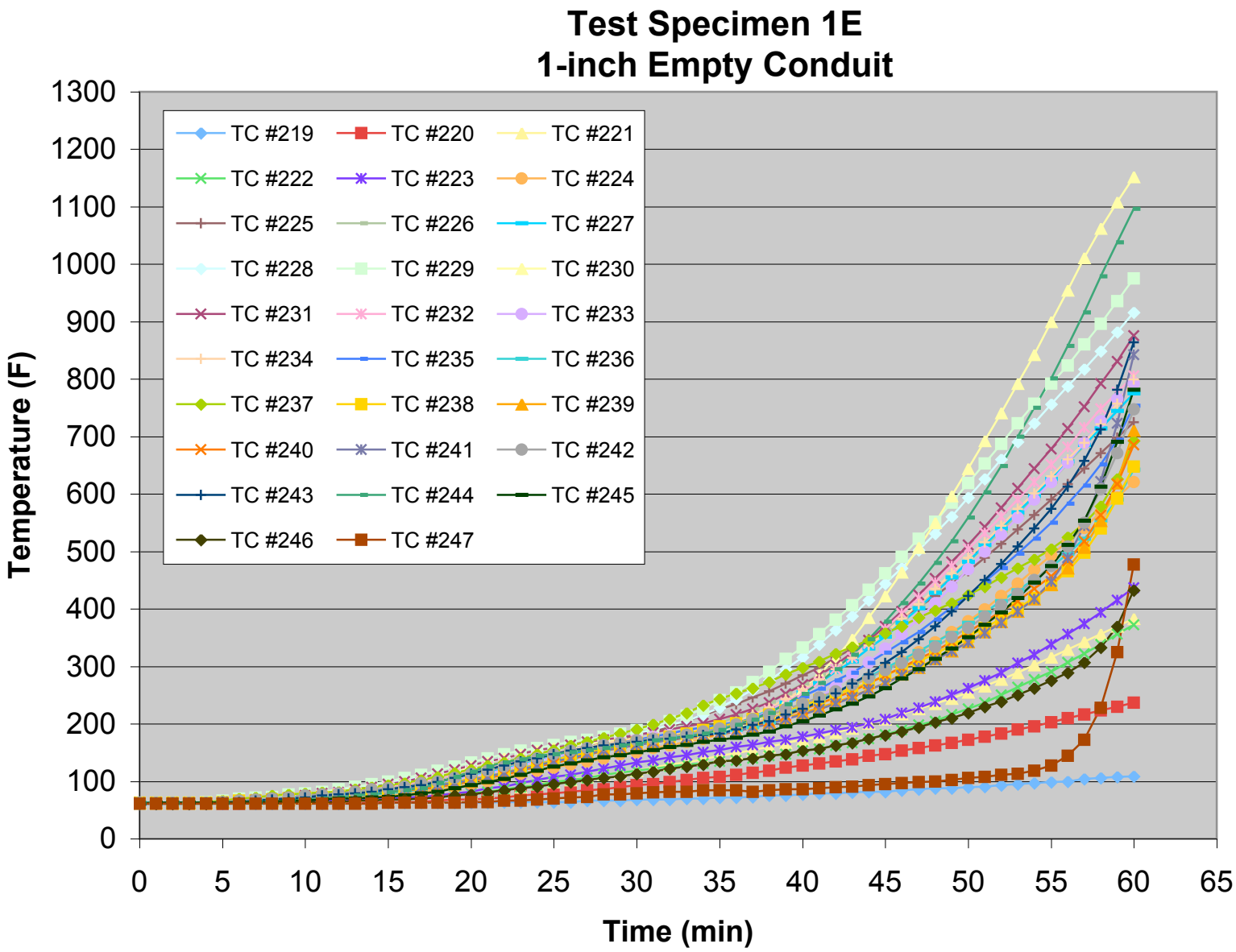

Test Specimen 1B - Bare #8
4-inch Loaded Conduit
Temperature (F)
Time (min)
0
50
100
150
200
250
300
350
400
0
5
10
15
20
25
30
35
40
45
50
55
60
65
TC #32
TC #33
TC #34
TC #35
TC #36
TC #37
TC #38
TC #39
TC #40
TC #41
TC #42
TC #43
TC #44
TC #45
TC #46
TC #47
TC #48
TC #49
TC #50
TC #51
TC #52
TC #53
TC #54
TC #55
TC #56
TC #57

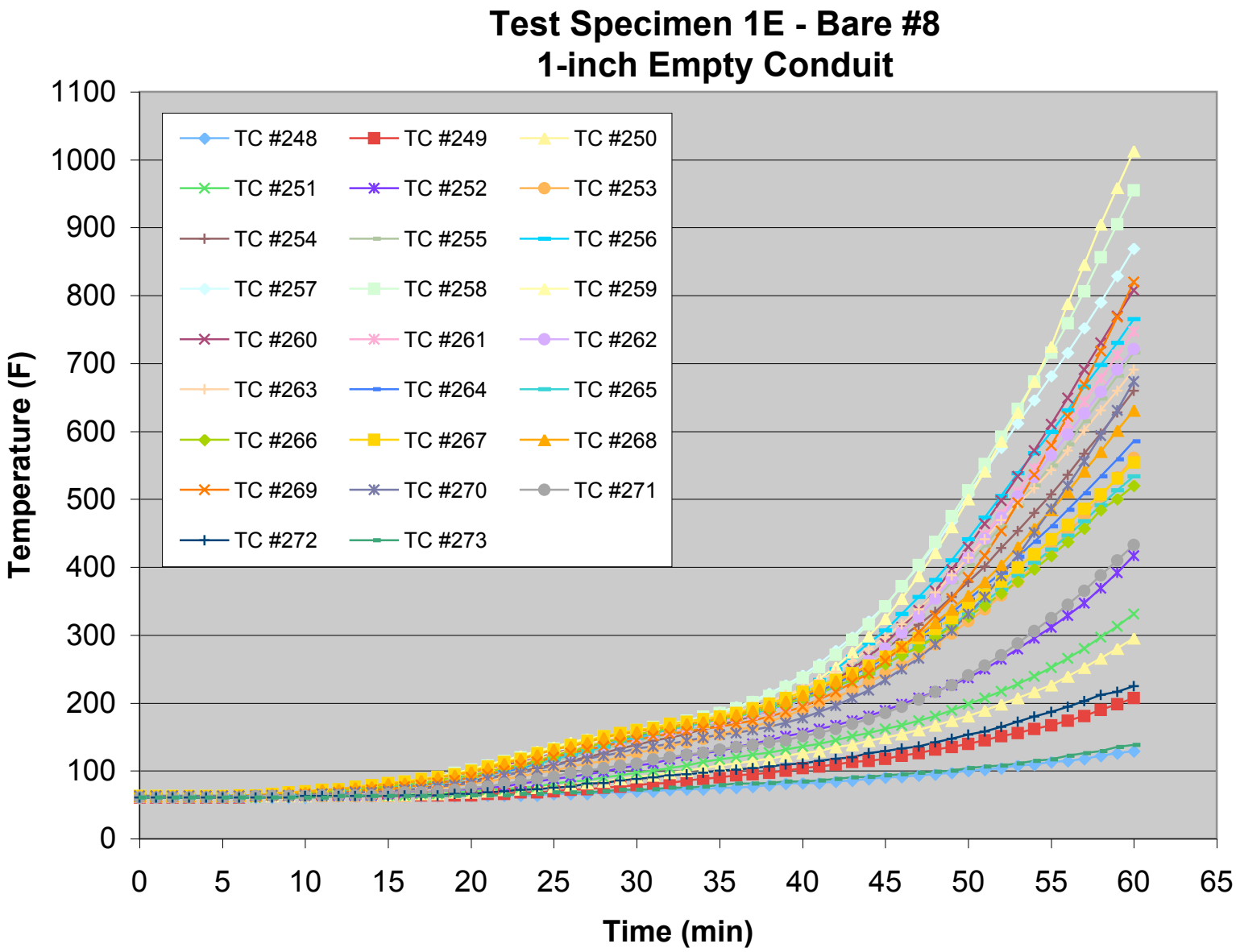

Test Speciment 1C
2 1/2-inch Empty Conduit
Temperature (F)
Time (min)
0
100
200
300
400
500
600
700
800
900
1000
0
5
10
15
20
25
30
35
40
45
50
55
60
65
TC #166
TC #167
TC #168
TC #169
TC #170
TC #171
TC #172
TC #173
TC #174
TC #175
TC #176
TC #177
TC #178
TC #179
TC #180
TC #181
TC #182
TC #183
TC #184
TC #185
TC #186
TC #187
TC #188
TC #189
TC #190
TC #191
TC #192
TC #193

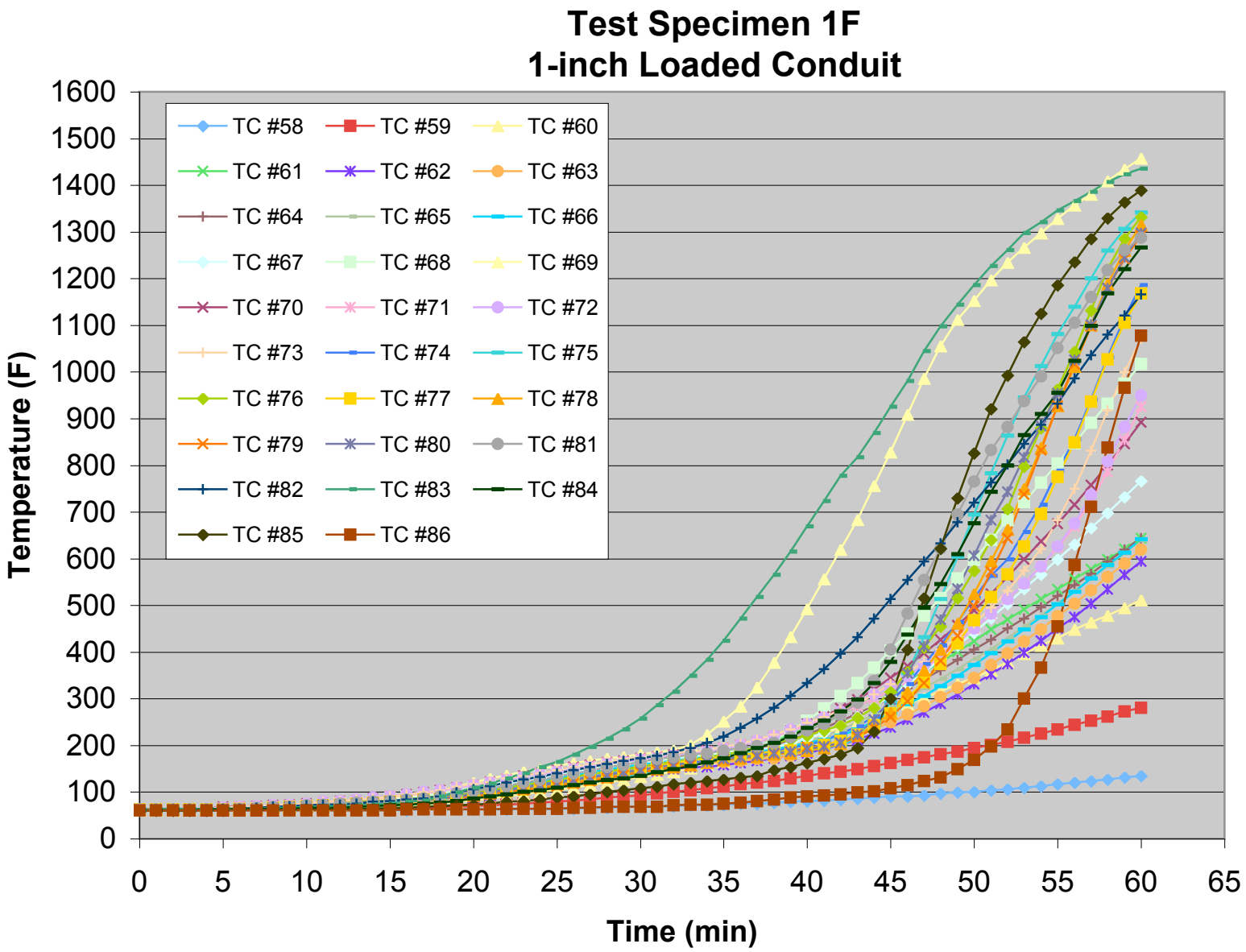

Test Speciment 1C - Bare #8
2 1/2-inch Empty Conduit
Temperature (F)
Time (min)
0
100
200
300
400
500
600
700
800
0
5
10
15
20
25
30
35
40
45
50
55
60
65
TC #194
TC #195
TC #196
TC #197
TC #198
TC #199
TC #200
TC #201
TC #202
TC #203
TC #204
TC #205
TC #206
TC #207
TC #208
TC #209
TC #210
TC #211
TC #212
TC #213
TC #214
TC #215
TC #216
TC #217
TC #218

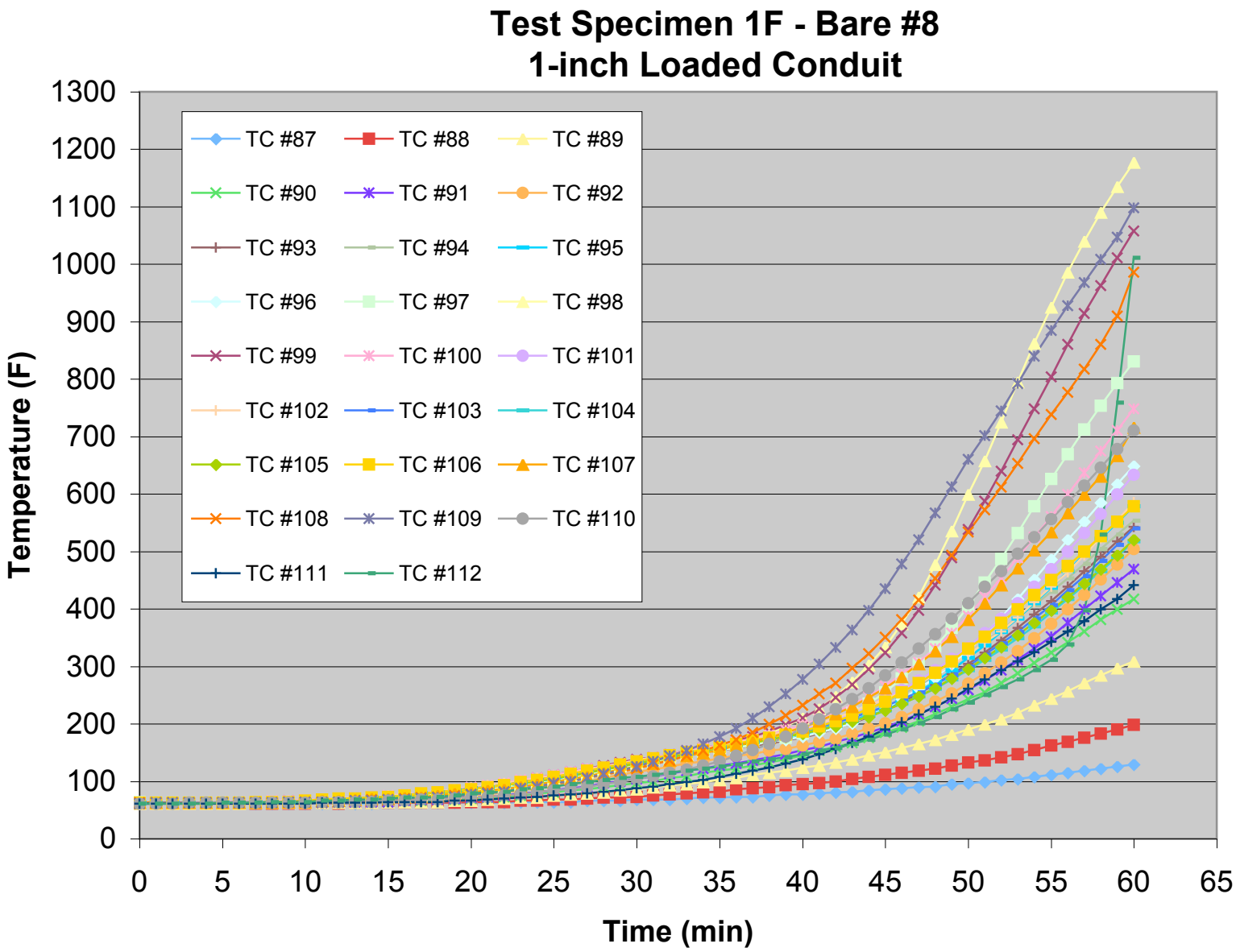

Test Specimen 1D
2 1/2-inch Loaded Conduit
Temperature (F)
Time (min)
TC #113
TC #114
TC #115
TC #116
TC #117
TC #118
TC #119
TC #120
TC #121
TC #122
TC #123
TC #124
TC #125
TC #126
TC #127
TC #128
TC #129
TC #130
TC #131
TC #132
TC #133
TC #134
TC #135
TC #136
TC #137
TC #138
TC #139
TC #140
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
0
5
10
15
20
25
30
35
40
45
50
55
60
65

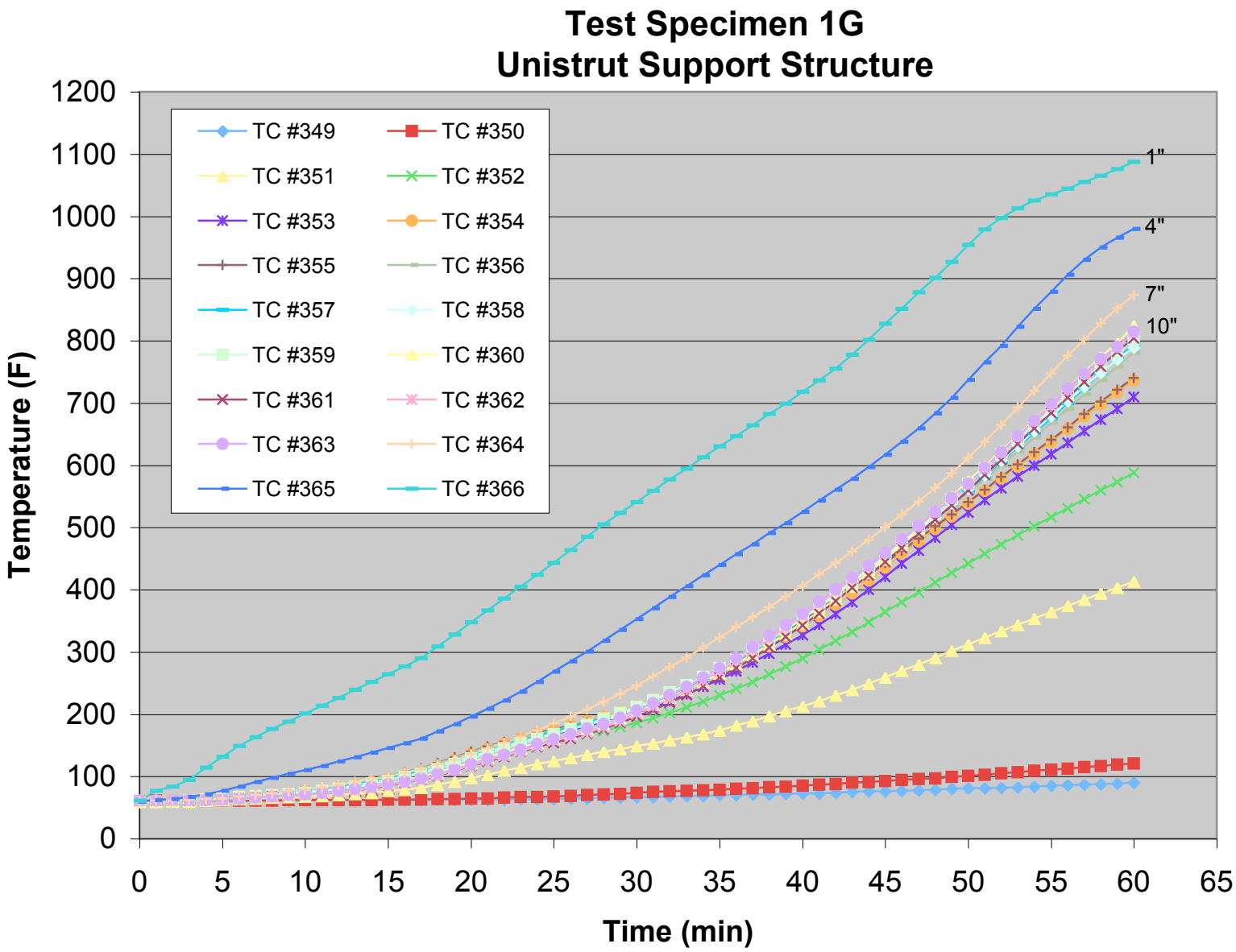

Test Speciment 1D - Bare #8
2 1/2-inch Loaded Conduit
Temperature (F)
Time (min)
0
50
100
150
200
250
300
350
400
450
500
0
5
10
15
20
25
30
35
40
45
50
55
60
65
TC #141
TC #142
TC #143
TC #144
TC #145
TC #146
TC #147
TC #148
TC #149
TC #150
TC #151
TC #152
TC #153
TC #154
TC #155
TC #156
TC #157
TC #158
TC #159
TC #160
TC #161
TC #162
TC #163
TC #164
TC #165

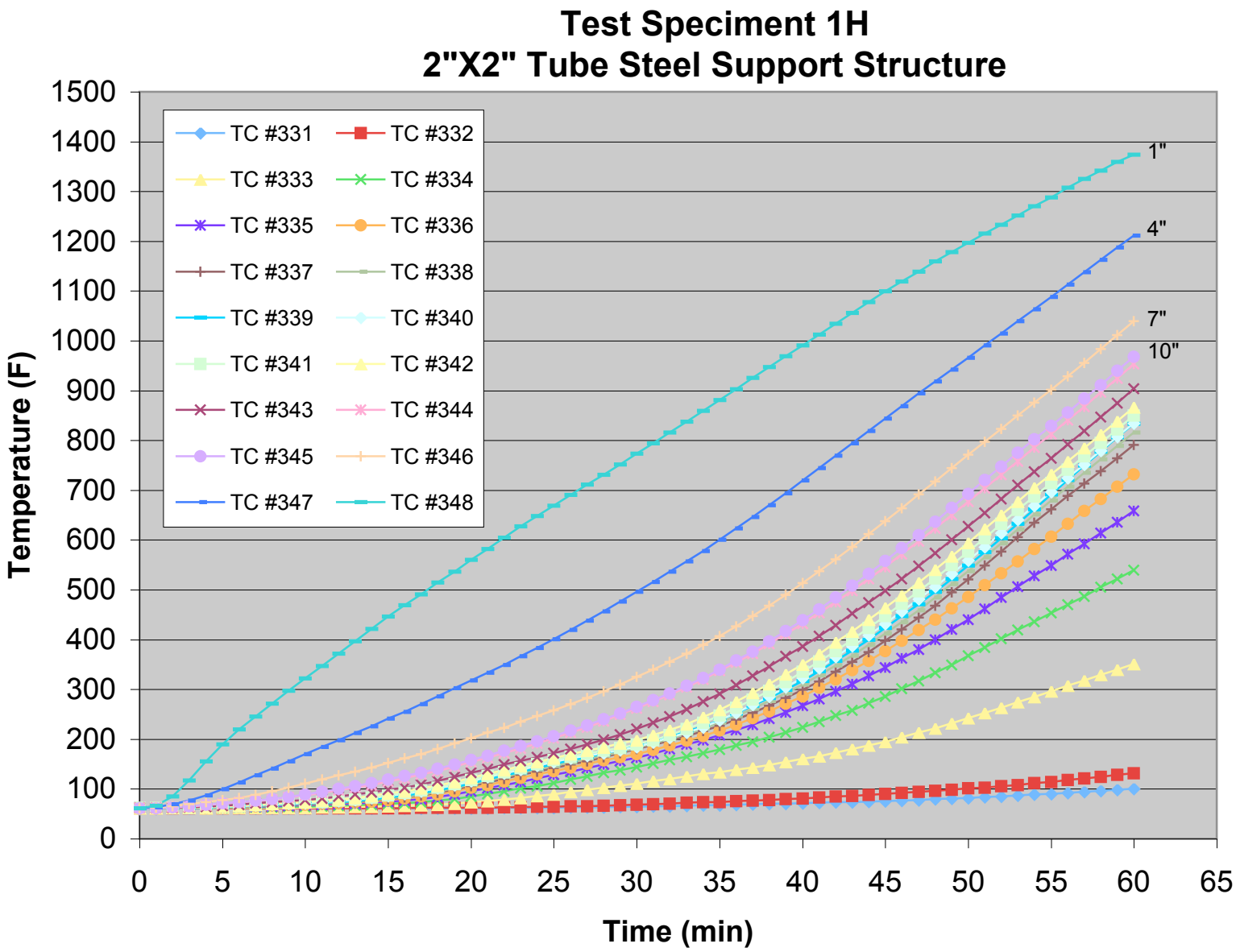

Test Specimen 1E
1-inch Empty Conduit
Temperature (F)
Time (min)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
0
5
10
15
20
25
30
35
40
45
50
55
60
65
TC #219
TC #220
TC #221
TC #222
TC #223
TC #224
TC #225
TC #226
TC #227
TC #228
TC #229
TC #230
TC #231
TC #232
TC #233
TC #234
TC #235
TC #236
TC #237
TC #238
TC #239
TC #240
TC #241
TC #242
TC #243
TC #244
TC #245
TC #246
TC #247

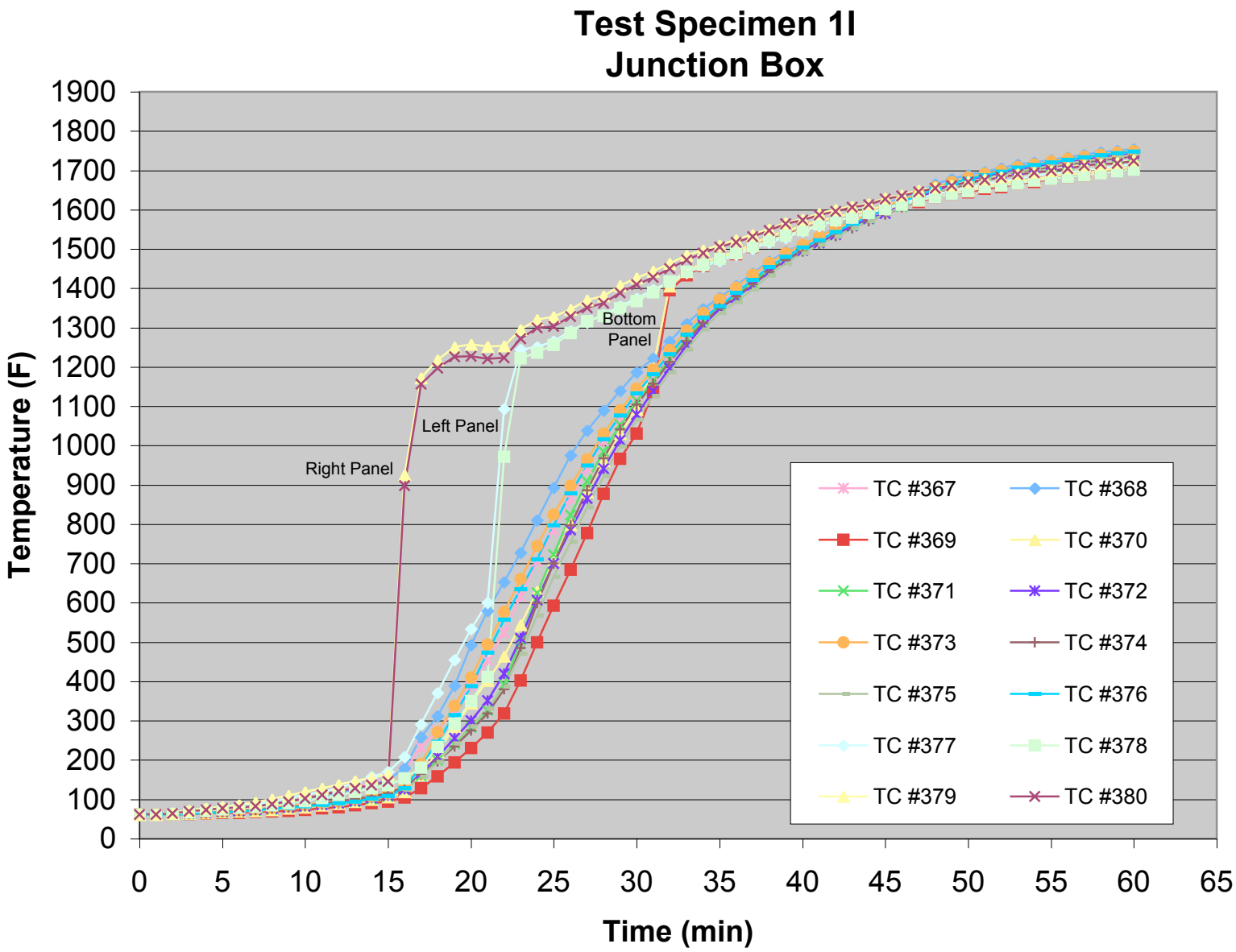

Test Specimen 1E - Bare #8
1-inch Empty Conduit
Temperature (F)
Time (min)
0
100
200
300
400
500
600
700
800
900
1000
1100
0
5
10
15
20
25
30
35
40
45
50
55
60
65
TC #248
TC #249
TC #250
TC #251
TC #252
TC #253
TC #254
TC #255
TC #256
TC #257
TC #258
TC #259
TC #260
TC #261
TC #262
TC #263
TC #264
TC #265
TC #266
TC #267
TC #268
TC #269
TC #270
TC #271
TC #272
TC #273


Test Specimen 1F
1-inch Loaded Conduit
Temperature (F)
Time (min)
TC #58
TC #59
TC #60
TC #61
TC #62
TC #63
TC #64
TC #65
TC #66
TC #67
TC #68
TC #69
TC #70
TC #71
TC #72
TC #73
TC #74
TC #75
TC #76
TC #77
TC #78
TC #79
TC #80
TC #81
TC #82
TC #83
TC #84
TC #85
TC #86
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
0
5
10
15
20
25
30
35
40
45
50
55
60
65


Test Specimen 1F - Bare #8
1-inch Loaded Conduit
Temperature (F)
Time (min)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
0
5
10
15
20
25
30
35
40
45
50
55
60
65
TC #87
TC #88
TC #89
TC #90
TC #91
TC #92
TC #93
TC #94
TC #95
TC #96
TC #97
TC #98
TC #99
TC #100
TC #101
TC #102
TC #103
TC #104
TC #105
TC #106
TC #107
TC #108
TC #109
TC #110
TC #111
TC #112


Test Specimen 1G
Unistrut Support Structure
Temperature (F)
Time (min)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
0
5
10
15
20
25
30
35
40
45
50
55
60
65
TC #349
TC #350
TC #351
TC #352
TC #353
TC #354
TC #355
TC #356
TC #357
TC #358
TC #359
TC #360
TC #361
TC #362
TC #363
TC #364
TC #365
TC #366
1"
4"
7"
10"


Test Speciment 1H
2"X2" Tube Steel Support Structure
Temperature (F)
Time (min)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
0
5
10
15
20
25
30
35
40
45
50
55
60
65
TC #331
TC #332
TC #333
TC #334
TC #335
TC #336
TC #337
TC #338
TC #339
TC #340
TC #341
TC #342
TC #343
TC #344
TC #345
TC #346
TC #347
TC #348
1"
4"
7"
10"


Test Specimen 1I
Junction Box
Temperature (F)
Time (min)
Bottom Panel
Left Panel
Right Panel
TC #367
TC #368
TC #369
TC #370
TC #371
TC #372
TC #373
TC #374
TC #375
TC #376
TC #377
TC #378
TC #379
TC #380

Time (min)	Item 1A Empty 4" Conduit Steel Min (°F)	Item 1A Empty 4" Conduit Steel Avg (°F)	Item 1A Empty 4" Conduit Steel Max (°F)	Item 1A Empty 4" Conduit Bare #8 Min (°F)	Item 1A Empty 4" Conduit Bare #8 Avg (°F)	Item 1A Empty 4" Conduit Bare #8 Max (°F)	Item 1B Loaded 4" Conduit Steel Min (°F)
0	61	63	64	61	63	65	63
1	61	63	64	61	63	65	63
2	61	64	64	61	63	65	63
3	61	64	70	61	64	65	63
4	61	65	77	61	64	65	63
5	61	67	82	61	64	65	63
6	61	68	88	61	64	66	63
7	61	70	93	62	65	67	63
8	61	71	97	62	65	68	63
9	61	73	102	62	66	69	63
10	61	75	108	62	67	71	63
11	61	77	115	62	68	73	63
12	61	79	122	62	69	75	63
13	61	81	129	62	70	77	63
14	61	84	136	62	71	79	63
15	61	87	145	63	73	82	63
16	63	91	153	63	75	85	63
17	63	94	160	63	77	89	63
18	63	98	167	64	79	92	63
19	63	102	174	64	82	96	63
20	63	107	180	65	85	101	63
21	63	112	189	65	88	105	63
22	64	117	201	66	91	110	64
23	64	123	217	67	95	116	64
24	64	129	234	68	99	121	64
25	66	135	253	70	103	127	64
26	66	141	273	71	108	133	64
27	68	146	291	72	112	139	64
28	68	152	309	74	117	145	66
29	70	159	327	76	122	152	66
30	70	165	345	77	127	159	66
31	72	171	361	79	132	166	68
32	72	177	378	81	137	173	68
33	73	183	394	82	142	180	68
34	75	189	408	84	147	188	68
35	77	195	421	86	153	196	70
36	77	202	435	87	158	205	70
37	79	208	448	89	163	216	72
38	81	215	460	91	169	228	72
39	82	223	487	94	175	241	73
40	84	230	522	94	181	254	73
41	86	238	549	97	188	269	75
42	88	247	579	97	194	286	75
43	88	255	612	101	201	303	77
44	90	264	648	105	209	322	77
45	91	273	684	107	217	342	79
46	93	282	721	105	225	365	81
47	95	292	756	110	234	390	81

Time (min)	Item 1A Empty 4" Conduit Steel Min (°F)	Item 1A Empty 4" Conduit Steel Avg (°F)	Item 1A Empty 4" Conduit Steel Max (°F)	Item 1A Empty 4" Conduit Bare #8 Min (°F)	Item 1A Empty 4" Conduit Bare #8 Avg (°F)	Item 1A Empty 4" Conduit Bare #8 Max (°F)	Item 1B Loaded 4" Conduit Steel Min (°F)
48	97	302	792	110	243	418	82
49	100	313	829	112	253	449	82
50	102	323	869	115	264	484	84
51	104	334	903	116	275	520	86
52	106	345	941	119	286	556	86
53	108	356	973	121	298	594	88
54	109	368	1008	126	311	632	90
55	111	379	1038	126	323	668	91
56	115	391	1067	130	336	704	91
57	117	402	1096	131	349	741	93
58	118	414	1123	140	362	782	95
59	122	426	1150	139	376	824	97
60	124	438	1171	143	389	865	97
Max Temp:	124	438	1171	143	389	865	97
Max Allowed:	386	313	389	386	313	390	388

Time (min)	Item 1B Loaded 4" Conduit Steel Avg (°F)	Item 1B Loaded 4" Conduit Steel Max (°F)	Item 1B Loaded 4" Conduit Bare #8 Min (°F)	Item 1B Loaded 4" Conduit Bare #8 Avg (°F)	Item 1B Loaded 4" Conduit Bare #8 Max (°F)	Item 1C Empty 2.5" Conduit Steel Min (°F)	Item 1C Empty 2.5" Conduit Steel Avg (°F)
0	64	66	63	64	66	61	63
1	64	66	63	64	66	61	63
2	64	68	63	64	66	61	63
3	65	70	63	64	66	61	64
4	66	72	63	64	66	61	64
5	67	73	63	64	66	61	65
6	67	75	63	64	66	61	67
7	68	77	63	64	66	61	68
8	69	79	63	64	66	61	70
9	69	79	63	64	66	61	71
10	70	81	63	65	66	61	73
11	71	84	63	64	66	61	74
12	72	86	63	65	66	61	76
13	73	90	63	65	66	61	79
14	74	93	63	65	66	61	81
15	76	99	63	65	66	61	85
16	77	102	63	65	68	61	88
17	79	108	63	65	68	61	91
18	82	113	63	65	68	61	95
19	84	118	64	66	68	61	99
20	87	122	64	66	68	63	104
21	90	126	63	66	68	63	109
22	94	131	64	67	70	63	115
23	97	136	64	67	70	63	119
24	100	142	64	67	70	63	125
25	104	147	64	68	72	64	131
26	108	153	64	69	72	64	136
27	112	158	64	69	73	64	142
28	116	165	64	70	73	66	147
29	120	172	64	70	75	66	153
30	125	180	64	71	77	68	158
31	130	187	64	72	79	68	164
32	134	194	64	73	79	68	169
33	139	201	66	74	81	70	174
34	143	208	66	75	82	72	180
35	148	219	66	76	84	72	185
36	153	230	66	77	86	73	191
37	159	248	66	79	88	75	198
38	165	275	66	80	91	75	205
39	170	298	66	82	93	77	213
40	176	324	66	83	95	79	221
41	182	349	68	85	99	79	230
42	189	376	68	86	100	81	239
43	196	401	68	88	104	82	249
44	203	432	68	90	106	84	259
45	210	460	68	91	109	86	271
46	217	493	68	94	113	88	282
47	225	527	68	96	117	90	294

Time (min)	Item 1B Loaded 4" Conduit Steel Avg (°F)	Item 1B Loaded 4" Conduit Steel Max (°F)	Item 1B Loaded 4" Conduit Bare #8 Min (°F)	Item 1B Loaded 4" Conduit Bare #8 Avg (°F)	Item 1B Loaded 4" Conduit Bare #8 Max (°F)	Item 1C Empty 2.5" Conduit Steel Min (°F)	Item 1C Empty 2.5" Conduit Steel Avg (°F)
48	233	559	68	98	120	90	307
49	242	595	68	100	124	91	320
50	250	630	68	103	127	93	334
51	259	662	68	106	133	95	347
52	268	694	68	108	138	97	361
53	277	725	68	111	144	100	376
54	286	754	68	114	151	102	390
55	294	781	68	118	158	104	405
56	303	808	68	121	165	106	420
57	313	833	70	125	172	108	435
58	322	856	68	129	181	111	451
59	330	882	70	133	190	113	466
60	339	903	70	137	199	115	482
Max Temp:	339	903	70	137	199	115	482
Max Allowed:	314	391	388	314	391	386	313

Time (min)	Item 1C Empty 2.5" Conduit Steel Max (°F)	Item 1C Empty 2.5" Conduit Bare #8 Min (°F)	Item 1C Empty 2.5" Conduit Bare #8 Avg (°F)	Item 1C Empty 2.5" Conduit Bare #8 Max (°F)	Item 1D Loaded 2.5" Conduit Steel Min (°F)	Item 1D Loaded 2.5" Conduit Steel Avg (°F)
0	64	61	63	64	61	63
1	64	61	63	64	61	64
2	66	61	63	64	63	64
3	70	61	63	64	63	64
4	73	61	63	64	63	66
5	79	61	63	64	63	67
6	79	61	63	64	63	68
7	84	61	64	66	63	69
8	86	61	64	68	63	70
9	88	61	65	68	63	72
10	91	61	66	70	63	72
11	95	61	67	72	63	74
12	99	61	69	73	63	76
13	102	61	70	75	63	78
14	106	61	71	79	63	80
15	111	61	73	81	63	82
16	115	61	75	84	63	85
17	120	61	77	88	63	88
18	131	61	79	91	63	91
19	140	61	82	95	63	95
20	149	63	85	100	63	99
21	156	63	89	106	63	103
22	163	63	92	111	64	108
23	169	63	96	117	64	113
24	176	64	100	124	64	118
25	181	64	105	129	64	123
26	187	64	109	135	64	128
27	194	66	114	142	66	132
28	203	66	119	147	66	137
29	214	68	124	153	66	142
30	226	68	128	158	68	147
31	237	70	134	163	68	152
32	250	72	138	169	68	157
33	262	72	143	174	70	162
34	277	73	148	180	70	167
35	293	75	153	187	72	172
36	311	77	158	196	72	178
37	327	79	163	205	73	183
38	342	81	170	216	73	190
39	358	81	176	226	75	196
40	376	82	182	239	75	203
41	396	84	190	252	77	210
42	419	86	197	266	79	218
43	441	88	206	282	79	226
44	464	90	215	298	81	236
45	489	91	225	316	82	246
46	516	93	235	334	84	256
47	541	95	246	354	84	267

Time (min)	Item 1C Empty 2.5" Conduit Steel Max (°F)	Item 1C Empty 2.5" Conduit Bare #8 Min (°F)	Item 1C Empty 2.5" Conduit Bare #8 Avg (°F)	Item 1C Empty 2.5" Conduit Bare #8 Max (°F)	Item 1D Loaded 2.5" Conduit Steel Min (°F)	Item 1D Loaded 2.5" Conduit Steel Avg (°F)
48	568	99	258	374	86	277
49	597	100	270	396	88	289
50	628	102	283	417	90	300
51	662	106	296	441	91	312
52	694	108	310	468	93	324
53	725	111	325	495	93	336
54	756	113	341	527	95	347
55	786	117	358	558	97	359
56	817	118	374	588	99	370
57	846	122	391	617	100	380
58	874	126	408	648	102	391
59	905	129	425	678	104	402
60	934	133	442	709	108	412
Max Temp:	934	133	442	709	108	412
Max Allowed:	389	386	313	389	386	313

Time (min)	Item 1D Loaded 2.5" Conduit Steel Max (°F)	Item 1D Loaded 2.5" Conduit Bare #8 Min (°F)	Item 1D Loaded 2.5" Conduit Bare #8 Avg (°F)	Item 1D Loaded 2.5" Conduit Bare #8 Max (°F)	Item 1E Empty 1" Conduit Steel Min (°F)	Item 1E Empty 1" Conduit Steel Avg (°F)	Item 1E Empty 1" Conduit Steel Max (°F)
0	64	61	67	64	61	62	63
1	64	61	67	64	61	62	63
2	64	61	67	64	61	62	63
3	72	61	67	72	61	62	63
4	79	61	67	79	61	63	64
5	82	61	67	82	61	64	66
6	84	61	67	84	61	64	70
7	88	61	68	88	61	65	72
8	90	61	68	90	61	67	75
9	93	61	68	93	61	68	77
10	97	61	69	97	61	70	79
11	102	61	69	102	61	72	82
12	108	63	70	108	61	73	86
13	115	63	70	115	61	76	91
14	120	63	71	120	61	78	95
15	127	63	71	127	63	81	100
16	136	63	72	136	63	84	106
17	144	63	73	144	63	88	111
18	151	63	73	151	63	92	118
19	158	63	74	158	63	97	126
20	165	63	76	165	63	102	133
21	172	63	77	172	63	108	140
22	183	63	78	183	64	113	147
23	192	63	80	192	64	119	153
24	203	63	81	203	64	125	158
25	212	63	83	212	64	130	163
26	223	63	85	223	64	135	169
27	234	64	87	234	66	140	172
28	244	64	90	244	66	145	178
29	255	64	92	255	66	150	183
30	266	64	95	266	68	154	190
31	279	64	98	279	68	159	199
32	289	64	101	289	68	163	208
33	300	66	103	300	70	168	219
34	309	66	106	309	70	173	232
35	320	66	110	320	72	178	243
36	331	66	113	331	72	185	255
37	354	68	116	354	73	192	273
38	387	68	119	387	75	202	291
39	421	68	123	421	75	212	313
40	459	70	127	459	77	224	333
41	496	70	130	496	79	236	356
42	540	70	134	540	79	249	381
43	586	72	139	586	81	263	406
44	637	72	144	637	82	279	433
45	691	73	149	691	82	295	462
46	741	73	154	741	84	312	491
47	788	75	160	788	86	331	522

Time (min)	Item 1D Loaded 2.5" Conduit Steel Max (°F)	Item 1D Loaded 2.5" Conduit Bare #8 Min (°F)	Item 1D Loaded 2.5" Conduit Bare #8 Avg (°F)	Item 1D Loaded 2.5" Conduit Bare #8 Max (°F)	Item 1E Empty 1" Conduit Steel Min (°F)	Item 1E Empty 1" Conduit Steel Avg (°F)	Item 1E Empty 1" Conduit Steel Max (°F)
48	831	75	166	831	88	349	552
49	876	77	174	876	88	369	597
50	921	77	181	921	90	389	644
51	961	79	189	961	91	411	693
52	997	79	198	997	93	433	741
53	1027	81	207	1027	95	456	792
54	1056	81	217	1056	97	479	842
55	1080	82	227	1080	99	505	900
56	1099	84	238	1099	100	533	955
57	1117	84	249	1117	104	564	1011
58	1134	86	260	1134	106	601	1062
59	1150	88	272	1150	108	643	1108
60	1166	90	284	1166	109	694	1152
Max Temp:	1166	90	284	1166	109	694	1152
Max Allowed:	389	386	317	389	386	312	388

Time (min)	Item 1E Empty 1" Conduit Bare #8 Min (°F)	Item 1E Empty 1" Conduit Bare #8 Avg (°F)	Item 1E Empty 1" Conduit Bare #8 Max (°F)	Item 1F Loaded 1" Conduit Steel Min (°F)	Item 1F Loaded 1" Conduit Steel Avg (°F)	Item 1F Loaded 1" Conduit Steel Max (°F)	Item 1F Loaded 1" Conduit Bare #8 Min (°F)
0	61	62	63	61	62	63	61
1	61	62	63	61	63	64	61
2	61	62	63	61	63	64	61
3	61	62	63	61	63	64	61
4	61	62	63	61	63	64	61
5	61	62	63	61	64	68	61
6	61	63	64	61	64	68	61
7	61	63	64	61	65	70	61
8	61	64	66	61	66	72	61
9	61	64	68	61	68	73	61
10	61	65	70	61	69	75	61
11	61	67	72	61	71	79	61
12	63	68	73	61	72	81	61
13	63	69	77	61	74	84	61
14	63	70	79	61	76	88	61
15	63	72	82	61	78	91	63
16	63	74	84	61	81	95	63
17	63	76	88	63	83	100	63
18	63	79	91	63	87	104	63
19	63	82	97	63	91	111	63
20	64	85	102	63	96	120	63
21	64	89	109	63	101	129	63
22	64	93	115	63	106	136	63
23	64	98	122	64	111	144	64
24	64	102	129	64	116	153	64
25	66	107	135	64	121	165	64
26	66	112	142	64	127	180	64
27	66	117	147	66	132	196	66
28	68	122	151	66	138	214	66
29	68	127	156	68	144	234	66
30	70	131	160	68	149	257	68
31	70	135	165	68	154	286	68
32	72	140	169	70	160	315	68
33	73	144	174	72	166	349	70
34	73	148	180	72	172	383	72
35	75	152	187	73	179	424	72
36	75	157	194	75	187	471	73
37	77	162	203	75	196	518	73
38	79	168	214	77	206	565	75
39	81	175	226	79	218	615	77
40	82	182	241	81	232	669	77
41	82	191	257	82	246	723	79
42	84	201	277	84	262	777	81
43	86	213	297	86	280	817	82
44	88	225	320	88	304	869	84
45	90	238	343	90	333	925	86
46	91	254	372	91	369	981	88
47	93	270	403	93	406	1045	90

Time (min)	Item 1E Empty 1" Conduit Bare #8 Min (°F)	Item 1E Empty 1" Conduit Bare #8 Avg (°F)	Item 1E Empty 1" Conduit Bare #8 Max (°F)	Item 1F Loaded 1" Conduit Steel Min (°F)	Item 1F Loaded 1" Conduit Steel Avg (°F)	Item 1F Loaded 1" Conduit Steel Max (°F)	Item 1F Loaded 1" Conduit Bare #8 Min (°F)
48	95	288	437	97	442	1098	91
49	97	307	475	99	483	1144	95
50	100	328	513	100	523	1186	97
51	102	349	552	104	565	1227	99
52	104	371	592	106	605	1261	102
53	108	394	633	109	650	1297	104
54	109	417	673	113	693	1321	108
55	113	442	725	117	740	1346	111
56	115	468	788	120	788	1366	115
57	118	494	846	124	838	1386	118
58	122	522	905	127	890	1409	122
59	126	549	959	131	936	1434	126
60	129	577	1013	135	977	1458	129
Max Temp:	129	577	1013	135	977	1458	129
Max Allowed:	386	312	388	386	312	388	386

Time (min)	Item 1F Loaded 1" Conduit Bare #8 Avg (°F)	Item 1F Loaded 1" Conduit Bare #8 Max (°F)	Item 1G Unistrut Support Structure Min (°F)	Item 1G Unistrut Support Structure Average (°F)	Item 1G Unistrut Support Structure Max (°F)	Item 1H 2"x2" Support Structure Min (°F)	Item 1H 2"x2" Support Structure Averag (°F)	Item 1H 2"x2" Support Structure Max (°F)
0	62	64	60	60	61	60	61	62
1	62	63	60	61	77	60	62	66
2	63	63	60	62	84	61	64	85
3	63	63	60	63	94	61	67	117
4	63	63	61	66	114	61	70	155
5	63	64	61	69	132	61	74	189
6	63	64	61	71	149	61	78	219
7	63	64	61	74	163	61	81	245
8	63	66	61	76	176	61	85	271
9	64	66	61	79	188	61	89	297
10	64	68	62	82	201	61	93	322
11	66	68	62	85	214	61	97	347
12	66	70	62	88	226	61	101	372
13	67	72	62	92	239	61	106	396
14	68	73	62	97	252	61	111	421
15	69	75	62	101	264	61	116	446
16	71	77	62	106	277	61	121	469
17	73	79	62	112	290	61	127	491
18	74	82	63	119	309	61	134	514
19	77	86	63	127	328	61	141	536
20	79	90	63	136	348	61	149	560
21	82	93	63	144	367	61	157	582
22	84	97	63	152	386	62	165	605
23	88	102	64	159	405	62	173	627
24	92	106	64	167	424	62	181	648
25	96	111	64	175	443	62	190	669
26	100	117	65	182	464	63	198	690
27	104	122	65	190	485	63	206	711
28	109	127	66	198	505	63	215	731
29	114	133	66	206	523	64	223	752
30	118	138	67	216	541	64	232	773
31	123	142	67	226	559	65	242	794
32	128	147	68	237	577	65	252	816
33	133	153	69	248	595	66	264	837
34	138	165	69	260	613	67	275	859
35	143	178	70	272	630	67	288	881
36	149	192	70	285	647	68	301	903
37	155	210	71	299	664	69	315	925
38	161	230	71	313	682	70	330	947
39	168	252	72	327	699	70	345	969
40	176	277	73	342	718	71	361	991
41	186	304	73	358	736	72	378	1012
42	196	333	74	374	755	73	396	1034
43	208	363	75	390	778	74	414	1056
44	221	397	76	408	802	75	432	1078
45	236	435	76	426	827	76	451	1099
46	253	478	77	444	851	77	471	1119
47	271	520	78	463	878	78	491	1139

Time (min)	Item 1F Loaded 1" Conduit Bare #8 Avg (°F)	Item 1F Loaded 1" Conduit Bare #8 Max (°F)	Item 1G Unistrut Support Structure Min (°F)	Item 1G Unistrut Support Structure Average (°F)	Item 1G Unistrut Support Structure Max (°F)	Item 1H 2"x2" Support Structure Min (°F)	Item 1H 2"x2" Support Structure Averag (°F)	Item 1H 2"x2" Support Structure Max (°F)
48	291	567	79	481	901	80	512	1159
49	313	613	80	501	927	81	533	1178
50	336	660	81	520	954	82	555	1197
51	360	702	81	540	979	84	577	1215
52	386	745	82	560	997	85	599	1233
53	412	795	83	579	1013	87	621	1252
54	440	862	84	599	1025	89	643	1270
55	468	925	85	618	1035	90	665	1288
56	497	986	86	637	1044	92	687	1307
57	526	1040	87	656	1055	94	709	1325
58	559	1090	88	675	1065	96	731	1342
59	595	1135	89	692	1076	98	753	1359
60	635	1177	90	709	1087	100	775	1374
Max Temp:	635	1177	90	709	1087	100	775	1374
Max Allowed:	312	389	385	310	386	385	311	387

Time (min)	Item 1l Junction Box Sides Min (°F)	Item 1l Junction Box Sides Average (°F)	Item 1l Junction Box Sides Max (°F)
0	62	62	62
1	62	62	62
2	62	63	66
3	63	66	72
4	64	69	77
5	65	72	81
6	66	75	86
7	68	78	93
8	69	82	101
9	71	87	110
10	74	92	119
11	77	97	128
12	80	104	138
13	85	111	147
14	90	119	157
15	95	128	171
16	105	253	926
17	128	329	1172
18	159	379	1218
19	194	432	1251
20	231	484	1257
21	270	535	1252
22	319	658	1253
23	403	757	1296
24	499	829	1321
25	593	896	1328
26	685	965	1346
27	777	1029	1370
28	877	1086	1381
29	966	1141	1407
30	1031	1190	1427
31	1127	1240	1444
32	1187	1309	1463
33	1244	1351	1484
34	1296	1385	1498
35	1338	1413	1511
36	1365	1435	1524
37	1398	1460	1537
38	1433	1486	1551
39	1464	1507	1567
40	1489	1525	1576
41	1510	1542	1591
42	1531	1559	1601
43	1552	1574	1609
44	1571	1588	1615
45	1588	1604	1630
46	1606	1619	1638
47	1620	1633	1649

Time (min)	Item 1l Junction Box Sides Min (°F)	Item 1l Junction Box Sides Average (°F)	Item 1l Junction Box Sides Max (°F)
48	1633	1647	1665
49	1640	1658	1678
50	1644	1667	1689
51	1654	1676	1697
52	1658	1684	1706
53	1667	1692	1715
54	1671	1698	1720
55	1678	1704	1727
56	1683	1710	1733
57	1687	1716	1740
58	1693	1721	1746
59	1698	1726	1750
60	1702	1730	1754
Max Temp:	1702	1730	1754
Max Allowed:	387	312	387

Time (min)	TC #1 (°F)	TC #2 (°F)	TC #3 (°F)	TC #4 (°F)	TC #5 (°F)	TC #6 (°F)	TC #7 (°F)	TC #8 (°F)	TC #9 (°F)	TC #10 (°F)	TC #11 (°F)	TC #12 (°F)
0	63	63	64	64	64	64	66	64	64	66	64	64
1	63	63	64	64	64	64	64	66	66	66	64	64
2	63	63	64	64	64	64	66	68	66	66	66	64
3	63	64	64	64	64	66	68	70	66	66	66	66
4	63	64	64	64	66	68	70	72	66	66	66	66
5	63	64	64	64	68	70	72	73	68	68	68	66
6	63	64	64	66	68	72	73	73	68	68	68	68
7	63	64	66	66	70	72	75	75	70	70	70	68
8	63	64	66	66	70	73	77	77	72	70	70	70
9	63	64	66	68	72	75	79	79	73	72	72	72
10	63	64	66	68	72	77	81	79	73	72	72	72
11	63	64	66	68	73	79	82	82	75	73	73	72
12	63	64	68	68	75	82	86	84	77	73	73	73
13	63	64	68	70	75	84	90	86	79	75	75	73
14	63	64	68	70	79	88	93	90	79	77	77	75
15	63	66	70	72	81	91	97	91	82	79	79	77
16	63	66	70	72	82	95	100	95	84	81	81	79
17	63	66	72	73	86	99	104	99	86	82	82	82
18	63	68	73	75	90	102	109	102	90	84	86	86
19	64	70	75	77	91	108	115	106	93	86	88	90
20	64	70	77	79	95	111	118	111	97	90	91	95
21	64	73	81	81	99	117	124	115	100	93	95	100
22	64	75	82	82	102	122	129	120	106	97	99	106
23	64	77	86	86	108	127	135	126	111	100	102	111
24	64	79	88	88	111	133	138	129	115	104	108	118
25	66	81	91	91	115	136	144	135	120	108	111	124
26	66	82	93	95	120	144	149	140	127	111	117	129
27	68	84	97	99	126	147	154	144	133	117	120	135
28	70	88	100	102	131	153	158	149	140	120	126	140
29	70	90	104	106	135	156	163	154	147	126	131	145
30	72	93	108	111	140	162	169	158	153	129	135	151
31	72	97	111	115	144	165	172	163	160	135	140	156
32	72	99	115	118	149	171	178	167	165	138	145	162
33	73	102	118	124	153	174	183	172	171	144	149	165
34	75	104	122	127	158	180	187	176	176	147	154	171
35	75	106	126	133	162	183	194	180	181	153	158	178
36	75	108	129	136	167	189	201	185	187	156	162	187
37	77	111	133	138	169	194	207	189	190	160	165	196
38	77	113	138	142	174	199	212	196	196	163	171	212
39	77	117	142	145	178	205	219	201	201	167	172	228
40	77	120	145	147	183	212	225	208	208	171	178	246
41	79	122	151	149	190	217	230	214	216	172	181	266
42	79	124	153	151	194	223	237	221	234	176	185	286
43	79	126	156	153	199	230	243	228	244	180	190	306
44	81	127	160	156	205	237	250	235	253	183	194	325
45	81	129	165	158	210	243	257	243	262	189	199	345
46	82	135	169	162	216	250	262	252	273	192	208	367
47	82	138	174	165	221	255	270	259	282	198	221	388
48	84	140	180	169	226	262	277	268	293	207	234	412
49	84	144	187	172	232	270	284	277	302	214	244	435
50	86	147	192	176	237	277	291	286	311	225	255	459
51	86	151	199	181	244	284	298	295	322	235	268	482

Time (min)	TC #1 (°F)	TC #2 (°F)	TC #3 (°F)	TC #4 (°F)	TC #5 (°F)	TC #6 (°F)	TC #7 (°F)	TC #8 (°F)	TC #9 (°F)	TC #10 (°F)	TC #11 (°F)	TC #12 (°F)
52	88	154	207	189	252	291	307	302	331	246	280	507
53	90	158	214	198	257	298	315	311	342	257	291	531
54	91	162	221	205	266	306	322	320	352	266	304	554
55	93	167	230	214	271	315	331	329	361	277	316	576
56	95	171	237	223	280	322	338	338	372	288	331	597
57	97	176	246	230	288	331	347	347	381	298	343	619
58	100	180	253	239	295	338	356	356	392	309	356	639
59	100	183	261	248	302	345	363	365	401	318	370	660
60	102	189	268	257	309	354	372	374	410	329	383	680
Max Temp:	102	189	268	257	309	354	372	374	410	329	383	680
Max Allowed:	388	388	389	389	389	389	391	389	389	391	389	389

Time (min)	TC #13 (°F)	TC #14 (°F)	TC #15 (°F)	TC #16 (°F)	TC #17 (°F)	TC #18 (°F)	TC #19 (°F)	TC #20 (°F)	TC #21 (°F)	TC #22 (°F)	TC #23 (°F)
0	64	64	64	64	64	64	64	64	64	64	64
1	64	64	64	64	64	64	64	64	64	64	64
2	64	64	64	64	64	64	64	66	64	64	64
3	64	66	64	64	64	64	66	68	64	64	64
4	66	66	66	66	64	66	68	70	64	64	64
5	66	66	66	66	66	66	72	73	66	66	66
6	66	68	68	66	66	66	73	75	66	66	66
7	66	68	68	68	66	66	73	77	66	66	66
8	68	70	68	68	66	66	75	79	68	68	68
9	68	70	70	68	68	66	75	79	68	68	68
10	68	72	70	70	68	68	77	81	68	68	68
11	70	72	72	70	68	68	81	84	70	68	70
12	70	72	72	70	68	68	82	86	70	70	70
13	72	73	73	72	70	70	86	90	70	70	72
14	72	75	75	72	70	70	88	93	72	72	72
15	73	77	77	73	72	72	91	99	72	72	73
16	75	79	79	75	72	72	95	102	73	73	75
17	77	81	81	77	73	73	99	108	75	75	77
18	81	84	84	81	75	75	104	113	77	77	79
19	86	86	88	84	77	77	111	118	79	79	81
20	91	90	91	88	81	79	117	122	82	81	82
21	97	93	97	91	82	82	122	126	84	82	84
22	102	99	100	97	86	84	129	131	86	84	88
23	109	102	106	100	90	88	133	136	90	86	91
24	115	108	109	104	93	91	138	142	91	90	95
25	120	111	115	109	97	95	142	147	95	91	100
26	127	117	120	115	100	99	147	153	99	95	106
27	133	122	126	118	104	102	153	158	102	97	111
28	140	127	131	124	109	108	158	165	108	100	115
29	145	133	136	129	113	113	163	172	111	104	120
30	153	136	142	135	118	118	171	180	117	108	126
31	158	144	147	140	124	126	180	187	122	111	129
32	167	147	153	145	129	133	187	194	127	113	135
33	176	153	158	151	135	140	198	201	133	117	140
34	190	158	163	156	140	147	208	208	138	120	144
35	207	162	167	162	145	154	219	216	145	124	149
36	225	167	172	167	151	160	230	225	151	127	154
37	248	171	178	171	156	169	243	234	158	131	160
38	275	174	183	176	162	176	255	241	165	135	163
39	298	180	189	180	167	183	268	250	171	138	169
40	324	183	194	183	171	190	280	259	178	144	172
41	349	189	201	190	176	198	293	268	183	147	176
42	376	196	208	196	178	207	306	277	196	151	181
43	401	207	217	203	181	216	318	286	207	154	185
44	432	217	226	212	185	225	331	295	217	160	190
45	460	226	235	219	190	234	343	304	226	163	194
46	493	239	244	228	199	243	356	313	237	167	201
47	527	250	255	237	210	252	367	322	248	172	207
48	559	262	264	246	219	262	378	331	257	178	214
49	595	275	275	255	230	271	387	338	268	183	221
50	630	289	284	266	239	282	397	345	279	187	232
51	662	302	295	275	248	291	408	354	289	192	241

Time (min)	TC #13 (°F)	TC #14 (°F)	TC #15 (°F)	TC #16 (°F)	TC #17 (°F)	TC #18 (°F)	TC #19 (°F)	TC #20 (°F)	TC #21 (°F)	TC #22 (°F)	TC #23 (°F)
52	694	318	306	286	257	302	419	361	300	198	252
53	725	333	316	297	266	313	428	369	311	203	261
54	754	349	327	306	277	322	439	376	322	210	270
55	781	363	340	316	286	333	448	383	333	216	279
56	808	379	351	327	295	343	459	392	345	221	288
57	833	396	363	338	306	354	468	399	356	226	297
58	856	412	374	349	316	365	477	405	369	234	306
59	882	428	387	360	325	376	486	412	381	239	313
60	903	444	399	370	336	387	495	419	392	246	322
Max Temp:	903	444	399	370	336	387	495	419	392	246	322
Max Allowed:	389	389	389	389	389	389	389	389	389	389	389

Time (min)	TC #24 (°F)	TC #25 (°F)	TC #26 (°F)	TC #27 (°F)	TC #28 (°F)	TC #29 (°F)	TC #30 (°F)	TC #31 (°F)	TC #32 (°F)	TC #33 (°F)	TC #34 (°F)
0	64	64	64	64	64	64	64	63	64	64	64
1	64	64	64	64	64	64	64	63	64	64	64
2	64	64	64	64	64	64	64	63	64	64	64
3	64	64	64	64	64	64	64	63	64	64	64
4	66	66	64	64	64	64	64	63	64	64	64
5	66	66	64	64	64	64	64	63	63	64	64
6	66	68	64	64	64	64	64	63	64	64	64
7	66	68	66	66	64	64	64	63	64	64	64
8	68	68	66	66	64	64	64	63	63	64	64
9	68	68	66	66	66	64	64	63	64	64	64
10	68	70	66	68	66	66	64	63	64	64	64
11	70	70	68	68	66	66	64	63	64	64	64
12	70	72	68	68	66	66	64	63	64	64	64
13	72	72	68	68	68	66	64	63	63	64	64
14	72	73	70	70	68	68	64	63	64	64	64
15	72	75	70	70	68	68	64	63	63	64	64
16	73	75	70	72	68	68	66	63	64	64	64
17	75	77	72	72	70	70	66	63	64	64	64
18	77	79	72	73	72	72	66	63	64	64	64
19	79	81	73	75	72	73	68	63	64	64	64
20	81	82	75	77	75	75	68	63	64	64	64
21	84	84	75	79	77	77	70	63	64	64	64
22	86	88	79	82	79	81	72	64	64	64	64
23	90	90	81	84	82	82	73	64	64	64	64
24	93	93	82	86	84	86	75	64	64	64	64
25	97	95	84	90	86	88	77	64	64	64	64
26	100	99	86	91	90	91	79	64	64	64	66
27	104	100	90	95	93	95	81	64	64	64	66
28	109	104	91	99	95	99	82	66	64	64	66
29	115	108	95	100	97	100	84	66	64	64	66
30	122	111	97	104	100	104	86	66	64	66	66
31	129	115	100	108	102	108	88	68	64	66	68
32	136	118	102	109	106	111	91	68	64	66	68
33	144	122	104	113	108	115	93	68	66	66	68
34	151	126	108	117	111	118	95	68	66	66	68
35	158	129	111	120	115	122	99	70	66	68	68
36	163	133	113	122	118	126	100	70	66	68	70
37	171	136	117	126	120	129	104	72	68	68	70
38	180	140	120	129	124	133	106	72	68	68	72
39	189	144	122	133	127	136	108	73	68	70	72
40	199	147	126	136	131	140	111	73	68	70	72
41	208	151	129	138	133	144	113	75	70	70	73
42	219	154	133	142	136	147	117	75	70	72	73
43	230	158	136	145	140	153	118	77	70	72	75
44	241	162	138	149	142	156	122	77	72	72	75
45	252	165	142	151	145	160	126	79	72	73	77
46	262	171	144	154	149	163	127	81	72	73	77
47	273	174	147	158	153	167	131	81	73	75	79
48	284	180	151	160	154	171	133	82	73	75	79
49	297	185	153	163	158	174	136	82	73	77	81
50	307	189	156	165	162	180	140	84	75	77	81
51	318	196	158	169	165	183	144	86	75	79	82

Time (min)	TC #24 (°F)	TC #25 (°F)	TC #26 (°F)	TC #27 (°F)	TC #28 (°F)	TC #29 (°F)	TC #30 (°F)	TC #31 (°F)	TC #32 (°F)	TC #33 (°F)	TC #34 (°F)
52	331	203	162	172	169	187	145	86	77	79	84
53	342	208	163	176	174	192	149	88	77	81	84
54	352	216	167	180	178	196	153	90	79	81	86
55	365	221	169	183	183	201	156	91	79	82	88
56	376	226	171	189	189	205	160	91	81	84	90
57	388	234	174	194	194	210	163	93	81	84	91
58	401	239	178	198	201	216	167	95	82	86	91
59	412	246	181	203	208	221	169	97	84	88	93
60	423	252	185	210	217	226	172	97	84	90	95
Max Temp:	423	252	185	210	217	226	172	97	84	90	95
Max Allowed:	389	389	389	389	389	389	389	388	389	389	389

Time (min)	TC #35 (°F)	TC #36 (°F)	TC #37 (°F)	TC #38 (°F)	TC #39 (°F)	TC #40 (°F)	TC #41 (°F)	TC #42 (°F)	TC #43 (°F)	TC #44 (°F)	TC #45 (°F)
0	64	64	66	66	66	66	64	64	64	64	64
1	64	64	64	66	66	66	64	64	64	64	64
2	64	64	64	66	66	66	64	64	64	64	64
3	64	64	64	64	66	66	64	64	64	64	64
4	64	64	64	64	66	66	64	64	64	64	64
5	64	64	64	64	66	66	64	64	64	64	64
6	64	64	64	66	66	66	64	64	64	64	64
7	64	64	64	66	66	66	64	64	64	64	64
8	64	64	64	64	66	66	64	64	64	64	64
9	64	64	64	66	66	66	64	64	64	64	64
10	64	64	64	66	66	66	64	66	66	66	66
11	64	64	64	66	66	66	64	64	66	64	64
12	64	64	64	66	66	66	64	66	66	66	66
13	64	64	64	66	66	66	66	66	66	66	66
14	64	64	66	66	66	66	66	66	66	66	66
15	64	64	66	66	66	66	66	66	66	66	66
16	64	66	66	66	66	68	66	66	66	66	66
17	64	66	66	66	68	68	66	66	66	66	66
18	64	66	66	66	68	68	66	66	66	66	66
19	66	66	66	68	68	68	66	66	66	66	66
20	66	66	66	68	68	68	68	68	68	68	68
21	66	66	68	68	68	68	68	68	68	68	68
22	66	66	68	68	68	70	68	68	68	68	68
23	66	68	68	68	70	70	68	68	70	68	68
24	66	68	68	68	70	70	70	68	70	70	70
25	66	68	70	70	70	72	70	70	70	70	70
26	68	68	70	70	72	72	70	70	72	72	72
27	68	68	70	70	72	72	72	72	72	72	72
28	68	70	72	72	72	73	72	73	73	73	73
29	68	70	72	72	73	73	73	73	73	73	73
30	70	72	72	72	73	75	75	75	75	75	75
31	70	72	73	73	75	77	75	77	77	77	75
32	70	72	73	73	75	77	77	77	79	77	77
33	72	73	75	75	77	79	79	79	81	79	79
34	72	73	75	75	79	81	79	81	81	81	81
35	73	75	77	77	79	82	81	82	82	82	82
36	73	75	79	79	81	82	82	84	86	84	84
37	75	77	79	79	82	84	84	86	86	86	86
38	75	77	81	81	84	86	86	88	90	88	88
39	77	79	82	82	86	88	88	90	91	90	90
40	77	81	84	84	86	90	90	93	93	93	91
41	79	82	84	86	88	91	93	95	97	95	93
42	81	82	86	86	90	93	95	97	99	97	97
43	81	84	88	88	91	95	97	100	102	100	99
44	82	86	90	90	93	99	100	102	104	102	102
45	84	86	91	91	95	100	102	106	108	106	104
46	84	88	93	93	99	102	106	109	111	109	108
47	86	90	95	95	100	106	108	113	115	113	111
48	88	91	97	97	102	108	111	117	118	117	115
49	90	93	99	99	104	111	115	120	124	120	118
50	90	95	100	102	108	115	118	126	127	124	124
51	93	97	102	104	109	118	122	131	133	129	129

Time (min)	TC #35 (°F)	TC #36 (°F)	TC #37 (°F)	TC #38 (°F)	TC #39 (°F)	TC #40 (°F)	TC #41 (°F)	TC #42 (°F)	TC #43 (°F)	TC #44 (°F)	TC #45 (°F)
52	93	99	104	106	113	120	127	135	138	135	133
53	95	100	108	108	117	126	133	142	144	140	138
54	97	102	109	111	118	129	136	147	151	145	145
55	99	104	111	115	122	133	144	154	158	153	151
56	100	108	115	117	126	138	149	162	165	160	158
57	104	109	117	120	131	144	156	169	172	167	165
58	106	111	120	124	135	147	162	178	181	174	172
59	108	115	122	126	138	154	169	187	190	183	181
60	111	117	126	129	144	160	178	196	199	190	190
Max Temp:	111	117	126	129	144	160	178	196	199	190	190
Max Allowed:	389	389	391	391	391	391	389	389	389	389	389

Time (min)	TC #46 (°F)	TC #47 (°F)	TC #48 (°F)	TC #49 (°F)	TC #50 (°F)	TC #51 (°F)	TC #52 (°F)	TC #53 (°F)	TC #54 (°F)	TC #55 (°F)	TC #56 (°F)
0	63	64	64	64	64	64	64	64	64	63	63
1	63	64	64	64	64	64	64	64	64	63	63
2	63	64	64	64	64	64	64	64	64	64	63
3	63	64	64	64	64	64	64	64	64	63	63
4	63	64	64	64	64	64	64	64	64	63	63
5	63	64	64	64	64	64	64	64	63	63	63
6	63	64	64	64	64	64	64	64	64	64	63
7	63	64	64	64	64	64	64	64	64	64	63
8	63	64	64	64	64	64	64	64	64	63	63
9	63	64	64	64	64	64	64	64	64	63	63
10	64	64	64	66	66	64	64	64	64	63	63
11	64	64	64	66	64	64	64	64	64	63	63
12	64	64	64	66	66	64	64	64	64	63	63
13	64	64	66	66	66	64	64	64	64	63	63
14	64	64	66	66	66	64	66	64	64	63	63
15	64	66	66	66	66	64	66	64	64	63	63
16	64	66	66	66	66	64	66	64	64	64	63
17	64	66	66	66	66	66	66	64	64	64	63
18	64	66	66	66	66	66	66	64	64	64	63
19	64	66	66	68	68	66	68	64	64	64	64
20	64	66	68	68	68	66	68	64	64	64	64
21	64	66	68	68	68	66	68	64	64	64	63
22	64	68	68	68	68	68	68	66	64	64	64
23	64	68	68	70	70	68	70	66	64	64	64
24	64	68	68	70	70	68	70	66	64	64	64
25	64	68	70	72	72	70	72	66	66	64	64
26	64	70	70	72	72	70	72	68	66	64	64
27	64	70	72	73	72	70	73	68	66	64	64
28	66	70	72	73	73	72	73	68	66	66	64
29	66	72	73	75	73	72	75	68	66	66	64
30	66	72	73	75	75	73	77	70	68	66	64
31	66	73	75	77	77	75	79	70	68	66	66
32	66	73	77	79	79	75	79	72	68	66	66
33	66	75	79	81	79	77	81	72	70	68	66
34	66	77	79	82	81	79	82	73	70	68	66
35	66	79	81	84	82	81	84	73	72	68	68
36	66	79	82	86	84	82	86	75	72	70	68
37	66	81	84	88	86	84	88	77	73	70	68
38	66	82	86	90	88	86	91	77	73	72	68
39	66	84	90	93	91	88	93	79	75	72	70
40	66	86	91	95	93	90	95	81	75	73	70
41	68	90	93	99	95	91	99	82	77	73	72
42	68	91	97	100	99	93	100	82	79	75	72
43	68	93	99	104	100	95	102	84	79	75	72
44	68	95	100	106	104	99	106	86	81	77	73
45	68	99	104	109	106	100	109	88	82	77	73
46	68	100	108	113	109	102	111	90	84	79	75
47	68	104	111	117	113	106	115	91	84	81	75
48	68	108	113	120	115	108	118	93	86	81	77
49	68	109	117	124	118	111	122	95	88	82	79
50	68	113	120	127	122	115	126	97	90	84	79
51	68	117	126	133	126	117	129	100	91	84	81

Time (min)	TC #46 (°F)	TC #47 (°F)	TC #48 (°F)	TC #49 (°F)	TC #50 (°F)	TC #51 (°F)	TC #52 (°F)	TC #53 (°F)	TC #54 (°F)	TC #55 (°F)	TC #56 (°F)
52	68	120	129	136	129	120	133	102	93	86	81
53	68	126	133	140	133	124	136	104	95	88	82
54	68	129	138	145	138	127	140	108	97	90	84
55	70	133	142	151	142	131	144	109	99	91	84
56	70	138	147	156	147	135	149	111	100	93	86
57	70	144	153	162	151	138	154	115	102	95	88
58	70	149	158	167	156	142	158	117	104	97	88
59	70	154	163	172	160	145	163	120	108	99	90
60	70	162	171	178	165	151	169	122	109	100	91
Max Temp:	70	162	171	178	165	151	169	122	109	100	91
Max Allowed:	388	389	389	389	389	389	389	389	389	388	388

Time (min)	TC #57 (°F)	TC #58 (°F)	TC #59 (°F)	TC #60 (°F)	TC #61 (°F)	TC #62 (°F)	TC #63 (°F)	TC #64 (°F)	TC #65 (°F)	TC #66 (°F)	TC #67 (°F)
0	63	61	61	61	61	61	63	63	63	63	63
1	63	61	61	61	63	63	63	63	63	63	63
2	63	61	61	61	63	63	63	63	63	63	63
3	63	61	61	63	63	63	63	63	63	63	63
4	63	61	61	63	63	63	63	63	63	63	64
5	63	61	61	63	63	63	63	63	64	64	64
6	64	61	61	63	63	64	64	64	64	64	66
7	64	61	61	63	64	64	64	64	66	66	68
8	64	61	61	64	64	64	66	66	66	68	70
9	64	61	63	64	64	66	66	68	68	70	72
10	64	61	63	64	64	66	68	68	70	70	73
11	64	61	63	64	66	68	68	70	72	72	75
12	64	61	63	66	66	68	70	72	73	73	77
13	64	61	63	66	68	70	72	73	75	75	79
14	64	61	63	68	70	72	72	75	77	77	81
15	64	61	64	70	72	73	73	77	79	81	84
16	64	61	64	72	72	75	75	81	82	84	88
17	64	63	64	73	75	77	79	84	86	86	91
18	64	63	66	75	77	81	81	88	90	90	95
19	64	63	68	79	82	84	86	93	93	95	100
20	64	63	70	82	88	88	90	99	99	100	106
21	64	63	72	86	93	93	95	104	104	106	111
22	64	63	73	90	99	100	100	109	109	111	118
23	64	64	75	95	104	106	106	115	115	118	124
24	64	64	77	100	109	111	111	120	120	124	129
25	64	64	79	104	115	118	117	127	126	129	136
26	66	64	82	109	120	124	124	133	133	136	142
27	66	66	84	115	126	129	129	138	140	142	147
28	66	66	88	120	131	133	136	145	147	149	153
29	66	68	90	126	136	136	142	151	153	154	158
30	66	68	93	133	142	142	147	156	158	160	163
31	66	68	97	138	147	145	151	162	163	165	167
32	66	70	100	144	154	149	156	165	169	171	172
33	66	72	104	151	162	153	160	169	172	174	176
34	66	72	108	158	169	154	162	172	176	178	180
35	66	73	111	165	178	158	165	178	178	181	183
36	66	75	117	174	189	162	167	183	181	185	187
37	66	75	120	183	199	167	171	190	185	189	190
38	66	77	124	192	210	172	172	201	190	192	196
39	66	79	129	203	223	178	178	212	198	198	203
40	66	81	135	214	237	183	187	223	208	205	214
41	68	82	140	226	252	192	198	237	219	212	228
42	68	84	144	237	266	201	208	252	234	221	244
43	68	86	149	250	284	212	221	268	250	234	262
44	68	88	156	262	300	225	235	284	266	252	282
45	68	90	162	275	318	239	250	302	284	268	306
46	68	91	169	288	338	255	266	322	302	288	331
47	68	93	174	302	358	271	284	342	322	306	356
48	68	97	181	316	378	289	304	361	342	327	385
49	68	99	187	331	401	309	324	383	363	349	414
50	68	100	194	345	423	331	345	405	385	372	442
51	68	104	201	361	448	352	372	426	406	397	473

Time (min)	TC #57 (°F)	TC #58 (°F)	TC #59 (°F)	TC #60 (°F)	TC #61 (°F)	TC #62 (°F)	TC #63 (°F)	TC #64 (°F)	TC #65 (°F)	TC #66 (°F)	TC #67 (°F)
52	68	106	208	379	469	374	397	450	430	423	504
53	68	109	216	396	491	399	423	471	455	448	536
54	68	113	225	414	513	424	448	496	478	475	567
55	68	117	234	430	534	450	477	520	504	502	599
56	68	120	244	448	556	475	504	543	531	529	631
57	70	124	253	464	577	504	532	568	558	558	666
58	68	127	262	478	599	534	561	594	583	586	698
59	70	131	273	495	621	565	590	619	612	613	732
60	70	135	280	511	644	594	619	644	639	642	766
Max Temp:	70	135	280	511	644	594	619	644	639	642	766
Max Allowed:	388	386	386	386	386	386	388	388	388	388	388

Time (min)	TC #68 (°F)	TC #69 (°F)	TC #70 (°F)	TC #71 (°F)	TC #72 (°F)	TC #73 (°F)	TC #74 (°F)	TC #75 (°F)	TC #76 (°F)	TC #77 (°F)	TC #78 (°F)
0	63	63	63	63	63	63	63	63	63	63	63
1	63	63	64	63	63	63	63	63	63	63	63
2	63	63	64	63	63	63	63	63	63	63	63
3	63	63	64	63	63	63	63	63	63	63	63
4	63	63	64	64	64	64	63	63	63	63	63
5	64	64	68	66	66	66	64	63	64	63	64
6	64	64	68	68	68	68	64	64	64	64	64
7	66	66	70	68	70	70	66	64	66	64	66
8	68	68	72	70	72	72	68	64	68	66	68
9	70	70	73	72	73	73	68	66	70	68	68
10	72	72	75	73	75	75	70	68	72	70	70
11	75	73	77	77	79	79	72	70	73	72	72
12	77	77	81	79	81	81	75	72	75	73	73
13	79	79	82	82	84	84	77	73	79	75	75
14	82	82	86	84	88	86	79	75	81	77	79
15	86	88	90	90	91	90	82	77	82	79	81
16	90	91	95	93	95	95	84	79	84	81	82
17	93	97	99	97	100	99	88	82	88	84	84
18	99	104	104	102	104	104	90	84	91	86	88
19	104	111	109	108	109	111	93	88	95	90	91
20	111	120	115	115	115	117	99	90	100	93	95
21	117	129	122	120	120	122	102	95	104	99	99
22	124	136	127	127	126	129	108	99	109	102	104
23	129	144	135	133	133	135	111	102	115	106	108
24	135	149	140	140	138	140	117	108	120	111	113
25	142	156	147	145	144	147	122	111	126	117	118
26	147	162	153	151	149	154	127	117	133	122	122
27	153	167	158	156	154	160	133	122	138	127	127
28	158	172	163	162	160	165	138	127	144	135	133
29	162	176	167	165	165	171	144	133	149	142	138
30	165	181	172	171	169	174	149	140	154	149	144
31	171	185	176	174	172	178	154	145	160	154	149
32	174	190	180	178	178	183	160	153	165	162	153
33	178	201	185	183	181	187	165	158	169	167	158
34	181	223	189	187	187	190	169	163	174	172	163
35	187	252	194	194	192	196	174	169	180	176	169
36	192	284	201	201	201	203	178	172	187	180	172
37	199	325	208	208	210	212	183	176	196	183	176
38	210	378	219	219	221	223	187	181	205	185	181
39	232	433	232	230	234	234	194	183	212	189	183
40	253	493	246	243	246	248	201	189	221	194	189
41	279	556	262	255	259	261	210	194	232	201	194
42	306	619	279	268	273	275	225	201	243	210	203
43	334	684	298	284	291	289	241	214	259	223	221
44	367	756	320	300	309	309	262	243	280	243	241
45	403	828	345	318	327	331	291	291	315	268	271
46	439	909	370	340	349	356	331	354	358	302	315
47	478	986	397	363	372	379	374	432	410	336	361
48	516	1056	426	390	396	405	414	514	455	374	405
49	558	1112	457	419	423	432	464	604	516	419	462
50	597	1153	489	450	451	462	516	694	574	468	525
51	640	1197	525	480	482	495	563	783	640	518	595

Time (min)	TC #68 (°F)	TC #69 (°F)	TC #70 (°F)	TC #71 (°F)	TC #72 (°F)	TC #73 (°F)	TC #74 (°F)	TC #75 (°F)	TC #76 (°F)	TC #77 (°F)	TC #78 (°F)
52	682	1234	561	513	513	531	599	864	707	567	662
53	721	1267	599	547	547	574	657	945	797	626	750
54	763	1297	637	583	583	621	716	1013	880	696	838
55	804	1328	675	624	626	682	788	1081	963	775	927
56	847	1357	716	669	676	750	856	1139	1044	849	1011
57	891	1380	757	723	736	831	941	1200	1132	936	1101
58	932	1409	801	786	808	918	1031	1260	1220	1027	1188
59	975	1434	846	855	882	999	1116	1306	1285	1105	1260
60	1017	1458	892	925	950	1071	1186	1342	1332	1168	1315
Max Temp:	1017	1458	892	925	950	1071	1186	1342	1332	1168	1315
Max Allowed:	388	388	388	388	388	388	388	388	388	388	388

Time (min)	TC #79 (°F)	TC #80 (°F)	TC #81 (°F)	TC #82 (°F)	TC #83 (°F)	TC #84 (°F)	TC #85 (°F)	TC #86 (°F)	TC #87 (°F)	TC #88 (°F)	TC #89 (°F)
0	63	63	63	61	61	61	61	61	61	61	61
1	63	63	63	63	63	61	61	61	61	61	61
2	63	63	63	63	64	61	61	61	61	61	61
3	63	63	63	63	63	61	61	61	61	61	61
4	63	63	63	63	63	63	61	61	61	61	61
5	63	64	63	64	64	63	61	61	61	61	61
6	64	64	64	64	64	64	63	61	61	61	61
7	64	64	66	66	64	64	63	61	61	61	63
8	66	66	68	68	66	64	63	61	61	61	63
9	68	68	68	70	66	64	63	61	61	61	63
10	68	70	72	72	68	66	63	61	61	61	63
11	72	72	73	73	70	66	63	61	61	63	63
12	73	73	75	73	70	66	64	61	61	61	63
13	75	75	77	75	72	68	64	61	61	63	63
14	77	77	79	79	73	70	64	61	61	63	63
15	79	79	81	81	75	72	66	61	63	63	64
16	81	82	84	84	79	73	66	63	63	63	64
17	82	84	86	86	82	75	68	63	63	63	64
18	86	86	91	91	90	77	70	63	63	63	64
19	88	91	97	99	99	81	72	63	63	63	66
20	91	95	102	106	109	86	73	63	63	64	66
21	95	100	108	113	118	90	75	63	63	64	68
22	100	104	113	120	129	95	79	64	63	64	70
23	104	109	120	127	140	100	81	64	64	66	72
24	108	115	126	133	153	104	84	64	64	66	72
25	113	118	133	140	165	109	88	64	64	68	75
26	118	126	140	147	180	115	91	66	64	68	77
27	124	131	145	154	196	120	95	66	66	70	79
28	129	136	153	160	214	126	100	68	66	72	81
29	136	142	158	167	234	129	104	68	66	72	84
30	142	147	165	172	257	135	108	68	68	73	86
31	147	153	171	178	286	142	111	68	68	75	90
32	154	158	174	185	315	149	117	72	68	77	93
33	158	162	180	194	349	156	120	73	70	79	95
34	165	165	183	205	383	163	124	73	72	81	99
35	169	171	189	219	424	172	127	75	72	82	102
36	172	174	194	237	471	183	131	77	73	86	106
37	176	178	199	257	518	194	135	81	73	88	111
38	181	183	205	280	565	205	147	84	75	90	115
39	185	187	217	306	615	219	153	88	77	93	118
40	196	192	232	334	669	237	162	91	77	95	124
41	196	198	246	363	723	253	171	93	79	97	127
42	205	205	266	396	777	273	180	95	81	100	133
43	217	223	291	432	817	298	194	99	82	104	138
44	237	255	338	471	869	333	230	102	84	108	145
45	261	298	405	513	925	379	300	108	86	111	151
46	295	354	482	554	981	437	405	115	88	115	158
47	334	412	554	594	1045	495	516	124	90	118	165
48	381	469	622	633	1098	545	622	131	91	122	172
49	435	536	694	678	1144	610	730	149	95	127	181
50	498	606	765	720	1186	676	826	169	97	133	190
51	572	682	833	763	1227	743	921	198	99	136	199

Time (min)	TC #79 (°F)	TC #80 (°F)	TC #81 (°F)	TC #82 (°F)	TC #83 (°F)	TC #84 (°F)	TC #85 (°F)	TC #86 (°F)	TC #87 (°F)	TC #88 (°F)	TC #89 (°F)
52	644	743	882	802	1261	799	993	234	102	142	208
53	738	817	937	846	1297	865	1065	300	104	147	219
54	833	885	991	887	1321	910	1125	367	108	154	232
55	928	954	1051	932	1346	955	1186	455	111	162	244
56	1017	1026	1105	986	1366	1024	1236	586	115	169	257
57	1098	1101	1161	1036	1386	1099	1285	711	118	176	271
58	1179	1179	1218	1080	1407	1168	1330	838	122	183	284
59	1242	1245	1261	1121	1423	1220	1364	966	126	190	297
60	1292	1297	1288	1166	1436	1267	1389	1078	129	198	309
Max Temp:	1292	1297	1288	1166	1436	1267	1389	1078	129	198	309
Max Allowed:	388	388	388	386	386	386	386	386	386	386	386

Time (min)	TC #90 (°F)	TC #91 (°F)	TC #92 (°F)	TC #93 (°F)	TC #94 (°F)	TC #95 (°F)	TC #96 (°F)	TC #97 (°F)	TC #98 (°F)	TC #99 (°F)	TC #100 (°F)
0	63	61	63	63	63	63	63	64	63	63	63
1	63	61	63	63	63	63	63	63	63	63	63
2	63	63	63	63	63	63	63	63	63	63	63
3	63	63	63	63	63	63	63	63	63	63	63
4	63	61	63	63	63	63	63	63	63	63	63
5	63	63	63	63	63	63	63	63	63	64	64
6	63	63	63	63	63	63	63	63	63	64	64
7	63	63	63	63	64	64	63	63	64	64	64
8	63	63	63	64	64	64	64	64	64	64	66
9	63	63	63	64	64	64	64	64	64	66	66
10	63	63	64	64	66	66	64	64	64	66	68
11	63	63	64	66	66	66	66	66	66	68	68
12	64	64	64	66	68	68	66	66	68	68	70
13	64	64	66	68	68	68	68	68	68	70	72
14	64	64	66	68	70	70	70	70	70	72	73
15	64	64	68	70	72	72	70	70	72	73	75
16	66	66	68	72	73	73	72	72	73	75	77
17	66	68	70	73	75	75	73	73	75	79	79
18	68	68	72	75	77	77	75	75	79	81	82
19	68	70	73	79	81	81	79	79	81	84	86
20	70	72	75	81	84	84	81	81	84	88	90
21	72	73	77	84	88	86	84	84	88	91	93
22	73	75	81	88	91	91	88	88	91	95	97
23	75	79	84	93	95	95	91	91	97	100	102
24	79	81	88	97	100	100	97	97	100	106	106
25	81	84	93	102	106	104	100	100	106	111	111
26	84	88	97	108	111	109	106	106	111	117	117
27	86	91	100	113	117	115	111	111	117	122	122
28	90	97	106	118	122	122	117	117	122	127	126
29	93	100	111	124	127	127	122	122	127	133	131
30	97	104	117	129	133	133	127	127	133	138	136
31	100	109	120	135	140	138	133	133	138	142	142
32	106	113	126	140	144	144	138	138	144	147	147
33	109	118	131	144	149	151	144	144	147	153	153
34	115	122	135	149	154	154	149	149	154	158	158
35	118	127	140	153	158	160	154	154	160	163	163
36	122	131	144	158	163	163	160	158	167	171	169
37	127	136	147	162	167	169	163	163	174	178	174
38	133	142	153	165	172	172	169	171	183	187	181
39	138	147	156	171	178	176	172	176	196	198	189
40	145	154	162	176	183	181	178	183	210	210	198
41	153	160	169	183	192	189	185	194	226	226	208
42	160	169	174	192	201	196	192	205	248	246	219
43	167	176	183	201	212	205	201	219	273	268	234
44	176	185	192	212	223	216	214	235	302	295	248
45	185	194	201	225	237	226	226	255	334	324	266
46	194	205	212	237	252	241	243	279	374	358	286
47	205	217	225	253	266	257	261	304	421	397	307
48	217	230	239	268	284	273	280	334	477	441	331
49	230	244	253	286	302	293	304	367	536	489	358
50	243	259	270	304	322	315	327	405	599	538	388
51	255	275	288	324	342	336	356	446	658	588	421

Time (min)	TC #90 (°F)	TC #91 (°F)	TC #92 (°F)	TC #93 (°F)	TC #94 (°F)	TC #95 (°F)	TC #96 (°F)	TC #97 (°F)	TC #98 (°F)	TC #99 (°F)	TC #100 (°F)
52	271	293	307	345	363	360	385	487	725	640	453
53	288	311	327	367	385	383	417	532	795	694	489
54	306	331	349	390	406	410	451	579	862	748	525
55	324	352	374	414	430	437	486	626	925	804	561
56	342	376	399	439	453	466	520	669	986	860	599
57	361	399	424	466	478	495	552	712	1040	914	637
58	381	423	451	491	504	522	585	754	1090	963	675
59	399	446	477	518	529	550	617	793	1135	1011	711
60	417	469	504	543	554	579	649	831	1177	1058	748
Max Temp:	417	469	504	543	554	579	649	831	1177	1058	748
Max Allowed:	388	386	388	388	388	388	388	389	388	388	388

Time (min)	TC #101 (°F)	TC #102 (°F)	TC #103 (°F)	TC #104 (°F)	TC #105 (°F)	TC #106 (°F)	TC #107 (°F)	TC #108 (°F)	TC #109 (°F)	TC #110 (°F)
0	63	63	63	63	63	63	63	63	61	61
1	63	63	63	63	63	63	63	63	63	61
2	63	63	63	63	63	63	63	63	63	61
3	63	63	63	63	63	63	63	63	63	63
4	63	63	63	63	63	63	63	63	63	63
5	63	63	63	63	63	63	63	63	63	63
6	63	63	63	63	63	63	63	63	63	63
7	64	64	64	64	63	64	63	63	63	63
8	64	64	64	64	64	64	63	63	63	63
9	64	66	64	64	64	64	64	64	64	63
10	66	66	66	66	66	66	64	64	64	63
11	68	68	68	68	68	68	66	64	64	64
12	68	70	68	68	68	70	66	64	64	64
13	70	72	70	70	70	70	68	66	66	64
14	72	73	72	72	72	72	70	68	66	64
15	73	75	73	73	73	73	70	68	68	66
16	75	77	75	75	75	75	72	70	68	66
17	77	79	79	79	77	79	73	72	70	68
18	81	82	81	81	81	81	75	73	72	68
19	84	86	84	84	82	84	79	75	73	70
20	86	90	88	86	86	86	81	77	77	72
21	90	93	90	90	90	90	84	81	79	73
22	93	97	93	93	93	93	86	82	82	75
23	99	100	99	97	97	99	91	86	88	77
24	102	106	102	100	100	102	95	91	91	81
25	108	109	108	106	106	108	99	95	97	84
26	113	115	111	111	109	113	104	100	100	86
27	118	120	117	115	115	118	109	106	106	90
28	124	126	122	120	120	124	115	111	113	95
29	129	131	127	126	126	129	120	117	118	99
30	135	136	133	131	131	135	126	122	126	104
31	140	142	138	136	136	140	131	129	135	109
32	144	145	144	142	142	145	136	136	144	115
33	149	151	149	147	147	151	144	144	153	120
34	154	156	154	153	153	154	149	153	165	127
35	160	162	158	158	158	160	154	162	178	135
36	165	167	163	163	162	165	162	172	192	144
37	171	172	169	169	167	171	169	185	210	154
38	178	180	174	172	172	176	176	199	230	165
39	183	187	181	178	178	181	185	214	252	178
40	190	194	187	183	183	187	194	232	277	192
41	199	201	194	190	189	196	205	252	304	208
42	208	210	203	198	196	205	217	271	333	225
43	219	221	210	205	205	214	230	297	363	243
44	232	232	221	214	212	226	246	322	397	262
45	244	243	230	223	223	239	262	351	435	284
46	259	255	243	235	235	255	282	381	478	307
47	275	270	255	248	248	271	304	415	520	331
48	293	286	268	261	262	289	327	453	567	356
49	313	302	284	277	279	309	352	493	613	383
50	333	320	300	293	295	331	381	534	660	410
51	358	342	320	311	315	352	410	572	702	439

Time (min)	TC #101 (°F)	TC #102 (°F)	TC #103 (°F)	TC #104 (°F)	TC #105 (°F)	TC #106 (°F)	TC #107 (°F)	TC #108 (°F)	TC #109 (°F)	TC #110 (°F)
52	383	361	340	329	334	376	441	612	745	466
53	410	385	360	349	354	399	471	653	792	496
54	439	412	383	370	376	424	502	696	840	525
55	469	439	406	394	397	450	534	738	885	556
56	500	464	432	417	421	475	567	777	928	586
57	532	493	457	441	444	500	599	817	968	615
58	565	523	484	466	469	527	631	860	1008	646
59	599	554	511	491	493	552	667	910	1047	678
60	633	586	540	518	520	579	716	986	1098	711
Max Temp:	633	586	540	518	520	579	716	986	1098	711
Max Allowed:	388	388	388	388	388	388	388	388	386	386

Time (min)	TC #111 (°F)	TC #112 (°F)	TC #113 (°F)	TC #114 (°F)	TC #115 (°F)	TC #116 (°F)	TC #117 (°F)	TC #118 (°F)	TC #119 (°F)	TC #120 (°F)
0	61	61	61	63	63	63	64	64	64	64
1	61	61	61	61	63	63	63	64	64	64
2	61	61	63	63	63	63	64	64	64	64
3	61	61	63	63	63	64	64	66	64	66
4	61	61	63	63	63	64	64	66	66	68
5	61	63	63	63	64	64	64	68	68	70
6	61	63	63	63	64	64	64	70	70	72
7	61	63	63	63	64	64	64	70	72	72
8	61	64	63	63	64	64	64	72	72	73
9	61	64	63	63	64	66	66	72	73	75
10	61	64	63	63	64	66	66	73	73	75
11	63	66	63	64	66	66	66	75	75	77
12	63	66	63	64	66	68	68	77	77	79
13	63	68	63	64	68	68	68	81	79	82
14	63	68	63	64	68	70	70	82	82	86
15	64	70	63	64	68	72	70	86	84	88
16	64	72	63	64	70	72	72	90	88	91
17	64	72	63	66	72	73	72	93	91	95
18	64	73	63	66	73	77	73	97	95	100
19	66	75	63	68	77	81	75	100	99	104
20	66	79	63	68	81	84	77	106	104	109
21	68	81	63	70	84	86	81	109	109	115
22	70	82	64	72	88	90	82	115	115	120
23	72	86	64	73	91	93	86	120	118	126
24	73	88	64	75	95	97	90	126	126	131
25	75	91	64	77	99	100	91	131	131	136
26	77	95	64	81	102	106	95	135	136	142
27	79	99	66	82	108	109	99	140	142	147
28	82	102	66	84	113	115	102	145	147	153
29	84	106	66	86	117	118	106	151	153	158
30	88	108	68	90	122	124	111	156	158	162
31	91	111	68	93	127	127	115	160	163	167
32	95	115	68	95	133	133	118	165	167	171
33	99	118	70	99	138	136	122	171	172	174
34	102	122	70	100	144	142	126	174	176	178
35	108	126	72	104	149	145	129	180	181	183
36	113	129	72	108	154	151	133	185	187	190
37	118	135	73	111	162	156	136	190	192	199
38	124	138	73	113	167	162	140	198	198	208
39	131	142	75	117	172	165	144	203	205	216
40	138	147	75	120	178	171	147	208	210	221
41	147	153	77	124	185	176	151	214	217	228
42	156	158	79	127	190	181	154	221	226	235
43	167	165	79	131	198	187	158	226	234	244
44	178	172	81	133	203	190	162	234	241	252
45	190	181	82	138	210	196	165	239	250	259
46	203	190	84	142	217	201	169	246	257	268
47	216	201	84	145	225	207	172	252	264	275
48	230	212	86	149	232	212	176	259	271	284
49	244	225	88	154	241	219	180	266	280	291
50	261	237	90	158	248	225	187	273	288	300
51	277	250	91	162	257	232	192	280	297	309

Time (min)	TC #111 (°F)	TC #112 (°F)	TC #113 (°F)	TC #114 (°F)	TC #115 (°F)	TC #116 (°F)	TC #117 (°F)	TC #118 (°F)	TC #119 (°F)	TC #120 (°F)
52	293	264	93	167	264	239	198	288	304	318
53	309	277	93	171	271	246	205	295	313	327
54	325	293	95	176	280	253	212	304	320	336
55	343	311	97	180	288	261	221	311	329	347
56	361	338	99	185	295	268	230	320	338	356
57	379	397	100	190	302	277	239	327	347	365
58	399	529	102	194	309	284	250	336	356	376
59	417	759	104	198	316	293	261	345	365	387
60	441	1011	108	203	324	302	273	354	376	396
Max Temp:	441	1011	108	203	324	302	273	354	376	396
Max Allowed:	386	386	386	388	388	388	389	389	389	389

Time (min)	TC #121 (°F)	TC #122 (°F)	TC #123 (°F)	TC #124 (°F)	TC #125 (°F)	TC #126 (°F)	TC #127 (°F)	TC #128 (°F)	TC #129 (°F)
0	64	64	64	64	64	64	64	64	64
1	64	64	64	64	64	64	64	64	64
2	64	64	64	64	64	64	64	64	64
3	64	64	64	64	64	64	64	64	64
4	68	64	64	64	64	64	64	64	64
5	68	66	66	66	64	66	66	66	66
6	70	68	68	68	64	68	68	68	68
7	72	68	70	68	66	68	68	70	70
8	72	70	72	70	66	70	70	70	72
9	73	72	72	72	68	72	72	72	73
10	73	72	73	72	68	73	73	73	73
11	75	73	75	73	70	75	75	75	75
12	77	75	77	75	73	77	77	77	77
13	79	77	79	75	75	79	79	79	79
14	82	79	81	77	77	81	81	81	81
15	84	81	84	79	81	84	82	82	82
16	88	82	86	82	86	88	86	86	86
17	90	86	90	86	90	91	88	88	88
18	93	90	93	88	97	95	91	91	91
19	97	93	99	91	104	100	95	95	95
20	100	97	102	97	115	104	100	100	100
21	104	100	108	100	126	111	104	104	104
22	109	104	111	106	135	117	109	109	109
23	113	109	117	111	144	124	115	115	113
24	118	113	122	118	153	129	120	118	118
25	124	118	127	124	160	136	126	124	126
26	129	124	133	129	165	144	131	129	131
27	133	129	138	135	171	149	136	133	138
28	138	135	144	140	176	154	142	140	144
29	144	138	149	145	183	160	147	144	151
30	147	144	154	151	192	163	153	149	156
31	153	149	160	154	205	169	156	154	162
32	156	154	163	160	221	172	162	160	167
33	160	158	169	165	241	176	165	163	172
34	163	162	172	169	268	181	169	169	178
35	167	165	176	174	297	189	174	172	180
36	171	169	180	178	325	196	178	176	181
37	172	172	183	183	354	207	181	180	185
38	176	176	187	190	387	225	187	185	187
39	180	180	190	199	421	239	192	189	187
40	183	183	196	212	459	255	198	196	190
41	187	187	203	226	496	271	207	203	196
42	190	190	212	241	540	291	217	210	201
43	198	196	223	255	586	309	230	221	212
44	223	201	234	271	637	329	243	232	225
45	235	208	246	289	691	351	257	243	234
46	244	223	259	307	741	372	270	253	243
47	255	237	273	327	788	396	284	266	252
48	264	252	286	347	831	419	298	277	262
49	273	266	300	367	876	444	313	289	273
50	282	279	316	388	921	468	329	302	284
51	293	293	331	412	961	491	345	316	295

Time (min)	TC #121 (°F)	TC #122 (°F)	TC #123 (°F)	TC #124 (°F)	TC #125 (°F)	TC #126 (°F)	TC #127 (°F)	TC #128 (°F)	TC #129 (°F)
52	302	306	347	433	997	516	363	331	307
53	311	318	363	455	1027	540	379	345	318
54	320	331	379	477	1056	565	396	361	331
55	331	345	397	500	1080	588	414	376	340
56	340	358	414	522	1099	612	430	388	352
57	351	370	432	543	1117	637	444	401	363
58	361	385	450	567	1134	660	462	412	374
59	372	397	466	590	1150	684	478	424	385
60	383	410	484	613	1166	707	496	437	397
Max Temp:	383	410	484	613	1166	707	496	437	397
Max Allowed:	389	389	389	389	389	389	389	389	389

Time (min)	TC #130 (°F)	TC #131 (°F)	TC #132 (°F)	TC #133 (°F)	TC #134 (°F)	TC #135 (°F)	TC #136 (°F)	TC #137 (°F)	TC #138 (°F)
0	64	63	64	64	63	63	63	63	63
1	64	64	64	64	64	64	63	63	63
2	64	64	64	64	64	64	63	63	63
3	72	68	64	64	66	64	63	63	63
4	79	75	68	66	68	64	64	63	64
5	82	81	70	68	70	66	64	64	64
6	82	84	72	72	73	66	66	64	66
7	84	88	75	73	75	68	68	64	66
8	86	90	77	77	75	70	68	66	68
9	86	93	79	79	79	72	70	66	68
10	88	97	81	81	81	72	72	68	68
11	90	102	84	84	82	73	72	70	68
12	91	108	86	86	86	75	73	70	70
13	95	115	90	90	90	77	75	72	72
14	99	120	95	91	93	79	77	73	73
15	102	127	99	95	97	81	81	75	75
16	108	136	104	99	102	84	82	79	77
17	111	144	109	102	108	88	86	81	79
18	117	151	115	106	111	90	88	84	82
19	122	158	120	111	117	95	91	88	86
20	127	165	126	115	122	99	95	93	90
21	133	172	131	120	129	102	100	97	93
22	140	183	136	126	135	108	104	100	99
23	145	192	144	131	140	111	108	106	102
24	151	203	149	136	145	115	113	109	108
25	156	212	154	142	153	120	118	115	113
26	162	223	160	147	156	126	124	118	118
27	167	234	165	151	162	131	127	122	122
28	172	244	171	156	165	136	133	127	127
29	178	255	178	160	171	140	138	131	133
30	183	266	183	165	176	145	144	135	136
31	190	279	190	169	180	151	147	138	138
32	194	289	198	174	185	156	153	142	142
33	199	300	203	178	192	160	158	147	144
34	207	309	210	181	199	165	162	151	147
35	217	320	217	185	205	169	165	154	151
36	228	331	223	189	210	172	169	158	154
37	237	342	228	194	217	176	172	162	158
38	246	351	235	198	223	180	176	165	162
39	255	360	244	207	228	183	180	169	165
40	264	370	252	219	235	187	185	171	171
41	273	378	259	230	243	189	190	172	174
42	282	387	268	241	250	187	196	174	180
43	291	394	275	252	257	192	201	176	183
44	300	403	282	261	264	208	205	180	189
45	309	410	291	271	273	221	212	185	194
46	316	419	298	280	280	232	219	192	199
47	327	428	307	291	289	241	226	201	208
48	336	437	316	300	298	252	234	212	219
49	345	446	324	309	306	262	243	225	228
50	356	455	333	320	315	273	252	239	237
51	365	464	342	329	324	284	261	255	253

Time (min)	TC #130 (°F)	TC #131 (°F)	TC #132 (°F)	TC #133 (°F)	TC #134 (°F)	TC #135 (°F)	TC #136 (°F)	TC #137 (°F)	TC #138 (°F)
52	376	475	352	338	333	298	270	273	266
53	385	484	360	347	342	309	280	291	275
54	396	493	370	356	352	320	289	309	288
55	405	502	379	367	361	331	300	329	300
56	415	511	388	378	370	340	311	345	306
57	424	522	397	387	379	347	320	363	315
58	435	531	406	396	388	354	331	379	324
59	446	540	415	405	399	363	342	396	333
60	455	549	426	414	408	370	352	412	338
Max Temp:	455	549	426	414	408	370	352	412	338
Max Allowed:	389	388	389	389	388	388	388	388	388

Time (min)	TC #139 (°F)	TC #140 (°F)	TC #141 (°F)	TC #142 (°F)	TC #143 (°F)	TC #144 (°F)	TC #145 (°F)	TC #146 (°F)	TC #147 (°F)
0	63	61	61	63	63	63	63	64	64
1	63	63	61	63	63	63	63	64	64
2	63	63	63	63	63	63	63	64	64
3	63	63	63	63	63	63	63	64	64
4	63	63	63	63	63	63	63	64	64
5	63	63	63	63	63	63	63	64	64
6	64	63	61	63	63	63	63	64	64
7	64	63	63	63	63	63	64	64	64
8	64	63	63	63	63	63	64	64	64
9	64	63	63	63	63	63	64	64	64
10	64	63	63	63	63	63	64	64	64
11	64	63	63	63	63	64	64	64	64
12	64	63	63	63	63	64	64	64	66
13	66	63	63	63	63	64	64	66	66
14	66	63	63	63	64	64	64	66	66
15	68	63	63	63	64	64	64	66	68
16	68	63	63	63	64	64	66	68	68
17	70	64	63	63	64	64	66	68	70
18	72	63	63	63	64	66	66	68	70
19	73	63	63	64	64	66	68	70	72
20	75	64	63	64	64	66	68	72	73
21	77	64	63	64	66	68	70	72	73
22	79	64	63	64	66	68	70	73	75
23	82	64	64	64	66	70	72	75	77
24	86	64	64	66	68	70	72	77	79
25	90	66	64	66	68	72	73	79	82
26	93	68	64	66	70	73	75	81	84
27	97	68	64	68	70	73	77	82	86
28	100	68	64	68	72	75	79	84	88
29	104	68	66	70	73	77	81	86	91
30	108	70	66	70	73	79	82	90	93
31	113	72	66	72	75	81	84	91	97
32	117	72	68	72	77	82	86	93	100
33	122	72	68	73	79	84	88	97	102
34	124	73	70	75	81	86	91	99	106
35	127	75	70	75	82	90	93	102	109
36	131	75	72	77	84	91	95	104	111
37	133	77	72	79	86	93	99	108	115
38	135	79	73	81	88	95	100	111	118
39	138	79	73	82	90	99	104	113	122
40	140	81	75	84	91	100	106	117	126
41	142	82	77	86	95	104	109	120	127
42	142	84	77	88	97	106	111	124	133
43	144	84	79	90	99	109	115	127	136
44	145	86	81	91	102	111	118	131	140
45	149	88	82	93	104	115	122	135	144
46	151	91	82	95	108	118	124	138	149
47	154	95	84	99	109	120	127	144	154
48	160	100	86	100	113	124	131	147	158
49	163	111	88	102	115	127	135	153	165
50	167	120	90	106	118	131	138	156	171
51	172	133	91	108	122	135	144	162	176

Time (min)	TC #139 (°F)	TC #140 (°F)	TC #141 (°F)	TC #142 (°F)	TC #143 (°F)	TC #144 (°F)	TC #145 (°F)	TC #146 (°F)	TC #147 (°F)
52	178	151	93	111	126	138	147	167	183
53	183	165	95	113	129	142	153	172	190
54	187	169	99	117	133	147	156	180	198
55	192	174	100	120	136	151	162	185	205
56	198	178	102	122	140	156	167	190	212
57	203	189	104	126	144	160	172	198	219
58	208	187	108	129	149	165	178	205	228
59	214	183	109	133	153	171	183	212	237
60	219	167	111	136	158	176	190	219	246
Max Temp:	219	189	111	136	158	176	190	219	246
Max Allowed:	388	386	386	388	388	388	388	389	389

Time (min)	TC #148 (°F)	TC #149 (°F)	TC #150 (°F)
0	64	64	64
1	63	64	64
2	64	64	64
3	64	64	64
4	64	64	64
5	64	64	64
6	64	64	64
7	64	64	64
8	64	64	64
9	64	64	64
10	64	64	64
11	64	64	64
12	64	64	66
13	64	66	66
14	64	66	66
15	64	66	66
16	66	66	68
17	66	68	68
18	66	68	68
19	68	68	70
20	68	70	70
21	68	70	72
22	70	72	73
23	72	73	73
24	72	75	75
25	73	75	77
26	75	77	79
27	77	81	81
28	79	82	84
29	81	84	86
30	82	86	90
31	84	90	91
32	86	91	95
33	90	95	97
34	91	99	100
35	93	100	104
36	97	104	108
37	99	108	111
38	102	111	115
39	104	115	118
40	108	118	122
41	111	122	127
42	113	126	133
43	117	129	136
44	120	135	144
45	124	140	149
46	127	144	156
47	131	149	163
48	135	156	171
49	140	162	180
50	144	169	189
51	149	178	199

Time (min)	TC #148 (°F)	TC #149 (°F)	TC #150 (°F)
52	154	185	210
53	160	194	223
54	165	205	235
55	172	214	250
56	180	226	264
57	185	237	280
58	192	250	297
59	201	262	313
60	208	275	329
Max Temp:	208	275	329
Max Allowed:	389	389	389

Time (min)	TC #151 (°F)	TC #152 (°F)	TC #153 (°F)	TC #154 (°F)	TC #155 (°F)	TC #156 (°F)	TC #157 (°F)	TC #158 (°F)	TC #159 (°F)	TC #160 (°F)
0	64	64	64	64	64	64	64	64	64	64
1	64	64	64	64	64	64	64	64	64	64
2	64	64	64	64	64	64	64	64	64	64
3	64	64	64	64	64	64	64	64	64	64
4	64	64	64	64	64	64	64	64	64	64
5	64	64	64	64	64	64	64	64	64	64
6	64	64	64	64	64	64	64	64	64	64
7	64	64	64	64	64	66	64	64	64	64
8	64	64	64	64	64	66	66	66	64	64
9	64	64	64	64	66	66	66	66	64	64
10	66	64	64	64	66	68	68	68	64	64
11	66	64	66	66	66	68	68	68	66	64
12	66	66	66	66	68	70	68	68	66	66
13	66	66	66	66	68	70	70	70	68	66
14	68	66	66	66	68	72	72	72	68	66
15	68	66	66	68	70	72	72	72	68	68
16	68	68	68	68	70	73	73	73	70	68
17	70	68	68	70	72	75	75	75	72	68
18	70	68	68	70	73	77	77	77	72	70
19	72	70	70	72	73	79	79	79	73	70
20	72	70	72	72	75	81	81	82	75	72
21	73	72	72	73	77	82	82	84	77	73
22	75	73	73	75	79	86	84	86	79	73
23	77	75	75	77	81	88	88	90	81	75
24	79	77	77	79	84	91	90	93	82	77
25	82	79	79	81	86	93	93	95	84	79
26	84	81	82	84	90	97	97	99	88	81
27	86	82	84	86	93	100	100	102	90	84
28	90	86	86	90	95	104	104	106	93	86
29	93	88	90	91	99	108	108	109	97	88
30	95	91	93	95	102	111	111	115	99	91
31	99	95	97	99	106	117	115	118	102	93
32	102	99	100	102	109	120	118	122	106	97
33	106	100	102	106	113	124	124	126	109	99
34	109	104	108	109	117	129	127	131	113	102
35	113	109	111	113	120	133	133	135	117	106
36	118	113	115	117	126	136	136	140	120	108
37	122	118	118	122	129	140	140	144	124	111
38	126	122	124	126	133	144	145	149	127	115
39	131	127	129	131	136	149	149	153	131	117
40	136	133	135	135	142	153	154	158	135	120
41	144	138	140	140	145	158	158	162	138	124
42	149	145	145	145	151	162	163	167	142	126
43	156	153	153	153	156	167	169	171	145	129
44	165	162	160	158	162	172	174	176	151	133
45	174	171	169	165	169	180	180	181	154	136
46	183	180	178	174	176	185	185	187	158	140
47	194	192	189	183	183	194	192	194	163	144
48	207	205	201	192	192	201	198	199	169	147
49	219	217	214	203	201	208	207	207	174	153
50	234	234	226	214	210	217	214	214	180	158
51	250	250	243	226	221	226	221	221	187	162

Time (min)	TC #151 (°F)	TC #152 (°F)	TC #153 (°F)	TC #154 (°F)	TC #155 (°F)	TC #156 (°F)	TC #157 (°F)	TC #158 (°F)	TC #159 (°F)	TC #160 (°F)
52	266	268	259	241	232	235	230	228	192	167
53	284	288	275	253	243	246	239	237	199	174
54	302	307	295	270	255	257	248	246	207	180
55	322	329	313	286	268	266	257	253	214	187
56	343	351	334	302	282	279	268	262	223	194
57	363	374	356	320	295	289	277	271	230	201
58	387	397	378	338	309	302	288	282	239	208
59	410	423	401	356	324	313	298	291	246	216
60	433	446	424	376	340	325	309	302	255	223
Max Temp:	433	446	424	376	340	325	309	302	255	223
Max Allowed:	389	389	389	389	389	389	389	389	389	389

Time (min)	TC #161 (°F)	TC #162 (°F)	TC #163 (°F)	TC #164 (°F)	TC #165 (°F)	TC #166 (°F)	TC #167 (°F)	TC #168 (°F)	TC #169 (°F)	TC #170 (°F)
0	63	63	63	61	61	61	61	63	63	64
1	63	63	61	61	61	61	61	63	63	64
2	63	63	63	61	61	61	61	63	63	64
3	63	63	63	61	61	61	61	63	63	64
4	63	63	63	61	61	61	61	63	63	64
5	63	63	63	61	61	61	61	63	63	64
6	63	63	63	63	61	61	61	63	64	64
7	63	63	63	63	61	61	63	63	64	64
8	63	63	63	61	61	61	63	64	64	64
9	63	63	63	63	61	61	63	64	64	66
10	63	63	63	63	61	61	63	64	66	66
11	64	63	63	63	61	61	63	64	66	68
12	64	63	63	63	63	61	63	64	66	68
13	64	63	63	63	63	61	63	66	68	70
14	64	63	63	63	63	61	63	66	68	70
15	64	64	63	63	63	61	64	68	70	72
16	66	64	63	63	63	61	64	68	72	73
17	66	64	63	63	63	61	64	70	73	75
18	66	64	63	63	63	61	66	72	75	77
19	68	64	63	63	63	61	66	73	77	81
20	68	66	64	63	63	63	68	77	81	84
21	70	66	64	63	63	63	70	81	86	88
22	70	66	64	63	63	63	72	84	90	91
23	72	68	64	63	63	63	73	88	93	95
24	73	68	64	64	63	63	75	93	99	100
25	75	70	66	64	63	64	77	97	104	104
26	75	70	66	64	63	64	81	100	108	108
27	79	72	68	64	64	64	82	106	113	113
28	79	73	68	64	64	66	86	111	118	118
29	82	73	68	66	64	66	88	115	124	122
30	84	75	70	66	64	68	91	120	129	127
31	86	77	72	68	64	68	95	124	133	133
32	88	79	72	68	64	68	97	129	138	138
33	90	81	73	68	66	70	100	133	144	142
34	93	82	73	70	66	72	104	138	149	147
35	95	84	75	70	66	72	108	144	153	153
36	97	86	77	72	66	73	111	149	158	158
37	100	88	77	72	68	75	113	154	162	162
38	102	90	79	73	68	75	117	160	165	167
39	104	91	81	73	68	77	120	165	169	171
40	108	93	82	75	70	79	124	171	176	174
41	109	95	84	75	70	79	127	176	181	178
42	113	97	84	77	70	81	131	181	187	180
43	115	100	86	79	72	82	135	189	194	183
44	118	102	88	79	72	84	138	194	201	190
45	120	104	90	81	73	86	142	201	210	199
46	124	106	91	82	73	88	145	208	219	208
47	127	108	93	82	75	90	149	216	226	216
48	129	111	95	84	75	90	154	225	237	226
49	135	113	97	86	77	91	158	232	248	237
50	138	117	99	86	77	93	163	241	257	248
51	142	118	100	88	79	95	167	248	268	259

Time (min)	TC #161 (°F)	TC #162 (°F)	TC #163 (°F)	TC #164 (°F)	TC #165 (°F)	TC #166 (°F)	TC #167 (°F)	TC #168 (°F)	TC #169 (°F)	TC #170 (°F)
52	147	122	104	90	79	97	172	259	280	271
53	151	126	106	91	81	100	178	268	291	284
54	158	129	108	93	81	102	183	277	302	295
55	163	135	111	95	82	104	189	288	315	309
56	169	138	113	97	84	106	194	297	327	322
57	176	144	117	99	84	108	201	307	340	334
58	181	147	118	100	86	111	207	316	352	349
59	189	153	122	102	88	113	212	327	367	363
60	196	158	126	106	90	115	219	338	379	378
Max Temp:	196	158	126	106	90	115	219	338	379	378
Max Allowed:	388	388	388	386	386	386	386	388	388	389

Time (min)	TC #171 (°F)	TC #172 (°F)	TC #173 (°F)	TC #174 (°F)	TC #175 (°F)	TC #176 (°F)	TC #177 (°F)	TC #178 (°F)	TC #179 (°F)	TC #180 (°F)
0	63	63	63	63	63	63	64	64	64	64
1	63	63	63	63	63	63	64	64	64	64
2	63	63	63	63	63	63	64	64	64	64
3	63	63	64	64	64	64	64	64	64	64
4	64	64	64	64	64	64	64	64	64	64
5	66	66	66	66	66	66	66	64	64	64
6	66	66	68	68	68	68	68	64	66	66
7	68	68	68	68	70	70	68	66	66	68
8	70	70	70	70	72	72	72	68	68	68
9	70	72	72	72	73	73	73	70	70	72
10	72	73	73	73	75	75	75	73	72	73
11	73	73	75	75	77	79	77	77	73	75
12	73	75	77	77	79	81	81	81	75	77
13	75	79	79	81	82	84	82	86	79	79
14	77	81	82	82	86	88	86	91	81	81
15	81	82	86	86	90	91	91	97	84	84
16	82	86	90	90	93	95	95	102	86	86
17	86	90	93	93	97	100	100	108	90	90
18	90	93	97	99	102	106	106	115	95	93
19	93	99	100	104	108	111	113	122	99	97
20	99	102	108	109	113	118	118	129	104	100
21	102	108	111	115	118	124	126	135	109	106
22	108	113	118	120	126	131	133	142	115	109
23	113	118	124	127	131	138	140	147	118	115
24	118	126	129	133	138	144	147	153	126	120
25	126	131	136	140	145	151	153	158	131	127
26	131	138	144	147	151	158	158	162	136	133
27	136	144	149	153	158	163	163	167	142	140
28	142	149	156	158	163	167	169	171	147	145
29	147	156	162	163	169	172	172	176	153	151
30	153	162	167	169	174	176	176	180	158	158
31	158	167	172	172	178	181	180	183	162	163
32	163	171	176	176	181	185	183	189	167	169
33	169	176	180	181	187	189	187	192	171	174
34	172	180	183	185	190	198	194	198	176	178
35	178	185	189	189	194	207	201	205	180	181
36	183	189	194	198	199	214	212	212	183	187
37	189	198	201	207	210	223	221	225	187	190
38	196	207	208	214	219	234	230	241	190	194
39	203	216	216	225	228	243	241	257	194	201
40	210	223	226	237	239	253	253	273	201	208
41	217	232	237	246	250	264	266	293	210	217
42	226	241	246	257	261	277	280	313	219	226
43	234	252	257	268	271	289	295	333	228	235
44	243	261	270	279	284	302	311	354	241	246
45	252	271	280	289	295	316	327	378	253	257
46	261	282	291	302	307	331	343	403	268	270
47	270	293	304	313	320	345	361	430	282	282
48	279	304	316	325	334	360	381	459	298	295
49	289	316	329	336	347	376	399	487	316	309
50	300	327	342	349	361	392	421	522	333	324
51	309	340	356	363	376	408	441	554	351	338

Time (min)	TC #171 (°F)	TC #172 (°F)	TC #173 (°F)	TC #174 (°F)	TC #175 (°F)	TC #176 (°F)	TC #177 (°F)	TC #178 (°F)	TC #179 (°F)	TC #180 (°F)
52	322	352	369	376	390	424	462	586	370	352
53	333	367	383	388	405	441	484	621	388	369
54	343	379	397	401	419	459	505	657	408	385
55	356	392	412	415	433	475	529	696	430	401
56	369	406	426	430	448	493	552	732	450	417
57	381	421	442	444	464	511	576	768	471	433
58	394	435	457	459	478	529	601	802	493	451
59	406	450	471	473	493	545	626	838	514	468
60	419	464	487	487	509	565	651	871	538	486
Max Temp:	419	464	487	487	509	565	651	871	538	486
Max Allowed:	388	388	388	388	388	388	389	389	389	389

Time (min)	TC #181 (°F)	TC #182 (°F)	TC #183 (°F)	TC #184 (°F)	TC #185 (°F)	TC #186 (°F)	TC #187 (°F)	TC #188 (°F)	TC #189 (°F)	TC #190 (°F)
0	64	64	63	64	63	64	64	64	63	63
1	64	63	63	64	64	64	63	64	63	63
2	64	64	64	64	64	64	64	64	63	66
3	64	64	64	64	64	66	64	64	63	70
4	64	64	66	64	66	68	68	64	64	73
5	64	66	68	64	68	70	72	64	64	79
6	66	66	70	66	70	72	75	66	66	79
7	68	68	72	68	72	73	77	68	70	84
8	70	70	73	70	73	75	81	70	72	86
9	72	72	75	72	75	77	82	72	73	88
10	73	73	77	73	79	81	86	73	77	91
11	75	77	81	75	81	82	88	75	79	95
12	77	79	82	79	84	86	91	77	82	99
13	81	81	86	81	86	91	97	79	86	102
14	82	84	90	82	91	95	100	82	90	106
15	86	86	93	86	95	100	106	84	93	111
16	88	90	97	88	99	106	111	88	97	115
17	91	93	100	91	102	111	118	91	100	120
18	95	97	104	95	108	118	126	95	104	131
19	99	100	109	100	113	124	133	100	109	140
20	104	106	115	106	118	129	140	104	117	149
21	109	111	120	111	124	135	147	109	122	156
22	115	117	126	117	129	142	154	115	129	163
23	120	122	131	122	135	147	160	120	136	169
24	126	127	136	127	140	154	167	126	142	176
25	133	133	144	133	147	160	174	133	149	181
26	140	140	151	140	153	165	183	138	156	187
27	145	147	156	147	160	171	192	145	162	194
28	153	153	162	153	165	176	201	151	169	203
29	158	158	167	160	172	181	210	158	172	214
30	165	163	172	165	178	190	219	163	178	226
31	171	169	178	171	185	199	230	169	181	237
32	176	174	183	176	192	207	239	172	185	250
33	180	178	189	180	198	214	250	178	190	262
34	185	183	194	187	205	221	262	181	194	277
35	190	187	199	194	208	230	273	185	201	293
36	194	190	205	199	210	237	284	189	212	311
37	203	194	210	207	216	244	295	192	221	327
38	208	198	216	214	226	250	306	198	230	342
39	216	208	223	221	234	257	316	205	239	358
40	225	217	228	228	241	266	327	212	250	376
41	234	226	235	235	248	273	338	223	262	396
42	243	237	246	244	255	280	349	232	275	419
43	253	248	255	253	264	289	360	244	289	441
44	264	259	266	262	273	298	370	255	306	464
45	275	271	277	271	284	307	379	270	322	489
46	288	282	288	282	295	316	390	282	340	516
47	300	295	300	293	306	327	401	295	358	541
48	315	307	313	304	316	336	412	309	378	568
49	327	320	324	315	327	347	423	322	396	597
50	342	333	336	327	340	358	433	336	415	628
51	356	345	351	338	351	369	444	351	435	662

Time (min)	TC #181 (°F)	TC #182 (°F)	TC #183 (°F)	TC #184 (°F)	TC #185 (°F)	TC #186 (°F)	TC #187 (°F)	TC #188 (°F)	TC #189 (°F)	TC #190 (°F)
52	370	358	363	351	363	379	457	365	457	694
53	385	372	378	363	374	390	468	379	477	725
54	399	385	392	376	388	401	478	394	496	756
55	414	399	406	388	399	414	491	408	518	786
56	430	414	421	401	414	426	504	423	540	817
57	446	426	433	414	426	439	514	439	561	846
58	460	442	448	428	439	451	527	453	585	874
59	477	455	460	441	451	464	540	469	606	905
60	493	471	475	455	464	478	552	486	630	934
Max Temp:	493	471	475	455	464	478	552	486	630	934
Max Allowed:	389	389	388	389	388	389	389	389	388	388

Time (min)	TC #191 (°F)	TC #192 (°F)	TC #193 (°F)	TC #194 (°F)	TC #195 (°F)	TC #196 (°F)	TC #197 (°F)	TC #198 (°F)	TC #199 (°F)	TC #200 (°F)
0	63	61	61	61	61	61	63	63	63	64
1	63	61	61	61	61	61	63	63	63	64
2	63	61	61	61	61	61	63	63	63	64
3	63	61	61	61	61	61	63	63	63	64
4	63	61	61	61	61	61	63	63	63	64
5	64	63	61	61	61	61	63	63	63	64
6	66	63	61	61	61	61	63	63	63	64
7	68	63	61	61	61	63	63	63	64	64
8	68	63	61	61	61	63	63	63	64	64
9	70	63	61	61	61	63	63	63	64	64
10	73	64	61	61	61	63	63	64	64	66
11	75	64	61	61	61	63	63	64	64	66
12	77	64	61	61	61	63	64	64	66	68
13	81	66	61	61	61	63	64	64	66	68
14	84	68	61	61	63	63	64	66	68	70
15	88	70	63	61	63	63	64	66	68	70
16	93	72	63	61	63	64	64	66	70	72
17	97	73	63	61	63	64	66	68	70	73
18	102	75	63	61	63	64	66	68	72	75
19	109	79	63	61	63	64	68	70	73	77
20	117	84	63	63	64	66	68	72	75	79
21	124	88	64	63	64	68	70	73	77	82
22	131	93	64	63	64	68	72	75	81	86
23	138	97	64	63	66	70	75	79	82	88
24	144	100	66	64	66	72	77	81	86	93
25	153	106	68	64	68	73	79	84	90	97
26	160	111	72	64	70	77	82	88	93	100
27	167	117	73	66	72	79	86	91	99	106
28	174	122	75	66	72	82	90	95	102	111
29	181	127	79	68	75	84	93	100	108	115
30	190	133	82	68	77	88	97	104	111	120
31	198	136	86	70	79	91	102	108	117	126
32	205	142	90	72	81	95	106	113	122	131
33	214	147	93	72	82	99	111	118	127	136
34	223	153	97	73	84	102	115	122	133	142
35	234	158	100	75	88	106	118	127	136	147
36	243	162	102	77	90	109	124	133	142	153
37	253	167	104	79	93	113	127	136	147	156
38	264	172	104	81	95	117	133	142	151	162
39	275	176	104	81	97	120	136	147	156	167
40	286	181	102	82	100	124	142	151	162	172
41	297	187	102	84	104	127	145	156	167	180
42	309	194	102	86	106	133	151	162	172	187
43	322	201	104	88	109	136	154	167	180	192
44	336	208	106	90	111	140	160	172	185	201
45	351	216	108	91	115	144	165	178	192	208
46	367	223	111	93	118	149	172	185	199	217
47	381	232	115	95	120	154	178	190	208	226
48	397	241	118	99	126	160	185	198	216	235
49	415	250	122	100	129	165	192	207	225	246
50	432	259	126	102	133	171	199	216	234	257
51	450	268	129	106	136	178	208	225	244	268

Time (min)	TC #191 (°F)	TC #192 (°F)	TC #193 (°F)	TC #194 (°F)	TC #195 (°F)	TC #196 (°F)	TC #197 (°F)	TC #198 (°F)	TC #199 (°F)	TC #200 (°F)
52	468	279	133	108	140	185	216	234	255	280
53	486	288	136	111	145	192	226	244	266	293
54	502	298	140	113	151	199	235	255	277	306
55	522	309	145	117	154	208	246	266	289	318
56	540	320	151	118	160	216	257	279	302	331
57	558	333	156	122	167	225	268	291	315	345
58	577	345	162	126	172	234	280	304	329	360
59	597	356	167	129	178	243	293	318	342	374
60	615	369	172	133	183	253	306	331	356	390
Max Temp:	615	369	172	133	183	253	306	331	356	390
Max Allowed:	388	386	386	386	386	386	388	388	388	389

Time (min)	TC #201 (°F)	TC #202 (°F)	TC #203 (°F)	TC #204 (°F)	TC #205 (°F)	TC #206 (°F)	TC #207 (°F)	TC #208 (°F)	TC #209 (°F)	TC #210 (°F)
0	63	63	63	63	63	64	64	64	64	64
1	63	63	63	63	64	64	64	64	64	64
2	63	63	63	63	63	64	64	64	64	64
3	63	63	63	63	63	64	64	64	64	64
4	63	63	64	64	64	64	64	64	64	64
5	63	64	64	64	64	64	64	64	64	64
6	64	64	64	64	64	64	64	64	64	64
7	64	64	66	66	64	64	64	64	66	66
8	64	64	68	66	66	64	64	66	66	66
9	64	66	68	68	66	66	66	66	68	68
10	66	66	70	70	68	66	66	68	68	68
11	66	68	72	72	68	68	68	70	70	70
12	68	70	73	73	70	70	70	72	72	72
13	68	72	75	75	73	72	72	73	73	73
14	70	73	77	79	75	73	73	75	75	75
15	72	75	81	81	77	77	75	77	77	79
16	73	77	82	84	81	79	79	79	79	81
17	75	79	86	88	84	82	82	82	82	82
18	77	82	90	91	88	86	84	84	86	86
19	79	84	93	95	91	90	88	88	88	90
20	82	88	99	100	97	95	93	91	91	93
21	86	91	102	106	100	100	97	95	97	97
22	90	97	108	111	106	104	102	100	100	100
23	93	100	113	117	111	109	108	104	106	106
24	97	106	118	124	118	115	111	109	111	111
25	102	111	126	129	124	120	117	115	115	117
26	108	117	131	135	129	126	122	120	122	122
27	111	122	136	142	136	133	127	126	127	127
28	118	127	144	147	142	136	133	131	133	135
29	122	133	149	153	147	144	138	136	140	140
30	129	138	154	158	153	147	144	144	145	145
31	135	144	160	163	158	153	149	149	151	153
32	140	149	165	169	162	158	154	154	156	158
33	145	154	169	174	167	163	158	160	162	163
34	151	160	174	180	172	167	163	165	167	169
35	154	165	180	185	178	172	169	169	172	174
36	160	171	187	190	183	178	172	174	180	180
37	165	176	192	198	190	183	178	180	185	185
38	171	181	199	205	198	190	185	187	190	190
39	178	189	207	212	205	198	190	192	198	198
40	183	194	214	221	214	207	198	199	205	205
41	190	201	223	230	223	216	207	207	212	212
42	198	210	232	241	234	226	217	216	221	219
43	205	219	243	252	246	239	226	225	230	228
44	214	228	252	264	259	253	239	235	239	237
45	223	237	262	277	273	268	252	246	250	248
46	232	248	275	289	288	286	266	257	261	259
47	243	259	288	304	306	304	282	270	271	270
48	253	270	300	318	324	324	298	282	284	280
49	264	282	313	334	342	343	316	297	297	293
50	277	295	327	352	363	365	334	309	311	306
51	289	307	340	369	385	390	354	325	324	318

Time (min)	TC #201 (°F)	TC #202 (°F)	TC #203 (°F)	TC #204 (°F)	TC #205 (°F)	TC #206 (°F)	TC #207 (°F)	TC #208 (°F)	TC #209 (°F)	TC #210 (°F)
52	302	320	354	385	406	417	376	342	338	331
53	315	334	370	405	433	450	399	358	354	345
54	329	349	385	423	462	484	426	376	369	360
55	342	363	401	444	493	520	453	396	385	372
56	358	378	417	464	522	556	478	414	401	388
57	372	392	433	484	550	588	502	433	417	403
58	388	408	450	504	579	622	525	453	433	417
59	405	424	466	523	608	655	549	471	450	432
60	421	442	484	543	635	691	574	491	466	448
Max Temp:	421	442	484	543	635	691	574	491	466	448
Max Allowed:	388	388	388	388	388	389	389	389	389	389

Time (min)	TC #211 (°F)	TC #212 (°F)	TC #213 (°F)	TC #214 (°F)	TC #215 (°F)	TC #216 (°F)	TC #217 (°F)	TC #218 (°F)	TC #219 (°F)	TC #220 (°F)
0	63	63	63	63	63	61	63	61	61	61
1	63	63	63	63	63	61	61	61	61	61
2	63	63	63	63	63	61	61	61	61	61
3	63	63	63	63	63	63	61	61	61	61
4	63	63	63	63	63	63	61	61	61	61
5	64	64	63	63	63	63	61	61	61	61
6	64	64	64	64	64	63	63	61	61	61
7	64	64	64	64	64	64	63	61	61	63
8	66	66	64	66	66	64	63	61	61	63
9	66	66	66	66	68	66	63	61	61	63
10	68	68	68	68	70	68	64	63	61	63
11	70	70	68	70	72	68	64	63	61	63
12	72	72	70	72	73	70	64	63	61	63
13	73	73	72	75	75	72	66	63	63	63
14	75	75	75	77	77	73	66	64	63	63
15	77	77	77	79	81	75	68	64	63	64
16	81	81	81	82	84	79	70	64	63	64
17	82	82	82	86	86	81	72	66	63	64
18	86	86	86	88	90	84	73	66	63	66
19	90	90	90	91	93	86	75	68	63	68
20	93	93	93	97	99	91	77	70	63	68
21	97	99	97	100	104	95	81	72	63	70
22	102	102	102	106	109	100	84	73	64	72
23	108	108	108	111	115	104	86	75	64	75
24	111	113	113	117	118	109	91	77	64	77
25	118	118	118	122	126	115	95	79	64	79
26	124	124	124	129	131	120	97	81	64	82
27	129	129	129	135	136	126	102	82	66	84
28	135	136	135	140	142	131	106	86	66	86
29	140	142	140	145	147	136	109	88	66	90
30	147	147	147	151	153	140	113	91	68	93
31	153	154	153	156	158	145	118	93	68	95
32	158	160	158	162	165	153	122	97	68	99
33	165	165	163	167	172	158	126	99	70	102
34	171	172	169	172	180	165	131	102	70	106
35	176	178	174	180	187	172	135	104	72	108
36	181	183	180	187	196	180	140	108	72	111
37	187	190	185	194	205	187	145	109	73	115
38	194	198	192	203	216	196	151	113	75	118
39	201	203	198	212	226	205	156	117	75	124
40	208	210	207	221	239	216	162	120	77	127
41	216	219	214	234	252	226	169	124	79	131
42	223	226	223	244	266	237	176	127	79	135
43	232	235	234	259	282	250	183	133	81	138
44	241	244	244	273	298	262	190	136	82	144
45	252	255	257	288	316	277	199	142	82	147
46	262	266	270	306	334	291	208	147	84	153
47	273	277	282	324	354	306	217	151	86	158
48	284	288	297	342	374	322	226	158	88	162
49	295	300	309	360	396	336	235	162	88	167
50	307	313	325	381	417	354	246	169	90	172
51	320	325	342	401	441	370	257	176	91	178

Time (min)	TC #211 (°F)	TC #212 (°F)	TC #213 (°F)	TC #214 (°F)	TC #215 (°F)	TC #216 (°F)	TC #217 (°F)	TC #218 (°F)	TC #219 (°F)	TC #220 (°F)
52	333	338	356	423	468	392	268	181	93	183
53	345	351	374	446	495	412	280	187	95	190
54	360	365	390	469	527	435	291	194	97	196
55	374	379	408	496	558	459	304	201	99	203
56	388	394	426	522	588	482	315	207	100	210
57	403	408	444	549	617	502	329	214	104	216
58	417	424	464	576	648	523	340	219	106	223
59	432	439	482	603	678	545	352	226	108	230
60	446	453	502	628	709	568	363	232	109	237
Max Temp:	446	453	502	628	709	568	363	232	109	237
Max Allowed:	388	388	388	388	388	386	388	386	386	386

Time (min)	TC #221 (°F)	TC #222 (°F)	TC #223 (°F)	TC #224 (°F)	TC #225 (°F)	TC #226 (°F)	TC #227 (°F)	TC #228 (°F)	TC #229 (°F)	TC #230 (°F)
0	61	61	61	61	61	61	61	61	61	63
1	61	61	61	61	61	61	61	61	63	63
2	61	61	61	61	61	61	61	61	63	63
3	61	61	61	61	63	63	61	63	63	63
4	61	61	63	63	64	63	63	64	64	63
5	63	63	63	63	66	64	64	66	66	63
6	63	63	63	64	66	66	64	68	70	64
7	63	63	63	64	68	68	66	72	72	66
8	63	64	64	66	70	70	68	73	73	68
9	64	64	64	68	72	72	70	75	77	70
10	64	64	64	68	73	73	72	79	79	72
11	64	66	66	70	75	75	75	81	82	75
12	64	66	66	70	77	75	77	84	86	79
13	66	66	68	72	79	79	79	88	91	82
14	66	68	70	73	82	81	82	93	95	86
15	68	68	70	75	86	84	84	97	100	91
16	68	70	72	79	90	88	88	102	106	97
17	70	72	73	81	95	91	93	108	111	102
18	72	72	75	86	100	97	97	115	118	109
19	75	75	79	90	108	102	102	120	126	117
20	79	79	82	95	113	109	109	127	133	126
21	82	82	88	100	120	118	115	135	140	133
22	86	86	91	108	127	126	122	142	147	140
23	90	90	97	113	133	133	129	147	153	147
24	95	93	102	118	140	140	136	153	158	153
25	99	99	108	124	147	145	142	158	163	158
26	102	102	111	129	154	151	149	163	169	162
27	108	106	117	135	160	156	154	167	172	165
28	111	111	122	140	167	162	160	171	178	169
29	115	115	127	147	172	165	165	176	183	172
30	118	118	133	151	180	169	169	183	189	174
31	124	122	136	158	187	172	174	190	194	176
32	129	126	142	162	194	176	178	198	205	178
33	133	129	145	169	205	181	183	205	214	180
34	138	131	151	174	214	187	187	216	226	183
35	144	135	154	181	225	199	194	228	241	187
36	149	136	160	190	234	214	203	243	255	190
37	154	140	163	199	246	226	212	259	273	201
38	160	144	169	208	257	239	223	275	291	221
39	167	147	172	219	270	253	237	295	313	239
40	172	153	178	230	284	270	255	316	333	261
41	178	156	183	241	298	286	271	338	356	286
42	185	162	189	253	315	304	291	363	381	315
43	192	167	194	266	331	322	309	388	406	347
44	201	174	201	280	347	342	331	415	433	385
45	208	181	208	295	365	363	352	444	462	423
46	217	189	219	309	385	385	376	471	491	464
47	226	198	228	325	403	408	401	502	522	507
48	235	205	239	342	423	432	428	531	552	550
49	244	216	250	360	444	455	455	561	585	597
50	255	226	262	379	466	482	482	594	619	644
51	266	237	275	399	489	509	511	626	653	693

Time (min)	TC #221 (°F)	TC #222 (°F)	TC #223 (°F)	TC #224 (°F)	TC #225 (°F)	TC #226 (°F)	TC #227 (°F)	TC #228 (°F)	TC #229 (°F)	TC #230 (°F)
52	277	250	289	423	513	536	540	660	687	741
53	289	264	306	444	538	563	568	691	723	792
54	302	277	320	468	563	592	597	723	757	842
55	316	291	338	493	590	622	626	756	792	900
56	329	307	356	518	617	653	657	788	824	955
57	343	322	374	541	644	684	685	817	860	1011
58	356	338	394	568	671	714	714	849	896	1062
59	370	356	415	594	698	745	745	882	936	1108
60	383	372	437	621	725	775	775	916	975	1152
Max Temp:	383	372	437	621	725	775	775	916	975	1152
Max Allowed:	386	386	386	386	386	386	386	386	386	388

Time (min)	TC #231 (°F)	TC #232 (°F)	TC #233 (°F)	TC #234 (°F)	TC #235 (°F)	TC #236 (°F)	TC #237 (°F)	TC #238 (°F)	TC #239 (°F)	TC #240 (°F)
0	61	61	61	61	61	63	63	63	63	63
1	61	61	61	61	61	63	63	63	63	63
2	61	61	61	61	63	63	63	63	63	63
3	63	61	61	61	63	63	63	63	63	63
4	63	63	61	63	63	63	64	63	63	63
5	64	64	63	63	63	63	66	64	64	64
6	66	64	63	64	64	64	70	66	64	64
7	68	66	64	64	64	64	72	66	66	64
8	70	68	64	66	66	66	75	68	68	66
9	72	70	68	68	68	68	77	70	68	68
10	75	73	70	72	70	70	79	72	70	70
11	79	75	73	75	72	72	81	73	72	72
12	81	79	75	77	75	73	82	75	73	73
13	86	82	79	81	77	75	86	77	75	75
14	90	86	82	84	79	77	90	79	79	79
15	95	91	86	88	82	79	93	82	81	81
16	100	95	90	91	86	82	97	86	84	84
17	106	100	95	97	90	86	102	90	86	86
18	113	106	99	100	93	90	108	93	91	90
19	120	113	102	108	99	95	115	99	95	95
20	127	118	108	113	104	100	120	104	100	100
21	135	126	113	120	109	106	127	109	106	106
22	140	131	120	126	115	113	133	115	111	111
23	147	136	127	133	122	118	140	122	118	118
24	154	142	135	140	129	126	147	129	126	126
25	158	147	142	147	136	133	154	136	133	131
26	163	153	149	154	144	140	162	144	140	138
27	169	158	156	160	153	147	169	149	147	145
28	172	163	162	165	160	154	176	156	153	153
29	176	167	169	171	167	160	183	162	160	158
30	181	171	172	174	172	165	190	167	163	163
31	185	176	178	178	178	171	199	172	169	169
32	190	180	180	181	183	176	208	178	172	172
33	196	183	181	185	189	180	219	183	176	176
34	201	187	183	189	194	181	232	189	180	178
35	208	192	185	196	198	185	243	196	183	181
36	216	198	187	203	203	189	253	201	187	187
37	226	208	194	216	208	194	262	208	194	194
38	237	223	203	228	221	203	273	216	203	205
39	252	237	214	243	234	219	286	223	210	214
40	268	255	228	259	248	230	298	232	219	225
41	284	273	246	277	261	243	309	241	228	235
42	302	295	264	295	275	255	322	250	237	246
43	324	316	286	315	289	268	334	261	248	257
44	345	340	307	336	306	282	345	271	259	270
45	370	365	331	358	324	297	358	284	271	284
46	396	392	356	383	342	311	370	297	286	298
47	424	419	383	408	360	327	385	309	298	313
48	453	446	410	435	381	342	397	322	313	327
49	482	475	439	462	403	358	410	336	327	343
50	511	504	469	489	424	376	424	352	343	360
51	543	532	500	516	448	394	439	367	360	378

Time (min)	TC #231 (°F)	TC #232 (°F)	TC #233 (°F)	TC #234 (°F)	TC #235 (°F)	TC #236 (°F)	TC #237 (°F)	TC #238 (°F)	TC #239 (°F)	TC #240 (°F)
52	576	561	529	545	471	414	455	383	378	396
53	610	590	559	574	496	432	471	401	396	414
54	644	621	590	601	522	451	486	419	417	435
55	678	651	621	631	550	473	504	441	442	457
56	714	682	655	660	583	496	525	466	471	484
57	752	716	689	689	615	522	549	498	507	518
58	792	748	727	721	651	554	579	540	554	563
59	831	777	765	757	694	590	626	592	619	617
60	876	806	792	799	754	642	693	648	711	685
Max Temp:	876	806	792	799	754	642	693	648	711	685
Max Allowed:	386	386	386	386	386	388	388	388	388	388

Time (min)	TC #241 (°F)	TC #242 (°F)	TC #243 (°F)	TC #244 (°F)	TC #245 (°F)	TC #246 (°F)	TC #247 (°F)	TC #248 (°F)	TC #249 (°F)	TC #250 (°F)
0	63	63	63	63	61	61	61	61	61	63
1	63	63	63	63	63	61	61	61	61	63
2	63	63	63	63	63	61	61	61	61	63
3	63	63	63	63	63	61	61	61	61	63
4	63	63	63	63	63	61	61	61	61	63
5	64	64	64	63	63	63	61	61	61	63
6	64	66	64	64	64	63	61	61	61	63
7	66	68	66	64	64	63	61	61	63	63
8	68	70	68	64	64	63	61	61	63	63
9	70	72	70	66	66	64	61	61	63	63
10	72	75	72	68	66	64	61	61	63	63
11	73	77	75	70	68	64	61	63	63	64
12	75	79	77	72	70	64	61	63	63	64
13	77	82	79	75	70	66	61	63	63	64
14	81	86	82	77	72	66	61	63	63	64
15	82	88	86	81	73	68	63	63	63	64
16	86	91	90	84	75	68	63	63	63	64
17	90	97	93	88	79	70	63	63	64	66
18	93	100	99	97	82	72	63	63	64	66
19	97	106	106	108	88	75	63	63	64	68
20	102	113	113	117	93	77	64	64	64	68
21	108	118	120	126	99	81	64	64	66	70
22	115	126	127	133	104	84	66	64	66	72
23	120	133	135	138	111	88	66	64	68	73
24	127	140	140	144	118	91	68	64	68	75
25	135	147	147	147	126	95	70	66	70	77
26	140	153	153	151	131	99	72	66	72	79
27	147	158	158	154	136	102	73	66	73	82
28	153	163	162	158	142	106	77	68	75	84
29	158	167	165	162	145	109	77	68	77	88
30	163	171	169	165	151	113	79	70	79	91
31	167	174	172	171	154	117	81	70	81	93
32	172	178	174	174	160	122	82	72	82	97
33	176	181	178	178	163	126	82	73	86	100
34	180	187	180	183	169	129	84	73	88	104
35	183	192	183	189	172	135	84	75	90	108
36	187	199	190	198	176	136	84	75	93	111
37	194	208	198	207	181	140	82	77	95	115
38	199	216	205	219	187	144	84	79	97	118
39	208	225	216	234	196	147	86	81	100	122
40	216	235	226	252	205	153	86	82	104	126
41	225	246	239	271	214	156	88	82	106	129
42	235	257	253	295	225	162	90	84	109	135
43	246	268	270	320	235	167	91	86	113	138
44	259	280	286	347	248	174	93	88	115	144
45	270	293	306	378	262	180	95	90	118	149
46	284	306	325	410	279	187	97	91	122	154
47	297	320	347	444	295	194	99	93	126	160
48	311	334	370	480	313	203	100	95	131	167
49	327	351	396	518	331	210	102	97	135	174
50	342	367	423	559	351	219	106	100	140	181
51	358	387	450	603	372	230	108	102	145	189

Time (min)	TC #241 (°F)	TC #242 (°F)	TC #243 (°F)	TC #244 (°F)	TC #245 (°F)	TC #246 (°F)	TC #247 (°F)	TC #248 (°F)	TC #249 (°F)	TC #250 (°F)
52	376	406	478	649	394	239	111	104	151	198
53	396	426	509	700	419	250	113	108	156	207
54	417	450	540	750	446	262	118	109	162	216
55	448	475	574	801	475	275	127	113	167	226
56	489	509	613	858	511	289	144	115	174	239
57	545	550	658	916	554	307	172	118	181	252
58	622	608	712	979	613	333	228	122	190	266
59	723	671	781	1038	691	370	325	126	198	280
60	842	747	864	1096	781	432	477	129	207	295
Max Temp:	842	747	864	1096	781	432	477	129	207	295
Max Allowed:	388	388	388	388	386	386	386	386	386	388

Time (min)	TC #251 (°F)	TC #252 (°F)	TC #253 (°F)	TC #254 (°F)	TC #255 (°F)	TC #256 (°F)	TC #257 (°F)	TC #258 (°F)	TC #259 (°F)	TC #260 (°F)
0	61	61	61	61	61	61	61	63	63	63
1	61	61	61	61	61	63	63	63	63	63
2	61	61	61	61	61	61	63	63	63	63
3	61	61	61	61	61	61	63	63	63	63
4	61	61	61	61	61	63	63	63	63	63
5	61	61	61	63	61	63	63	63	63	63
6	61	61	63	63	63	63	63	63	63	63
7	61	63	63	63	63	63	64	64	64	64
8	63	63	63	64	64	64	64	64	64	64
9	63	63	63	64	64	64	66	66	66	64
10	63	63	64	64	66	66	68	68	68	66
11	63	64	64	66	68	68	70	70	70	68
12	63	64	66	68	68	70	72	72	72	70
13	64	64	68	68	70	72	73	75	73	72
14	64	64	68	70	72	73	77	77	77	73
15	64	66	70	72	73	75	79	81	81	77
16	64	68	72	73	75	79	82	84	84	79
17	66	68	73	75	77	82	86	88	88	82
18	66	70	75	79	81	84	90	91	91	86
19	68	72	77	81	84	90	95	97	97	91
20	70	73	81	84	88	93	99	102	102	97
21	72	75	84	90	93	99	104	108	109	100
22	73	77	88	93	97	102	111	115	115	108
23	75	81	91	99	102	109	117	120	122	113
24	77	84	97	104	108	115	122	127	129	118
25	81	88	100	109	115	120	129	133	135	126
26	84	91	106	115	120	126	135	138	142	131
27	86	95	111	120	126	133	140	145	147	136
28	90	99	115	126	133	138	147	151	151	142
29	93	104	120	133	138	144	153	154	156	147
30	97	108	126	138	144	149	158	160	160	153
31	100	111	131	144	149	154	162	165	165	158
32	104	117	136	149	154	160	169	169	169	162
33	108	122	142	154	160	165	174	174	171	167
34	113	126	147	162	165	171	180	180	174	172
35	117	129	153	167	171	176	187	185	180	176
36	120	135	160	174	176	183	194	192	183	181
37	124	140	165	181	183	190	203	201	190	187
38	127	145	172	190	192	198	214	210	198	192
39	131	151	181	199	201	208	226	223	208	201
40	136	156	190	210	212	221	241	237	221	210
41	140	162	199	221	225	234	257	253	235	221
42	145	167	208	234	237	250	277	271	253	234
43	151	174	219	248	253	268	297	293	275	250
44	156	181	230	262	270	288	320	316	298	268
45	162	189	243	279	288	307	343	342	324	288
46	167	198	255	297	307	331	372	372	354	311
47	174	207	270	315	329	356	401	403	387	336
48	181	216	286	334	352	381	432	437	421	365
49	189	226	302	356	378	410	468	475	459	396
50	198	237	320	378	403	441	507	513	500	430
51	207	250	338	401	432	473	541	552	541	464

Time (min)	TC #251 (°F)	TC #252 (°F)	TC #253 (°F)	TC #254 (°F)	TC #255 (°F)	TC #256 (°F)	TC #257 (°F)	TC #258 (°F)	TC #259 (°F)	TC #260 (°F)
52	217	264	358	428	460	505	576	592	585	498
53	228	279	379	453	491	538	612	633	628	534
54	239	295	403	480	520	568	646	673	673	572
55	252	311	426	507	550	599	682	716	725	610
56	266	329	450	536	581	631	716	759	788	649
57	280	347	475	567	615	666	752	806	846	691
58	297	369	504	597	648	698	790	856	905	730
59	313	392	532	628	682	730	829	905	959	770
60	331	417	561	660	716	765	869	955	1013	808
Max Temp:	331	417	561	660	716	765	869	955	1013	808
Max Allowed:	386	386	386	386	386	386	386	388	388	388

Time (min)	TC #261 (°F)	TC #262 (°F)	TC #263 (°F)	TC #264 (°F)	TC #265 (°F)	TC #266 (°F)	TC #267 (°F)	TC #268 (°F)	TC #269 (°F)	TC #270 (°F)
0	61	61	63	63	63	63	63	63	63	63
1	63	61	63	63	63	63	63	63	63	63
2	61	61	63	63	63	63	63	63	63	63
3	63	63	63	63	63	63	63	63	63	63
4	63	63	63	63	63	63	63	63	63	63
5	63	63	63	63	63	63	63	63	63	63
6	63	63	63	63	63	63	64	64	63	63
7	63	63	63	63	63	64	64	64	63	63
8	63	63	64	64	64	64	66	66	64	64
9	64	64	64	64	64	66	68	68	64	64
10	64	64	66	66	66	68	70	68	66	64
11	66	66	68	68	68	70	72	72	66	66
12	68	68	70	68	70	72	73	73	68	66
13	70	70	72	70	72	73	77	75	70	68
14	72	72	75	72	73	75	79	77	72	68
15	75	75	77	75	75	77	82	81	73	70
16	77	77	81	77	77	81	84	82	77	72
17	81	81	84	79	81	82	88	86	79	73
18	84	84	86	82	82	86	91	90	82	77
19	88	88	91	86	86	90	95	93	86	79
20	91	91	95	90	90	93	100	99	90	82
21	97	97	100	95	95	99	106	104	95	88
22	102	100	106	99	100	104	113	111	100	93
23	108	108	111	104	106	109	118	117	108	97
24	113	113	118	111	111	115	126	124	113	102
25	118	118	124	117	117	122	131	131	120	108
26	126	126	131	124	124	129	138	136	126	113
27	131	131	138	129	129	135	144	142	131	118
28	136	138	144	136	136	142	151	149	136	122
29	144	144	151	144	144	147	156	154	142	127
30	149	151	156	151	149	153	160	158	145	133
31	154	156	162	156	154	158	163	162	151	136
32	158	162	167	162	162	163	169	165	154	140
33	163	165	172	167	165	167	172	169	158	144
34	169	171	178	172	171	172	176	172	162	149
35	172	174	183	176	176	176	180	178	165	153
36	178	180	187	181	180	181	185	183	169	156
37	183	183	194	187	185	187	192	189	174	160
38	189	189	201	192	190	192	199	196	180	165
39	196	196	212	199	198	199	207	203	187	171
40	205	205	221	208	205	207	216	212	194	178
41	216	216	234	217	214	214	225	221	205	187
42	228	228	246	228	223	225	234	232	216	196
43	243	244	262	241	234	234	244	243	230	207
44	261	262	279	253	244	244	255	255	244	219
45	280	280	297	266	257	257	268	270	262	234
46	304	304	316	280	270	270	282	284	282	250
47	327	327	338	297	284	282	295	300	304	266
48	356	354	363	315	298	297	309	318	329	286
49	385	383	388	333	315	311	325	338	354	307
50	415	414	414	352	331	327	342	358	385	331
51	448	442	441	372	349	343	360	379	417	356

Time (min)	TC #261 (°F)	TC #262 (°F)	TC #263 (°F)	TC #264 (°F)	TC #265 (°F)	TC #266 (°F)	TC #267 (°F)	TC #268 (°F)	TC #269 (°F)	TC #270 (°F)
52	478	473	469	392	367	361	379	403	453	387
53	511	504	493	415	387	379	399	430	495	417
54	545	532	516	437	406	397	419	457	536	451
55	577	565	543	460	426	417	441	484	579	486
56	612	595	572	484	446	437	462	511	622	520
57	644	626	601	509	468	457	486	541	669	556
58	678	658	631	534	491	484	507	570	718	594
59	712	691	660	559	513	500	531	601	768	631
60	747	721	691	585	534	520	554	631	820	673
Max Temp:	747	721	691	585	534	520	554	631	820	673
Max Allowed:	386	386	388	388	388	388	388	388	388	388

Time (min)	TC #271 (°F)	TC #272 (°F)	TC #273 (°F)	TC #274 (°F)	TC #275 (°F)	TC #276 (°F)	TC #277 (°F)	TC #278 (°F)	TC #279 (°F)	TC #280 (°F)
0	61	61	61	61	61	63	64	63	64	64
1	61	61	61	61	61	63	63	64	64	64
2	61	61	61	61	63	63	63	64	64	64
3	61	61	61	61	63	63	63	64	68	64
4	61	61	61	61	63	63	63	66	70	66
5	61	61	61	61	63	64	64	68	72	68
6	61	61	61	61	63	64	64	70	72	70
7	63	61	61	61	63	64	64	72	73	72
8	63	61	61	61	63	64	66	73	75	72
9	63	61	61	61	63	66	66	75	79	73
10	63	63	61	61	63	66	68	77	81	75
11	64	63	61	61	63	68	68	79	84	77
12	64	63	63	61	64	68	70	82	88	79
13	64	63	63	61	64	70	72	86	91	82
14	64	63	63	61	64	72	72	90	97	86
15	66	63	63	61	64	73	73	93	100	90
16	68	64	63	63	66	75	75	97	106	93
17	68	64	63	63	68	77	79	102	111	97
18	70	64	63	63	68	81	81	106	117	102
19	72	66	63	63	70	84	82	111	122	108
20	75	66	64	63	72	88	86	117	127	113
21	77	68	64	63	73	93	90	122	133	118
22	81	70	64	64	77	97	93	127	140	124
23	84	72	66	64	79	100	99	133	145	129
24	88	73	66	64	81	106	102	138	151	135
25	91	75	68	66	84	109	108	144	156	142
26	97	77	68	66	86	115	111	149	162	147
27	100	81	68	68	90	118	115	154	167	153
28	104	82	70	68	93	124	120	158	172	158
29	108	86	72	70	97	129	124	163	176	163
30	111	88	72	70	99	133	127	169	181	169
31	117	90	73	72	102	138	133	174	187	172
32	120	93	75	72	106	144	136	180	194	178
33	124	95	75	73	109	147	140	185	199	181
34	127	97	77	75	113	153	144	190	207	189
35	131	100	79	77	117	158	147	196	212	196
36	135	102	81	77	118	162	151	201	219	201
37	138	104	81	79	122	167	156	207	226	208
38	142	106	82	81	126	172	160	212	232	216
39	145	109	84	82	129	176	163	219	239	223
40	151	111	84	84	133	181	167	225	246	230
41	156	115	86	86	136	187	171	230	252	239
42	162	118	88	88	140	192	176	235	259	246
43	169	120	90	88	144	198	180	241	266	253
44	176	126	91	90	147	201	185	248	273	262
45	185	129	93	91	151	207	190	253	280	270
46	194	133	95	93	156	212	196	259	286	277
47	205	136	97	95	160	217	201	266	293	286
48	216	142	99	97	163	223	208	271	300	295
49	226	147	100	100	167	228	214	279	309	304
50	241	153	104	102	172	234	221	286	316	313
51	255	158	106	104	176	241	230	293	324	322

Time (min)	TC #271 (°F)	TC #272 (°F)	TC #273 (°F)	TC #274 (°F)	TC #275 (°F)	TC #276 (°F)	TC #277 (°F)	TC #278 (°F)	TC #279 (°F)	TC #280 (°F)
52	270	165	108	106	180	246	237	300	331	331
53	288	172	111	108	185	252	246	307	340	340
54	306	180	115	109	189	259	255	315	349	349
55	325	187	117	111	192	264	264	324	356	360
56	345	194	122	115	198	271	275	331	365	370
57	365	203	126	117	201	279	286	338	374	379
58	388	212	129	118	207	284	297	347	383	390
59	410	216	135	122	212	291	307	356	392	401
60	433	225	138	124	217	298	320	365	403	412
Max Temp:	433	225	138	124	217	298	320	365	403	412
Max Allowed:	386	386	386	386	386	388	389	388	389	389

Time (min)	TC #281 (°F)	TC #282 (°F)	TC #283 (°F)	TC #284 (°F)	TC #285 (°F)	TC #286 (°F)	TC #287 (°F)	TC #288 (°F)	TC #289 (°F)	TC #290 (°F)
0	63	64	64	64	64	64	64	64	64	64
1	63	64	64	64	64	64	64	64	64	64
2	63	64	64	64	64	64	64	64	64	64
3	64	64	64	64	64	64	64	64	64	64
4	64	64	64	64	64	66	64	64	64	64
5	64	64	64	64	64	70	66	66	66	66
6	66	66	66	64	66	72	68	68	68	68
7	68	66	68	66	68	75	70	70	70	68
8	70	68	68	68	70	79	72	72	72	70
9	72	70	70	68	72	82	73	73	73	72
10	72	72	72	70	75	86	77	75	73	73
11	73	72	72	72	77	90	79	77	75	75
12	75	73	73	73	81	93	81	79	79	77
13	77	75	75	75	84	99	84	81	81	81
14	79	77	75	77	88	104	88	84	84	82
15	81	79	77	79	91	109	93	88	86	86
16	84	82	79	81	95	115	97	93	91	90
17	88	84	82	82	99	120	102	97	95	95
18	90	88	84	86	104	126	108	102	100	99
19	95	91	88	90	108	133	113	108	106	102
20	99	97	91	93	113	140	118	113	111	108
21	104	100	95	97	118	147	126	120	118	113
22	108	106	100	100	124	156	131	127	124	118
23	113	111	104	106	129	162	138	133	131	126
24	118	117	109	111	135	171	144	140	138	133
25	126	122	115	117	140	180	151	147	145	138
26	131	127	120	120	145	192	158	154	151	145
27	136	133	126	126	151	203	163	162	158	153
28	142	140	133	133	158	216	169	167	165	160
29	149	145	138	138	163	241	174	172	171	167
30	154	151	144	144	169	264	180	176	174	172
31	160	156	149	149	174	284	183	181	180	176
32	165	162	154	154	180	302	187	185	183	181
33	169	167	160	158	185	325	190	190	187	185
34	174	171	165	163	190	351	198	194	192	189
35	176	174	169	169	196	376	205	198	198	194
36	180	178	174	172	203	399	217	208	203	198
37	181	181	176	176	214	424	230	219	212	203
38	185	183	180	180	226	451	243	228	219	212
39	187	187	183	183	239	487	257	239	228	225
40	192	189	185	187	252	522	271	250	237	235
41	205	194	189	190	266	549	288	261	248	246
42	219	205	190	198	280	579	302	271	257	255
43	230	214	196	205	297	612	318	284	266	264
44	239	221	199	216	313	648	336	295	277	275
45	248	230	207	228	329	684	352	306	288	284
46	257	239	217	241	349	721	370	318	298	295
47	266	248	228	252	367	756	387	331	309	304
48	275	259	239	264	388	792	405	345	320	315
49	286	270	252	277	410	829	423	358	333	327
50	295	280	262	289	433	869	442	372	343	338
51	306	289	273	302	457	903	460	385	356	349

Time (min)	TC #281 (°F)	TC #282 (°F)	TC #283 (°F)	TC #284 (°F)	TC #285 (°F)	TC #286 (°F)	TC #287 (°F)	TC #288 (°F)	TC #289 (°F)	TC #290 (°F)
52	316	302	286	316	480	941	480	399	367	360
53	325	313	298	331	507	973	500	415	381	372
54	336	324	311	345	532	1008	520	430	394	385
55	347	334	324	360	558	1038	540	446	406	399
56	358	347	336	376	583	1067	559	460	421	410
57	369	360	349	392	610	1096	579	477	433	423
58	381	372	363	408	635	1123	601	493	448	435
59	392	385	378	424	664	1150	622	509	462	446
60	405	397	390	442	689	1171	642	525	475	459
Max Temp:	405	397	390	442	689	1171	642	525	475	459
Max Allowed:	388	389	389	389	389	389	389	389	389	389

Time (min)	TC #291 (°F)	TC #292 (°F)	TC #293 (°F)	TC #294 (°F)	TC #295 (°F)	TC #296 (°F)	TC #297 (°F)	TC #298 (°F)	TC #299 (°F)	TC #300 (°F)
0	63	63	63	63	63	64	64	64	64	64
1	63	63	63	64	64	64	64	64	64	64
2	64	64	64	64	64	64	64	64	64	64
3	64	68	70	64	66	64	64	64	64	64
4	68	77	75	68	68	64	66	66	64	64
5	70	82	79	70	70	66	68	68	64	64
6	72	88	82	72	72	68	70	70	66	64
7	73	93	86	75	72	70	72	70	66	66
8	75	97	90	77	73	72	73	72	68	66
9	77	102	93	79	75	75	75	73	68	66
10	81	108	99	82	79	77	77	75	70	68
11	82	115	106	84	81	81	81	77	72	68
12	86	122	111	88	84	82	82	79	72	70
13	91	129	118	91	86	86	86	82	73	72
14	95	136	127	97	90	90	90	84	75	72
15	100	145	135	100	95	93	93	88	79	73
16	106	153	144	106	99	97	99	93	81	75
17	111	160	151	111	102	100	102	97	82	77
18	117	167	158	117	108	104	108	100	86	79
19	122	174	167	122	113	108	113	106	90	81
20	129	180	176	129	118	113	120	111	93	84
21	135	189	187	135	124	118	126	117	99	86
22	142	201	198	142	129	122	133	122	102	90
23	149	217	207	149	136	127	138	127	108	93
24	156	234	217	154	142	133	144	133	113	97
25	162	253	230	162	147	138	151	136	118	100
26	167	273	241	167	154	144	158	142	126	106
27	172	291	252	172	160	149	163	147	131	109
28	178	309	264	176	165	154	171	153	136	113
29	185	327	280	183	172	160	176	158	140	118
30	190	345	297	189	176	165	183	162	145	122
31	199	361	313	198	181	169	189	167	151	127
32	210	378	325	205	187	174	196	171	154	133
33	219	394	340	216	194	178	205	176	158	136
34	230	408	352	225	199	183	216	181	162	140
35	239	421	365	234	203	187	225	190	167	145
36	250	435	378	244	210	190	234	196	171	149
37	259	448	390	255	216	192	243	201	174	153
38	270	460	399	264	223	196	252	208	178	158
39	280	473	412	275	230	201	261	214	183	162
40	289	486	423	286	237	208	271	221	187	165
41	300	498	435	295	246	216	282	228	192	169
42	309	511	446	306	253	226	293	237	198	172
43	320	523	455	316	262	235	304	244	201	176
44	331	538	464	327	271	246	315	253	207	178
45	342	550	473	338	279	259	325	262	207	180
46	352	563	484	349	288	270	336	273	214	181
47	363	576	493	360	297	282	349	282	228	183
48	374	590	504	370	306	295	361	293	237	187
49	385	603	514	381	316	307	374	304	244	192
50	396	615	525	392	325	318	387	315	252	198
51	408	628	534	403	336	331	399	324	261	208

Time (min)	TC #291 (°F)	TC #292 (°F)	TC #293 (°F)	TC #294 (°F)	TC #295 (°F)	TC #296 (°F)	TC #297 (°F)	TC #298 (°F)	TC #299 (°F)	TC #300 (°F)
52	419	640	545	414	345	343	414	336	270	216
53	432	655	554	426	356	356	428	347	279	223
54	444	669	565	437	369	369	442	360	288	232
55	455	684	574	450	379	381	457	370	297	239
56	468	698	583	460	390	396	471	383	306	248
57	480	711	594	473	401	408	484	394	316	255
58	493	725	603	486	414	421	496	405	325	264
59	504	739	613	496	424	432	511	415	334	273
60	516	752	624	509	435	446	522	428	345	282
Max Temp:	516	752	624	509	435	446	522	428	345	282
Max Allowed:	388	388	388	388	388	389	389	389	389	389

Time (min)	TC #301 (°F)	TC #302 (°F)	TC #303 (°F)	TC #304 (°F)	TC #305 (°F)	TC #306 (°F)	TC #307 (°F)	TC #308 (°F)	TC #309 (°F)	TC #310 (°F)
0	64	63	63	61	61	62	62	63	64	64
1	64	63	63	61	61	62	62	63	64	64
2	64	63	63	61	62	62	62	63	64	64
3	64	64	63	61	61	62	62	63	64	64
4	64	64	63	61	61	62	62	63	64	64
5	65	64	64	61	62	62	62	63	64	65
6	66	65	64	61	61	62	63	63	64	65
7	66	65	65	61	62	62	63	64	65	65
8	67	65	65	61	62	62	63	64	65	66
9	68	66	65	62	62	62	63	64	66	67
10	68	67	66	62	62	62	64	65	67	68
11	69	67	66	62	62	63	64	66	67	69
12	70	68	67	62	62	63	64	66	69	71
13	71	69	68	62	62	63	65	67	70	72
14	72	70	69	62	62	63	66	68	71	73
15	74	71	71	62	63	64	66	69	73	76
16	75	73	72	63	63	64	67	71	74	78
17	77	75	74	63	63	65	68	72	77	80
18	80	77	77	63	64	66	70	74	79	83
19	82	81	80	64	64	67	71	76	81	86
20	86	85	85	64	65	68	73	78	84	89
21	89	89	89	65	65	69	75	81	87	93
22	92	93	94	66	66	70	77	83	91	97
23	96	96	100	66	67	72	79	87	95	101
24	100	100	104	67	68	74	82	90	98	105
25	105	104	109	68	70	76	85	93	103	110
26	110	108	114	69	71	78	88	97	107	115
27	114	112	118	70	72	80	91	101	111	120
28	119	116	123	71	74	82	94	105	116	125
29	124	120	125	73	76	85	98	109	121	130
30	128	124	128	75	77	87	101	113	125	135
31	132	128	132	77	79	90	105	117	130	140
32	136	132	135	79	81	93	108	121	135	145
33	140	136	138	81	82	95	112	126	139	150
34	145	140	141	83	84	98	116	130	144	155
35	149	144	145	84	86	100	119	134	149	160
36	153	147	147	85	87	103	123	138	153	166
37	157	150	148	86	90	106	127	142	158	171
38	160	153	151	88	92	110	131	147	163	177
39	164	156	155	90	94	113	134	151	168	182
40	168	161	158	91	96	115	138	155	173	187
41	172	166	161	93	98	118	142	159	178	193
42	176	170	164	95	100	121	146	164	183	199
43	180	175	168	96	102	124	150	168	189	205
44	183	180	171	98	105	128	154	174	195	212
45	187	185	175	99	107	130	159	178	200	218
46	192	191	179	101	110	134	163	183	206	225
47	197	196	183	102	112	137	167	189	213	233
48	202	202	187	104	114	140	172	194	219	240
49	208	208	192	106	116	144	177	199	226	248
50	213	214	198	108	119	147	181	206	233	256
51	220	219	204	110	122	152	186	213	241	264

Time (min)	TC #301 (°F)	TC #302 (°F)	TC #303 (°F)	TC #304 (°F)	TC #305 (°F)	TC #306 (°F)	TC #307 (°F)	TC #308 (°F)	TC #309 (°F)	TC #310 (°F)
52	226	226	210	113	125	156	193	220	248	273
53	233	232	219	115	128	159	198	226	256	282
54	241	239	225	118	130	163	204	234	265	292
55	249	246	234	120	133	168	210	241	274	301
56	258	253	239	123	136	172	216	249	283	311
57	266	260	245	126	139	176	223	257	291	321
58	275	269	249	129	143	181	229	265	301	331
59	285	277	254	133	147	186	236	274	310	342
60	293	285	258	135	150	191	243	283	320	352
Max Temp:	293	285	258	135	150	191	243	283	320	352
Max Allowed:	389	388	388	386	386	387	387	388	389	389

Time (min)	TC #311 (°F)	TC #312 (°F)	TC #313 (°F)	TC #314 (°F)	TC #315 (°F)	TC #316 (°F)	TC #317 (°F)	TC #318 (°F)	TC #319 (°F)	TC #320 (°F)
0	64	65	65	64	64	65	64	64	64	65
1	64	65	65	64	64	64	64	64	64	64
2	64	65	65	64	64	64	64	64	64	64
3	64	65	65	64	65	65	65	64	64	65
4	64	65	65	64	65	65	65	65	64	65
5	65	65	65	65	65	65	65	65	65	65
6	65	65	65	65	65	65	65	65	65	65
7	65	66	66	65	65	65	66	66	66	66
8	66	67	67	66	66	66	67	67	67	67
9	67	67	67	66	66	67	68	68	68	68
10	68	68	68	67	67	68	69	69	69	70
11	69	69	69	68	68	70	71	70	70	71
12	70	70	70	69	69	71	73	72	72	72
13	72	71	71	70	70	73	75	74	73	74
14	73	73	72	71	72	75	77	76	75	76
15	75	74	74	72	73	77	79	79	78	79
16	77	76	75	74	75	80	82	81	80	81
17	79	78	77	76	77	82	85	84	83	84
18	82	81	79	78	79	86	88	88	87	88
19	85	83	81	80	82	89	92	91	90	92
20	88	86	84	82	85	92	96	95	94	96
21	92	89	87	85	87	96	100	100	99	101
22	96	93	91	88	91	100	104	105	104	106
23	100	97	94	92	94	104	109	110	109	111
24	104	101	98	95	98	109	115	115	115	117
25	109	105	103	99	103	114	120	121	121	123
26	114	110	107	104	107	119	126	127	127	129
27	119	115	112	109	112	124	132	133	133	136
28	124	121	117	113	117	130	138	139	139	142
29	130	126	123	119	122	136	145	146	146	148
30	135	131	128	124	128	142	152	152	152	154
31	140	137	134	130	133	149	160	158	157	160
32	146	143	139	135	139	156	168	165	163	165
33	151	148	145	141	145	164	176	171	169	170
34	156	154	151	147	151	172	185	178	175	176
35	162	159	156	152	157	180	195	186	181	181
36	167	164	161	158	164	189	205	194	187	187
37	172	168	166	163	170	198	216	202	194	193
38	178	173	170	168	176	208	228	212	201	199
39	183	178	175	173	182	218	241	222	209	207
40	189	183	179	177	189	230	254	233	217	214
41	195	188	184	182	196	243	269	245	227	222
42	201	194	189	187	203	256	286	258	237	231
43	208	201	194	192	211	271	303	272	248	241
44	214	207	200	198	220	287	322	286	259	251
45	221	214	207	205	230	304	342	302	272	262
46	229	222	215	213	241	323	365	319	285	273
47	237	230	222	221	253	344	390	337	299	284
48	245	239	231	230	266	367	418	355	313	296
49	253	247	240	240	280	393	449	376	328	309
50	262	257	250	251	296	421	484	398	344	321
51	271	267	261	263	312	451	520	421	361	334

Time (min)	TC #311 (°F)	TC #312 (°F)	TC #313 (°F)	TC #314 (°F)	TC #315 (°F)	TC #316 (°F)	TC #317 (°F)	TC #318 (°F)	TC #319 (°F)	TC #320 (°F)
52	281	277	271	276	330	483	556	446	378	348
53	290	287	283	289	348	516	594	471	396	362
54	301	298	295	302	367	549	632	498	415	376
55	311	309	306	316	387	581	668	524	434	391
56	321	321	319	330	407	614	704	550	453	405
57	332	332	332	345	428	645	741	577	473	421
58	343	344	344	360	449	678	782	604	493	436
59	354	356	358	375	471	713	824	631	513	452
60	365	368	371	391	493	746	865	657	533	467
Max Temp:	365	368	371	391	493	746	865	657	533	467
Max Allowed:	389	390	390	389	389	390	389	389	389	390

Time (min)	TC #321 (°F)	TC #322 (°F)	TC #323 (°F)	TC #324 (°F)	TC #325 (°F)	TC #326 (°F)	TC #327 (°F)	TC #328 (°F)	TC #329 (°F)	TC #330 (°F)
0	64	64	64	63	63	63	62	62	61	61
1	64	64	64	64	63	63	63	62	62	61
2	64	64	64	63	63	63	63	62	62	61
3	64	64	64	64	63	63	63	62	62	61
4	64	65	64	64	63	63	63	62	62	61
5	64	65	65	64	63	63	63	62	62	61
6	65	66	66	65	64	63	63	62	62	61
7	66	67	67	66	65	64	63	63	62	62
8	67	68	68	67	65	65	63	63	62	62
9	68	69	69	69	66	65	64	63	62	62
10	69	71	71	70	67	66	64	63	63	62
11	71	72	73	72	68	67	65	64	63	62
12	72	74	75	74	70	68	66	65	63	62
13	74	76	77	76	71	69	66	65	64	62
14	76	79	79	78	73	70	67	66	64	63
15	78	81	82	81	75	71	68	66	65	63
16	81	84	85	84	77	73	69	67	65	64
17	84	88	89	87	80	75	71	68	66	64
18	87	92	92	90	82	77	72	69	67	64
19	91	95	96	94	85	79	73	71	68	65
20	95	100	101	98	88	81	76	73	70	65
21	100	105	105	103	91	84	78	75	71	67
22	105	110	110	107	95	87	80	77	73	67
23	110	115	116	112	99	90	83	79	74	68
24	116	121	121	117	103	94	86	82	76	69
25	121	127	127	123	108	98	89	85	78	71
26	128	132	133	129	112	102	93	88	81	72
27	134	138	139	135	117	106	96	91	83	73
28	140	145	145	141	123	111	100	94	86	75
29	146	151	152	148	128	115	104	98	88	77
30	152	158	159	154	133	120	108	101	92	79
31	158	165	166	161	139	125	112	104	94	80
32	165	172	173	168	145	130	116	108	97	82
33	171	179	180	175	150	135	120	111	100	84
34	177	186	188	182	156	139	124	115	102	87
35	183	194	196	190	162	145	128	118	105	87
36	189	202	204	197	168	150	133	122	108	88
37	196	209	212	204	174	155	137	125	110	89
38	203	218	220	212	180	160	141	129	112	91
39	210	226	229	220	186	165	145	133	115	95
40	218	235	237	228	192	170	150	136	118	94
41	226	244	247	236	198	175	153	140	121	97
42	235	253	256	244	204	179	157	144	124	97
43	244	263	266	251	210	184	161	148	128	101
44	254	273	276	259	216	190	166	152	131	105
45	264	284	286	267	221	194	170	155	133	107
46	275	295	296	276	228	200	174	159	137	105
47	286	306	308	285	234	205	178	163	139	110
48	297	318	318	293	241	209	183	168	142	110
49	309	330	330	302	248	215	188	172	146	112
50	321	342	342	312	255	221	193	177	149	115
51	333	354	354	321	262	228	199	182	153	116

Time (min)	TC #321 (°F)	TC #322 (°F)	TC #323 (°F)	TC #324 (°F)	TC #325 (°F)	TC #326 (°F)	TC #327 (°F)	TC #328 (°F)	TC #329 (°F)	TC #330 (°F)
52	345	367	367	332	271	234	204	187	157	119
53	358	381	380	343	280	242	211	193	160	121
54	372	395	395	353	288	249	218	199	165	126
55	386	409	408	367	297	257	225	206	169	126
56	399	423	423	379	306	264	233	213	173	130
57	413	438	437	390	315	273	241	221	178	131
58	427	451	450	402	325	281	249	228	184	140
59	441	465	464	414	334	290	258	236	188	139
60	455	479	477	426	343	299	267	245	194	143
Max Temp:	455	479	477	426	343	299	267	245	194	143
Max Allowed:	389	389	389	388	388	388	387	387	386	386

Time (min)	TC #331 (°F)	TC #332 (°F)	TC #333 (°F)	TC #334 (°F)	TC #335 (°F)	TC #336 (°F)	TC #337 (°F)	TC #338 (°F)	TC #339 (°F)	TC #340 (°F)
0	60	61	61	61	61	61	61	61	62	62
1	60	61	61	61	61	61	61	61	62	62
2	61	61	62	61	61	61	62	62	62	62
3	61	61	62	61	62	62	62	62	62	62
4	61	61	61	62	62	62	62	62	62	63
5	61	61	62	62	63	63	63	63	63	64
6	61	61	62	63	64	64	65	65	65	66
7	61	61	62	63	64	65	66	66	66	67
8	61	61	62	63	65	67	67	67	68	69
9	61	61	62	64	66	68	68	69	69	70
10	61	61	62	64	67	68	69	70	70	71
11	61	61	63	65	68	70	70	71	72	73
12	61	61	63	66	69	71	72	73	74	76
13	61	61	64	67	70	73	74	75	76	78
14	61	61	64	68	72	75	77	78	79	82
15	61	61	65	70	75	78	80	81	83	86
16	61	61	66	71	77	81	83	84	87	90
17	61	62	67	74	80	85	87	88	91	95
18	61	62	68	77	84	89	92	94	97	101
19	61	62	70	80	89	95	99	101	104	108
20	61	62	73	85	95	102	106	109	111	116
21	61	62	76	90	101	108	113	116	119	124
22	62	63	79	95	108	115	120	124	127	131
23	62	63	82	101	114	122	128	131	134	139
24	62	64	86	106	121	129	135	139	142	147
25	62	64	89	112	128	136	142	146	150	154
26	63	65	94	119	135	143	149	153	157	161
27	63	65	98	125	142	150	155	160	164	167
28	63	66	102	132	149	157	164	167	171	172
29	64	67	107	138	156	164	172	174	178	178
30	64	68	111	144	163	170	180	182	187	184
31	65	69	116	151	171	178	188	191	196	194
32	65	70	120	158	180	187	197	200	205	203
33	66	72	125	165	189	197	206	210	215	213
34	67	73	130	172	198	206	216	221	226	224
35	67	74	134	179	208	217	227	233	238	238
36	68	76	139	187	218	229	239	246	252	253
37	69	77	143	195	229	242	253	261	267	269
38	70	78	148	204	241	256	267	276	283	286
39	70	80	154	213	254	271	283	292	299	304
40	71	81	160	224	267	286	299	310	317	323
41	72	83	166	235	281	303	316	328	336	343
42	73	85	173	247	296	320	335	348	357	365
43	74	86	180	258	311	338	355	368	378	387
44	75	88	187	272	327	357	375	389	400	409
45	76	90	195	286	344	377	397	412	423	432
46	77	92	204	301	362	398	420	435	447	457
47	78	94	213	317	380	419	444	459	471	481
48	80	96	222	333	400	440	468	484	496	506
49	81	98	232	349	420	463	495	511	522	532
50	82	101	242	367	440	485	521	537	549	559
51	84	103	253	384	462	509	549	565	576	586

Time (min)	TC #331 (°F)	TC #332 (°F)	TC #333 (°F)	TC #334 (°F)	TC #335 (°F)	TC #336 (°F)	TC #337 (°F)	TC #338 (°F)	TC #339 (°F)	TC #340 (°F)
52	85	106	263	402	484	533	577	593	604	614
53	87	108	274	419	506	557	606	621	633	641
54	89	112	285	436	528	582	635	651	662	669
55	90	114	296	453	549	607	662	679	691	697
56	92	118	307	470	571	632	688	707	721	725
57	94	121	318	487	592	658	713	735	750	752
58	96	124	329	505	614	682	738	762	777	780
59	98	128	340	522	636	707	764	789	806	807
60	100	131	351	539	658	732	791	816	833	834
Max Temp:	100	131	351	539	658	732	791	816	833	834
Max Allowed:	385	386	386	386	386	386	386	386	387	387

Time (min)	TC #341 (°F)	TC #342 (°F)	TC #343 (°F)	TC #344 (°F)	TC #345 (°F)	TC #346 (°F)	TC #347 (°F)	TC #348 (°F)	TC #349 (°F)	TC #350 (°F)
0	62	62	62	62	61	61	61	61	60	60
1	62	62	62	62	61	62	63	66	60	61
2	62	62	62	63	63	65	69	85	60	61
3	62	63	63	64	65	69	77	117	61	61
4	63	63	64	67	68	73	87	155	61	61
5	64	65	66	70	71	78	99	189	61	61
6	65	66	68	73	73	82	113	219	61	61
7	67	68	71	76	77	88	127	245	61	61
8	69	70	73	79	80	95	141	271	61	61
9	71	72	76	83	84	103	155	297	61	62
10	72	74	78	87	89	111	170	322	62	62
11	74	77	81	92	94	119	184	347	62	62
12	77	79	85	97	100	127	198	372	62	62
13	79	82	89	102	106	135	212	396	62	62
14	83	86	93	108	112	143	226	421	62	62
15	87	91	98	115	119	152	241	446	62	63
16	92	95	103	121	126	161	255	469	62	63
17	97	101	109	129	133	170	270	491	62	63
18	103	107	116	136	141	180	286	514	63	64
19	110	114	124	145	149	191	302	536	63	64
20	118	122	133	154	158	202	318	560	63	65
21	126	130	140	163	167	213	333	582	63	65
22	134	138	149	172	177	223	349	605	63	66
23	142	146	156	181	186	235	366	627	64	67
24	150	154	164	191	196	246	383	648	64	67
25	158	162	172	202	206	258	401	669	64	68
26	165	170	180	213	217	270	419	690	65	69
27	171	177	189	224	228	283	438	711	65	70
28	177	183	199	236	240	296	457	731	66	71
29	182	191	209	249	252	310	476	752	66	72
30	189	198	220	262	265	325	496	773	67	74
31	198	208	233	275	278	340	516	794	67	75
32	208	218	245	289	292	355	536	816	68	76
33	220	230	260	304	307	372	557	837	69	77
34	233	244	275	320	323	389	578	859	69	78
35	247	259	291	337	340	407	600	881	70	79
36	263	275	308	354	358	427	623	903	70	80
37	279	293	327	372	376	447	646	925	71	81
38	297	311	346	391	396	468	670	947	71	83
39	315	330	366	411	417	490	694	969	72	84
40	335	350	386	432	439	513	719	991	73	85
41	356	371	407	453	461	537	744	1012	73	87
42	377	394	429	475	484	561	769	1034	74	88
43	400	416	452	498	508	586	794	1056	75	90
44	423	440	474	522	532	612	819	1078	76	91
45	447	464	498	546	558	638	844	1099	76	93
46	472	489	522	571	584	664	869	1119	77	94
47	497	514	548	597	610	691	894	1139	78	96
48	523	540	573	623	637	717	918	1159	79	97
49	550	567	600	650	665	744	942	1178	80	99
50	577	594	627	677	693	771	966	1197	81	101
51	604	622	654	704	720	797	991	1215	81	103

Time (min)	TC #341 (°F)	TC #342 (°F)	TC #343 (°F)	TC #344 (°F)	TC #345 (°F)	TC #346 (°F)	TC #347 (°F)	TC #348 (°F)	TC #349 (°F)	TC #350 (°F)
52	632	650	682	731	747	823	1015	1233	82	105
53	660	677	710	758	775	850	1039	1252	83	107
54	687	705	737	786	802	876	1063	1270	84	109
55	714	732	764	813	829	902	1088	1288	85	111
56	741	758	792	841	856	929	1113	1307	86	113
57	768	785	819	868	884	956	1138	1325	87	115
58	795	812	847	896	911	983	1163	1342	88	117
59	822	839	875	924	940	1011	1187	1359	89	119
60	850	866	904	953	968	1039	1211	1374	90	121
Max Temp:	850	866	904	953	968	1039	1211	1374	90	121
Max Allowed:	387	387	387	387	386	386	386	386	385	385

Time (min)	TC #351 (°F)	TC #352 (°F)	TC #353 (°F)	TC #354 (°F)	TC #355 (°F)	TC #356 (°F)	TC #357 (°F)	TC #358 (°F)	TC #359 (°F)	TC #360 (°F)
0	60	60	60	60	60	60	60	60	60	60
1	60	60	60	60	60	60	60	60	60	60
2	60	61	61	60	60	60	61	60	61	61
3	60	61	61	61	62	61	61	61	62	61
4	61	62	63	63	64	63	63	63	63	63
5	62	65	65	65	66	65	65	65	65	65
6	64	66	67	67	68	68	67	67	67	66
7	65	68	69	69	70	70	70	69	69	68
8	66	70	71	71	72	72	72	71	70	69
9	67	71	73	73	75	74	74	73	72	71
10	68	73	75	76	77	77	76	75	74	73
11	69	74	77	78	80	80	79	78	77	75
12	70	77	80	82	84	84	82	81	80	77
13	72	80	84	86	89	89	87	85	84	81
14	74	84	88	91	94	94	92	90	89	85
15	77	87	93	96	100	100	97	95	93	89
16	79	92	98	102	107	106	103	100	99	94
17	82	97	104	108	113	113	109	106	104	99
18	87	103	112	117	122	121	116	115	112	106
19	92	112	121	127	131	130	125	124	120	114
20	98	120	130	137	140	139	134	132	129	122
21	103	128	139	145	148	147	142	140	137	131
22	109	135	147	153	156	155	150	148	145	138
23	114	143	155	161	163	162	157	156	153	146
24	120	149	161	168	170	168	165	162	161	154
25	125	155	168	175	176	174	172	169	168	161
26	130	162	174	182	181	180	180	176	176	168
27	135	168	181	189	186	185	187	183	183	176
28	140	173	187	196	191	191	194	190	193	184
29	144	180	194	204	198	200	201	199	202	194
30	149	186	202	213	210	211	210	210	212	204
31	153	194	211	223	222	222	220	221	223	215
32	158	202	221	233	233	233	231	232	235	227
33	163	211	232	244	246	246	243	245	247	239
34	168	220	244	255	259	259	256	258	260	252
35	174	230	256	268	273	273	270	272	274	266
36	182	241	269	281	287	288	285	287	289	281
37	189	252	283	295	302	304	300	302	304	296
38	197	264	297	309	318	321	317	319	319	312
39	205	277	312	325	334	339	334	336	336	329
40	213	290	327	341	351	357	353	354	354	346
41	221	304	344	358	368	376	372	374	372	365
42	230	318	361	376	386	395	393	393	391	385
43	239	332	380	394	404	414	413	413	411	405
44	249	348	400	415	423	433	433	433	432	427
45	259	364	421	436	443	453	453	454	453	449
46	270	380	442	458	463	473	474	474	475	473
47	280	396	463	478	482	494	494	495	498	498
48	291	412	484	498	502	514	516	517	522	524
49	302	427	504	518	521	535	538	539	546	550
50	312	442	524	538	541	556	560	562	571	575
51	323	458	544	559	561	578	582	584	595	599

Time (min)	TC #351 (°F)	TC #352 (°F)	TC #353 (°F)	TC #354 (°F)	TC #355 (°F)	TC #356 (°F)	TC #357 (°F)	TC #358 (°F)	TC #359 (°F)	TC #360 (°F)
52	334	473	563	579	581	600	605	608	618	624
53	344	488	582	598	601	622	629	631	642	648
54	354	502	600	618	621	644	652	655	666	673
55	364	517	618	638	641	668	676	679	689	698
56	374	531	636	658	661	691	700	703	713	723
57	384	546	655	678	682	714	724	726	737	749
58	394	560	673	697	702	737	748	749	760	774
59	403	573	691	717	721	759	772	770	782	796
60	413	588	710	736	740	781	793	789	802	824
Max Temp:	413	588	710	736	740	781	793	789	802	824
Max Allowed:	385	385	385	385	385	385	385	385	385	385

Time (min)	TC #361 (°F)	TC #362 (°F)	TC #363 (°F)	TC #364 (°F)	TC #365 (°F)	TC #366 (°F)	TC #367 (°F)	TC #368 (°F)	TC #369 (°F)	TC #370 (°F)
0	61	61	61	60	60	61	62	62	62	62
1	61	61	61	61	62	77	62	62	62	62
2	61	61	62	61	64	84	63	63	62	63
3	61	62	62	62	67	94	66	67	63	64
4	62	62	62	64	71	114	71	73	64	66
5	63	63	63	65	77	132	76	77	65	68
6	65	65	65	68	84	149	80	81	66	70
7	66	66	66	70	91	163	84	86	68	71
8	68	67	68	73	98	176	89	90	69	74
9	69	69	70	76	104	188	95	95	71	77
10	71	71	71	79	110	201	102	101	74	80
11	73	73	74	83	117	214	111	109	77	85
12	75	75	77	87	124	226	120	117	80	89
13	78	78	80	91	131	239	131	126	85	94
14	81	82	84	96	138	252	142	138	90	100
15	85	86	88	100	146	264	155	150	95	106
16	90	91	92	106	153	277	175	180	105	119
17	95	95	97	111	161	290	232	258	128	163
18	101	102	104	119	172	309	276	312	159	222
19	109	110	111	127	184	328	326	390	194	284
20	117	118	120	136	196	348	388	493	231	345
21	124	126	128	145	209	367	454	579	270	402
22	132	133	135	154	222	386	524	653	319	464
23	140	141	143	164	236	405	616	728	403	544
24	147	149	152	174	252	424	705	810	499	630
25	154	157	160	185	268	443	786	893	593	709
26	161	164	168	196	285	464	866	975	685	798
27	169	171	177	208	301	485	941	1038	777	882
28	176	179	185	220	318	505	1011	1090	877	961
29	186	189	195	233	335	523	1073	1139	966	1031
30	196	201	206	246	353	541	1129	1187	1031	1092
31	207	213	218	261	370	559	1177	1222	1137	1198
32	219	225	231	276	388	577	1229	1265	1395	1406
33	231	239	244	291	406	595	1281	1310	1433	1442
34	245	254	259	307	423	613	1326	1348	1457	1466
35	259	269	274	323	440	630	1363	1377	1475	1482
36	274	286	291	340	457	647	1390	1407	1487	1493
37	290	303	308	356	473	664	1420	1439	1505	1512
38	307	321	326	372	491	682	1451	1469	1525	1533
39	325	339	344	389	507	699	1478	1493	1536	1545
40	343	358	362	407	525	718	1499	1510	1551	1561
41	362	378	381	425	543	736	1517	1532	1564	1572
42	382	397	401	443	561	755	1538	1554	1572	1582
43	403	417	420	461	578	778	1559	1575	1579	1591
44	423	437	439	480	597	802	1578	1593	1589	1598
45	445	458	460	500	617	827	1594	1611	1602	1612
46	467	480	481	521	638	851	1611	1632	1613	1623
47	490	502	503	542	659	878	1629	1646	1620	1629
48	513	524	525	564	683	901	1646	1665	1633	1643
49	536	547	547	587	708	927	1660	1678	1641	1649
50	560	570	571	612	737	954	1672	1689	1644	1652
51	585	595	596	638	765	979	1682	1697	1654	1661

Time (min)	TC #361 (°F)	TC #362 (°F)	TC #363 (°F)	TC #364 (°F)	TC #365 (°F)	TC #366 (°F)	TC #367 (°F)	TC #368 (°F)	TC #369 (°F)	TC #370 (°F)
52	609	619	621	665	792	997	1691	1706	1658	1666
53	634	645	647	692	822	1013	1700	1715	1667	1674
54	659	670	672	720	851	1025	1706	1720	1671	1676
55	684	695	698	748	879	1035	1713	1727	1678	1686
56	709	720	723	776	906	1044	1719	1733	1684	1691
57	734	745	747	802	930	1055	1724	1740	1688	1692
58	759	769	771	828	950	1065	1730	1746	1694	1701
59	783	790	791	852	966	1076	1735	1750	1699	1705
60	804	813	815	874	980	1087	1739	1754	1703	1709
Max Temp:	804	813	815	874	980	1087	1739	1754	1703	1709
Max Allowed:	386	386	386	385	385	386	387	387	387	387

Time (min)	TC #371 (°F)	TC #372 (°F)	TC #373 (°F)	TC #374 (°F)	TC #375 (°F)	TC #376 (°F)	TC #377 (°F)	TC #378 (°F)	TC #379 (°F)	TC #380 (°F)
0	62	62	62	62	62	62	62	62	62	62
1	62	62	62	62	62	62	62	62	62	62
2	62	63	63	62	62	62	65	63	66	64
3	63	64	64	63	63	63	70	67	72	69
4	65	66	66	66	65	65	76	71	77	73
5	67	69	69	68	67	67	80	75	81	77
6	70	71	72	71	70	70	83	79	86	80
7	72	74	75	74	72	72	88	81	93	83
8	75	77	79	77	75	76	94	85	101	88
9	79	80	83	80	78	79	103	90	110	95
10	82	83	86	84	81	82	111	96	119	102
11	86	86	90	89	84	86	119	103	128	111
12	90	91	95	94	88	90	129	111	138	120
13	95	96	101	101	93	95	143	119	147	129
14	101	103	108	108	100	102	157	128	155	136
15	108	110	116	116	108	109	171	137	164	145
16	124	126	137	131	125	129	209	153	926	898
17	160	166	190	163	157	183	291	181	1172	1156
18	199	209	271	197	195	247	371	234	1218	1197
19	241	256	338	235	242	315	455	293	1251	1226
20	283	300	411	276	286	388	534	350	1257	1227
21	327	351	494	319	331	474	601	412	1252	1221
22	392	419	577	380	387	557	1093	971	1253	1223
23	506	510	661	485	471	635	1244	1222	1296	1272
24	625	607	745	599	568	711	1251	1237	1321	1300
25	723	700	825	700	666	797	1266	1256	1328	1304
26	823	785	898	797	755	878	1291	1286	1346	1328
27	909	866	965	887	843	949	1314	1316	1370	1350
28	985	941	1030	968	922	1016	1334	1330	1381	1363
29	1053	1013	1089	1041	998	1077	1354	1349	1407	1389
30	1114	1079	1145	1104	1066	1133	1374	1367	1427	1410
31	1166	1138	1193	1158	1127	1182	1396	1390	1444	1428
32	1219	1197	1243	1213	1187	1232	1416	1417	1463	1450
33	1272	1255	1293	1266	1244	1282	1440	1443	1484	1473
34	1319	1306	1337	1313	1296	1326	1455	1459	1498	1490
35	1357	1348	1372	1349	1338	1355	1470	1475	1511	1505
36	1384	1377	1402	1380	1365	1389	1485	1490	1524	1517
37	1415	1408	1435	1411	1398	1422	1501	1506	1537	1532
38	1448	1443	1465	1443	1433	1454	1517	1523	1551	1547
39	1475	1473	1490	1472	1464	1481	1529	1534	1567	1564
40	1497	1496	1510	1494	1489	1504	1546	1549	1576	1573
41	1516	1516	1531	1513	1510	1522	1559	1563	1591	1587
42	1537	1537	1552	1533	1531	1543	1572	1574	1601	1596
43	1558	1559	1572	1553	1552	1564	1580	1580	1609	1606
44	1576	1577	1590	1571	1571	1582	1592	1592	1615	1613
45	1592	1591	1607	1588	1589	1601	1604	1602	1630	1627
46	1608	1611	1625	1606	1608	1620	1616	1613	1638	1635
47	1627	1631	1641	1624	1626	1637	1628	1623	1649	1646
48	1643	1647	1657	1640	1643	1653	1639	1633	1657	1655
49	1657	1662	1671	1654	1657	1667	1648	1640	1663	1661
50	1668	1673	1682	1666	1669	1679	1656	1647	1672	1670
51	1678	1683	1691	1677	1680	1688	1666	1657	1678	1676

Time (min)	TC #371 (°F)	TC #372 (°F)	TC #373 (°F)	TC #374 (°F)	TC #375 (°F)	TC #376 (°F)	TC #377 (°F)	TC #378 (°F)	TC #379 (°F)	TC #380 (°F)
52	1687	1693	1700	1686	1689	1697	1672	1661	1683	1682
53	1695	1701	1709	1695	1698	1707	1679	1667	1692	1690
54	1703	1708	1715	1702	1705	1714	1687	1675	1696	1694
55	1710	1715	1723	1709	1712	1721	1691	1678	1700	1699
56	1715	1721	1729	1715	1718	1727	1696	1683	1707	1705
57	1721	1727	1735	1720	1724	1733	1701	1687	1714	1713
58	1726	1733	1740	1726	1730	1739	1706	1693	1717	1717
59	1732	1738	1745	1731	1735	1744	1711	1698	1721	1718
60	1736	1742	1749	1736	1740	1748	1716	1702	1727	1724
Max Temp:	1736	1742	1749	1736	1740	1748	1716	1702	1727	1724
Max Allowed:	387	387	387	387	387	387	387	387	387	387

Time (min)	E119 Std Average (°F)	Furnace Average (°F)	Integration of Furnace Average (°F·min)	Integration of E119 Std Average (°F·min)	Error (%)	Furnace Probe #1 (°F)	Furnace Probe #2 (°F)	Furnace Probe #3 (°F)	Furnace Probe #4 (°F)	Furnace Probe #5 (°F)
0	68	63	0	0	0.00	65	63	63	bad TC	62
1	254	215	25	139	-15.4	bad TC	229	134	bad TC	163
2	441	682	328	588	54.8	bad TC	820	426	631	612
3	627	1001	1107	1429	59.5	bad TC	1079	777	985	1028
4	814	1063	2072	2461	30.6	1075	1057	911	1046	1102
5	1000	1074	3073	3529	7.4	1082	1028	959	1054	1111
6	1060	1077	4079	4604	1.6	1078	1011	984	1055	1114
7	1120	1121	5100	5703	0.1	1149	1053	1018	1084	1152
8	1180	1185	6180	6856	0.5	1232	1111	1074	1134	1211
9	1240	1232	7318	8065	-0.7	1272	1146	1127	1178	1253
10	1300	1259	8493	9310	-3.1	1301	1171	1160	1205	1276
11	1328	1294	9698	10587	-2.5	1338	1207	1194	1236	1310
12	1347	1329	10938	11899	-1.3	1368	1245	1230	1270	1343
13	1364	1360	12212	13243	-0.3	1397	1284	1260	1301	1369
14	1381	1386	13514	14616	0.4	1425	1312	1287	1326	1392
15	1396	1404	14841	16012	0.6	1440	1327	1307	1343	1412
16	1410	1415	16182	17421	0.3	1450	1338	1323	1354	1420
17	1424	1416	17530	18836	-0.6	1452	1336	1332	1358	1424
18	1436	1435	18883	20261	-0.1	1464	1375	1350	1384	1445
19	1448	1465	20262	21711	1.2	1510	1431	1391	1435	1467
20	1459	1484	21668	23186	1.7	1542	1465	1427	1471	1479
21	1470	1484	23085	24670	0.9	1536	1466	1444	1481	1475
22	1480	1478	24498	26151	-0.1	1529	1461	1448	1482	1468
23	1490	1480	25909	27630	-0.7	1542	1468	1463	1489	1467
24	1499	1483	27321	29111	-1.1	1550	1479	1480	1500	1465
25	1508	1488	28738	30596	-1.4	1563	1491	1496	1511	1464
26	1517	1496	30160	32088	-1.4	1579	1504	1510	1522	1469
27	1525	1509	31593	33591	-1.1	1595	1521	1525	1534	1479
28	1533	1519	33038	35105	-0.9	1603	1539	1540	1547	1487
29	1541	1529	34493	36628	-0.8	1622	1547	1554	1557	1494
30	1549	1540	35958	38163	-0.5	1633	1558	1563	1564	1505
31	1556	1550	37434	39708	-0.4	1640	1570	1574	1575	1513
32	1563	1559	38919	41262	-0.3	1657	1579	1585	1583	1521
33	1570	1568	40413	42826	-0.1	1664	1586	1594	1591	1530
34	1576	1570	41914	44394	-0.4	1659	1586	1597	1593	1534
35	1583	1572	43417	45965	-0.7	1659	1588	1600	1596	1536
36	1589	1576	44923	47540	-0.8	1666	1592	1605	1599	1539
37	1595	1581	46433	49118	-0.9	1670	1596	1610	1604	1543
38	1601	1586	47947	50701	-0.9	1679	1602	1618	1611	1548
39	1606	1592	49467	52290	-0.9	1688	1605	1623	1615	1554
40	1612	1597	50993	53885	-0.9	1688	1614	1629	1621	1559
41	1617	1603	52525	55485	-0.9	1691	1619	1636	1628	1565
42	1623	1608	54062	57090	-0.9	1699	1624	1643	1634	1571
43	1628	1613	55604	58700	-0.9	1701	1628	1645	1637	1575
44	1633	1618	57151	60316	-0.9	1706	1632	1650	1641	1580
45	1638	1623	58702	61936	-0.9	1713	1641	1657	1648	1585
46	1643	1629	60260	63562	-0.9	1719	1645	1661	1652	1591
47	1648	1634	61823	65193	-0.8	1722	1652	1668	1658	1597
48	1652	1639	63391	66830	-0.8	1727	1655	1672	1663	1601
49	1657	1643	64963	68470	-0.9	1732	1656	1676	1666	1605

Time (min)	E119 Std Average (°F)	Furnace Average (°F)	Integration of Furnace Average (°F·min)	Integration of E119 Std Average (°F·min)	Error (%)	Furnace Probe #1 (°F)	Furnace Probe #2 (°F)	Furnace Probe #3 (°F)	Furnace Probe #4 (°F)	Furnace Probe #5 (°F)
50	1661	1648	66539	70115	-0.8	1736	1663	1681	1670	1609
51	1666	1654	68121	71766	-0.7	1746	1674	1686	1677	1615
52	1670	1659	69710	73423	-0.7	1746	1678	1692	1683	1620
53	1674	1664	71303	75084	-0.6	1755	1680	1697	1688	1626
54	1678	1669	72901	76751	-0.5	1751	1688	1701	1692	1630
55	1682	1674	74504	78422	-0.5	1760	1694	1706	1698	1635
56	1686	1679	76111	80099	-0.5	1763	1698	1709	1701	1640
57	1690	1684	77724	81780	-0.4	1771	1702	1715	1705	1645
58	1694	1688	79341	83466	-0.4	1773	1704	1719	1710	1649
59	1698	1692	80963	85155	-0.3	1776	1706	1723	1713	1654
60	1701	1696	82588	86849	-0.3	1782	1713	1728	1718	1659

Time (min)	Furnace Probe #6 (°F)	Furnace Probe #7 (°F)	Furnace Probe #8 (°F)	Furnace Probe #9 (°F)	Furnace Probe #10 (°F)	Furnace Probe #11 (°F)	Furnace Probe #12 (°F)	Lab Ambient (°F)
0	62	62	62	62	63	62	62	65
1	251	252	359	153	291	158	161	65
2	778	774	1098	487	791	553	537	65
3	1128	1050	1197	816	1111	916	920	65
4	1161	1110	1161	966	1126	1003	1033	65
5	1150	1131	1126	1031	1122	1025	1064	65
6	1148	1139	1104	1063	1117	1032	1074	65
7	1191	1208	1144	1109	1173	1064	1111	65
8	1272	1282	1206	1166	1241	1120	1176	65
9	1326	1332	1252	1213	1287	1168	1225	65
10	1361	1354	1274	1245	1311	1198	1255	65
11	1411	1382	1314	1275	1342	1230	1291	65
12	1463	1415	1348	1307	1373	1263	1324	65
13	1488	1452	1373	1338	1407	1298	1351	65
14	1519	1479	1400	1364	1435	1324	1374	65
15	1533	1496	1428	1384	1447	1340	1396	65
16	1544	1501	1436	1397	1454	1352	1406	65
17	1534	1500	1430	1404	1450	1355	1411	65
18	1547	1514	1435	1422	1474	1382	1426	65
19	1520	1561	1441	1465	1479	1427	1453	66
20	1502	1583	1440	1498	1471	1461	1472	65
21	1482	1579	1429	1506	1460	1472	1475	65
22	1466	1568	1418	1506	1450	1473	1472	65
23	1464	1561	1414	1501	1446	1472	1467	65
24	1465	1568	1414	1491	1447	1473	1463	65
25	1467	1574	1413	1488	1448	1477	1461	66
26	1473	1584	1419	1491	1453	1486	1465	65
27	1483	1596	1431	1500	1464	1500	1475	65
28	1494	1604	1439	1507	1473	1511	1483	65
29	1502	1613	1448	1515	1482	1522	1491	65
30	1510	1626	1463	1526	1495	1536	1505	65
31	1520	1634	1470	1533	1505	1548	1514	66
32	1529	1640	1478	1541	1515	1557	1521	66
33	1538	1651	1488	1549	1525	1567	1530	66
34	1543	1650	1491	1552	1529	1571	1534	66
35	1546	1650	1495	1554	1532	1574	1536	66
36	1549	1651	1499	1556	1537	1579	1540	66
37	1555	1654	1504	1560	1542	1585	1544	66
38	1562	1654	1509	1564	1547	1589	1547	66
39	1567	1664	1517	1572	1552	1595	1554	66
40	1574	1667	1521	1577	1558	1600	1557	66
41	1580	1674	1526	1581	1564	1606	1563	66
42	1586	1674	1532	1587	1568	1611	1568	66
43	1590	1684	1538	1591	1574	1616	1574	66
44	1595	1688	1545	1595	1580	1621	1578	66
45	1600	1691	1547	1600	1585	1628	1583	66
46	1606	1697	1556	1606	1591	1633	1589	66
47	1613	1700	1562	1610	1596	1638	1593	66
48	1617	1705	1566	1615	1601	1643	1598	66
49	1621	1710	1571	1619	1606	1647	1602	66

Time (min)	Furnace Probe #6 (°F)	Furnace Probe #7 (°F)	Furnace Probe #8 (°F)	Furnace Probe #9 (°F)	Furnace Probe #10 (°F)	Furnace Probe #11 (°F)	Furnace Probe #12 (°F)	Lab Ambient (°F)
50	1625	1714	1577	1623	1611	1654	1608	66
51	1632	1718	1585	1629	1617	1660	1613	66
52	1638	1719	1589	1634	1622	1664	1618	66
53	1643	1727	1595	1640	1628	1669	1624	66
54	1648	1734	1599	1646	1634	1675	1630	66
55	1654	1734	1605	1649	1639	1679	1634	66
56	1659	1739	1612	1654	1644	1684	1640	66
57	1663	1744	1617	1659	1650	1690	1645	66
58	1668	1748	1620	1664	1654	1693	1650	66
59	1672	1754	1626	1668	1658	1697	1654	66
60	1676	1754	1631	1671	1663	1701	1658	66

Appendix E

HEMYC INSTALLATION PROCEDURES

ISSUE DESIGNATION IN THIS COL INDICATES CURRENT CHANGE

FABRICATION OF HEMYC PROTECTIVE WRAP SYSTEM COMPONENTS

1.0 PURPOSE

The purpose of this procedure is to assure that the fabrication of the HEMYC Cable Protection System Components is consistent with the system components as tested in the various qualification tests. The Fire Qualification Test, referenced as CTP-1026, consisted of a One (1) Hour Fire Exposure, per ASTM E-119 criteria, including hose stream in accordance with the American Nuclear Insurers Information Bulletin No. 5(79) entitled, "ANI/MAERP Standard Fire Endurance Test Method to Qualify a Protective Envelope for Class Circuits".

2.0 SCOPE

This procedure provides the methods and guidelines for the fabrication of both cable tray and conduit protection system components. The fabrication and quality verification shall be performed on-site by Client personnel that have been trained and certified by PROMATEC.

3.0 REFERENCE

3.1 10CFR50, Appendix R

3.2 ANI Bulletin No. 5(79)

3.3 HEMYC Fire Qualification Test, CTP-1026

3.4 ANI Acceptance dated 08/02/82

3.5 QCP-10001, Packaging, Shipping, Receiving, Handling and Storage for HEMYC Protective Wrap Components

3.6 QCP-10002, Fabrication Inspection for HEMYC Protective Wrap Components

3.7 HEMYC Protective Wrap System Typicals, PROMATEC Drawings B-310, B-311, B-312 and B-313

4.0 DEFINITIONS

None

5.0 RESPONSIBILITIES

5.1 The authorized Installer's ENGINEERING DEPARTMENT shall be responsible to define the scope of work as prescribed on the applicable contract documents and to provide the applicable drawings, specifications, requirements, instructions, etc., to the department responsible for fabrication and installation.

This department shall also be responsible to provide liaison with applicable client personnel and other internal departments to assure a smooth flow of communication.

5.2 The authorized Installer's PRODUCTION DEPARTMENT shall be responsible for the identification and scheduling of work to be performed as defined on the documents furnished by ENGINEERING.

The Installer's FABRICATION DEPARTMENT, as trained and certified by PROMATEC, shall be responsible for the initiation of appropriate Fabrication Orders, verify their authenticity, initiate appropriate procurement documents and provide these documents to the fabrication facility.

5.3 The Installer's QUALITY CONTROL PERSONNEL, as trained and certified by PROMATEC, shall be responsible for appropriate inspection, documentation and monitoring.

6.0 PROCEDURE

6.1 Only approved materials as listed below shall be utilized in the fabrication of HEMYC Cable Protection System Components.

ACCEPTABLE MATERIALS

6.1.1 External Fabric

A. Siltemp WR84CSR, Thermal Barrier Cloth, 0.030 nom. thickness, 18oz/yd^2

B. or Approved equal

6.1.2 Internal Fabric

A. Klever 600/6 or J.P. Stevens #332 Fiberglass Cloth, 49" width, 13oz/yd^2

B. or Approved equal (Internal fabric may be used on the non-fire side of protective blanket as necessary. If used, external fabric must overlap a minimum of six (6") inches on to non-fire side.

6.1.3 Internal Filler

A. Johns-Manville Cerablanket
6 or 8 lb density
0.5, 1.5 and/or 2.0 inch thickness

OR

B. Babcock & Wilcox Kaowool Ceramic Fiber Blanket
6 or 8 lb density
0.5, 1.5 and/or 2.0 inch thickness

OR

ISSUE DESIGNATION IN THIS COLL INDICATES CURRENT CHANGE

C. Approval equal

6.1.4 Thread

A. Astroquartz sewing thread Type Q-24 Teflon coated; approximately .020" diameter
Breaking Strength -- 20 lbs

OR

B. Alphaquartz sewing thread Type Q-24 Teflon coated; approximately .020" diameter
Breaking Strength -- 20 lbs

OR

C. Approved equal

6.2 Fabrication Order (Form QC-59)

6.2.1 The completed Fabrication Order (Form QC-59) shall be provided to the fabrication facility.

6.2.2 This form shall define information as listed below:

A. Fabrication Order

B. Blanket Number

C. Project Number

D. Project Name

E. Location -- building, room, elevation

F. Drawing Reference

G. Blanket Length

H. Width

I. Thickness ___0.5", ___1.5", ___2"

J. Tray Identification

K. Conduit Identification

L. Other -- General comments, description, etc.

M. Sketch -- Brief sketch as required

N. Client Acceptance

O. Certification

P. Ordered by and Date

Q. PROMATEC QA/QC Acceptance and Date

If any information is not required, N/A shall be inserted in the applicable area.

6.3 Manufacture of Protective Wrap Components

6.3.1 Initial Envelope Assembly (Figure 1)

6.3.1.1 Cut external and internal (if required) fabrics to proper dimensions - as defined by fabricator to assure proper finished dimensions as specified on the applicable fabrication order. As applicable, fabricator shall measure from the "finished" edge of fabrics not the "factory" edge.

6.3.1.2 Double stitch external and internal fabrics together as shown in Figure 1. If only external fabric is used double stitch fabric together as shown in Figure 1A.

6.3.1.3 Double stitch one end of blanket as shown in Figure 2/2B, if applicable. Fabricator may elect to insert blanket prior to closure of either end. In this case, refer to Item 6.3.3.2 for instructions.

During fabrication of wraps it may be necessary to use staples, pins or clips to hold fabrics together while sewing. These may remain within the system but shall not damage or be detrimental to the wrap.

6.3.1.4 Turn envelope assembly inside out to hide exposed rough edges of fabric and provide a "finished" seam appearance.

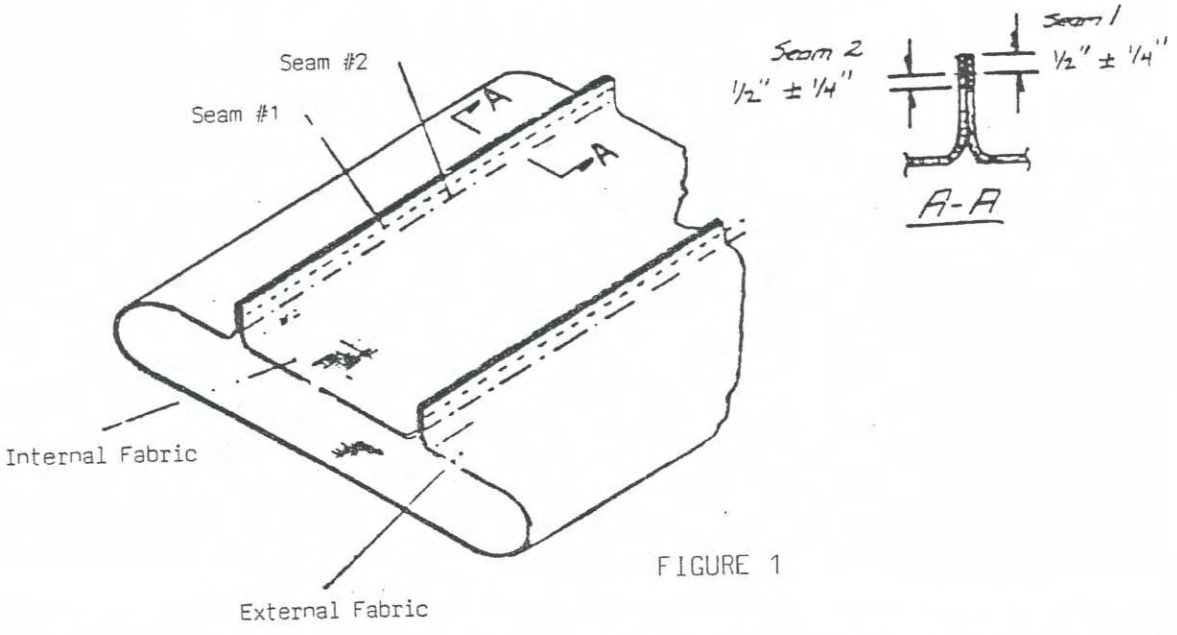


FIGURE 1

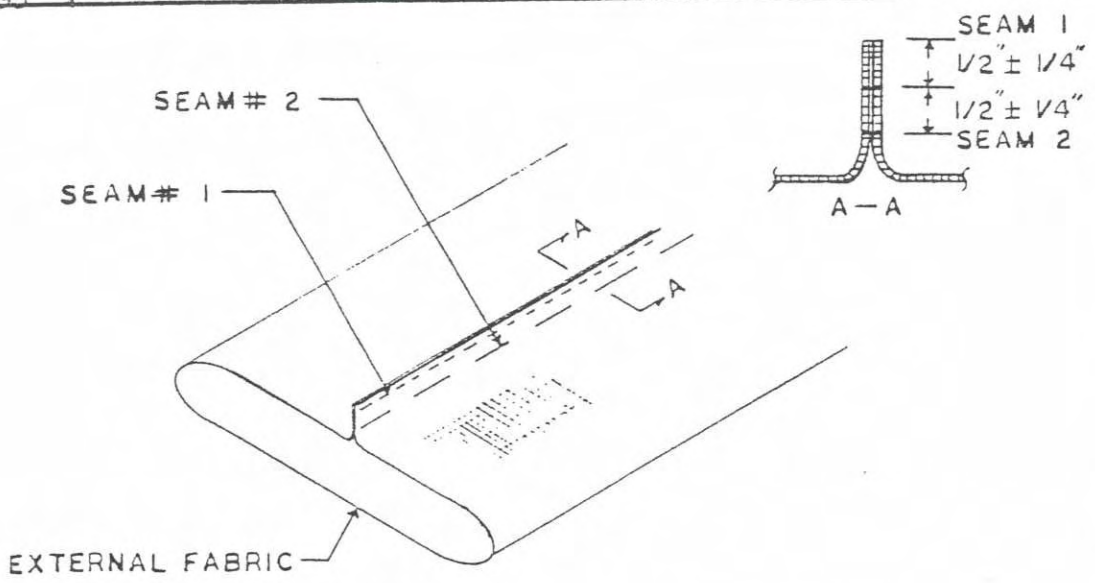
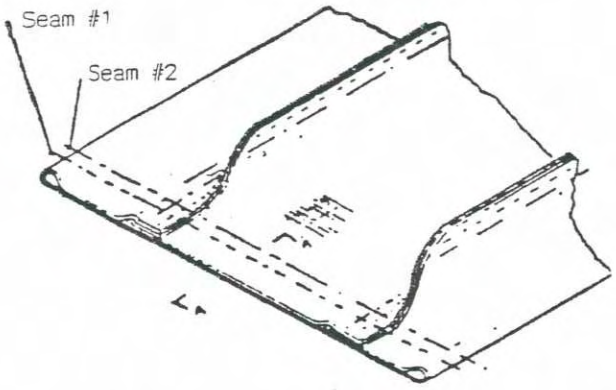


FIGURE 1A



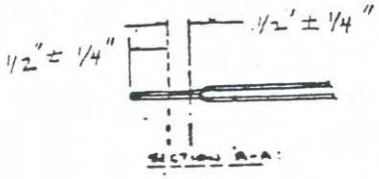
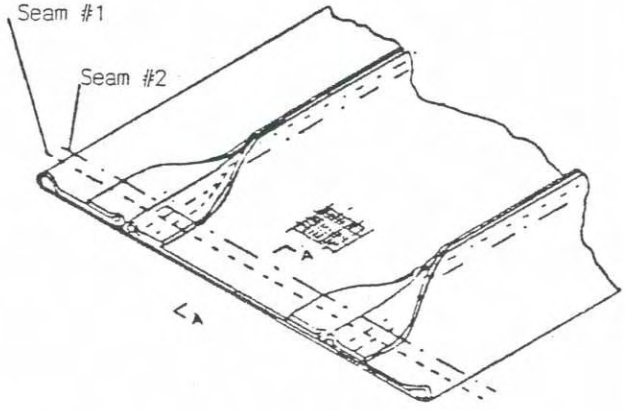


FIGURE 2

OR



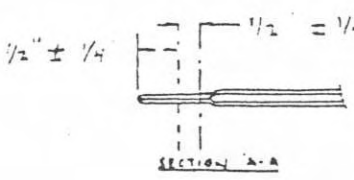


FIGURE 2B

6.3.2 Insertion of Filler Material

6.3.2.1 Cut filler material to proper size (as defined by fabricator to assure proper finished dimension) 0.5" thick - HEMYC Wrap; 1.5" thick - Cable Tray; 2" thick - Conduit.

6.3.2.2 Multiple pieces of filler material may be required to fabricate wraps. To prevent joint gaps in filler material, trim pieces as shown in Figure 3 and secure "darts" spaced on maximum nine (9") inch centers for two (2") inch blankets or four (4") inch hand sewn seam (See Figure 4) for 0.5" and 1.5" blankets. Darts or seam shall be placed parallel to overlap pieces a minimum six (6") inches = 1" from center line of overlap.

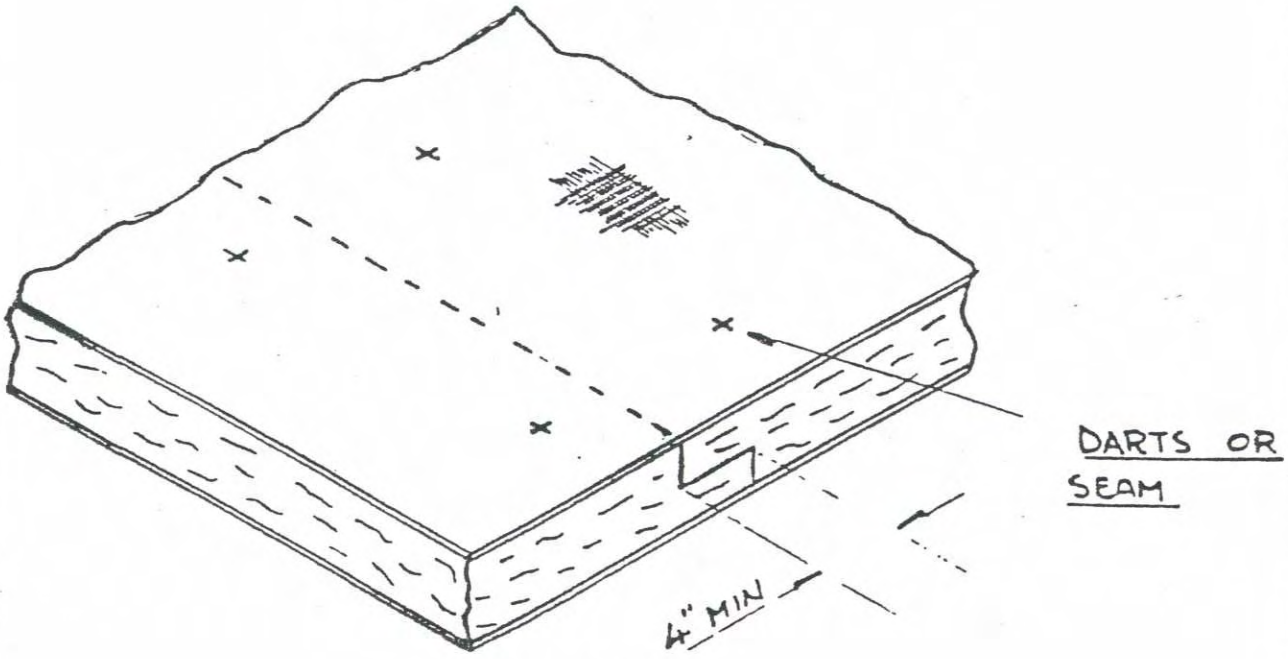


FIGURE 3

6.3.2.3 Insert filler material inside envelope assembly assuring that filler material is kept flat and occupies the entire interior of the envelope and is relatively tight.

6.3.2.4 If filler material has a tendency to "bunch up" during installation, the fabricator shall smooth by hand or use other means to assure total fill. Method used shall not cause damage or be detrimental to the Wrap System.

NOTE: If filler material appears to be too large creating "puckers" at

stitches, remove filler material and trim as necessary.

6.3.3 Completion of Envelope Assembly

6.3.3.1 Roll under fabric at open end and double stitch as shown in Figure 4A.

6.3.3.2 If both ends were left open until insertion of filler material, both ends shall now be closed as shown in Figure 4A.

6.3.4 Longitudinal Stitching

6.3.4.1 Longitudinal stitching shall be performed as shown in Figure 4. When multiple widths of filler material are required (Item 6.3.2.2) a minimum of two (2) rows of longitudinal stitches must be in each multiple width.

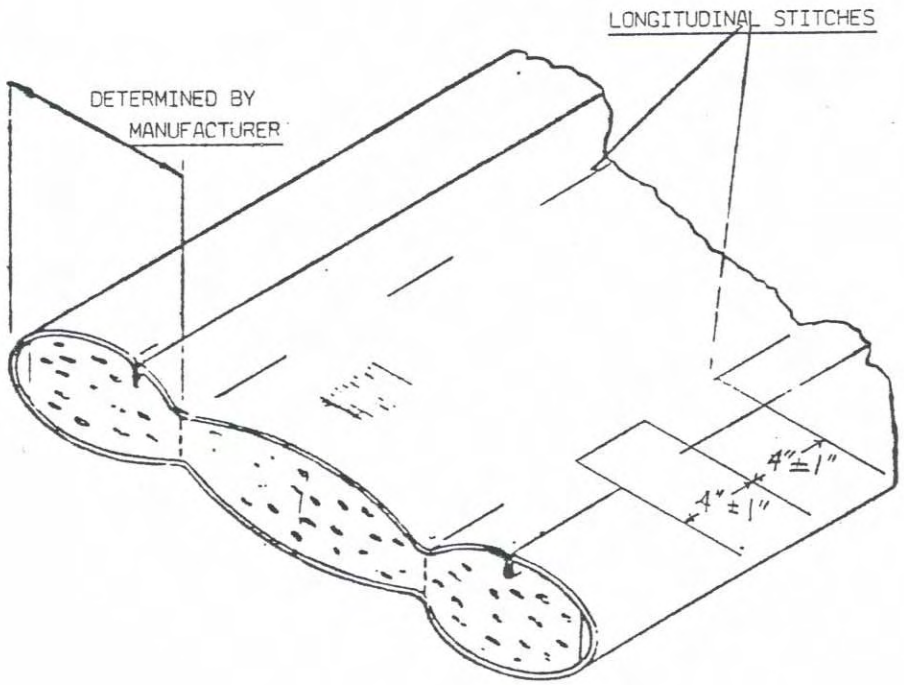


FIGURE 4
Typical Section Through Blanket

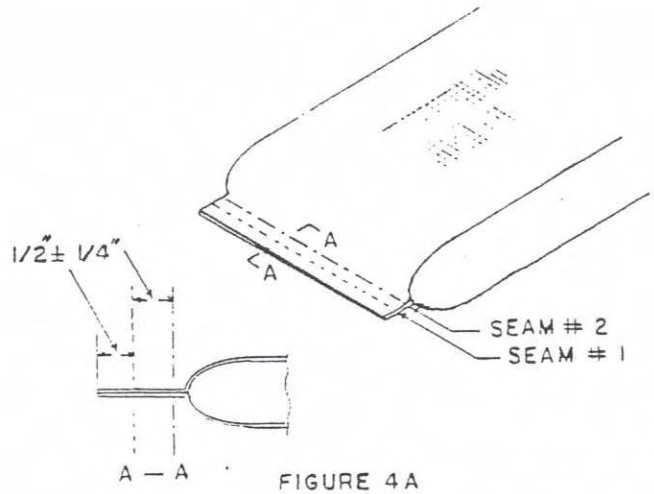


FIGURE 4A

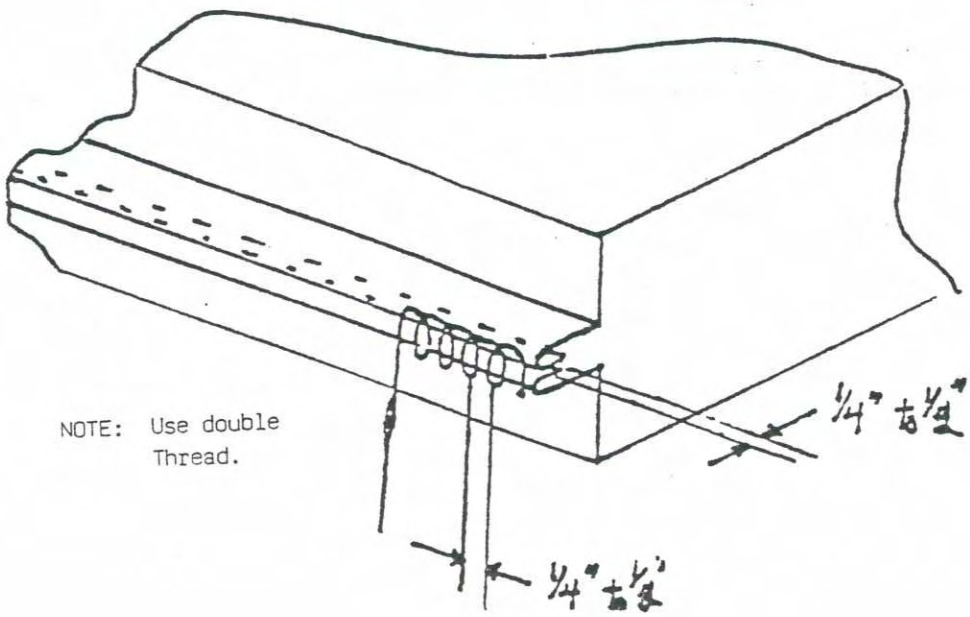


FIGURE 4B
ALTERNATE BLANKET CLOSURE
HAND SEWN METHOD

6.3.4.2 The specific placement of the longitudinal stitches is at the discretion of the fabricator.

6.3.4.3 Darts or similar may be used instead of longitudinal seams to secure the filler material in position. Refer to Figure 5.

6.3.4.4 The following requirements shall be complied with for darting/stitching to secure the filler material in position for HEMYC Blankets:

A) Any blanket with a circumferential dimension of sixteen (16") inches or less need not be darted if the filler material is of one piece.

B) Any blanket with a circumferential dimension of more than sixteen (16") inches but less than twenty-four (24") inches shall have at least one row of darts/stitches. Every multiple of eight (8") inches in that same dimension shall require an additional row of darts/stitches thereafter. Blankets with multiple pieces of filler material shall have at least one row of darts/stitches per piece.

C) For stitching to secure filler material the distance, in length, between stitches shall not exceed four (4") inches. For darts the distance shall not exceed nine (9") inches.

D) Equidistant placement of darts across the circumferential dimension is required unless there are multiple pieces of filler material, then the requirements of Item B above also apply.

E) All tolerances in darting/stitching shall be $\pm$ 1/4 inch.

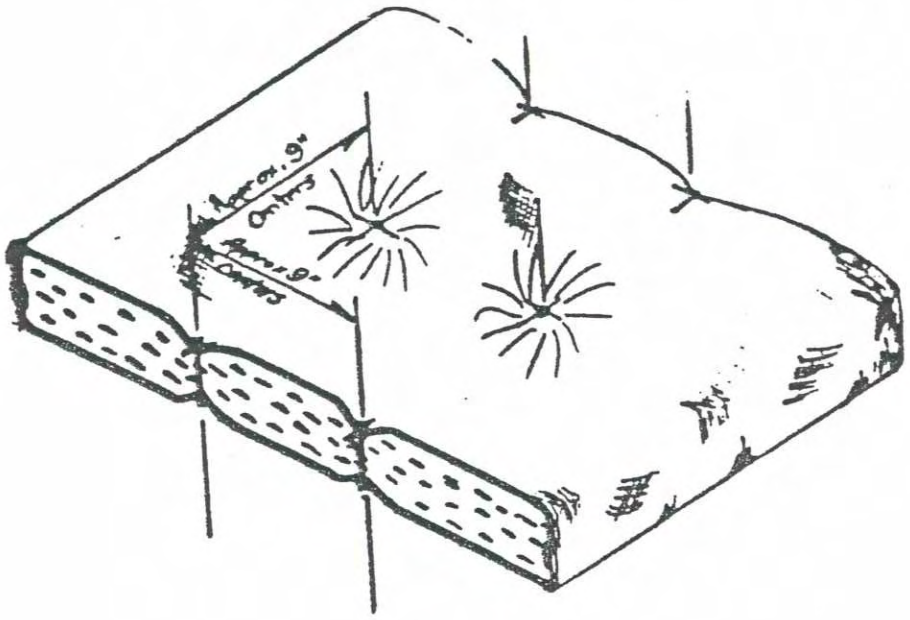


FIGURE 5

ISSUE DESIGNATION IN THIS COL INDICATES CURRENT CHANGE

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6.4 Fabricator Inspector

6.4.1 The fabricator shall assure that the completed wrap assembly conforms to the requirements specified on the applicable fabrication order.

6.4.2 This inspection by fabricator shall be in addition to verification by QC as defined in QCP-10002.

6.5 Identification Markings

6.5.1 Identification markings shall be placed on each wrap assembly at a minimum of two locations.

A) In close proximity to one of the lengthwise edges on the exposed surface.

B) In close proximity to one of the ends on the exposed surface.

C. Various project requirements may specify that this marking is also provided on the interior (non-fire) surface.

6.5.2 These markings shall be the blanket number as defined on the applicable fabrication order.

6.5.3 Markings shall be of a waterproof paint or ink which will retain the marking, withstand weathering deterioration, and other handling effects and shall not be deleterious to the fabric.

6.5.4 These markings shall be in characters no less than three-fourths (3/4") inches (19mm) high.

7.0 ATTACHMENTS

None

PROMATEC

PROMATEC

PROGRESSIVE MATERIALS AND TECHNOLOGIES, INC.

PROCEDURE FOR:	PROCEDURE NUMBER:
INSTALLATION OF HEMYC PROTECTIVE WRAP SYSTEM ONTO SINGLE OR MULTIPLE CONDUITS	IP-8400.103

PROCEDURE ISSUE SUMMARY

ISSUE/DATE	PREPARER	APPROVED	COMMENTS
F ISSUE 01/25/95	L.C. Spriggs	R.J. Block	Revised as noted. Issue for use.
G ISSUE 08/16/95	L.C. Spriggs	R.J. Block	Revised as noted. Issue for use.

ISSUE DESIGNATION IN THIS COLL NDICATES CURRENT CHANGE

INSTALLATION OF
HEMYC PROTECTIVE WRAP SYSTEM
ONTO SINGLE OR MULTIPLE CONDUITS

1.0 PURPOSE

The purpose of this procedure is to assure that the installation of the HEMYC Protective Wrap System is consistent with the system as tested on the various qualification tests. The Fire Qualification Test, referenced as CTP-1026, consisted of a One (1) Hour Fire Exposure, per ASTM E-119 criteria, including hose stream test in accordance with the American Nuclear Insurers Information Bulletin No. 5(79) entitled, "ANI/MAERP Standard Fire Endurance Test Method to Qualify a Protective Envelope for Class IE Electrical Circuits".

2.0 SCOPE

This procedure provides the methods and guidelines to be utilized for the installation of HEMYC Protective Wrap Systems for conduits.

3.0 REFERENCE

3.1 10CFR50, Appendix R

3.2 ANI Bulletin 5(79)

3.3 IP-8400.101, Installation of HEMYC Protective Wrap System - Straight Sections of Cable Tray

3.4 IP-8400.102, Installation of HEMYC Protective Wrap System - Curved Sections of Cable Tray

3.5 QCP-10001, Packaging, Shipping, Receiving, Handling and Storage for HEMYC Protective Wrap Components

3.6 QCP-10002, Fabrication Inspection for HEMYC Protective Wrap Components

3.7 QCP-10003, Installation Inspection Criteria for HEMYC Protective Wrap Components

3.8 HEMYC Protective Cable Wrap System Typicals; PROMATEC Drawings B-310, B-311, B-312 and B-313

3.9 IP-8400.106, Installation of Fire Stops and Terminations Within the HEMYC Protective Wrap System for Cable Tray(s) and Conduits

ISSUE DESIGNATION IN THIS COLL INDICATES CURRENT CHANGE

4.0 DEFINITIONS

4.1 **CLIP** - sheet metal clip used to hold Wrap System onto finger strap.

4.2 **COLLAR** - a blanket used at wrap joints on conduit in place of wrap overlay.

4.3 **CONDUIT STANDOFF** - bracket used to allow two (2") inch airspace between conduit and blanket.

4.4 **FINGER STRAP** - thin, sheet metal strapping with pre-punched sections that may be bent out to provide anchoring for Wrap System.

4.5 **CLAMP/BANDING** - stainless steel or galvanized hose type clamp or banding. Hose clamps shall be a minimum gauge of .015" and a minimum width of one-half (1/2") inch.

4.6 **FLEX CONDUIT** - Non-rigid conduit that shall be covered using procedure IP-8400.112 for cable drops.

5.0 RESPONSIBILITIES

5.1 The authorized Installer's ENGINEERING DEPARTMENT shall be responsible to define the scope of work as prescribed on the applicable contract documents and provide the appropriate drawings, specifications, requirements, instructions, etc., to the department responsible for installation.

This department shall also be responsible to provide liaison with applicable client personnel and other internal departments to assure smooth flow of communication.

5.2 The authorized Installer's PRODUCTION DEPARTMENT shall be responsible for the identification and scheduling of work to be performed as defined on the documents furnished by ENGINEERING.

5.3 The Installers, as trained and certified by PROMATEC, shall be responsible for the performance of installation activities herein prescribed.

5.4 The Installer's QUALITY CONTROL PERSONNEL, as trained and certified by PROMATEC, shall be responsible for appropriate inspection, documentation and monitoring.

6.0 PROCEDURE

6.1 Stretch finger strapping along conduit to be protected and bend fingers out away from conduit.

6.2 Holding finger strapping against conduit, attach clamps on approximate eighteen (18") inch centers around conduit and tighten clamps. (See Figure 1.)

G

6.3 Impale wrap onto finger strap. Allow two (2") inch minimum between edge of wrap and fingers as shown on Figure 3.

6.4 Bring rest of wrap around conduit and impale edge of wrap onto fingers over the other edge. (See Figure 2.)

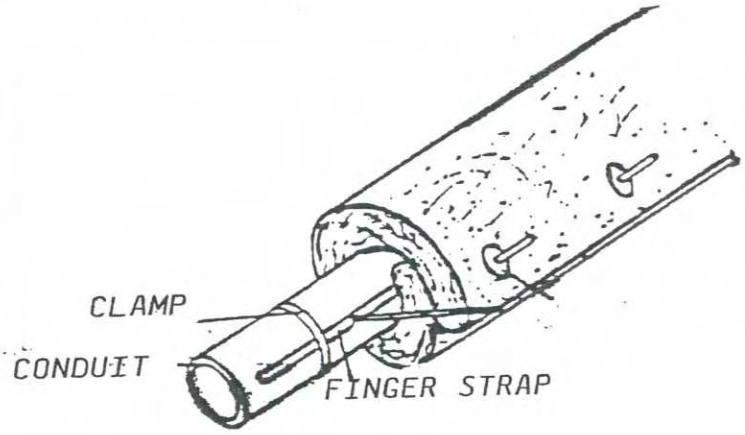


FIGURE 1

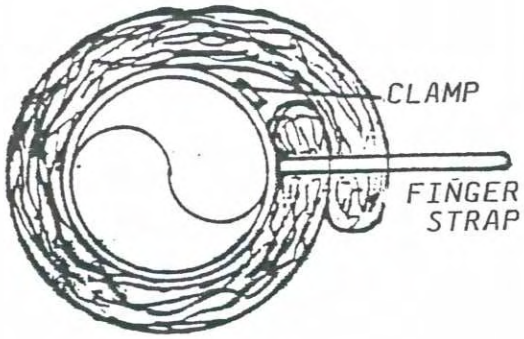


FIGURE 2

6.5 Attach clips onto fingers, compressing wrap approximately one-fourth to one-half (1/4" - 1/2") inch and bend finger over to secure blanket.

6.6 Multiple conduits are similar but only one conduit needs finger strapping. (Reference Figure 3.)

6.7 The number of conduits that may be wrapped is limited by wrap size. Large, bulky wrap sizes should be avoided due to difficulty in handling and possible damage.

If wrap sags excessively below conduit additional finger straps may be attached to centrally located conduits and used for additional wrap support.

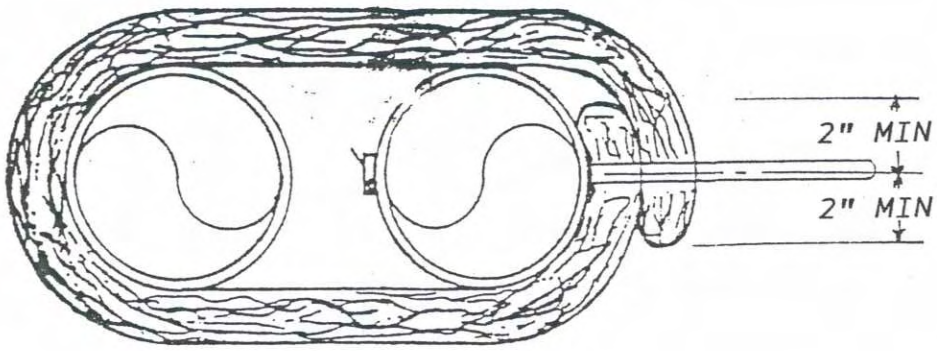


FIGURE 3

ISSUE DESIGNATION IN THIS COLI INDICATES CURRENT CHANGE

G

G 6.8 An alternate method of wrap attachment is to place the wrap around the conduit ensuring that the proper overlap is achieved. The proper overlap is a MINIMUM of two (2") inches for the circumferences of conduits and collars as shown on Fig. 4B. Attach clamps around the wrap to secure wrap to conduit. Clamp spacing shall be placed on maximum nine (9") inch centers.

Tighten clamps until wrap is compressed one-fourth to one-half (1/4" - 1/2") inches. DO NOT OVER-TIGHTEN as distortion of the blanket will result.

If gaps occur at wrap overlap, loosen clamps, shift blanket as necessary and re-tighten clamps.

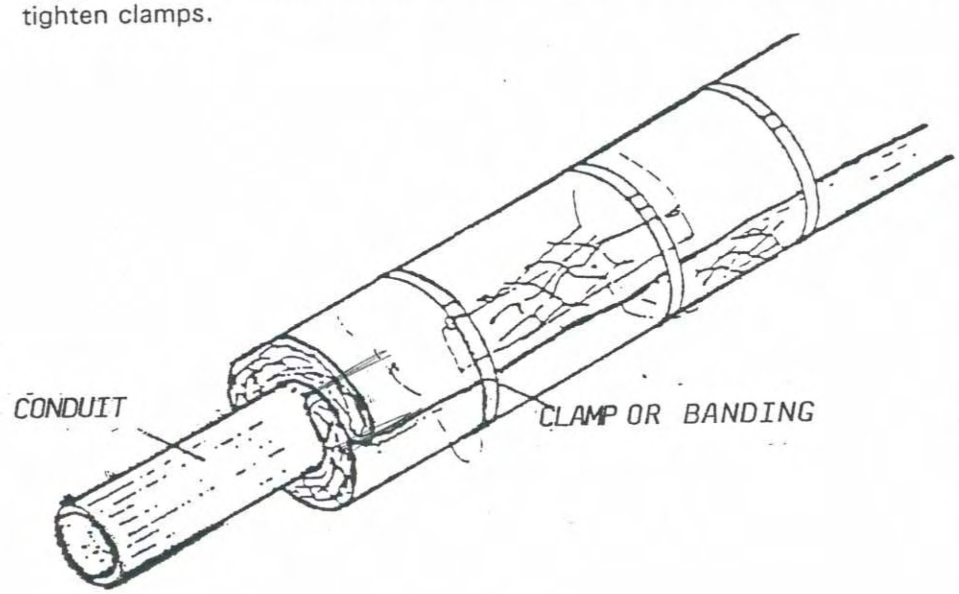


FIGURE 4A

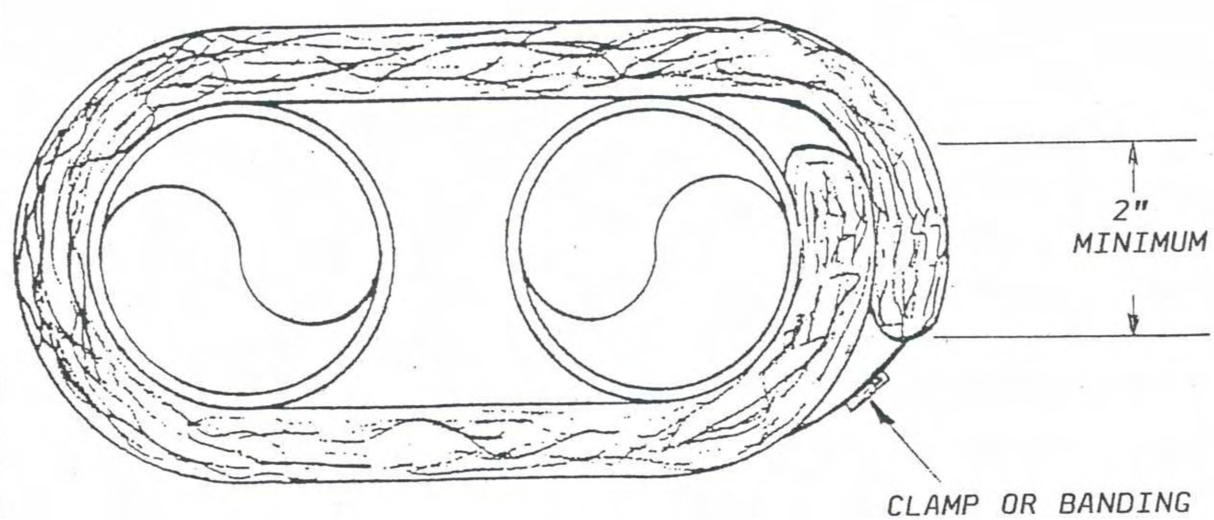


FIGURE 4B

ISSUE DESIGNATION IN THIS COLL NDICATES CURRENT CHANGE

6.9 In areas where ceiling, wall or floor clearances do not allow for wrap thickness, the wrap may be attached using methods and materials outlined in Procedure No. IP-8400.104, Section 6.3.

6.10 One of the two methods as shown in Figures 5 and 6 shall be outlined at wrap joints. Clamps or banding to secure should be installed as shown.

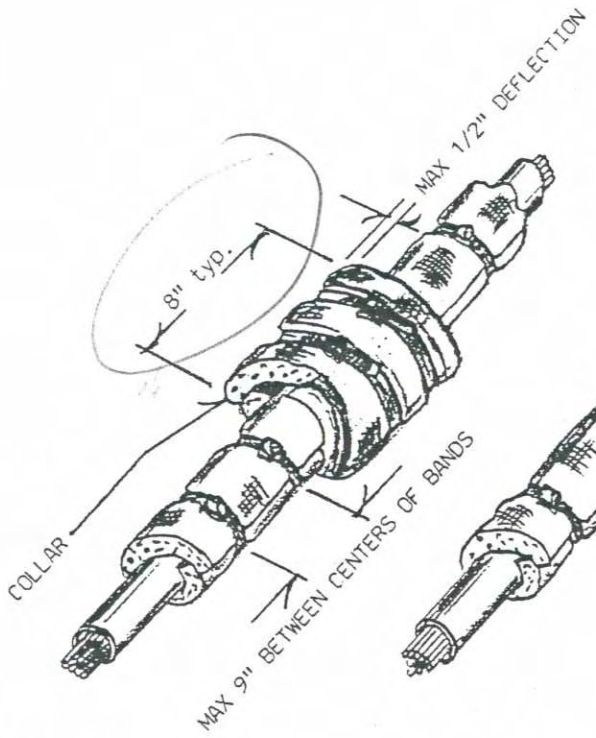


FIGURE 5
Typical Conduit Wrap
(Separate Wrap Style)

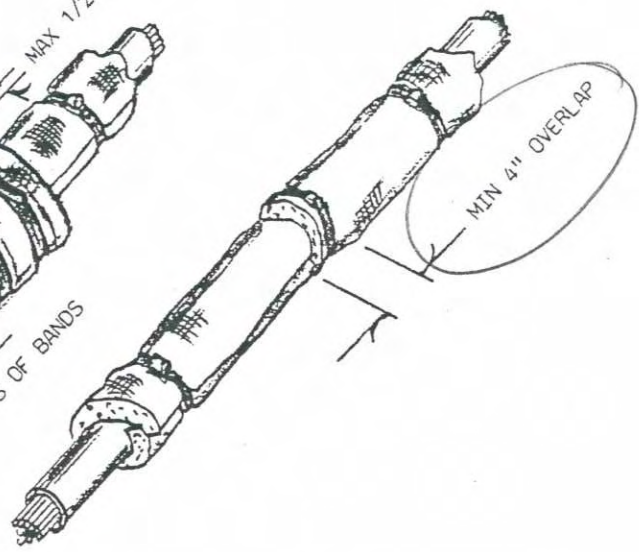


FIGURE 6
Typical Conduit Wrap
Joint Detail
(Overlap Type)

6.11 The following method is to be used where two (2") inch standoff bracket is required. Attach conduit standoff to conduit using all thread rod (See Figure 7). Use lock-washer and bolt to secure to conduit.

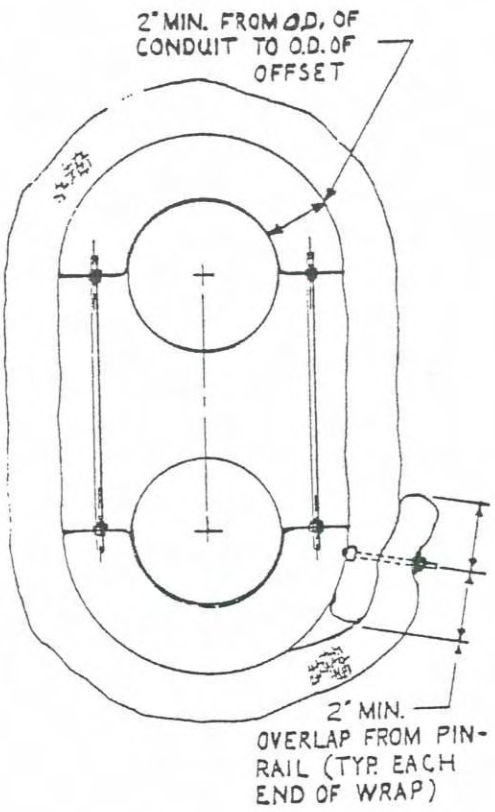


FIGURE 7

6.12 Conduit standoff are to be placed on maximum eighteen (18") inch centers. Attach rail and/or strut using bolts and lockwashers. Stud spacing is on nine (9") inch maximum centers (See Figure 8). Additional pin rail and/or strut may be used as determined by Installer's Site Engineer.

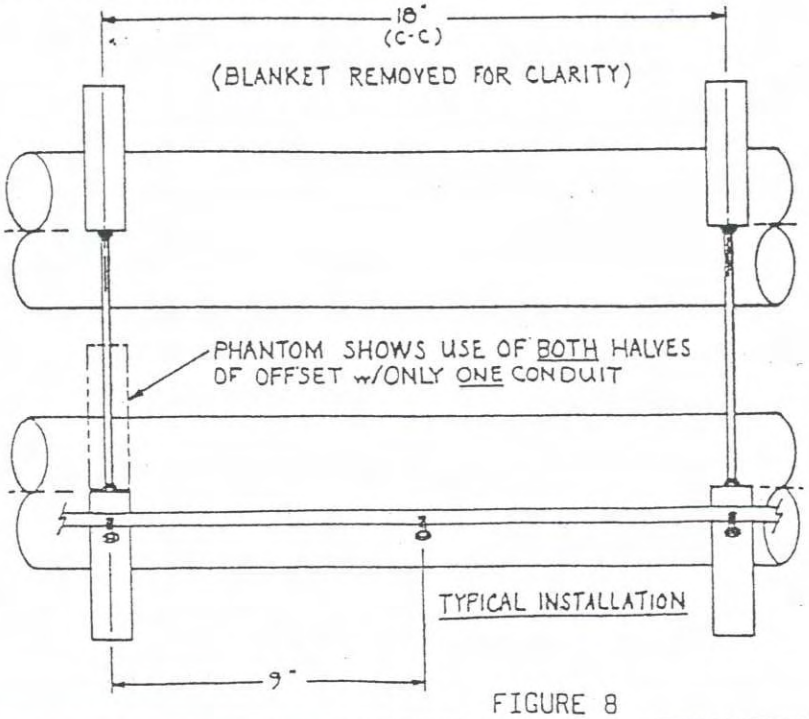


FIGURE 8

6.13 After framework is complete be sure to tighten all bolts.

6.14 Place blanket over studs allowing a minimum two (2") inch overlap from stud to edge of wrap. Bring wrap around standoff and impale edge of wrap onto studs. Allow minimum two (2") inch overlap from stud to edge of wrap. (See Figure 7.)

6.15 Use fender washer locknut to secure wrap to pin rail. Tighten locknut until wrap is compressed one-fourth to one-half (1/4" - 1/2") inch.

6.16 Use termination of system similar to procedure IP-8400.106, Section 6.3 Termination - Conduit (Floor, Ceiling or Wall).

7.0 ATTACHMENTS

7.1 ADDENDUM I

ISSUE DESIGNATION IN THIS COLL INDICATES CURRENT CHANGE

ADDENDUM I
ROCHESTER GAS & ELECTRIC
SITE SPECIFIC
GINNA STATION

4.5 **BANDING** - stainless steel banding shall be a minimum gauge of .015" and a minimum width of three-fourths (3/4") inches with wing seals.

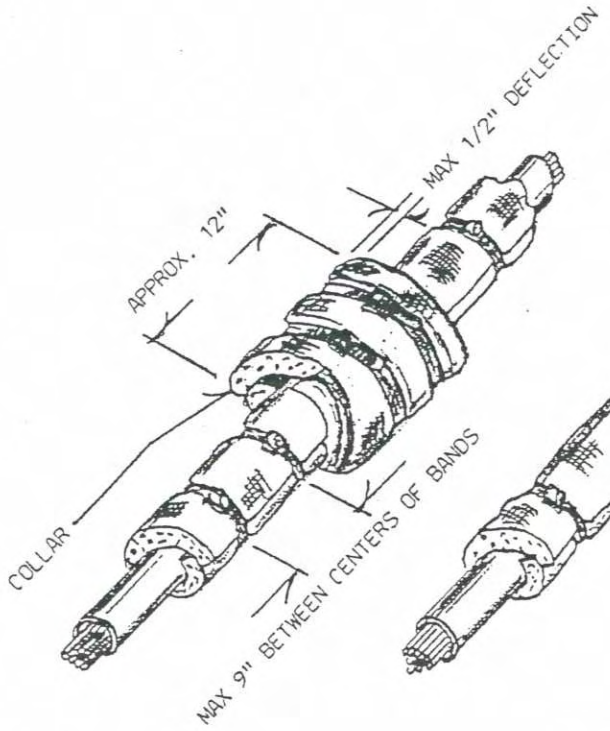


FIGURE 5a
Typical Conduit Wrap
(Separate Wrap Style)

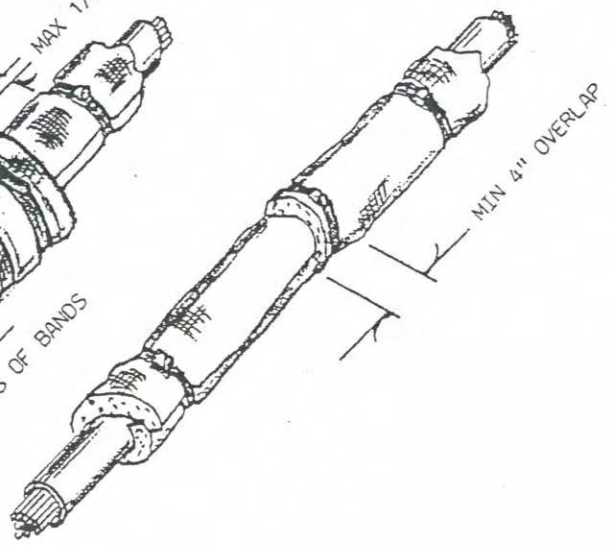


FIGURE 6a
Typical Conduit Wrap
Joint Detail
(Overlap Type)

ISSUE DESIGNATION IN THIS COLL .DICATES CURRENT CHANGE

CONTROL NO. ECN01

PROMATEC

PROGRESSIVE MATERIALS AND TECHNOLOGIES, INC.

PROCEDURE FOR:	PROCEDURE NUMBER:
REPAIR AND INSTALLATION OF HEMYC PROTECTIVE WRAP SYSTEM AROUND INTERFERENCES AND OBSTRUCTIONS	IP-8400.104

PROCEDURE ISSUE SUMMARY

ISSUE/DATE	PREPARER	APPROVED	COMMENTS
F ISSUE 01/25/95	L.C. Spriggs	R.J. Block	Revised as noted. Issue for use.

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

REPAIR AND INSTALLATION OF HEMYC PROTECTIVE WRAP SYSTEM AROUND INTERFERENCES AND OBSTRUCTIONS

1.0 PURPOSE

The purpose of this procedure is to assure that the installation of the HEMYC Protective Wrap System is consistent with the system as tested on the various qualification tests. The Fire Qualification Test, referenced as CTP-1026, consisted of a One (1) Hour Fire Exposure, per ASTM E-119 criteria, including hose stream test in accordance with the American Nuclear Insurers Information Bulletin No. 5(79) entitled "ANI/MAERP Standard Fire Endurance Test Method to Qualify a Protective Envelope for Class IE Electrical Circuits".

2.0 SCOPE

This procedure provides the methods and guidelines to be utilized for the repair and installation of the HEMYC Protective Wrap Systems around interferences and obstructions.

3.0 REFERENCE

3.1 10CFR50, Appendix R

3.2 ANI Bulletin No. 5(79)

3.3 HEMYC Test CTP-1026

3.4 QCP-10001, Packaging, Shipping, Receiving, Handling and Storage for the HEMYC Protective Wrap Components

3.5 QCP-10002, Fabric Inspection for HEMYC Protective Wrap Components

3.6 QCP-10003, Installation Inspection Criteria for HEMYC Protective Wrap Components

3.7 HEMYC Protective Cable Wrap System Typicals, PROMATEC Drawings B-310, B-311, B-312 and B-313.

4.0 DEFINITIONS

4.1 **CONCRETE ANCHORS** - site approved anchors such as HILTI or Phillips Wedge Anchors used to hold blanket to walls, ceiling or partitions.

4.2 **NEEDLE** - a needle, curved or straight, capable of handling the thread type noted in these definitions.

4.3 **PLUMBERS TAPE** - flexible metal strip having pre-punched holes running the length

of the attached wrap.

4.4 **RETAINER STRAP** - rigid metal strip having pre-punched holes running the length of the attached blanket.

4.5 **THREAD** - fire and heat resistant, quartz type thread such as Alpha Quartz Q-24.

5.0 RESPONSIBILITIES

5.1 The authorized Installer's ENGINEERING DEPARTMENT shall be responsible to define the scope of work as prescribed on the applicable contract documents and provide the appropriate drawings, specifications, requirements, instructions, etc., to the department responsible for installation.

This department shall also be responsible to provide liaison with applicable client personnel and other internal departments to assure smooth flow of communications.

5.2 The authorized Installer's PRODUCTION DEPARTMENT shall be responsible for the identification and scheduling of work to be performed as defined on the documents furnished by ENGINEERING.

F 5.3 The Installers, as trained and certified by PROMATEC, shall be responsible for the performance of installation activities herein prescribed.

F 5.4 The Installer's QUALITY CONTROL PERSONNEL, as trained and certified by PROMATEC, shall be responsible for appropriate inspection, documentation, and monitoring.

6.0 PROCEDURE

6.1 Penetrating Members

6.1.1 Cut affected wrap to a depth sufficient to allow the wrap to be installed around the penetrating member (See Figure 1).

6.1.2 Using quartz thread and proper needle (curved needle suggested), sew the inner portion of the wrap (Siltemp or fiberglass) together around the penetrating member.

6.1.3 Fill any gaps in the ceramic fiber fill with additional fiber and sew the outer Siltemp material together (See Figure 2). Stitches shall be no more than one-half (1/2") inch apart.

6.1.4 Fill any gaps around the penetrating member with ceramic fiber.

F 6.1.5 Cut a four (4") inch wide piece of ceramic blanket and place around the penetrating member with a one to two (1" - 2") inch overlap at the ends. (See Figure 3).

F 6.1.6 A slightly larger section of Siltemp shall be placed over the ceramic blanket and sewn top, sides and bottom to tightly seal the Wrap System (See Figure 4). Stitches shall be no more than one-half (1/2") inch apart. Seal shall be accomplished by sewing/banding the blanket in place. Interfering cable trays may be wrapped as described in Procedure IP-8400.106, Sections 6.1.2

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

through 6.1.5.

6.1.7 It may not be possible in all cases to get the Siltemp cloth tight against the penetrating member. In these cases ensure that the ceramic blanket is forced tightly against the penetrating member by the Siltemp to prevent flame and/or heat passage into system. Clamps may be used to accomplish this, as necessary.

F 6.1.8 All supports and interferences shall be protected a minimum of four (4") inches measured linearly from the structure being protected.

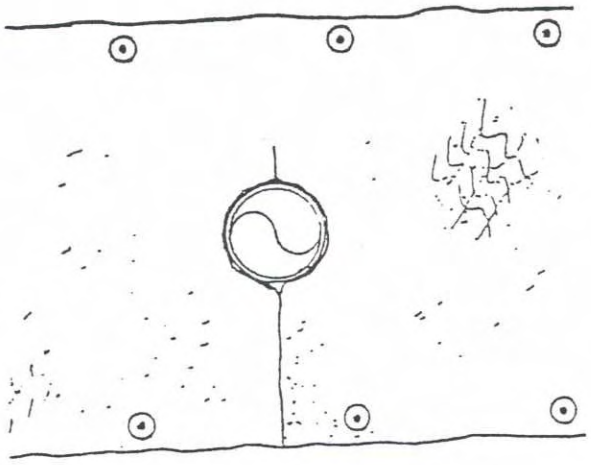


FIGURE 1

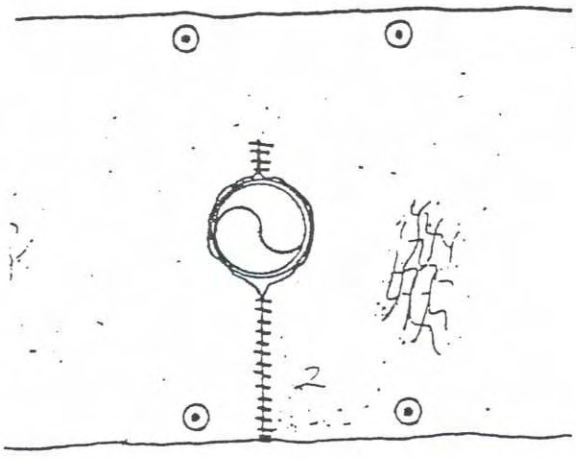


FIGURE 2

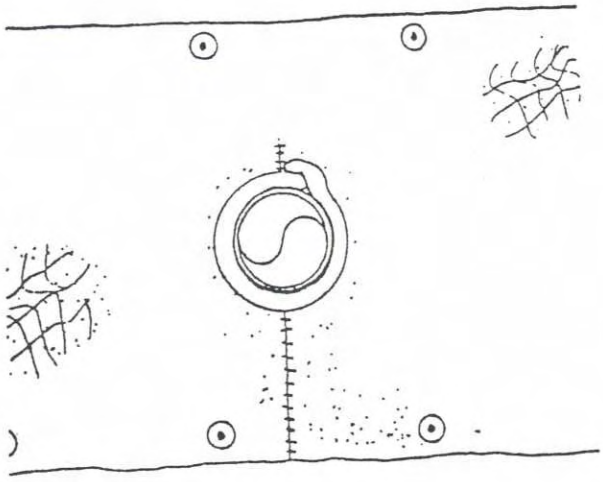


FIGURE 3

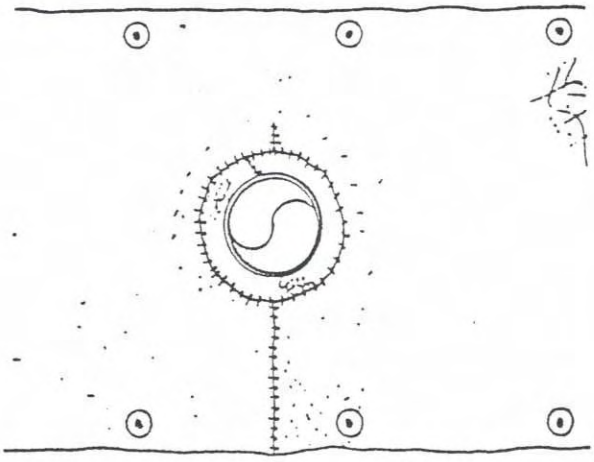


FIGURE 4

6.2 Adjoining or Supporting Members

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

F

6.2.1 If possible the adjoining or supporting member should be encapsulated within the system using the procedure outlined in Section 6.1 to seal any openings. (See Figure 5.) In addition, these interfering members may have pin rail banded to them to help secure the wrap. This configuration may be substituted for pin rail studs where top and/or bottom rails meet these interfering members, maintaining nine (9") inch maximum spacing between adjacent pin rail studs. All stud spacings are as measured along the rail.

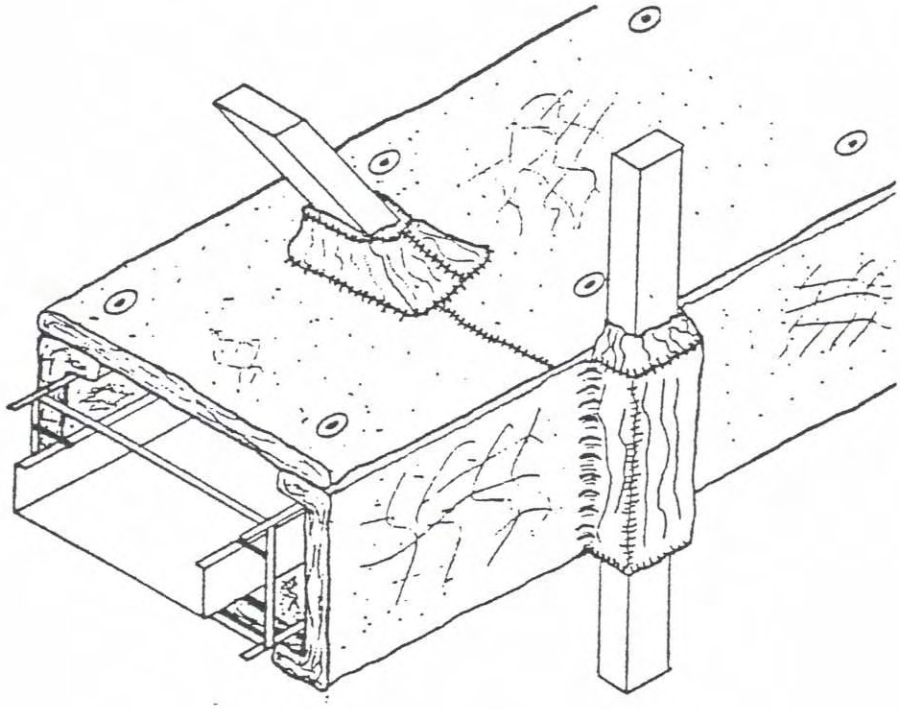


FIGURE 5

6.2.2 Where, due to size, shape or location, the adjoining or supporting member cannot be encapsulated, the Installer's Site Engineer shall determine alternate methods on a case by case basis. Client's Engineer or authorized representative shall review alternate methods, as required. Such alternates shall be within the parameters established by the HEMYC fire testing.

6.3 Wall, Ceiling or Floor Interferences

6.3.1 Where walls, ceilings or floors prevent the installation of the full system, the wraps may be installed as shown in Figure 6. Extra wrap supports may be required as determined by the Installer's Site Engineer.

6.3.2 Framework shall be attached to the interfering surface using concrete anchors and L-Brackets #B-6102 as shown in Figure 6.

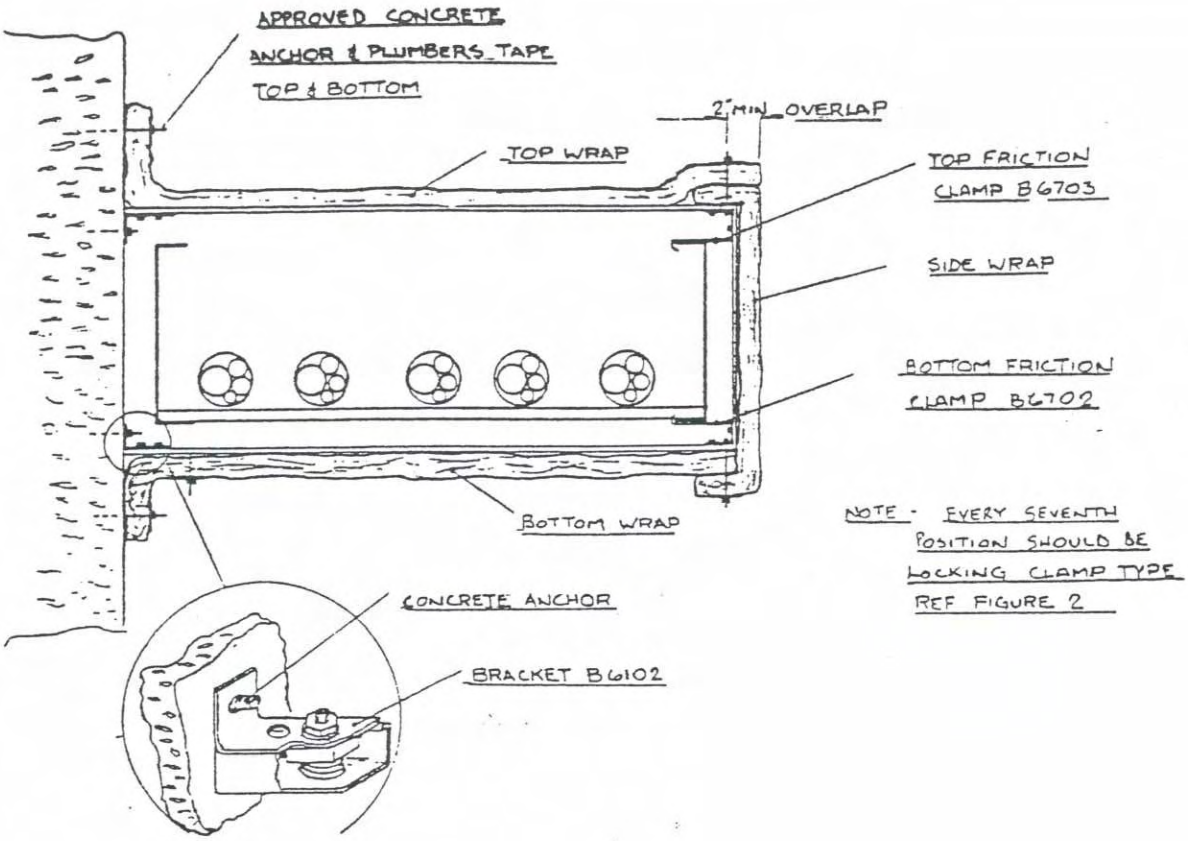


FIGURE 6

6.3.3 Concrete anchors for wrap shall be placed no more than nine (9") inches apart.

6.3.4 Plumbers tape or retainer strap must be installed in the areas where the Wrap System is attached to a wall or ceiling. The plumbers tape or retainer strap is to be installed over the studs after the blanket is installed and prior to the fender washer and locknut. (See Figure 7.) Tape should be kept as tight as possible to prevent the wrap from sagging away from the wall creating a passage for heat and/or flame. Additional holes in plumbers tape or retainer strap may be made as necessary to accommodate variations in stud placement.

F 6.3.5 Where the Wrap System is to be attached to a termination surface (e.g., wall, floor, ceiling, adjoining structure), pin rail may be mounted as an alternative to installing multiple anchor studs.

To attach pin rail to the surface:

- Install a strip of ceramic blanket as a "gasket", between the pin rail and the surface. This blanket strip shall be one-fourth to one-half (1/4" - 1/2") inch thick and at least twice as wide as the rail.

- At least one (1) anchoring stud shall be located at each end of the pin rail.

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

F

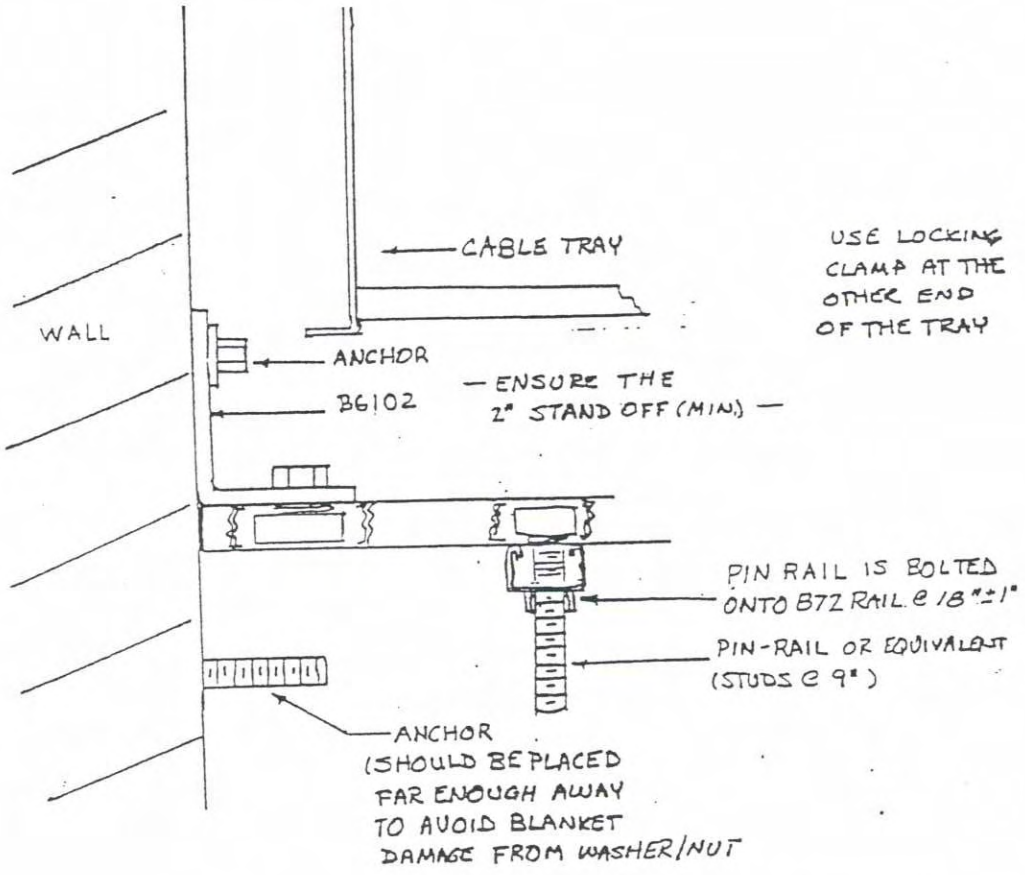
Install the end studs one-half (1/2") inches to five (5") inches O.C. from each end.

- For pin rail up to twenty-four (24") inches long use a minimum of two (2) anchoring studs; one at each end.

- For pin rail twenty-five (25") inches to sixty (60") inches long, use a minimum of three (3) studs; each end and one in the approximate middle.

- For pin rails sixty-one (61") inches to one hundred twenty (120") inches long, use a minimum of four (4) studs; each end and another two approximately evenly spaced between the end anchoring studs.

NOTE: Anchoring studs may be site approved concrete anchors, 1/4-20 through-bolts or other engineering approved fasteners.



NOTE: IT IS SUGGESTED THAT LOCK WASHERS AND NUTS BE USED ON THE ANCHORS RATHER THAN LOCKNUTS, TO AVOID OVER TORQUING OF ANCHORS

FIGURE 6A
TRAY MOUNTING DETAIL
WALL TO WALL WRAP
BOTTOM SECTION

F

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

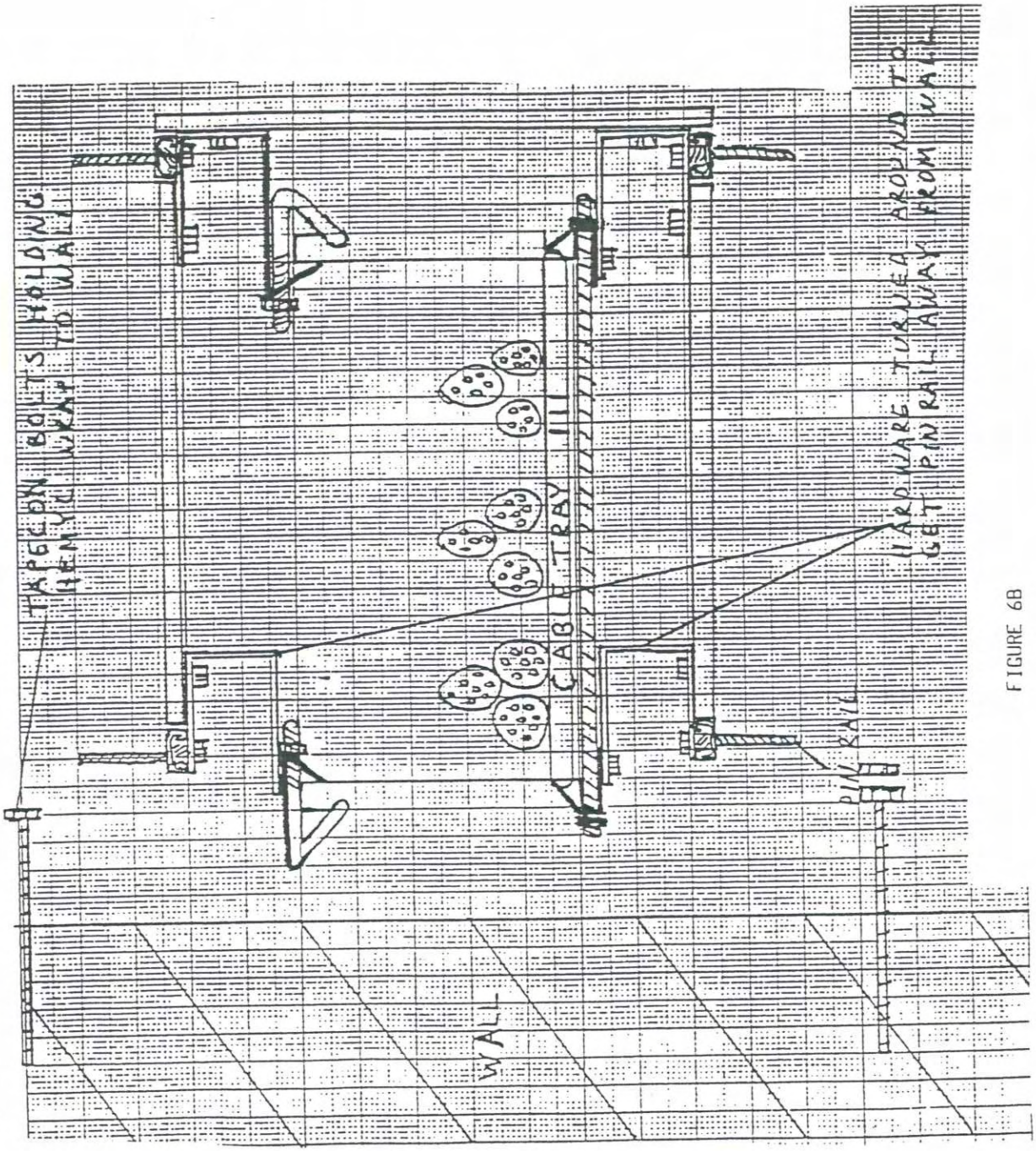


FIGURE 6B

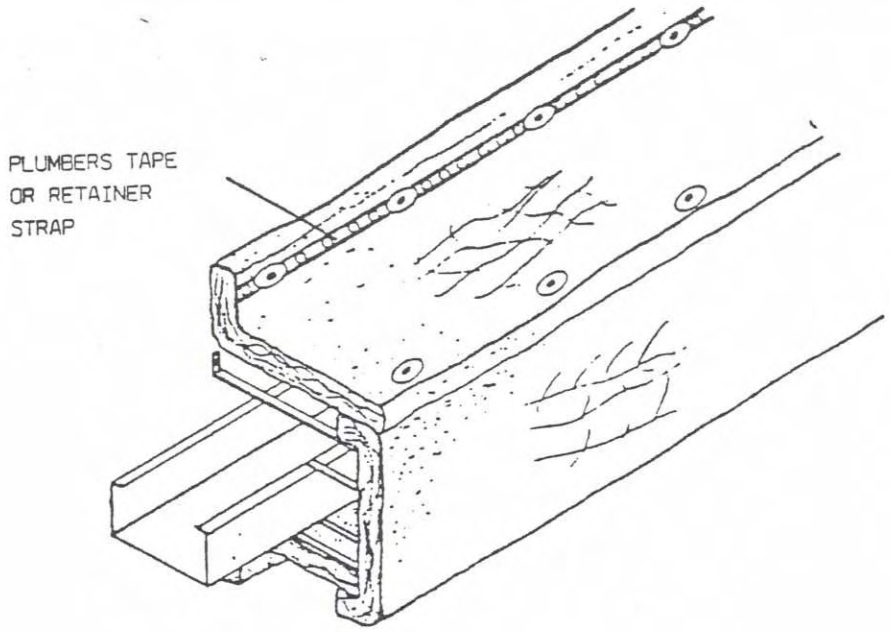


FIGURE 7

6.4 Repair Procedure

6.4.1 Responsible parties shall inspect damaged wrap to determine the extent of damage and if repair or replacement is required. Order replacement wrap if damage is extensive.

6.4.2 Remove damaged wrap to work area.

6.4.3 Replace any damaged or deformed framework/support materials utilizing methods outlined in PROMATEC Installation Procedures IP-8400.101, IP-8400.102 and/or IP-8400.103.

6.4.4 Rips

6.4.4.1 Sew the interior fabric, if necessary, the full length of the ripped fabric with stitches no more than one-half (1/2") inch apart. Extra stitches will need to be added to each end of rip to ensure that the rip does not "creep".

6.4.4.2 Replace any ceramic fiber lost due to damage. Ensure that no gaps remain in fiber filler and that proper thickness is maintained.

6.4.4.3 Sew the exterior fabric together as outlined in Section 6.4.4.1. If any gaps are found in fabric it may be necessary to insert an appropriately sized piece of fabric inside the system prior to sewing fabric closed.

6.4.4.4 Reinstall wrap as outlined in PROMATEC Procedure IP-8400.101.

6.4.5 Holes or Large Tears

6.4.5.1 Patches of the proper type fabric, Siltemp or fiberglass, should be cut to a size sufficient to cover the hole with an approximate two (2") inch overlap onto undamaged fabric

6.4.5.2 Repair the interior surface first, if necessary, by placing patch over hole and sewing around the perimeter of patch with stitches no more than one-half (1/2") inch apart.

6.4.5.3 Replace any ceramic fiber as necessary. Ensure that no gaps remain and that proper thickness is maintained.

6.4.5.4 Place the exterior patch over the hole and sew as noted in Section 6.4.5.2. (See Figure 8.)

6.4.5.5 Reinstall wrap as outlined in PROMATEC Procedure IP-8400.101, using new locknuts on studs.

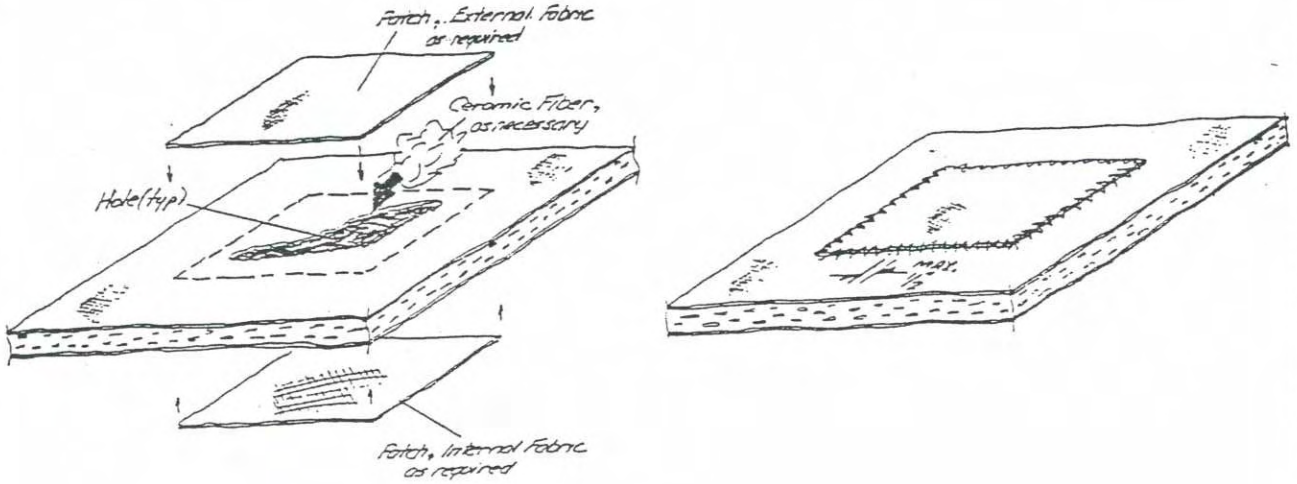


FIGURE 8

7.0 ATTACHMENTS

None

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

INSTALLATION OF HEMYC PROTECTIVE WRAP SYSTEM ONTO CABLE DROPS

1.0 PURPOSE

The purpose of this procedure is to assure that the installation of the HEMYC Protective Wrap System is consistent with the system as tested on the various qualification tests. The Fire Qualification Test, referenced as CTP-1026, consisted of a One (1) Hour Fire Exposure, per ASTM E-119 criteria, including hose stream test in accordance with the American Nuclear Insurers Information Bulletin 5(79) entitled, "ANI/MAERP Standard Fire Endurance Test Method to Qualify a Protective Envelope for Class IE Electrical Circuits",

2.0 SCOPE

C This procedure provides the methods and guidelines to be utilized for the installation of HEMYC Protective Wrap Systems onto cable drops.

3.0 REFERENCE

3.1 10CFR50, Appendix R

3.2 ANI Bulletin 5(79)

3.3 IP-8400.103, Installation for HEMYC Protective Wrap System - Onto Single or Multiple conduits

3.4 IP-8400.104, Installation for HEMYC Protective Wrap System - Around Interferences and Obstructions.

3.5 IP-8400.106, Installation for HEMYC Protective Wrap System for Cable Tray(s) and Conduit

C 3.6 QCP-10001, Packaging, Shipping, Receiving, Handling and Storage for HEMYC Protective Wrap Components

C 3.7 QCP-10002, Fabrication Inspection for HEMYC Protective Wrap Components

C 3.8 QCP-10003, Installation Inspection Criteria for HEMYC Protective Wrap Components

4.0 DEFINITIONS

4.1 **CLIP** - stainless steel metal clip used to hold banding in place.

C 4.2 **COLLAR** - a blanket used at wrap joints on conduit and/or cable wrap in place of wrap overlap.

C 4.3 **CLAMP** - stainless steel or galvanized hose type clamp or stainless steel banding.

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

C 4.4 **STRIP** - ceramic blanket sufficiently thick to achieve two (2") inches air space between cable and blanket wrap.

C 4.5 **WRAP** - a fireproof product consisting of ceramic fiber material sewn into an envelope of fireproof fabric.

5.0 RESPONSIBILITIES

5.1 The authorized Installer's ENGINEERING DEPARTMENT shall be responsible to define the scope of work as prescribed on the applicable contract documents and provide the appropriate drawings, specifications, requirements, instructions, etc., to the department responsible for installation.

C This department shall also be responsible to provide liaison with applicable client personnel and other internal departments to assure smooth flow of communication.

C 5.2 The authorized Installer's PRODUCTION DEPARTMENT shall be responsible for the identification and scheduling of work to be performed as defined on the documents furnished by Engineering.

C 5.3 The Installers, as trained and certified by PROMATEC, shall be responsible for the performance of installation activities herein prescribed.

C 5.4 The Installer's QUALITY CONTROL PERSONNEL, as trained and certified by PROMATEC, shall be responsible for appropriate inspection, documentation and monitoring.

6.0 PROCEDURE

C 6.1 Cut ceramic fiber blanket sufficiently thick to achieve two (2") inch air space in approximately three (3") inch wide strips, place around cable(s) and secure, space the three (3") inch wide strips on maximum nine (9") inch centers. A minimum of two (2") inch air space is required between cable and blanket wrap.

C 6.2 Additional three (3") inch wide ceramic fiber blanket sufficiently thick to achieve two (2") inch air space may be utilized in order to maintain two (2") inch air space.

C 6.3 Place minimum one and one-half (1-1/2") inch blanket wrap around three (3") inch wide strips and cable. Banding to be placed around blanket wrap at point over three (3") inch wide strip. Blanket must overlap a minimum of three (3") inches. Outside (blanket wrap band) banding is to be placed over the three (3") inch wide strips only.

Tighten banding until blanket is compressed one-fourth to one-half (1/4" - 1/2") inch. DO NOT OVER-TIGHTEN.

6.4 At blanket wrap joints, or overlap, a two (2") inch ceramic fiber blanket cut in approximate six (6") inch wide strip should be used around cable. See IP-8400.103, Section 6.9 for detail of blanket wrap.

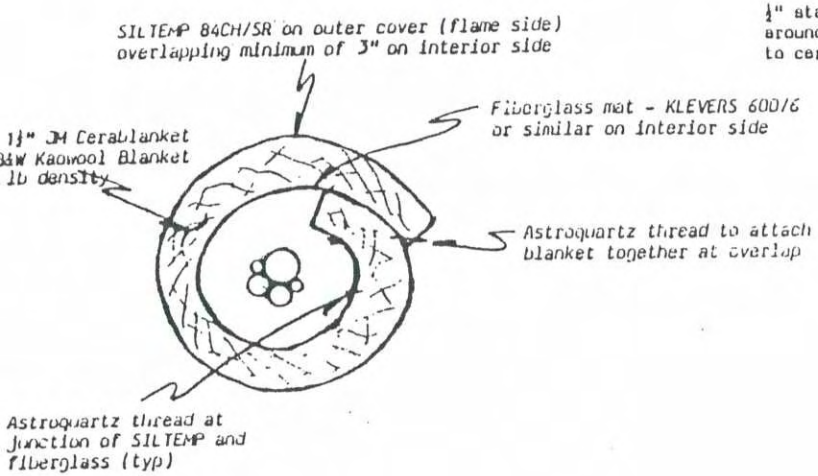
6.5 For termination to wall, floor or ceiling, use IP-8400.106 Conduit.

6.6 For Cable Drops into Cable Tray Wrap System, use IP-8400.104, Section 6.1 Penetrating Member.

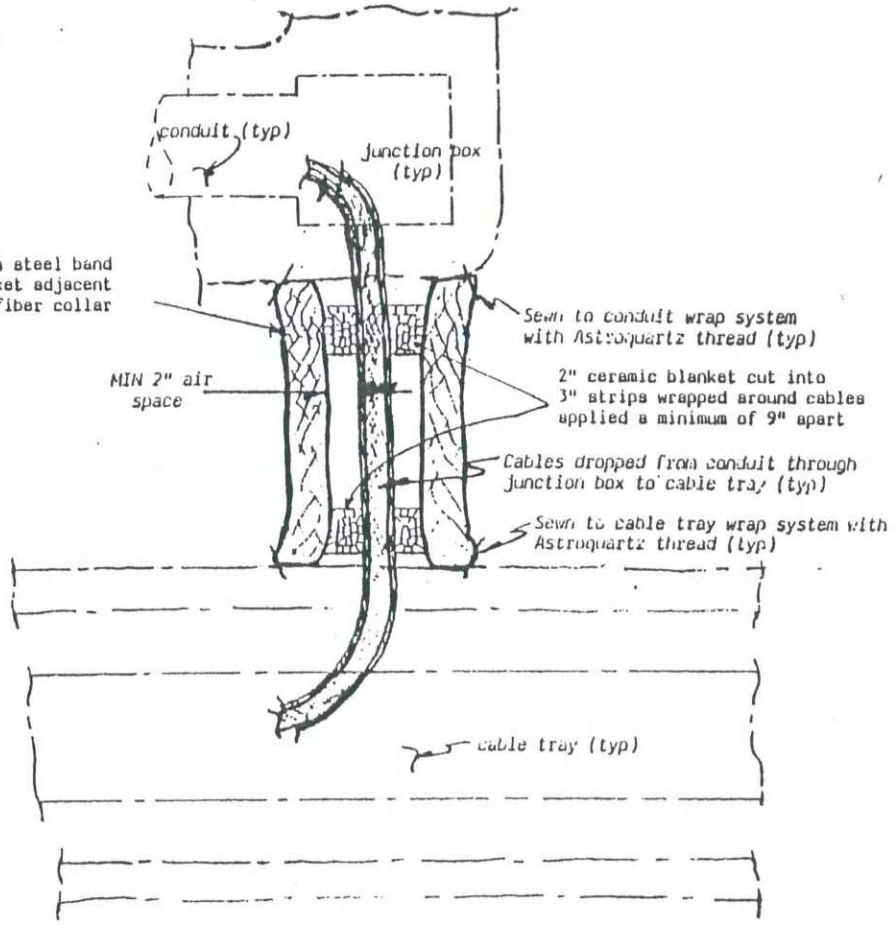
7.0 ATTACHMENTS

7.1 Drawing B-272.11, HEMYC System Cable Drop with Air Space

NOTE:
Prefabricated blanket section dimensions determined by installers on a case by case basis. SILTEMP and fiberglass to be sewn with fire retardant Astroquartz or similar thread.



SECTION C-C
CABLE DROP W/ AIR SPACE
(TEST TWO)



TYPICAL INSTALLATION
OF CABLE DROP W/ AIR SPACE

REVISIONS		
NO	DATE	BY
1	3-30-84	KWS
2		
3		
4		
5		

INSULATION, INC.

HEMYC SYSTEM
CABLE DROP W/ AIR SPACE

DRAWN BY LCS	SCALE nts	MATERIAL as noted
CHK'D [illegible]	DATE 7/19/82	DRAWING NO B - 272.11
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IP-8400.112 ATTACHMENT 7.1

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

INSTALLATION OF HEMYC PROTECTIVE WRAP SYSTEM TO JUNCTION BOXES AND SIMILAR EQUIPMENT

1.0 PURPOSE

The purpose of this procedure is to assure that the installation of the HEMYC Protective Wrap System is consistent with the system as tested in the various qualification tests. The Fire Qualification Test, referenced as CTP-1026, consisted of a One (1) Hour Fire Exposure, per ASTM E-119 criteria, including hose stream test in accordance with the American Nuclear Insurers Information Bulletin No. 5(79) entitled, "ANI/MAERP Standard Fire Endurance Test Method to Qualify a Protective Envelope for Class IE Electrical Circuits."

2.0 SCOPE

This procedure provides the methods and guidelines to be utilized for the installation of Protective Wrap Components to electrical junction boxes and similar equipment.

3.0 REFERENCE

3.1 10CFR50, Appendix R

3.2 ANI Bulletin No. 5(79)

3.3 HEMYC Test CTP-1026

3.4 IP-8400.101, Installation Procedure for HEMYC Protective Wrap System - Straight Sections

3.5 QCP-10001, Packaging, Shipping, Receiving, Handling, and Storage for HEMYC Protective Wrap Components

3.6 QCP-10002, Fabrication Inspection for HEMYC Protective Wrap Components

3.7 QCP-10003, Installation Inspection Criteria for HEMYC Protective Wrap Components

3.8 HEMYC Protective Cable Wrap System Typicals, PROMATEC Drawings B-310, B-311, B-312 and B-313.

4.0 DEFINITIONS

None

5.0 RESPONSIBILITIES

5.1 The authorized Installer's ENGINEERING DEPARTMENT shall be responsible to define the scope of work as prescribed on the applicable contract documents and provide the appropriate drawings, specifications, requirements, instruction, etc., to the department responsible for installation.

This department shall also be responsible to provide liaison with applicable client personnel and other internal departments to assure smooth flow of communication.

5.2 The authorized Installer's PRODUCTION DEPARTMENT shall be responsible for the identification and scheduling of work to be performed as defined on the documents furnished by ENGINEERING.

C 5.3 The Installers, as trained and certified by PROMATEC, shall be responsible for the performance of installation activities herein prescribed.

C 5.4 The Installer's QUALITY CONTROL PERSONNEL shall be responsible for appropriate inspection, documentation, and monitoring.

6.0 PROCEDURE

6.1 Layout of Wrap

6.1.1 The Installer's Site Engineer shall take exterior measurements of the junction boxes to be protected and develop a pattern similar to the pattern shown in Figure 1. An alternate method would be to develop pieces that could be sewn as shown in Figure 2.

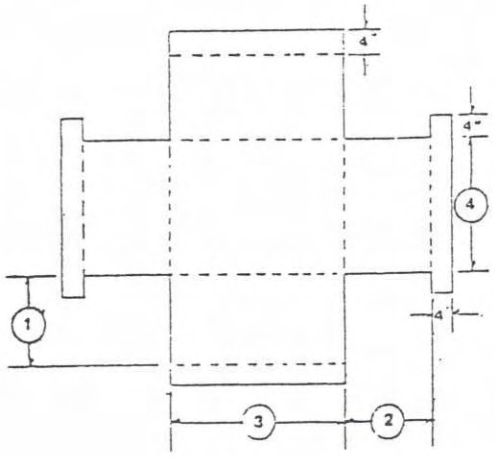


FIGURE 1

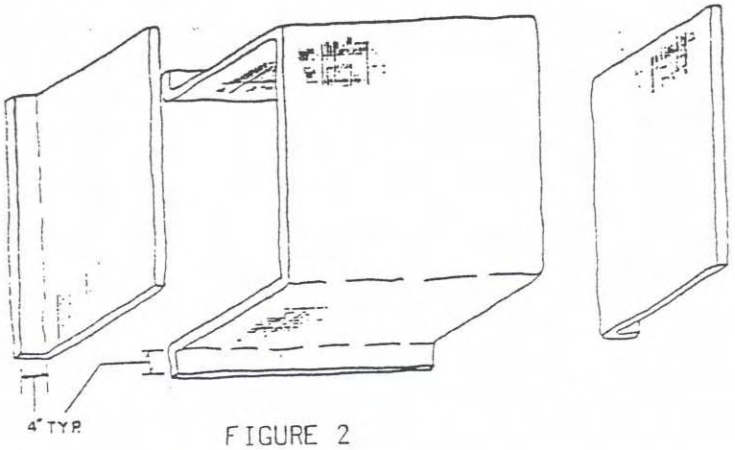


FIGURE 2

6.1.2 Dimensions #1, 2 and 3 on Figure 1 should be increased four (4") inches from junction box dimensions to allow for wrap thickness.

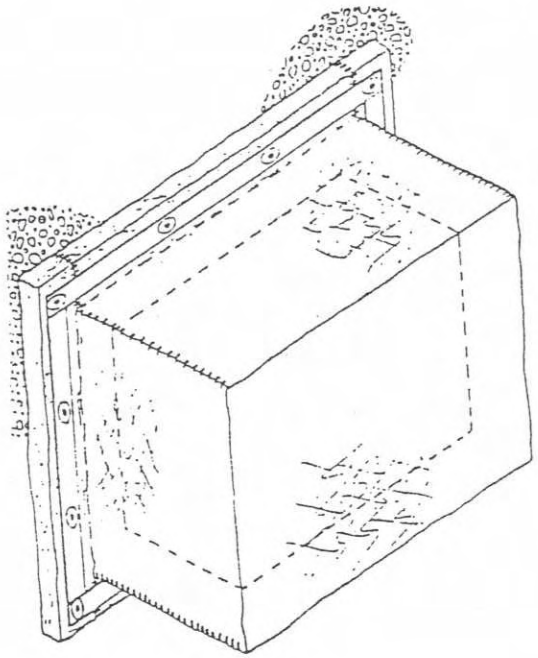
6.1.3 Note on Figures 1 and 2 that approximately four (4") inches is allowed at ends to overlap onto surface for attachment.

6.1.4 The Installer's Site Engineer should ensure that sufficient material allowances are made on all patterns to provide for overlap at corners of junction box.

6.2 Installation

6.2.1 Wrap System may be installed as shown in Figure 3 for floor, wall or ceiling mounting or as shown in Figure 4 in the case of free standing equipment.

FIGURE 3



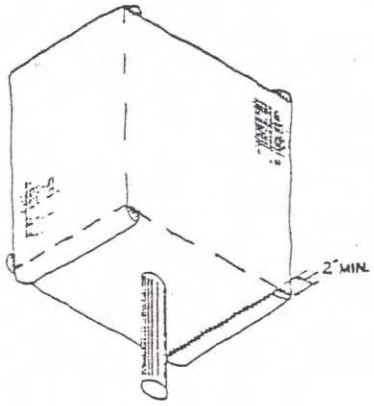


FIGURE 4

6.2.2 For equipment that will require frequent access, a framework may be used as shown in Figure 5 to provide ease of system removal.

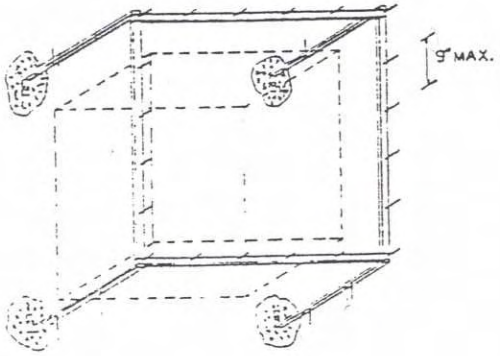


FIGURE 5

6.2.3 Concrete anchors used for floor, wall or ceiling installation shall be placed as determined by the Installer's Site Engineer.

6.2.4 Mounting of wrap to floor, wall or ceiling shall be done similar to that described in Procedure IP-8400.104.

6.2.5 All sewing shall be done in accordance with the requirements of Procedure IP-8400.104.

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6.2.6 Ensure that no gaps exist in Wrap System. Minimum thickness of wrap at all points is two (2") inches. Fill as necessary with ceramic blanket to maintain minimum thickness.

7.0 ATTACHMENTS

None

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PROGRESSIVE MATERIALS AND TECHNOLOGIES, INC.

PROCEDURE FOR:	PROCEDURE NUMBER:
INSTALLATION OF HEMYC PROTECTIVE WRAP SYSTEM - STRAIGHT SECTIONS OF CABLE TRAY	IP-8400.101

PROCEDURE ISSUE SUMMARY

ISSUE/DATE	PREPARER	APPROVED	COMMENTS
G ISSUE 01/25/95	L.C. Spriggs	R.J. Block	Revised as noted. Issue for use.

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

INSTALLATION OF HEMYC PROTECTIVE WRAP SYSTEM STRAIGHT SECTIONS OF CABLE TRAY

1.0 PURPOSE

The purpose of this procedure is to assure that the installation of the HEMYC Protective Wrap System is consistent with the system as tested on various qualification tests. The Fire Qualification Test, referenced as PROMATEC CTP-1026, consisted of a One (1) Hour Fire Exposure, per ASTM E-119 criteria, including hose stream test in accordance with the American Nuclear Insurers Information Bulletin No. 5(79) entitled, "ANI/MAERP Standard Fire Endurance Test Method to Qualify a Protective Envelope for Class IE Electrical Circuits".

2.0 SCOPE

This procedure provides the methods and guidelines to be utilized for the installation of HEMYC Protective Wrap Systems.

3.0 REFERENCE

3.1 10CFR50, Appendix R

3.2 ANI Bulletin No. 5(79)

3.3 HEMYC Test CTP-1026

3.4 QCP-10001, Packaging, Shipping, Receiving, Handling and Storage for HEMYC Protective Wrap Components

3.5 QCP-10002, Fabrication Inspection for HEMYC Protective Wrap Components

3.6 QCP-10003, Installation Inspection Criteria for HEMYC Protective Wrap Components

3.7 HEMYC Protective Cable Wrap System Typicals; PROMATEC Drawings B-310, B-311, B-312 and B-313

4.0 DEFINITIONS

4.1 **BASE** - slotted and drilled, formed plate used in assembly of locking clamp.

4.2 **BRACKET** - galvanized "C" used in conjunction with a base and U-Bolt to make a locking clamp.

4.3 **FENDER WASHER** - a flat washer approximately 1-1/2" O.D. with a small inside hole to slip over rail studs. The function is to prevent or minimize damage to wrap by the locknut and to provide more wrap support.

4.4 **FRAMEWORK** - an assembly consisting of four struts and four clamps (friction or

locking) that surrounds the cable tray, normally spaced on eighteen (18") inch centers.

4.5 **FRICTION CLAMP** - pre-galvanized device used to connect framework to cable tray.

4.6 **LOCKING CLAMP** - galvanized assembly similar to friction clamp but is tightly bolted to the cable tray to prevent movement of the framework.

4.7 **LOCKNUT** - a specially designed, vibration resistant nut having a plastic insert on the threaded portion. These are used primarily on the locking clamp and the rail studs.

4.8 **RAIL** - long sections of strut with threaded anchors stud-welded to it. These are attached to the framework parallel to the tray. Rails provide anchors to secure the Wrap System and add longitudinal support to the framework.

4.9 **SPRING NUTS** - a specially designed rhomboid shaped nut with a spring permanently attached that is used to secure clamps to the struts.

4.10 **STRUTS** - lightweight, pre-galvanized channel used to provide structural support to the Wrap System.

4.11 **U-BOLT** - a "U" shaped bolt bent to provide attachment of locking clamp to cable tray.

4.12 **WRAP** - a fireproof product consisting of ceramic fiber material sewn into an envelope of fireproof fabric.

5.0 RESPONSIBILITIES

5.1 The authorized Installer's ENGINEERING DEPARTMENT shall be responsible to define the scope of work as prescribed on the applicable contract documents and provide the appropriate drawings, specifications, requirements, instructions, etc., to the department responsible for installation.

This department shall also be responsible to provide liaison with applicable client personnel and other internal departments to assure smooth flow of communication.

5.2 The authorized Installer's PRODUCTION DEPARTMENT shall be responsible for the identification and scheduling of work to be performed as defined on the documents furnished by Engineering.

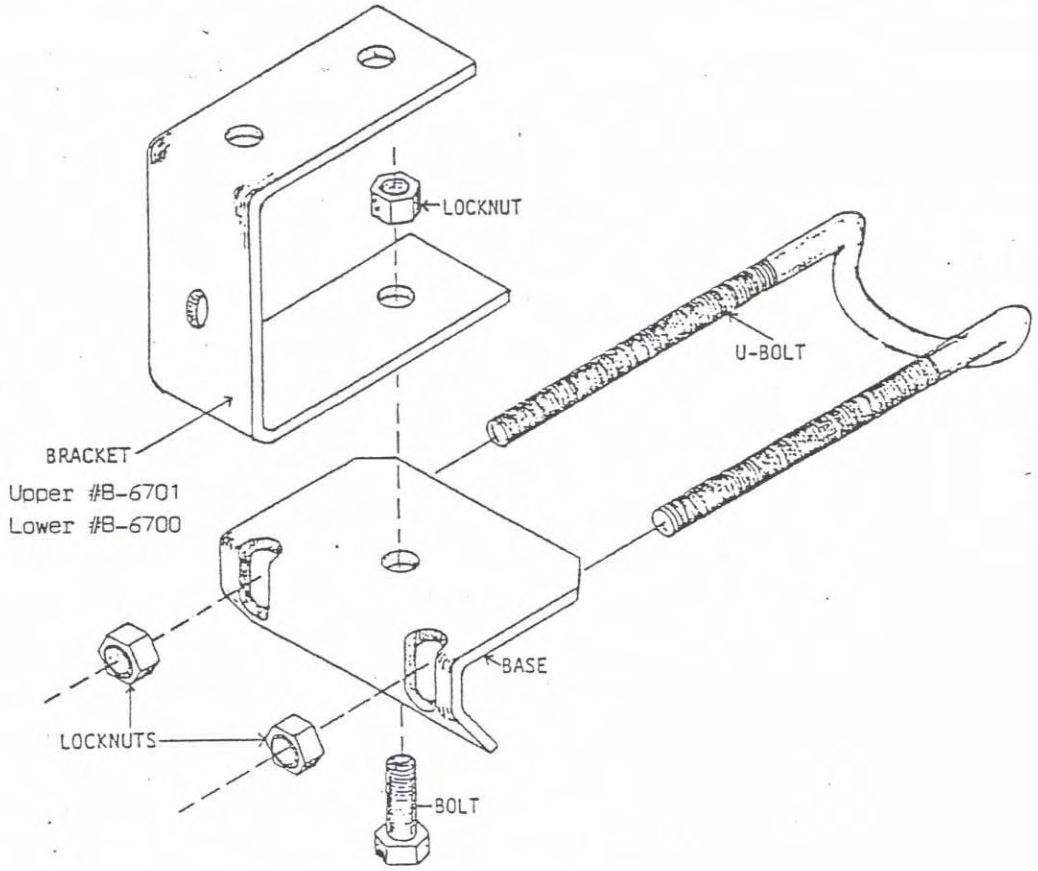
G 5.3 The Installer's, as trained and certified by PROMATEC, shall be responsible for performance of installation activities herein prescribed.

G 5.4 The Installer's QUALITY CONTROL PERSONNEL, as trained and certified by PROMATEC, shall be responsible for appropriate inspection, documentation and monitoring.

6.0 PROCEDURE

6.1 Locking Clamp Assembly (See Figure 1).

G 6.1.1 Attach U-Bolt to base by sliding U-Bolt through slots in base. U-Bolt and base plate may be turned 180°.



LOCKING CLAMP - ASSEMBLY

FIGURE 1

6.1.2 Secure U-Bolt by threading locknuts onto legs until threads contact nylon insert in locknut. DO NOT TIGHTEN.

G

6.1.3 Insert 1/4" x 3/4" - 20 Thread Bolt through hole in bottom of base and through hole on long leg of bracket. For cable tray 90° or 45° bend sections, two clamp bases may share this bolt.

6.1.4 Thread locknut onto bolt and tighten. Ensure that a minimum of one (1) full thread is visible above the locknut. Keep bracket as square as possible in relation to base.

6.1.5 For alternate cable tray types, the Installer's Site Engineer shall determine the type of clamping devices to be utilized. (Alternate clamping devices shall, as a minimum, provide adequate support similar to those devices utilized in the fire test.)

6.2 Framework Assembly and Installation

6.2.1 Insert Spring nuts near ends of strut sections.

ISSUE DESIGNATION IN THIS COLL .DICATES CURRENT CHANGE

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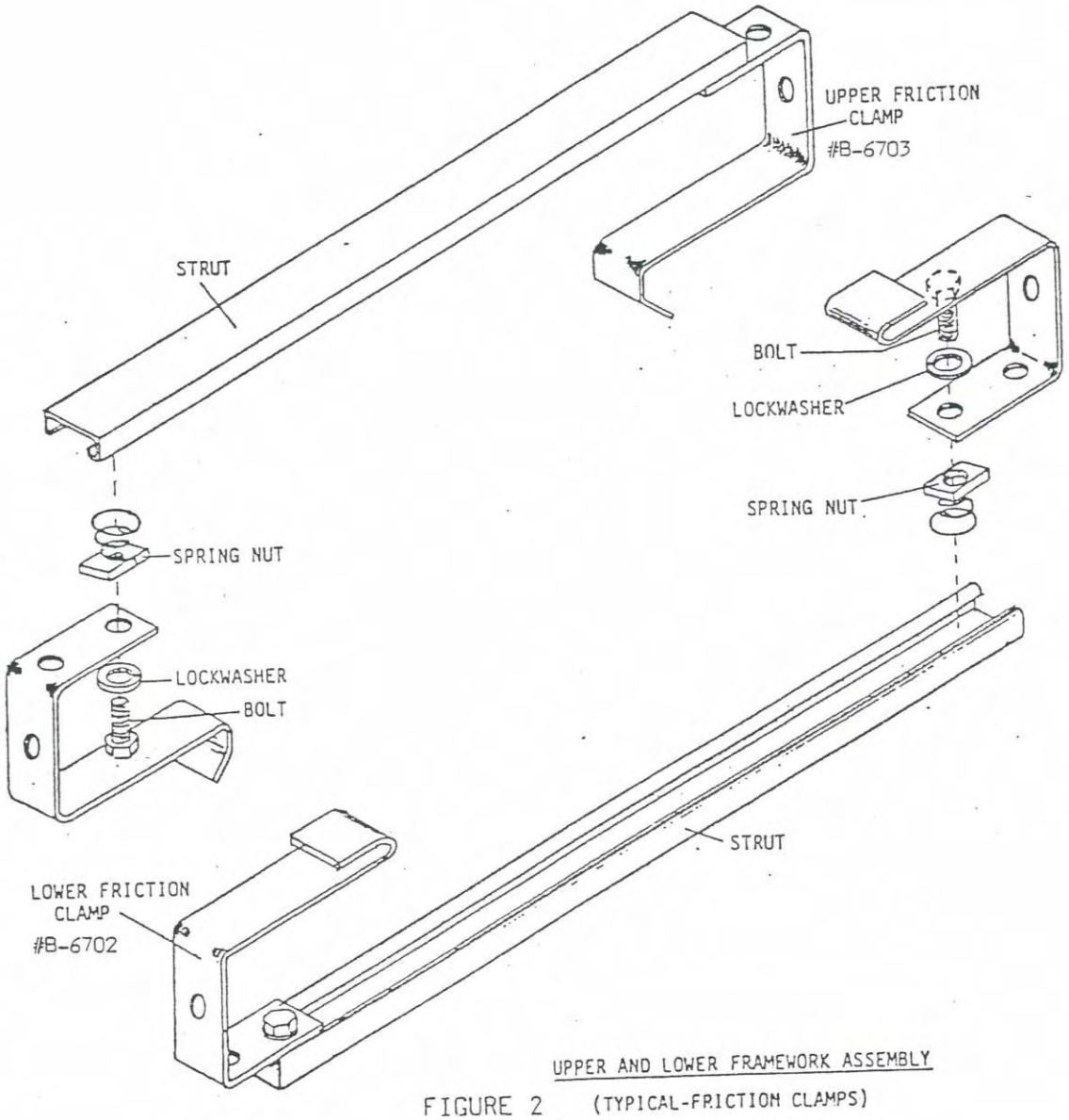
6.2.2 Attach clamps to each end of horizontal struts using bolt and lockwasher threaded into spring nut. (Written instruction for installation of alternate clamping devices shall be delineated on site specific addendums to this and/or other procedures.)

When necessary for additional support, horizontal strut may be attached to an adjacent support using the #B-6141 flat bracket. In order to match existing interferences, horizontal and side struts may be installed at acute or obtuse angles.



UPPER AND LOWER FRAMEWORK ASSEMBLY

FIGURE 2 (TYPICAL-FRICTION CLAMPS)

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

6.2.3 Install clamp and strut assembly onto cable tray on approximate eighteen (18") inch centers. At least every seventh assembly should be locking clamps. Additional locking clamps may be installed if required by Installer's Site Engineer. Clamps may be mixed as determined by the Installer's Site Engineer (See Figure 3A and Figure 3B). Do not damage cable during installation.

G #B-6700 and #B-6701 brackets may be bent as necessary to install framework. Two (2") inch minimum air space to be maintained in all directions between the outside of the tray and the outside of the struts, unless approved by FCR.

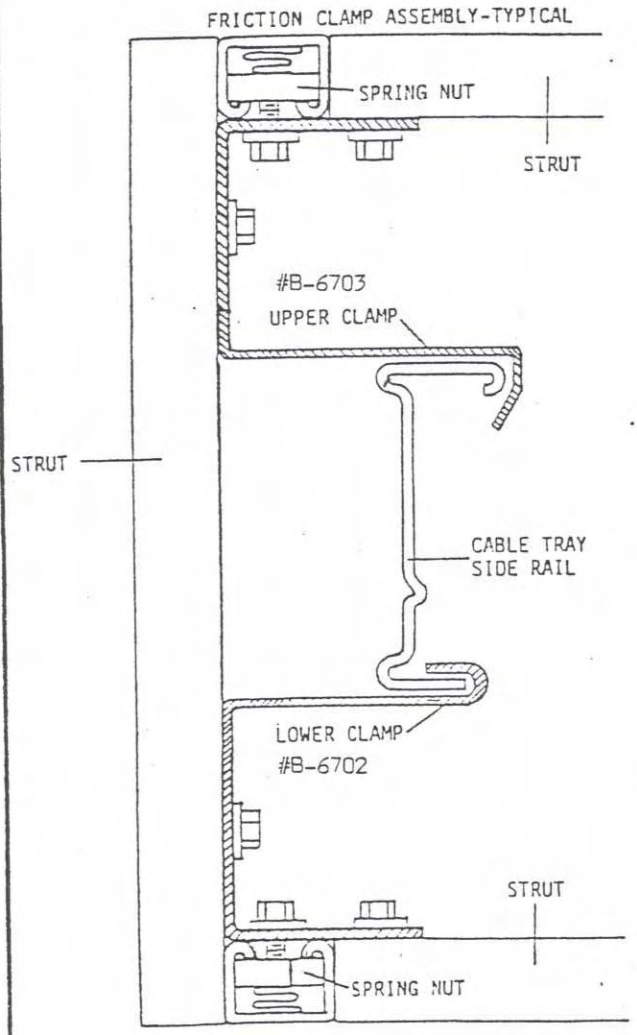


FIGURE 3A

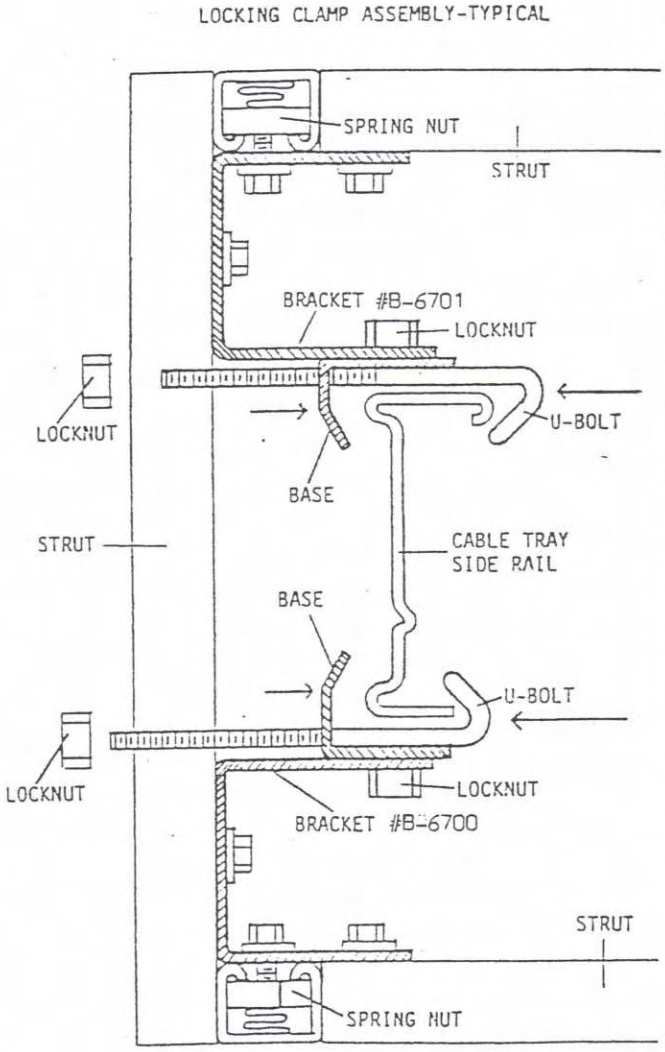


FIGURE 3B

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6.2.4 Attach side struts to horizontal assemblies using bolt and lockwasher threaded into spring nut. Strut may need to be moved up or down to facilitate bolt insertion. (See Figure 4.) In order to match existing interferences, horizontal and side struts may be installed at acute or obtuse angles.

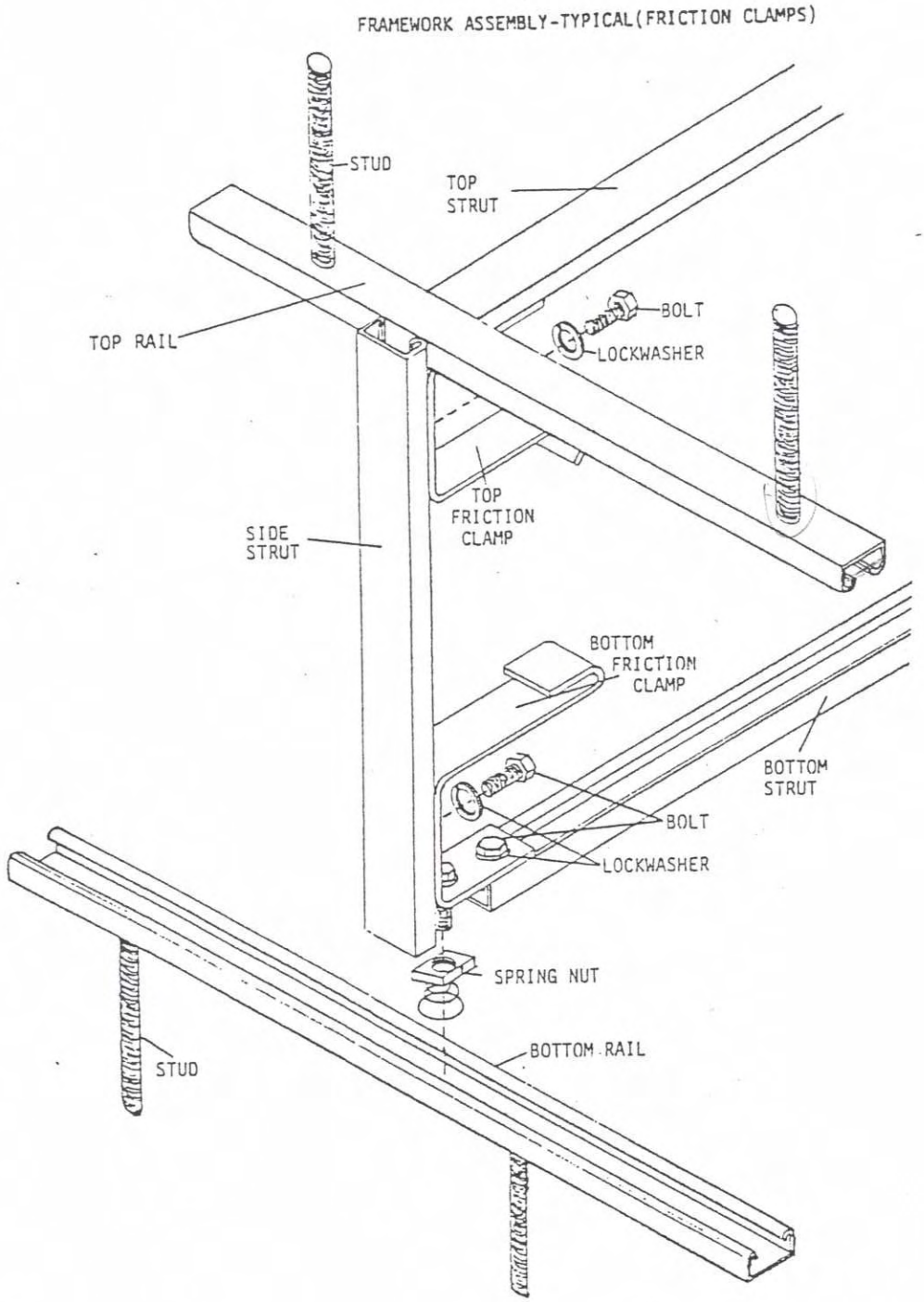


FIGURE 4

6.2.5 Insert spring nuts into rails on approximate eighteen (18") inch centers.

6.2.6 With the framework sections placed on approximate eighteen (18") inch centers (± 1"), attach rails using bolts and lockwashers.

6.2.7 Check to ensure that side struts are flush (± 1/4") with the rails and firmly tighten bolts to ensure side struts to clamps.

6.2.8 Firmly tighten bolts to ensure rails to clamps.

6.2.9 Remove gaps, if any, between rails and horizontal strut by pulling on opposing side strut or rail and firmly tighten bolt to secure horizontal struts.

6.2.10 Firmly tighten locknuts on positive clamp U-Bolt to secure framework.

6.2.11 Frameworks may be shifted, if necessary, by loosening bolt to rail, moving framework as required, and retightening bolt.

6.3 Wrap Installation

6.3.1 Assemble materials, wraps, washers, nuts, etc., in area of cable tray to be protected.

6.3.2 For ease of installation either the sides or bottom wrap may be placed on the framework first. The top blanket should be the last blanket to be placed on the framework in order to have ease of access to cables.

6.3.3 Attach side wraps to top rails by forcing wraps onto studs (Use of pointed instrument, such as a punch, to start holes in wraps is suggested). Ensure the wrap is secured to studs. Impale wrap (inside filler material) at least two (2") inches past the edge of the stud. (See Figure 5.)

[CONTINUED ON NEXT PAGE]

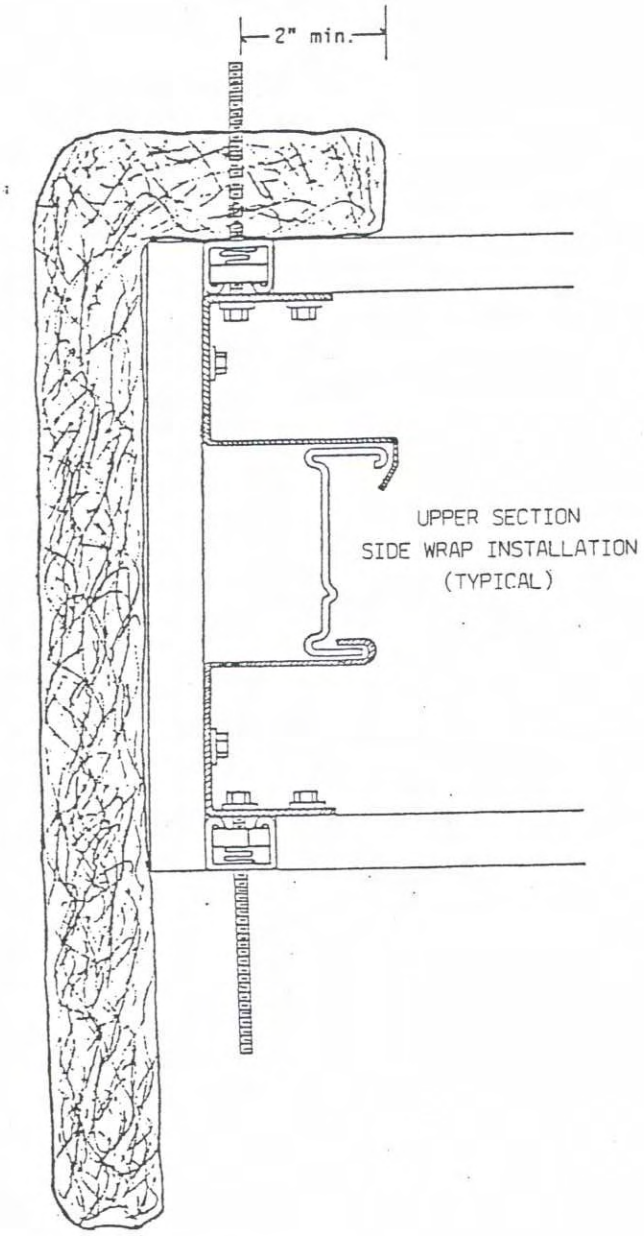


FIGURE 5

6.3.4 Install bottom wrap onto bottom rails. This is easier if both sides are done at the same time working from one end. Use fender washers and locknuts to hold the wrap onto the studs temporarily. Do not tighten the locknuts or damage the plastic insert. (See Figure 6.) If locknut is damaged, replace with a new one.

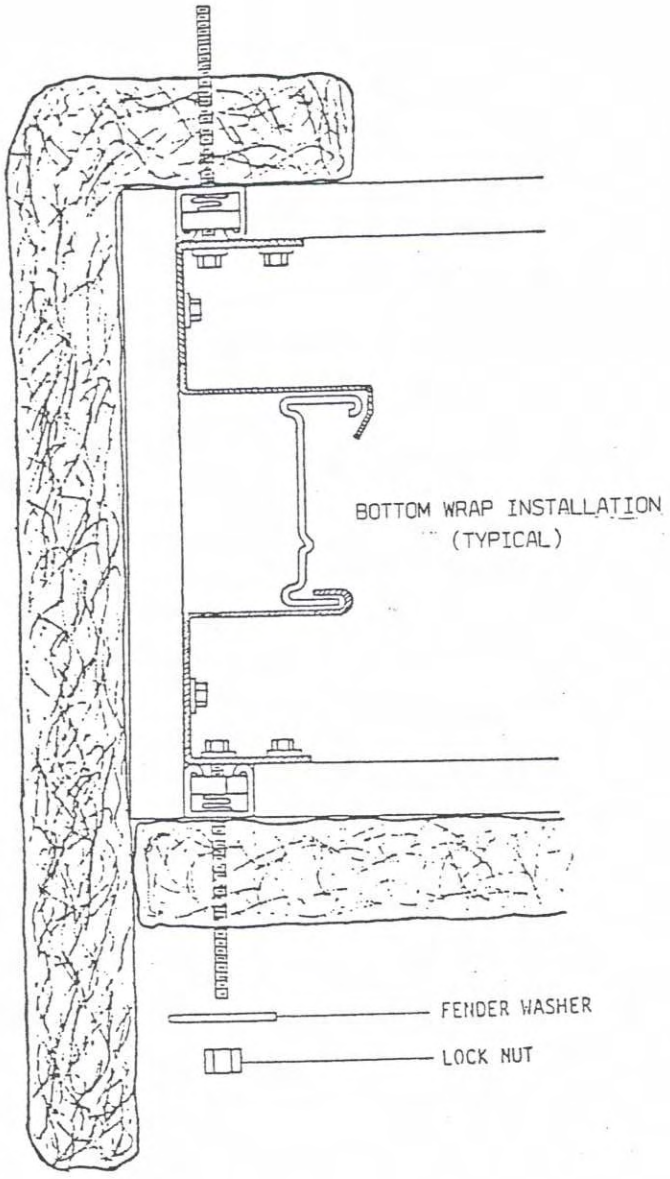


FIGURE 6

ISSUE DESIGNATION IN THIS COLU INDICATES CURRENT CHANGE

6.3.5 Attach lower end of side wraps to bottom rail. This is best accomplished by removing, one at a time, a fender washer and locknut supporting the bottom wrap, forcing the side wrap onto the stud and re-installing the fender washer and locknut. Make sure that the side wrap extends a minimum of two (2") inches past the studs. (See Figure 7.)

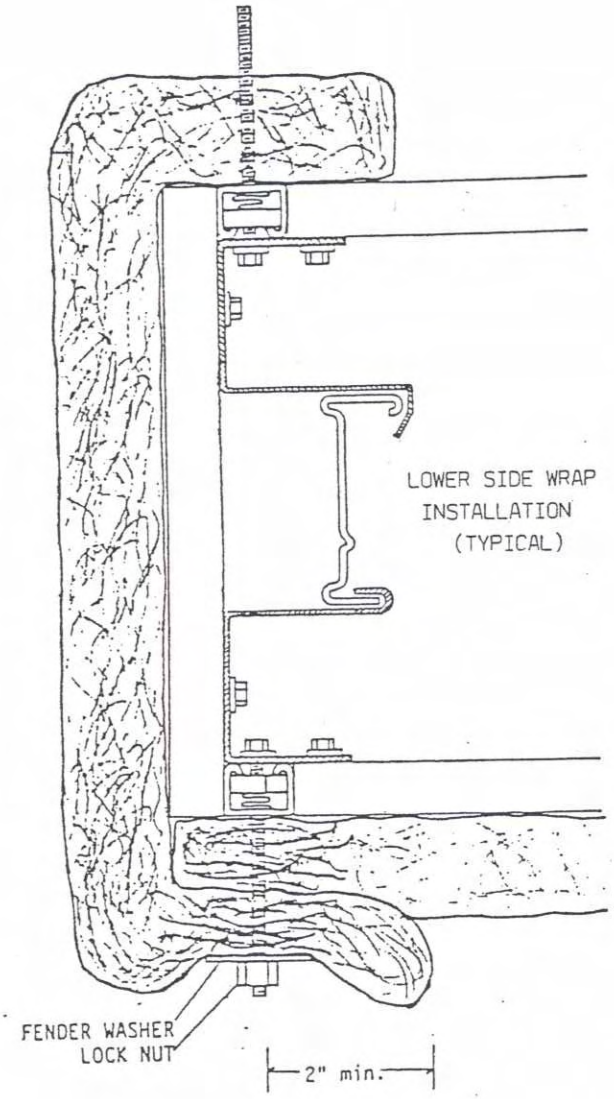


FIGURE 7

6.3.6 Place top wrap on top framework approximately centered. Push wrap onto studs and install fender washer and locknuts. (See Figure 8.)

6.3.7 Tighten locknuts onto studs until the wraps are compressed one-fourth to one-half (1/4" - 1/2") inches.

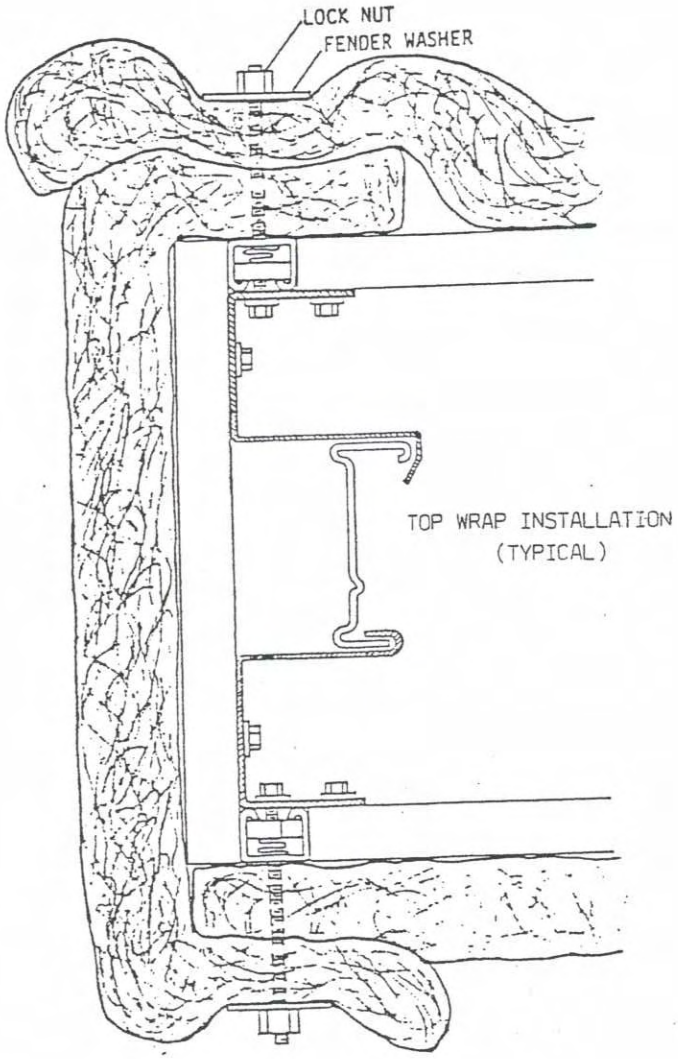
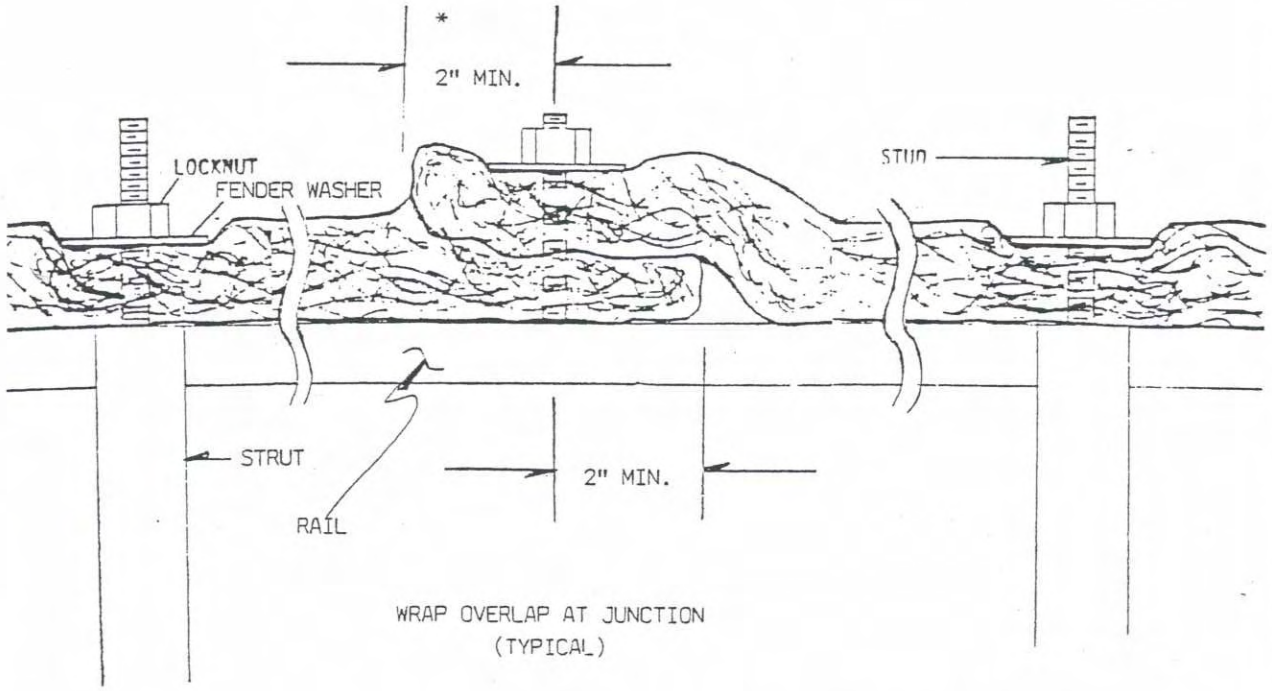


FIGURE 8

ISSUE DESIGNATION IN THIS COLU .DICATES CURRENT CHANGE

G 6.3.8 At Wrap System continuation joints, the continuing Wrap System must overlap four to six (4" - 6") inches onto the other system. (See Figure 9.) Additional studs may be required as determined by Installer's Site Engineer. These studs are to be installed by Construction or any required or additional framework rail or strut where Wrap System needs additional support. In some cases, pin rail may need to be installed in place of strut. Engineering approval is not required for additional support.



WRAP OVERLAP AT JUNCTION
(TYPICAL)

* SEE PARA 6.3.9 WHEN EXTERIOR BLANKET DOES NOT EXTEND BEYOND THE STUDS THE REQUIRED 2" MINIMUM.

FIGURE 9

6.3.9 In those situations where the exterior blanket at any joint does not extend beyond the studs the recommended two (2") inch minimum, an overlap of less than two (2") inches used in conjunction with a continual quartz thread stitching along the joint is an acceptable alternate.

6.3.10 Stagger Wrap System continuation joints so that only opposite sides stop at any one stud (two side wraps or top and bottom wrap). No more than three thicknesses of wrap should be on any one stud.

ISSUE DESIGNATION IN THIS CO N INDICATES CURRENT CHANGE

FABRICATION PROCEDURE FOR THREE HOUR FIRE M.T. BARRIER COMPONENTS

1.0 PURPOSE

The purpose of this procedure is to assure that the fabrication of the Three Hour Fire M.T. Barrier Components are consistent with the system components as tested in PROMATEC Three Hour Fire qualification tests.

2.0 SCOPE

The PROMATEC Three Hour M.T. Barrrier System is comprised of Three compponent assemblies: 1) Inner Blanket Assembly, 2) Moisture Barrier, 3) Outer Blanket Assembly. This procedure shall address the Inner Assembly and Outer Assembly only and shall provide the methods and guidelines utilized in the fabrication of these assemblies.

3.0 REFERENCES

3.1 Fabrication Order (Form QC-59). See Attachment 7.1.

3.2 QCP-0042 -- Fabrication Inspection for PROMATEC protective wrap envelopes (Blankets).

3.3 QCP-0041 -- Packaging, shipping, receiving, handling and storage of PROMATEC protective wrap components

4.0 DEFINITIONS

4.1 Hot Side -- The outermost surface of a blanket assembly. See Attachment 7.2, Figure 3.

4.2 Cold Side -- The innermost surface of a blanket assembly. See Attachment 7.9, Figure 7.

5.0 RESPONSIBILITY

5.1 The Construction Manager or designee shall be responsible for the preparation and processing Fabrication Orders (QC-59) in accordance with PROMATEC field engineering and/or client requirements.

5.2 The Technical Services Manager or designee shall be responsible for providing assistance and direction for unique design configurations.

5.3 The authorized fabricator shall follow Fabrication Order form (QC-59), fabrication procedure, and Quality Control Procedure. The Quality Assurance Manager or designee shall be responsible for the development and implementation of appropriate procedures for shop field and source inspection of fabricated components to verify conformance with design requirements.

6.0 PROCEDURE

6.1 This procedure applies to the fabrication of the Three Hour M.T. Barrier Components by PROMATEC at the shop and field level, by PROMATEC qualified fabrication sources, and by client or their contractors (when written agreements allow).

6.2 Fabrication performed by any organization other than PROMATEC shall require qualification of such organizations and approval of programs established for controlling fabrication.

6.3 PROMATEC Quality Assurance shall have right of access for source inspection and/or audit to verify compliance with design and quality requirements.

6.4 Prior to the fabrication of any blankets the applicable portions of Fabrication Order Forms (QC-59) shall be completed as outlined in Fabrication Inspection (QCP-0042) guideline. Only acceptable materials listed on Attachment 7.2 will be utilized for fabrication.

6.5 Fabrication of Inner Blanket Assembly

6.5.1 Cut alumina/silica fiber blanket to proper dimensions per Fabrication Order Form (QC-59), to assure finished edge. Cut alumina/silica fiber back six inches as shown on fabrication order to allow for ship lap. See figure 1, Attachment 7.3.

6.5.2 Cut two pieces of fiberglass cloth to proper dimensions for alumina/silica blanket. Allow enough fiberglass cloth to assure all ends have a min. 3/8" tuck. See figure 2, Attachment 7.4.

6.5.3 Place fiberglass cloth and alumina/silica fiber blanket in appropriate position, allow for 3/8" min. tuck on ends and hog ring all edges of fiberglass cloth on hot side of envelope. For spacing of hog rings and clarification of finish edge see figure 3, Attachment 7.5.

6.6 Fabrication of Outer Blanket Assembly

6.6.1 The outer blanket assembly consists of two subassemblies, enveloped in silica dioxide fabric cloth. These subassemblies consist of, alumina/silica fiber blanket and powder (Honey Comb and/or straight tube) envelope.

6.6.2 Fabrication of the powder envelope (Honey Comb).

6.6.2.1 Cut three pieces of coated fiberglass cloth to dimensions assuring proper finished edges as per fabrication order form.

6.6.2.2 Lay all three pieces of coated fiberglass cloth together and sew a single stitch the length of the fabric 1/2"(±1/4") from the edge on one side only.

6.6.2.3 Sew top and center layers of cloth 3/8"(±1/8") form first sewn edge. Sew with a single stitch the length of the fabric.

6.6.2.4 Fold bottom end of fabric (across grain of tubes) 1/2"(±1/4") and sew across the length of fold with a single stitch.

6.6.2.5 Alternate sewing with a single stitch the length of the fabric from the top and center layers and the bottom and center layers every 7/8"(±1/8"). See figure 4, Attachment 7.6.

6.6.2.6 Fold bottom end of fabric (across grain of tubes) 1/2"(±1/4") and sew across the length of fold with a single stitch.

6.6.2.7 Fill each tube with powder to the size required for each assembly. As per Fabrication form (QC-59).

6.6.2.8 Fold top end of fabric (across grain of tubes) 1/2"(±1/4") and sew across fabric with a single stitch to seal tubes. See figure 5, Attachment 7.7.

6.6.3 Alternate-Fabrication of the powder envelope (straight tubes).

6.6.3.1 Cut two pieces of coated fiberglass cloth to dimension assuring proper finished edges as per fabrication order form.

6.6.3.2 Lay the two pieces of coated fiberglass cloth together and sew a single stitch the length of the fabric 1/2"(±1/4") from the edge on one side only.

6.6.3.3 Continue to sew the length of the fabric every 1 5/8"(±1/8") from the first sewn edge with a single stitch. See figure 6, Attachment 7.8.

6.6.3.4 Fold bottom end of fabric (across grain of tubes) 1/2"(±1/4") and sew across the length of fold with a single stitch.

6.6.3.5 Fill each tube with powder to the size required for each assembly. As per Fabrication form (QC-59)

6.6.3.6 Fold top of fabric (across fabric of tubes) 1/2" ($\pm$1/4") and sew across fabric with a single stitch to seal tubes. Reference of finished assembly, see figure 5, Attachment 7.7.

6.7 Cut Alumina/Silica Fiber Blanket to proper dimensions per Fabrication Order Form (QC-59) to assure finished edge.

6.7.1 Cut two pieces of silica dioxide cloth to proper dimensions to make one envelope for alumina/silica fiber blanket and powder assembly.

6.7.2 Place silica dioxide cloth, alumina/silica fiber blanket, and powder assembly in proper layer. Adjust alumina/silica fiber blanket as shown on fabrication order to allow for 6" ship lap design. Hog ring silica dioxide cloth on cold side of outer blanket assembly. See figure 7, Attachment 7.9.

6.7.3 Alternate method for hog rings on outer blanket assembly, is the use of (Type Q-24) teflon coated thread.

6.7.4 Lacing hooks shall be placed 7-1/2"($\pm$1/4") from finished edges. They shall be place on all top ship lap edges 1-1/2" ($\pm$1/4") from the edge. Lacing hooks to be spaced on maximum of 6" centers. See figure 8, Attachment 7.10.

6.8 Identification Markings of Inner and Outer Blankets

6.8.1 Identification markings shall be placed on every blanket assembly, both inner and outer at a minimum of two locations as follows:

a) In close proximity to one of the lengthwise edges on the hot side surface.

b) In close proximity to one of the end edges on the hot side surface.

c) Various project requirements may specify that these markings are also provided on the cold side surface.

6.8.2 These markings shall be the blanket number as shown on Fabrication Order Form (QC-59).

6.8.3 These markings shall be of a site approved waterproof paint and/or ink which will retain the marking, withstand weather deterioration, other handling effects and shall not be deleterious to the fabrics.

6.8.4 These markings shall be in character no less than 3/4" high.

6.8.5 Other Client approved methods of identification, i.e., tags, etc. may be used in lieu of blanket marking as described if required by project specification.

6.9 Multiple Pieces of Ceramic Fiber Blanket

6.9.1 Whenever multiple pieces of alumina/silica fiber blanket are utilized within one envelope the use of ship lap design is to be used, and darting with Quartz (Type Q-24) thread is to be used to avoid separation of the pieces of alumina/silica fiber blanket. See figure 9, Attachment 7.11.

7.0 ATTACHMENTS

7.1 Fabrication Order Form (QC-59)

7.2 Acceptable Material (Proprietary Information)

7.3 Figure 1

7.4 Figure 2

7.5 Figure 3

7.6 Figure 4

7.7 Figure 5

7.8 Figure 6

7.9 Figure 7

7.10 Figure 8

7.11 Figure 9

ISSUE DESIGNATION IN THIS CC ↓ INDICATES CURRENT CHANGE

PROMATEC

FABRICATION ORDER

PFO-

PROJECT NAME	CUSTOMER	CUSTOMER ORDER NO.	JOB NO.

TYPE _____ QUANTITY _____

LENGTH _____ WIDTH _____ THICKNESS _____ TOTAL FT^2 _____

SCHEMATIC DRAWING REF. _____ SCHEMATIC NO. _____

I.D. NO. _____

ORDERED BY _____ DATE _____

SKETCH

CERTIFICATE OF CONFORMANCE

We hereby certify that all items furnished were fabricated with materials provided by PROMATEC and conform to the requirements of Purchase Order No. _____.

Signature _____ Company _____ Date _____

PROMATEC QUALITY ASSURANCE ACCEPTANCE

Signature _____ Title _____ Date _____

ISSUE DESIGNATION IN THIS CL ↓ INDICATES CURRENT CHANGE

ATTACHMENT 7.2

Only approved materials as listed below shall be utilized in the fabrication of PROMATEC's protective wrap components.

1. Silica Dioxide Cloth

   a. Siltemp S84 and/or 84 SRWR
   b. Santex
   c. Refrasil

2. Fiberglass cloth (Inner Blanket).

   a. Alpha 76281-4634
   b. J.P. Stevens 3582 3910
   c. J.P. Stevens 2025
   d. Havaglass

3. Coated fiberlass cloth

   a. Alpha 76281-4634
   ~~b. J.P. Stevens 3582 3910~~

INNER
OUTER
not same as Figure 1

4. Alumina Silica Fiber Blanket - 1" and 1-1/2" nom.

   a. Johns Manville Cerablanket, 8# density 2400° F.
   b. Babcock & Wilcox Kaowool Blanket, 8# density 2300° F. Carborundum Durablanket, 8# density 2300° F.

5. Trihydrate Alumina Grade 30

   a. Alcoa-C30 and/or B. Solem-SB30

6. Hog Rings

   a. Spenaz 16SS-110
   b. Or approved equal

7. Lacing Hooks

   a. Alpha-Maritex 2-1/2" AML-1201-SS
   b. Erico Jones
   c. Or approved equal.

8. Nylon Thread

   a. Tex 90 Spun Kevlar

9. Quartz Thread

   a. Astroquartz - Type Q-24 teflon coated
      and/or
   b. Alphaquartz - Type Q-24 teflon coated

ISSUE DESIGNATION IN THIS COL. A INDICATES CURRENT CHANGE

INNER BLANKET ASSEMBLY
ALUMINA/SILICA FIBER BLANKET

ONE - ONE HALF - TWO INCH THICK

not same as 4.0

1" inner } per
1½ outer } IP-001
4.1 & 4.3

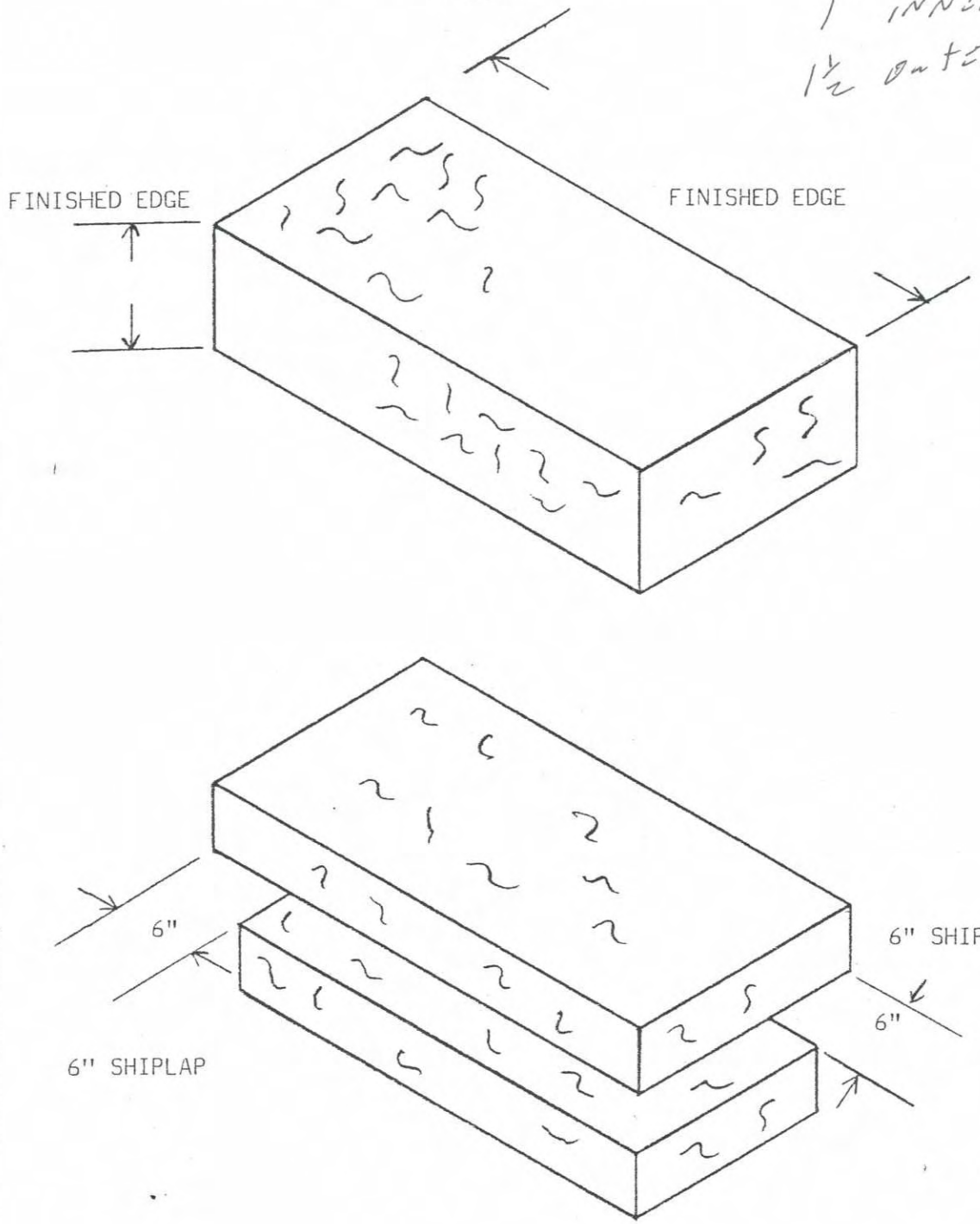


FIGURE 1

ISSUE DESIGNATION IN THIS CO N INDICATES CURRENT CHANGE

INNER BLANKET ASSEMBLY

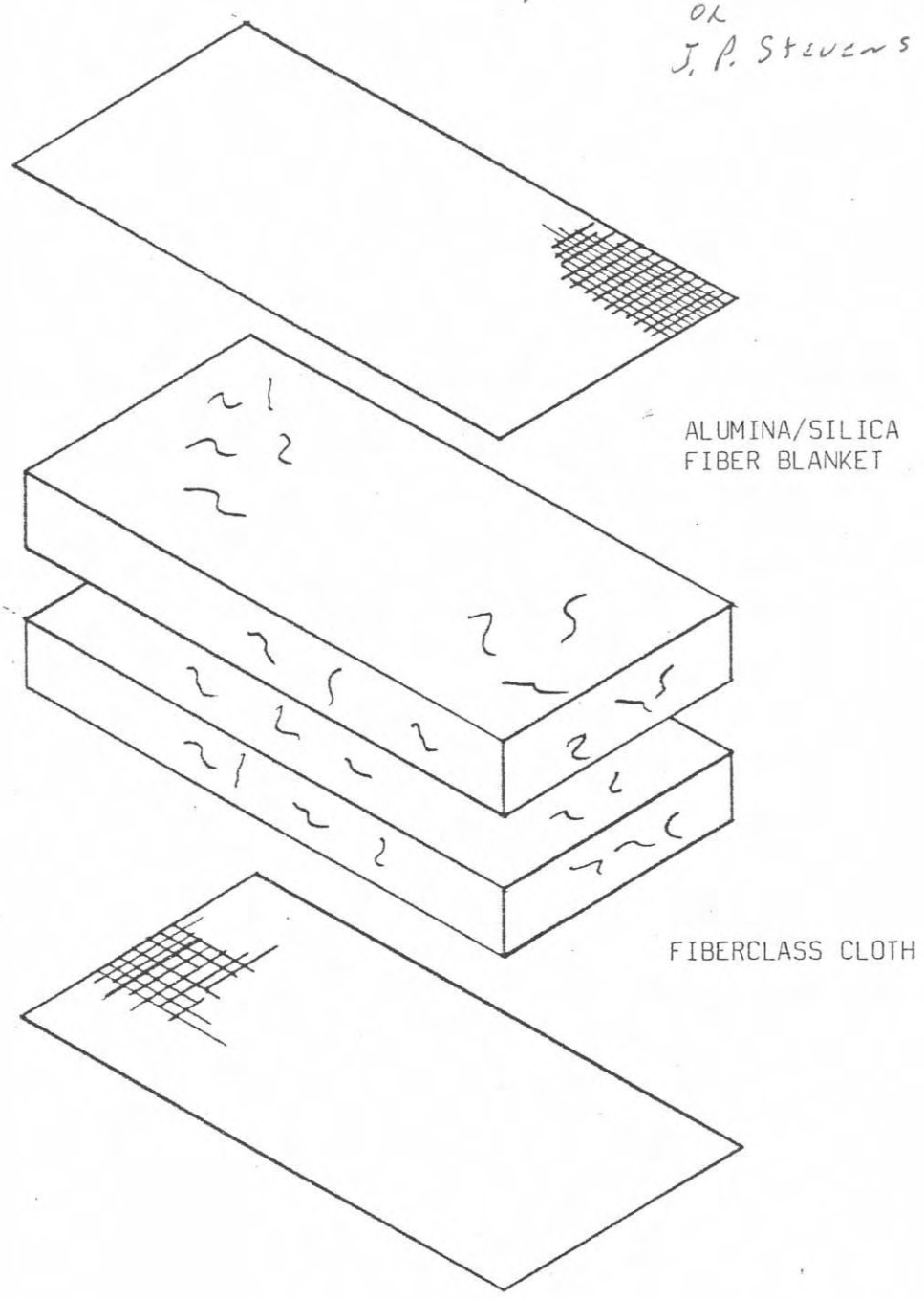


FIGURE 2

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

INNER BLANKET ASSEMBLY

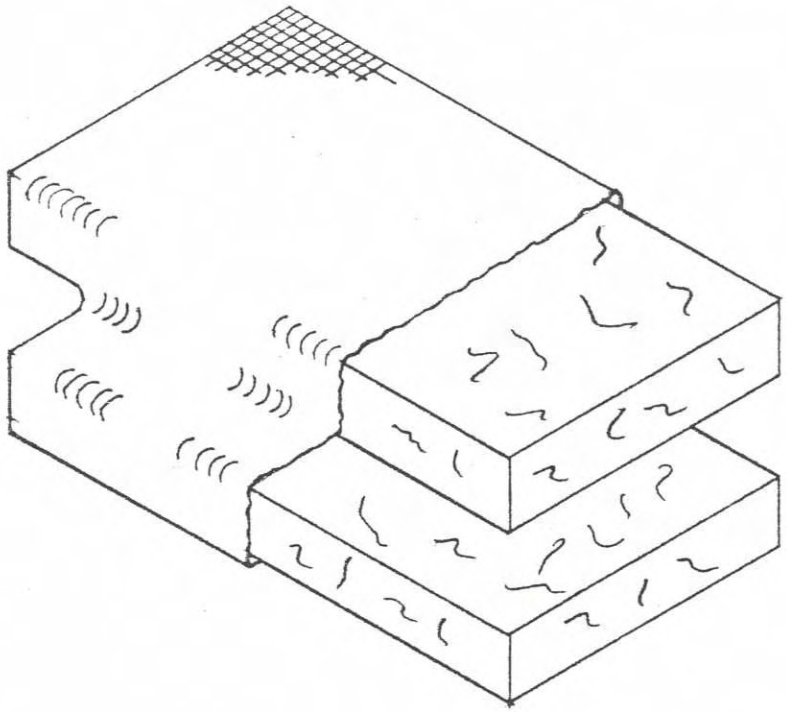


FIGURE 3

ISSUE DESIGNATION IN THIS CL N INDICATES CURRENT CHANGE

HONEY COMB TUBE ASSEMBLY

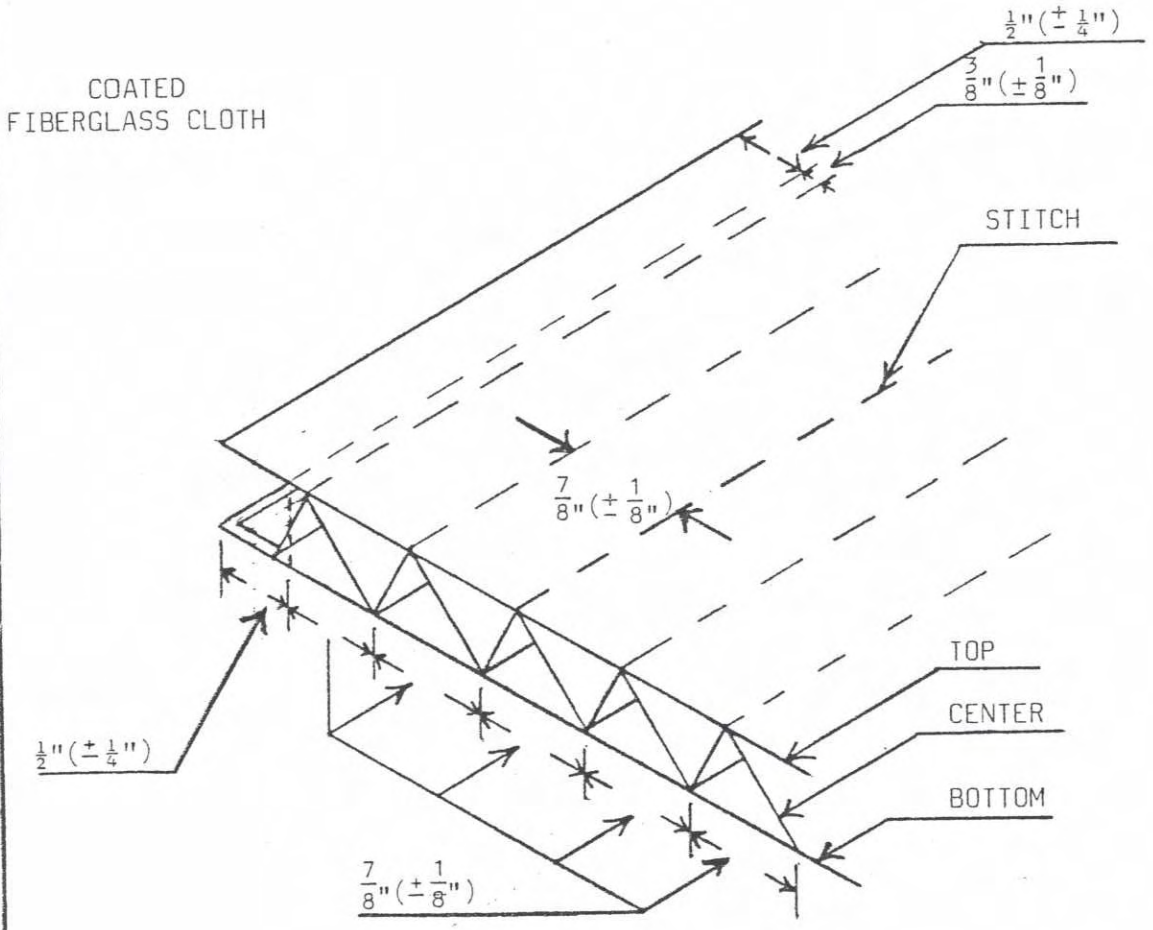


FIGURE 4

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

HONEY COMB AND/OR STRAIGHT TUBE POWDER ASSEMBLY

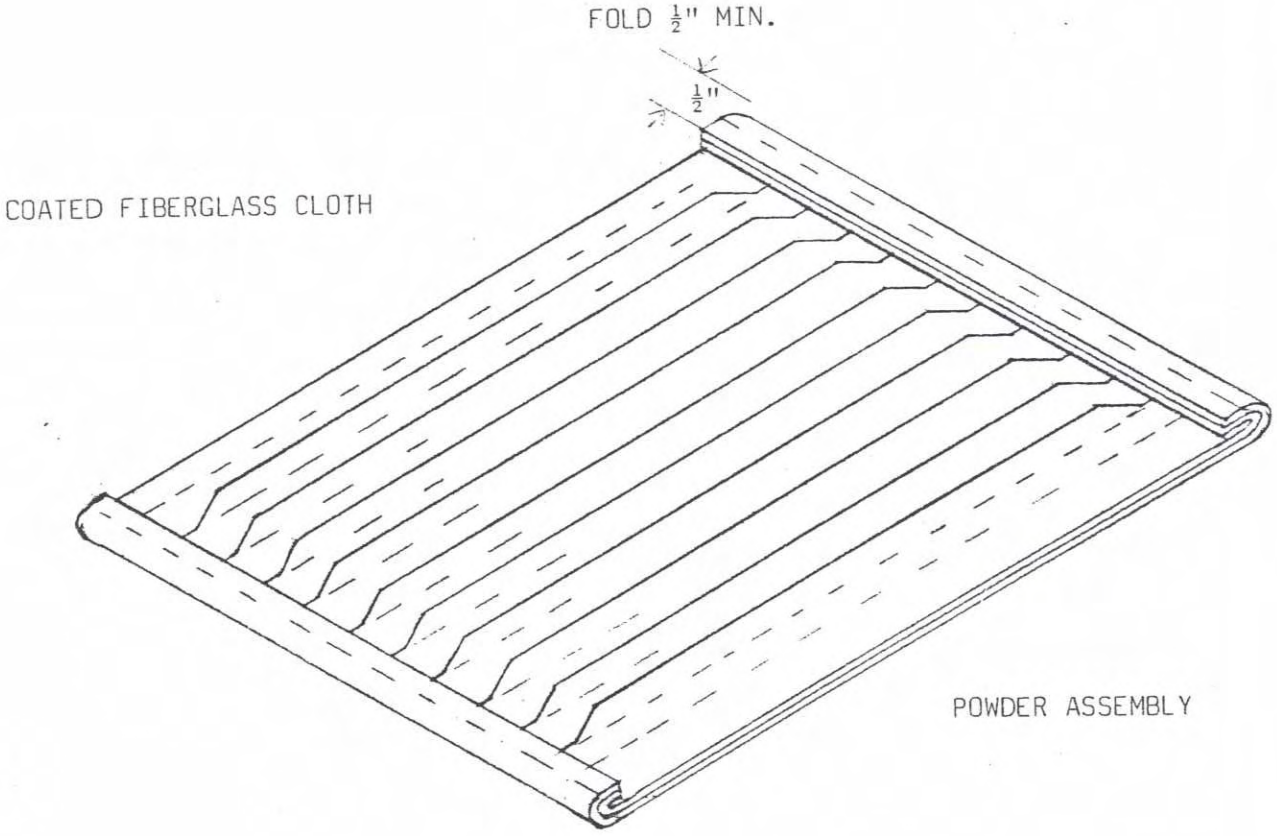
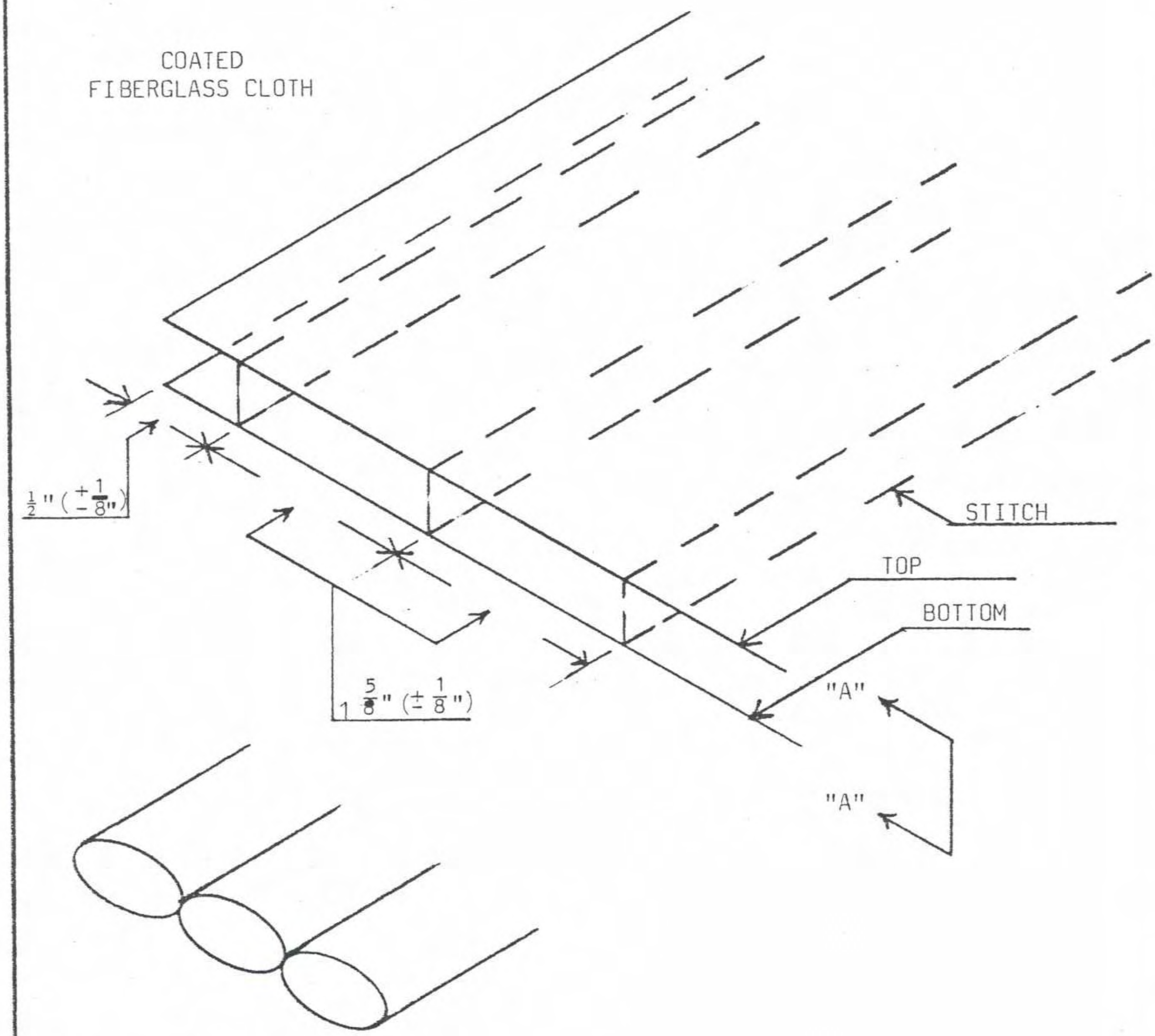


FIGURE 5

ISSUE DESIGNATION IN THIS LOCATION INDICATES CURRENT CHANGE

STRAIGHT TUBE ASSEMBLY



SECTION "A"-"A"

FIGURE 6

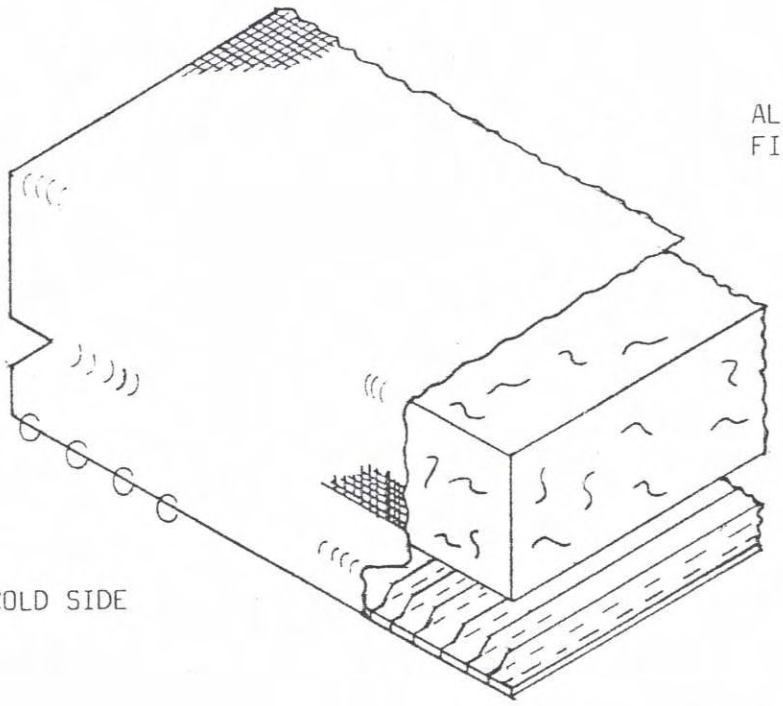
ISSUE DESIGNATION IN THIS C N INDICATES CURRENT CHANGE

OUTER BLANKET ASSEMBLY

SILTEMP CLOTH

ALUMINA/SILICA
FIBER BLANKET

SHIPLAP
6"MIN.



HOG RINGS
SPACING 1"($\pm\frac{1}{4}$")

COLD SIDE

POWDER ASSEMBLY

FIGURE 7

ISSUE DESIGNATION IN THIS C. IN INDICATES CURRENT CHANGE

OUTER BLANKET ASSEMBLY

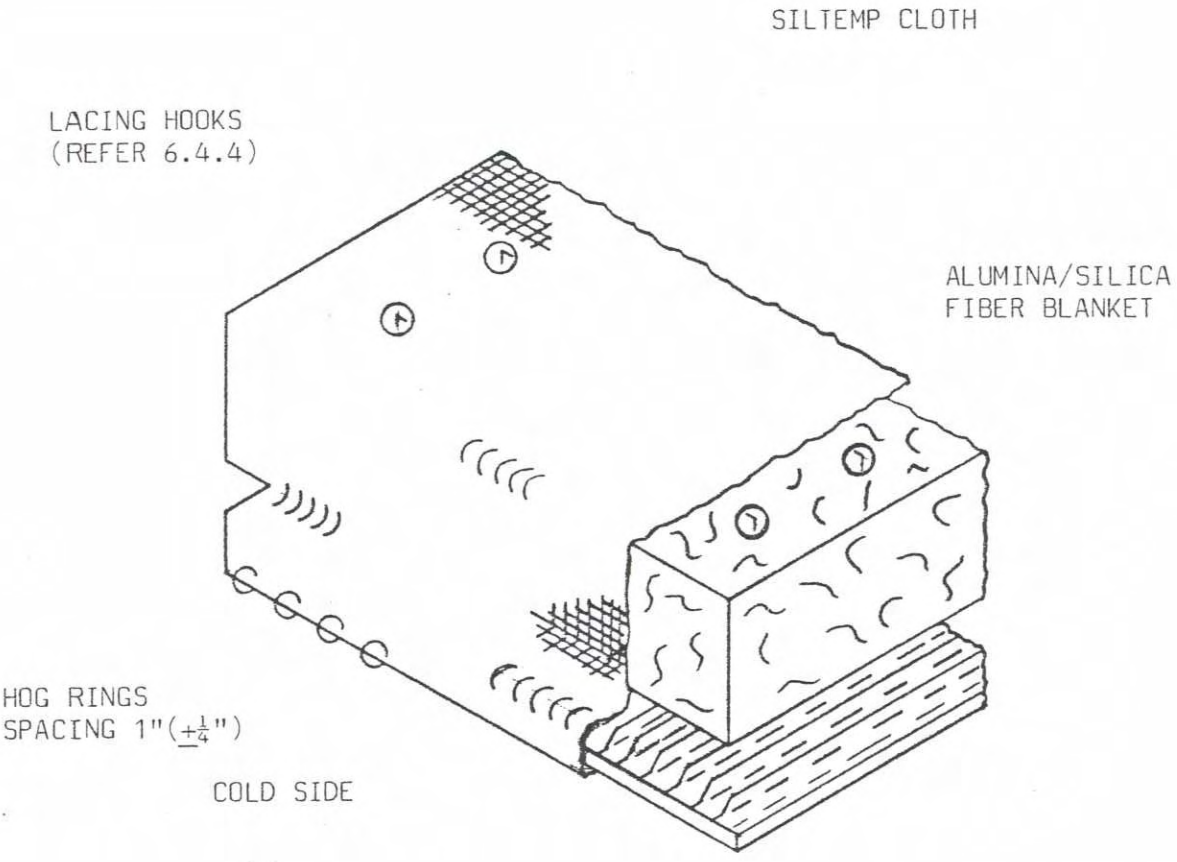


FIGURE 8

ISSUE DESIGNATION IN THIS C. N INDICATES CURRENT CHANGE

MULTIPLE ALUMINA/SILICA FIBER BLANKET

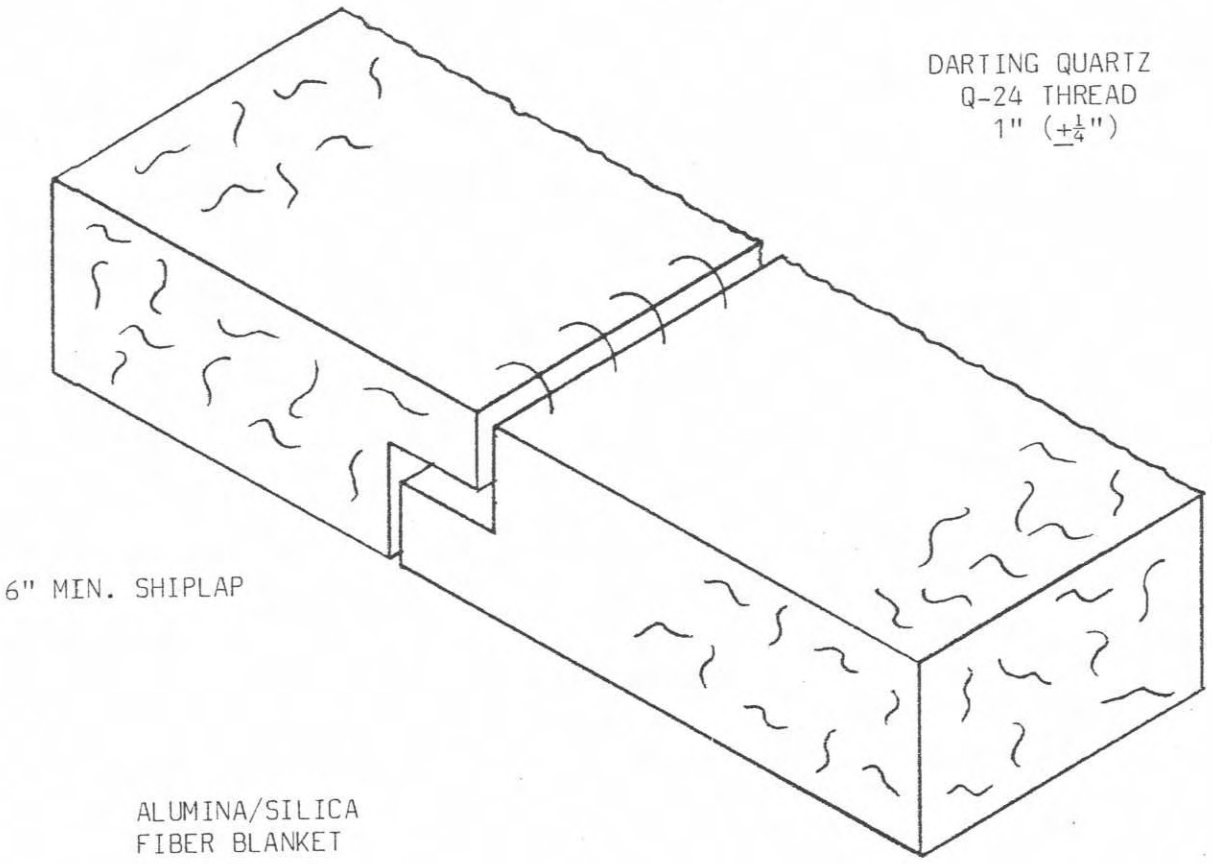


FIGURE 9

ISSUE DESIGNATION IN THIS COLL INDICATES CURRENT CHANGE

INSTALLATION OF
THREE HOUR PROTECTIVE WRAP SYSTEMS
CONDUITS / THREE SIDED WRAP / CABLE DROPS

1.0 PURPOSE

To establish methods and guidelines for the installation of PROMATEC Three Hour Fire Protective Wrap Systems in accordance with established design criteria.

2.0 SCOPE

2.1 To provide methods and sequence steps for installation of inner blanket assemblies, foil barrier and the outer blanket assemblies.

2.2 To establish dimensional requirements for installation.

2.3 To provide requirements and methods for field repairs and modifications.

2.4 Inform craft personnel of the Quality Control inspection notification points to assure work does not proceed until such inspection is performed.

3.0 REFERENCE

3.1 QCP-0041, Installation Inspection of Three Hour Fire Protective Wrap Systems

3.2 Typical Design Details B-495 and B-496

4.0 DEFINITIONS

4.1 **INNER BLANKET** - total one (1") inch thickness of alumina silica blanket enveloped with fiberglass cloth.

4.2 **FOIL BARRIER** - .002 thick stainless steel foil.

4.3 **OUTER BLANKET** - a multi-layered outer blanket assembly consisting of a one and one-half (1-1/2") inch alumina silica blanket and a separate prefabricated fiberglass assembly containing a powdered ingredient with either both enveloped by a fire resistant outer fabric or as two separate components with alumina silica blanket enveloped with a fire resistant fabric.

5.0 RESPONSIBILITIES

5.1 The authorized Installer's ENGINEERING DEPARTMENT shall be responsible to define

the scope of work as prescribed on the applicable contract documents and provide the appropriate drawings, specifications, requirements, instructions, etc., to the department responsible for installation.

This department shall also be responsible to provide liaison with applicable client personnel and other internal departments to assure smooth flow of communication.

5.2 The authorized Installer's PRODUCTION DEPARTMENT shall be responsible for the identification and scheduling of work to be performed as defined on the documents furnished by Engineering.

5.3 The Installer's, as trained and certified by PROMATEC, shall be responsible for performance of installation activities herein prescribed.

5.4 The Installer's QUALITY CONTROL PERSONNEL, as trained and certified by PROMATEC, shall be responsible for appropriate inspection, documentation and monitoring.

6.0 PROCEDURE

6.1 Only approved materials as supplied by PROMATEC, issued under controlled conditions, shall be used in the installation, modification and repair of Three Hour Fire Protective Wrap System components.

6.2 Conduit/Junction Box Installation

6.2.1 Installation of Inner Blanket Assemblies
(Refer to FIRST STEP as shown on Figure 1)

6.2.1.1 Install first inner blanket around the conduit/junction box assuring that the shiplap joint is a tight as possible. Maximum allowable gap is one-half (1/2") inch.

6.2.1.2 Duct tape may be utilized to hold blanket firmly in place (duct tape may be applied completely around blanket to provide tape to tape adhesion).

6.2.1.3 Install subsequent blankets per 6.2.1.1 assuring that lengthwise shiplap joints are as tight as possible. Maximum allowable gap is one-half (1/2") inch.

6.2.1.4 Duct tape per 6.2.1.2.

6.2.1.5 Notify Quality Control for inspection prior to proceeding.

6.2.2 Installation of Stainless Steel Foil Barrier
(Refer to SECOND STEP as shown on Figure 1)

6.2.2.1 Install foil strips lengthwise around the conduit/junction box providing a MINIMUM six (6") inch overlap on ends and edges.

6.2.2.2 In cases where a six (6") inch overlap cannot be achieved due to conduit curvature, foil strips shall be installed with a minimum two (2") inch overlap.

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

6.2.2.3 Duct tape may be utilized to hold foil strips firmly in place. Duct tape and/or aluminum foil tape may be used at the edges of the strips if gap appears excessive due to conduit curvature.

6.2.2.4 Notify Quality Control for inspection prior to proceeding.

6.2.3 Installation of Outer Blanket Assemblies
Refer to THIRD STEP as shown on Figure 2)

6.2.3.1 Install first outer blanket around conduit/junction box assuring that the shiplap joint is as tight as possible. Maximum allowable gap is one-half (1/2") inch.

6.2.3.2 Connect ends by fastening 16 gauge stainless steel tie wire between corresponding lacing hook. Recheck final positioning and tighten securely exercising caution to prevent blanket damage.

NOTE: An additional tie wire may be used after blanket is in final position as necessary to assure a snug fit.

F 6.2.3.3 Install subsequent blankets per 6.2.3.1 and 6.2.3.2 assuring that lengthwise shiplap joints are properly aligned.

F 6.2.3.4 Connect adjoining blankets at circumferential shiplap joints by fastening 16 gauge stainless steel tie wire between each corresponding lacing hook.

NOTE: An additional tie wire may be used after blanket is in final position as necessary to assure a snug fit.

6.2.3.5 Notify Quality Control for final inspection.

6.3 Three Sided Wrap Installation
(Refer to Typical Design Drawings B-495 and B-496)

A three sided or similar installation is required in the event that the conduit or a junction box is installed in close proximity to a wall or floor preventing installation of a wrap surrounding the conduits.

This type of installation requires attachment to concrete surface utilizing site approved anchoring devices as outlined herein. If anchors are installed by others, notify Quality Control for inspection per 6.3.3 prior to proceeding with blanket installation.

6.3.1 Install site approved concrete anchors (minimum 1/4" diameter recommended) on maximum twelve (12") inch centers. Distance from sides of conduit or junction boxes to be determined by Engineering.

Factors to consider are: 1) blanket size, 2) surface characteristics of concrete, 3) number and type of interferences.

6.3.2 Anchors should be pre-set before blankets are impaled onto studs.

6.3.3 Notify Quality Control for inspection before proceeding.

6.3.4 Place inner blanket around conduit or junction box and impale on studs going from side to side to assure proper alignment. Maintain a one (1") inch nominal thickness of inner blanket.

6.3.5 Duct tape may be utilized to keep joints flush and to hold blanket(s) in position.

6.3.6 Edge of inner blanket shall extend a minimum of two (2") inches from center of studs.

6.3.7 Notify Quality Control for inspection before proceeding.

6.3.8 Install stainless steel foil barrier over inner blanket providing a MINIMUM six (6") inch overlap on all joints. In cases where six (6") inch overlap cannot be achieved due to sharp curvatures install foil strips with a minimum two (2") inch overlap.

6.3.9 Impale foil over studs allowing for the two (2") inch minimum requirements.

6.3.10 Duct tape may be utilized to hold foil firmly in place. Aluminum foil tape may be utilized if gaps are excessive.

6.3.11 Notify Quality Control for inspection before proceeding.

6.3.12 Install outer blanket over foil barrier and impale over studs. Edge of outer blanket shall extend a minimum of two (2") inches over studs. Maintain a two and one-half (2-1/2") inch nominal thickness of outer blanket.

6.3.13 Install fender washers and/or B72 strut and/or flat bar retainer strap over studs assuring that blanket assemblies are not wrinkled or bunched.

6.3.14 Install appropriate sized locknuts (or double nuts) and securely tighten. Do not over-tighten. Depression of blanket shall not exceed three-fourths (3/4") inch.

6.3.15 Connect adjacent blankets or edges of a prefabricated blanket together with 16 gauge stainless steel tie wire between each corresponding lacing hook.

NOTE: An additional tie wire may be used after blanket is in final position as necessary to assure a snug fit.

6.3.16 Recheck final positioning and tighten securely. Exercise caution to prevent damage to blanket assemblies.

6.3.17 Notify Quality Control for final inspection.

6.4 Field Modifications and Repairs

6.4.1 Should an opening in the Wrap System exist due to installation conditions, fill with appropriate inner blanket, alumina silica blanket/fiber, foil barrier and/or outer blanket materials. Engineering to determine size of such small assemblies required.

ISSUE DESIGNATION IN THIS COL[UMN I]NDICATES CURRENT CHANGE

If hog rings are to be used to close blanket assembly, rings are to be installed on one (1") inch MAXIMUM centers. Q-24 Quartz Thread may be used in lieu of hog rings for inner and/or outer blanket.

Site craft installers to fabricate under supervision of Engineering. Quality Control to provide inspection of such fabrication and/or installation.

6.4.2 Non-electrical interferences (piping, hangers, supports, etc.) shall be protected with a nominal four (4") inch thickness of alumina silica blanket. The outer layer of alumina silica blanket shall be enveloped with an approved outer fabric. Wrap for a minimum distance of eighteen (18") inches or for full length of interference if less than eighteen (18") inches as shown on Figure 3, page 11 of this procedure. Install a sufficient number of lacing hooks and tie wire to close longitudinal seam and to secure wrap to primary system.

6.4.3 When a protected conduit is in close proximity to an electrical cable tray, the interfering portion of the tray shall be included within the conduit wrap system.

Insert alumina silica blanket/fiber around cables for a minimum distance of eighteen (18") inches from each side of the protected conduit as shown on Figure 4, page 12 of this procedure.

6.4.4 Craft installers shall repair damaged blanket assemblies under supervision of Engineering. Only acceptable materials shall be utilized.

6.4.4.1 Patches of proper fabric type shall be cut to a size sufficient to cover a tear or hole overlapping a minimum of two (2") inches onto undamaged fabric. Patches shall have a finished edge on all sides. Install as shown on Figure 5, page 13 of this procedure.

NOTE: Small tears not exceeding two (2") inches in length can be loop stitched with Q-24 thread at maximum spacing of one-half (1/2") inch. Holes or tears in fiberglass cloth and outer fabric not exceeding one (1") inch shall not require repair.

6.4.4.2 If inner alumina silica blanket material is damaged or has a void, add additional material as necessary.

6.4.4.3 Engineering concurrence shall be obtained for any repair activities. Upon completion, notify Quality Control for inspection.

6.4.5 Additional lacing hooks may be added as needed in conjunction with original installation or modification.

6.5 Cable Drop Installation

6.5.1 Installation of Inner Blanket Assemblies
(Refer to first step as shown in Figure 6)

6.5.1.1 Bundle cables into as nearly a round configuration as feasible. Duct tape or cable tie wraps may be used to maintain this configuration.

6.5.1.2 Install first inner blanket around cable bundle assuring that shiplap joint is as tight as possible. Maximum allowable gap is one-half (1/2") inch.

6.5.1.3 Duct tape may be utilized to hold blanket firmly in place (duct tape may be applied completely around blanket to provide tape to tape adhesion).

6.5.1.4 Install subsequent blankets (if required) per 6.5.1.2 assuring the lengthwise shiplap joints are as tight as possible.

6.5.1.5 Duct tape per 6.5.1.3.

6.5.1.6 Notify Quality Control for inspection prior to proceeding.

6.5.2 Installation of Stainless Steel Foil Barrier
(Refer to second step as shown in Figure 6)

6.5.2.1 Install foil strips length wise around the cable bundle providing a minimum six (6") inch overlap on ends and edges.

6.5.2.2 Duct tape may be utilized to hold foil strips firmly in place. Duct tape and/or aluminum foil tape may be used at the edges of the strips if gaps appear excessive due to curvature of the cable drop bundle.

6.5.2.3 Notify Quality Control for inspection prior to proceeding.

6.5.3 Installation of Outer Blanket Assemblies
(Refer to third step as shown on Figure 7)

6.5.3.1 Install first outer blanket around conduit assuring that the shiplap joint is as tight as possible. Maximum allowable gap is one-half (1/2") inch.

6.5.3.2 Connect ends by fastening 16 gauge stainless steel tie wire between each corresponding lacing hook. Recheck final positioning and tighten securely exercising caution to prevent blanket damage.

NOTE: An additional tie wire may be used after blanket is in final position as necessary to assure a snug fit.

6.5.3.3 Install subsequent blankets per 6.2.3.1 and 6.2.3.2 assuring that lengthwise shiplap joints are properly aligned.

6.5.3.4 Connect adjoining blankets at circumferential shiplap joints by fastening 16 gauge stainless steel tie wire between each corresponding lacing hook.

NOTE: An additional tie wire may be used after blanket is in final position as necessary to assure a snug fit.

6.5.3.5 Notify Quality Control for final inspection.

6.6 Alternate method for installing outer blanket assemblies.

6.6.1 Wrap tube assembly around foil barrier assuring that ends abut with no apparent gaps. Install approved tape completely around assembly with tape-to tape adhesion at sufficient spacing to assure no gaps at longitudinal joint.

6.6.2 Install subsequent tube assemblies per 6.6.1 assuring that circumferential joints firmly abut with no apparent gaps and that longitudinal joints are properly aligned. Apply duct tape lengthwise across each circumferential joint to hold in place.

6.6.3 Notify Quality Control for inspection prior to proceeding.

6.6.4 Install alumina silica blanket around tube assembly assuring that ends abut with no apparent gaps. Stagger longitudinal and circumferential joints a minimum six (6") inches from respective tube assembly joints.

6.6.5 Connect longitudinal joints by fastening 16 gauge stainless steel tie wires between each adjacent lacing hook.

NOTE: An additional tie wire may be used after blanket is in final position as necessary to assure a snug fit.

6.6.6 Notify Quality Control for inspection after each blanket is installed.

6.6.7 Install subsequent blankets as noted above. Stagger circumferential joints a minimum six (6") inches from tube assembly joints.

6.6.8 Connect adjoining blankets by fastening 16 gauge stainless steel tie wire between each adjacent lacing hook at circumferential joints assuring tight fit with no apparent gaps.

NOTE: An additional tie wire may be used after blanket is in final position as necessary to assure a snug fit.

6.7 Raceway Identification Tags

6.7.1 Upon completion of Wrap System installation, raceway identification (as furnished by client) shall be affixed on both ends with stainless steel tie wire as follows:

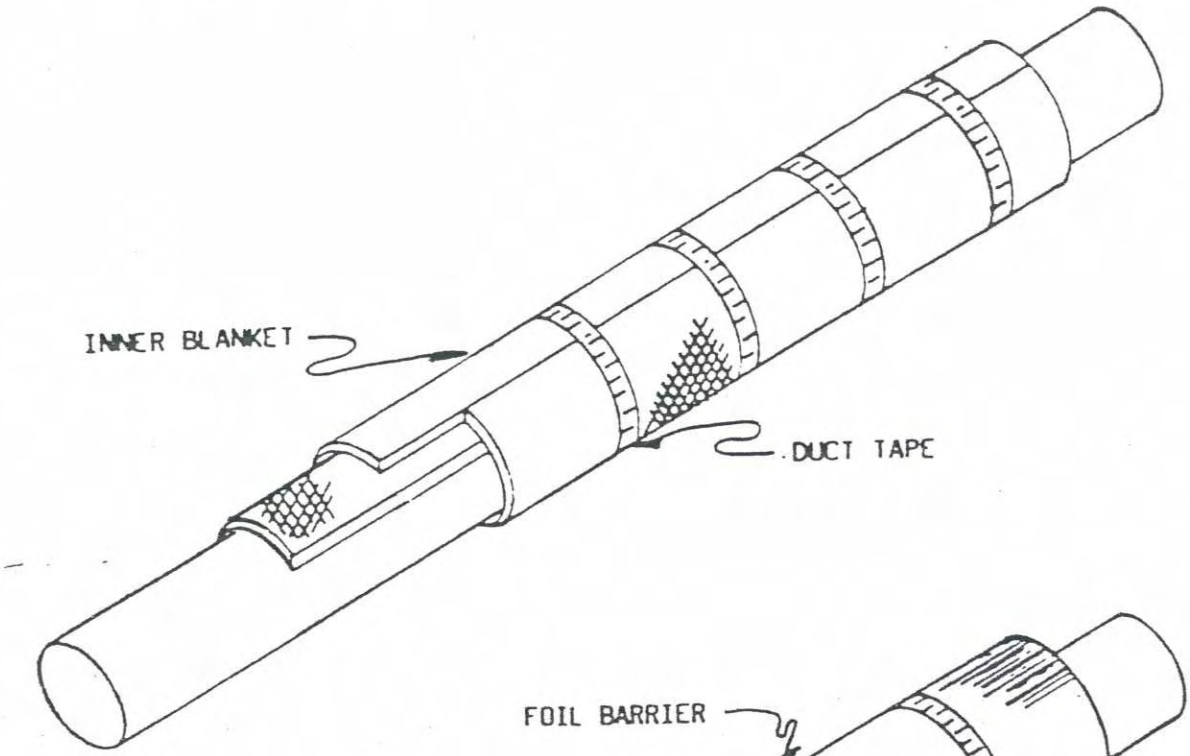
6.7.1.1 If conduit funs five (5') feet or longer, affix tags at all entrance and exit points (walls, floors) and at the origin and destination points (cable tray, junction box, etc.).

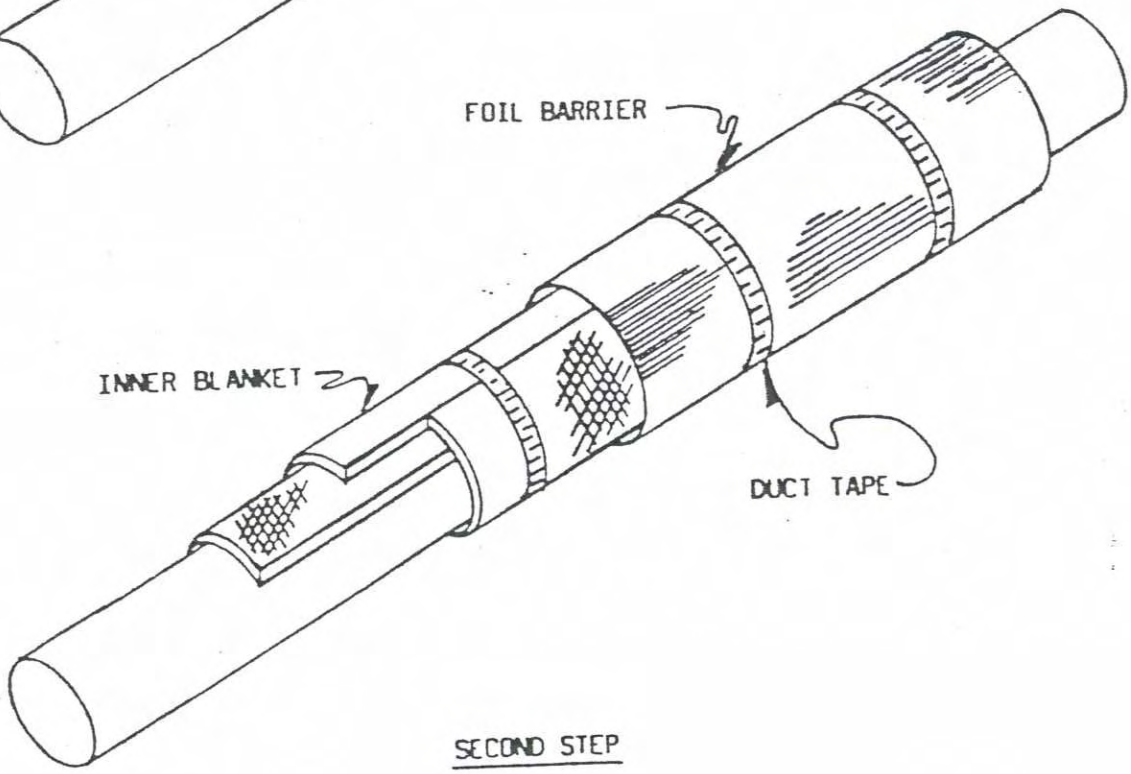
6.7.1.2 If conduit run is less than five (5') feet, affix one tag at a central location or at the most visible location of the conduit. Conduits shall be identified at intervals not greater than fifteen (15') feet.

7.0 ATTACHMENTS

None

FIRST STEP



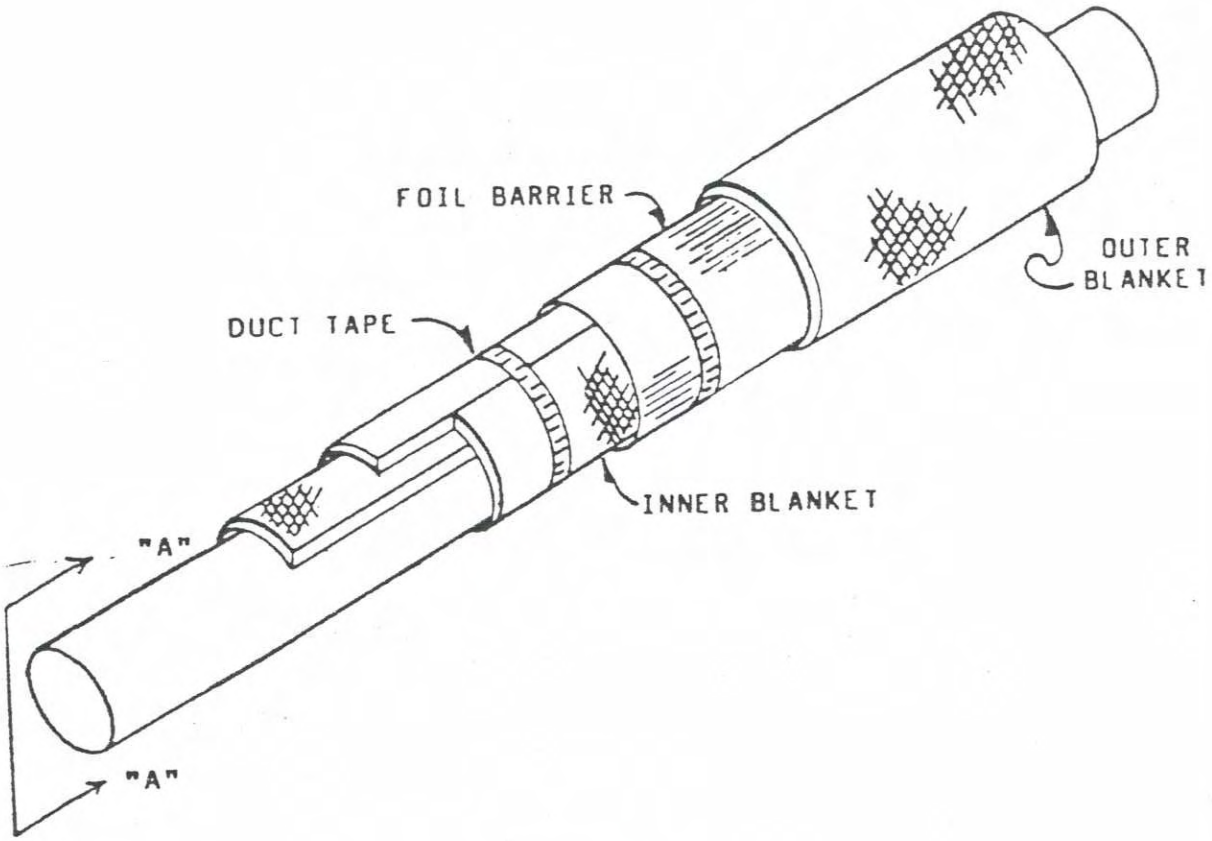


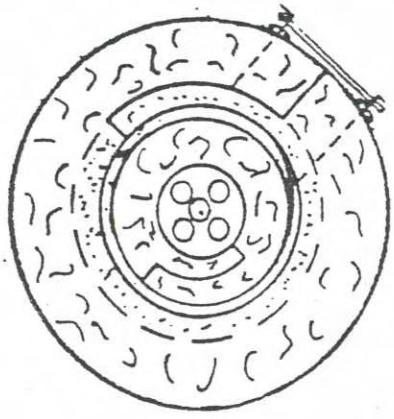
SECOND STEP

FIGURE - 1

ISSUE DESIGNATION IN THIS COL . NDICATES CURRENT CHANGE

THIRD STEP





SECTION "A"-"A"

FIGURE - 2

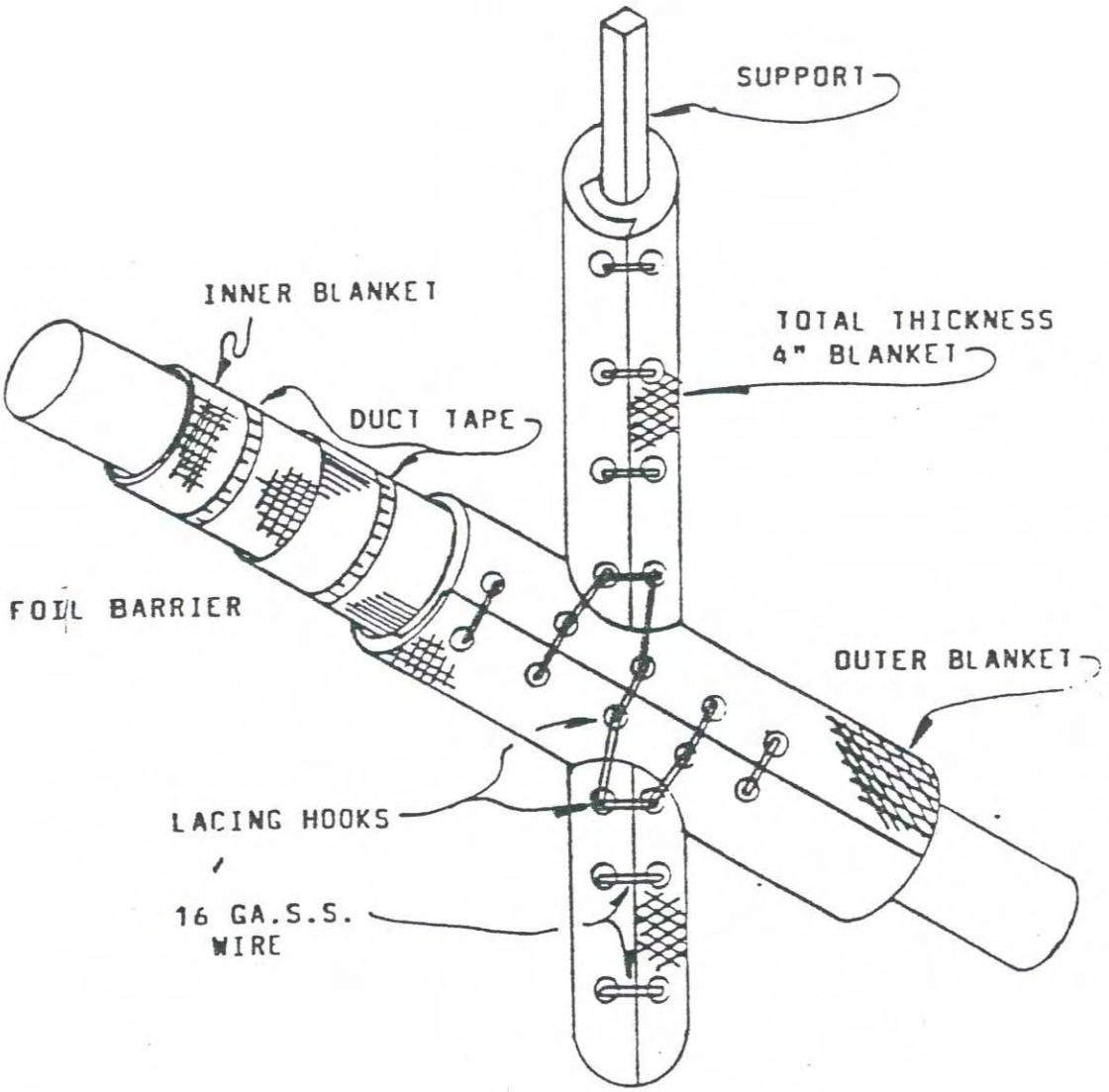


FIGURE - 3

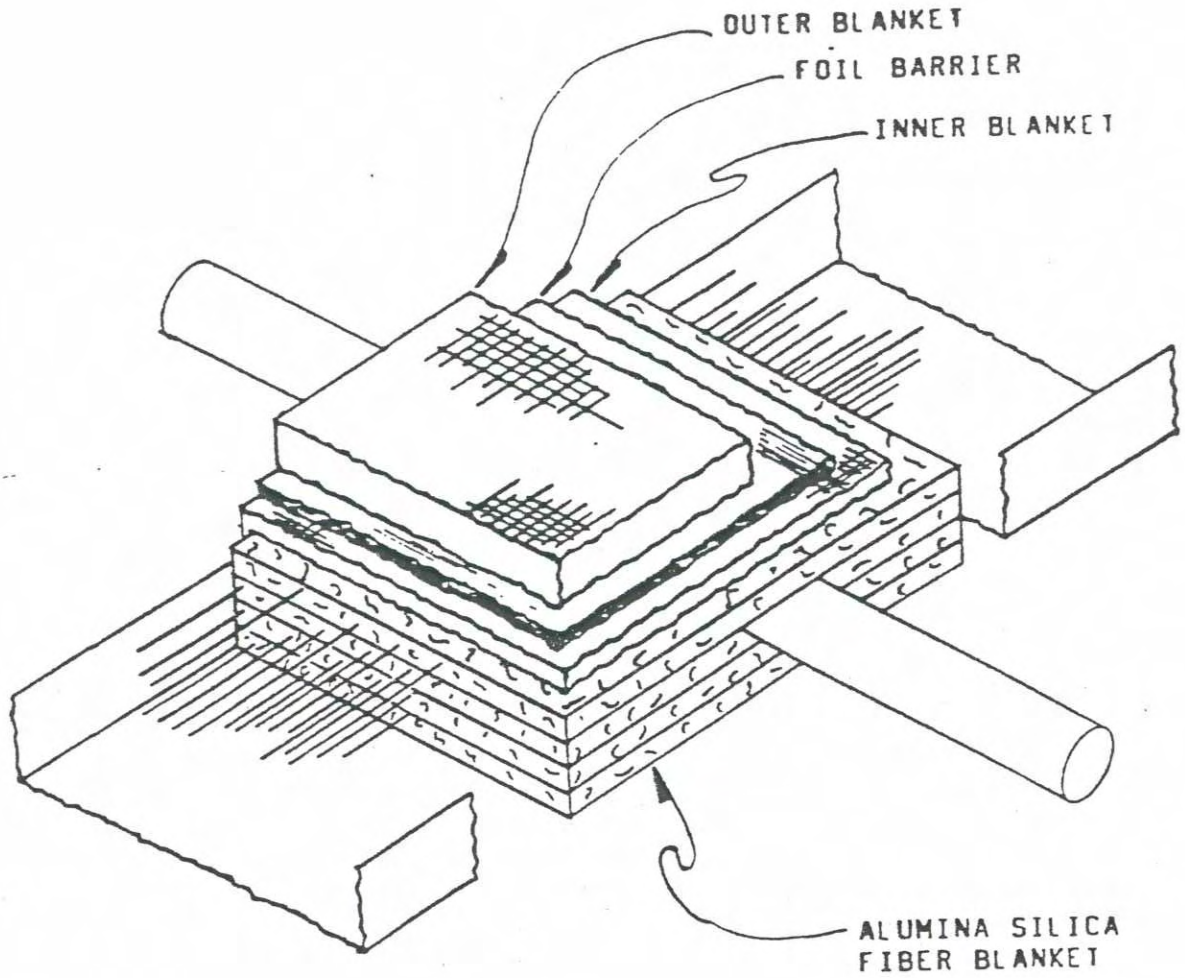


FIGURE - 4

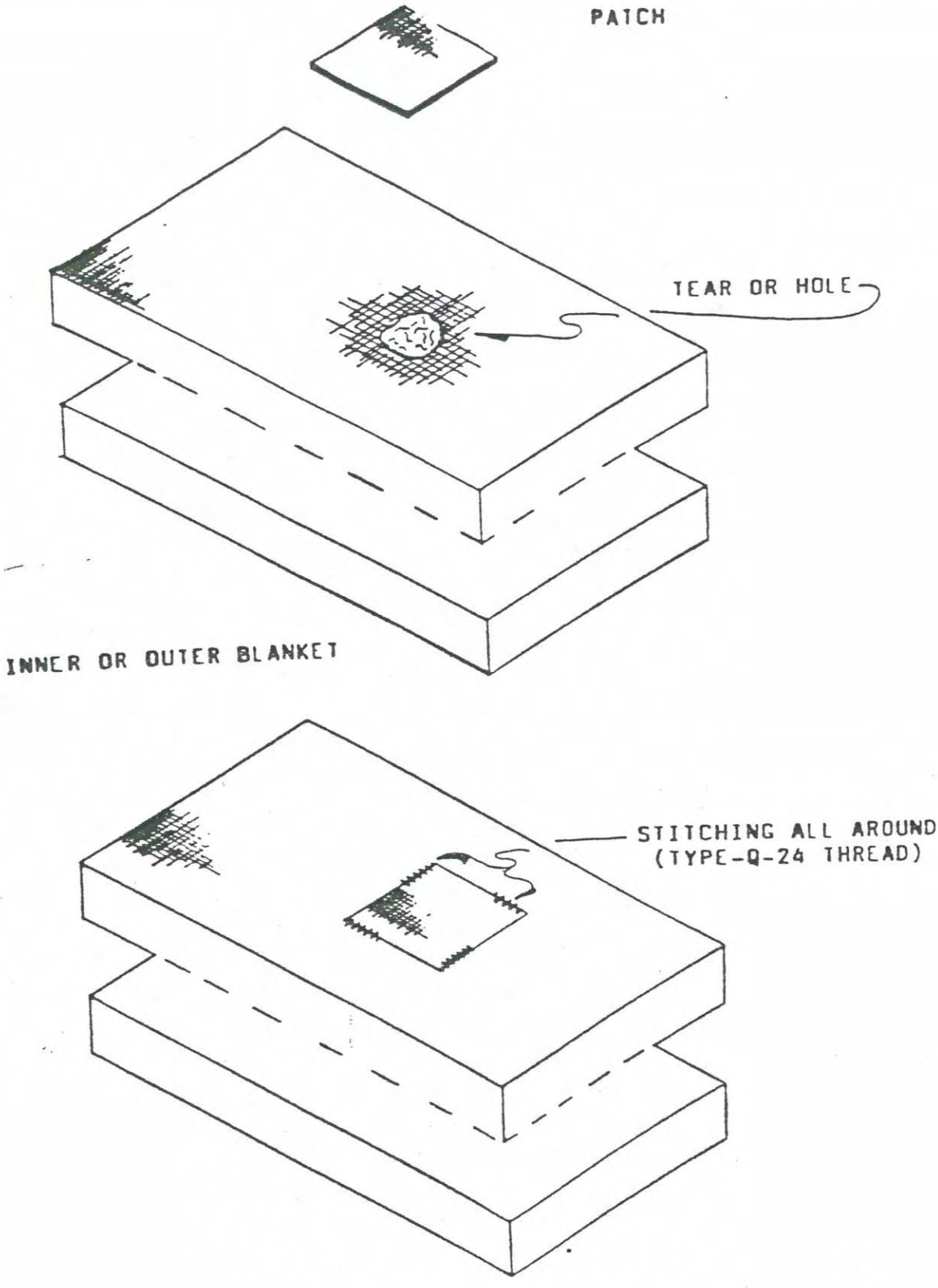


FIGURE - 5

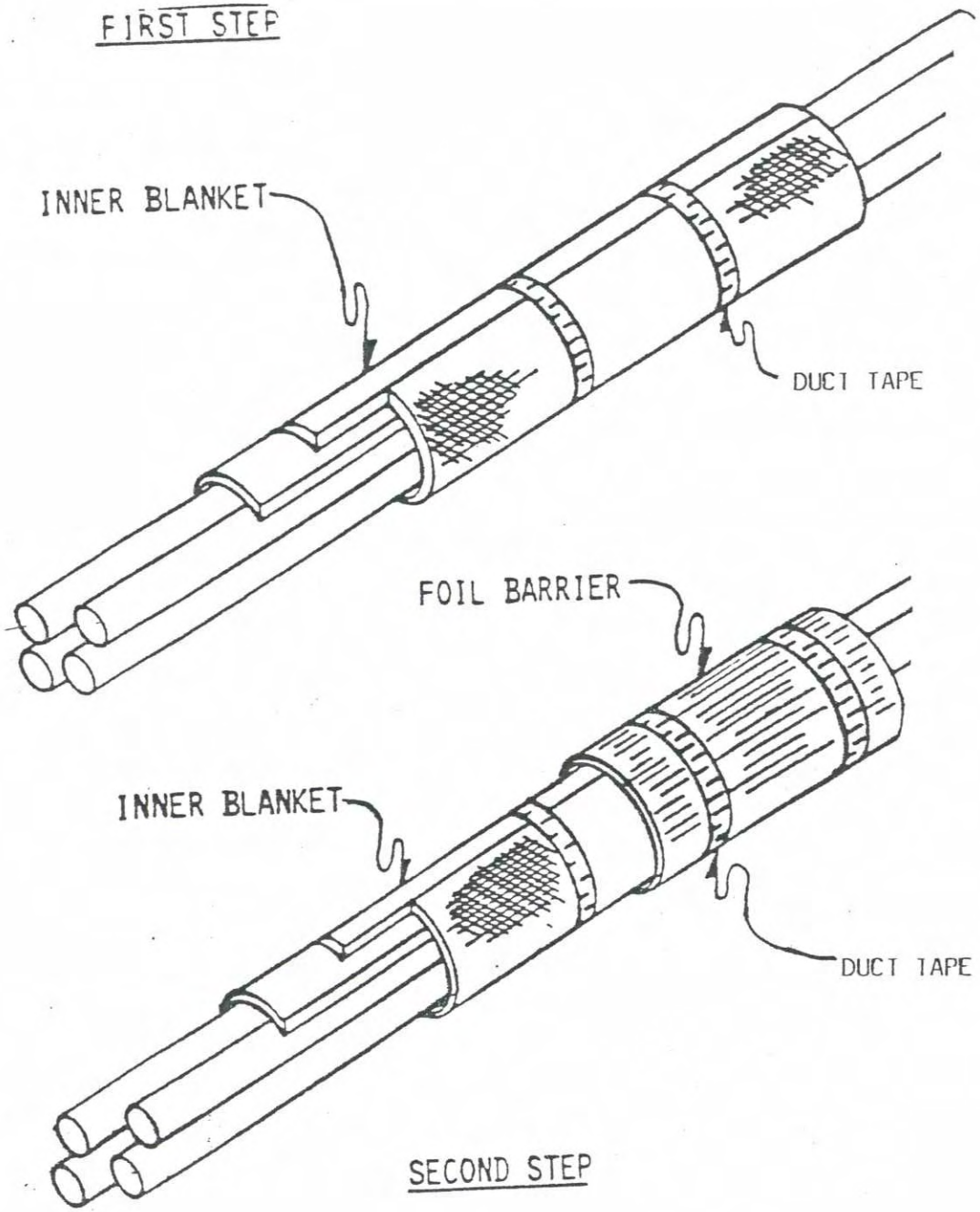
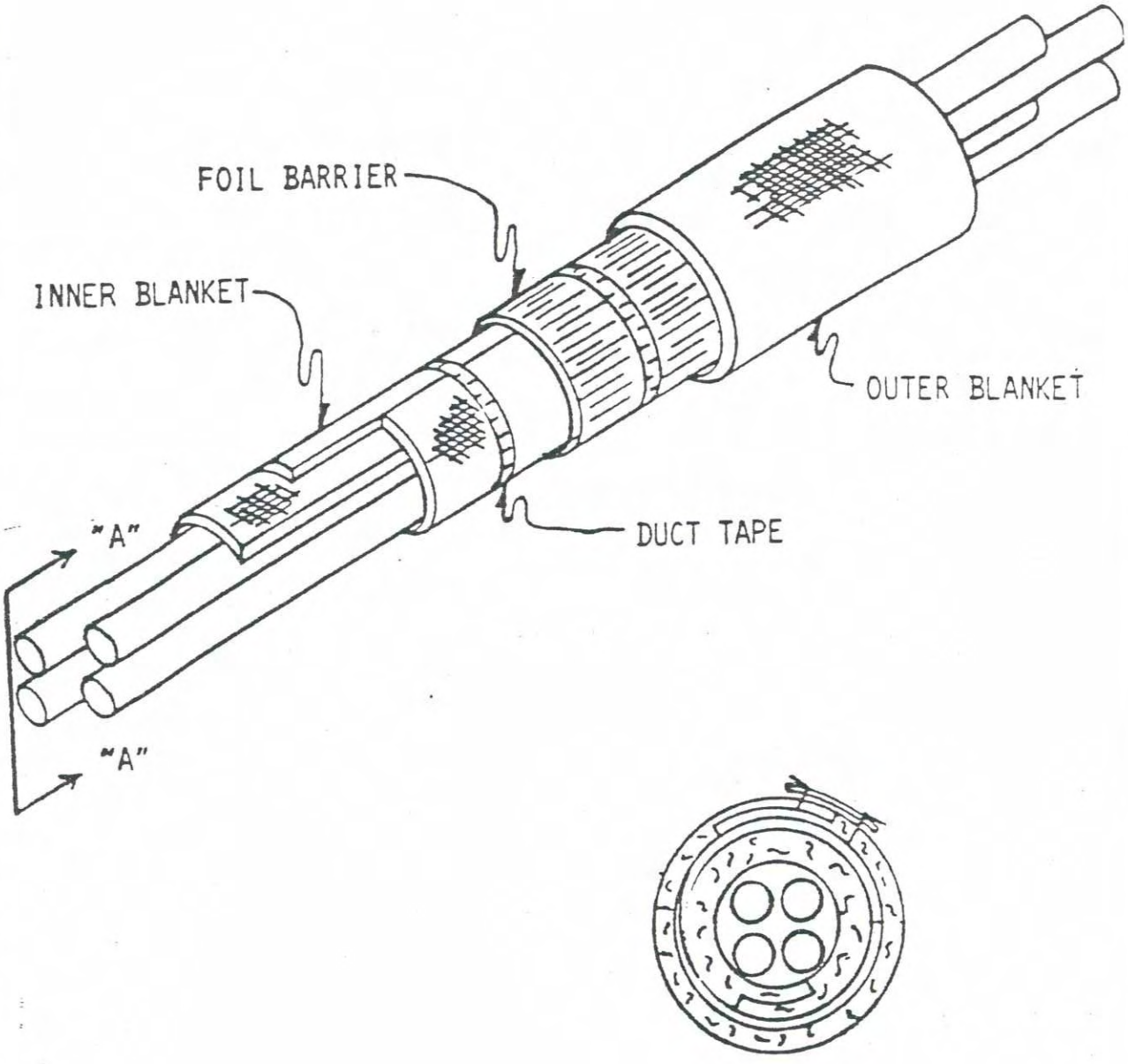


FIGURE 6

ISSUE DESIGNATION IN THIS COL INDICATES CURRENT CHANGE

THIRD STEP



SECTION "A" - "A"

FIGURE 7

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

FABRICATION INSPECTION FOR HEMYC PROTECTIVE WRAP COMPONENTS

1.0 PURPOSE

The purpose of this procedure is to assure that the manufacture of the HEMYC Protective Wrap Components is consistent with the system as tested on the various qualification tests. The Fire Qualification Test, referenced as CTP-1026, consisted of a one (1) hour fire exposure, per ASTM E-119 criteria including hose stream test in accordance with the ANI Information Bulletin No. 5(79) entitled, "ANI/MAERP Standard Fire Endurance Test Method to Qualify a Protective Envelope for Class IE Electrical Circuits".

2.0 SCOPE

This procedure provides the methods and guidelines for the inspection and verification activities performed to ascertain the manufacture and/or fabrication of the protective wrap components is within acceptable standards.

3.0 REFERENCES

3.1 IP-8400.105, Fabrication of HEMYC Cable Protection System Components

3.2 CTP-1026, HEMYC Fire Qualification Test

3.3 American Nuclear Insurers Acceptance dated 08/02/82

4.0 DEFINITIONS

Refer to Quality Assurance/Quality Control terms and definitions contained in the back of the PROMATEC Quality Assurance Program.

5.0 RESPONSIBILITIES

B 5.1 When fabrication is performed at jobsite, the Installer's QUALITY CONTROL PERSONNEL, as trained and certified by PROMATEC, shall be responsible for appropriate inspection, documentation and monitoring activities.

B When fabrication is performed at a separate manufacturing facility, the facility's INSPECTOR shall be responsible for the performance of these activities.

B 5.2 The DOCUMENT CONTROL COORDINATOR shall be responsible to implement and maintain an adequate filing system of the documentation provided by jobsites or as provided from the manufacturing facility Inspector.

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

6.0 PROCEDURE

B The assigned Quality Control Inspector shall perform the verification activities herein prescribed. The Fabrication Inspection Register (QC-61) shall be completed as defined in Item 7.1 of this procedure.

6.1 HOLD POINT ONE

6.1.1 All materials utilized in the construction of the specific order shall have been previously accepted as outlined in QCP-0008. This includes the verification that applicable certification documents were received with shipment or are available at PROMATEC.

6.1.2 If certification documents are not available with the material, an Inspection Report (Form QC-20) shall be instrumented as outlined in QCP-0019. PROMATEC Quality Assurance may elect to authorize use of the subject material after verification from manufacturer that required certification documents are either in transit or have been reviewed and accepted by PROMATEC.

6.1.3 Only approved materials as listed below shall be utilized in the fabrication of HEMYC Cable Protection System Components.

ACCEPTABLE MATERIALS

a. External Fabric

1. SILTEMP WR84CSR Water Repellent, Thermal Barrier Cloth .030 nom. thickness, 18oz/yd(2).

2. Or Approved equal.

b. Internal Fabric

1. Klever 600/6 or J.P. Stevens #332 Fiberglass Cloth, 49" width, 13oz/yd(2).

2. Or Approved equal.

(Internal Fabric may be used on the non-fire side of protection blanket as necessary. If used, external fabric must overlap a minimum of six (6") inches on to non-fire side.)

c. Internal Filler

1. Johns-Manville Cerablanket; 6 or 8 lb density; 1.5 and/or 2.0 inch thickness.

Or

2. Babcock & Wilcox Ceramic Fiber blanket; 6 or 8 lb density; 1.5 and/or 2.0 inch thickness.

Or

3. Approved equal.

d. Thread

1. Astroquartz Sewing Thread Type Q-24 Teflon coated approximately .020" diameter; Breaking strength - 20lbs.

Or

2. Alphaquartz Sewing Thread Type Q-24 Teflon coated approximately .020" diameter; Breaking strength - 20lbs.

Or

3. Approved equal.

6.2 HOLD POINT TWO

Refer to IP-8400.105 for specific fabrication requirements.

In Process Inspection

6.2.1 The assigned Quality Control Inspector shall periodically inspect on a random basis, compliance to the manufacture of Protective Wrap Components as outlined in Items 6.3.1, 6.3.2 and 6.3.3 of IP-8400.105.

As a minimum requirement, all wrap assemblies constructed shall be 100% Quality Control inspected the first week of fabrication, and a minimum of one day's production per week thereafter.

6.2.2 Verification that each wrap assembly is properly identified and marked as specified in Item 6.5 of IP-8400.105 shall be performed.

B 6.2.3 Verification that the Traceability ID Register (QC-60) is accurately completed for each wrap assembly as defined in Item 7.3 of this procedure.

6.3 HOLD POINT THREE

6.3.1 Each wrap component (blanket) shall be physically inspected by the assigned Quality Control Inspector prior to final acceptance from fabricator. This inspection shall verify conformance to the finished dimension requirements as specified on the applicable fabrication order.

7.0 ATTACHMENTS

7.1 Instructions for the completion of Form QC-61, Fabrication Inspection Register

7.2 Form QC-61

7.3 Instructions for the completion of Form QC-60, Traceability ID Register

7.4 Form QC-60

QCP-10002
ATTACHMENT 7.1

INSTRUCTIONS FOR COMPLETION OF FABRICATION INSPECTION REGISTER (FORM QC-61)

1. REPORT NUMBER - This is a two part number utilizing the numerical portion of the Project Number and the numerical sequence of the individual sequence of the individual report sheet, i.e., 274/03. This defines the third QC-61 used on Project No. FS-274.

2. PROJECT NAME - Name of Project or Plant.

3. PROJECT NUMBER - The PROMATEC Job Number (i.e., 0027-CM).

4. FABRICATOR - The name of the company fabricating blanket.

5. BLANKET NUMBER/ BLANKET FAB ORDER NO. - Identification of assigned blanket number per blanket fab order (Form QC-59).

6. QC-60 NUMBER - Number of the QC-60, Traceability ID Register for reference of traceability.

QC HOLD POINT ONE - MATERIAL RECEIVING

7. ACCEPT/REJECT - Insert appropriate check mark upon verification that only accepted materials as prescribed in QCP-10002 are utilized.

8. BY - Initials of the assigned Quality Control Representative performing this inspection.

9. DATE - Date of performance of this inspection.

QC HOLD POINT TWO - IN PROCESS INSPECTION

The assigned Quality Control Inspector shall periodically spot check on a random basis, compliance to the fabrication of Protective Wrap Components as outlined in IP-8400.105.

As a minimum requirement, all wrap assemblies constructed shall be 100% Q.C. inspected the first scheduled week of fabrication, and a minimum of one day's production per week thereafter.

When this inspection is performed, Items 12 and 13 (below) shall be completed.

10. ACCEPT/REJECT -

(a.) External and Internal fabrics are cut to proper dimensions, as determined by fabricator to assure proper finished dimensions as specified on the applicable fabrication order (Form QC-59).

(b.) Stitching is performed per IP-8400.105, Item 6.3.1.

(c.) Filler material is proper size to assure proper finished dimension per IP-8400.105, Item 6.3.2.

(d.) Fabric at open end of envelope is rolled under and double stitched per IP-8400.105, Item 6.3.3.

(e.) Longitudinal stitching performed per IP-8400.105, Item 6.3.4.

(f.) Identification markings are performed per IP-8400.105, Item 6.5.

11. BY - Initials of inspector performing documentation.

12. DATE - Date of documentation of QC HOLD POINT TWO

QC HOLD POINT THREE & FINAL ACCEPTANCE

13. ACCEPT/REJECT - Insert appropriate check mark upon acceptance or rejection of Completed Wrap Assembly.

14. BY - Initials of inspector performing inspection.

15. DATE - Date of Final Acceptance of Completed Wrap Assembly.

PROMATEC

PROGRESSIVE MATERIALS AND TECHNOLOGIES, INC.

FABRICATION INSPECTION REGISTER

REPORT NUMBER (2)

PROJECT NAME

PROJECT NUMBER (3)

FABRICATOR (4)

QCP-10002
B ISSUE

ATTACHMENT 7.2

MT BARRIER WRAP	FORM	HOLD POINT ONE				HOLD POINT TWO				HOLD POINT THREE			
COMPONENT / BLANKET	QC-60	MATERIAL INSPECTION				FABRICATION INSPECTION				FINAL INSPECTION			
IDENTIFICATION NUMBER	NUMBER	REJECT	ACCEPT	BY	DATE	REJECT	ACCEPT	BY	DATE	REJECT	ACCEPT	BY	DATE
(5)	(6)	(7)		(8)	(9)	(10)		(11)	(12)	(13)		(14)	(15)

QCP-10002
ATTACHMENT 7.3

INSTRUCTIONS FOR COMPLETION OF TRACEABILITY ID REGISTER (FORM QC-60)

1.	REPORT NUMBER -	This is a two part number utilizing the numerical portion of the Project Number and the numerical sequence of the individual sequence of the individual report sheet, i.e., 274/02. This defines the second QC-60 used on Project No. FS-274.
2.	PROJECT NAME -	Name of Project or Plant.
3.	PROJECT NUMBER -	The PROMATEC Job Number (i.e., 0027-CM).
4.	FABRICATOR -	The name of the company fabricating blanket.
5.	BLANKET NUMBER/ BLANKET FAB ORDER NO. -	Identification of assigned blanket number per blanket fab order (Form QC-59).
6.	EXTERNAL FABRIC -	Name of external fabric manufacturing company, type of fabric, lot number of external fabric and receiving report number.
7.	INTERNAL FABRIC -	Name of internal fabric manufacturing company, type of fabric, lot number of internal fabric and receiving report number.
8 & 9.	FILLER MATERIAL -	Name of filler material manufacturing company, type of material, lot number of filler material and receiving report number.
10.	THREAD -	Name of thread manufacturing company, type of material, lot number of thread and receiving report number.
11.	HARDWARE -	Types of hardware and receiving report numbers.
12.	INSPECTOR -	Initials of inspector performing documentation, and date inspection performed.

PROMATEC

PROGRESSIVE MATERIALS AND TECHNOLOGIES, INC.

TRACEABILITY ID REGISTER

REPORT NUMBER (1)

PROJECT NAME (2)

PROJECT NUMBER (3)

FABRICATOR (4)

QCP-10002
ISSUE B

MT BARRIER WRAP	EXTERNAL FABRIC		INTERNAL FABRIC		FILLER MATERIAL		FILLER MATERIAL		THREAD		HARDWARE		INSPECTOR
MFG													
TYPE													
IDENTIFICATION NO.	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	R.R.#	R.R.#	BY / DATE
(5)	(6)		(7)		(8)		(9)		(10)		(11)		(12)

ATTACHMENT 7.4

ISSUE DESIGNATION IN THIS COLL INDICATES CURRENT CHANGE

INSTALLATION INSPECTION OF CRITERIA FOR HEMYC PROTECTIVE WRAP COMPONENTS

1.0 PURPOSE

The purpose of this procedure is to assure that the installation of the HEMYC Protective Wrap System components is inspected to verify consistency with the system as tested on the various qualification tests. The Fire Qualification Test, referenced as CTP-1026, consisted of a One (1) Hour Fire Exposure, per ASTM-119 criteria, including hose stream test in accordance with the American Nuclear Insurers Information Bulletin No. 5(79) entitled, "ANI/MAERP Standard Fire Endurance Test Method to Qualify a Protective Envelope for Class IE Electrical Circuits."

2.0 SCOPE

This procedure provides the inspection criteria to enable the assigned Quality Control Inspector to perform adequate verification of compliance to quality requirements for the fabrication of HEMYC Protective Wrap System components.

3.0 REFERENCES

3.1 10CFR50, Appendix R

3.2 ANI Bulletin No. 5(79)

3.3 CTP-1026, HEMYC Fire Qualification Test

3.4 ANI Acceptance dated 08/02/82

3.5 IP-8400.101, Installation of HEMYC Protective Wrap System - Straight Sections

3.6 IP-8400.102, Installation of HEMYC Protective Wrap System - Curved Sections of Cable Tray

3.7 IP-8400.103, Installation of HEMYC Protective Wrap System onto Single or Multiple Conduits

3.8 IP-8400.104, Repair and Installation of the HEMYC Protective Wrap System Around Interferences and Obstructions.

3.9 IP-8400.105, Manufacture of HEMYC Cable Protection System Components

3.10 IP-8400.106, Installation of Firestops and Terminations within the HEMYC Protective Wrap System for Cable Tray(s) and Conduit(s)

3.11 IP-8400.107, Installation of HEMYC Protective Wrap System - Multiple Cable Trays

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

4.0 DEFINITIONS

None

5.0 RESPONSIBILITIES

5.1 The Installer's QUALITY CONTROL PERSONNEL, as trained and certified by PROMATEC, shall be responsible for appropriate inspection, documentation and monitoring activities.

5.2 The DOCUMENT CONTROL COORDINATOR shall be responsible to implement and maintain an adequate filing system of the documentation herein prescribed.

6.0 PROCEDURE

Inspection and acceptance criteria of the framework installation for cable tray and conduit assemblies. The assigned Quality Control Inspector shall inspect the installed framework for compliance to requirements established in the applicable PROMATEC procedures and as defined herein.

6.1 **QUALITY CONTROL HOLD POINT NO. ONE**

6.1.1 Verify that clamping devices are adequate for the specific type and size of cable tray.

6.1.2 Clamps must be used in sets. All clamps in a single set must be either all locking type or all friction type. NO INTERMIXING of types in a single set is acceptable (Refer to Figure 1 and 2).

6.1.3 Locking type clamps must be utilized at least every seventh clamp set.

6.1.4 Clamp sets are located on approximate eighteen (18") inch centers.

6.1.5 Locknuts shall be securely tightened to secure frame to cable tray. Locknuts shall only be used once.

6.1.6 Verify that a minimum of two (2") inch Dead Air Space is maintained between side, bottom and top of cable tray and outside of frame on all configurations, unless approved by FCR. (See Figure 3.)

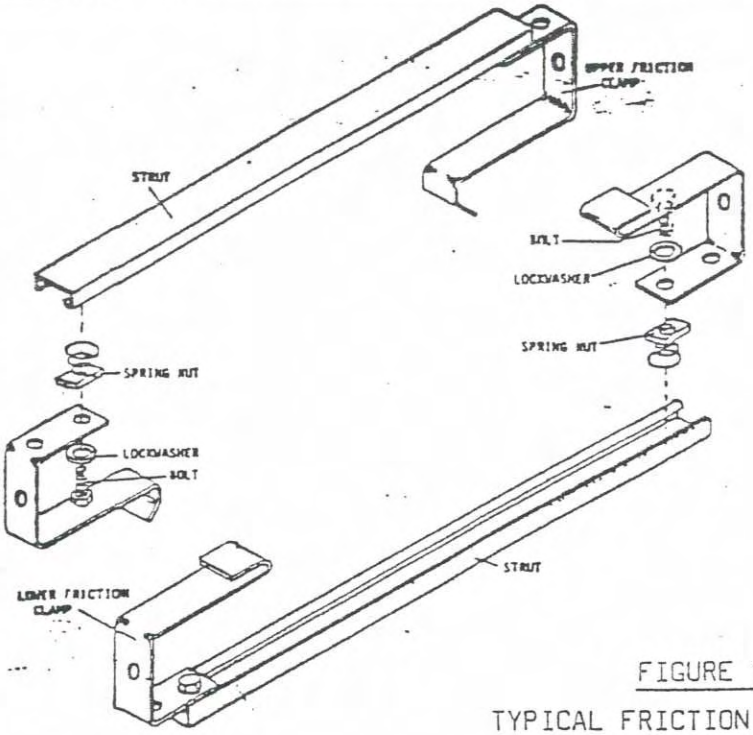


FIGURE 1

TYPICAL FRICTION CLAMP AND
TYPICAL INSTALLATION

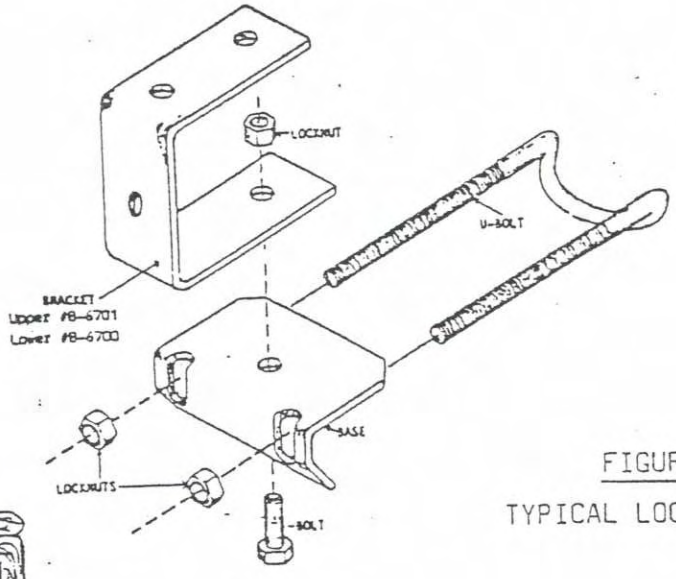


FIGURE 2

TYPICAL LOCKING CLAMP

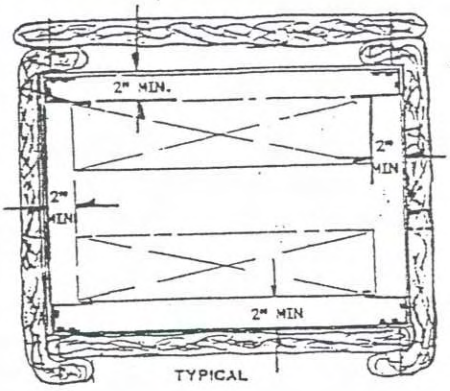


FIGURE 3

2" DEAD AIR SPACE
Single and Multiple Tray Configurations

6.1.7 Verify that top and bottom rails have blanket anchors spaced at a maximum nine (9") inch between centers throughout (Refer to Figure 4).

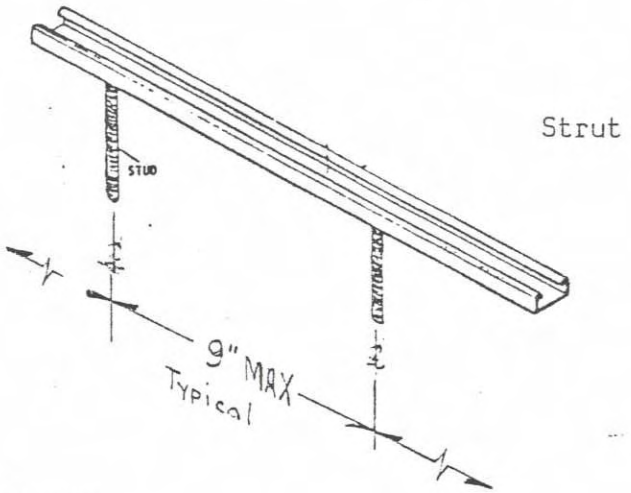


FIGURE 4
BLANKET ANCHOR SPACING

6.1.8 If concrete anchors are utilized to attach blankets to wall, ceiling or floor, they shall be a site-approved type. These anchors shall be spaced on a maximum nine (9") inch between centers throughout.

6.1.9 In the case of direct wrap on conduit, verify that finger strap is firmly attached to conduit per IP-8400.103 (if applicable).

6.1.10 Verify that frame is firmly attached to cable tray and that all nuts are securely tightened.

6.2 QUALITY CONTROL HOLD POINT NO. TWO

Inspection and acceptance criteria for installation of blanket wrap for single and multiple cable trays and conduits.

6.2.1 Assure that blanket to be installed is blanket number assigned for the designated section of cable tray or conduit.

6.2.2 Verify that a minimum of two (2") inches between center of anchors and edges of blanket on overlaps at top, bottom, and side of cable trays is maintained. (See Figure 5.)

6.2.3 Verify that either a eight (8") inch collar is on joints of conduit blanket wrap or that blanket wraps extend over adjoining blanket a minimum of four (4") inches. (See Figure 6.)

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

D

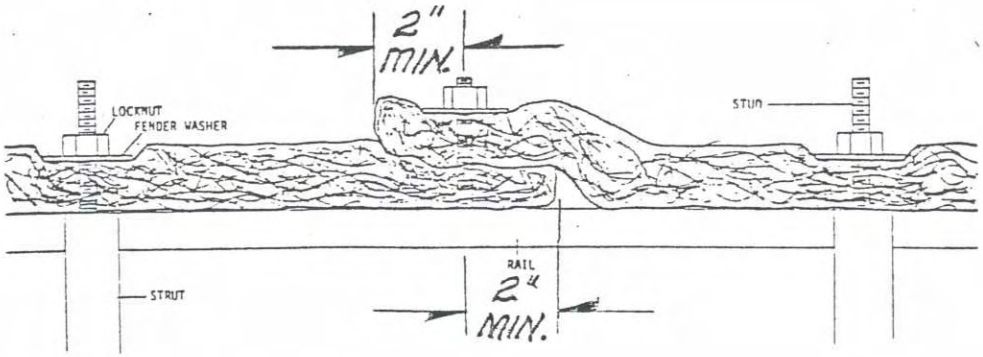


FIGURE 5
TYPICAL OVERLAP

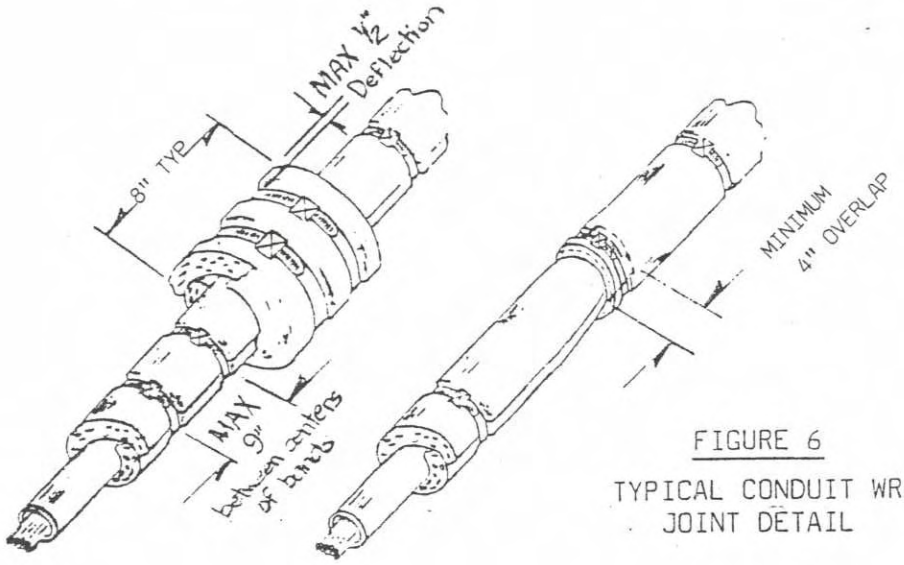


FIGURE 6
TYPICAL CONDUIT WRAP
JOINT DETAIL

6.2.4 Verify that either stainless steel strapping or stainless steel band clamps are attached to blanket wrap on a maximum nine (9") inch center on conduit blanket wrap. If single conduit is attached to concrete surface, verify that concrete anchors are of site approved type. These anchors shall be spaced on a maximum of nine (9") inches between centers throughout. (See Figure No. 7.) Banding shall be a minimum gauge of .015 and a minimum width of one-half (1/2") inches.

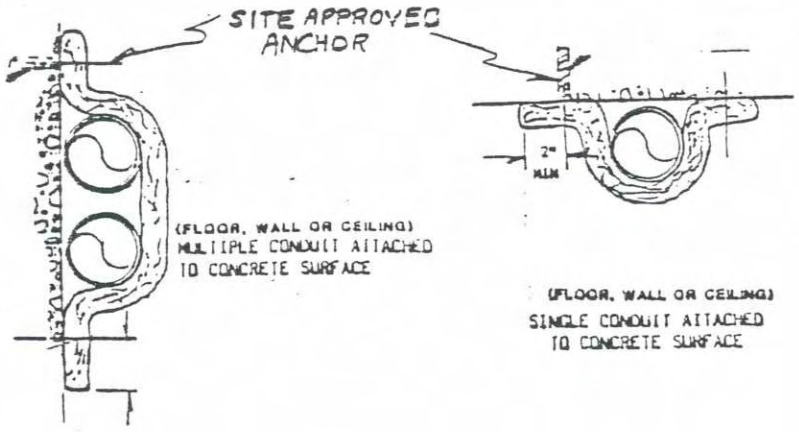


FIGURE 7

CONCRETE ATTACHMENT

6.2.5 Verify that termination of cable tray (floor, ceiling or wall) complies with IP-8400.106, Section 6.2. Check to assure that frame work stops within six (6") inches of surface and ensure that wraps are long enough to extend onto the surface. Wraps shall be attached to surface using the methods outlined in IP-8400.104, Section 6.3 (Refer to Figure 8).

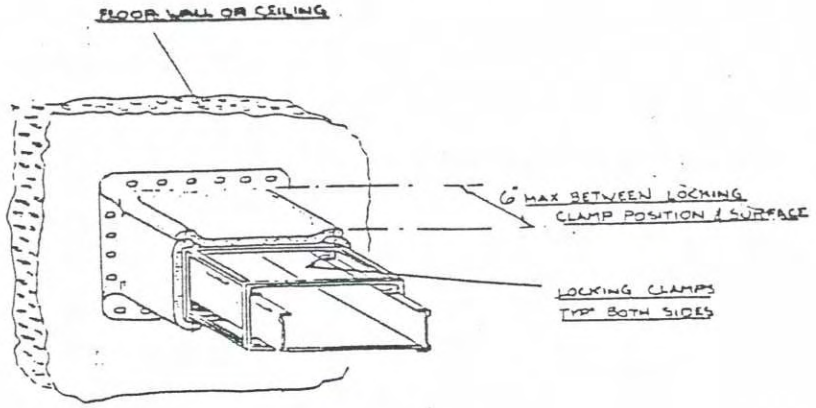


FIGURE 8

TYPICAL TERMINATION OF CABLE TRAY AT WALL, FLOOR OR CEILING

6.2.6 Verify that termination of conduit (floor, ceiling or wall) complies with IP-8400.106, Section 6.3. Assure that flange portion of termination collar is firmly attached onto concrete nuts and lock nuts are firmly tightened and that if gaps exist, they have plumbers tape or equivalent installed as outlined in IP-8400.104, Section 6.3.3 (Refer to Figure 9).

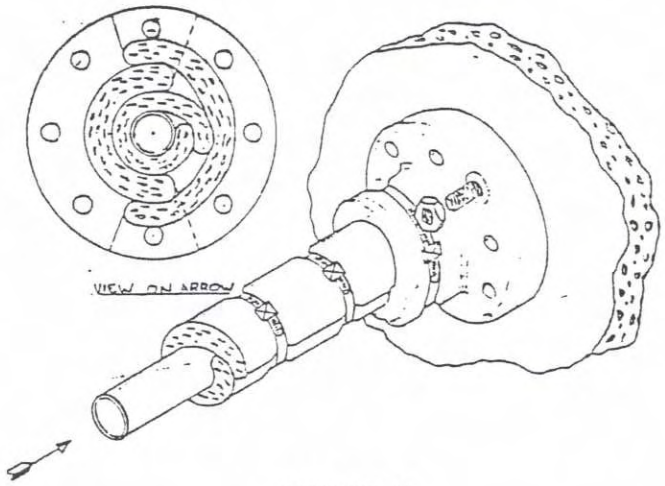


FIGURE 9

TYPICAL TERMINATION OF CONDUIT AT WALL, FLOOR OR CEILING

6.3 If fire stops are required on cable tray that ends with cable protruding, verify that firestops comply with IP-8400.106, Section 6.1.

6.3.1 Assure that a minimum of twelve (12") inch width layer of ceramic blanket is wrapped around bottom, sides and top of cable tray. Tray shall be filled with bulk fiber to that width. Two bands must be applied at four to six (4" - 6") inches apart and compressing both wraps and ceramic fiber filler. (See Figure 10 and 11.)

NOTE: Completed installation shall reflect a good workmanship product with tight folds and secured seams and bands.

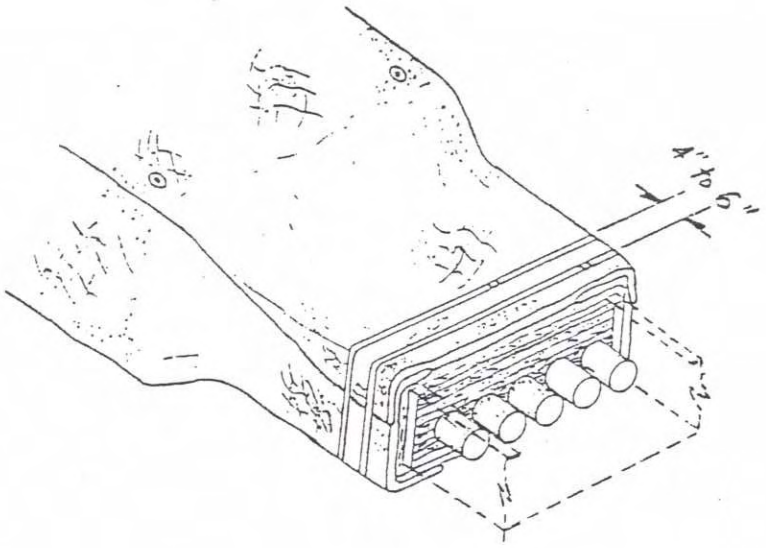


FIGURE 10

TYPICAL TERMINATION OF CABLE TRAY PROTECTIVE SYSTEM
NOT AT WALL, FLOOR OR CEILING (FIRESTOP)

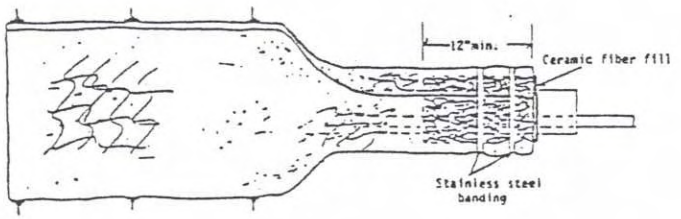


FIGURE 11

TYPICAL TERMINATION SHOWING CERAMIC BLANKET AND
BULK FIBER FILL. (FIRESTOP)

7.0 ATTACHMENTS

D 7.1 PROMATEC Form QC-62 with instructions.

7.2 ADDENDDUM I

HOLD POINT INSPECTION & CLIENT FINAL SIGNOFF REPORT

(QCP-10003)

PROJECT NAME: 2

PROJECT NUMBER: 3

REPORT NO. 1

STRUCTURAL INSPECTION

IDENTIFICATION NUMBER CABLE TRAY/CONDUIT	LOCATION - AREA/ELEVATION/ROOM ETC.	QC HOLD POINTS - STRUCTURAL INTEGRITY						VISUAL INSPECTION & RELEASE			
		1 DEAD AIR SPACE-2"	2 CLAMP DEVICES	3 FRAME SECURE	4 BLANKET ANCHORS	5 CONCRETE ANCHORS	6 OTHER --------	PASS	REJECT	DATE	BY
4	5	6	7	8	9	10	11	12	13	14	15

WRAP INSTALLATION INSPECTION & ACCEPTANCE

BLANKET NO./FAB ORDER NO.									QC HOLD POINTS - WRAP INSTALLATION				QC HOLD POINT 6 & FINAL ACCEPTANCE				
COND.	CABLE TRAY(S)								1 OVERLAPS	2 WRAP RETAINE	3 BANDING	4 TERMINATION	VISUAL INSPECTION			FINAL ACCEPTANCE	
	TOP	BOT.	SIDE	SIDE	SIDE	SIDE	SIDE	SIDE	4" MIN	INTACT	DEFLECT	ADEQUATE	ACCEPT	HOLD	REJECT	DATE	BY
16	17	18	19		21		23		25	26	27	28	29	30	31	32	33

FORM QC-82/REV. 1 07-20-95

QCP-10003
ATTACHMENT 7.1

HOLD POINT INSPECTION
AND
FINAL SIGNOFF REPORT

1.	Report Number -	This is a two part number utilizing the numerical portion of the project number and the numerical sequence of the individual report sheet, i.e., 274/04 (This defines the fourth QC-62 used on Project FS-274).
2.	Project Name -	Name of project or plant.
3.	Project Number -	The PROMATEC assigned job number, i.e., FS-274.
4.	Identification Number Cable Tray/Conduit -	Cable tray identification number and conduit identification number obtained from customer supplied information.
5.	Location/Area/Elevation/ Room/etc. -	Location of Area, Elevation, Room, etc., obtained from customer supplied information.
6.	Dead Air Space - 2" -	Verify that a minimum of two (2") inch Dead Air space is maintained between side, bottom and top of cable tray and outside of frame on all configurations per QCP-10003, page 3, Section 6.1.
7.	Clamp Devices -	Verify that clamps are in sets. Clamps in a single set must be either locking type or all friction type. No intermixing of types in a single set is acceptable per QCP-10003, page 3, Section 6.1.2, Figures 1 & 2. If acceptable, designate with a check mark.
8.	Frame Secure -	Verify that frame is firmly attached to cable tray and that all nuts are securely tightened. If acceptable designate with a check mark.
9.	Blanket Anchors -	Verify that top and bottom rails have blanket anchors spaced on a maximum nine (9") inches between centers throughout, per QCP-10003, page 5, Section 6.1.7, Figure 4.
10.	Concrete Anchors -	Verify that concrete anchors are site approved, maximum spacing of nine (9") inches between centers allowed. If acceptable designate with a check mark.

11. Other - Mark N/A. This space is for other Hold Points, as required.

12. Pass - If frame is secured to frame, all nuts firmly tightened, and visual inspection verifies that frame work is structurally sound, designate by check mark.

13. Reject - If above is rejected designate by check mark.

14. Date - Date of visual inspection and release.

15. By - Name of inspector performing inspection.

BLANKET NO./FAB ORDER NUMBER FOR CABLE TRAY(S)

16. Conduit - Number of conduit assigned by customer supplied information. Refer to Number (4) identification of cable tray or conduit above. If cable tray number, mark N/A.

17. Top - Identification of blanket number and fab order number for top section.

18. Bottom (Bot.) - Identification of blanket number and fab order number for bottom section.

19 thru 24 (Side) - Identification of blanket number and fab order number of required side sections. If side sections identification is not required, mark N/A.

QC HOLD POINTS & FINAL ACCEPTANCE

25. Overlaps - Overlaps four (4") inches minimum, verify that top, bottom, and side sections overlap each other by at least four (4") inches minimum. If accepted, designate by check mark.

26. Retainer Intact - Verify that Retainers are tight and secure, nuts, lock nuts, finger strap clips, etc. If accepted, designate by check mark.

27. Banding Spacing Deflection - Verify that the maximum deflection of the banding into the blanket is a maximum of one-half (1/2") inches. If so, designate by check mark.

28. Termination Adequate - Verify that the termination of the cable tray (floor, ceiling, or wall) complies with Procedure No. 8400.106, Section 6.2. Verify also that all nuts are securely tightened. If so, designate by a check mark.

29. Accept Visual Inspection - Insert check mark upon acceptance of completed blanket assembly.

30.	Hold -	Insert check mark if blanket assembly is incomplete or repairs are needed. Indicate appropriate action on a separate page if necessary.
31.	Reject -	Insert check mark if blanket assembly is rejected. Initiate appropriate action.
32.	Date -	Date inspection was performed.
33.	By -	Name of inspector performing inspection.

ISSUE DESIGNATION IN THIS COLL INDICATES CURRENT CHANGE

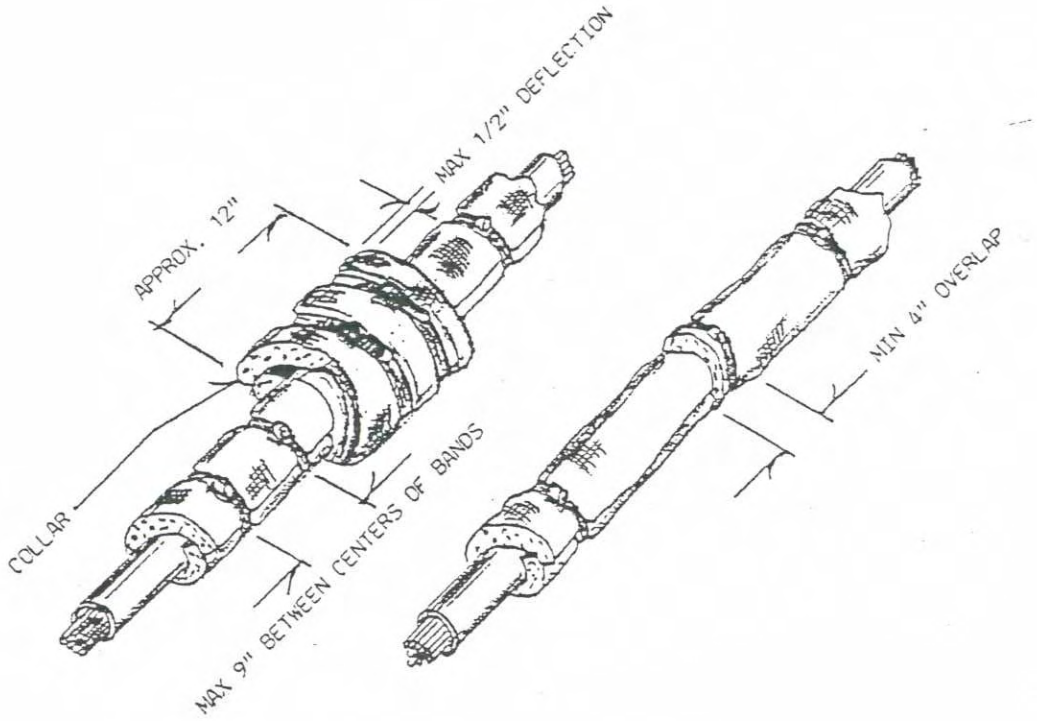
ADDENDUM

TO QCP-10003

ROCHESTER GAS & ELECTRIC

SITE SPECIFIC - GINNA STATION

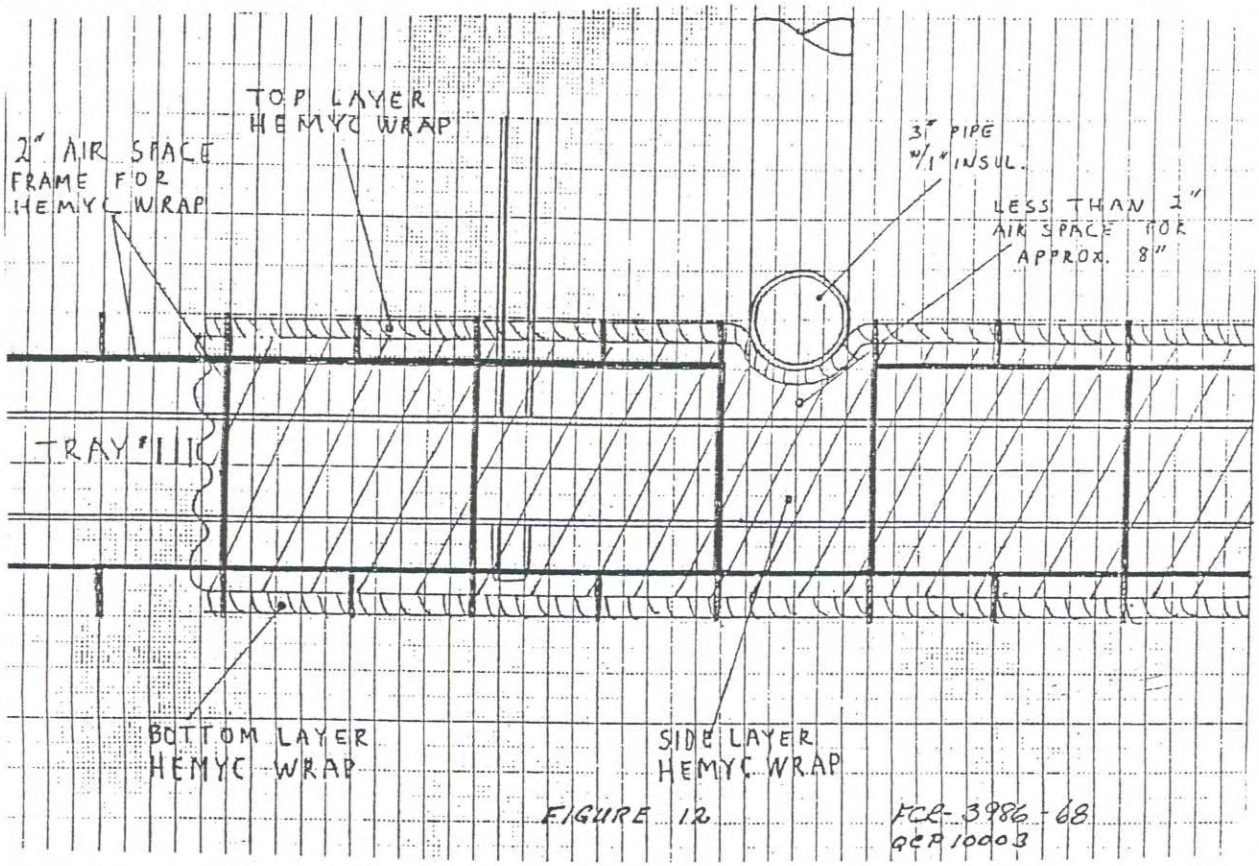
PART A - Figure 6 / Typical Conduit Wrap Joint Detail

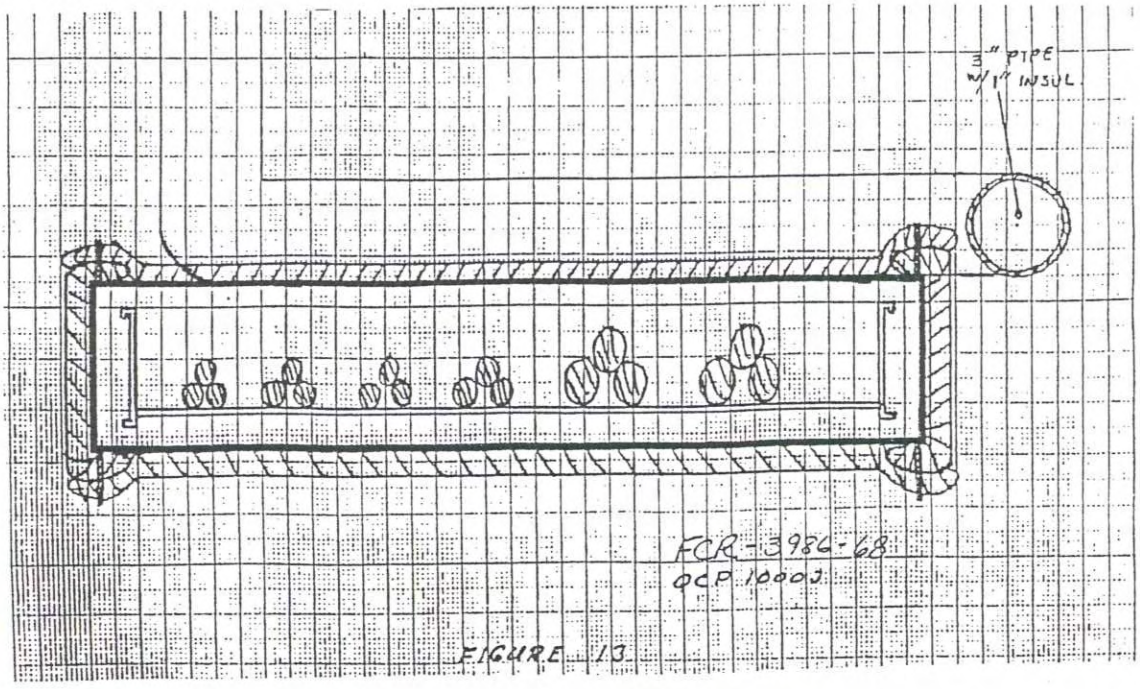


ISSUE DESIGNATION IN THIS COLU NDICATES CURRENT CHANGE

PART B - Figure 12 & Figure 13

Rochester Gas & Electric Note: Due to a pipe interference over Tray 111 the two (2") inch dead air space may be reduced as needed as shown on Figure 12 and 13 below.





ISSUE DESIGNATION IN THIS COL INDICATES CURRENT CHANGE

FABRICATION INSPECTION OF THREE HOUR PROTECTIVE WRAP COMPONENTS

1.0 PURPOSE

1.1 To establish inspection methods and acceptance criteria to assure three hour protective wrap systems are fabricated in accordance with established fabrication procedures.

2.0 SCOPE

2.1 Provide methods for the inspection of protective wrap components during fabrication to verify correct materials are utilized.

2.2 Provide methods for the inspection of protective wrap componets during fabrication to verify conformance to fabrication procedures.

2.3 Provide methods for the final inspection of completed protective wrap components to verify conformance to design requirements.

2.4 Establish requirements for recording inspection activities to provide documentary evidence of proper fabrication.

3.0 REFERENCES

3.1 Procedure No. IP-002, Fabrication Procedure for Three Hour Fire Protective components.

4.0 DEFINITIONS

4.1 Approved Materials -- Materials qualified for use as protective wrap components and issued for fabrication under controlled conditions.

4.2 Hold Point -- Critical steps in the fabrication process that require Quality Control inspection and acceptance prior to proceeding.

4.3 Check Point -- Random sample inspection of fabrication process performed at the descretion of Quality Control. Notification is not required.

4.4 Hot Side -- Outer surface of wrap design.

4.5 Cold Side -- Inner surface of wrap design.

4.6 In-Process Inspection -- Hold Point I and II.

4.7 Final Inspection -- Hold Point III.

ISSUE DESIGNATION IN THIS COL INDICATES CURRENT CHANGE

5.0 RESPONSIBILITIES

5.1 The Quality Assurance Manager or Designee shall be responsible for the development and proper implementation of this procedure.

5.2 The assigned Quality Control Inspector shall be responsible for performing activities established in this procedure.

6.0 PROCEDURE

6.1 Inspection instruments required to perform the activities described in this procedure include a measuring tape. Calibrated instruments are not required.

6.2 Inspection activities (Hold Point I, Hold Point II, Hold Point III) required by this procedure shall be documented on Form QC-61 (Fabrication Inspection Register).

6.3 Approved material traceability identification shall be documented on Form QC-60 (Traceability ID Register).

6.4 Non-conforming conditions identified in paragraph 6.8 shall be documented on Form QC-16 (Nonconformance Report) and dispositioned in accordance with QCP-0018.

6.5 Inspection activities described herein are mandatory hold points. Release for work to proceed shall be given by the assigned Quality Control Inspector upon satisfactory completion of all inspection activities required for each hold point.

6.6 Check point inspections may be performed at any time at the discreation of Quality Control. Such inspections are not mandatory and need not be documented unless discrepancies are identified.

6.7 Discrepancies identified during in process inspection that can be corrected within a (24) twenty four hour period in accorance with Procedure No. IP-002 may be accomplished without generating a non conformance report.

6.8 Non conformance reports shall be generated when any of the following conditions exist.

6.8.1 Discrepancies identified during in-process inspection are not corrected in accordance with IP-002 within (24) twenty four hours.

6.8.2 Discrepancies identified during final inspection where dispositioning party plans to recommend use-as-is, repair or reject dispositions (as defined in QCP-0018).

ISSUE DESIGNATION IN THIS CO INDICATES CURRENT CHANGE

6.8.3 Any failure to notify Quality Control for hold point inspection prior to proceeding or proceeding prior to acceptance by Quality Control of each inspection attribute required, including satisfactory completion of any discrepancies identified.

6.9 A fabrication order shall be initated and complete, for the exception of the final release signatures at the bottom of Form QC-59, prior to any fabrication.

6.10 Copies of Fabrication Procedure No. IP-002 shall be issued in conjunction with this procedure to each assigned Quality Control Inspector for use and reference.

6.11 Hold Point One -- Material inspection

6.11.1 Only approved materials as listed in IP-002 shall be utilized in the fabrication of three hour fire protective components.

6.11.2 Document individual blanket material traceability on Form QC-60. Document Hold Point I on Form QC-61 after completion of Form QC-60.

6.12 Hold Point Two -- Inspection of inner blanket.

6.12.1 Inspect alumina silicia fiber blanket for proper dimensions in accordance with fabrication order. Verify 6" min. shiplap with 1/2" ± 1/4" deep trim in ceramic fiber blanket.

6.12.2 Inspect fiberglass cloth for proper dimensions in accordance with fabrication order. Verify 3/8" min. tuck allowed for securing hog rings. Verify hog rings are spaced 1" max apart around edges of fiberglass cloth on hot side of envelope.

6.13 Hold Point Two -- Inspection of outer blanket.

6.13.1 The outer blanket consists of two sub-assemblies, enveloped into a silica dioxide cloth. The sub-assemblies consist of, powder envelope (honeycomb and/or straight tubes) and the alumina/silica fiber blanket.

6.13.2 Inspect honeycomb tube powder envelope coated fiberglass cloth for stitching spaced 7/8"± 1/8" apart before powder fill. Verify two sides are stitched 1/2" min. from edge of cloth. Verify two adjacent sides are folded across grain of tube 1"±1/4" and double stitched. Verify 100% fill of powder in tubes. Verify overall dimensions are in accordance with fabrication order 3/4".

ISSUE DESIGNATION IN THIS CO INDICATES CURRENT CHANGE

6.13.3 Inspect straight tube powder envelope coated fiberglass cloth for stitching spaced 1 5/8"±1/8" apart before powder fill. Verify two sides are stitch 1/2" min. from edge of cloth. Verify adjacent two sides are folded across grain of tubes 1"±1/4" and double stitched. Verify 100% fill of powder in tubes. Verify overall dimensions are in accordance with fabrication order 3/4".

6.13.4 Inspect alumina/silica fiber blanket for proper dimensions in accordance with fabrication order. Inspect siltemp for proper dimensions in accordance with fabrication order. Verify siltemp envelope and sub-assemblies (powder envelope and alumina/silica fiber blanket) are placed in proper order and are arranged to allow for min. 6" ship lap design in accordance with fabrication order. Verify siltemp has 3/8" min. tuck for securing hog rings. Verify hog rings are spaced 1" min. around edges of siltemp on cold side of envelope. Type Q-24 telfon coated nylon thread may be used in lieu of hog rings on outer blanket. Verify lacing hooks are placed on hot side 1 1/2" ± 1/4" from edge of all upper shiplap edges and are spaced on maximum of 6" centers. Verify lacing hooks are placed on hot side 7 1/2"± 1/4" from edge of all inner ship lap edges and spaced on 6" centers.

6.13.5 Verify that inner and outer blankets are marked with appropriate blanket identification numbers from applicable fabrication order. These markings shall be in min. 3/4" lettering. Marking shall be made with waterproof paint and/or ink which will retain the marking, withstand weather deterioration other handling effects and shall not be deleterious to the fabrics. These markings shall be in close proximity of the edges of any (2) two adjacent sides on the hot side of blanket.

6.13.6 A maximum of two pieces of cermic fiber blanket utilized in one envelope are acceptable only with the use of ship lap design and darting with approved thread to avoid seperation.

6.13.7 A maximum of two pieces of siltemp utilized in one side of envelope are acceptable only with the use of splicing by double stitching. Verify first stitch is 1/2" ± 1/4" from edges of siltemp and second stitch is 1/2" ±1/4" from first stitch.

6.14 Hold Point III - Final Inspection

6.14.1 Inspect completed three hour fire protective blankets for damage, proper dimensions and markings in accordance with fabrication order.

6.14.2 Verify Q.C. Forms 59, 60 and 61 are accurately completed.

ISSUE DESIGNATION IN THIS CO INDICATES CURRENT CHANGE

7.0 ATTACHMENTS

7.1 Instructions for completion of tractability ID Register. (Form QC-60)

7.2 Form QC-60

7.3 Instruction for completion of Fabrication Inspection Register (Form QC-61)

7.4 Form QC-61

7.5 Instructions for completion of Fabrication Order (Form QC-59).

7.6 Form QC-59

ATTACHMENT 7.1
INSTRUCTIONS FOR COMPLETION OF TRACEABILITY ID REGISTER
FORM QC-60

Report Number	This is a two part number utilizing the numberical portion of the project number and the numerical sequence of the individual report sheet initiated in this project. (i.e. 027/011. This defines the eleventh QC-60 used on project number PMT-027).
Project Name	Name of the project or plant.
Project Number	The PROMATEC job number (i.e. PMT-027)
Fabricaator	Name of company fabricating.
MT Barrier Wrap Identification Number	Identification number assigned on fabrication order (form QC-119)
MFG	Name of appropriate material manufacturer.
Type	Name of appropriate material type/description
I.D. No.	Manufacturers ID/lot number (if applicable).
R.R.#	Promatecs' assigned receiving report number
Inspector By/date	Inspectors initials and date of inspection.

PROMATEC

PROGRESSIVE MATERIALS AND TECHNOLOGIES, INC.

REPORT NUMBER _____

PROJECT NAME _____

PROJECT NUMBER _____

TRACEABILITY ID REGISTER.

FABRICATOR _____

MT BARRIER WRAP	EXTERNAL FABRIC		INTERNAL FABRIC		FILLER MATERIAL		FILLER MATERIAL		THREAD		HARDWARE		INSPECTOR
MFG *	*		*		*		*		*		*	*	
TYPE *	*		*		*		*		*		*	*	
IDENTIFICATION NO:	ID NO.	R.R.#	ID NO.	R.R.#	ID NO.	R.R.#	ID NO.	R.R.#	ID NO.	R.R.#	R.R.#	R.R.#	BY / DATE

ATTACHMENT 7.3
INSTRUCTION FOR COMPLETION OF FABRICATION INSPECTION REGISTER
FORM QC-61

Report Number	This is a two part number utilizing the numberical portion of the project number and the numerical sequence of the individual report sheet initiated on this project (i.e. 027/011. This defines the eleventh QC-61 used on project number PMT-027.)
Project Name	Name of project or plant.
Project Number	The Promatec job number (i.e. PMT-027).
Fabricator	Name of company fabricating blanket.
MT Barrier Wrap Identification Number	Identification number assigned on fabrication order (form QC-119).
QC-60 Number	Report number of the QC-60, Traceability ID Register for reference to traceability.
Hold Point One	
Reject/Accept	Place check mark in appropriate column.
By	Inspectors initials.
Date	Date of inspection.
Hold Point Two	
Reject/Accept	Place check mark in appropriate column.
By	Inspectors initials.
Date	Date of inspection.
Hold Point Three	
Reject/Accept	Place check mark in appropriate column.
By	Inspectors initials.
Date	Date of inspection.

PROMATEC
PROGRESSIVE MATERIALS AND TECHNOLOGIES, INC.

REPORT NUMBER _____

PROJECT NAME _____

PROJECT NUMBER _____

FABRICATION INSPECTION REGISTER

FABRICATOR _____

MT BARRIER WRAP	FORM	HOLD POINT ONE				HOLD POINT TWO				HOLD POINT THREE			
COMPONENT / BLANKET	QC-60	MATERIAL INSPECTION				FABRICATION INSPECTION				FINAL INSPECTION			
IDENTIFICATION NUMBER	NUMBER	REJECT	ACCEPT	BY	DATE	REJECT	ACCEPT	BY	DATE	REJECT	ACCEPT	BY	DATE

ATTACHMENT 7.5
INSTRUCTIONS FOR COMPLETION OF FORM QC-59

PFO	Promatec fabriction order. Assigned by Corporate Q.A. document control. Prefix with numberic portion of job number. Second portion is numerical sequence on that job. (027/011 represents the eleventh PFO on job #027).
ENG. PORTION	To be completed by Promatec Field Engineers.
PROJECT NAME	Project name.
CUSTOMER	Client
CUSTOMER ORDER NO.	Client order number
JOB NO.	Promatec assigned job number
TYPE	Name of fire protective wrap
QUANTITY	Number of pieces
LENGTH	Dimension in inches
WIDTH	Dimension in inches
THICKNESS	Dimension in inches
TOTAL FT 2	Dimenision in feet
SCHEMATIC DRAWING REF.	
SCHEMATIC NO.	
ID NO.	Individual wrap I.D. No. Ordered by Corporate QA Document Control.
ORDERED BY	Eng. signature
DATE	Date ordered
SKETCH	Eng. to sketch wrap and assign dimension.
CERTIFICTE OF CONFORMANCE	To be completed by Fabricator.
PROMATEC QUALITY ASSURANCE ACCEPTANCE	Promatec Quality Control signature.

ATTACHMENT 7.6

PROMATEC

FABRICATION ORDER

PFO-

PROJECT NAME	CUSTOMER	CUSTOMER ORDER NO.	JOB NO.

TYPE _____ QUANTITY _____

LENGTH _____ WIDTH _____ THICKNESS _____ TOTAL FT^2 _____

SCHEMATIC DRAWING REF. _____ SCHEMATIC NO. _____

I.D. NO. _____

ORDERED BY _____ DATE _____

SKETCH

CERTIFICATE OF CONFORMANCE

We hereby certify that all items furnished were fabricated with materials provided by PROMATEC and conform to the requirements of Purchase Order No. _____.

Signature _____ Company _____ Date _____

PROMATEC QUALITY ASSURANCE ACCEPTANCE

Signature _____ Title _____ Date _____

Form QC-59
Rev. 1 - 10/16/85

ISSUE DESIGNATION IN THIS COLUMN INDICATES CURRENT CHANGE

INSTALLATION INSPECTION OF THREE HOUR PROTECTIVE FIRE WRAP SYSTEMS

1.0 PURPOSE

To establish inspection methods and acceptance criteria to assure three hour protective wrap systems are installed in accordance with established installation procedures.

2.1 SCOPE

2.1 To provide methods for the inspection of protective wrap components during installation to verify correct materials are issued.

2.2 To provide methods for in-process and final inspection of protective wrap systems to verify conformance to design requirements.

2.3 To establish requirements for recording inspection activities to provide documentary evidence proper installation.

3.0 REFERENCES

3.1 Procedure No. IP-001, Installation of Three Hour Fire Protective Wrap Systems

3.2 Typical Design Detail B-495 and B-496

3.3 Procedure No. QCP-0042, Fabrication Inspection of Three Hour Protective Wrap Components

4.0 DEFINITIONS

4.1 **APPROVED MATERIALS** - Materials qualified for use as protective wrap system components and issued for installation under controlled conditions.

4.2 **HOLD POINT** - Criteria steps in the installation process that require Quality Control inspection and acceptance prior to proceeding.

4.3 **CHECK POINT** - Random sample inspection of installation processes performed at the discretion of Quality Control. Notification is not required.

5.0 RESPONSIBILITIES

5.1 The Quality Assurance Manager or Designee shall be responsible for the development and proper implementation of this procedure.

5.2 The assigned Quality Control Inspector shall be responsible for performing activities established in this procedure.

5.3 The Construction Manager or Designee shall be responsible for assuring that craft personnel notify Quality Control for inspections as referenced in IP-001.

ISSUE DESIGNATION IN THIS COLU NDICATES CURRENT CHANGE

6.0 PROCEDURE

6.1 Inspection instruments required to perform the activities described in this procedure include a six (6") inch scale and a measuring tape. Calibrated instruments are not required.

D 6.2 Inspection activities required by this procedure shall be documented on Form No. QC-117 (Three Hour Fire Protective Wrap Inspection Report) or an approved QC checklist. Nonconforming conditions identified in accordance with paragraph 6.5 shall be documented on Form QC-16 (Nonconformance Report) and dispositioned in accordance with Procedure No. QCP-0018.

D 6.3 Inspection activities described herein are mandatory hold points. Release for work to proceed shall be given by the assigned Quality Control Inspector upon satisfactory completion of all inspection activities required for each hold point and sign-off of Form QC-117 or approved QC checklist.

6.4 Random sample check points may be performed at anytime at the discretion of Quality Control. Such inspections are not mandatory and need not be documented unless discrepancies are identified.

6.5 Minor deviations identified during in-process inspection may be corrected without the issuance of Nonconformance Reports provided corrective action is taken immediately and documented on Form QC- 117 or an approved QC checklist. Minor deviations that cannot be corrected immediately shall be documented on Form QC-121 and processed in accordance with Procedure No. QCP-0018.

6.6 Nonconforming conditions that could adversely affect product integrity shall be documented on Form No. QC-16 and processed in accordance with Procedure No. QCP-0018.

6.7 Copies of Installation Procedure No. IP-001 shall be issued in conjunction with this procedure to each assigned Quality Control Inspector for field use and reference.

6.8 Conduit, Cable Drop and Junction Box Wrap Inspection.

6.8.1 Hold Point One - Inner Blanket Inspection

6.8.1.1 For cable drops, verify that cables are bundled tightly with duct tape, cable tie wrap or other suitable means.

D 6.8.1.2 Upon completion of installation, verify that serial number for each blanket is clearly visible and record on Form QC-117 or approved QC checklist.

6.8.1.3 Visually examine each blanket for damage. Holes and tears exceeding one (1") inch shall be repaired in accordance with IP-001 and re-inspected per section 6.13 of this procedure.

6.8.1.4 Inspect shiplap joints on each blanket for tightness and verify that gaps, if any, do not exceed one-half (1/2") inch, including blanket to blanket joints.

6.8.1.5 Inspect duct tape and verify application at full circumference around each blanket with tape to tape adhesion

6.8.2 Hold Point Two - Foil Barrier Inspection

6.8.2.1 Upon completion of installation visually examine each foil barrier strip for damage. Cuts, tears and holes shall be repaired with additional strips of foil exceeding one (1") inch and re-inspected prior to installation of outer blankets.

6.8.2.2 Inspect each foil barrier strip for lengthwise application and verify a minimum six (6") inch overlap on ends and edges (two (2") inches for sharp curvatures).

6.8.2.3 Inspect tape for sufficient spacing to assure no excessive gaps exist in overlaps with particular emphasis on conduit curvatures.

6.8.3 Hold Point Three - Outer Blanket Inspection

D

6.8.3.1 Upon completion of installation, verify that serial number for each blanket is clearly visible and record on Form QC-117 or approved QC checklist.

6.8.3.2 Visually examine each blanket for damage. Holes and tears exceeding one (1") inch shall be repaired in accordance with IP-001 and re-inspected per section 6.13 of this procedure.

6.8.3.3 Inspect shiplap joints for tightness and proper alignment. Verify that gaps, if any, do not exceed one-half (1/2") inch. Inspect each lacing hook and verify 16 gauge stainelss steel tie wire is securely fastened between each adjacent hook.

6.8.4 Hold Point Four - Final Inspection

6.8.4.1 Perform final examination of completed system to assure correct installation in accordance with this section.

6.8.4.2 Verify that correct raceway identification tags are affixed at all entrance and exit points (walls, floors) and at origin and destination points on runs five (5') feet and longer or at the most visible location on runs less than five (5') feet.

6.9 Three sided wrap installation inspection

6.9.1 Hold Point One - Concrete Anchor Inspection

6.9.1.1 Upon completion of installation inspect anchors for compliance to site requirements.

6.9.1.2 Measure anchor spacing for maximum twelve (12") inch centers and verify that each anchor is pre-set.

6.9.2 Hold Point Two - Inner Blanket Inspection

ISSUE DESIGNATION IN THIS COLU... INDICATES CURRENT CHANGE

ISSUE DESIGNATION IN THIS COLL INDICATES CURRENT CHANGE

6.9.2.1 Upon completion of installation inspect each blanket in accordance with subsection 6.8.1 of this procedure. Additionally:

6.9.2.2 Inspect each blanket and verify proper alignment following impalement through studs.

6.9.2.3 Measure from blanket edges of each inner blanket to center of corresponding studs and verify minimum two (2") extension.

6.9.3 Hold Point Three - Foil Barrier Inspection

6.9.3.1 Upon completion of installation inspect each foil barrier strip in accordance with subsection 6.8.2. Additionally:

6.9.3.2 Inspect each foil barrier strip and verify proper alignment following impalement through studs.

6.9.3.3 Measure from edges of foil barrier to center of studs on each barrier strip and verify minimum two (2") extension.

6.9.4 Hold Point Four - Outer Blanket Inspection

6.9.4.1 Upon completion of installation inspect each blanket in accordance with subsection 6.8.3 . Additionally:

6.9.4.2 Inspect blanket and verify proper alignment following impalement through studs.

6.9.4.3 Inspect anchor assembly and verify that fender washers and/or B72 studs and/or flat bars are in place and that locknuts (or double nuts) are securely tightened.

6.9.4.4 Visually examine blanket assembly for wrinkles and bunches, and verify that assembly is not depressed over three-fourth (3/4") inch at anchors.

6.9.5 Hold Point Five - Final Inspection

6.9.5.1 Perform final examination of completed system to assure correct installation in accordance with this section.

6.9.5.2 Verify that correct raceway identification tags are affixed at all entrance and exit points (walls, floors) and at origin and destination points on runs five (5') feet and longer or at the most visible location on runs less than five (5') feet.

6.10 Field Modification Inspection - Non-Electrical Interferences

6.10.1 Hold Point One - Fabrication Inspection

D 6.10.1.1 Upon issuance of alumina silica blankets and outer fabric for fabrication record lot number(s) and receiving report number(s) on Form No. QC-117 or approved QC checklist.

ISSUE DESIGNATION IN THIS COLL NDICATES CURRENT CHANGE

6.10.2 Hold Point Two - Installation Inspection

6.10.2.1 Upon completion of fabrication and installation, verify correct thickness based alumina silica blanket size issued (actual measurement is not required due to blanket compression factor). Measure for minimum distance of eighteen (18") inches from point of interference or full length if interference is less than eighteen (18") inches.

6.10.2.2 Inspect lacing hooks and tie wire fasteners for sufficient spacing and tightness (six (6") inch minimum spacing is not required for interferences).

6.10.2.3 Inspect blanket joint and seam, and verify that no apparent gaps exist.

6.11 Cable Tray Interference Installation Inspection

6.11.1 Hold Point - Cable Inspection

D 6.11.1.1 Upon issuance of alumina silica blankets, record lot number and receiving report number on Form QC-117 or approved QC checklist.

6.11.1.2 Upon completion of installation inspect alumina silica blanket and verify that distance from each side of protected conduit is a minimum of eighteen (18") inches.

6.11.2 Cable Tray Interference Wrap Inspection

6.11.2.1 Installation inspection of cable tray wrap systems shall be in accordance with section 6.8 of this procedure and design details as established by Engineering.

6.12 Inspection of Field Fabrication Components

6.12.1 Primary wrap components fabricated in the field shall be inspected and documented in accordance with QCP-0042 prior to installation.

D 6.12.2 Field fabrication of items used for modification of existing wrap components shall be inspected in accordance with the applicable sections of QCP-0042. Inspection results and material traceability shall be recorded on Form QC-117 (or approved QC checklist) in lieu of Form QC-60 and QC-61.

6.13 Field Repair Inspection

D 6.13.1 Record lot numbers and receiving report numbers for materials issued for use on Form No. QC-117 or approved QC checklist.

6.13.2 Upon completion of installation inspect for tightness and verify that patch overlaps a minimum of two (2") inches on undamaged fabric, and that patches have finished edges.

6.13.3 Inspect Q-24 thread stitching on patches and tears two (2") inches and under and verify minimum spacing of one-half (1/2") inch.

6.14 When the alternate method for installing outer blanket assemblies is utilized as described in subsection 6.6 of IP-001, the following Inspection Hold Point shall apply in lieu of subsection 6.8.3 and 6.8.4.

6.14.1 Hold Point Three - Tube Assembly Inspection

D 6.14.1.1 Upon completion of tube assembly installation, verify that serial numbers are clearly visible and record on Form QC-117 or approved QC checklist.

6.14.1.2 Visually examine each component for damage and verify that tubes are parallel with system run. Holes and tears shall be patches with aluminum or duct tape to prevent powder leakage. If holes and tears result in excessive powder loss, the affected component shall be replaced.

6.14.1.3 Inspect circumferential and longitudinal joints and verify abutting fit with no apparent gaps. Inspect duct tape for sufficient spacing and tape to tape adhesion.

6.14.2 Hold Point Four - Alumina Silica Blanket Inspection

D 6.14.2.1 Upon completion of installation of each alumina silica blanket, verify that serial number is clearly visible and record on Form QC-117 or an approved QC checklist.

6.14.2.2 Visually examine each blanket for damage. Holes or tears in fabric exceeding one (1") inch shall be repaired per IP-001 and inspected per section 6.13 of this procedure.

6.14.2.3 Verify that circumferential and longitudinal joints are staggered a minimum six (6") inches from tube assembly joints.

6.14.2.4 Inspect longitudinal and circumferential joints for tightness with no apparent gaps. Verify that 16 gauge stainless steel tie wire is securely fastened between adjacent lacing hooks.

6.14.3 Hold Point Five - Final Inspection

6.14.3.1 Upon completion of total system installation perform final visual inspection of system to assure compliance with all applicable requirements.

6.14.3.2 Verify that correct raceway identification tags are affixed in accordance with paragraph 6.8.4.2.

7.0 ATTACHMENTS

7.1 Form No. QC-117, Three Hour Protective Wrap Inspection Report

7.2 Form No. QC-122, Three Hour MT Barrier Installation Inspection Report Register

ISSUE DESIGNATION IN THIS COLL INDICATES CURRENT CHANGE

A. MATEC

INSTALLATION INSPECTI(.EPORT
THREE HOUR MT BARRIER

Page 1 of ____

Report .: /

Project Name:	Job No.:	Raceway I.D. No.:	Schematic No.:	System Description:	Area:	Elevation:

Component Identification Number	Type	Hold Point No.	Tags/ Marking		Visual		Shiplap Overlap		Seam/ Joint		Duct Tape		Stagger		Lacing Hooks		Tie Wire		Anchors		Bolting		Cable-Blanket Bundle		Length/ Thick-ness		Repair/ Modif.		Insp. Initial	Insp. Date
			A	U	A	U	A	U	A	U	A	U	A	U	A	U	A	U	A	U	A	U	A	U	A	U	A	U		

SUPPLEMENTAL MATERIALS TRACEABILITY					
TYPE	LOT NO.	APPLICATION	TYPE	LOT NO.	APPLICATION

REMARKS:

Final Acceptance:	Date:	Client Acceptance:	Date:

FORM QC-117

QCP-0041 ATTACHMENT 7.1

3 HR MT BARRIER
INSTALLATION INSPECTION REPORT REGISTER

PROJECT NAME: _____

PROJECT NO.: _____

REPORT NUMBER	RACEWAY I.D. NO.	SCHEMATIC NUMBER	SYSTEM DESCRIPTION	RELEASE DATE	ACCEPTANCE DATE	COMMENTS

FORM QC-122 REV. 1-07/20/95

PROMATEC

FABRICATION ORDER

PFO-

PROJECT NAME	CUSTOMER	CUSTOMER ORDER NO.	JOB NO.

TYPE _____ QUANTITY _____

LENGTH _____ WIDTH _____ THICKNESS _____ TOTAL FT² _____

SCHEMATIC DRAWING REF. _____ SCHEMATIC NO. _____

I.D. NO. _____

ORDERED BY _____ DATE _____

SKETCH

CERTIFICATE OF CONFORMANCE

We hereby certify that all items furnished were fabricated with materials provided by PROMATEC and conform to the requirements of Purchase Order No. _____.

Signature _____ Company _____ Date _____

PROMATEC QUALITY ASSURANCE ACCEPTANCE

Signature _____ Title _____ Date _____

(QC 002)
PROJECT NAME _____ REPORT NUMBER ____-____

PROJECT NUMBER _____

FABRICATOR _____

FABRICATOR ADDRESS _____

TRACEABILITY ID REGISTER

CABLE WRAP FABRICATION

FORM QC-60
03/01/83
REV. 1 - 11/20/84
REV. 2 - 03/04/85

BLANKET NUMBER/ FAB ORDER NUMBER	EXTERNAL FABRIC MFG:_____ TYPE:_____ MFG ID NO:	INTERNAL FABRIC MFG:_____ TYPE:_____ MFG ID NO:	FILLER MATERIAL MFG:_____ TYPE:_____ MFG ID NO:	THREAD 1 MFG:_____ TYPE:_____ MFG ID NO:	COMMENTS	DATE	BY

Appendix F

QA DOCUMENTATION FOR HEMYC INSTALLATION

SANDIA TEST NUMBER 1

FABRICATION AND INSTALLATION CLARIFICATIONS

1. Hemyc pieces used to cover the 90° angles on conduits and hangers were factory stitched miters (except for the 4" conduits A & B and the Junction Box hanger pieces 1I-7 & 8 and 1I-9 & 10 which were field stitched miters).
2. Hemyc pieces used to cover the conduit radial sweeps were factory stitched gores. After installation the Hemyc was opened on the heel of the radius of Conduit C and D, additional Kaowool was added and a patch was applied to fill joint separation.
3. An addition band was installed on the 90° angles on Conduit A and the 2 field fabricated Junction Box Hangers to reduce the distance between bands, as measured on the heel side, to less than 9". Also an additional band was added just above the vertical perimeter overlap joint on Conduit C to close down the longitudinal overlap joint.
4. A 4" width of 2" thick Kaowool and a field fabricated 6" wide collar (1C-C1 and 1D-C4) was added to the top of the radius piece on the 2 – 2 _" Conduits C & D, to extend the coverage out of the furnace the minimum 6" to 12".
5. Field fabricated darts were added to field fabricated piece # 1I-6 after it was installed. The darts did not penetrate through the inner cloth. They only penetrated through approximately 1 _" of the Kaowool.
6. An additional field fabricated collar was added above the 90° angles on Conduits A and B due to an additional Perimeter Butt Joint that was required for 1A-3 and 1B-3.
7. The circumference length of pieces 1A-2A, 1A-2B, 1B-2A and 1B-2B were too long and violated the maximum 2" longitudinal overlap. These pieces were field modified. The circumference of the pieces was reduced by 3 1/2 " along longitudinal overlap portion of the pieces so they would meet the 2" maximum overlap.
8. Patches of Refrasil cloth were installed over various areas were the cloth was scuffed or torn during installation.
9. IP-8400.103, Issue G specifies an 8" minimum width on collars for perimeter butt joints and a 4" perimeter overlap joint. A 6" maximum width collar and a 2" maximum perimeter overlap was used in the test that conform to the minimum collar and overlap dimensions specified in IP-8400.103, Issue E (5/1/84).
10. Two field fabricated Hemyc pads were used to cover the interior hanger supports for 1I.

Mike w Jordan
3-30-03

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME Sandia
LIENT/PROJECT NUMBER 14790-123263, 64465
RECEIVED FROM Promatec
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 2698 . 14790
DATE RECEIVED 3-3-05
DATE INSPECTED 3-3-05
INSPECTED BY: [signature]

ITEM DESCRIPTION	P.O . NO.	QUANTITY			I.D. NO.	CON'tD MATL Y/N	CERT REC'D Y/N	SAFETY RELATED Y/N	CONTAINER INTEGRITY	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
Hemyc	NA	Q	Various	Q	see attached Sheets	Y	N	N	Good	X			Promatec brought the Hemyc material with them. All pieces were labeled w/ appropriate numbering. Receiving only

09-016-11/02

Complete

PERFORMANCE CONTRACTING INC PROMATEC

FABRICATION ORDER

PFO - 051179

PROJECT NAME	CUSTOMER	CUSTOMER ORDER NO.	JOB NO.
HEMYC TEST #1	SANDIA LAB	401177 Rev. 1	1039

TYPE ONE HOUR QUANTITY 8

LENGTH SEE DRAWING WIDTH SEE DRAWING THICKNESS 2" TOTAL FT ² _____

SCHEMATIC DRAWING REF. SEE BELOW SCHEMATIC NO. N/A

I.D. NO. 4" CONDUIT # 1B

ORDERED BY MICHAEL JORDAN DATE 2/22/05

SKETCH

SEE ATTACHED SEGMENT DRAWINGS

4235495-30-3 1B-1 ✓
1B-2 B+ 1B-2A - 29-3
29-2 1B-3
30-2 1B-4 ✓
30-3 1B-5 ✓
29-3 1B-C1 — 1B-6 - 29-3
29-3 1B-C2
29-3 1B-C3
1B-C4 - 29-2

CERTIFICATE OF CONFORMANCE

We hereby certify that all items furnished were fabricated with materials provided by PCI-Promatec and conform to the requirements of Purchase Order No. 051179.

Signature _____ Company _____ Date _____

PCI-PROMATEC QUALITY ASSURANCE ACCEPTANCE

Signature _____ Title _____ Date _____

Complete

PCI PERFORMANCE CONTRACTING INC PROMATEC

FABRICATION ORDER

PFO - 051179

PROJECT NAME	CUSTOMER	CUSTOMER ORDER NO.	JOB NO.
HEMYC TEST #1	SANDIA LAB	401177 Rev. 1	1039

TYPE ONE HOUR QUANTITY 8

LENGTH SEE DRAWING WIDTH SEE DRAWING THICKNESS 2" TOTAL FT ² _____

SCHEMATIC DRAWING REF. SEE BELOW SCHEMATIC NO. N/A

I.D. NO. 4" CONDUIT # 1A

ORDERED BY MICHAEL JORDAN DATE 2/22/05

SKETCH

SEE ATTACHED SEGMENT DRAWINGS

4235495-30-3 1A-1 ✓
29-3 1A-2 A+B ✓
29.3 1A-3 ✓
30-2 1A-4 ✓
30-3 1A-5 ✓
29.3 1A-C1 ✓
29-3 1A-C2 ✓
29-3 1A-C3 ✓
29-3 1A-C4 ✓

CERTIFICATE OF CONFORMANCE

We hereby certify that all items furnished were fabricated with materials provided by PCI-Promatec and conform to the requirements of Purchase Order No. 051179.

Signature _____ Company _____ Date _____

PCI-PROMATEC QUALITY ASSURANCE ACCEPTANCE

Signature _____ Title _____ Date _____

PCI PERFORMANCE CONTRACTING INC PROMATEC

FABRICATION ORDER

PFO - 051179

PROJECT NAME	CUSTOMER	CUSTOMER ORDER NO.	JOB NO.
HEMYC TEST #1	SANDIA LAB	401177 Rev. 1	1039

TYPE ONE HOUR QUANTITY 8

LENGTH SEE DRAWING WIDTH SEE DRAWING THICKNESS 2" TOTAL FT ² _____

SCHEMATIC DRAWING REF. SEE BELOW SCHEMATIC NO. N/A

I.D. NO. 2 1/2" CONDUIT # 1D

ORDERED BY MICHAEL JORDAN DATE 2/22/05

SKETCH

SEE ATTACHED SEGMENT DRAWINGS

4235495-30-3 1D-1 ✓
29.2 ✓ 1D-2
30-2 1D-3
30-3 1D-4
1D-5 ✓
1D-C1
1D-C2
1D-C3

CERTIFICATE OF CONFORMANCE

We hereby certify that all items furnished were fabricated with materials provided by PCI-Promatec and conform to the requirements of Purchase Order No. 051179.

Signature _____ Company _____ Date _____

PCI-PROMATEC QUALITY ASSURANCE ACCEPTANCE

Signature _____ Title _____ Date _____

Form QC-59
Rev. 2 – 02/18/05

Complete

PERFORMANCE CONTRACTING INC PROMATEC

FABRICATION ORDER

PFO - 051179

PROJECT NAME	CUSTOMER	CUSTOMER ORDER NO.	JOB NO.
HEMYC TEST #1	SANDIA LAB	401177 Rev. 1	1039

TYPE ONE HOUR QUANTITY 5

LENGTH SEE DRAWING WIDTH SEE DRAWING THICKNESS 2" TOTAL FT ² _____

SCHEMATIC DRAWING REF. SEE BELOW SCHEMATIC NO. N/A

I.D. NO. 2 1/2" CONDUIT # 1C Duct Caps

ORDERED BY MICHAEL JORDAN DATE 2/22/05

SKETCH

SEE ATTACHED SEGMENT DRAWINGS

4235495- 29.2 1C-1
29.2 1C-2 ✓
29.2 1C-3
29.3 1C-4 ✓
29-3 1C-5

CERTIFICATE OF CONFORMANCE

We hereby certify that all items furnished were fabricated with materials provided by PCI-Promatec and conform to the requirements of Purchase Order No. 0521179.

Signature _____ Company _____ Date _____

PCI-PROMATEC QUALITY ASSURANCE ACCEPTANCE

Signature _____ Title _____ Date _____

Complete

PERFORMANCE CONTRACTING INC PROMATEC

FABRICATION ORDER

PFO - 051179

PROJECT NAME	CUSTOMER	CUSTOMER ORDER NO.	JOB NO.
HEMYC TEST #1	SANDIA LAB	401177 Rev. 1	1039

TYPE ONE HOUR QUANTITY 8

LENGTH SEE DRAWING WIDTH SEE DRAWING THICKNESS 2" TOTAL FT ² _____

SCHEMATIC DRAWING REF. SEE BELOW SCHEMATIC NO. N/A

I.D. NO. 1" CONDUIT # 1E

ORDERED BY MICHAEL JORDAN DATE 2/22/05

SKETCH

SEE ATTACHED SEGMENT DRAWINGS

4235495-30.3 1E-1 ✓
29.2 1E-2
1E-3
30.3 < 1E-4 ✓
1E-5 ✓
30-3 1E-C1 ✓
30.2 1E-C2
30.2 1E-C3
~~1E-C4~~

CERTIFICATE OF CONFORMANCE

We hereby certify that all items furnished were fabricated with materials provided by PCI-Promatec and conform to the requirements of Purchase Order No. 051179 .

Signature _____ Company _____ Date _____

PCI-PROMATEC QUALITY ASSURANCE ACCEPTANCE

Signature _____ Title _____ Date _____

PCI PERFORMANCE CONTRACTING INC PROMATEC

FABRICATION ORDER

PFO 051179

PROJECT NAME	CUSTOMER	CUSTOMER ORDER NO.	JOB NO.
HEMYC TEST #1	SANDIA LAB	401177 Rev. 1	1039

TYPE ONE HOUR QUANTITY 2

LENGTH SEE DRAWING WIDTH SEE DRAWING THICKNESS 2" TOTAL FT ² _____

SCHEMATIC DRAWING REF. SEE BELOW SCHEMATIC NO. N/A

I.D. NO. HANGER 1H

ORDERED BY MICHAEL JORDAN DATE 2/22/05

SKETCH

SEE ATTACHED SEGMENT DRAWINGS

42354 95-29.3 1H-1

~~29.3~~ 29.3 1H-2

CERTIFICATE OF CONFORMANCE

We hereby certify that all items furnished were fabricated with materials provided by PCI-Promatec and conform to the requirements of Purchase Order No. 051179.

Signature _____ Company _____ Date _____

PCI-PROMATEC QUALITY ASSURANCE ACCEPTANCE

Signature _____ Title _____ Date _____

Complete

PCI PERFORMANCE CONTRACTING INC PROMATEC

FABRICATION ORDER

PFO - 051179

PROJECT NAME	CUSTOMER	CUSTOMER ORDER NO.	JOB NO.
HEMYC TEST #1	SANDIA LAB	401177 Rev. 1	1039

TYPE ONE HOUR QUANTITY 2

LENGTH SEE DRAWING WIDTH SEE DRAWING THICKNESS 2" TOTAL FT ² _____

SCHEMATIC DRAWING REF. SEE BELOW SCHEMATIC NO. N/A

I.D. NO. HANGER 1G

ORDERED BY MICHAEL JORDAN DATE 2/22/05

SKETCH

SEE ATTACHED SEGMENT DRAWINGS

~~30~~ 29-3 { 1G-1, 1G-2

29-3 { 1H-1, 1H-2

CERTIFICATE OF CONFORMANCE

We hereby certify that all items furnished were fabricated with materials provided by PCI-Promatec and conform to the requirements of Purchase Order No. 051179.

Signature _____ Company _____ Date _____

PCI-PROMATEC QUALITY ASSURANCE ACCEPTANCE

Signature _____ Title _____ Date _____

PCI PERFORMANCE CONTRACTING INC PROMATEC

TRACEABILITY ID REGISTER

REPORT NUMBER 1

PROJECT NAME Sandia #1

PROJECT NUMBER 1039

FABRICATOR MIT Conduit A

MT BARRIER WRAP	EXTERNAL FABRIC		INTERNAL FABRIC		FILLER MATERIAL		FILLER MATERIAL		THREAD		HARDWARE		INSPECTOR
MFG	Hitco		Hitco		Kaowool		N/A		Alpha		N/A		JT
TYPE	Refrasil-18		Refrasil		#8				Q-24				
IDENTIFICATION NO.	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	R.R.#	R.R.#	BY / DATE
	4235495-	R0511 04	4235495-		4365A-2	R0511105			35957	R051102			3/5/05
1A-1	30-3		30-3		↓				↓				↓
1A-2 A+B	29-3		29-3										
1A-3	29-3		29-3										
1A-4	30-4		30-4										
1A-5	30-3		30-3										
1A-C1	29-3		29-3										
1A-C2	29-3		29-3										
1A-C3	29-3		29-3										
1A-C4	29-3		29-3										

PCI PERFORMANCE CONTRACTING INC PROMATEC

TRACEABILITY ID REGISTER

REPORT NUMBER 1

PROJECT NAME Sandia #1

PROJECT NUMBER 1039

FABRICATOR MIT Conduit #1A

MT BARRIER WRAP	EXTERNAL FABRIC		INTERNAL FABRIC		FILLER MATERIAL		FILLER MATERIAL		THREAD		HARDWARE		INSPECTOR
MFG	Hitco		Hitco		KAOWOOL		N/A		ALPHA		N/A		JT
TYPE	REFRASIL-18		REFRASIL		#8				Q-24				
IDENTIFICATION NO.	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	R.R.#	R.R.#	BY / DATE
	4235495-		4235495-		4365A-2				35957				3/5/05
		R0511 04				R051105				R05162			
1A-1	30-3		30-3										
1A-2 A+B	29-3		29-3										
1A-3	29-3		29-3										
1A-4	30-4		30-4										
1A-5	30-3		30-3										
1A-C1	29-3		29-3										
1A-C2	29-3		29-3										
1A-C3	29-3		29-3										
1A-C4	29-3		29-3										

PCI PERFORMANCE CONTRACTING INC PROMATEC

TRACEABILITY ID REGISTER

REPORT NUMBER 1

PROJECT NAME Sandia #1

PROJECT NUMBER 1039

FABRICATOR MIT Conduit #1B

MT BARRIER WRAP	EXTERNAL FABRIC		INTERNAL FABRIC		FILLER MATERIAL		FILLER MATERIAL		THREAD		HARDWARE		INSPECTOR
MFG	Hitco		Hitco		Kaowool		N/A		Alpha		N/A		J.T.
TYPE	Refrasil-18		Refrasil		#8				Q-24				
IDENTIFICATION NO.	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	R.R.#	R.R.#	BY / DATE
	4235495-	R051104	4235495-		4365A-2	R051105			35957	R051102			3/5/05
1B-1	30-3		30-3										
1B-2A	29-3		29-3										
1B-2B	29-3		29-3										
1B-3	29-2		29-2										
1B-4	30-2		30-2										
1B-5	30-3		30-3										
1B-C1	29-2		29-2										
1B-C2	29-3		29-3										
1B-C3	29-2		29-2										
1B-C4	29-2		29-2										

PCI PERFORMANCE CONTRACTING INC PROMATEC

TRACEABILITY ID REGISTER

REPORT NUMBER 1

PROJECT NAME Sandia #1

PROJECT NUMBER 1039

FABRICATOR MIT CONDUIT #1C

MT BARRIER WRAP	EXTERNAL FABRIC		INTERNAL FABRIC		FILLER MATERIAL		FILLER MATERIAL		THREAD		HARDWARE		INSPECTOR
MFG	Hitco		Hitco		KAOWOOL		N/A		ALPHA		N/A		JT
TYPE	REFRASIL-18		REFRASIL		#8				Q-24				
IDENTIFICATION NO.	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	R.R.#	R.R.#	BY / DATE
	4235495-		4235495-		4365A-2				35957				3/5/05
		R05104				R05105				R05102			
1C-1	29-2		29-2										
1C-2	29-2		29-2										
1C-3	29-2		29-2										
1C-4	29-3		29-3										
1C-5	29-3		29-3										
1C-C1	30-1		30-1										

PCI PERFORMANCE CONTRACTING INC PROMATEC

TRACEABILITY ID REGISTER

REPORT NUMBER 1

PROJECT NAME Sandia #1

PROJECT NUMBER 1039

FABRICATOR MIT 2½ CONDUIT #ID

MT BARRIER WRAP	EXTERNAL FABRIC		INTERNAL FABRIC		FILLER MATERIAL		FILLER MATERIAL		THREAD		HARDWARE		INSPECTOR
MFG	Hitco		Hitco		Kaowool #8		N/A		Alpha Q-24		N/A		JT
TYPE	Refrasil-18		Refrasil										
IDENTIFICATION NO.	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	R.R.#	R.R.#	BY / DATE
	4235495	R051104	4235495		4365A-2	R051105			35957	R051102			3/5/05
ID-1	30.3		30.3										
ID-2	29.2		29.2										
ID-3	29.2		29.2										
ID-4	30-2		30-2										
ID-5	30-3		30-3										
ID-C1	30-3		30-3										
ID-C2	30-3		30-3										
ID-C-3	30-3		30-3										
ID-C-4	30-3		30-3										

PCI PERFORMANCE CONTRACTING INC PROMATEC

TRACEABILITY ID REGISTER

REPORT NUMBER 1

PROJECT NAME Sandia #1

PROJECT NUMBER 1039

FABRICATOR MIT 1" CONDUIT #1E

MT BARRIER WRAP	EXTERNAL FABRIC		INTERNAL FABRIC		FILLER MATERIAL		FILLER MATERIAL		THREAD		HARDWARE		INSPECTOR
MFG	Hitco		Hitco		KAOWOOL #8		N/A		ALPHA R.24		N/A		J.T.
TYPE	REFRASIL-18		REFRASIL										
IDENTIFICATION NO.	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	R.R.#	R.R.#	BY / DATE
	4235495-		4235495-		4365A-2	105105			35957	105102			3/5/05
		105104											
1E-1	30-3		30-3										
1E-2	29-2		29-2										
1E-3	29-2		29-2										
1E-4	30-3		30-3										
1E-5	30-3		30-3										
1E-C1	30-3		30-3										
1E-C2	30-2		30-2										
1E-C3	30-2		30-2										

PCI PERFORMANCE CONTRACTING INC PROMATEC

TRACEABILITY ID REGISTER

REPORT NUMBER 1

PROJECT NAME Sandia #1

PROJECT NUMBER 1039

FABRICATOR MIT 1" Conduit #1F

MT BARRIER WRAP	EXTERNAL FABRIC		INTERNAL FABRIC		FILLER MATERIAL		FILLER MATERIAL		THREAD		HARDWARE		INSPECTOR
MFG	Hitco		Hitco		Kaowool		N/A		Alpha		N/A		JT
TYPE	Refrasil-18		Refrasil		#8				R-24				
IDENTIFICATION NO.	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	R.R.#	R.R.#	BY / DATE
	4235495	R051104	4235495		4365A-2	R051105			35957	R051103			3/5/05
1F-1	30-3		30-3										
1F-2	29-2		29-2										
1F-3	30-2		30-2										
1F-4	29-3		29-3										
1F-5	30-2		30-2										

PCI PERFORMANCE CONTRACTING INC PROMATEC

TRACEABILITY ID REGISTER

REPORT NUMBER 1

PROJECT NAME Sandia #1

PROJECT NUMBER 1039

FABRICATOR MIT HANGER IG

MT BARRIER WRAP	EXTERNAL FABRIC		INTERNAL FABRIC		FILLER MATERIAL		FILLER MATERIAL		THREAD		HARDWARE		INSPECTOR
MFG	Hitco		Hitco		Kaowool #8		N/A		Alpha R-24		N/A		J.T.
TYPE	Refrasil-18		Refrasil										
IDENTIFICATION NO.	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	R.R.#	R.R.#	BY / DATE
	4235495	R051104	4235495		4365A-2	R051105			35957	R051102			3/5/05
IG-1	29-3		29-3		↓	↓	↓	↓	↓	↓	↓	↓	↓
IG-2	29-3		29-3										

PCI PERFORMANCE CONTRACTING INC PROMATEC

TRACEABILITY ID REGISTER

REPORT NUMBER 1

PROJECT NAME Sandia #1

PROJECT NUMBER 1039

FABRICATOR MIT HANGER 1H

MT BARRIER WRAP	EXTERNAL FABRIC		INTERNAL FABRIC		FILLER MATERIAL		FILLER MATERIAL		THREAD		HARDWARE		INSPECTOR
MFG	Hitco		Hitco		Kaowool		N/A		Alpha		N/A		J.T.
TYPE	Refrasil-18		Refrasil		#8				Q-24				
IDENTIFICATION NO.	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	R.R.#	R.R.#	BY / DATE
	4235495-	051104	4235495-		4365A-2	Lot 05			35957	051102			3/5/05
1H-1	29.3		29.3		↓	↓			↓				↓
1H-2	29.3		29.3										

PCI PERFORMANCE CONTRACTING INC PROMATEC

TRACEABILITY ID REGISTER

REPORT NUMBER 1

PROJECT NAME Sandia #1

PROJECT NUMBER 1039

FABRICATOR MIT Junction Box I

MT BARRIER WRAP	EXTERNAL FABRIC		INTERNAL FABRIC		FILLER MATERIAL		FILLER MATERIAL		THREAD		HARDWARE		INSPECTOR
MFG	Hitco		Hitco		Kaowool #8		N/A		Alpha R-24		N/A		J.T.
TYPE	Refrasil-18		Refrasil		I.D. NO.	R.R.#	I.D. NO.	R.R.#	I.D. NO.	R.R.#	R.R.#	R.R.#	BY / DATE
IDENTIFICATION NO.	I.D. NO.	R.R.#	I.D. NO.	R.R.#									
	4235495-	R051104	4235495		4365A-2	R051105			35957	R051102			3/5/05
11-1	30-1		30-1										
11-2	30-1		30-1										
11-3	30-1		30-1										
11-4	30-1		30-1										
11-5	30-3		30-3										
11-6	30-1		30-1										
11-7	30-1		30-1										
11-8	30-1		30-1										
11-9	30-1		30-1										
11-10	30-1		30-1										

HOLD POINT INSPECTION & CLIENT FINAL SIGNOFF REPORT

PCI PERFORMANCE CONTRACTING INC PROMATEC

(QCP-10003)

PROJECT NAME: SANDIA #1

PROJECT NUMBER: 1039

REPORT NO. _____

STRUCTURAL INSPECTION

IDENTIFICATION NUMBER CABLE TRAY/CONDUIT	LOCATION - AREA/ELEVATION/ROOM ETC.	QC HOLD POINTS - STRUCTURAL INTEGRITY						VISUAL INSPECTION & RELEASE			
		1 DEAD AIR SPACE-2"	2 CLAMP DEVICES	3 FRAME SECURE	4 BLANKET ANCHORS	5 CONCRETE ANCHORS	6 OTHER -------	PASS	REJECT	DATE	BY
				N/A							

WRAP INSTALLATION INSPECTION & ACCEPTANCE

COND.	BLANKET NO./FAB ORDER NO. CABLE TRAY(S)								QC HOLD POINTS - WRAP INSTALLATION				QC HOLD POINT 6 & FINAL ACCEPTANCE				
													VISUAL INSPECTION			FINAL ACCEPTANCE	
	TOP	BOT	SIDE	SIDE	SIDE	SIDE	SIDE	SIDE	1 OVERLAPS 2" MIN	2 WRAP RETAINE INTACT	3 BANDING DEFLECT	4 TERMINATION ADEQUATE	ACCEPT	HOLD	REJECT	DATE	BY
#1A									J.T.	J.T.	J.T.	N/A	JT			3/5/05	J.T.
			N/A														

HOLD POINT INSPECTION & CLIENT FINAL SIGNOFF REPORT

PCI PERFORMANCE CONTRACTING INC PROMATEC

(QCP-10003)

PROJECT NAME: SANDIA #1

PROJECT NUMBER: 1039

REPORT NO. _____

STRUCTURAL INSPECTION

IDENTIFICATION NUMBER CABLE TRAY/CONDUIT	LOCATION - AREA/ELEVATION/ROOM ETC.	QC HOLD POINTS - STRUCTURAL INTEGRITY						VISUAL INSPECTION & RELEASE			
		1 DEAD AIR SPACE-2"	2 CLAMP DEVICES	3 FRAME SECURE	4 BLANKET ANCHORS	5 CONCRETE ANCHORS	6 OTHER -------	PASS	REJECT	DATE	BY
				N/A							

WRAP INSTALLATION INSPECTION & ACCEPTANCE

BLANKET NO./FAB ORDER NO.									QC HOLD POINTS - WRAP INSTALLATION				QC HOLD POINT 6 & FINAL ACCEPTANCE				
COND.	CABLE TRAY(S)								1 OVERLAPS 2" MIN	2 WRAP RETAINE INTACT	3 BANDING DEFLECT	4 TERMINATION ADEQUATE	VISUAL INSPECTION			FINAL ACCEPTANCE	
	TOP	BOT.	SIDE	SIDE	SIDE	SIDE	SIDE	SIDE					ACCEPT	HOLD	REJECT	DATE	BY
#1B									J.T.	J.T.	J.T.	J.T.	J.T.			3/5/05	J.T.
					N/A												
				N/A													

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HOLD POINT INSPECTION & CLIENT FINAL SIGNOFF REPORT

PCI PERFORMANCE CONTRACTING INC PROMATEC

(QCP-10003)

PROJECT NAME: SANDIA #1

REPORT NO.

PROJECT NUMBER: 1039

STRUCTURAL INSPECTION

IDENTIFICATION NUMBER CABLE TRAY/CONDUIT	LOCATION - AREA/ELEVATION/ROOM ETC.	QC HOLD POINTS - STRUCTURAL INTEGRITY						VISUAL INSPECTION & RELEASE			
		1 DEAD AIR SPACE-2"	2 CLAMP DEVICES	3 FRAME SECURE	4 BLANKET ANCHORS	5 CONCRETE ANCHORS	6 OTHER --------	PASS	REJECT	DATE	BY
				N/A							
				N/A							

WRAP INSTALLATION INSPECTION & ACCEPTANCE

BLANKET NO./FAB ORDER NO.									QC HOLD POINTS - WRAP INSTALLATION				QC HOLD POINT 6 & FINAL ACCEPTANCE				
COND.	CABLE TRAY(S)								1 OVERLAPS 2" MIN	2 WRAP RETAINE INTACT	3 BANDING DEFLECT	4 TERMINATION ADEQUATE	VISUAL INSPECTION			FINAL ACCEPTANCE	
	TOP	BOT.	SIDE	SIDE	SIDE	SIDE	SIDE	SIDE					ACCEPT	HOLD	REJECT	DATE	BY
#1C									J.T.	J.T.	J.T.	J.T.	J.T.			3/5/05	J.T.
					N/A												

FORM QC-62/REV. 1 07-20-95

HOLD POINT INSPECTION & CLIENT FINAL SIGNOFF REPORT

PCI PERFORMANCE CONTRACTING INC PROMATEC

(QCP-10003)

PROJECT NAME: SANDIA #1

PROJECT NUMBER: 1039

REPORT NO. _____

STRUCTURAL INSPECTION

IDENTIFICATION NUMBER CABLE TRAY/CONDUIT	LOCATION - AREA/ELEVATION/ROOM ETC.	QC HOLD POINTS - STRUCTURAL INTEGRITY						VISUAL INSPECTION & RELEASE			
		1 DEAD AIR SPACE-2"	2 CLAMP DEVICES	3 FRAME SECURE	4 BLANKET ANCHORS	5 CONCRETE ANCHORS	6 OTHER -------	PASS	REJECT	DATE	BY
				N/A							
				N/A							

WRAP INSTALLATION INSPECTION & ACCEPTANCE

BLANKET NO./FAB ORDER NO.									QC HOLD POINTS - WRAP INSTALLATION				QC HOLD POINT 6 & FINAL ACCEPTANCE				
COND.	CABLE TRAY(S)								1 OVERLAPS 2" MIN	2 WRAP RETAINE INTACT	3 BANDING DEFLECT	4 TERMINATION ADEQUATE	VISUAL INSPECTION			FINAL ACCEPTANCE	
	TOP	BOT.	SIDE	SIDE	SIDE	SIDE	SIDE	SIDE					ACCEPT	HOLD	REJECT	DATE	BY
#1D									J.T.	J.T.	J.T.	J.T.	J.T.			3/5/05	J.T.
					N/A												
					N/A												

FORM QC-62/REV. 1 07-20-95

HOLD POINT INSPECTION & CLIENT FINAL SIGNOFF REPORT

PCI PERFORMANCE CONTRACTING INC PROMATEC

(QCP-10003)

PROJECT NAME: SANDIA #1 REPORT NO.

PROJECT NUMBER: 1039

STRUCTURAL INSPECTION

IDENTIFICATION NUMBER CABLE TRAY/CONDUIT	LOCATION - AREA/ELEVATION/ROOM ETC.	QC HOLD POINTS - STRUCTURAL INTEGRITY						VISUAL INSPECTION & RELEASE			
		1 DEAD AIR SPACE-2"	2 CLAMP DEVICES	3 FRAME SECURE	4 BLANKET ANCHORS	5 CONCRETE ANCHORS	6 OTHER -------	PASS	REJECT	DATE	BY
				A							
				N							

WRAP INSTALLATION INSPECTION & ACCEPTANCE

BLANKET NO./FAB ORDER NO.									QC HOLD POINTS - WRAP INSTALLATION				QC HOLD POINT 6 & FINAL ACCEPTANCE				
COND.	CABLE TRAY(S)								1 OVERLAPS 2" MIN	2 WRAP RETAINE INTACT	3 BANDING DEFLECT	4 TERMINATION ADEQUATE	VISUAL INSPECTION			FINAL ACCEPTANCE	
	TOP	BOT.	SIDE	SIDE	SIDE	SIDE	SIDE	SIDE					ACCEPT	HOLD	REJECT	DATE	BY
#1E									J.T.	J.T.	J.T.	J.T.	J.T.			3/31/05	J.T.
						A											
					N												

HOLD POINT INSPECTION & CLIENT FINAL SIGNOFF REPORT

PCI PERFORMANCE CONTRACTING INC PROMATEC

(QCP-10003)

PROJECT NAME: SANDIA #1

PROJECT NUMBER: 1039

REPORT NO. _____

STRUCTURAL INSPECTION

IDENTIFICATION NUMBER CABLE TRAY/CONDUIT	LOCATION - AREA/ELEVATION/ROOM ETC.	QC HOLD POINTS - STRUCTURAL INTEGRITY						VISUAL INSPECTION & RELEASE			
		1 DEAD AIR SPACE-2"	2 CLAMP DEVICES	3 FRAME SECURE	4 BLANKET ANCHORS	5 CONCRETE ANCHORS	6 OTHER ----------	PASS	REJECT	DATE	BY
				N/A							
				N/A							

WRAP INSTALLATION INSPECTION & ACCEPTANCE

BLANKET NO./FAB ORDER NO.									QC HOLD POINTS - WRAP INSTALLATION				QC HOLD POINT 6 & FINAL ACCEPTANCE				
COND.	CABLE TRAY(S)								1 OVERLAPS 2" MIN	2 WRAP RETAINE INTACT	3 BANDING DEFLECT	4 TERMINATION ADEQUATE	VISUAL INSPECTION			FINAL ACCEPTANCE	
	TOP	BOT.	SIDE	SIDE	SIDE	SIDE	SIDE	SIDE					ACCEPT	HOLD	REJECT	DATE	BY
#1F									J.T.	J.T.	J.T.	J.T.	J.T.			3/5/05	J.T.
				N/A													
				N/A													

FORM QC-62/REV. 1 07-20-95

HOLD POINT INSPECTION & CLIENT FINAL SIGNOFF REPORT

PCI PERFORMANCE CONTRACTING INC PROMATEC

(QCP-10003)

PROJECT NAME: SANDIA #1

PROJECT NUMBER: 1039

REPORT NO. _____

STRUCTURAL INSPECTION

IDENTIFICATION NUMBER CABLE TRAY/CONDUIT	LOCATION - AREA/ELEVATION/ROOM ETC.	QC HOLD POINTS - STRUCTURAL INTEGRITY						VISUAL INSPECTION & RELEASE			
		1 DEAD AIR SPACE-2"	2 CLAMP DEVICES	3 FRAME SECURE	4 BLANKET ANCHORS	5 CONCRETE ANCHORS	6 OTHER --------	PASS	REJECT	DATE	BY
		N/A									
		N									

WRAP INSTALLATION INSPECTION & ACCEPTANCE

BLANKET NO./FAB ORDER NO.									QC HOLD POINTS - WRAP INSTALLATION				QC HOLD POINT 6 & FINAL ACCEPTANCE				
COND.	CABLE TRAY(S)								1 OVERLAPS	2 WRAP RETAINE	3 BANDING	4 TERMINATION	VISUAL INSPECTION			FINAL ACCEPTANCE	
	TOP	BOT.	SIDE	SIDE	SIDE	SIDE	SIDE	SIDE	2" MIN	INTACT	DEFLECT	ADEQUATE	ACCEPT	HOLD	REJECT	DATE	BY
HANGER IG-1									J.T.	J.T.	J.T.	J.T.	J.T.			3/5/05	J.T.
HANGER IG-2									J.T.	J.T.	J.T.	J.T.	J.T.			3/5/05	J.T.
					N/A												

HOLD POINT INSPECTION & CLIENT FINAL SIGNOFF REPORT

PCI PERFORMANCE CONTRACTING INC PROMATEC

(QCP-10003)

PROJECT NAME: SANDIA #1

REPORT NO.

PROJECT NUMBER: 1039

STRUCTURAL INSPECTION

IDENTIFICATION NUMBER CABLE TRAY/CONDUIT	LOCATION - AREA/ELEVATION/ROOM ETC.	QC HOLD POINTS - STRUCTURAL INTEGRITY						VISUAL INSPECTION & RELEASE			
		1 DEAD AIR SPACE-2"	2 CLAMP DEVICES	3 FRAME SECURE	4 BLANKET ANCHORS	5 CONCRETE ANCHORS	6 OTHER --------	PASS	REJECT	DATE	BY
				N/A							
				N/A							

WRAP INSTALLATION INSPECTION & ACCEPTANCE

BLANKET NO./FAB ORDER NO.									QC HOLD POINTS - WRAP INSTALLATION				QC HOLD POINT 6 & FINAL ACCEPTANCE				
COND.	CABLE TRAY(S)								1 OVERLAPS	2 WRAP RETAINE	3 BANDING	4 TERMINATION	VISUAL INSPECTION			FINAL ACCEPTANCE	
	TOP	BOT.	SIDE	SIDE	SIDE	SIDE	SIDE	SIDE	2" MIN	INTACT	DEFLECT	ADEQUATE	ACCEPT	HOLD	REJECT	DATE	BY
HANGER 1H-1									J.T.	J.T.	J.T.	J.T.	J.T.			3/5/05	J.T.
HANGER 1H-2									J.T.	J.T.	J.T.	J.T.	J.T.				J.T.
										N/A							
										N/A							

HOLD POINT INSPECTION & CLIENT FINAL SIGNOFF REPORT

PCI PERFORMANCE CONTRACTING INC PROMATEC

(QCP-10003)

PROJECT NAME: SANDIA # 1

REPORT NO.

PROJECT NUMBER: 1039

STRUCTURAL INSPECTION

IDENTIFICATION NUMBER CABLE TRAY/CONDUIT	LOCATION - AREA/ELEVATION/ROOM ETC.	QC HOLD POINTS - STRUCTURAL INTEGRITY						VISUAL INSPECTION & RELEASE			
		1 DEAD AIR SPACE-2"	2 CLAMP DEVICES	3 FRAME SECURE	4 BLANKET ANCHORS	5 CONCRETE ANCHORS	6 OTHER -------	PASS	REJECT	DATE	BY

WRAP INSTALLATION INSPECTION & ACCEPTANCE

BLANKET NO./FAB ORDER NO.									QC HOLD POINTS - WRAP INSTALLATION				QC HOLD POINT 6 & FINAL ACCEPTANCE				
COND.	CABLE TRAY(S)								1 – OVERLAPS 2" MIN	2 WRAP RETAINE INTACT	3 BANDING DEFLECT	4 TERMINATION ADEQUATE	VISUAL INSPECTION			FINAL ACCEPTANCE	
	TOP	BOT.	SIDE	SIDE	SIDE	SIDE	SIDE	SIDE					ACCEPT	HOLD	REJECT	DATE	BY
JUNCTION BOX 1									J.T.	J.T.	J.T.	J.T.	J.T.			3/5/05	J.T.
				N/A													

Appendix G

QUALITY ASSURANCE DOCUMENTATION

Quality Assurance Statement

Omega Point Laboratories, Inc. is an independent, wholly owned company incorporated in the state of Texas, devoted to engineering, inspection, quality assurance and testing of building materials, products and assemblies. The company has developed and implemented a Quality Assurance Program designed to provide its clients with a planned procedure of order and document processing for inspection and testing services it provides to assure conformity to requirements, codes, standards and specifications. The Program is designed to meet the intent of ANSI 45.2 Quality Assurance Program Requirements for Nuclear Power Plants, and complies with the requirements of the ASME Code, SPPE, Military Standards and other less stringent programs. It is the Laboratory's intention to adhere strictly to this Program, to assure that the services offered to its clients remains of the highest quality and accuracy possible.

The overall responsibility of the supervision, operation and coordination of this Quality Assurance Program is that of the Quality Assurance Manager, a person not involved with the performance of the inspection or testing services, and who is under the full time employ of the Laboratory. This individual is responsible for implementing and enforcing all procedures presented in the Quality Assurance Manual and the Procedures Manual. All personnel involved with activities which fall under the scope of this Program are required to cooperate with the letter and intent of this Program.

All QA Surveillance documents remain on file at the Laboratory, and are available for inspection by authorized personnel in the performance of an on-site QA Audit. All materials, services and supplies utilized herein were obtained with appropriate QA Certifications of Compliance, and the inclusion of these in this report would not be practical nor useful to the reader.

ACCEPTABILITY DOCUMENTATION

PROJECT NO. 14790-123263

SANDIA NATIONAL LABORATORIES

The following signatures attest to the review and acceptance of each attribute (Hold Point) listed regarding the above-noted project:

I. TEST ARTICLE DECK

Omega Point Laboratories, Inc. — Date: 1/27/05

SANDIA National Laboratories — Date: 1/27/05

II. TEST ARTICLE RACEWAYS & JB

Omega Point Laboratories, Inc. — Date: 1/27/05

SANDIA National Laboratories — Date: 1/27/05

Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, Texas 78112-9784 USA
210-635-8100 / FAX: 210-635-8101 / 800-966-5253
www.opl.com moreinfo@opl.com

III. TEST SPECIMEN THERMOCOUPLE PLACEMENT

Omega Point Laboratories, Inc. — Date 2/8/05

SANDIA National Laboratories — Date 2/8/05

IV. COPPER WIRE THERMOCOUPLE PLACEMENT

Omega Point Laboratories, Inc. — Date 2/8/05

SANDIA National Laboratories — Date 2/8/05

V. PRE ERFBS INSTALLATION APPROVAL

Omega Point Laboratories, Inc. — Date 2/8/05

SANDIA National Laboratories — Date 2/8/05

VI. ERFBS INSTALLATION APPROVAL

Omega Point Laboratories, Inc. — Date 3/11/05

SANDIA National Laboratories — Date 3/11/05

OMEGA POINT LABORATORIES

VII. COMPLETED PRE TEST ARTICLE INSPECTION

Omega Point Laboratories, Inc. — Date: 3/11/05

SANDIA National Laboratories — Date: 3/11/05

VIII. PRE-TEST DATA ACQUISITION VERIFICATION

Omega Point Laboratories, Inc. — Date: 3/11/05

SANDIA National Laboratories — Date: 3/11/05

IX. POST-TEST DATA ACQUISITION VERIFICATION

Omega Point Laboratories, Inc. — Date: 3/11/05

SANDIA National Laboratories — Date: 3/11/05

Test 1

EVENT LOG

Fire Resistance Test of Conduits Protected by Hemyc ERFBS

PROJECT NUMBER:

14790-123263

SANDIA NATIONAL LABORATORIES

EVENT LOG

SANDIA NATIONAL LABORATORIES
Client # 14790

NOTE:
This Log is used to document the date and note the significant events during the completion of test project #123263 for SANDIA National Laboratories. The following is a brief description of this project:

Project No. 123263: **One Hour ASTM E1725 Fire Test of Various Sizes of Conduit and a Junction Box Protected by Hemyc 1-Hour Rated ERFBS.**

ITEM	DATE	INIT'L
Request for Quotation (RFQ) # 7253 received by Omega Point Labs from Patricia Brown of Sandia Labs.	11/5/04	CH
Technical Proposal no. P041206-01 issued to Sandia Labs by Deg Priest, President of Omega Point Labs.	12/6	CH
Sandia Labs issues Purchase Order Number 389803 to Omega Point.	12/22	CH
Deg Priest from Omega Point accepts contract terms by signing and returning P.O. signature page by fax. Second acceptance faxed 12/27/04	12/22	CH
Deg Priest completes initial project drawings for Sandia review.	12/30	CH
Project Hold Points are determined by Frank Wyant, Sandia Technical Contact and Connie Humphrey OPL QA Director. Fig. 3 Test Assembly drawing revised 1/4/05 CH	1/4/05	CH
~~Connie~~ CH 1/4/05 Cleda Patton, QA assistant, orders project steel for test decks.	1/4/05	CH
Connie Humphrey receives approval for the qualification method of the thermocouple supplier. (10CFR50 App. B)	1/5	CH
QA/QC personnel receive steel shipment and OPL technicians begin fabrication of the steel decks for all three Sandia projects.	1/5	CH
Construction of test decks continues.	1/6	CH
Determination was made regarding the extent of the video monitoring of the construction process of the test articles is made by Frank Wyant of Sandia Labs.	1/7	CH
Construction continues on test decks.	1/10/05	CH

EVENT LOG

SANDIA NATIONAL LABORATORIES
Client # 14790

NOTE:
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Project No. 123263: **One Hour ASTM E1725 Fire Test of Various Sizes of Conduit and a Junction Box Protected by Hemyc 1-Hour Rated ERFBS.**

ITEM	DATE	INIT'L
Deg Priest issues Junction Box Thermocouple drawing.	1/11/05	CH
OPL QA/QC personnel receive the documents for Shipment #44855 enroute to Omega Point from Sandia Labs.	1/11	CH
OPL QA/QC personnel ship 46 Quick Disconnect Thermocouples to Bruce Levin, Technical Contact at Sandia Labs for verification using Transmittal Letter # 1126.	1/11	CH
OPL QA/QC personnel verify the test decks dimensions ± 0 1/2"	1/12	CH
OPL QA/QC personnel receive the Hardware shipment #44855 from Sandia Labs. all items received.	1/14	CH
OPL technicians begin fabricating the test article raceways.	1/18	CH
Raceway fabrication continues.	1/19	CH
OPL technicians continue work on the test article raceways	1/21	CH
Chuck Girard, Sandia consultant arrives at OPL. Group meeting is held to discuss project requirements.	1/24	CH
Chuck Girard verifies test article measurements.	1/25	CH
Deg Priest issues Rev 1 to Figure 2 drawing and Figure 6 drawing for test one	1/25	CH
Conduits and cable trays are weighed after removing from decks.	1/26	CH
OPL QA/QC re-verify the installation measurements after the raceways are re-installed to	1/26/05	CH

EVENT LOG

SANDIA NATIONAL LABORATORIES
Client # 14790

NOTE:
This Log is used to document the date and note the significant events during the completion of test project #123263 for SANDIA National Laboratories. The following is a brief description of this project:

Project No. 123263: **One Hour ASTM E1725 Fire Test of Various Sizes of Conduit and a Junction Box Protected by Hemyc 1-Hour Rated ERFBS.**

ITEM	DATE	INIT'L
the test deck.	1/26/05	CH
Frank Wyant, Sandia Technical Contact arrives. A meeting is held in the conference room with all involved personnel.	1/27	CH
The Bare #8 copper wires are cut for 1F conduit by OPL technicians under direction of Frank Wyant and Chuck Ginald. Dee Priest signed the fill percentage for the copper wire in all conduits. The fill was calculated at approximately 30%.	1/27	CH
Dee Priest issues Figure 7, Test 1 Steel and Unistrut Support Drawing.	1/27	CH
OPL QA/QC personnel verify the unistrut supports.	1/28	CH
All conduits and cable trays are marked for thermocouple location by OPL technicians.	1/28	CH
OPL technicians begin installing the fiberglas wrapped thermocouples on test one.	1/28	CH
Junction boxes are welded to frame. This is weighed along with the steel supports by OPL technicians.	1/28	CH
All thermocouple locations are verified by OPL QA/QC personnel.	1/31	CH
The junction box and frame is installed.	1/31	CH
Thermocouples installed on the Bare #8 Copper wires are verified by OPL QA/QC personnel.	2/2	CH
	2/2/05	CH

Test 1

EVENT LOG

SANDIA NATIONAL LABORATORIES
Client # 14790

NOTE:
This Log is used to document the date and note the significant events during the completion of test project #123263 for SANDIA National Laboratories. The following is a brief description of this project:

Project No. 123263: **One Hour ASTM E1725 Fire Test of Various Sizes of Conduit and a Junction Box Protected by Hemyc 1-Hour Rated ERFBS.**

ITEM	DATE	INIT'L
Technicians cut Bare #8 copper wire for 1B (4" conduit).	2/2/05	CH
Quick Disconnect Thermocouples sent to Sandia for verification are received at OPL by QA/QC.	2/2	CH
Technicians cut Bare #8 copper wire for 1D (2-1/2" conduit).	2/3	CH
Thermocouples are verified by QA/QC on the unistrut supports.	2/4	CH
OPL technicians cut Bare #8 copper wire for the two air drops on 1st one.	2/4	CH
Installation of the Quick Disconnect thermocouples to the junction box is completed by OPL technicians and verified by QA/QC personnel.	2/4	CH
One hundred and thirteen bare #8 copper wires are cut for the 2-1/2" conduit fill. One of the bare #8 copper wires is instrumented with thermocouples and verified by QA/QC.	2/7	CH
The bundles are weighed and lengths of bundles measured.	2/7	CH
French Vigeant arrives at OPL.	2/7	CH
Mike Murphy and Michael Jordan of Promatec Technologies arrive to meet with Frank Vigeant.	2/8	CH
The instrumented thermocouples for conduit 1-B were damaged during the attempt to pull the wire bundle into the 4" conduit and the instrumented bare #8 wire was re-instrumented with	2/8/05	CH

EVENT LOG

SANDIA NATIONAL LABORATORIES
Client # 14790

NOTE:
This Log is used to document the date and note the significant events during the completion of test project #123263 for SANDIA National Laboratories. The following is a brief description of this project:

Project No. 123263: **One Hour ASTM E1725 Fire Test of Various Sizes of Conduit and a Junction Box Protected by Hemyc 1-Hour Rated ERFBS.**

ITEM	DATE	INIT'L
new thermocouples and again verified by QA/QC. Dee Priest and Frank Wyant decided to place the instrumented bare #8 copper wire in the center of the wire bundle to protect the TC's when being installed into the conduits. Conduits numbers 1-B (4") 1-D (2-1/2") and 1-F (1") had the wire bundles installed by OPL technicians.	2/8/05	CH
Frank Wyant and Promatec Technologies personnel depart.	2/8	CH
Frank Wyant and Chuck Girard Sandia consultant arrive to witness Hemyc installation, but the Promatec installers did not show. Chuck Girard departs.	2/22	CH
Frank Wyant departs OPL	2/24	CH
Mike Murphy, Michael Jordan Jerry Shotton arrive from Promatec. Frank Haese, contract installers, arrives at OPL.	3/3	CH
OPL QA/QC receives the Hemyc material and other related project materials brought by Promatec personnel.	3/3	CH
Training session on project installation requirements is held by Michael Jordan and attended by Promatec personnel and Cleda Patton OPL QA/QC.	3/3	CH
Promatec installers begin installing the Hemyc material	3/3/05	CH

EVENT LOG

SANDIA NATIONAL LABORATORIES
Client # 14790

NOTE:
This Log is used to document the date and note the significant events during the completion of test project #123263 for SANDIA National Laboratories. The following is a brief description of this project:

Project No. 123263: **One Hour ASTM E1725 Fire Test of Various Sizes of Conduit and a Junction Box Protected by Hemyc 1-Hour Rated ERFBS.**

ITEM	DATE	INIT'L
and continues work on 3/4/05 Frank Wyant arrives to witness installation procedures.	3/4/05	CH
Hemyc installation is completed. Inspection of completed test article revealed several areas on the Hemyc material that needed patching. These areas are identified by Michael Jordan of Promatec, Frank Wyant of Sandia and Oleda Patton, OPL QA/QC. Promatec departs.	3/5	CH
Frank Haese, Promatec contract installer arrives to patch Hemyc with Frank Wyant observing.	3/7	CH
OPL technicians install the decking insulation.	3/8	CH
Test article is moved to the test furnace by OPL technicians with Frank Wyant observing.	3/9	CH
Michael Jordan and Jerry Thorton of Promatec arrived. Additional ceramic fiber blanket is added to the 4" conduit 90° bend and repatched with Hemyc material.	3/9	CH
Two additional bands were added to the test article by Promatec. Michael Jordan, Jerry Thorton Frank Wyant and Oleda Patton review the documents of project requirements. Jerry Thorton departs OPL.	3/10	CH
Mark Salley, USNRC, Roy Woods	3/10/05	CH

EVENT LOG

SANDIA NATIONAL LABORATORIES
Client # 14790

NOTE:
This Log is used to document the date and note the significant events during the completion of test project #123263 for SANDIA National Laboratories. The following is a brief description of this project:

Project No. 123263: **One Hour ASTM E1725 Fire Test of Various Sizes of Conduit and a Junction Box Protected by Hemyc 1-Hour Rated ERFBS.**

ITEM	DATE	INIT'L
USNRC and Mark Allen of Sandia arrive to inspect test article and witness testing.	3/10/05	CH
OPL QA/QC verifies the thermocouple attachment to the data acquisition equipment. There are a total of 380 thermocouples.	3/10	CH
~~3/10~~ 3/11/05 The following personnel ~~date~~ arrived at OPL to witness the test of project #123263:	3/11	CH
Frank Wyant — Sandia		
Mark Allen — "		
Mark Salley — USNRC		
Roy Woods — "		
OPL technicians and project Manager Dee Priest perform pre-burn checklist. Frank Wyant and Dee Priest sign final pre-burn approval documents.		
The following OPL personnel are present to conduct this fire test:		
Dee Priest, President		
Connie Humphrey, QA Director		
Cleda Patton, QA/QC		
Mike Dey — Dept 02 Mgr		
Richard Beasley — Technician		
Laudencio Castanon — "		
Oscar Estrada — "		
~~Troy Bronstad — Foreman~~ CH 3/11/05		
Promatec personnel on site:		
Randy Brown — General Mgr		
Michael Jordan — Project Mgr		
Frank Hadbe — Contract Installer		
Temperature at time of test start is 54°F and the Relative Humidity is 60.	3/11/05	CH

EVENT LOG

SANDIA NATIONAL LABORATORIES
Client # 14790

NOTE:
This Log is used to document the date and note the significant events during the completion of test project #123263 for SANDIA National Laboratories. The following is a brief description of this project:

Project No. 123263: **One Hour ASTM E1725 Fire Test of Various Sizes of Conduit and a Junction Box Protected by Hemyc 1-Hour Rated ERFBS.**

Page 8 of 8

ITEM	DATE	INIT'L
The one hour fire test of Project #123263 is started at 9:09 am The test furnace is shut off at 10:09 and the thermocouples are disconnected from the data acquisition equipment.	3/11/05	CH
The test article is moved by overhead crane to the hose stream area. A five minute hose stream test followed the fire test using a 1-½" fog nozzle with a 15 degree spray pattern at 75 psi from a distance of 10 feet.	3/11	CH
After completion of the testing, Mike Dey / OPC Dept. 2 manager performed the post test data acquisition verification.	3/11	CH
Tear down and inspection of the test article was performed by Mike Dey and OPC technicians with Frank Wyant observing.	3/11	CH

Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, Texas 78112
800-966-5253 FAX 210-635-8101

Certificate of Verification

Certification No.:	92143
Verification Date:	02/25/2005
Re-verification Date:	08/25/2005
Manufacturer:	Yokogawa
Model No.:	300 Channel DAU-
Serial No.:	48JF0082
Equipment Description:	300 Channel Data Acquisition System with YOKOGAWA Darwin Series
Calibration Sources:	Tegam T-156701 due: 07/26/2005

PERFORMANCE:

Temperature: (75°F) +1.8/-1.1	Temperature: (150°F) +1.7/-1	Temperature: (300°F) +1.8/-1.1	Temperature: (400°F) +1.9/-0.8	Temperature: (1000°F) +1.8/-0.5	Temperature: (2000°F) +2.5/-0.8

Measurement Uncertainty: ± 0.2%

Verification Performed by:

Mike Dey
Manager Fire Resistance

Verification Approved by:

Javier Trevino
Manager of Special Projects

Channel Verification for Yokogawa 300 Channel

Serial No.: 48JF0082

Calibrator Used: SNT156701

Temperature Setting (°F): 75.0

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	74.7	-0.3	101	75.0	0.0	201	74.5	-0.5
2	74.7	-0.3	102	75.0	0.0	202	74.5	-0.5
3	74.7	-0.3	103	75.0	0.0	203	74.5	-0.5
4	74.7	-0.3	104	75.0	0.0	204	74.5	-0.5
5	74.7	-0.3	105	75.0	0.0	205	74.7	-0.3
6	74.7	-0.3	106	75.0	0.0	206	74.7	-0.3
7	74.8	-0.2	107	75.2	0.2	207	74.8	-0.2
8	74.8	-0.2	108	75.2	0.2	208	74.8	-0.2
9	75.0	0.0	109	75.4	0.4	209	75.0	0.0
10	75.2	0.2	110	75.5	0.5	210	75.2	0.2
11	74.5	-0.5	111	75.0	0.0	211	74.5	-0.5
12	74.3	-0.7	112	75.0	0.0	212	74.5	-0.5
13	74.5	-0.5	113	75.4	0.4	213	74.5	-0.5
14	74.5	-0.5	114	75.4	0.4	214	74.5	-0.5
15	74.5	-0.5	115	75.4	0.4	215	74.5	-0.5
16	74.5	-0.5	116	75.4	0.4	216	74.7	-0.3
17	74.5	-0.5	117	75.5	0.5	217	74.7	-0.3
18	74.5	-0.5	118	75.5	0.5	218	74.7	-0.3
19	74.7	-0.3	119	75.5	0.5	219	74.8	-0.2
20	75.0	0.0	120	75.7	0.7	220	75.2	0.2
21	74.5	-0.5	121	75.5	0.5	221	73.9	-1.1
22	74.5	-0.5	122	75.5	0.5	222	74.1	-0.9
23	74.5	-0.5	123	75.4	0.4	223	74.3	-0.7
24	74.5	-0.5	124	75.5	0.5	224	74.3	-0.7
25	74.5	-0.5	125	75.5	0.5	225	74.3	-0.7
26	74.7	-0.3	126	75.5	0.5	226	74.5	-0.5
27	74.7	-0.3	127	75.5	0.5	227	74.5	-0.5
28	74.8	-0.2	128	75.5	0.5	228	74.5	-0.5
29	75.0	0.0	129	75.7	0.7	229	74.7	-0.3
30	75.2	0.2	130	76.1	1.1	230	75.0	0.0
31	74.5	-0.5	131	75.0	0.0	231	74.3	-0.7
32	74.5	-0.5	132	74.8	-0.2	232	74.3	-0.7
33	74.5	-0.5	133	74.8	-0.2	233	74.3	-0.7
34	74.5	-0.5	134	74.8	-0.2	234	74.3	-0.7
35	74.5	-0.5	135	75.0	0.0	235	74.5	-0.5
36	74.7	-0.3	136	75.0	0.0	236	74.5	-0.5
37	74.5	-0.5	137	75.2	0.2	237	74.5	-0.5
38	74.5	-0.5	138	75.2	0.2	238	74.7	-0.3
39	74.8	-0.2	139	75.4	0.4	239	74.8	-0.2
40	75.2	0.2	140	75.7	0.7	240	75.2	0.2
41	73.9	-1.1	141	75.0	0.0	241	74.8	-0.2
42	73.9	-1.1	142	75.0	0.0	242	74.7	-0.3
43	74.1	-0.9	143	75.0	0.0	243	74.8	-0.2
44	74.1	-0.9	144	75.0	0.0	244	74.8	-0.2
45	74.3	-0.7	145	75.0	0.0	245	75.0	0.0
46	74.3	-0.7	146	75.0	0.0	246	75.0	0.0
47	74.1	-0.9	147	75.0	0.0	247	75.2	0.2
48	74.5	-0.5	148	75.0	0.0	248	75.2	0.2
49	74.5	-0.5	149	75.0	0.0	249	75.2	0.2
50	75.0	0.0	150	75.0	0.0	250	75.2	0.2
51	76.1	1.1	151	75.0	0.0	251	74.7	-0.3
52	76.3	1.3	152	74.8	-0.2	252	74.5	-0.5
53	76.3	1.3	153	74.8	-0.2	253	74.5	-0.5
54	76.3	1.3	154	74.8	-0.2	254	74.5	-0.5

55	76.3	1.3	155	75.0	0.0	255	74.5	-0.5
56	76.3	1.3	156	75.0	0.0	256	74.8	-0.2
57	76.3	1.3	157	75.0	0.0	257	74.8	-0.2
58	76.3	1.3	158	75.2	0.2	258	74.8	-0.2
59	76.5	1.5	159	75.2	0.2	259	74.8	-0.2
60	76.6	1.6	160	75.6	0.6	260	75.2	0.2
61	76.6	1.6	161	74.7	-0.3	261	74.7	-0.3
62	76.5	1.5	162	74.7	-0.3	262	74.7	-0.3
63	76.5	1.5	163	74.7	-0.3	263	74.8	-0.2
64	76.5	1.5	164	74.7	-0.3	264	74.7	-0.3
65	76.6	1.6	165	74.7	-0.3	265	74.8	-0.2
66	76.8	1.8	166	75.0	0.0	266	74.8	-0.2
67	76.8	1.8	167	75.0	0.0	267	74.8	-0.2
68	76.6	1.6	168	75.0	0.0	268	75.2	0.2
69	75.0	0.0	169	75.2	0.2	269	75.2	0.2
70	75.0	0.0	170	75.4	0.4	270	75.4	0.4
71	76.1	1.1	171	74.5	-0.5	271	75.0	0.0
72	76.5	1.5	172	74.3	-0.7	272	75.0	0.0
73	76.3	1.3	173	74.5	-0.5	273	75.0	0.0
74	76.3	1.3	174	74.5	-0.5	274	75.0	0.0
75	76.3	1.3	175	74.5	-0.5	275	75.2	0.2
76	76.1	1.1	176	74.5	-0.5	276	75.2	0.2
77	76.3	1.3	177	74.8	-0.2	277	75.2	0.2
78	76.3	1.3	178	74.8	-0.2	278	75.2	0.2
79	76.3	1.3	179	74.8	-0.2	279	75.4	0.4
80	76.6	1.6	180	75.0	0.0	280	75.7	0.7
81	76.3	1.3	181	74.8	-0.2	281	74.5	-0.5
82	76.1	1.1	182	74.8	-0.2	282	74.5	-0.5
83	76.3	1.3	183	74.8	-0.2	283	74.5	-0.5
84	76.3	1.3	184	74.8	-0.2	284	74.5	-0.5
85	76.1	1.1	185	74.8	-0.2	285	74.5	-0.5
86	76.1	1.1	186	75.0	0.0	286	74.7	-0.3
87	76.3	1.3	187	75.2	0.2	287	74.7	-0.3
88	76.3	1.3	188	75.2	0.2	288	74.7	-0.3
89	76.5	1.5	189	75.4	0.4	289	74.8	-0.2
90	76.6	1.6	190	75.7	0.7	290	75.2	0.2
91	76.3	1.3	191	74.8	-0.2	291	74.3	-0.7
92	76.3	1.3	192	74.7	-0.3	292	74.5	-0.5
93	76.3	1.3	193	74.8	-0.2	293	74.5	-0.5
94	76.3	1.3	194	74.8	-0.2	294	74.7	-0.3
95	76.3	1.3	195	74.8	-0.2	295	74.7	-0.3
96	76.5	1.5	196	74.8	-0.2	296	74.7	-0.3
97	76.3	1.3	197	75.0	0.0	297	75.0	0.0
98	76.3	1.3	198	75.0	0.0	298	75.0	0.0
99	76.3	1.3	199	75.0	0.0	299	75.0	0.0
100	76.3	1.3	200	75.0	0.0	300	75.0	0.0

Range for 75°F Signal: **+1.8/-1.1**

Allowable range: ±1.8

Within specification for this temperature? Yes

Performed by: Mike Dey

Mgr. Fire Resistance — Title

2/25/05 — Date

Approved by:

mgr of

Title

Date

Channel Verification for Yokogawa 300 Channel

Serial No.: 48JF0082

Calibrator Used: SNT156701

Temperature Setting (°F): 150.0

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	149.7	-0.3	101	150.1	0.1	201	149.7	-0.3
2	149.7	-0.3	102	150.1	0.1	202	149.5	-0.5
3	149.7	-0.3	103	150.1	0.1	203	149.5	-0.5
4	149.7	-0.3	104	150.1	0.1	204	149.5	-0.5
5	149.7	-0.3	105	150.1	0.1	205	149.5	-0.5
6	149.7	-0.3	106	150.1	0.1	206	149.7	-0.3
7	149.7	-0.3	107	150.2	0.2	207	149.7	-0.3
8	149.9	-0.1	108	150.2	0.2	208	149.9	-0.1
9	149.9	-0.1	109	150.4	0.4	209	150.1	0.1
10	150.3	0.3	110	150.6	0.6	210	150.3	0.3
11	149.4	-0.6	111	150.1	0.1	211	149.4	-0.6
12	149.4	-0.6	112	150.1	0.1	212	149.4	-0.6
13	149.4	-0.6	113	150.1	0.1	213	149.5	-0.5
14	149.4	-0.6	114	150.1	0.1	214	149.4	-0.6
15	149.5	-0.5	115	150.2	0.2	215	149.5	-0.5
16	149.5	-0.5	116	150.2	0.2	216	149.7	-0.3
17	149.7	-0.3	117	150.4	0.4	217	149.7	-0.3
18	149.7	-0.3	118	150.4	0.4	218	149.7	-0.3
19	149.7	-0.3	119	150.6	0.6	219	149.7	-0.3
20	149.9	-0.1	120	151.0	1.0	220	149.9	-0.1
21	149.4	-0.6	121	150.6	0.6	221	149.0	-1.0
22	149.4	-0.6	122	150.6	0.6	222	149.2	-0.8
23	149.4	-0.6	123	150.2	0.2	223	149.2	-0.8
24	149.4	-0.6	124	150.2	0.2	224	149.4	-0.6
25	149.4	-0.6	125	150.6	0.6	225	149.4	-0.6
26	149.5	-0.5	126	150.6	0.6	226	149.4	-0.6
27	149.4	-0.6	127	150.6	0.6	227	149.4	-0.6
28	149.5	-0.5	128	150.6	0.6	228	149.5	-0.5
29	149.7	-0.3	129	150.8	0.8	229	149.5	-0.5
30	149.7	-0.3	130	151.1	1.1	230	149.9	-0.1
31	149.5	-0.5	131	150.1	0.1	231	149.4	-0.6
32	149.5	-0.5	132	150.1	0.1	232	149.4	-0.6
33	149.5	-0.5	133	150.1	0.1	233	149.4	-0.6
34	149.7	-0.3	134	150.1	0.1	234	149.4	-0.6
35	149.5	-0.5	135	150.1	0.1	235	149.5	-0.5
36	149.7	-0.3	136	150.1	0.1	236	149.5	-0.5
37	149.7	-0.3	137	150.4	0.4	237	149.5	-0.5
38	149.9	-0.1	138	150.4	0.4	238	149.5	-0.5
39	149.9	-0.1	139	150.6	0.6	239	149.7	-0.3
40	150.1	0.1	140	150.8	0.8	240	150.1	0.1
41	149.0	-1.0	141	150.1	0.1	241	149.9	-0.1
42	149.0	-1.0	142	149.9	-0.1	242	149.7	-0.3
43	149.0	-1.0	143	150.1	0.1	243	149.7	-0.3
44	149.0	-1.0	144	150.1	0.1	244	149.7	-0.3
45	149.2	-0.8	145	150.1	0.1	245	149.9	-0.1
46	149.4	-0.6	146	150.1	0.1	246	150.1	0.1
47	149.2	-0.8	147	150.1	0.1	247	150.3	0.3
48	149.4	-0.6	148	150.1	0.1	248	150.3	0.3
49	149.4	-0.6	149	150.1	0.1	249	150.3	0.3
50	149.4	-0.6	150	150.1	0.1	250	150.3	0.3
51	150.8	0.8	151	149.9	-0.1	251	149.5	-0.5
52	150.8	0.8	152	149.7	-0.3	252	149.5	-0.5
53	150.8	0.8	153	149.7	-0.3	253	149.5	-0.5
54	151.0	1.0	154	149.7	-0.3	254	149.5	-0.5

55	151.0	1.0	155	149.9	-0.1	255	149.7	-0.3
56	151.0	1.0	156	150.1	0.1	256	149.5	-0.5
57	151.2	1.2	157	150.1	0.1	257	149.7	-0.3
58	151.2	1.2	158	150.1	0.1	258	149.7	-0.3
59	151.3	1.3	159	150.3	0.3	259	150.1	0.1
60	151.3	1.3	160	150.4	0.4	260	150.3	0.3
61	150.6	0.6	161	149.7	-0.3	261	149.7	-0.3
62	151.0	1.0	162	149.5	-0.5	262	149.7	-0.3
63	151.2	1.2	163	149.5	-0.5	263	149.7	-0.3
64	151.3	1.3	164	149.7	-0.3	264	149.7	-0.3
65	151.3	1.3	165	149.7	-0.3	265	149.7	-0.3
66	151.3	1.3	166	149.7	-0.3	266	149.9	-0.1
67	151.3	1.3	167	149.7	-0.3	267	149.9	-0.1
68	151.7	1.7	168	149.9	-0.1	268	149.9	-0.1
69	151.7	1.7	169	150.1	0.1	269	150.1	0.1
70	151.7	1.7	170	150.4	0.4	270	150.3	0.3
71	151.2	1.2	171	149.4	-0.6	271	149.9	-0.1
72	151.2	1.2	172	149.4	-0.6	272	149.9	-0.1
73	151.2	1.2	173	149.4	-0.6	273	149.9	-0.1
74	151.2	1.2	174	149.4	-0.6	274	149.9	-0.1
75	151.3	1.3	175	149.5	-0.5	275	150.1	0.1
76	151.2	1.2	176	149.5	-0.5	276	150.1	0.1
77	151.3	1.3	177	149.7	-0.3	277	150.1	0.1
78	151.3	1.3	178	149.7	-0.3	278	150.1	0.1
79	151.3	1.3	179	149.7	-0.3	279	150.3	0.3
80	151.7	1.7	180	150.1	0.1	280	150.4	0.4
81	151.3	1.3	181	150.1	0.1	281	149.4	-0.6
82	151.2	1.2	182	150.1	0.1	282	149.4	-0.6
83	151.0	1.0	183	150.1	0.1	283	149.4	-0.6
84	151.2	1.2	184	150.1	0.1	284	149.4	-0.6
85	151.0	1.0	185	150.1	0.1	285	149.4	-0.6
86	151.2	1.2	186	150.1	0.1	286	149.5	-0.5
87	151.3	1.3	187	150.3	0.3	287	149.7	-0.3
88	151.3	1.3	188	150.3	0.3	288	149.7	-0.3
89	151.5	1.5	189	150.4	0.4	289	149.7	-0.3
90	151.5	1.5	190	150.8	0.8	290	150.1	0.1
91	151.3	1.3	191	149.7	-0.3	291	149.4	-0.6
92	151.3	1.3	192	149.7	-0.3	292	149.4	-0.6
93	151.3	1.3	193	149.7	-0.3	293	149.4	-0.6
94	151.3	1.3	194	149.7	-0.3	294	149.4	-0.6
95	151.3	1.3	195	149.9	-0.1	295	149.5	-0.5
96	151.3	1.3	196	149.9	-0.1	296	149.7	-0.3
97	151.3	1.3	197	149.9	-0.1	297	149.7	-0.3
98	151.3	1.3	198	150.1	0.1	298	149.7	-0.3
99	151.3	1.3	199	150.1	0.1	299	149.7	-0.3
100	151.3	1.3	200	150.1	0.1	300	149.7	-0.3

Range for 150°F Signal: **+1.7/-1**

Allowable range: ±1.8

Within specification for this temperature? Yes

Performed by: Mike Dey

Mgr. Fire Resistance — 2/25/05

Title — Date

Approved by:

mgr 04

Title — Date

Channel Verification for Yokogawa 300 Channel

Serial No.: 48JF0082

Calibrator Used: SNT156701

Temperature Setting (°F): 300.0

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	299.5	-0.5	101	300.0	0.0	201	299.5	-0.5
2	299.5	-0.5	102	300.0	0.0	202	299.5	-0.5
3	299.5	-0.5	103	300.0	0.0	203	299.5	-0.5
4	299.5	-0.5	104	300.0	0.0	204	299.5	-0.5
5	299.5	-0.5	105	300.0	0.0	205	299.5	-0.5
6	299.5	-0.5	106	300.0	0.0	206	299.8	-0.2
7	299.7	-0.3	107	300.0	0.0	207	299.8	-0.2
8	299.7	-0.3	108	300.0	0.0	208	299.8	-0.2
9	299.8	-0.2	109	300.2	0.2	209	300.0	0.0
10	300.2	0.2	110	300.5	0.5	210	300.2	0.2
11	299.5	-0.5	111	300.0	0.0	211	299.5	-0.5
12	299.1	-0.9	112	300.0	0.0	212	299.3	-0.7
13	299.3	-0.7	113	300.2	0.2	213	299.5	-0.5
14	299.3	-0.7	114	300.2	0.2	214	299.5	-0.5
15	299.3	-0.7	115	300.4	0.4	215	299.5	-0.5
16	299.3	-0.7	116	300.2	0.2	216	299.5	-0.5
17	299.5	-0.5	117	300.4	0.4	217	299.5	-0.5
18	299.5	-0.5	118	300.4	0.4	218	299.5	-0.5
19	299.5	-0.5	119	300.5	0.5	219	299.8	-0.2
20	299.8	-0.2	120	300.7	0.7	220	300.0	0.0
21	299.5	-0.5	121	300.4	0.4	221	299.1	-0.9
22	299.3	-0.7	122	300.2	0.2	222	299.1	-0.9
23	299.3	-0.7	123	300.0	0.0	223	299.3	-0.7
24	299.5	-0.5	124	300.0	0.0	224	299.3	-0.7
25	299.5	-0.5	125	300.4	0.4	225	299.3	-0.7
26	299.5	-0.5	126	300.4	0.4	226	299.3	-0.7
27	299.5	-0.5	127	300.5	0.5	227	299.5	-0.5
28	299.5	-0.5	128	300.7	0.7	228	299.5	-0.5
29	299.5	-0.5	129	300.7	0.7	229	299.5	-0.5
30	299.8	-0.2	130	301.1	1.1	230	299.8	-0.2
31	299.7	-0.3	131	300.0	0.0	231	299.3	-0.7
32	299.7	-0.3	132	299.8	-0.2	232	299.3	-0.7
33	299.5	-0.5	133	299.8	-0.2	233	299.3	-0.7
34	299.5	-0.5	134	299.8	-0.2	234	299.5	-0.5
35	299.5	-0.5	135	299.8	-0.2	235	299.5	-0.5
36	299.5	-0.5	136	299.8	-0.2	236	299.5	-0.5
37	299.7	-0.3	137	300.0	0.0	237	299.5	-0.5
38	299.7	-0.3	138	300.0	0.0	238	299.5	-0.5
39	299.8	-0.2	139	300.4	0.4	239	299.8	-0.2
40	300.2	0.2	140	300.7	0.7	240	300.0	0.0
41	299.1	-0.9	141	299.8	-0.2	241	299.8	-0.2
42	298.9	-1.1	142	299.8	-0.2	242	299.7	-0.3
43	298.9	-1.1	143	300.0	0.0	243	299.8	-0.2
44	299.1	-0.9	144	300.0	0.0	244	299.8	-0.2
45	299.1	-0.9	145	300.0	0.0	245	300.0	0.0
46	299.3	-0.7	146	300.0	0.0	246	300.2	0.2
47	299.3	-0.7	147	300.0	0.0	247	300.2	0.2
48	299.5	-0.5	148	300.0	0.0	248	300.2	0.2
49	299.5	-0.5	149	300.0	0.0	249	300.2	0.2
50	300.6	0.6	150	299.8	-0.2	250	300.2	0.2
51	300.6	0.6	151	299.8	-0.2	251	299.5	-0.5
52	300.6	0.6	152	299.8	-0.2	252	299.5	-0.5
53	300.6	0.6	153	299.8	-0.2	253	299.5	-0.5
54	300.7	0.7	154	299.8	-0.2	254	299.5	-0.5
55	300.7	0.7	155	299.8	-0.2	255	299.5	-0.5
56	300.6	0.6	156	299.8	-0.2	256	299.5	-0.5

57	300.7	0.7	157	300.0	0.0	257	299.7	-0.3			
58	300.9	0.9	158	300.2	0.2	258	299.7	-0.3			
59	301.1	1.1	159	300.2	0.2	259	300.0	0.0			
60	301.3	1.3	160	300.4	0.4	260	300.2	0.2			
61	301.3	1.3	161	299.5	-0.5	261	299.5	-0.5			
62	301.3	1.3	162	299.5	-0.5	262	299.5	-0.5			
63	301.1	1.1	163	299.5	-0.5	263	299.5	-0.5			
64	301.1	1.1	164	299.5	-0.5	264	299.7	-0.3			
65	301.3	1.3	165	299.7	-0.3	265	299.8	-0.2			
66	301.3	1.3	166	299.7	-0.3	266	299.8	-0.2			
67	301.3	1.3	167	299.8	-0.2	267	300.0	0.0			
68	301.3	1.3	168	300.0	0.0	268	300.0	0.0			
69	301.5	1.5	169	300.2	0.2	269	300.2	0.2			
70	301.8	1.8	170	300.4	0.4	270	300.4	0.4			
71	301.1	1.1	171	299.1	-0.9	271	299.8	-0.2			
72	300.9	0.9	172	299.3	-0.7	272	299.8	-0.2			
73	301.1	1.1	173	299.3	-0.7	273	299.8	-0.2			
74	301.1	1.1	174	299.3	-0.7	274	299.8	-0.2			
75	301.3	1.3	175	299.3	-0.7	275	300.0	0.0			
76	301.1	1.1	176	299.5	-0.5	276	300.0	0.0			
77	301.3	1.3	177	299.5	-0.5	277	300.2	0.2			
78	301.3	1.3	178	299.5	-0.5	278	300.2	0.2			
79	301.5	1.5	179	299.7	-0.3	279	300.4	0.4			
80	301.8	1.8	180	300.2	0.2	280	300.7	0.7			
81	301.3	1.3	181	299.8	-0.2	281	299.3	-0.7			
82	301.3	1.3	182	299.7	-0.3	282	299.3	-0.7			
83	301.3	1.3	183	299.8	-0.2	283	299.3	-0.7			
84	301.3	1.3	184	300.0	0.0	284	299.3	-0.7			
85	301.1	1.1	185	300.0	0.0	285	299.5	-0.5			
86	301.3	1.3	186	300.0	0.0	286	299.5	-0.5			
87	301.3	1.3	187	300.2	0.2	287	299.5	-0.5			
88	301.3	1.3	188	300.2	0.2	288	299.5	-0.5			
89	301.3	1.3	189	300.4	0.4	289	299.7	-0.3			
90	301.6	1.6	190	300.7	0.7	290	300.0	0.0			
91	301.3	1.3	191	299.7	-0.3	291	299.3	-0.7			
92	301.3	1.3	192	299.7	-0.3	292	299.3	-0.7			
93	301.3	1.3	193	299.7	-0.3	293	299.5	-0.5			
94	301.3	1.3	194	299.7	-0.3	294	299.5	-0.5			
95	301.3	1.3	195	299.8	-0.2	295	299.7	-0.3			
96	301.3	1.3	196	299.8	-0.2	296	299.7	-0.3			
97	301.3	1.3	197	299.8	-0.2	297	299.8	-0.2			
98	301.3	1.3	198	299.8	-0.2	298	299.7	-0.3			
99	301.3	1.3	199	299.8	-0.2	299	299.7	-0.3			
100	301.3	1.3	200	299.8	-0.2	300	299.7	-0.3			

Range for 300°F Signal: **+1.8/-1.1**

Allowable range ±1.9

Within specification for this temperature? Yes

Performed by: Mark Dey

Mgr. Fire Resistance — Title

2/25/05 — Date

Approved by:

Mgr 04 — Title

Date

Channel Verification for Yokogawa 300 Channel

Serial No.: 48JF0082

Calibrator Used: SNT156701

Temperature Setting (°F): 400.0

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	399.6	-0.4	101	400.3	0.3	201	399.7	-0.3
2	399.6	-0.4	102	400.1	0.1	202	399.6	-0.4
3	399.6	-0.4	103	400.1	0.1	203	399.6	-0.4
4	399.6	-0.4	104	400.3	0.3	204	399.6	-0.4
5	399.6	-0.4	105	400.3	0.3	205	399.6	-0.4
6	399.6	-0.4	106	400.3	0.3	206	399.7	-0.3
7	399.6	-0.4	107	400.3	0.3	207	399.9	-0.1
8	399.6	-0.4	108	400.4	0.4	208	399.9	-0.1
9	399.7	-0.3	109	400.4	0.4	209	400.3	0.3
10	399.9	-0.1	110	400.6	0.6	210	400.3	0.3
11	399.2	-0.8	111	400.1	0.1	211	399.4	-0.6
12	399.2	-0.8	112	400.1	0.1	212	399.6	-0.4
13	399.2	-0.8	113	400.3	0.3	213	399.6	-0.4
14	399.4	-0.6	114	400.3	0.3	214	399.6	-0.4
15	399.4	-0.6	115	400.4	0.4	215	399.6	-0.4
16	399.4	-0.6	116	400.4	0.4	216	399.7	-0.3
17	399.4	-0.6	117	400.6	0.6	217	399.7	-0.3
18	399.4	-0.6	118	400.6	0.6	218	399.7	-0.3
19	399.6	-0.4	119	400.8	0.8	219	399.9	-0.1
20	399.7	-0.3	120	400.8	0.8	220	400.1	0.1
21	399.4	-0.6	121	400.8	0.8	221	399.4	-0.6
22	399.4	-0.6	122	400.6	0.6	222	399.4	-0.6
23	399.2	-0.8	123	400.4	0.4	223	399.2	-0.8
24	399.2	-0.8	124	400.4	0.4	224	399.4	-0.6
25	399.4	-0.6	125	400.6	0.6	225	399.4	-0.6
26	399.4	-0.6	126	400.6	0.6	226	399.4	-0.6
27	399.6	-0.4	127	400.6	0.6	227	399.6	-0.4
28	399.6	-0.4	128	400.6	0.6	228	399.6	-0.4
29	399.6	-0.4	129	400.8	0.8	229	399.7	-0.3
30	399.7	-0.3	130	401.2	1.2	230	400.1	0.1
31	399.6	-0.4	131	400.1	0.1	231	399.6	-0.4
32	399.4	-0.6	132	400.1	0.1	232	399.6	-0.4
33	399.4	-0.6	133	400.1	0.1	233	399.6	-0.4
34	399.6	-0.4	134	400.1	0.1	234	399.6	-0.4
35	399.6	-0.4	135	400.1	0.1	235	399.6	-0.4
36	399.6	-0.4	136	400.1	0.1	236	399.6	-0.4
37	399.6	-0.4	137	400.3	0.3	237	399.6	-0.4
38	399.9	-0.1	138	400.3	0.3	238	399.6	-0.4
39	399.9	-0.1	139	400.4	0.4	239	399.7	-0.3
40	400.3	0.3	140	400.6	0.6	240	400.3	0.3
41	399.4	-0.6	141	400.1	0.1	241	399.9	-0.1
42	399.4	-0.6	142	399.9	-0.1	242	399.9	-0.1
43	399.4	-0.6	143	400.1	0.1	243	399.9	-0.1
44	399.4	-0.6	144	400.1	0.1	244	399.9	-0.1
45	399.4	-0.6	145	400.1	0.1	245	400.1	0.1
46	399.4	-0.6	146	400.1	0.1	246	400.3	0.3
47	399.4	-0.6	147	400.1	0.1	247	400.3	0.3
48	399.6	-0.4	148	400.1	0.1	248	400.5	0.5
49	399.6	-0.4	149	400.1	0.1	249	400.5	0.5
50	399.6	-0.4	150	400.1	0.1	250	400.5	0.5
51	400.8	0.8	151	399.9	-0.1	251	399.6	-0.4
52	400.8	0.8	152	399.7	-0.3	252	399.6	-0.4
53	400.8	0.8	153	399.7	-0.3	253	399.6	-0.4
54	400.8	0.8	154	399.7	-0.3	254	399.6	-0.4

55	400.8	0.8	155	400.1	0.1	255	399.6	-0.4
56	401.0	1.0	156	399.9	-0.1	256	399.6	-0.4
57	401.0	1.0	157	400.1	0.1	257	399.6	-0.4
58	401.2	1.2	158	400.1	0.1	258	399.7	-0.3
59	401.2	1.2	159	400.3	0.3	259	399.9	-0.1
60	401.4	1.4	160	400.6	0.6	260	400.3	0.3
61	401.4	1.4	161	399.7	-0.3	261	399.6	-0.4
62	401.2	1.2	162	399.6	-0.4	262	399.6	-0.4
63	401.2	1.2	163	399.6	-0.4	263	399.7	-0.3
64	401.2	1.2	164	399.7	-0.3	264	399.6	-0.4
65	401.4	1.4	165	399.7	-0.3	265	399.7	-0.3
66	401.4	1.4	166	399.7	-0.3	266	399.7	-0.3
67	401.5	1.5	167	399.9	-0.1	267	399.9	-0.1
68	401.5	1.5	168	400.3	0.3	268	400.1	0.1
69	401.7	1.7	169	400.3	0.3	269	400.3	0.3
70	401.1	1.1	170	400.3	0.3	270	400.5	0.5
71	401.2	1.2	171	399.6	-0.4	271	399.7	-0.3
72	401.2	1.2	172	399.4	-0.6	272	399.7	-0.3
73	401.2	1.2	173	399.6	-0.4	273	399.7	-0.3
74	401.2	1.2	174	399.6	-0.4	274	399.7	-0.3
75	401.4	1.4	175	399.6	-0.4	275	400.1	0.1
76	401.4	1.4	176	399.6	-0.4	276	400.1	0.1
77	401.4	1.4	177	399.7	-0.3	277	400.3	0.3
78	401.4	1.4	178	399.7	-0.3	278	400.3	0.3
79	401.5	1.5	179	399.9	-0.1	279	400.5	0.5
80	401.9	1.9	180	400.3	0.3	280	400.6	0.6
81	401.4	1.4	181	399.9	-0.1	281	399.4	-0.6
82	401.2	1.2	182	399.7	-0.3	282	399.4	-0.6
83	401.2	1.2	183	399.6	-0.4	283	399.4	-0.6
84	401.4	1.4	184	399.7	-0.3	284	399.6	-0.4
85	401.4	1.4	185	399.7	-0.3	285	399.6	-0.4
86	401.4	1.4	186	399.9	-0.1	286	399.6	-0.4
87	401.4	1.4	187	399.9	-0.1	287	399.7	-0.3
88	401.4	1.4	188	400.3	0.3	288	399.9	-0.1
89	401.5	1.5	189	400.3	0.3	289	399.9	-0.1
90	401.9	1.9	190	400.6	0.6	290	400.1	0.1
91	401.4	1.4	191	399.6	-0.4	291	399.4	-0.6
92	401.4	1.4	192	399.6	-0.4	292	399.4	-0.6
93	401.4	1.4	193	399.6	-0.4	293	399.6	-0.4
94	401.4	1.4	194	399.6	-0.4	294	399.6	-0.4
95	401.4	1.4	195	399.6	-0.4	295	399.6	-0.4
96	401.5	1.5	196	399.7	-0.3	296	399.6	-0.4
97	401.4	1.4	197	399.7	-0.3	297	399.7	-0.3
98	401.4	1.4	198	399.7	-0.3	298	399.9	-0.1
99	401.4	1.4	199	399.7	-0.3	299	399.9	-0.1
100	401.4	1.4	200	399.6	-0.4	300	399.9	-0.1

Range for 400°F Signal: **+1.9/-0.8**

Allowable range: ±2.0

Within specification for this temperature? Yes

Performed by: Mike Dey

Mgr. Fire Resistance — Title

2/25/05 — Date

Approved by:

mgr 04 — Title

Date

Channel Verification for Yokogawa 300 Channel

Serial No.: 48JF0082

Calibrator Used: SNT156701

Temperature Setting (°F): 1000.0

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	999.7	-0.3	101	1000.0	0.0	201	1000.0	0.0
2	999.5	-0.5	102	1000.0	0.0	202	1000.0	0.0
3	999.5	-0.5	103	1000.0	0.0	203	1000.0	0.0
4	999.7	-0.3	104	1000.0	0.0	204	1000.0	0.0
5	999.7	-0.3	105	1000.0	0.0	205	1000.2	0.2
6	999.7	-0.3	106	1000.0	0.0	206	1000.4	0.4
7	999.9	-0.1	107	1000.0	0.0	207	1000.4	0.4
8	999.9	-0.1	108	1000.0	0.0	208	1000.4	0.4
9	1000.0	0.0	109	1000.2	0.2	209	1000.6	0.6
10	1000.2	0.2	110	1000.4	0.4	210	1000.6	0.6
11	999.5	-0.5	111	999.8	-0.2	211	999.9	-0.1
12	999.5	-0.5	112	999.8	-0.2	212	999.9	-0.1
13	999.5	-0.5	113	1000.0	0.0	213	999.9	-0.1
14	999.5	-0.5	114	1000.0	0.0	214	999.9	-0.1
15	999.5	-0.5	115	1000.2	0.2	215	999.9	-0.1
16	999.5	-0.5	116	1000.2	0.2	216	1000.0	0.0
17	999.5	-0.5	117	1000.4	0.4	217	1000.0	0.0
18	999.7	-0.3	118	1000.4	0.4	218	1000.0	0.0
19	999.7	-0.3	119	1000.6	0.6	219	1000.2	0.2
20	999.9	-0.1	120	1000.6	0.6	220	1000.6	0.6
21	999.5	-0.5	121	1000.4	0.4	221	999.7	-0.3
22	999.5	-0.5	122	1000.2	0.2	222	999.7	-0.3
23	999.5	-0.5	123	1000.0	0.0	223	999.9	-0.1
24	999.5	-0.5	124	1000.0	0.0	224	999.9	-0.1
25	999.5	-0.5	125	1000.4	0.4	225	999.9	-0.1
26	999.5	-0.5	126	1000.4	0.4	226	999.9	-0.1
27	999.5	-0.5	127	1000.4	0.4	227	999.9	-0.1
28	999.7	-0.3	128	1000.6	0.6	228	999.9	-0.1
29	999.7	-0.3	129	1000.6	0.6	229	1000.0	0.0
30	1000.0	0.0	130	1000.9	0.9	230	1000.2	0.2
31	1000.0	0.0	131	999.8	-0.2	231	999.7	-0.3
32	999.7	-0.3	132	999.7	-0.3	232	999.7	-0.3
33	999.9	-0.1	133	999.7	-0.3	233	999.9	-0.1
34	999.9	-0.1	134	999.8	-0.2	234	999.9	-0.1
35	999.9	-0.1	135	1000.0	0.0	235	1000.0	0.0
36	999.9	-0.1	136	999.8	-0.2	236	1000.0	0.0
37	1000.0	0.0	137	1000.0	0.0	237	1000.0	0.0
38	1000.0	0.0	138	1000.2	0.2	238	1000.2	0.2
39	1000.0	0.0	139	1000.2	0.2	239	1000.4	0.4
40	1000.4	0.4	140	1000.6	0.6	240	1000.6	0.6
41	999.5	-0.5	141	999.8	-0.2	241	1000.4	0.4
42	999.5	-0.5	142	999.7	-0.3	242	1000.2	0.2
43	999.5	-0.5	143	999.8	-0.2	243	1000.2	0.2
44	999.5	-0.5	144	999.7	-0.3	244	1000.2	0.2
45	999.7	-0.3	145	999.7	-0.3	245	1000.4	0.4
46	999.7	-0.3	146	999.7	-0.3	246	1000.2	0.2
47	999.7	-0.3	147	999.8	-0.2	247	1000.4	0.4
48	999.7	-0.3	148	999.8	-0.2	248	1000.6	0.6
49	999.7	-0.3	149	1001.8	1.8	249	1000.6	0.6
50	999.7	-0.3	150	1001.8	1.8	250	1000.6	0.6
51	1000.6	0.6	151	1000.2	0.2	251	1000.0	0.0
52	1000.6	0.6	152	1000.0	0.0	252	999.7	-0.3
53	1000.8	0.8	153	1000.0	0.0	253	999.7	-0.3
54	1000.8	0.8	154	1000.0	0.0	254	999.9	-0.1
55	1000.9	0.9	155	1000.0	0.0	255	1000.0	0.0
56	1000.9	0.9	156	1000.2	0.2	256	1000.0	0.0

57	1000.9	0.9	157
58	1000.9	0.9	158
59	1001.1	1.1	159
60	1001.3	1.3	160
61	1001.5	1.5	161
62	1001.3	1.3	162
63	1001.3	1.3	163
64	1001.3	1.3	164
65	1001.5	1.5	165
66	1001.3	1.3	166
67	1001.3	1.3	167
68	1001.5	1.5	168
69	1001.7	1.7	169
70	1001.8	1.8	170
71	1001.1	1.1	171
72	1001.1	1.1	172
73	1001.1	1.1	173
74	1001.1	1.1	174
75	1001.1	1.1	175
76	1001.3	1.3	176
77	1001.5	1.5	177
78	1001.5	1.5	178
79	1001.5	1.5	179
80	1001.8	1.8	180
81	1001.5	1.5	181
82	1001.3	1.3	182
83	1001.3	1.3	183
84	1001.3	1.3	184
85	1001.3	1.3	185
86	1001.3	1.3	186
87	1001.3	1.3	187
88	1001.5	1.5	188
89	1001.5	1.5	189
90	1001.7	1.7	190
91	1001.5	1.5	191
92	1001.1	1.1	192
93	1001.3	1.3	193
94	1001.3	1.3	194
95	1001.5	1.5	195
96	1001.5	1.5	196
97	1001.5	1.5	197
98	1001.5	1.5	198
99	1001.5	1.5	199
100	1001.5	1.5	200

1000.4	0.4	257
1000.6	0.6	258
1000.6	0.6	259
1000.9	0.9	260
1000.0	0.0	261
1000.0	0.0	262
1000.0	0.0	263
1000.0	0.0	264
1000.0	0.0	265
1000.0	0.0	266
1000.0	0.0	267
1000.2	0.2	268
1000.4	0.4	269
1000.6	0.6	270
999.7	-0.3	271
999.7	-0.3	272
999.9	-0.1	273
999.9	-0.1	274
999.7	-0.3	275
999.9	-0.1	276
1000.0	0.0	277
1000.0	0.0	278
1000.2	0.2	279
1000.6	0.6	280
1000.6	0.6	281
1000.4	0.4	282
1000.6	0.6	283
1000.6	0.6	284
1000.6	0.6	285
1000.6	0.6	286
1000.6	0.6	287
1000.8	0.8	288
1000.9	0.9	289
1001.1	1.1	290
1000.2	0.2	291
1000.2	0.2	292
1000.2	0.2	293
1000.4	0.4	294
1000.6	0.6	295
1000.6	0.6	296
1000.6	0.6	297
1000.6	0.6	298
1000.6	0.6	299
1000.6	0.6	300

1000.0	0.0
1000.0	0.0
1000.0	0.0
1000.6	0.6
1000.0	0.0
999.9	-0.1
1000.0	0.0
1000.0	0.0
1000.2	0.2
1000.2	0.2
1000.2	0.2
1000.4	0.4
1000.6	0.6
1000.6	0.6
1000.0	0.0
1000.0	0.0
1000.0	0.0
1000.0	0.0
1000.0	0.0
1000.0	0.0
1000.2	0.2
1000.2	0.2
1000.6	0.6
1000.6	0.6
999.5	-0.5
999.5	-0.5
999.5	-0.5
999.5	-0.5
999.5	-0.5
999.5	-0.5
999.7	-0.3
999.7	-0.3
999.9	-0.1
1000.0	0.0
999.5	-0.5
999.7	-0.3
999.7	-0.3
999.7	-0.3
999.7	-0.3
999.7	-0.3
999.7	-0.3
999.7	-0.3
999.7	-0.3

Range for 1000°F Signal: +1.8/-0.5

Allowable range: ±2.3

Within specification for this temperature? Yes

Performed by: Mike Dey

Mgr. Fire Resistance — Title

2/25/05 — Date

Approved by:

Mgr of — Title

Date

Channel Verification for Yokogawa 300 Channel

Serial No.: 48JF0082

Calibrator Used: SNT156701

Temperature Setting (°F): 2000.0

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	1999.8	-0.2	101	1999.7	-0.3	201	2000.7	0.7
2	1999.6	-0.4	102	1999.7	-0.3	202	2000.7	0.7
3	1999.4	-0.6	103	1999.7	-0.3	203	2000.7	0.7
4	1999.6	-0.4	104	1999.7	-0.3	204	2000.7	0.7
5	1999.6	-0.4	105	1999.9	-0.1	205	2000.7	0.7
6	1999.6	-0.4	106	1999.9	-0.1	206	2000.8	0.8
7	1999.8	-0.2	107	2000.1	0.1	207	2001.0	1.0
8	1999.8	-0.2	108	2000.1	0.1	208	2001.0	1.0
9	1999.9	-0.1	109	2000.3	0.3	209	2001.2	1.2
10	2000.3	0.3	110	2000.6	0.6	210	2001.6	1.6
11	1999.4	-0.6	111	1999.7	-0.3	211	2000.7	0.7
12	1999.2	-0.8	112	1999.7	-0.3	212	2000.7	0.7
13	1999.2	-0.8	113	1999.9	-0.1	213	2000.7	0.7
14	1999.4	-0.6	114	1999.9	-0.1	214	2000.8	0.8
15	1999.4	-0.6	115	1999.9	-0.1	215	2000.8	0.8
16	1999.4	-0.6	116	2000.1	0.1	216	2000.8	0.8
17	1999.4	-0.6	117	2000.1	0.1	217	2001.0	1.0
18	1999.4	-0.6	118	2000.3	0.3	218	2001.0	1.0
19	1999.4	-0.6	119	2000.5	0.5	219	2001.0	1.0
20	1999.9	-0.1	120	2000.6	0.6	220	2001.2	1.2
21	1999.2	-0.8	121	2000.1	0.1	221	2000.5	0.5
22	1999.2	-0.8	122	2000.1	0.1	222	2000.5	0.5
23	1999.2	-0.8	123	1999.7	-0.3	223	2000.7	0.7
24	1999.2	-0.8	124	1999.7	-0.3	224	2000.7	0.7
25	1999.6	-0.4	125	2000.3	0.3	225	2000.7	0.7
26	1999.6	-0.4	126	2000.3	0.3	226	2000.7	0.7
27	1999.6	-0.4	127	2000.5	0.5	227	2000.7	0.7
28	1999.8	-0.2	128	2000.6	0.6	228	2000.7	0.7
29	1999.9	-0.1	129	2000.6	0.6	229	2001.0	1.0
30	2000.1	0.1	130	2001.0	1.0	230	2001.0	1.0
31	2000.1	0.1	131	1999.9	-0.1	231	2000.7	0.7
32	2000.1	0.1	132	1999.7	-0.3	232	2000.7	0.7
33	2000.3	0.3	133	1999.7	-0.3	233	2000.7	0.7
34	2000.3	0.3	134	1999.9	-0.1	234	2000.7	0.7
35	2000.3	0.3	135	1999.7	-0.3	235	2000.8	0.8
36	2000.3	0.3	136	1999.7	-0.3	236	2000.8	0.8
37	2000.5	0.5	137	2000.1	0.1	237	2001.0	1.0
38	2000.7	0.7	138	2000.1	0.1	238	2001.0	1.0
39	2000.7	0.7	139	2000.3	0.3	239	2001.0	1.0
40	2000.8	0.8	140	2000.6	0.6	240	2001.2	1.2
41	1999.9	-0.1	141	1999.7	-0.3	241	2000.7	0.7
42	1999.9	-0.1	142	1999.7	-0.3	242	2000.7	0.7
43	1999.9	-0.1	143	1999.7	-0.3	243	2000.7	0.7
44	1999.9	-0.1	144	1999.7	-0.3	244	2000.7	0.7
45	1999.9	-0.1	145	1999.7	-0.3	245	2000.8	0.8
46	1999.9	-0.1	146	1999.7	-0.3	246	2000.8	0.8
47	1999.9	-0.1	147	1999.7	-0.3	247	2001.0	1.0
48	2000.1	0.1	148	1999.9	-0.1	248	2001.0	1.0
49	2000.1	0.1	149	1999.9	-0.1	249	2001.0	1.0
50	2000.1	0.1	150	1999.9	-0.1	250	2001.0	1.0
51	2000.7	0.7	151	2000.7	0.7	251	2000.1	0.1
52	2000.7	0.7	152	2000.7	0.7	252	1999.9	-0.1
53	2000.7	0.7	153	2000.7	0.7	253	2000.1	0.1
54	2000.7	0.7	154	2000.7	0.7	254	2000.3	0.3
55	2000.8	0.8	155	2000.8	0.8	255	2000.5	0.5
56	2000.7	0.7	156	2000.8	0.8	256	2000.5	0.5

57	2000.7	0.7	157	2001.0	1.0	257	2000.7	0.7			
58	2000.8	0.8	158	2001.0	1.0	258	2000.7	0.7			
59	2001.0	1.0	159	2001.0	1.0	259	2000.7	0.7			
60	2001.2	1.2	160	2001.4	1.4	260	2000.8	0.8			
61	2001.7	1.7	161	2000.7	0.7	261	2000.3	0.3			
62	2001.6	1.6	162	2000.5	0.5	262	2000.1	0.1			
63	2001.6	1.6	163	2000.5	0.5	263	2000.1	0.1			
64	2001.6	1.6	164	2000.7	0.7	264	2000.3	0.3			
65	2001.7	1.7	165	2000.7	0.7	265	2000.5	0.5			
66	2001.7	1.7	166	2000.7	0.7	266	2000.7	0.7			
67	2001.7	1.7	167	2000.8	0.8	267	2000.7	0.7			
68	2001.7	1.7	168	2001.0	1.0	268	2000.7	0.7			
69	2002.1	2.1	169	2001.0	1.0	269	2000.8	0.8			
70	2002.5	2.5	170	2001.2	1.2	270	2001.0	1.0			
71	2001.6	1.6	171	2000.3	0.3	271	1999.9	-0.1			
72	2001.7	1.7	172	2000.3	0.3	272	2000.1	0.1			
73	2001.6	1.6	173	2000.3	0.3	273	2000.1	0.1			
74	2001.6	1.6	174	2000.5	0.5	274	2000.1	0.1			
75	2001.6	1.6	175	2000.7	0.7	275	2000.3	0.3			
76	2001.6	1.6	176	2000.7	0.7	276	2000.3	0.3			
77	2001.7	1.7	177	2000.7	0.7	277	2000.3	0.3			
78	2001.7	1.7	178	2000.7	0.7	278	2000.3	0.3			
79	2001.7	1.7	179	2000.8	0.8	279	2000.7	0.7			
80	2002.1	2.1	180	2001.0	1.0	280	2000.8	0.8			
81	2001.6	1.6	181	2001.0	1.0	281	1999.4	-0.6			
82	2001.6	1.6	182	2001.0	1.0	282	1999.6	-0.4			
83	2001.6	1.6	183	2001.0	1.0	283	1999.6	-0.4			
84	2001.6	1.6	184	2001.0	1.0	284	1999.8	-0.2			
85	2001.6	1.6	185	2001.0	1.0	285	1999.8	-0.2			
86	2001.6	1.6	186	2001.0	1.0	286	1999.8	-0.2			
87	2001.7	1.7	187	2001.4	1.4	287	1999.9	-0.1			
88	2001.7	1.7	188	2001.4	1.4	288	1999.9	-0.1			
89	2001.7	1.7	189	2001.7	1.7	289	1999.9	-0.1			
90	2002.1	2.1	190	2002.1	2.1	290	2000.1	0.1			
91	2001.6	1.6	191	2001.0	1.0	291	1999.4	-0.6			
92	2001.6	1.6	192	2001.0	1.0	292	1999.4	-0.6			
93	2001.6	1.6	193	2001.0	1.0	293	1999.6	-0.4			
94	2001.4	1.4	194	2001.0	1.0	294	1999.8	-0.2			
95	2001.6	1.6	195	2001.0	1.0	295	1999.8	-0.2			
96	2001.6	1.6	196	2001.0	1.0	296	1999.9	-0.1			
97	2001.6	1.6	197	2001.0	1.0	297	1999.9	-0.1			
98	2001.6	1.6	198	2001.2	1.2	298	2000.1	0.1			
99	2001.6	1.6	199	2001.2	1.2	299	2000.1	0.1			
100	2001.6	1.6	200	2001.2	1.2	300	2000.1	0.1			

Range for 2000°F Signal: +2.5/-0.8

Allowable range: ±2.8

Within specification for this temperature? Yes

Performed by: Mike Dey

Mgr. Fire Resistance — 2/25/05

Title — Date

Approved by:

mgr 04

Title — Date

Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, Texas 78112
800-966-5253 FAX 210-635-8101

Certificate of Verification

Certification No.: 92142

Verification Date: 02/25/2005

Reverification Date: 08/25/2005

Manufacturer: Yokogawa

Model No.: 100 Channel DAU

Serial No.: 99LE004

Equipment Description: 100 Channel Data Acquisition System with YOKOGAWA Darwin Series

Verification Sources: TEGAM Model 840-A, SN: T-156701. Calibration due 07/26/2005

PERFORMANCE:

Temperature: (75°F) +0.7/-1.1	Temperature: (150°F) +0.4/-1.2	Temperature: (300°F) +0.7/-1.2	Temperature: (400°F) +0.6/-1.2	Temperature: (1000°F) +0.8/-0.7	Temperature: (2000°F) +1.6/-0.6

Verification Performed by:

Mike Dey
Manager of Fire Resistance

Verification Approved by:

Javier Trevino
Manager of Special Projects

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-004

Within specs? Yes/No

Calibrator Used: SNT156701

Performed by: Mike Dey

Title: Mgr. Dept. 2

Temperature Setting (°F): 75.0

Approved by:

Title: mgr 04

Date: 2/25/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	75.2	0.2	51	73.9	-1.1
2	74.8	-0.2	52	73.9	-1.1
3	74.8	-0.2	53	73.9	-1.1
4	75.0	0.0	54	73.9	-1.1
5	74.8	-0.2	55	73.9	-1.1
6	75.0	0.0	56	74.1	-0.9
7	75.0	0.0	57	74.1	-0.9
8	75.2	0.2	58	74.3	-0.7
9	75.2	0.2	59	74.3	-0.7
10	75.7	0.7	60	74.5	-0.5
11	74.7	-0.3	61	74.8	-0.2
12	74.5	-0.5	62	74.5	-0.5
13	74.5	-0.5	63	74.5	-0.5
14	74.5	-0.5	64	74.5	-0.5
15	74.5	-0.5	65	74.7	-0.3
16	74.5	-0.5	66	74.8	-0.2
17	74.5	-0.5	67	75.0	0.0
18	74.7	-0.3	68	75.0	0.0
19	74.8	-0.2	69	75.2	0.2
20	75.4	0.4	70	75.6	0.6
21	74.8	-0.2	71	74.5	-0.5
22	74.7	-0.3	72	74.3	-0.7
23	74.7	-0.3	73	74.3	-0.7
24	74.7	-0.3	74	74.5	-0.5
25	74.7	-0.3	75	74.5	-0.5
26	74.8	-0.2	76	74.5	-0.5
27	74.8	-0.2	77	74.7	-0.3
28	75.0	0.0	78	74.7	-0.3
29	75.2	0.2	79	74.8	-0.2
30	75.6	0.6	80	75.2	0.2
31	74.5	-0.5	81	74.5	-0.5
32	74.5	-0.5	82	74.3	-0.7
33	74.5	-0.5	83	74.3	-0.7
34	74.5	-0.5	84	74.5	-0.5
35	74.5	-0.5	85	74.5	-0.5
36	74.5	-0.5	86	74.5	-0.5
37	74.5	-0.5	87	74.7	-0.3
38	74.5	-0.5	88	74.7	-0.3
39	74.8	-0.2	89	74.8	-0.2
40	75.4	0.4	90	75.2	0.2
41	74.7	-0.3	91	74.1	-0.9
42	74.5	-0.5	92	74.1	-0.9
43	74.7	-0.3	93	74.1	-0.9
44	74.7	-0.3	94	74.1	-0.9
45	74.7	-0.3	95	74.1	-0.9
46	74.8	-0.2	96	74.1	-0.9
47	74.8	-0.2	97	74.3	-0.7
48	74.8	-0.2	98	74.3	-0.7
49	75.2	0.2	99	74.5	-0.5
50	75.6	0.6	100	74.7	-0.3

			Lower	Upper	
Range of 75°F Readings:	+0.7/-1.1	Allowable limits	73.2	76.8	(±1.8)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-004

Within specs? (Yes)/No

Calibrator Used: SNT156701

Performed by: Mike Dey

Title: Mgr. Dept. 2

Temperature Setting (°F): 150.0

Approved by:

Title: Mgr QC

Date: 2/25/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	150.1	0.1	51	149.0	-1.0
2	149.9	-0.1	52	148.8	-1.2
3	149.9	-0.1	53	148.8	-1.2
4	149.9	-0.1	54	149.0	-1.0
5	149.9	-0.1	55	149.0	-1.0
6	149.9	-0.1	56	149.0	-1.0
7	150.1	0.1	57	149.2	-0.8
8	150.3	0.3	58	149.4	-0.6
9	150.3	0.3	59	149.4	-0.6
10	150.4	0.4	60	149.7	-0.3
11	149.5	-0.5	61	149.9	-0.1
12	149.5	-0.5	62	149.5	-0.5
13	149.4	-0.6	63	149.5	-0.5
14	149.4	-0.6	64	149.7	-0.3
15	149.5	-0.5	65	149.7	-0.3
16	149.5	-0.5	66	149.7	-0.3
17	149.5	-0.5	67	149.9	-0.1
18	149.7	-0.3	68	149.9	-0.1
19	149.9	-0.1	69	150.1	0.1
20	150.3	0.3	70	150.4	0.4
21	149.7	-0.3	71	149.4	-0.6
22	149.7	-0.3	72	149.4	-0.6
23	149.7	-0.3	73	149.2	-0.8
24	149.7	-0.3	74	149.4	-0.6
25	149.7	-0.3	75	149.4	-0.6
26	149.7	-0.3	76	149.4	-0.6
27	149.9	-0.1	77	149.5	-0.5
28	149.9	-0.1	78	149.7	-0.3
29	150.1	0.1	79	149.7	-0.3
30	150.4	0.4	80	150.3	0.3
31	149.7	-0.3	81	149.4	-0.6
32	149.5	-0.5	82	149.4	-0.6
33	149.5	-0.5	83	149.4	-0.6
34	149.5	-0.5	84	149.4	-0.6
35	149.5	-0.5	85	149.4	-0.6
36	149.7	-0.3	86	149.5	-0.5
37	149.7	-0.3	87	149.5	-0.5
38	149.7	-0.3	88	149.7	-0.3
39	149.7	-0.3	89	149.7	-0.3
40	150.3	0.3	90	150.3	0.3
41	149.7	-0.3	91	149.2	-0.8
42	149.5	-0.5	92	149.0	-1.0
43	149.5	-0.5	93	149.0	-1.0
44	149.7	-0.3	94	149.2	-0.8
45	149.7	-0.3	95	149.4	-0.6
46	149.7	-0.3	96	149.0	-1.0
47	149.7	-0.3	97	149.4	-0.6
48	149.7	-0.3	98	149.4	-0.6
49	149.9	-0.1	99	149.5	-0.5
50	150.3	0.3	100	149.7	-0.3

Range of 150°F Readings: +0.4/-1.2

	Lower	Upper	
Allowable limits	148.2	151.8	(±1.8)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-004

Within specs? Yes/No

Calibrator Used: SNT156701

Performed by: Mike Dey

Title: Mgr. Dept. 2

Temperature Setting (°F): 300.0

Approved by:

Title: Mgr

Date: 2/25/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	300.2	0.2	51	298.8	-1.2
2	299.8	-0.2	52	298.8	-1.2
3	299.8	-0.2	53	298.8	-1.2
4	299.8	-0.2	54	298.8	-1.2
5	299.7	-0.3	55	298.9	-1.1
6	299.8	-0.2	56	298.9	-1.1
7	300.0	0.0	57	298.9	-1.1
8	300.0	0.0	58	299.1	-0.9
9	300.2	0.2	59	299.3	-0.7
10	300.7	0.7	60	299.5	-0.5
11	299.5	-0.5	61	299.7	-0.3
12	299.3	-0.7	62	299.5	-0.5
13	299.3	-0.7	63	299.5	-0.5
14	299.5	-0.5	64	299.5	-0.5
15	299.3	-0.7	65	299.7	-0.3
16	299.5	-0.5	66	299.7	-0.3
17	299.5	-0.5	67	299.7	-0.3
18	299.5	-0.5	68	300.0	0.0
19	299.8	-0.2	69	300.2	0.2
20	300.2	0.2	70	300.4	0.4
21	300.0	0.0	71	299.3	-0.7
22	299.7	-0.3	72	299.3	-0.7
23	299.7	-0.3	73	299.3	-0.7
24	299.7	-0.3	74	299.1	-0.9
25	299.7	-0.3	75	299.5	-0.5
26	299.7	-0.3	76	299.5	-0.5
27	299.8	-0.2	77	299.5	-0.5
28	300.0	0.0	78	299.7	-0.3
29	300.2	0.2	79	299.8	-0.2
30	300.6	0.6	80	300.2	0.2
31	299.5	-0.5	81	299.3	-0.7
32	299.5	-0.5	82	299.3	-0.7
33	299.5	-0.5	83	299.1	-0.9
34	299.3	-0.7	84	299.3	-0.7
35	299.5	-0.5	85	299.5	-0.5
36	299.5	-0.5	86	299.3	-0.7
37	299.5	-0.5	87	299.5	-0.5
38	299.7	-0.3	88	299.5	-0.5
39	299.7	-0.3	89	299.7	-0.3
40	300.2	0.2	90	300.0	0.0
41	299.5	-0.5	91	298.9	-1.1
42	299.5	-0.5	92	298.9	-1.1
43	299.5	-0.5	93	298.9	-1.1
44	299.5	-0.5	94	298.9	-1.1
45	299.5	-0.5	95	299.1	-0.9
46	299.5	-0.5	96	299.1	-0.9
47	299.5	-0.5	97	299.1	-0.9
48	299.7	-0.3	98	299.1	-0.9
49	300.0	0.0	99	299.3	-0.7
50	300.2	0.2	100	299.5	-0.5

Range of 300°F Readings: +0.7/-1.2

	Lower	Upper	
Allowable limits	298.1	301.9	(±1.9)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-004

Within specs? (Yes)/No

Calibrator Used: SNT156701

Performed by: Mike Dey

Title: Mgr. Dept. 2

Temperature Setting (°F): 400.0

Approved by:

Title: Mgr QE

Date: 2/25/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	400.1	0.1	51	399.0	-1.0
2	400.1	0.1	52	398.8	-1.2
3	399.9	-0.1	53	398.8	-1.2
4	400.1	0.1	54	399.0	-1.0
5	400.1	0.1	55	399.0	-1.0
6	400.1	0.1	56	399.0	-1.0
7	400.1	0.1	57	399.4	-0.6
8	400.3	0.3	58	399.4	-0.6
9	400.3	0.3	59	399.4	-0.6
10	400.6	0.6	60	399.6	-0.4
11	399.6	-0.4	61	399.9	-0.1
12	399.6	-0.4	62	399.6	-0.4
13	399.6	-0.4	63	399.6	-0.4
14	399.6	-0.4	64	399.6	-0.4
15	399.6	-0.4	65	399.6	-0.4
16	399.6	-0.4	66	399.9	-0.1
17	399.6	-0.4	67	400.1	0.1
18	399.6	-0.4	68	400.1	0.1
19	399.9	-0.1	69	400.1	0.1
20	400.3	0.3	70	400.6	0.6
21	399.7	-0.3	71	399.6	-0.4
22	399.6	-0.4	72	399.4	-0.6
23	399.6	-0.4	73	399.4	-0.6
24	399.6	-0.4	74	399.6	-0.4
25	399.6	-0.4	75	399.6	-0.4
26	399.7	-0.3	76	399.6	-0.4
27	399.7	-0.3	77	399.7	-0.3
28	399.7	-0.3	78	399.7	-0.3
29	400.1	0.1	79	400.1	0.1
30	400.5	0.5	80	400.3	0.3
31	399.6	-0.4	81	399.4	-0.6
32	399.6	-0.4	82	399.4	-0.6
33	399.6	-0.4	83	399.4	-0.6
34	399.4	-0.6	84	399.4	-0.6
35	399.6	-0.4	85	399.4	-0.6
36	399.6	-0.4	86	399.6	-0.4
37	399.6	-0.4	87	399.6	-0.4
38	399.6	-0.4	88	399.6	-0.4
39	399.9	-0.1	89	399.7	-0.3
40	400.3	0.3	90	400.3	0.3
41	399.9	-0.1	91	399.4	-0.6
42	399.6	-0.4	92	399.4	-0.6
43	399.6	-0.4	93	399.4	-0.6
44	399.6	-0.4	94	399.4	-0.6
45	399.6	-0.4	95	399.4	-0.6
46	399.6	-0.4	96	399.4	-0.6
47	399.9	-0.1	97	399.6	-0.4
48	399.9	-0.1	98	399.4	-0.6
49	399.9	-0.1	99	399.6	-0.4
50	400.3	0.3	100	399.9	-0.1

Range of 400°F Readings: +0.6/-1.2

	Lower	Upper	
Allowable limits	398.0	402.0	(±2.0)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-004

Calibrator Used: SNT156701

Temperature Setting (°F): 1000.0

Within specs? Yes/No

Performed by: Mike Dey

Title: Mgr. Dept. 2

Approved by:

Title: Mgr of

Date: 2/25/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	1000.4	0.4	51	999.5	-0.5
2	1000.2	0.2	52	999.5	-0.5
3	1000.2	0.2	53	999.5	-0.5
4	1000.2	0.2	54	999.5	-0.5
5	1000.2	0.2	55	999.5	-0.5
6	1000.2	0.2	56	999.5	-0.5
7	1000.2	0.2	57	999.5	-0.5
8	1000.4	0.4	58	999.7	-0.3
9	1000.6	0.6	59	999.7	-0.3
10	1000.8	0.8	60	999.9	-0.1
11	999.7	-0.3	61	1000.0	0.0
12	999.7	-0.3	62	999.9	-0.1
13	999.7	-0.3	63	999.9	-0.1
14	999.7	-0.3	64	999.7	-0.3
15	999.7	-0.3	65	1000.0	0.0
16	999.7	-0.3	66	1000.0	0.0
17	999.7	-0.3	67	1000.0	0.0
18	999.9	-0.1	68	1000.2	0.2
19	1000.0	0.0	69	1000.6	0.6
20	1000.6	0.6	70	1000.6	0.6
21	1000.0	0.0	71	999.7	-0.3
22	999.9	-0.1	72	999.7	-0.3
23	999.7	-0.3	73	999.7	-0.3
24	1000.0	0.0	74	999.7	-0.3
25	999.9	-0.1	75	999.9	-0.1
26	999.9	-0.1	76	1000.0	0.0
27	1000.0	0.0	77	1000.0	0.0
28	1000.0	0.0	78	1000.0	0.0
29	1000.0	0.0	79	1000.2	0.2
30	1000.6	0.6	80	1000.6	0.6
31	1000.0	0.0	81	999.7	-0.3
32	999.7	-0.3	82	999.5	-0.5
33	999.7	-0.3	83	999.5	-0.5
34	999.9	-0.1	84	999.7	-0.3
35	999.7	-0.3	85	999.7	-0.3
36	999.7	-0.3	86	999.7	-0.3
37	999.9	-0.1	87	999.9	-0.1
38	999.9	-0.1	88	999.9	-0.1
39	999.9	-0.1	89	999.9	-0.1
40	1000.6	0.6	90	1000.2	0.2
41	999.7	-0.3	91	999.5	-0.5
42	999.7	-0.3	92	999.3	-0.7
43	999.7	-0.3	93	999.3	-0.7
44	999.7	-0.3	94	999.5	-0.5
45	999.9	-0.1	95	999.5	-0.5
46	999.9	-0.1	96	999.5	-0.5
47	999.9	-0.1	97	999.7	-0.3
48	1000.0	0.0	98	999.5	-0.5
49	1000.0	0.0	99	999.9	-0.1
50	1000.2	0.2	100	1000.0	0.0

Range of 2000°F Readings: +0.8/-0.7

	Lower	Upper	
Allowable limits	997.7	1002.3	(±2.3)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-004

Within specs? Yes/No

Calibrator Used: SNT156701

Performed by: Mike Dey

Title: Mgr. Dept. 2

Temperature Setting (°F): 2000.0

Approved by:

Title: Mgr OP

Date: 2/25/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	2001.0	1.0	51	1999.8	-0.2
2	2000.7	0.7	52	1999.4	-0.6
3	2000.7	0.7	53	1999.4	-0.6
4	2000.7	0.7	54	1999.6	-0.4
5	2000.7	0.7	55	1999.6	-0.4
6	2000.7	0.7	56	1999.8	-0.2
7	2000.8	0.8	57	1999.8	-0.2
8	2000.8	0.8	58	1999.9	-0.1
9	2001.0	1.0	59	1999.9	-0.1
10	2001.6	1.6	60	2000.3	0.3
11	2000.3	0.3	61	2000.3	0.3
12	2000.1	0.1	62	1999.9	-0.1
13	2000.1	0.1	63	2000.1	0.1
14	2000.1	0.1	64	2000.1	0.1
15	2000.1	0.1	65	2000.1	0.1
16	2000.3	0.3	66	2000.3	0.3
17	2000.5	0.5	67	2000.7	0.7
18	2000.5	0.5	68	2000.7	0.7
19	2000.5	0.5	69	2000.7	0.7
20	2001.0	1.0	70	2001.0	1.0
21	2000.7	0.7	71	2000.7	0.7
22	2000.5	0.5	72	2000.3	0.3
23	2000.3	0.3	73	2000.3	0.3
24	2000.3	0.3	74	2000.5	0.5
25	2000.5	0.5	75	2000.5	0.5
26	2000.5	0.5	76	2000.7	0.7
27	2000.7	0.7	77	2000.7	0.7
28	2000.7	0.7	78	2000.7	0.7
29	2000.8	0.8	79	2000.8	0.8
30	2001.2	1.2	80	2001.2	1.2
31	2000.1	0.1	81	1999.4	-0.6
32	2000.1	0.1	82	1999.4	-0.6
33	2000.1	0.1	83	1999.4	-0.6
34	1999.9	-0.1	84	1999.4	-0.6
35	2000.1	0.1	85	1999.4	-0.6
36	2000.1	0.1	86	1999.6	-0.4
37	2000.1	0.1	87	1999.6	-0.4
38	2000.3	0.3	88	1999.8	-0.2
39	2000.5	0.5	89	1999.9	-0.1
40	2000.8	0.8	90	2000.1	0.1
41	1999.9	-0.1	91	1999.8	-0.2
42	1999.6	-0.4	92	1999.6	-0.4
43	1999.8	-0.2	93	1999.6	-0.4
44	1999.9	-0.1	94	1999.8	-0.2
45	1999.9	-0.1	95	1999.8	-0.2
46	1999.9	-0.1	96	1999.8	-0.2
47	1999.9	-0.1	97	1999.9	-0.1
48	1999.9	-0.1	98	1999.9	-0.1
49	2000.3	0.3	99	1999.9	-0.1
50	2000.7	0.7	100	2000.3	0.3

Range of 2000°F Readings: +1.6/-0.6

	Lower	Upper	
Allowable limits	1997.2	2002.8	(±2.8)

Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, Texas 78112
800-966-5253 FAX 210-635-8101

Certificate of Verification

Certification No.:	92141
Verification Date:	02/25/2005
Reverification Date:	08/25/2005
Manufacturer:	Yokogawa
Model No.:	100 Channel DAU
Serial No.:	99LE006
Equipment Description:	100 Channel Data Acquisition System with YOKOGAWA Darwin Series
Calibration Sources:	TEGAM Model 840-A, SN: T-156701. Calibration due 07/26/2005.

PERFORMANCE:

Temperature: (75°F) +1.1/-0.5	Temperature: (150°F) +1.2/-0.5	Temperature: (300°F) +0.9/-0.7	Temperature: (400°F) +1.2/-0.6	Temperature: (1000°F) +1.3/-0.5	Temperature: (2000°F) +1.7/-1.1

Verification Performed by:

Mike Dey
Manager of Fire Resistance

Verification Approved by:

Javier Trevino
Manager of Special Projects

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-006

Within specs? (Yes)/No

Calibrator Used: SNT156701

Performed by: Mike Dey
Title: Mgr. Dept. 2

Temperature Setting (°F): 75.0

Approved by:
Title: Mgr OP

Date: 2/25/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	75.6	0.6	51	74.7	-0.3
2	75.6	0.6	52	74.7	-0.3
3	75.6	0.6	53	74.8	-0.2
4	75.2	0.2	54	74.5	-0.5
5	75.0	0.0	55	74.5	-0.5
6	75.0	0.0	56	74.5	-0.5
7	75.2	0.2	57	74.5	-0.5
8	75.0	0.0	58	74.5	-0.5
9	75.0	0.0	59	74.5	-0.5
10	75.2	0.2	60	74.5	-0.5
11	75.4	0.4	61	75.2	0.2
12	75.6	0.6	62	75.2	0.2
13	75.6	0.6	63	75.2	0.2
14	75.2	0.2	64	75.0	0.0
15	75.2	0.2	65	75.0	0.0
16	75.0	0.0	66	75.0	0.0
17	75.0	0.0	67	74.8	-0.2
18	75.0	0.0	68	74.8	-0.2
19	74.8	-0.2	69	75.0	0.0
20	75.0	0.0	70	75.0	0.0
21	75.2	0.2	71	75.4	0.4
22	75.4	0.4	72	75.6	0.6
23	75.4	0.4	73	75.6	0.6
24	75.2	0.2	74	75.2	0.2
25	75.0	0.0	75	75.2	0.2
26	75.0	0.0	76	75.2	0.2
27	75.0	0.0	77	75.2	0.2
28	74.8	-0.2	78	75.2	0.2
29	75.2	0.2	79	75.2	0.2
30	75.2	0.2	80	75.2	0.2
31	75.0	0.0	81	75.4	0.4
32	75.0	0.0	82	75.2	0.2
33	75.0	0.0	83	75.2	0.2
34	74.8	-0.2	84	75.0	0.0
35	75.0	0.0	85	75.0	0.0
36	75.0	0.0	86	74.8	-0.2
37	75.0	0.0	87	74.8	-0.2
38	74.8	-0.2	88	74.8	-0.2
39	75.2	0.2	89	75.0	0.0
40	75.2	0.2	90	75.2	0.2
41	75.2	0.2	91	74.5	-0.5
42	75.4	0.4	92	74.8	-0.2
43	75.7	0.7	93	74.8	-0.2
44	75.2	0.2	94	74.5	-0.5
45	75.2	0.2	95	74.7	-0.3
46	75.2	0.2	96	76.1	1.1
47	75.2	0.2	97	74.7	-0.3
48	75.0	0.0	98	74.8	-0.2
49	75.0	0.0	99	74.8	-0.2
50	75.2	0.2	100	74.8	-0.2

		Lower	Upper	
Range of 75°F Readings:	+1.1/-0.5	Allowable limits	73.2	76.8 (±1.8)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-006

Within specs? (Yes)/No

Calibrator Used: SNT156701

Performed by: Mike Dey

Title: Mgr. Dept. 2

Temperature Setting (°F): 150.0

Approved by:

Title: Mgr 04

Date: 2/25/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	150.4	0.4	51	149.7	-0.3
2	150.4	0.4	52	149.7	-0.3
3	150.4	0.4	53	149.7	-0.3
4	150.1	0.1	54	149.5	-0.5
5	150.1	0.1	55	149.5	-0.5
6	149.9	-0.1	56	149.5	-0.5
7	149.9	-0.1	57	149.5	-0.5
8	149.9	-0.1	58	149.5	-0.5
9	149.9	-0.1	59	149.5	-0.5
10	149.9	-0.1	60	149.5	-0.5
11	150.4	0.4	61	149.9	-0.1
12	150.4	0.4	62	149.9	-0.1
13	150.4	0.4	63	149.7	-0.3
14	150.3	0.3	64	149.7	-0.3
15	150.1	0.1	65	149.7	-0.3
16	150.1	0.1	66	149.5	-0.5
17	150.1	0.1	67	149.5	-0.5
18	149.9	-0.1	68	149.7	-0.3
19	149.9	-0.1	69	149.5	-0.5
20	150.1	0.1	70	149.5	-0.5
21	150.1	0.1	71	150.3	0.3
22	150.3	0.3	72	150.3	0.3
23	150.1	0.1	73	150.3	0.3
24	149.7	-0.3	74	150.1	0.1
25	149.7	-0.3	75	150.1	0.1
26	149.7	-0.3	76	149.9	-0.1
27	149.7	-0.3	77	150.1	0.1
28	149.7	-0.3	78	150.1	0.1
29	149.7	-0.3	79	149.9	-0.1
30	149.9	-0.1	80	150.1	0.1
31	150.3	0.3	81	149.9	-0.1
32	150.3	0.3	82	149.9	-0.1
33	150.3	0.3	83	149.7	-0.3
34	150.1	0.1	84	149.7	-0.3
35	149.9	-0.1	85	149.7	-0.3
36	149.9	-0.1	86	149.5	-0.5
37	149.9	-0.1	87	149.5	-0.5
38	149.9	-0.1	88	149.5	-0.5
39	149.7	-0.3	89	149.7	-0.3
40	150.1	0.1	90	149.9	-0.1
41	150.3	0.3	91	149.7	-0.3
42	150.4	0.4	92	149.7	-0.3
43	150.3	0.3	93	149.7	-0.3
44	150.3	0.3	94	149.5	-0.5
45	150.1	0.1	95	149.5	-0.5
46	150.1	0.1	96	151.2	1.2
47	149.9	-0.1	97	149.7	-0.3
48	150.1	0.1	98	149.7	-0.3
49	149.9	-0.1	99	149.7	-0.3
50	149.9	-0.1	100	149.9	-0.1

Range of 150°F Readings: +1.2/-0.5

	Lower	Upper	
Allowable limits	148.2	151.8	(±1.8)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-006

Within specs? (Yes)/No

Calibrator Used: SNT156701

Performed by: Mike Dey

Title: Mgr. Dept. 2

Temperature Setting (°F): 300.0

Approved by:

Title: Mgr Dept

Date: 2/25/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	300.2	0.2	51	299.5	-0.5
2	300.2	0.2	52	299.5	-0.5
3	300.2	0.2	53	299.7	-0.3
4	299.8	-0.2	54	299.5	-0.5
5	299.8	-0.2	55	299.3	-0.7
6	299.7	-0.3	56	299.5	-0.5
7	299.7	-0.3	57	299.5	-0.5
8	299.7	-0.3	58	299.5	-0.5
9	299.7	-0.3	59	299.5	-0.5
10	299.8	-0.2	60	299.5	-0.5
11	300.2	0.2	61	299.8	-0.2
12	300.2	0.2	62	299.8	-0.2
13	300.4	0.4	63	299.8	-0.2
14	300.2	0.2	64	299.5	-0.5
15	300.2	0.2	65	299.5	-0.5
16	300.0	0.0	66	299.5	-0.5
17	300.0	0.0	67	299.5	-0.5
18	299.8	-0.2	68	299.5	-0.5
19	300.0	0.0	69	299.5	-0.5
20	300.0	0.0	70	299.7	-0.3
21	300.2	0.2	71	300.2	0.2
22	300.2	0.2	72	300.2	0.2
23	300.2	0.2	73	300.2	0.2
24	300.0	0.0	74	299.8	-0.2
25	299.8	-0.2	75	299.8	-0.2
26	299.8	-0.2	76	299.8	-0.2
27	299.8	-0.2	77	299.7	-0.3
28	299.8	-0.2	78	299.8	-0.2
29	300.0	0.0	79	299.7	-0.3
30	300.0	0.0	80	299.8	-0.2
31	300.2	0.2	81	299.5	-0.5
32	300.4	0.4	82	299.5	-0.5
33	300.4	0.4	83	299.5	-0.5
34	300.2	0.2	84	299.5	-0.5
35	300.0	0.0	85	299.5	-0.5
36	300.0	0.0	86	299.5	-0.5
37	299.8	-0.2	87	299.5	-0.5
38	299.8	-0.2	88	299.5	-0.5
39	300.0	0.0	89	299.5	-0.5
40	300.0	0.0	90	299.5	-0.5
41	300.0	0.0	91	299.5	-0.5
42	300.4	0.4	92	299.7	-0.3
43	300.4	0.4	93	299.5	-0.5
44	300.0	0.0	94	299.5	-0.5
45	300.0	0.0	95	299.5	-0.5
46	299.8	-0.2	96	300.9	0.9
47	299.8	-0.2	97	299.5	-0.5
48	299.8	-0.2	98	299.7	-0.3
49	299.8	-0.2	99	299.7	-0.3
50	299.8	-0.2	100	299.7	-0.3

Range of 300°F Readings: +0.9/-0.7

	Lower	Upper	
Allowable limits	298.1	301.9	(±1.9)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-006

Within specs? (Yes)/No

Calibrator Used: SNT156701

Performed by: Mike Dey
Title: Mgr. Dept. 2

Temperature Setting (°F): 400.0

Approved by:
Title: Mgr QE

Date: 2/25/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	400.3	0.3	51	399.6	-0.4
2	400.3	0.3	52	399.6	-0.4
3	400.3	0.3	53	399.6	-0.4
4	399.9	-0.1	54	399.6	-0.4
5	399.7	-0.3	55	399.4	-0.6
6	399.6	-0.4	56	399.6	-0.4
7	399.7	-0.3	57	399.6	-0.4
8	399.6	-0.4	58	399.6	-0.4
9	399.6	-0.4	59	399.6	-0.4
10	399.7	-0.3	60	399.6	-0.4
11	400.5	0.5	61	399.9	-0.1
12	400.3	0.3	62	399.9	-0.1
13	400.5	0.5	63	399.9	-0.1
14	400.3	0.3	64	399.6	-0.4
15	399.9	-0.1	65	399.6	-0.4
16	399.9	-0.1	66	399.6	-0.4
17	399.9	-0.1	67	399.6	-0.4
18	399.9	-0.1	68	399.6	-0.4
19	399.7	-0.3	69	399.6	-0.4
20	400.1	0.1	70	399.6	-0.4
21	400.3	0.3	71	399.9	-0.1
22	400.3	0.3	72	400.3	0.3
23	400.3	0.3	73	400.3	0.3
24	400.1	0.1	74	399.7	-0.3
25	399.9	-0.1	75	399.7	-0.3
26	399.7	-0.3	76	399.7	-0.3
27	399.9	-0.1	77	399.6	-0.4
28	399.7	-0.3	78	399.6	-0.4
29	399.9	-0.1	79	399.6	-0.4
30	399.9	-0.1	80	399.6	-0.4
31	400.3	0.3	81	399.6	-0.4
32	400.5	0.5	82	399.9	-0.1
33	400.3	0.3	83	399.7	-0.3
34	400.3	0.3	84	399.6	-0.4
35	399.9	-0.1	85	399.6	-0.4
36	399.9	-0.1	86	399.6	-0.4
37	399.9	-0.1	87	399.6	-0.4
38	399.9	-0.1	88	399.6	-0.4
39	399.9	-0.1	89	399.7	-0.3
40	400.3	0.3	90	399.9	-0.1
41	400.1	0.1	91	399.6	-0.4
42	400.5	0.5	92	399.7	-0.3
43	400.5	0.5	93	399.7	-0.3
44	399.9	-0.1	94	399.6	-0.4
45	399.9	-0.1	95	399.6	-0.4
46	399.9	-0.1	96	401.2	1.2
47	399.7	-0.3	97	399.9	-0.1
48	399.7	-0.3	98	399.9	-0.1
49	399.9	-0.1	99	399.9	-0.1
50	399.7	-0.3	100	399.9	-0.1

Range of 400°F Readings: +1.2/-0.6

	Lower	Upper	
Allowable limits	398.0	402.0	(±2.0)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-006

Within specs? (Yes)/No

Calibrator Used: SNT156701

Performed by: Mike Dey

Title: Mgr. Dept. 2

Temperature Setting (°F): 1000.0

Approved by: mgr

Title: Mgr oy

Date: 2/25/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	999.9	-0.1	51	999.5	-0.5
2	1000.0	0.0	52	999.7	-0.3
3	1000.0	0.0	53	999.7	-0.3
4	999.7	-0.3	54	999.5	-0.5
5	999.7	-0.3	55	999.5	-0.5
6	999.5	-0.5	56	999.5	-0.5
7	999.5	-0.5	57	999.5	-0.5
8	999.7	-0.3	58	999.7	-0.3
9	999.5	-0.5	59	999.5	-0.5
10	999.5	-0.5	60	999.5	-0.5
11	1000.2	0.2	61	999.9	-0.1
12	1000.2	0.2	62	1000.0	0.0
13	1000.2	0.2	63	1000.0	0.0
14	1000.0	0.0	64	999.7	-0.3
15	1000.0	0.0	65	999.7	-0.3
16	1000.0	0.0	66	999.9	-0.1
17	999.9	-0.1	67	999.7	-0.3
18	999.7	-0.3	68	999.7	-0.3
19	999.9	-0.1	69	999.7	-0.3
20	1000.0	0.0	70	999.7	-0.3
21	1000.6	0.6	71	999.9	-0.1
22	1000.8	0.8	72	999.9	-0.1
23	1000.6	0.6	73	1000.0	0.0
24	1000.4	0.4	74	999.7	-0.3
25	1000.6	0.6	75	999.5	-0.5
26	1000.6	0.6	76	999.7	-0.3
27	1000.4	0.4	77	999.7	-0.3
28	1000.4	0.4	78	999.5	-0.5
29	1000.6	0.6	79	999.5	-0.5
30	1000.6	0.6	80	999.7	-0.3
31	1000.0	0.0	81	999.7	-0.3
32	1000.2	0.2	82	999.7	-0.3
33	1000.4	0.4	83	999.7	-0.3
34	1000.0	0.0	84	999.7	-0.3
35	999.9	-0.1	85	999.5	-0.5
36	1000.0	0.0	86	999.5	-0.5
37	999.9	-0.1	87	999.5	-0.5
38	999.9	-0.1	88	999.5	-0.5
39	1000.0	0.0	89	999.5	-0.5
40	1000.0	0.0	90	999.7	-0.3
41	1000.2	0.2	91	999.9	-0.1
42	1000.4	0.4	92	1000.0	0.0
43	1000.6	0.6	93	999.9	-0.1
44	1000.2	0.2	94	999.9	-0.1
45	1000.0	0.0	95	1000.0	0.0
46	1000.0	0.0	96	1001.3	1.3
47	1000.0	0.0	97	1000.0	0.0
48	1000.0	0.0	98	1000.0	0.0
49	1000.0	0.0	99	1000.0	0.0
50	1000.0	0.0	100	1000.0	0.0

Range of 2000°F Readings: +1.3/-0.5

	Lower	Upper	
Allowable limits	997.7	1002.3	(±2.3)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-006

Within specs? Yes/No

Calibrator Used: SNT156701

Performed by: Mike Dey

Title: Mgr. Dept. 2

Temperature Setting (°F): 2000.0

Approved by:

Title: Mgr of

Date: 2/25/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	1999.4	-0.6	51	1999.8	-0.2
2	1999.4	-0.6	52	1999.9	-0.1
3	1999.4	-0.6	53	1999.9	-0.1
4	1999.0	-1.0	54	1999.6	-0.4
5	1998.9	-1.1	55	1999.8	-0.2
6	1999.0	-1.0	56	1999.9	-0.1
7	1999.0	-1.0	57	1999.8	-0.2
8	1998.9	-1.1	58	1999.8	-0.2
9	1998.9	-1.1	59	1999.8	-0.2
10	1999.2	-0.8	60	1999.8	-0.2
11	2000.1	0.1	61	2000.1	0.1
12	2000.3	0.3	62	2000.1	0.1
13	2000.3	0.3	63	2000.1	0.1
14	1999.9	-0.1	64	1999.9	-0.1
15	1999.9	-0.1	65	1999.9	-0.1
16	1999.9	-0.1	66	1999.9	-0.1
17	1999.9	-0.1	67	1999.9	-0.1
18	1999.9	-0.1	68	1999.9	-0.1
19	1999.8	-0.2	69	1999.9	-0.1
20	1999.9	-0.1	70	1999.9	-0.1
21	2001.2	1.2	71	1999.2	-0.8
22	2001.4	1.4	72	1999.6	-0.4
23	2001.4	1.4	73	1999.4	-0.6
24	2001.2	1.2	74	1999.2	-0.8
25	2001.0	1.0	75	1999.2	-0.8
26	2001.0	1.0	76	1999.0	-1.0
27	2001.0	1.0	77	1999.2	-0.8
28	2001.0	1.0	78	1999.2	-0.8
29	2001.0	1.0	79	1999.0	-1.0
30	2001.2	1.2	80	1999.0	-1.0
31	1999.9	-0.1	81	1999.4	-0.6
32	2000.1	0.1	82	1999.4	-0.6
33	2000.1	0.1	83	1999.4	-0.6
34	1999.9	-0.1	84	1999.2	-0.8
35	1999.9	-0.1	85	1999.2	-0.8
36	1999.8	-0.2	86	1999.2	-0.8
37	1999.8	-0.2	87	1999.2	-0.8
38	1999.9	-0.1	88	1999.2	-0.8
39	1999.9	-0.1	89	1999.2	-0.8
40	1999.9	-0.1	90	1999.4	-0.6
41	1999.9	-0.1	91	2000.1	0.1
42	2000.1	0.1	92	2000.5	0.5
43	2000.5	0.5	93	2000.5	0.5
44	1999.9	-0.1	94	2000.1	0.1
45	1999.8	-0.2	95	2000.3	0.3
46	1999.9	-0.1	96	2001.7	1.7
47	1999.8	-0.2	97	2000.5	0.5
48	1999.8	-0.2	98	2000.7	0.7
49	1999.9	-0.1	99	2000.7	0.7
50	1999.8	-0.2	100	2000.7	0.7

Range of 2000°F Readings: +1.7/-1.1

	Lower	Upper	
Allowable limits	1997.2	2002.8	(±2.8)

Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, Texas 78112
800-966-5253 FAX 210-635-8101

Certificate of Verification

Certification No.:	92147
Verification Date:	03/11/2005
Re-verification Date:	09/11/2005
Manufacturer:	Yokogawa
Model No.:	300 Channel DAU-
Serial No.:	48JF0082
Equipment Description:	300 Channel Data Acquisition System with YOKOGAWA Darwin Series
Calibration Sources:	Tegam T-207318 due: 05/03/2005

PERFORMANCE:

Temperature: (75°F) 1.3/-0.3	Temperature: (150°F) 1.2/-0.3	Temperature: (300°F) 1.3/-0.5	Temperature: (400°F) +1.2/-0.4	Temperature: (1000°F) 1.3/-0.1	Temperature: (2000°F) 1.7/-0.8

Measurement Uncertainty: ± 0.2%

Verification Performed by:

Mike Dey
Manager Fire Resistance

Verification Approved by:

Deg Priest
President/Chief Technical Officer

Channel Verification for Yokogawa 300 Channel

Serial No.: 48JF0082

Calibrator Used: T-207318

Temperature Setting (°F): 75.0

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	75.4	0.4	101	75.2	0.2	201	74.8	-0.2
2	75.2	0.2	102	75.2	0.2	202	75.2	-0.2
3	75.2	0.2	103	75.2	0.2	203	75.4	0.2
4	75.2	0.2	104	75.0	0.0	204	75.4	0.4
5	75.2	0.2	105	75.0	0.0	205	75.2	0.4
6	75.2	0.2	106	75.0	0.0	206	75.4	0.2
7	75.2	0.2	107	75.4	0.4	207	75.4	0.4
8	75.4	0.4	108	75.0	0.0	208	75.4	0.4
9	75.4	0.4	109	75.4	0.4	209	75.4	0.4
10	75.7	0.7	110	75.7	0.7	210	75.2	0.4
11	75.2	0.2	111	75.2	0.2	211	75.4	0.2
12	75.2	0.2	112	75.4	0.4	212	75.4	0.4
13	75.2	0.2	113	75.7	0.7	213	75.2	0.4
14	75.2	0.2	114	75.7	0.7	214	75.2	0.2
15	75.2	0.2	115	75.7	0.7	215	75.2	0.2
16	75.2	0.2	116	75.7	0.7	216	75.2	0.2
17	75.2	0.2	117	75.7	0.7	217	75.4	0.2
18	75.2	0.2	118	75.7	0.7	218	75.2	0.4
19	75.4	0.4	119	75.7	0.7	219	75.4	0.2
20	75.7	0.7	120	75.9	0.9	220	75.6	0.4
21	75.2	0.2	121	75.6	0.6	221	74.7	0.6
22	75.2	0.2	122	75.6	0.6	222	74.8	-0.3
23	75.2	0.2	123	75.4	0.4	223	74.8	-0.2
24	75.2	0.2	124	75.6	0.6	224	74.8	-0.2
25	75.4	0.4	125	75.7	0.7	225	75.0	-0.2
26	75.4	0.4	126	75.6	0.6	226	75.2	0.0
27	75.6	0.6	127	75.7	0.7	227	75.2	0.2
28	75.6	0.6	128	75.7	0.7	228	75.2	0.2
29	75.7	0.7	129	75.9	0.9	229	75.4	0.2
30	75.9	0.9	130	76.3	1.3	230	75.7	0.4
31	75.6	0.6	131	75.2	0.2	231	75.2	0.7
32	75.6	0.6	132	75.2	0.2	232	75.2	0.2
33	75.6	0.6	133	75.2	0.2	233	75.2	0.2
34	75.6	0.6	134	75.2	0.2	234	75.4	0.2
35	75.4	0.4	135	75.4	0.4	235	75.4	0.4
36	75.6	0.6	136	75.2	0.2	236	75.4	0.4
37	75.7	0.7	137	75.2	0.2	237	75.4	0.4
38	75.7	0.7	138	75.4	0.4	238	75.6	0.4
39	75.7	0.7	139	75.6	0.6	239	75.7	0.6
40	75.9	0.9	140	75.7	0.7	240	75.7	0.7
41	75.0	0.0	141	75.2	0.2	241	75.6	0.7
42	75.0	0.0	142	75.0	0.0	242	75.6	0.6
43	75.2	0.2	143	75.2	0.2	243	75.4	0.6
44	75.2	0.2	144	75.2	0.2	244	75.6	0.4
45	75.2	0.2	145	75.2	0.2	245	75.6	0.6
46	75.2	0.2	146	75.2	0.2	246	75.6	0.6
47	75.4	0.4	147	75.4	0.4	247	75.7	0.6
48	75.6	0.6	148	75.6	0.6	248	75.9	0.7
49	75.2	0.2	149	75.6	0.6	249	75.7	0.9
50	75.7	0.7	150	75.7	0.7	250	76.1	0.7
51	74.8	-0.2	151	75.6	0.6	251	75.0	1.1
52	75.2	0.2	152	75.6	0.6	252	75.0	0.0
53	75.2	0.2	153	75.6	0.6	253	75.0	0.0
54	75.2	0.2	154	75.7	0.7	254	75.2	0.0

55	75.2	0.2	155	75.7	0.7	255	75.2	0.2			
56	75.2	0.2	156	75.7	0.7	256	75.2	0.2			
57	75.2	0.2	157	75.7	0.7	257	75.2	0.2			
58	75.4	0.4	158	75.7	0.7	258	75.4	0.2			
59	75.6	0.6	159	76.1	1.1	259	75.6	0.4			
60	75.7	0.7	160	76.3	1.3	260	75.9	0.6			
61	75.6	0.6	161	75.6	0.6	261	75.4	0.9			
62	75.4	0.4	162	75.7	0.7	262	75.4	0.4			
63	75.4	0.4	163	75.6	0.6	263	75.4	0.4			
64	75.4	0.4	164	75.7	0.7	264	75.4	0.4			
65	75.6	0.6	165	75.7	0.7	265	75.4	0.4			
66	75.6	0.6	166	75.7	0.7	266	75.4	0.4			
67	75.6	0.6	167	75.9	0.9	267	75.6	0.4			
68	75.7	0.7	168	75.9	0.9	268	75.7	0.6			
69	75.7	0.7	169	76.1	1.1	269	75.7	0.7			
70	75.9	0.9	170	76.3	1.3	270	75.7	0.7			
71	75.2	0.2	171	75.2	0.2	271	75.4	0.7			
72	75.2	0.2	172	75.2	0.2	272	75.2	0.4			
73	75.2	0.2	173	75.4	0.4	273	75.4	0.2			
74	75.2	0.2	174	75.4	0.4	274	75.4	0.4			
75	75.6	0.6	175	75.2	0.2	275	75.6	0.4			
76	75.6	0.6	176	75.4	0.4	276	75.6	0.6			
77	75.6	0.6	177	75.4	0.4	277	75.7	0.6			
78	75.6	0.6	178	75.6	0.6	278	75.7	0.7			
79	75.7	0.7	179	75.7	0.7	279	75.7	0.7			
80	75.9	0.9	180	75.9	0.9	280	75.9	0.7			
81	75.4	0.4	181	75.4	0.4	281	74.7	0.9			
82	75.4	0.4	182	75.4	0.4	282	74.8	-0.3			
83	75.6	0.6	183	75.4	0.4	283	75.0	-0.2			
84	75.6	0.6	184	75.6	0.6	284	74.8	0.0			
85	75.6	0.6	185	75.6	0.6	285	75.2	-0.2			
86	75.6	0.6	186	75.6	0.6	286	75.2	0.2			
87	75.6	0.6	187	75.7	0.7	287	75.2	0.2			
88	75.7	0.7	188	75.7	0.7	288	75.2	0.2			
89	75.7	0.7	189	75.7	0.7	289	75.4	0.2			
90	75.9	0.9	190	76.1	1.1	290	75.7	0.4			
91	75.4	0.4	191	75.0	0.0	291	74.8	0.7			
92	75.4	0.4	192	75.0	0.0	292	75.0	-0.2			
93	75.2	0.2	193	75.0	0.0	293	75.2	0.0			
94	75.2	0.2	194	75.2	0.2	294	75.2	0.2			
95	75.4	0.4	195	75.4	0.4	295	75.2	0.2			
96	75.4	0.4	196	75.4	0.4	296	75.2	0.2			
97	75.4	0.4	197	75.2	0.2	297	75.2	0.2			
98	75.7	0.7	198	75.4	0.4	298	75.6	0.2			
99	75.7	0.7	199	75.4	0.4	299	75.2	0.6			
100	75.9	0.9	200	75.7	0.7	300	75.7	0.2			

Range for 75°F Signal: **+1.3/-0.3**

Allowable range: ±1.8

Within specification for this temperature? Yes

Performed by: Mike Dey MD

Mgr. Fire Resistance — Title

3/11/05 — Date

Approved by:

President — Title

3/11/05 — Date

Channel Verification for Yokogawa 300 Channel

Serial No.: 48JF0082

Calibrator Used: T-207318

Temperature Setting (°F): 150.0

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	150.3	0.3	101	150.1	0.1	201	150.1	0.1
2	150.3	0.3	102	150.3	0.3	202	150.1	0.1
3	150.1	0.1	103	150.3	0.3	203	150.1	0.1
4	150.1	0.1	104	150.3	0.3	204	150.1	0.1
5	150.3	0.3	105	150.3	0.3	205	150.1	0.1
6	150.3	0.3	106	150.4	0.4	206	150.3	0.3
7	150.3	0.3	107	150.6	0.6	207	150.3	0.3
8	150.3	0.3	108	150.6	0.6	208	150.3	0.3
9	150.4	0.4	109	150.8	0.8	209	150.3	0.3
10	150.8	0.8	110	151.0	1.0	210	150.8	0.8
11	150.3	0.3	111	150.3	0.3	211	149.9	-0.1
12	150.3	0.3	112	150.3	0.3	212	149.9	-0.1
13	150.1	0.1	113	150.3	0.3	213	149.9	-0.1
14	150.3	0.3	114	150.3	0.3	214	149.9	-0.1
15	150.1	0.1	115	150.3	0.3	215	149.9	-0.1
16	150.3	0.3	116	150.4	0.4	216	150.3	0.3
17	150.3	0.3	117	150.4	0.4	217	150.3	0.3
18	150.3	0.3	118	150.6	0.6	218	150.3	0.3
19	150.3	0.3	119	150.8	0.8	219	150.4	0.4
20	150.6	0.6	120	151.0	1.0	220	150.8	0.8
21	150.3	0.3	121	150.6	0.6	221	149.7	-0.3
22	150.1	0.1	122	150.4	0.4	222	149.9	-0.1
23	150.1	0.1	123	150.4	0.4	223	149.9	-0.1
24	150.3	0.3	124	150.4	0.4	224	149.9	-0.1
25	150.3	0.3	125	150.4	0.4	225	150.1	0.1
26	150.4	0.4	126	150.4	0.4	226	150.1	0.1
27	150.4	0.4	127	150.6	0.6	227	150.1	0.1
28	150.4	0.4	128	150.6	0.6	228	150.3	0.3
29	150.6	0.6	129	150.6	0.6	229	150.3	0.3
30	150.8	0.8	130	150.8	0.8	230	150.8	0.8
31	150.4	0.4	131	149.9	-0.1	231	150.1	0.1
32	150.4	0.4	132	149.9	-0.1	232	150.1	0.1
33	150.4	0.4	133	149.9	-0.1	233	150.3	0.3
34	150.4	0.4	134	150.1	0.1	234	150.3	0.3
35	150.4	0.4	135	150.1	0.1	235	150.3	0.3
36	150.6	0.6	136	150.1	0.1	236	150.3	0.3
37	150.6	0.6	137	150.3	0.3	237	150.3	0.3
38	150.8	0.8	138	150.3	0.3	238	150.3	0.3
39	150.8	0.8	139	150.3	0.3	239	150.6	0.6
40	151.2	1.2	140	150.6	0.6	240	150.8	0.8
41	150.3	0.3	141	149.9	-0.1	241	150.6	0.6
42	150.3	0.3	142	150.1	0.1	242	150.4	0.4
43	150.1	0.1	143	150.1	0.1	243	150.6	0.6
44	150.3	0.3	144	150.1	0.1	244	150.4	0.4
45	150.3	0.3	145	150.3	0.3	245	150.8	0.8
46	150.3	0.3	146	150.3	0.3	246	150.8	0.8
47	150.3	0.3	147	150.3	0.3	247	150.8	0.8
48	150.4	0.4	148	150.4	0.4	248	150.8	0.8
49	150.4	0.4	149	150.4	0.4	249	150.8	0.8
50	150.6	0.6	150	150.6	0.6	250	151.2	1.2
51	149.9	-0.1	151	150.4	0.4	251	150.4	0.4
52	149.9	-0.1	152	150.4	0.4	252	150.8	0.8
53	150.1	0.1	153	150.4	0.4	253	149.7	-0.3
54	150.1	0.1	154	150.3	0.3	254	149.9	-0.1

55	150.3	0.3	155	150.4	0.4	255	149.9	-0.1
56	150.3	0.3	156	150.4	0.4	256	149.9	-0.1
57	150.3	0.3	157	150.4	0.4	257	150.1	0.1
58	150.4	0.4	158	150.6	0.6	258	150.1	0.1
59	150.6	0.6	159	150.8	0.8	259	150.1	0.1
60	150.8	0.8	160	151.0	1.0	260	150.3	0.3
61	150.4	0.4	161	150.3	0.3	261	150.3	0.3
62	150.3	0.3	162	150.3	0.3	262	150.8	0.8
63	150.3	0.3	163	150.3	0.3	263	150.8	0.8
64	150.3	0.3	164	150.3	0.3	264	149.9	-0.1
65	150.3	0.3	165	150.4	0.4	265	150.1	0.1
66	150.4	0.4	166	150.4	0.4	266	150.1	0.1
67	150.4	0.4	167	150.6	0.6	267	150.1	0.1
68	150.6	0.6	168	150.6	0.6	268	150.3	0.3
69	150.8	0.8	169	150.8	0.8	269	150.3	0.3
70	151.0	1.0	170	151.0	1.0	270	150.8	0.8
71	150.3	0.3	171	149.9	-0.1	271	150.8	0.8
72	150.3	0.3	172	149.9	-0.1	272	150.1	0.1
73	150.3	0.3	173	150.1	0.1	273	150.1	0.1
74	150.3	0.3	174	150.1	0.1	274	150.1	0.1
75	150.3	0.3	175	150.3	0.3	275	150.4	0.4
76	150.4	0.4	176	150.3	0.3	276	150.4	0.4
77	150.4	0.4	177	150.3	0.3	277	150.4	0.4
78	150.4	0.4	178	150.4	0.4	278	150.4	0.4
79	150.6	0.6	179	150.6	0.6	279	150.8	0.8
80	150.8	0.8	180	150.8	0.8	280	151.0	1.0
81	150.3	0.3	181	150.3	0.3	281	149.7	-0.3
82	150.1	0.1	182	150.3	0.3	282	149.7	-0.3
83	150.3	0.3	183	150.3	0.3	283	149.9	-0.1
84	150.3	0.3	184	150.3	0.3	284	149.9	-0.1
85	150.3	0.3	185	150.3	0.3	285	150.1	0.1
86	150.3	0.3	186	150.4	0.4	286	150.1	0.1
87	150.3	0.3	187	150.4	0.4	287	150.1	0.1
88	150.4	0.4	188	150.4	0.4	288	150.1	0.1
89	150.4	0.4	189	150.6	0.6	289	150.3	0.3
90	150.8	0.8	190	151.0	1.0	290	150.6	0.6
91	150.3	0.3	191	150.1	0.1	291	149.7	-0.3
92	150.3	0.3	192	150.1	0.1	292	149.7	-0.3
93	150.3	0.3	193	150.3	0.3	293	149.9	-0.1
94	150.4	0.4	194	150.3	0.3	294	150.1	0.1
95	150.4	0.4	195	150.3	0.3	295	150.1	0.1
96	150.4	0.4	196	150.3	0.3	296	150.1	0.1
97	150.4	0.4	197	150.4	0.4	297	150.1	0.1
98	150.4	0.4	198	150.4	0.4	298	150.3	0.3
99	150.4	0.4	199	150.6	0.6	299	150.3	0.3
100	150.8	0.8	200	150.8	0.8	300	150.8	0.8

Range for 150°F Signal: **+1.2/-0.3**

Allowable range: ±1.8

Within specification for this temperature? Yes

Performed by: Mike Dey MD

Mgr. Fire Resistance — Title

3/11/05 — Date

Approved by:

President — Title

3/11/05 — Date

Channel Verification for Yokogawa 300 Channel

Serial No.: 48JF0082

Calibrator Used: T-207318

Temperature Setting (°F): 300.0

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	300.2	0.2	101	299.8	-0.2	201	300.0	0.0
2	300.2	0.2	102	299.8	-0.2	202	300.0	0.0
3	300.0	0.0	103	300.2	0.2	203	300.0	0.0
4	300.2	0.2	104	300.2	0.2	204	300.2	0.2
5	300.2	0.2	105	300.2	0.2	205	300.2	0.2
6	300.2	0.2	106	300.2	0.2	206	300.2	0.2
7	300.2	0.2	107	300.2	0.2	207	300.4	0.4
8	300.4	0.4	108	300.4	0.4	208	300.4	0.4
9	300.6	0.6	109	300.4	0.4	209	300.6	0.6
10	300.7	0.7	110	300.7	0.7	210	300.7	0.7
11	300.2	0.2	111	300.0	0.0	211	299.8	-0.2
12	300.2	0.2	112	300.0	0.0	212	299.8	-0.2
13	300.2	0.2	113	300.2	0.2	213	300.0	0.0
14	300.2	0.2	114	300.2	0.2	214	300.0	0.0
15	300.2	0.2	115	300.2	0.2	215	300.0	0.0
16	300.2	0.2	116	300.2	0.2	216	300.2	0.2
17	300.2	0.2	117	300.4	0.4	217	300.2	0.2
18	300.2	0.2	118	300.4	0.4	218	300.2	0.2
19	300.4	0.4	119	300.6	0.6	219	300.2	0.2
20	300.6	0.6	120	300.7	0.7	220	300.6	0.6
21	300.2	0.2	121	300.4	0.4	221	299.5	-0.5
22	300.2	0.2	122	300.2	0.2	222	299.7	-0.3
23	300.2	0.2	123	300.2	0.2	223	299.7	-0.3
24	300.2	0.2	124	300.2	0.2	224	299.7	-0.3
25	300.2	0.2	125	300.4	0.4	225	300.0	0.0
26	300.4	0.4	126	300.4	0.4	226	300.2	0.2
27	300.6	0.6	127	300.6	0.6	227	300.2	0.2
28	300.2	0.2	128	300.7	0.7	228	300.2	0.2
29	300.2	0.2	129	300.7	0.7	229	300.4	0.4
30	300.2	0.2	130	300.9	0.9	230	300.7	0.7
31	300.2	0.2	131	300.0	0.0	231	300.0	0.0
32	300.6	0.6	132	299.8	-0.2	232	300.0	0.0
33	300.4	0.4	133	299.8	-0.2	233	299.8	-0.2
34	300.6	0.6	134	300.0	0.0	234	300.0	0.0
35	300.6	0.6	135	300.0	0.0	235	300.0	0.0
36	300.6	0.6	136	300.2	0.2	236	300.2	0.2
37	300.4	0.4	137	300.2	0.2	237	300.2	0.2
38	300.6	0.6	138	300.2	0.2	238	300.2	0.2
39	300.7	0.7	139	300.2	0.2	239	300.6	0.6
40	301.1	1.1	140	300.6	0.6	240	300.7	0.7
41	300.2	0.2	141	299.8	-0.2	241	300.2	0.2
42	300.2	0.2	142	299.8	-0.2	242	300.2	0.2
43	300.2	0.2	143	300.0	0.0	243	300.2	0.2
44	300.2	0.2	144	300.0	0.0	244	300.2	0.2
45	300.2	0.2	145	300.0	0.0	245	300.4	0.4
46	300.2	0.2	146	300.0	0.0	246	300.4	0.4
47	300.2	0.2	147	300.2	0.2	247	300.6	0.6
48	300.4	0.4	148	300.2	0.2	248	300.7	0.7
49	300.6	0.6	149	300.4	0.4	249	300.7	0.7
50	300.7	0.7	150	300.6	0.6	250	301.3	1.3
51	299.8	-0.2	151	300.4	0.4	251	300.2	0.2
52	299.8	-0.2	152	300.4	0.4	252	300.0	0.0
53	299.8	-0.2	153	300.4	0.4	253	300.2	0.2
54	300.0	0.0	154	300.4	0.4	254	300.2	0.2
55	300.0	0.0	155	300.6	0.6	255	300.2	0.2
56	300.2	0.2	156	300.4	0.4	256	300.2	0.2

57	300.2	0.2	157	300.6	0.6	257	300.2	0.2			
58	300.2	0.2	158	300.7	0.7	258	300.2	0.2			
59	300.4	0.4	159	300.7	0.7	259	300.4	0.4			
60	300.7	0.7	160	301.1	1.1	260	300.7	0.7			
61	300.2	0.2	161	300.4	0.4	261	300.0	0.0			
62	300.2	0.2	162	300.4	0.4	262	300.2	0.2			
63	300.2	0.2	163	300.4	0.4	263	300.2	0.2			
64	300.2	0.2	164	300.4	0.4	264	300.2	0.2			
65	300.4	0.4	165	300.4	0.4	265	300.2	0.2			
66	300.4	0.4	166	300.6	0.6	266	300.2	0.2			
67	300.6	0.6	167	300.6	0.6	267	300.4	0.4			
68	300.6	0.6	168	300.7	0.7	268	300.6	0.6			
69	300.7	0.7	169	300.7	0.7	269	300.7	0.7			
70	300.7	0.7	170	301.3	1.3	270	301.1	1.1			
71	300.2	0.2	171	300.0	0.0	271	300.2	0.2			
72	300.2	0.2	172	300.0	0.0	272	300.0	0.0			
73	300.2	0.2	173	300.2	0.2	273	300.2	0.2			
74	300.2	0.2	174	300.2	0.2	274	300.2	0.2			
75	300.4	0.4	175	300.2	0.2	275	300.2	0.2			
76	300.4	0.4	176	300.2	0.2	276	300.2	0.2			
77	300.4	0.4	177	300.2	0.2	277	300.4	0.4			
78	300.4	0.4	178	300.2	0.2	278	300.4	0.4			
79	300.7	0.7	179	300.4	0.4	279	300.4	0.4			
80	300.9	0.9	180	300.7	0.7	280	300.7	0.7			
81	300.2	0.2	181	300.4	0.4	281	299.7	-0.3			
82	300.2	0.2	182	300.2	0.2	282	299.8	-0.2			
83	300.4	0.4	183	300.2	0.2	283	299.7	-0.3			
84	300.4	0.4	184	300.2	0.2	284	299.8	-0.2			
85	300.4	0.4	185	300.4	0.4	285	300.0	0.0			
86	300.4	0.4	186	300.4	0.4	286	300.2	0.2			
87	300.6	0.6	187	300.6	0.6	287	300.2	0.2			
88	300.6	0.6	188	300.6	0.6	288	300.2	0.2			
89	300.7	0.7	189	300.7	0.7	289	300.4	0.4			
90	300.9	0.9	190	301.1	1.1	290	300.7	0.7			
91	300.2	0.2	191	300.2	0.2	291	299.7	-0.3			
92	300.2	0.2	192	300.2	0.2	292	299.8	-0.2			
93	300.2	0.2	193	300.2	0.2	293	300.0	0.0			
94	300.2	0.2	194	300.2	0.2	294	300.0	0.0			
95	300.2	0.2	195	300.2	0.2	295	300.0	0.0			
96	300.2	0.2	196	300.2	0.2	296	300.2	0.2			
97	300.4	0.4	197	300.4	0.4	297	300.2	0.2			
98	300.6	0.6	198	300.4	0.4	298	300.4	0.4			
99	300.4	0.4	199	300.6	0.6	299	300.4	0.4			
100	300.7	0.7	200	300.7	0.7	300	300.7	0.7			

Range for 300°F Signal: **+1.3/-0.5**

Allowable range ±1.9

Within specification for this temperature? Yes

Performed by: Mike Dey MD

Mgr. Fire Resistance — Title

3/11/05 — Date

Approved by: [signature]

President — Title

3/11/05 — Date

Channel Verification for Yokogawa 300 Channel

Serial No.: 48JF0082

Calibrator Used: T-207318

Temperature Setting (°F): 400.0

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	400.3	0.3	101	400.1	0.1	201	400.3	0.3
2	400.3	0.3	102	400.3	0.3	202	400.3	0.3
3	400.1	0.1	103	400.3	0.3	203	400.3	0.3
4	400.1	0.1	104	400.3	0.3	204	400.3	0.3
5	400.1	0.1	105	400.3	0.3	205	400.3	0.3
6	400.3	0.3	106	400.3	0.3	206	400.5	0.5
7	400.3	0.3	107	400.3	0.3	207	400.6	0.6
8	400.3	0.3	108	400.3	0.3	208	400.8	0.8
9	400.3	0.3	109	400.5	0.5	209	400.8	0.8
10	400.6	0.6	110	400.6	0.6	210	400.8	0.8
11	400.1	0.1	111	400.1	0.1	211	399.9	-0.1
12	400.1	0.1	112	400.3	0.3	212	400.1	0.1
13	399.9	-0.1	113	400.3	0.3	213	400.1	0.1
14	400.1	0.1	114	400.3	0.3	214	400.1	0.1
15	400.1	0.1	115	400.5	0.5	215	400.1	0.1
16	400.1	0.1	116	400.6	0.6	216	400.3	0.3
17	400.1	0.1	117	400.6	0.6	217	400.3	0.3
18	400.3	0.3	118	400.8	0.8	218	400.3	0.3
19	400.3	0.3	119	400.8	0.8	219	400.3	0.3
20	400.5	0.5	120	400.8	0.8	220	400.6	0.6
21	400.1	0.1	121	400.5	0.5	221	399.7	-0.3
22	400.1	0.1	122	400.5	0.5	222	399.9	-0.1
23	400.3	0.3	123	400.3	0.3	223	400.1	0.1
24	400.3	0.3	124	400.3	0.3	224	400.1	0.1
25	400.5	0.5	125	400.3	0.3	225	400.1	0.1
26	400.1	0.1	126	400.3	0.3	226	400.1	0.1
27	400.1	0.1	127	400.5	0.5	227	400.3	0.3
28	400.3	0.3	128	400.6	0.6	228	400.3	0.3
29	400.3	0.3	129	400.8	0.8	229	400.5	0.5
30	400.3	0.3	130	401.0	1.0	230	400.6	0.6
31	400.5	0.5	131	399.9	-0.1	231	400.3	0.3
32	400.3	0.3	132	399.9	-0.1	232	400.1	0.1
33	400.3	0.3	133	399.9	-0.1	233	400.3	0.3
34	400.3	0.3	134	399.9	-0.1	234	400.3	0.3
35	400.3	0.3	135	399.9	-0.1	235	400.3	0.3
36	400.5	0.5	136	399.9	-0.1	236	400.3	0.3
37	400.5	0.5	137	399.9	-0.1	237	400.5	0.5
38	400.6	0.6	138	400.1	0.1	238	400.5	0.5
39	400.8	0.8	139	400.3	0.3	239	400.6	0.6
40	400.8	0.8	140	400.5	0.5	240	400.8	0.8
41	399.9	-0.1	141	399.7	-0.3	241	400.3	0.3
42	399.9	-0.1	142	399.7	-0.3	242	400.3	0.3
43	399.9	-0.1	143	399.9	-0.1	243	400.3	0.3
44	400.1	0.1	144	399.9	-0.1	244	400.3	0.3
45	400.1	0.1	145	399.9	-0.1	245	400.3	0.3
46	400.1	0.1	146	400.1	0.1	246	400.5	0.5
47	400.1	0.1	147	400.1	0.1	247	400.6	0.6
48	400.3	0.3	148	400.3	0.3	248	400.6	0.6
49	400.3	0.3	149	400.3	0.3	249	401.2	1.2
50	400.6	0.6	150	400.6	0.6	250	401.2	1.2
51	399.7	-0.3	151	400.5	0.5	251	400.1	0.1
52	399.9	-0.1	152	400.3	0.3	252	400.1	0.1
53	400.1	0.1	153	400.3	0.3	253	400.1	0.1
54	400.1	0.1	154	400.5	0.5	254	400.3	0.3

55	400.1	0.1	155	400.5	0.5	255	400.3	0.3			
56	400.3	0.3	156	400.6	0.6	256	400.3	0.3			
57	400.3	0.3	157	400.6	0.6	257	400.5	0.5			
58	400.3	0.3	158	400.6	0.6	258	400.6	0.6			
59	400.5	0.5	159	400.6	0.6	259	400.6	0.6			
60	400.6	0.6	160	400.8	0.8	260	400.8	0.8			
61	400.6	0.6	161	400.3	0.3	261	400.3	0.3			
62	400.3	0.3	162	400.3	0.3	262	400.3	0.3			
63	400.3	0.3	163	400.3	0.3	263	400.3	0.3			
64	400.3	0.3	164	400.3	0.3	264	400.3	0.3			
65	400.3	0.3	165	400.5	0.5	265	400.3	0.3			
66	400.3	0.3	166	400.6	0.6	266	400.3	0.3			
67	400.5	0.5	167	400.6	0.6	267	400.5	0.5			
68	400.6	0.6	168	400.8	0.8	268	400.6	0.6			
69	400.8	0.8	169	400.8	0.8	269	400.8	0.8			
70	400.8	0.8	170	401.0	1.0	270	400.8	0.8			
71	400.3	0.3	171	399.7	-0.3	271	400.3	0.3			
72	400.3	0.3	172	399.9	-0.1	272	400.3	0.3			
73	400.3	0.3	173	399.9	-0.1	273	400.3	0.3			
74	400.5	0.5	174	400.1	0.1	274	400.3	0.3			
75	400.3	0.3	175	400.3	0.3	275	400.5	0.5			
76	400.3	0.3	176	400.3	0.3	276	400.5	0.5			
77	400.5	0.5	177	400.3	0.3	277	400.5	0.5			
78	400.6	0.6	178	400.3	0.3	278	400.6	0.6			
79	400.6	0.6	179	400.6	0.6	279	400.6	0.6			
80	401.0	1.0	180	400.8	0.8	280	400.8	0.8			
81	400.3	0.3	181	400.5	0.5	281	399.6	-0.4			
82	400.3	0.3	182	400.3	0.3	282	399.6	-0.4			
83	400.5	0.5	183	400.3	0.3	283	399.7	-0.3			
84	400.5	0.5	184	400.5	0.5	284	399.9	-0.1			
85	400.5	0.5	185	400.5	0.5	285	399.9	-0.1			
86	400.5	0.5	186	400.6	0.6	286	400.1	0.1			
87	400.6	0.6	187	400.6	0.6	287	400.3	0.3			
88	400.6	0.6	188	400.8	0.8	288	400.3	0.3			
89	400.8	0.8	189	400.8	0.8	289	400.3	0.3			
90	400.8	0.8	190	401.2	1.2	290	400.6	0.6			
91	400.5	0.5	191	400.3	0.3	291	399.7	-0.3			
92	400.3	0.3	192	400.3	0.3	292	399.7	-0.3			
93	400.3	0.3	193	400.3	0.3	293	399.7	-0.3			
94	400.3	0.3	194	400.3	0.3	294	399.9	-0.1			
95	400.3	0.3	195	400.3	0.3	295	399.9	-0.1			
96	400.5	0.5	196	400.3	0.3	296	400.1	0.1			
97	400.5	0.5	197	400.5	0.5	297	400.3	0.3			
98	400.8	0.8	198	400.6	0.6	298	400.3	0.3			
99	400.8	0.8	199	400.6	0.6	299	400.3	0.3			
100	401.0	1.0	200	400.8	0.8	300	400.6	0.6			

Range for 400°F Signal: +1.2/-0.4

Allowable range: ±2.0

Within specification for this temperature? Yes

Performed by: Mike Dey (mi)

Mgr. Fire Resistance — Title

3/11/05 — Date

Approved by:

President — Title

3/11/05 — Date

Channel Verification for Yokogawa 300 Channel

Serial No.: 48JF0082

Calibrator Used: T-207318

Temperature Setting (°F): 1000.0

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	999.0	-1.0	101	1000.0	0.0	201	1000.4	0.4
2	999.0	-1.0	102	1000.0	0.0	202	1000.4	0.4
3	999.0	-1.0	103	1000.0	0.0	203	1000.4	0.4
4	999.5	-0.5	104	1000.2	0.2	204	1000.4	0.4
5	999.7	-0.3	105	1000.4	0.4	205	1000.4	0.4
6	999.7	-0.3	106	1000.4	0.4	206	1000.4	0.4
7	999.9	-0.1	107	1000.6	0.6	207	1000.6	0.6
8	1000.0	0.0	108	1000.6	0.6	208	1000.6	0.6
9	1000.2	0.2	109	1000.6	0.6	209	1000.8	0.8
10	1000.6	0.6	110	1000.9	0.9	210	1000.9	0.9
11	999.9	-0.1	111	1000.2	0.2	211	1000.0	0.0
12	999.7	-0.3	112	1000.4	0.4	212	1000.0	0.0
13	999.9	-0.1	113	1000.4	0.4	213	1000.0	0.0
14	999.9	-0.1	114	1000.4	0.4	214	1000.2	0.2
15	999.9	-0.1	115	1000.6	0.6	215	1000.2	0.2
16	999.7	-0.3	116	1000.6	0.6	216	1000.2	0.2
17	999.9	-0.1	117	1000.6	0.6	217	1000.2	0.2
18	999.9	-0.1	118	1000.8	0.8	218	1000.4	0.4
19	1000.0	0.0	119	1000.9	0.9	219	1000.6	0.6
20	1000.0	0.0	120	1000.9	0.9	220	1000.6	0.6
21	999.9	-0.1	121	1000.6	0.6	221	999.9	-0.1
22	999.7	-0.3	122	1000.4	0.4	222	1000.0	0.0
23	999.7	-0.3	123	1000.2	0.2	223	1000.0	0.0
24	999.9	-0.1	124	1000.4	0.4	224	1000.0	0.0
25	999.9	-0.1	125	1000.6	0.6	225	1000.0	0.0
26	999.7	-0.3	126	1000.6	0.6	226	1000.0	0.0
27	999.9	-0.1	127	1000.6	0.6	227	1000.0	0.0
28	999.9	-0.1	128	1000.6	0.6	228	1000.2	0.2
29	1000.0	0.0	129	1000.8	0.8	229	1000.4	0.4
30	1000.0	0.0	130	1000.9	0.9	230	1000.6	0.6
31	1000.0	0.0	131	1000.0	0.0	231	1000.0	0.0
32	1000.0	0.0	132	1000.0	0.0	232	1000.2	0.2
33	1000.2	0.2	133	1000.0	0.0	233	1000.4	0.4
34	1000.4	0.4	134	1000.0	0.0	234	1000.4	0.4
35	1000.4	0.4	135	1000.0	0.0	235	1000.6	0.6
36	1000.4	0.4	136	1000.0	0.0	236	1000.6	0.6
37	1000.6	0.6	137	1000.2	0.2	237	1000.6	0.6
38	1000.6	0.6	138	1000.4	0.4	238	1000.9	0.9
39	1000.6	0.6	139	1000.4	0.4	239	1000.4	0.4
40	1000.9	0.9	140	1000.6	0.6	240	1000.2	0.2
41	1000.0	0.0	141	1000.0	0.0	241	1000.2	0.2
42	999.9	-0.1	142	1000.0	0.0	242	1000.2	0.2
43	1000.0	0.0	143	1000.0	0.0	243	1000.2	0.2
44	1000.0	0.0	144	1000.0	0.0	244	1000.4	0.4
45	1000.0	0.0	145	1000.0	0.0	245	1000.4	0.4
46	1000.0	0.0	146	1000.0	0.0	246	1000.2	0.2
47	1000.0	0.0	147	1000.2	0.2	247	1000.2	0.2
48	1000.2	0.2	148	1000.6	0.6	248	1000.2	0.2
49	1000.6	0.6	149	1000.6	0.6	249	1000.8	0.8
50	1000.6	0.6	150	1000.6	0.6	250	1001.1	1.1
51	999.7	-0.3	151	1000.4	0.4	251	1000.2	0.2
52	999.9	-0.1	152	1000.4	0.4	252	1000.2	0.2
53	1000.0	0.0	153	1000.4	0.4	253	1000.4	0.4
54	1000.0	0.0	154	1000.2	0.2	254	1000.4	0.4
55	1000.0	0.0	155	1000.4	0.4	255	1000.4	0.4
56	1000.2	0.2	156	1000.4	0.4	256	1000.4	0.4

57	1000.2	0.2	157	1000.4	0.4	257	1000.4	0.4			
58	1000.4	0.4	158	1000.6	0.6	258	1000.6	0.6			
59	1000.4	0.4	159	1000.6	0.6	259	1000.6	0.6			
60	1000.6	0.6	160	1000.9	0.9	260	1000.8	0.8			
61	1000.6	0.6	161	1000.4	0.4	261	1000.0	0.0			
62	1000.4	0.4	162	1000.4	0.4	262	1000.0	0.0			
63	1000.4	0.4	163	1000.4	0.4	263	1000.2	0.2			
64	1000.4	0.4	164	1000.6	0.6	264	1000.2	0.2			
65	1000.4	0.4	165	1000.6	0.6	265	1000.4	0.4			
66	1000.6	0.6	166	1000.6	0.6	266	1000.4	0.4			
67	1000.6	0.6	167	1000.6	0.6	267	1000.6	0.6			
68	1000.6	0.6	168	1000.6	0.6	268	1000.6	0.6			
69	1000.9	0.9	169	1000.6	0.6	269	1000.6	0.6			
70	1000.9	0.9	170	1000.9	0.9	270	1000.9	0.9			
71	1000.6	0.6	171	999.9	-0.1	271	1000.0	0.0			
72	1000.4	0.4	172	1000.0	0.0	272	1000.0	0.0			
73	1000.6	0.6	173	1000.0	0.0	273	1000.0	0.0			
74	1000.4	0.4	174	1000.2	0.2	274	1000.0	0.0			
75	1000.8	0.8	175	1000.2	0.2	275	1000.0	0.0			
76	1000.6	0.6	176	1000.4	0.4	276	1000.0	0.0			
77	1000.8	0.8	177	1000.6	0.6	277	1000.2	0.2			
78	1000.8	0.8	178	1000.6	0.6	278	1000.2	0.2			
79	1000.9	0.9	179	1000.6	0.6	279	1000.6	0.6			
80	1000.9	0.9	180	1000.9	0.9	280	1000.8	0.8			
81	1000.4	0.4	181	1000.6	0.6	281	999.7	-0.3			
82	1000.4	0.4	182	1000.6	0.6	282	999.7	-0.3			
83	1000.4	0.4	183	1000.6	0.6	283	999.7	-0.3			
84	1000.4	0.4	184	1000.6	0.6	284	999.9	-0.1			
85	1000.6	0.6	185	1000.6	0.6	285	999.9	-0.1			
86	1000.6	0.6	186	1000.8	0.8	286	999.9	-0.1			
87	1000.6	0.6	187	1000.6	0.6	287	1000.0	0.0			
88	1000.6	0.6	188	1000.8	0.8	288	1000.0	0.0			
89	1000.9	0.9	189	1000.9	0.9	289	1000.0	0.0			
90	1000.9	0.9	190	1001.3	1.3	290	1000.4	0.4			
91	1000.4	0.4	191	1000.6	0.6	291	999.7	-0.3			
92	1000.4	0.4	192	1000.4	0.4	292	999.7	-0.3			
93	1000.6	0.6	193	1000.6	0.6	293	999.9	-0.1			
94	1000.6	0.6	194	1000.6	0.6	294	1000.0	0.0			
95	1000.6	0.6	195	1000.6	0.6	295	1000.0	0.0			
96	1000.6	0.6	196	1000.6	0.6	296	1000.0	0.0			
97	1000.6	0.6	197	1000.8	0.8	297	1000.0	0.0			
98	1000.6	0.6	198	1000.9	0.9	298	1000.2	0.2			
99	1000.6	0.6	199	1000.9	0.9	299	1000.0	0.0			
100	1000.9	0.9	200	1001.1	1.1	300	1000.4	0.4			

Range for 1000°F Signal: **+1.3/-1**

Allowable range: ±2.3

Within specification for this temperature? Yes

Performed by: Mike Dey MD

Mgr. Fire Resistance — 3/11/05

Title — Date

Approved by:

President — 3/11/05

Title — Date

Channel Verification for Yokogawa 300 Channel

Serial No.: 48JF0082

Calibrator Used: T-207318

Temperature Setting (°F): 2000.0

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	1999.8	-0.2	101	2000.7	0.7	201	2000.7	0.7
2	1999.8	-0.2	102	2000.7	0.7	202	2000.7	0.7
3	1999.6	-0.4	103	2000.7	0.7	203	2000.7	0.7
4	1999.6	-0.4	104	2000.7	0.7	204	2000.7	0.7
5	1999.6	-0.4	105	2000.7	0.7	205	2000.8	0.8
6	1999.8	-0.2	106	2000.7	0.7	206	2001.0	1.0
7	1999.8	-0.2	107	2000.8	0.8	207	2001.0	1.0
8	1999.8	-0.2	108	2000.8	0.8	208	2001.0	1.0
9	1999.9	-0.1	109	2001.0	1.0	209	2001.4	1.4
10	2000.3	0.3	110	2001.0	1.0	210	2001.4	1.4
11	1999.6	-0.4	111	2000.7	0.7	211	2000.7	0.7
12	1999.6	-0.4	112	2000.7	0.7	212	2000.7	0.7
13	1999.4	-0.6	113	2000.7	0.7	213	2000.7	0.7
14	1999.8	-0.2	114	2000.8	0.8	214	2000.7	0.7
15	1999.8	-0.2	115	2000.8	0.8	215	2000.7	0.7
16	1999.8	-0.2	116	2001.0	1.0	216	2000.7	0.7
17	1999.8	-0.2	117	2001.0	1.0	217	2000.7	0.7
18	1999.8	-0.2	118	2001.2	1.2	218	2000.7	0.7
19	1999.8	-0.2	119	2001.4	1.4	219	2000.8	0.8
20	1999.9	-0.1	120	2001.6	1.6	220	2001.0	1.0
21	1999.4	-0.6	121	2000.7	0.7	221	2000.3	0.3
22	1999.4	-0.6	122	2000.7	0.7	222	2000.3	0.3
23	1999.4	-0.6	123	2000.5	0.5	223	2000.5	0.5
24	1999.6	-0.4	124	2000.7	0.7	224	2000.5	0.5
25	1999.8	-0.2	125	2000.7	0.7	225	2000.5	0.5
26	1999.8	-0.2	126	2000.7	0.7	226	2000.5	0.5
27	1999.8	-0.2	127	2000.8	0.8	227	2000.7	0.7
28	1999.9	-0.1	128	2001.0	1.0	228	2000.7	0.7
29	1999.4	-0.6	129	2001.0	1.0	229	2000.8	0.8
30	1999.4	-0.6	130	2001.4	1.4	230	2001.0	1.0
31	2000.5	0.5	131	2000.5	0.5	231	2000.7	0.7
32	2000.5	0.5	132	2000.3	0.3	232	2000.7	0.7
33	2000.5	0.5	133	2000.3	0.3	233	2000.8	0.8
34	2000.3	0.3	134	2000.3	0.3	234	2000.8	0.8
35	2000.5	0.5	135	2000.3	0.3	235	2000.8	0.8
36	2000.5	0.5	136	2000.3	0.3	236	2001.0	1.0
37	2000.7	0.7	137	2000.3	0.3	237	2001.0	1.0
38	2000.7	0.7	138	2000.5	0.5	238	2001.0	1.0
39	2000.7	0.7	139	2000.7	0.7	239	2001.0	1.0
40	2001.0	1.0	140	2000.8	0.8	240	2001.4	1.4
41	2000.1	0.1	141	2000.1	0.1	241	2000.7	0.7
42	2000.3	0.3	142	2000.1	0.1	242	2000.7	0.7
43	2000.1	0.1	143	2000.3	0.3	243	2000.3	0.3
44	2000.5	0.5	144	2000.5	0.5	244	2000.5	0.5
45	2000.5	0.5	145	2000.5	0.5	245	2000.7	0.7
46	2000.5	0.5	146	2000.5	0.5	246	2000.7	0.7
47	2000.5	0.5	147	2000.5	0.5	247	2000.7	0.7
48	2000.5	0.5	148	2000.7	0.7	248	2000.8	0.8
49	2000.5	0.5	149	2000.7	0.7	249	2001.0	1.0
50	2000.7	0.7	150	2001.0	1.0	250	2001.2	1.2
51	1999.9	-0.1	151	2000.5	0.5	251	2000.1	0.1
52	1999.9	-0.1	152	2000.5	0.5	252	1999.9	-0.1
53	1999.9	-0.1	153	2000.3	0.3	253	1999.9	-0.1
54	1999.9	-0.1	154	2000.5	0.5	254	2000.1	0.1
55	2000.1	0.1	155	2000.7	0.7	255	2000.1	0.1
56	2000.3	0.3	156	2000.7	0.7	256	2000.3	0.3

57	2000.5	0.5	157	2000.7	0.7	257	2000.3	0.3			
58	2000.7	0.7	158	2000.7	0.7	258	2000.7	0.7			
59	2000.7	0.7	159	2001.0	1.0	259	2000.7	0.7			
60	2000.8	0.8	160	2001.2	1.2	260	2000.8	0.8			
61	2000.8	0.8	161	2000.7	0.7	261	2000.1	0.1			
62	2000.7	0.7	162	2000.7	0.7	262	2000.1	0.1			
63	2000.7	0.7	163	2000.7	0.7	263	2000.1	0.1			
64	2000.7	0.7	164	2000.7	0.7	264	2000.1	0.1			
65	2000.7	0.7	165	2000.7	0.7	265	2000.1	0.1			
66	2000.7	0.7	166	2000.7	0.7	266	2000.3	0.3			
67	2000.8	0.8	167	2000.7	0.7	267	2000.3	0.3			
68	2001.0	1.0	168	2000.8	0.8	268	2000.5	0.5			
69	2001.0	1.0	169	2001.0	1.0	269	2000.7	0.7			
70	2001.4	1.4	170	2001.2	1.2	270	2001.0	1.0			
71	2000.7	0.7	171	2000.1	0.1	271	1999.9	-0.1			
72	2000.8	0.8	172	2000.1	0.1	272	1999.9	-0.1			
73	2000.8	0.8	173	2000.3	0.3	273	1999.9	-0.1			
74	2001.0	1.0	174	2000.3	0.3	274	1999.9	-0.1			
75	2000.8	0.8	175	2000.5	0.5	275	1999.9	-0.1			
76	2001.0	1.0	176	2000.5	0.5	276	2000.1	0.1			
77	2000.8	0.8	177	2000.5	0.5	277	1999.9	-0.1			
78	2001.0	1.0	178	2000.7	0.7	278	2000.1	0.1			
79	2001.0	1.0	179	2000.8	0.8	279	2000.3	0.3			
80	2001.4	1.4	180	2001.0	1.0	280	2000.7	0.7			
81	2000.7	0.7	181	2001.2	1.2	281	1999.2	-0.8			
82	2000.7	0.7	182	2001.0	1.0	282	1999.2	-0.8			
83	2000.8	0.8	183	2001.0	1.0	283	1999.4	-0.6			
84	2000.8	0.8	184	2001.2	1.2	284	1999.4	-0.6			
85	2000.8	0.8	185	2001.2	1.2	285	1999.6	-0.4			
86	2001.0	1.0	186	2001.2	1.2	286	1999.6	-0.4			
87	2001.0	1.0	187	2001.4	1.4	287	1999.6	-0.4			
88	2000.8	0.8	188	2001.4	1.4	288	1999.6	-0.4			
89	2001.0	1.0	189	2001.6	1.6	289	1999.9	-0.1			
90	2001.2	1.2	190	2001.7	1.7	290	1999.9	-0.1			
91	2000.7	0.7	191	2001.0	1.0	291	1999.2	-0.8			
92	2000.7	0.7	192	2001.0	1.0	292	1999.2	-0.8			
93	2000.7	0.7	193	2001.0	1.0	293	1999.2	-0.8			
94	2000.7	0.7	194	2001.0	1.0	294	1999.4	-0.6			
95	2000.7	0.7	195	2001.0	1.0	295	1999.6	-0.4			
96	2000.7	0.7	196	2001.2	1.2	296	1999.6	-0.4			
97	2000.8	0.8	197	2001.4	1.4	297	1999.8	-0.2			
98	2001.0	1.0	198	2001.4	1.4	298	1999.9	-0.1			
99	2001.0	1.0	199	2001.4	1.4	299	1999.9	-0.1			
100	2001.4	1.4	200	2001.6	1.6	300	2000.3	0.3			

Range for 2000°F Signal: **+1.7/-0.8**

Allowable range: ±2.8

Within specification for this temperature? Yes

Performed by: Mike Dey MD

Mgr. Fire Resistance — Title

3/11/05 — Date

Approved by:

President — Title

3/11/05 — Date

Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, Texas 78112
800-966-5253 FAX 210-635-8101

Certificate of Verification

Certification No.: 92145

Verification Date: 03/11/2005

Reverification Date: 09/11/2005

Manufacturer: Yokogawa

Model No.: 100 Channel DAU

Serial No.: 99LE004

Equipment Description: 100 Channel Data Acquisition System with YOKOGAWA Darwin Series

Verification Sources: TEGAM Model 840-A, SN: T-207318. Calibration due 05/03/2005

PERFORMANCE:

Temperature: (75°F) +1.3/-0.2	Temperature: (150°F) +1.3/-0.1	Temperature: (300°F) +1.3/-0.3	Temperature: (400°F) +1/-0.3	Temperature: (1000°F) ++1.1/-0.3	Temperature: (2000°F) +1.2/-0.2

Verification Performed by:

Mike Dey
Manager of Fire Resistance

Verification Approved by:

Deg Priest
President/Chief Technical Officer

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-004

Within specs? Yes/No

Calibrator Used: T-207318

Performed by: Mike Dey MD

Title: Mgr. Dept. 2

Temperature Setting (°F): 75.0

Approved by: DP

Title: President

Date: 3/11/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	75.7	0.7	51	75.0	0.0
2	75.7	0.7	52	75.2	0.2
3	75.7	0.7	53	75.0	0.0
4	75.7	0.7	54	75.0	0.0
5	75.7	0.7	55	75.2	0.2
6	75.9	0.9	56	75.2	0.2
7	75.7	0.7	57	75.2	0.2
8	75.7	0.7	58	75.2	0.2
9	75.9	0.9	59	75.4	0.4
10	76.3	1.3	60	75.4	0.4
11	75.6	0.6	61	75.7	0.7
12	75.4	0.4	62	75.4	0.4
13	75.4	0.4	63	75.4	0.4
14	75.2	0.2	64	75.4	0.4
15	75.4	0.4	65	75.4	0.4
16	75.6	0.6	66	75.4	0.4
17	75.2	0.2	67	75.6	0.6
18	75.4	0.4	68	75.6	0.6
19	75.7	0.7	69	75.7	0.7
20	75.9	0.9	70	76.1	1.1
21	75.7	0.7	71	75.4	0.4
22	75.6	0.6	72	75.2	0.2
23	75.4	0.4	73	75.2	0.2
24	75.6	0.6	74	75.2	0.2
25	75.6	0.6	75	75.2	0.2
26	75.6	0.6	76	75.2	0.2
27	75.7	0.7	77	75.4	0.4
28	75.7	0.7	78	75.4	0.4
29	75.7	0.7	79	75.4	0.4
30	76.1	1.1	80	75.7	0.7
31	75.6	0.6	81	75.4	0.4
32	75.6	0.6	82	75.2	0.2
33	75.4	0.4	83	75.2	0.2
34	75.4	0.4	84	75.2	0.2
35	75.6	0.6	85	75.2	0.2
36	75.4	0.4	86	75.4	0.4
37	75.4	0.4	87	75.4	0.4
38	75.6	0.6	88	75.6	0.6
39	75.7	0.7	89	75.6	0.6
40	75.7	0.7	90	75.7	0.7
41	75.6	0.6	91	74.8	-0.2
42	75.4	0.4	92	75.0	0.0
43	75.2	0.2	93	74.8	-0.2
44	75.2	0.2	94	74.8	-0.2
45	75.4	0.4	95	75.2	0.2
46	75.4	0.4	96	75.0	0.0
47	75.4	0.4	97	75.2	0.2
48	75.6	0.6	98	75.2	0.2
49	75.7	0.7	99	75.2	0.2
50	75.7	0.7	100	75.2	0.2

Range of 75°F Readings: +1.3/-0.2

	Lower	Upper	
Allowable limits	73.2	76.8	(±1.8)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-004

Within specs? (Yes/No)

Calibrator Used: T-207318

Performed by: Mike Dey MD

Title: Mgr. Dept. 2

Temperature Setting (°F): 150.0

Approved by: DP

Title: President

Date: 3/11/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	151.0	1.0	51	150.1	0.1
2	150.8	0.8	52	149.9	-0.1
3	150.8	0.8	53	149.9	-0.1
4	150.8	0.8	54	150.1	0.1
5	150.8	0.8	55	150.1	0.1
6	150.8	0.8	56	150.1	0.1
7	150.8	0.8	57	150.1	0.1
8	151.0	1.0	58	150.3	0.3
9	151.0	1.0	59	150.3	0.3
10	151.3	1.3	60	150.4	0.4
11	150.6	0.6	61	150.6	0.6
12	150.3	0.3	62	150.3	0.3
13	150.3	0.3	63	150.3	0.3
14	150.3	0.3	64	150.3	0.3
15	150.3	0.3	65	150.3	0.3
16	150.3	0.3	66	150.4	0.4
17	150.4	0.4	67	150.6	0.6
18	150.4	0.4	68	150.4	0.4
19	150.6	0.6	69	150.6	0.6
20	150.8	0.8	70	150.8	0.8
21	150.6	0.6	71	150.3	0.3
22	150.4	0.4	72	149.9	-0.1
23	150.3	0.3	73	149.9	-0.1
24	150.4	0.4	74	150.1	0.1
25	150.4	0.4	75	150.1	0.1
26	150.4	0.4	76	150.1	0.1
27	150.6	0.6	77	150.3	0.3
28	150.6	0.6	78	150.3	0.3
29	150.8	0.8	79	150.3	0.3
30	151.0	1.0	80	150.6	0.6
31	150.8	0.8	81	150.3	0.3
32	150.4	0.4	82	150.3	0.3
33	150.3	0.3	83	150.3	0.3
34	150.4	0.4	84	150.3	0.3
35	150.4	0.4	85	150.3	0.3
36	150.3	0.3	86	150.3	0.3
37	150.3	0.3	87	150.4	0.4
38	150.4	0.4	88	150.4	0.4
39	150.6	0.6	89	150.6	0.6
40	150.8	0.8	90	150.8	0.8
41	150.6	0.6	91	150.1	0.1
42	150.3	0.3	92	149.9	-0.1
43	150.3	0.3	93	149.9	-0.1
44	150.4	0.4	94	150.1	0.1
45	150.4	0.4	95	150.3	0.3
46	150.4	0.4	96	150.1	0.1
47	150.6	0.6	97	150.3	0.3
48	150.6	0.6	98	150.3	0.3
49	150.6	0.6	99	150.3	0.3
50	151.0	1.0	100	150.6	0.6

Range of 150°F Readings: +1.3/-0.1

	Lower	Upper	
Allowable limits	148.2	151.8	(±1.8)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-004

Within specs? (Yes)/No

Calibrator Used: T-207318

Performed by: Mike Dey MD

Title: Mgr. Dept. 2

Temperature Setting (°F): 300.0

Approved by: DP

Title: President

Date: 3/11/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	300.7	0.7	51	299.8	-0.2
2	300.7	0.7	52	299.7	-0.3
3	300.7	0.7	53	299.8	-0.2
4	300.7	0.7	54	299.8	-0.2
5	300.7	0.7	55	299.8	-0.2
6	300.7	0.7	56	300.0	0.0
7	300.7	0.7	57	300.0	0.0
8	300.7	0.7	58	300.0	0.0
9	301.1	1.1	59	300.2	0.2
10	301.3	1.3	60	300.4	0.4
11	300.6	0.6	61	300.4	0.4
12	300.4	0.4	62	300.2	0.2
13	300.4	0.4	63	300.2	0.2
14	300.6	0.6	64	300.2	0.2
15	300.4	0.4	65	300.2	0.2
16	300.4	0.4	66	300.2	0.2
17	300.4	0.4	67	300.2	0.2
18	300.6	0.6	68	300.4	0.4
19	300.6	0.6	69	300.6	0.6
20	300.9	0.9	70	300.7	0.7
21	300.4	0.4	71	300.2	0.2
22	300.2	0.2	72	300.2	0.2
23	300.4	0.4	73	300.0	0.0
24	300.2	0.2	74	300.0	0.0
25	300.4	0.4	75	300.2	0.2
26	300.4	0.4	76	300.2	0.2
27	300.4	0.4	77	300.0	0.0
28	300.6	0.6	78	300.2	0.2
29	300.7	0.7	79	300.2	0.2
30	300.9	0.9	80	300.4	0.4
31	300.6	0.6	81	300.2	0.2
32	300.4	0.4	82	300.2	0.2
33	300.4	0.4	83	300.2	0.2
34	300.4	0.4	84	300.2	0.2
35	300.2	0.2	85	300.2	0.2
36	300.4	0.4	86	300.2	0.2
37	300.4	0.4	87	300.2	0.2
38	300.4	0.4	88	300.2	0.2
39	300.6	0.6	89	300.4	0.4
40	300.7	0.7	90	300.7	0.7
41	300.4	0.4	91	299.8	-0.2
42	300.2	0.2	92	299.8	-0.2
43	300.2	0.2	93	299.8	-0.2
44	300.4	0.4	94	299.8	-0.2
45	300.4	0.4	95	299.8	-0.2
46	300.4	0.4	96	300.0	0.0
47	300.6	0.6	97	300.0	0.0
48	300.4	0.4	98	300.0	0.0
49	300.6	0.6	99	300.2	0.2
50	300.7	0.7	100	300.4	0.4

Range of 300°F Readings: +1.3/-0.3

	Lower	Upper	
Allowable limits	298.1	301.9	(±1.9)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-004

Within specs? (Yes)/No

Calibrator Used: T-207318

Performed by: Mike Dey MD

Title: Mgr. Dept. 2

Temperature Setting (°F): 400.0

Approved by: FP

Title: President

Date: 3/11/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	400.8	0.8	51	399.7	-0.3
2	400.8	0.8	52	399.7	-0.3
3	400.6	0.6	53	399.7	-0.3
4	400.8	0.8	54	399.7	-0.3
5	400.8	0.8	55	399.9	-0.1
6	400.6	0.6	56	399.9	-0.1
7	400.8	0.8	57	399.9	-0.1
8	400.8	0.8	58	400.1	0.1
9	400.8	0.8	59	400.3	0.3
10	401.0	1.0	60	400.3	0.3
11	400.5	0.5	61	400.6	0.6
12	400.3	0.3	62	400.3	0.3
13	400.3	0.3	63	400.3	0.3
14	400.3	0.3	64	400.3	0.3
15	400.3	0.3	65	400.3	0.3
16	400.3	0.3	66	400.3	0.3
17	400.3	0.3	67	400.3	0.3
18	400.5	0.5	68	400.3	0.3
19	400.5	0.5	69	400.5	0.5
20	400.8	0.8	70	400.8	0.8
21	400.3	0.3	71	400.3	0.3
22	400.3	0.3	72	399.9	-0.1
23	400.1	0.1	73	399.9	-0.1
24	400.3	0.3	74	400.1	0.1
25	400.3	0.3	75	400.1	0.1
26	400.3	0.3	76	400.1	0.1
27	400.3	0.3	77	400.3	0.3
28	400.5	0.5	78	400.1	0.1
29	400.5	0.5	79	400.3	0.3
30	400.8	0.8	80	400.6	0.6
31	400.5	0.5	81	400.3	0.3
32	400.5	0.5	82	400.3	0.3
33	400.3	0.3	83	400.3	0.3
34	400.3	0.3	84	400.1	0.1
35	400.5	0.5	85	400.3	0.3
36	400.3	0.3	86	400.3	0.3
37	400.3	0.3	87	400.3	0.3
38	400.5	0.5	88	400.3	0.3
39	400.6	0.6	89	400.5	0.5
40	400.8	0.8	90	400.8	0.8
41	400.3	0.3	91	399.9	-0.1
42	400.3	0.3	92	399.9	-0.1
43	400.3	0.3	93	399.7	-0.3
44	400.3	0.3	94	399.9	-0.1
45	400.3	0.3	95	400.1	0.1
46	400.3	0.3	96	399.9	-0.1
47	400.3	0.3	97	400.1	0.1
48	400.5	0.5	98	400.3	0.3
49	400.6	0.6	99	400.3	0.3
50	400.6	0.6	100	400.3	0.3

Range of 400°F Readings: +1/-0.3

	Lower	Upper	
Allowable limits	398.0	402.0	(±2.0)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-004

Within specs? (Yes)/No

Calibrator Used: T-207318

Performed by: Mike Dey MD

Title: Mgr. Dept. 2

Temperature Setting (°F): 1000.0

Approved by: DP

Title: President

Date: 3/11/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	1000.9	0.9	51	999.9	-0.1
2	1000.8	0.8	52	999.9	-0.1
3	1000.6	0.6	53	999.7	-0.3
4	1000.8	0.8	54	999.9	-0.1
5	1000.8	0.8	55	999.9	-0.1
6	1000.6	0.6	56	999.9	-0.1
7	1000.9	0.9	57	1000.0	0.0
8	1000.9	0.9	58	1000.0	0.0
9	1000.9	0.9	59	1000.0	0.0
10	1001.1	1.1	60	1000.2	0.2
11	1000.6	0.6	61	1000.6	0.6
12	1000.2	0.2	62	1000.2	0.2
13	1000.2	0.2	63	1000.2	0.2
14	1000.4	0.4	64	1000.2	0.2
15	1000.2	0.2	65	1000.0	0.0
16	1000.2	0.2	66	1000.2	0.2
17	1000.4	0.4	67	1000.4	0.4
18	1000.4	0.4	68	1000.4	0.4
19	1000.6	0.6	69	1000.6	0.6
20	1000.8	0.8	70	1000.8	0.8
21	1000.6	0.6	71	1000.0	0.0
22	1000.2	0.2	72	1000.0	0.0
23	1000.4	0.4	73	1000.0	0.0
24	1000.6	0.6	74	1000.0	0.0
25	1000.4	0.4	75	1000.0	0.0
26	1000.6	0.6	76	1000.0	0.0
27	1000.6	0.6	77	1000.0	0.0
28	1000.6	0.6	78	1000.0	0.0
29	1000.6	0.6	79	1000.2	0.2
30	1000.9	0.9	80	1000.6	0.6
31	1000.6	0.6	81	1000.0	0.0
32	1000.2	0.2	82	1000.0	0.0
33	1000.4	0.4	83	1000.0	0.0
34	1000.4	0.4	84	1000.0	0.0
35	1000.2	0.2	85	1000.0	0.0
36	1000.2	0.2	86	1000.0	0.0
37	1000.4	0.4	87	1000.2	0.2
38	1000.2	0.2	88	1000.2	0.2
39	1000.4	0.4	89	1000.2	0.2
40	1000.8	0.8	90	1000.6	0.6
41	1000.2	0.2	91	1000.0	0.0
42	1000.0	0.0	92	999.7	-0.3
43	1000.0	0.0	93	999.7	-0.3
44	1000.0	0.0	94	1000.0	0.0
45	1000.0	0.0	95	1000.0	0.0
46	1000.0	0.0	96	1000.0	0.0
47	1000.2	0.2	97	1000.0	0.0
48	1000.2	0.2	98	1000.0	0.0
49	1000.2	0.2	99	1000.2	0.2
50	1000.6	0.6	100	1000.4	0.4

Range of 2000°F Readings: +1.1/-0.3

	Lower	Upper	
Allowable limits	997.7	1002.3	(±2.3)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-004

Within specs? (Yes) No

Calibrator Used: T-207318

Performed by: Mike Dey MD

Title: Mgr. Dept. 2

Temperature Setting (°F): 2000.0

Approved by: JSP

Title: President

Date: 3/11/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	2000.8	0.8	51	1999.9	-0.1
2	2000.8	0.8	52	1999.9	-0.1
3	2000.8	0.8	53	1999.9	-0.1
4	2000.7	0.7	54	1999.9	-0.1
5	2000.8	0.8	55	1999.9	-0.1
6	2000.8	0.8	56	1999.9	-0.1
7	2000.7	0.7	57	1999.9	-0.1
8	2000.8	0.8	58	2000.1	0.1
9	2001.0	1.0	59	2000.1	0.1
10	2001.2	1.2	60	2000.3	0.3
11	2000.7	0.7	61	2000.7	0.7
12	2000.5	0.5	62	2000.3	0.3
13	2000.5	0.5	63	2000.3	0.3
14	2000.3	0.3	64	2000.3	0.3
15	2000.5	0.5	65	2000.3	0.3
16	2000.7	0.7	66	2000.3	0.3
17	2000.5	0.5	67	2000.3	0.3
18	2000.7	0.7	68	2000.5	0.5
19	2000.7	0.7	69	2000.5	0.5
20	2000.8	0.8	70	2001.0	1.0
21	2000.7	0.7	71	2000.7	0.7
22	2000.7	0.7	72	2000.5	0.5
23	2000.7	0.7	73	2000.3	0.3
24	2000.7	0.7	74	2000.5	0.5
25	2000.7	0.7	75	2000.5	0.5
26	2000.7	0.7	76	2000.5	0.5
27	2000.7	0.7	77	2000.5	0.5
28	2000.7	0.7	78	2000.7	0.7
29	2001.0	1.0	79	2000.7	0.7
30	2001.0	1.0	80	2000.8	0.8
31	2000.5	0.5	81	1999.9	-0.1
32	2000.3	0.3	82	1999.8	-0.2
33	2000.3	0.3	83	1999.8	-0.2
34	2000.3	0.3	84	1999.8	-0.2
35	2000.5	0.5	85	1999.9	-0.1
36	2000.5	0.5	86	1999.9	-0.1
37	2000.3	0.3	87	1999.9	-0.1
38	2000.3	0.3	88	1999.9	-0.1
39	2000.7	0.7	89	2000.1	0.1
40	2000.7	0.7	90	2000.3	0.3
41	2000.3	0.3	91	1999.9	-0.1
42	2000.1	0.1	92	1999.9	-0.1
43	2000.1	0.1	93	1999.9	-0.1
44	1999.9	-0.1	94	1999.9	-0.1
45	2000.1	0.1	95	1999.9	-0.1
46	2000.3	0.3	96	2000.1	0.1
47	2000.3	0.3	97	2000.1	0.1
48	2000.3	0.3	98	2000.3	0.3
49	2000.5	0.5	99	2000.5	0.5
50	2000.7	0.7	100	2000.7	0.7

Range of 2000°F Readings: +1.2/-0.2

	Lower	Upper	
Allowable limits	1997.2	2002.8	(±2.8)

Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, Texas 78112
800-966-5253 FAX 210-635-8101

Certificate of Verification

Certification No.:	92146
Verification Date:	03/11/2005
Reverification Date:	09/11/2005
Manufacturer:	Yokogawa
Model No.:	100 Channel DAU
Serial No.:	99LE006
Equipment Description:	100 Channel Data Acquisition System with YOKOGAWA Darwin Series
Calibration Sources:	TEGAM Model 840-A, SN: T-207318. Calibration due 05/03/2005.

PERFORMANCE:

Temperature: (75°F) +1.6/-0	Temperature: (150°F) +1.3/-0.3	Temperature: (300°F) +1.3/-0.3	Temperature: (400°F) +1.4/-0.3	Temperature: (1000°F) +1.3/-0.3	Temperature: (2000°F) +1.7/-0.6

Verification Performed by:

Mike Dey
Manager of Fire Resistance

Verification Approved by:

Deg Priest
President/Chief Technical Officer

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-006

Within specs? (Yes)/No

Calibrator Used: T-207318

Performed by: Mike Dey MD

Title: Mgr. Dept. 2

Temperature Setting (°F): 75.0

Approved by: DP

Title:

Date: 3/11/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	76.5	1.5	51	75.2	0.2
2	76.3	1.3	52	75.6	0.6
3	76.6	1.6	53	75.6	0.6
4	75.9	0.9	54	75.0	0.0
5	75.7	0.7	55	75.0	0.0
6	75.7	0.7	56	75.0	0.0
7	75.7	0.7	57	75.0	0.0
8	75.7	0.7	58	75.0	0.0
9	75.9	0.9	59	75.0	0.0
10	76.3	1.3	60	75.2	0.2
11	75.7	0.7	61	75.7	0.7
12	76.3	1.3	62	75.9	0.9
13	76.5	1.5	63	75.9	0.9
14	75.7	0.7	64	75.6	0.6
15	75.7	0.7	65	75.6	0.6
16	75.6	0.6	66	75.6	0.6
17	75.6	0.6	67	75.6	0.6
18	75.6	0.6	68	75.6	0.6
19	75.7	0.7	69	75.7	0.7
20	75.9	0.9	70	75.9	0.9
21	75.9	0.9	71	75.7	0.7
22	75.7	0.7	72	76.3	1.3
23	76.1	1.1	73	76.1	1.1
24	75.7	0.7	74	75.4	0.4
25	75.4	0.4	75	75.6	0.6
26	75.4	0.4	76	75.4	0.4
27	75.6	0.6	77	75.6	0.6
28	75.6	0.6	78	75.6	0.6
29	75.7	0.7	79	75.4	0.4
30	75.7	0.7	80	75.7	0.7
31	75.7	0.7	81	75.2	0.2
32	76.3	1.3	82	75.6	0.6
33	76.3	1.3	83	75.6	0.6
34	75.6	0.6	84	75.2	0.2
35	75.4	0.4	85	75.2	0.2
36	75.4	0.4	86	75.2	0.2
37	75.4	0.4	87	75.2	0.2
38	75.4	0.4	88	75.2	0.2
39	75.6	0.6	89	75.2	0.2
40	75.7	0.7	90	75.6	0.6
41	75.9	0.9	91	75.4	0.4
42	76.5	1.5	92	75.7	0.7
43	76.5	1.5	93	75.7	0.7
44	75.7	0.7	94	75.4	0.4
45	75.7	0.7	95	75.7	0.7
46	75.7	0.7	96	75.6	0.6
47	75.7	0.7	97	75.7	0.7
48	75.6	0.6	98	75.7	0.7
49	75.7	0.7	99	75.7	0.7
50	76.1	1.1	100	75.7	0.7

		Lower	Upper	
Range of 75°F Readings:	+1.6/0	Allowable limits	73.2	76.8 (±1.8)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-006

Calibrator Used: T-207318

Temperature Setting (°F): 150.0

Within specs? Yes/No

Performed by: Mike Dey MD

Title: Mgr. Dept. 2

Approved by:

Title:

Date: 3/11/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	151.3	1.3	51	150.1	0.1
2	151.3	1.3	52	150.3	0.3
3	151.3	1.3	53	150.3	0.3
4	150.6	0.6	54	149.9	-0.1
5	150.6	0.6	55	149.9	-0.1
6	150.6	0.6	56	149.7	-0.3
7	150.6	0.6	57	149.7	-0.3
8	150.8	0.8	58	149.9	-0.1
9	150.8	0.8	59	149.9	-0.1
10	151.0	1.0	60	150.1	0.1
11	151.0	1.0	61	150.8	0.8
12	151.3	1.3	62	150.8	0.8
13	151.3	1.3	63	150.8	0.8
14	150.8	0.8	64	150.4	0.4
15	150.8	0.8	65	150.4	0.4
16	150.6	0.6	66	150.4	0.4
17	150.6	0.6	67	150.4	0.4
18	150.8	0.8	68	150.4	0.4
19	150.8	0.8	69	150.4	0.4
20	151.0	1.0	70	150.8	0.8
21	150.6	0.6	71	150.8	0.8
22	151.0	1.0	72	151.0	1.0
23	151.0	1.0	73	151.0	1.0
24	150.3	0.3	74	150.6	0.6
25	150.4	0.4	75	150.4	0.4
26	150.4	0.4	76	150.6	0.6
27	150.3	0.3	77	150.4	0.4
28	150.4	0.4	78	150.6	0.6
29	150.6	0.6	79	150.4	0.4
30	150.8	0.8	80	150.8	0.8
31	150.6	0.6	81	150.3	0.3
32	151.0	1.0	82	150.4	0.4
33	151.0	1.0	83	150.3	0.3
34	150.4	0.4	84	150.1	0.1
35	150.3	0.3	85	150.1	0.1
36	150.4	0.4	86	150.1	0.1
37	150.3	0.3	87	150.1	0.1
38	150.3	0.3	88	150.3	0.3
39	150.6	0.6	89	150.3	0.3
40	150.6	0.6	90	150.4	0.4
41	150.8	0.8	91	150.4	0.4
42	151.3	1.3	92	150.4	0.4
43	151.3	1.3	93	150.6	0.6
44	150.6	0.6	94	150.4	0.4
45	150.6	0.6	95	150.4	0.4
46	150.4	0.4	96	150.4	0.4
47	150.4	0.4	97	150.6	0.6
48	150.6	0.6	98	150.6	0.6
49	150.6	0.6	99	150.6	0.6
50	150.8	0.8	100	150.8	0.8

Range of 150°F Readings: +1.3/-0.3

Allowable limits

Lower	Upper	
148.2	151.8	(±1.8)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-006

Calibrator Used: T-207318

Temperature Setting (°F): 300.0

Within specs? (Yes)/No

Performed by: Mike Dey MD

Title: Mgr. Dept. 2

Approved by: BP

Title:

Date: 3/11/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	301.1	1.1	51	300.0	0.0
2	301.3	1.3	52	300.2	0.2
3	301.3	1.3	53	300.2	0.2
4	300.7	0.7	54	299.7	-0.3
5	300.2	0.2	55	299.7	-0.3
6	300.2	0.2	56	299.8	-0.2
7	300.6	0.6	57	299.7	-0.3
8	300.6	0.6	58	299.8	-0.2
9	300.6	0.6	59	300.0	0.0
10	300.9	0.9	60	300.0	0.0
11	300.7	0.7	61	300.6	0.6
12	301.1	1.1	62	300.7	0.7
13	301.3	1.3	63	300.7	0.7
14	300.6	0.6	64	300.4	0.4
15	300.4	0.4	65	300.2	0.2
16	300.4	0.4	66	300.4	0.4
17	300.2	0.2	67	300.2	0.2
18	300.4	0.4	68	300.6	0.6
19	300.4	0.4	69	300.6	0.6
20	300.7	0.7	70	300.7	0.7
21	300.4	0.4	71	300.6	0.6
22	300.9	0.9	72	301.1	1.1
23	300.7	0.7	73	300.9	0.9
24	300.2	0.2	74	300.2	0.2
25	300.2	0.2	75	300.4	0.4
26	300.2	0.2	76	300.2	0.2
27	300.2	0.2	77	300.2	0.2
28	300.2	0.2	78	300.4	0.4
29	300.2	0.2	79	300.4	0.4
30	300.6	0.6	80	300.6	0.6
31	300.7	0.7	81	300.0	0.0
32	300.9	0.9	82	300.2	0.2
33	300.9	0.9	83	300.2	0.2
34	300.4	0.4	84	300.0	0.0
35	300.2	0.2	85	300.0	0.0
36	300.2	0.2	86	299.8	-0.2
37	300.2	0.2	87	300.0	0.0
38	300.2	0.2	88	300.0	0.0
39	300.2	0.2	89	300.0	0.0
40	300.6	0.6	90	300.2	0.2
41	300.7	0.7	91	300.2	0.2
42	300.9	0.9	92	300.6	0.6
43	301.1	1.1	93	300.6	0.6
44	300.7	0.7	94	300.2	0.2
45	300.2	0.2	95	300.4	0.4
46	300.4	0.4	96	300.4	0.4
47	300.4	0.4	97	300.6	0.6
48	300.4	0.4	98	300.7	0.7
49	300.6	0.6	99	300.7	0.7
50	300.7	0.7	100	300.7	0.7

Range of 300°F Readings: +1.3/-0.3

	Lower	Upper	
Allowable limits	298.1	301.9	(±1.9)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-006

Calibrator Used: T-207318

Temperature Setting (°F): 400.0

Within specs? Yes/No

Performed by: Mike Dey

Title: Mgr. Dept. 2

Approved by:

Title:

Date: 3/11/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	401.0	1.0	51	399.9	-0.1
2	401.4	1.4	52	400.3	0.3
3	401.4	1.4	53	400.3	0.3
4	400.6	0.6	54	399.7	-0.3
5	400.3	0.3	55	399.7	-0.3
6	400.5	0.5	56	399.7	-0.3
7	400.5	0.5	57	399.7	-0.3
8	400.5	0.5	58	399.7	-0.3
9	400.6	0.6	59	399.7	-0.3
10	400.8	0.8	60	399.9	-0.1
11	400.8	0.8	61	400.8	0.8
12	401.4	1.4	62	401.0	1.0
13	401.4	1.4	63	400.8	0.8
14	400.6	0.6	64	400.5	0.5
15	400.6	0.6	65	400.5	0.5
16	400.6	0.6	66	400.5	0.5
17	400.5	0.5	67	400.3	0.3
18	400.5	0.5	68	400.5	0.5
19	400.8	0.8	69	400.5	0.5
20	400.8	0.8	70	401.0	1.0
21	400.6	0.6	71	400.6	0.6
22	400.8	0.8	72	400.8	0.8
23	400.8	0.8	73	400.8	0.8
24	400.3	0.3	74	400.3	0.3
25	400.3	0.3	75	400.3	0.3
26	400.3	0.3	76	400.3	0.3
27	400.3	0.3	77	400.3	0.3
28	400.3	0.3	78	400.3	0.3
29	400.5	0.5	79	400.3	0.3
30	400.6	0.6	80	400.6	0.6
31	400.5	0.5	81	400.1	0.1
32	401.0	1.0	82	400.3	0.3
33	401.0	1.0	83	400.3	0.3
34	400.3	0.3	84	400.1	0.1
35	400.3	0.3	85	399.9	-0.1
36	400.3	0.3	86	400.1	0.1
37	400.3	0.3	87	399.9	-0.1
38	400.3	0.3	88	399.9	-0.1
39	400.3	0.3	89	400.3	0.3
40	400.5	0.5	90	400.3	0.3
41	400.5	0.5	91	400.3	0.3
42	401.2	1.2	92	400.5	0.5
43	401.4	1.4	93	400.5	0.5
44	400.5	0.5	94	400.3	0.3
45	400.5	0.5	95	400.5	0.5
46	400.5	0.5	96	400.5	0.5
47	400.3	0.3	97	400.5	0.5
48	400.3	0.3	98	400.6	0.6
49	400.5	0.5	99	400.6	0.6
50	400.8	0.8	100	400.5	0.5

Range of 400°F Readings: +1.4/-0.3

	Lower	Upper	
Allowable limits	398.0	402.0	(±2.0)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-006

Calibrator Used: T-207318

Temperature Setting (°F): 1000.0

Within specs? (Yes)/No

Performed by: Mike Dey MD

Title: Mgr. Dept. 2

Approved by: DP

Title:

Date: 3/11/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	1000.9	0.9	51	1000.0	0.0
2	1000.9	0.9	52	1000.2	0.2
3	1000.9	0.9	53	1000.2	0.2
4	1000.4	0.4	54	1000.0	0.0
5	1000.4	0.4	55	999.7	-0.3
6	1000.2	0.2	56	999.7	-0.3
7	1000.2	0.2	57	999.7	-0.3
8	1000.4	0.4	58	999.9	-0.1
9	1000.4	0.4	59	999.7	-0.3
10	1000.6	0.6	60	1000.0	0.0
11	1000.6	0.6	61	1000.6	0.6
12	1000.9	0.9	62	1000.7	0.7
13	1000.8	0.8	63	1000.9	0.9
14	1000.4	0.4	64	1000.4	0.4
15	1000.2	0.2	65	1000.0	0.0
16	1000.2	0.2	66	1000.2	0.2
17	1000.4	0.4	67	1000.4	0.4
18	1000.4	0.4	68	1000.2	0.2
19	1000.4	0.4	69	1000.4	0.4
20	1000.6	0.6	70	1000.8	0.8
21	1000.8	0.8	71	1000.6	0.6
22	1001.3	1.3	72	1000.8	0.8
23	1001.1	1.1	73	1000.8	0.8
24	1000.6	0.6	74	1000.2	0.2
25	1000.6	0.6	75	1000.0	0.0
26	1000.6	0.6	76	1000.0	0.0
27	1000.6	0.6	77	1000.0	0.0
28	1000.6	0.6	78	1000.0	0.0
29	1000.8	0.8	79	1000.2	0.2
30	1000.9	0.9	80	1000.4	0.4
31	1000.6	0.6	81	999.9	-0.1
32	1000.8	0.8	82	1000.0	0.0
33	1000.6	0.6	83	1000.0	0.0
34	1000.2	0.2	84	999.7	-0.3
35	1000.2	0.2	85	999.9	-0.1
36	1000.0	0.0	86	999.7	-0.3
37	1000.0	0.0	87	999.7	-0.3
38	1000.2	0.2	88	999.9	-0.1
39	1000.2	0.2	89	999.9	-0.1
40	1000.4	0.4	90	1000.0	0.0
41	1000.6	0.6	91	1000.4	0.4
42	1000.9	0.9	92	1000.4	0.4
43	1000.9	0.9	93	1000.6	0.6
44	1000.2	0.2	94	1000.4	0.4
45	1000.2	0.2	95	1000.4	0.4
46	1000.0	0.0	96	1000.6	0.6
47	1000.2	0.2	97	1000.6	0.6
48	1000.2	0.2	98	1000.6	0.6
49	1000.0	0.0	99	1000.6	0.6
50	1000.6	0.6	100	1000.6	0.6

Range of 2000°F Readings: +1.3/-0.3

	Lower	Upper	
Allowable limits	997.7	1002.3	(±2.3)

Channel Verification for Yokogawa 100 Channel

Serial No.: 99-LE-006

Within specs? (Yes)/No

Calibrator Used: T-207318

Performed by: Mike Dey MD

Title: Mgr. Dept. 2

Temperature Setting (°F): 2000.0

Approved by: DP

Title:

Date: 3/11/05

Channel No.	Reading (°F)	+/-	Channel No.	Reading (°F)	+/-
1	2000.1	0.1	51	1999.9	-0.1
2	2000.3	0.3	52	2000.5	0.5
3	2000.3	0.3	53	2000.5	0.5
4	1999.8	-0.2	54	1999.9	-0.1
5	1999.4	-0.6	55	1999.9	-0.1
6	1999.6	-0.4	56	1999.9	-0.1
7	1999.6	-0.4	57	1999.9	-0.1
8	1999.6	-0.4	58	1999.9	-0.1
9	1999.9	-0.1	59	1999.9	-0.1
10	2000.1	0.1	60	2000.1	0.1
11	2000.7	0.7	61	2000.7	0.7
12	2001.0	1.0	62	2000.6	0.6
13	2001.0	1.0	63	2000.8	0.8
14	2000.3	0.3	64	2000.3	0.3
15	2000.3	0.3	65	2000.3	0.3
16	2000.3	0.3	66	2000.5	0.5
17	2000.3	0.3	67	2000.1	0.1
18	2000.3	0.3	68	2000.3	0.3
19	2000.5	0.5	69	2000.5	0.5
20	2000.7	0.7	70	2000.7	0.7
21	2001.6	1.6	71	2000.3	0.3
22	2001.7	1.7	72	2000.7	0.7
23	2001.7	1.7	73	2000.5	0.5
24	2001.2	1.2	74	1999.9	-0.1
25	2001.0	1.0	75	1999.9	-0.1
26	2001.2	1.2	76	1999.9	-0.1
27	2001.2	1.2	77	1999.9	-0.1
28	2001.2	1.2	78	1999.9	-0.1
29	2001.4	1.4	79	1999.9	-0.1
30	2001.7	1.7	80	2000.1	0.1
31	2000.3	0.3	81	1999.9	-0.1
32	2000.7	0.7	82	1999.9	-0.1
33	2000.8	0.8	83	2000.1	0.1
34	2000.1	0.1	84	1999.6	-0.4
35	1999.9	-0.1	85	1999.6	-0.4
36	1999.9	-0.1	86	1999.8	-0.2
37	1999.9	-0.1	87	1999.6	-0.4
38	1999.9	-0.1	88	1999.8	-0.2
39	2000.1	0.1	89	1999.9	-0.1
40	2000.5	0.5	90	2000.1	0.1
41	2000.5	0.5	91	2000.7	0.7
42	2000.7	0.7	92	2000.7	0.7
43	2001.0	1.0	93	2000.7	0.7
44	2000.3	0.3	94	2000.7	0.7
45	2000.1	0.1	95	2000.7	0.7
46	2000.3	0.3	96	2000.7	0.7
47	2000.1	0.1	97	2000.8	0.8
48	1999.9	-0.1	98	2001.0	1.0
49	2000.3	0.3	99	2000.8	0.8
50	2000.5	0.5	100	2001.0	1.0

Range of 2000°F Readings: +1.7/-0.6

	Lower	Upper	
Allowable limits	1997.2	2002.8	(±2.8)

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME Omega Point Labs
CLIENT/PROJECT NUMBER OPL Equipment
RECEIVED FROM SSC Lab Div.
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 2435 - OPL
DATE RECEIVED 5-5-04
DATE INSPECTED 5-6-04
INSPECTED BY:

ITEM DESCRIPTION	P.O. NO.	QUANTITY Ordered	QUANTITY Rec'd	QUANTITY B.O.	I.D. NO.	CONID MATL Y/N	CERT. REC'D Y/N	SAFETY RELATED Y/N	CONTAINER INTEGRITY	ACCEPTANCE Accept	ACCEPTANCE Hold	ACCEPTANCE Reject	REMARKS
200g Weight	143570	1	1	0	23137	Y	Y	N	Good	X			Dial indicator 5". SN: 013232851 was beyond repair - see memo.
200g Weight	143570	1	1	0	23138	Y	Y	N	Good	X			
0-100psi Pressure gage	143570	1	1	0	99LE001	Y	Y	N	Good	X			
0-100psi Pressure gage	143570	1	1	0	98LE001	Y	Y	N	Good	X			
5" dial indicator	143570	1	1	0	013021466	Y	Y	N	Good	X			
0-1000lb. Load Cell	143570	1	1	0	343765	Y	Y	N	Good	X			
6" digital caliper	143570	1	1	0	60246504	Y	Y	N	Good	X			
digital multimeter	143570	1	1	0	5700109	Y	Y	N	Good	X			

09-016-11/02

OMEGA POINT LABORATORIES
16015 SHADY FALLS RD.
ELMENDORF, TEXAS 78112
PH. (210) 635-8100
FAX (210) 635-8101

PURCHASE ORDER

14357Q

Date: 04/19/2004
Page: 1 of 1

Order From:
SSC Lab Division
7715 Distribution Dr.
Little Rock
AR 72209
501-562-2900/888-278-9292

Deliver to:
Omega Point Laboratories, Inc
16015 Shady Falls Road
Elmendorf
TX 78112
(210) 635-8100

Vendor No:

Your Item Number / Item Description	Our Reference	Qty Ordered	Units	Unit Cost	Extension
0-100psi Pressure Gage SN:99LE001	001	1.00	Each	$45.00	$45.00
0-100psi Pressure Gage SN: 98LE001	002	1.00	Each	$75.00	$75.00
Dial Indicator SN: 013021466	003	1.00	Each	$20.00	$20.00
Dial Indicator SN: 013232851 **Calibration&Repair**	004	1.00	Each	$120.00	$120.00
Load Cell 1k pound SN: 343765 **Calibration & Repair**	005	1.00	Each	$175.00	$175.00
Digital Multimeter SN: 5700109 **Calibration & Repair**	006	1.00	Each	$100.00	$100.00
Digital Caliper SN:6Q-2465-04	007	1.00	Each	$70.00	$70.00
200g Weight—SN: 23137	008	1.00	Each	$10.00	$10.00
200g Weight—SN: 23138	009	1.00	Each	$10.00	$10.00

CALIBRATION CERT. REQUIREMENTS
1. Statement of NIST traceability
2. NIST test or I.D. number
3. As Found
4. As Left Values
5. Uncertainties of calibration measurements
6. Calibration data
7. Calibration certificates must show accreditation to ISO/IEC 17025

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval
Date 4-19-04

Please Quote Purchase Order Number on all correspondence.

Special Instructions: Please include Certificate of Conformance to attached Specification Sheet and Calibration Data traceable to NIST.

Subtotal:	$620.00
Freight:	0.00
Tax Amount:	0.00
Total Value:	$620.00

0806:

VENDOR PURCHASING SPECIFICATION AND QUALITY ASSURANCE REQUIREMENTS

Vendor: SSC Lab Division
Purchase Order No. 14357 Q

Any of the following Quality Assurance requirements shall be incorporated as conditions to this procurement when corresponding box is marked. Failure to comply with any requirement specified may result in rejection and/or return of shipment at seller's expense.

1.0 QUALITY PROGRAM

☒ Seller shall furnish all items on this Purchase Order in accordance with Quality Program approved by Buyer.

2.0 Quality Verification

When additional quality verification activities are required as a condition to this procurement, invoices will not be paid until satisfactory completion of such activities.

☒ Receiving Inspection- Buyer shall inspect items upon receipt to verify compliance with purchase order requirements. Rejected items shall be returned at seller's expense.

☐ Independent Laboratory Tests- Samples of materials furnished shall be tested independently for conformance to specification requirements prior to final acceptance. Rejected materials shall be returned at seller's expense.

☒ Document Review- Final acceptance shall be based on satisfactory review or required certifications and other supporting documents.

3.0 CERTIFICATIONS

When certifications are required as a condition to this procurement, the seller shall furnish one reproducible copy either with or prior to each shipment. Shipments will not be accepted and invoices will not be paid until certifications are in buyer's possession.

☐ Certificate of Compliance/Conformance Required – Certification that materials and /or services comply with purchase order requirements. Certification shall reference purchase order number and traceability numbers (when applicable).

☐ Certified Test Report Required – Certification that material complies with applicable material specification (s) and the purchase order. Include actual results of required tests.

☒ Certificate of Calibration Required - Certification shall be traceable to National Bureau of Standards. (NIST, Nat'l Inst. of Science & Technology).

4.0 AUDITS/RIGHT OF ACCESS

☒ The buyer reserves the right to audit your facility to verify compliance with purchase order, code and specification requirements with (10) days notice,

☒ Shipments shall only originate form facilities approved by the buyer.

☐ Buyer reserves the right to inspect any or all work included in this order at seller's facility with as early notice as practicable.

5.0 IDENTIFICATION

☐ Seller shall identify each item with a unique traceability number by physical marking or tagging. Traceability numbers shall be traceable to certifications and packing lists.

☒ Seller shall identify each container with a unique identification number. The identification number shall be traceable to certifications and packing lists.

6.0 10CFR,PART 21

☐ The material, equipment and/or services to be furnished under this purchase order are involved in the testing of basic components of a Nuclear Regulatory Commission (NRC) licensed facility. Accordingly, the seller is subject to the provisions of 10 CFR, Part 21 (Reporting of Defects and Noncompliance)

7.0 PACKING/SHIPPING

☒ All materials shall be packaged in air tight, moisture free containers and shall be free from all foreign substance such as dirt, oil, grease or other deleterious material.

☐ All materials and equipment shall be suitable crated, boxed or otherwise prepared for shipment to prevent damage during handling and shipping. Wherever practical, equipment shall be palletized for ease of unloading and storage at destination. Each container shall be clearly marked with buyer's purchase order number.

QUALITY ASSURANCE APPROVAL _____ DATE 4/19/04

SSC LAB DIVISION
a Division of System Scale Corporation
Employee Owned
"Quality You Can Measure"

CERTIFICATE NO: 36283-0003

Page 1 of 1

ACCREDITED
Cert. #1754.01
Calibration Laboratory
ISO / IEC / 17025

CERTIFICATE OF CALIBRATION

SSC LAB DIVISION certifies that this instrument conforms to original manufacturers specifications or to tolerances indicated below and has been calibrated using standards with accuracies traceable to a National Measurement Institute, or to accepted values of natural physical constants, or have been derived by ratio techniques. This certificate complies with ISO / IEC 17025 & ANSI Z540. Unless otherwise stated, the M & T E for which this certificate is issued, based on interpretation of data, was found to meet the required specification. Reported uncertainty represents expanded uncertainty at approximately 95% confidence level, coverage factor of k=2.

Customer:	OMEGA POINT LAB.	Date Received:	4/21/04
Location:	16015 SHADY FALLS RD. ELMENDORF TX 78112	Date of Issue/Calibration:	04/22/2004
		Next Calibration Due:	04/22/2005
P.O. #:	14357Q	Metrologist:	Sean Rainey

Manufacturer:	McDANIEL CONTROLS INC.	Model:	316SS
Nomenclature:	GAGE- PRESSURE	Serial Number:	99LE001
Range:	0-100 PSI	Equipment ID:	99LE001

Calibration Data

Temp 68°F Humidity 38%

Calibration Accuracy: ± 2.5% FULL SCALE

Note: if the AS LEFT column is blank, no adjustments were required.

Note: Many factors may cause out of calibration condition prior to due date.The Calibration interval has been specified by the Customer. Current procedures and methods utilized by SSC Lab Division are approved by the Customer.

APPLIED	AS FOUND	AS LEFT	UNCERTAINTY	PROCEDURE #
25 LBS	25.78	25.78	2.9	NA17-20MP-06
50 LBS	51.24	51.24	2.9	
75 LBS	76.38	76.38	2.9	
100 LBS	101.72	101.72	2.9	

STANDARDS(S) USED

Identification Number	Description	Calibration Date	Expiration Date	Traceability Number
SSC30LD029	CALIBRATOR- PRESSURE	7/30/2003	7/30/2004	33426-0044
SSC30LD048	TRANSDUCER- PRESSURE	8/11/2003	8/11/2004	1000154760

Calibration Certificate Acceptance

Item 0-100 psi Pressure Gage

SN 99LE001

	Q/A	Eng.
NIST Traceability Adequate	JT	JT
As Found/As Left Values	DS	DS
Calibration Data Sufficient	SF	SF
Tolerance Range Adequate	S-6-04	5/11/04
Date of Review:		

OPL QA/QC Dept. Eng. Dept. Mgr.

Comments

Gary McCourt
Chief Metrology Engineer

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME Omega Point Labs
CLIENT/PROJECT NUMBER OPL Equipment
RECEIVED FROM PMC
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 2676 - OPL
DATE RECEIVED 10-25-04
DATE INSPECTED 10-25-04
INSPECTED BY:

ITEM DESCRIPTION	P.O . NO.	QUANTITY Order	QUANTITY Rec'd	QUANTITY B.O.	I.D. NO.	CON'tD MATL Y/N	CERT REC'D Y/N	SAFETY RELATED Y/N	CONTAINER INTEGRITY	ACCEPTANCE Accept	ACCEPTANCE Hold	ACCEPTANCE Reject	REMARKS
Fiberglass	145619	15K'	12K'	0	KK-FB/FB-24 Fiberglass	Y	Y	N	Good	X			Received 3K' on 9/27/04. RA# 2478 Spool # 00565655, 00565656, 00565657 and 00565658 and 00565660. P.O. Complete.
TC Wire													

09-016-11/02

OMEGA POINT LABORATORIES
16015 SHADY FALLS RD.
ELMENDORF, TEXAS 78112
PH. (210) 635-8100
FAX (210) 635-8101

PURCHASE ORDER

14561Q

Date: 09/16/2004
Page: 1 of 1

Order From: PMC
680 Hayward Street
Manchester
NH 03103
603-622-3500

Deliver to: Omega Point Laboratories, Inc
16015 Shady Falls Road
Elmendorf
TX 78112
(210) 635-8100

Vendor No: 0024

Your Item Number / Item Description	Our Reference	Qty Ordered	Units	Unit Cost	Extension
Fiberglass TC Wire KK-FB/FB-24	001	15,000	Feet	$218.00	$3270.00
Calibration Services	002	1.00	Each	$207.00	$207.00

Received 3,140 feet 9-27-04

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval
Date 9-16-04

Please Quote Purchase Order Number on all correspondence.

Special Instructions: Please include Certificate of Conformance to attached Specification Sheet and Calibration Data traceable to NIST.

Subtotal:	$3477.00
Freight:	0.00
Tax Amount:	0.00
Total Value:	$3477.00

080625/11

OMEGA POINT LABORATORIES
MATERIAL PURCHASING SPECIFICATIONS

SPECIFICATION NUMBER: MS-14561Q-OPL

VENDOR: PMC Corporation

ITEM NO.	VENDOR PRODUCT NUMBER	PRODUCT DESCRIPTION
_____	KK-TA/TA-24	Teflon Coated Thermocouple Wire
1.	KK-FB/FB-24	Fiberglas Braided Thermocouple Wire
_____	KK-TE/TE-24	FEP Insulated Thermocouple Wire

Material as defined above shall be provided in accordance with the Critical Characteristics as listed below:

TEST	DESCRIPTION	SPECIFICATION RANGES MIN. - MAX.
ASTM E220-96	Std. Test Method for Calibration of Thermocouples by Comparison	Temp. Range +32°F to +545°F Special Limits of Error ± 2% °F
	(Chromel/Alumel wire alloy)	Temp. Range +545°F to +2300°F Special Limits of Error ± .4%
ASTM E220-96	Std. Test Method for Calibration of Thermocouples by Comparison	Temp. Range -85°F to +270°F Special Limits of Error ±.9%°F
	(Copper/Constantan wire alloy)	Temp. Range +270°F to +660°F Special Limits of Error ±.4%

QUALITY ASSURANCE REQUIREMENTS

1.0 QUALITY PROGRAM

Seller shall furnish this item in accordance with Quality Program approved by Omega Point Laboratories. Material specified herein is to be produced and tested in accordance with vendor quality standards, methods, guidelines and manufacturing instructions as defined in that Quality Program.

2.0 QUALITY VERIFICATION

Receiving Inspection - Buyer shall inspect items upon receipt to verify compliance with purchase order requirements. Rejected items shall be returned at seller's expense.

Document Review - Final acceptance shall be based on satisfactory review of required certifications and/or supporting documents.

3.0 CERTIFICATIONS

3.1 Certification that supplied materials comply with this material specification and listing Critical Characteristics shall be provided. This certificates shall reference Omega Point Labs purchase order number and specification number for all material furnished under this specification. This Certification shall be signed by the appropriate vendor representative.

3.2 The material furnished under this specification shall be a product that complies with the following:

3.2.1 Has been tested and passed all tests specified herein.

3.2.2 Manufacturing methods for this material have not changed. Vendor will advise Omega Point in writing of any changes in the manufacturing prior to material manufacture.

3.2.3 Raw materials used in the manufacture of this material meet Vendor specifications.

4.0 AUDITS/RIGHTS OF ACCESS

Omega Point Labs reserves the right to audit your facility to verify compliance with the purchase order and specification requirements with a minimum ten (10) day notice.

5.0 IDENTIFICATION

Seller shall identify each item with a unique traceability number by physical marking or tagging. These identification numbers shall be traceable to certifications and packing lists.

6.0 PACKING/SHIPPING

All materials shall be packaged in air tight, moisture free containers and shall be free of foreign substances such as dirt, oil, grease or other deleterious materials.

All materials shall be suitably crated, boxed or otherwise prepared for shipment to prevent damage during handling and shipping.

QUALITY ASSURANCE APPROVAL:

Title QA Assistant

Date 9-16-04

AVL Verification

Class: A

PMC A DIVISION OF ROCKBESTOS-SURPRENANT CABLE CORP.
680 HAYWARD STREET, MANCHESTER, NH 03103 (603) 622-3500
SPECIALIZING IN WIRE & CABLE FOR THE SENSOR INDUSTRY FAX (800) 639-5701

CERTIFICATE OF CALIBRATION

SPOOL # 00565655

TO: OMEGA POINT LABS, INC.
16015 SHADY FALLS ROAD
ELMENDORF,TX 78112
USA

Date: 10/16/04
Cust PO#: 14561Q
JOB # PSO067407-3

CALIBRATION RESULTS ARE TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) AND MEET SPECIAL LIMITS DEVIATION TOLERANCES AS DEFINED IN ISA MC96.1 (FORMERLY ANSI) AND ASTM E 230-03. MS-14561Q-OPL.

TEST RESULTS FOR: PMC P/N: KK-FB/FB-24 Total Footage: 1520'

Test Temperature (°F)	Inside End	Outside End
200°	-1.3	-0.8
400°	-1.2	-1.7
600°	-2.0	-1.2
800°	-2.0	-1.5
1000°	+0.9	+1.4

Calibration Certificate Acceptance
Item Fiberglass TC Wire
SN 00565655
NIST Traceability Adequate QA Eng.
As Found / As left Values QA Eng.
Calibration Date Sufficient QA Eng.
Tolerance Range Adequate QA Eng.
Date of Review QA 10-25-04 Eng. 10-26-04
OPL QA/QC Dept. Eng./Dept. Mgr.

REPORTED RESULTS ARE DEVIATIONS FROM TEST TEMPERATURES. FOR CORRECTION FACTORS REVERSE THE SIGNS.

THE MATERIAL REFERENCED ABOVE HAS BEEN CALIBRATED UTILIZING TECHNIQUES CONSISTENT WITH THE GUIDELINES SET FORTH IN ANSI Z540-1 AND ASTM E-220-02. THIS IS TO CERTIFY THE MATERIAL FURNISHED ON THIS SHIPMENT ARE IN CONFORMANCE WITH THE REQUIREMENTS, SPECIFICATIONS, AND DRAWINGS OF THE ABOVE REFERENCED CUSTOMER PURCHASE ORDER. INSPECTION AND TEST RECORDS ARE ON FILE AND AVAILABLE FOR CUSTOMER REVIEW.

SECONDARY STANDARD THERMOCOUPLE: TYPE K
REEL # POS LEG: 00534834
REEL # NEG LEG: 00534833
CALIBRATION DATE: 3/17/00

NIST #: 263094C&A
263094B&D
(SINGLE USE THERMOCOUPLE FROM CALIBRATED REEL)

DIGITAL VOLT METER
MODEL: KAYE INSTRUMENTS: X1525S
SERIAL # 306172
CALIBRATION DUE DATE: 01/30/2005

EDC 100RC SERIAL # 15075
NIST # 811/267966-03
DUE : 12/17/2005

ICE POINT THERMOCOUPLE REFERENCE
MODEL, KAYE INSTRUMENTS: K-170-SP
SERIAL #: 306179
CALIBRATION DUE DATE: 01/30/2005

TYPE T STANDARD
REEL # 25926 & 26369
NIST # 258779B

Janice Rossell 10-16-04
QUALITY ASSURANCE TECHNICIAN DATE

PMC A DIVISION OF ROCKBESTOS-SURPRENANT CABLE CORP
680 HAYWARD STREET, MANCHESTER, NH 03103 (603) 622-3500
SPECIALIZING IN WIRE & CABLE FOR THE SENSOR INDUSTRY FAX (800) 639-5701

CERTIFICATE OF CALIBRATION

SPOOL # 00565656

TO: OMEGA POINT LABS, INC.
16015 SHADY FALLS ROAD
ELMENDORF,TX 78112
USA

Date: 10/16/04
Cust PO#: 14561Q
JOB # PSO067407-3

CALIBRATION RESULTS ARE TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) AND MEET SPECIAL LIMITS DEVIATION TOLERANCES AS DEFINED IN ISA MC96.1 (FORMERLY ANSI) AND ASTM E 230-03. MS-14561Q-OPL.

TEST RESULTS FOR: PMC P/N: KK-FB/FB-24 Total Footage: 1555'

Test Temperature (°F)	Inside End	Outside End
200º	-1.4	-0.9
400º	-1.2	-1.7
600º	-2.0	-1.7
800º	-2.0	-1.6
1000º	+0.9	+1.8

Calibration Certificate Acceptance
Item Fiberglass TC Wire
SN 00565656
NIST Traceability Adequate QA Eng.
As Found / As left Values QA Eng.
Calibration Date Sufficient QA Eng.
Tolerance Range Adequate QA Eng.
Date of Review QA 10-25-04 Eng. 10/26/04
OPL QA/QC Dept. Eng./Dept. Mgr.

REPORTED RESULTS ARE DEVIATIONS FROM TEST TEMPERATURES. FOR CORRECTION FACTORS REVERSE THE SIGNS.

THE MATERIAL REFERENCED ABOVE HAS BEEN CALIBRATED UTILIZING TECHNIQUES CONSISTENT WITH THE GUIDELINES SET FORTH IN ANSI Z540-1 AND ASTM E-220-02. THIS IS TO CERTIFY THE MATERIAL FURNISHED ON THIS SHIPMENT ARE IN CONFORMANCE WITH THE REQUIREMENTS, SPECIFICATIONS, AND DRAWINGS OF THE ABOVE REFERENCED CUSTOMER PURCHASE ORDER. INSPECTION AND TEST RECORDS ARE ON FILE AND AVAILABLE FOR CUSTOMER REVIEW.

SECONDARY STANDARD THERMOCOUPLE: TYPE K
REEL # POS LEG: 00534834
REEL # NEG LEG: 00534833
CALIBRATION DATE: 3/17/00

NIST #: 263094C&A
263094B&D
(SINGLE USE THERMOCOUPLE FROM CALIBRATED REEL)

EDC 100RC SERIAL # 15075
NIST # 811/267966-03
DUE : 12/17/2005

DIGITAL VOLT METER
MODEL: KAYE INSTRUMENTS: X1525S
SERIAL # 306172
CALIBRATION DUE DATE: 01/30/2005

ICE POINT THERMOCOUPLE REFERENCE
MODEL, KAYE INSTRUMENTS: K-170-SP
SERIAL #: 306179
CALIBRATION DUE DATE: 01/30/2005

TYPE T STANDARD
REEL # 25926 & 26369
NIST # 258779B

10-16-04
QUALITY ASSURANCE TECHNICIAN DATE

PMC A DIVISION OF ROCKBESTOS-SURPRENANT CABLE CORPORATION
680 HAYWARD STREET, MANCHESTER, NH 03103 (603) 622-3500
SPECIALIZING IN WIRE & CABLE FOR THE SENSOR INDUSTRY FAX (800) 639-5701

CERTIFICATE OF CALIBRATION

SPOOL # 00565657

TO: OMEGA POINT LABS, INC.
16015 SHADY FALLS ROAD
ELMENDORF,TX 78112
USA

Date: 10/16/04
Cust PO#: 14561Q
JOB # PSO067407-3

CALIBRATION RESULTS ARE TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) AND MEET SPECIAL LIMITS DEVIATION TOLERANCES AS DEFINED IN ISA MC96.1 (FORMERLY ANSI) AND ASTM E 230-03. MS-14561Q-OPL.

TEST RESULTS FOR: PMC P/N: KK-FB/FB-24 Total Footage: 1315'

Test Temperature (°F)	Inside End	Outside End
200°	-1.1	-0.3
400°	-1.0	-1.9
600°	-2.3	-1.3
800°	-2.3	-1.9
1000°	+0.5	+1.1

Calibration Certificate Acceptance
Item Fiberglass TC Wire
SN 00565657
NIST Traceability Adequate QA Eng:
As Found / As left Values QA Eng:
Calibration Date Sufficient QA Eng:
Tolerance Range Adequate QA Eng:
Date of Review QA 10-25-04 Eng. 10/26/04
OPL QA/QC Dept. Eng./Dept. Mgr.

REPORTED RESULTS ARE DEVIATIONS FROM TEST TEMPERATURES. FOR CORRECTION FACTORS REVERSE THE SIGNS.

THE MATERIAL REFERENCED ABOVE HAS BEEN CALIBRATED UTILIZING TECHNIQUES CONSISTENT WITH THE GUIDELINES SET FORTH IN ANSI Z540-1 AND ASTM E-220-02. THIS IS TO CERTIFY THE MATERIAL FURNISHED ON THIS SHIPMENT ARE IN CONFORMANCE WITH THE REQUIREMENTS, SPECIFICATIONS, AND DRAWINGS OF THE ABOVE REFERENCED CUSTOMER PURCHASE ORDER. INSPECTION AND TEST RECORDS ARE ON FILE AND AVAILABLE FOR CUSTOMER REVIEW.

SECONDARY STANDARD THERMOCOUPLE: TYPE K
REEL # POS LEG: 00534834
REEL # NEG LEG: 00534833
CALIBRATION DATE: 3/17/00

NIST #: 263094C&A
263094B&D
(SINGLE USE THERMOCOUPLE FROM CALIBRATED REEL)

DIGITAL VOLT METER
MODEL: KAYE INSTRUMENTS: X1525S
SERIAL # 306172
CALIBRATION DUE DATE: 01/30/2005

EDC 100RC SERIAL # 15075
NIST # 811/267966-03
DUE : 12/17/2005

ICE POINT THERMOCOUPLE REFERENCE
MODEL, KAYE INSTRUMENTS: K-170-SP
SERIAL #: 306179
CALIBRATION DUE DATE: 01/30/2005

TYPE T STANDARD
REEL # 25926 & 26369
NIST # 258779B

Bruce Robert 10-16-04
QUALITY ASSURANCE TECHNICIAN DATE

PMC A DIVISION OF ROCKBESTOS-SURPRENANT CABLE CORP. CANADA
680 HAYWARD STREET, MANCHESTER, NH 03103 (603) 622-3500
SPECIALIZING IN WIRE & CABLE FOR THE SENSOR INDUSTRY FAX (800) 639-5701

CERTIFICATE OF CALIBRATION

SPOOL # 00565658

TO: OMEGA POINT LABS, INC.
16015 SHADY FALLS ROAD
ELMENDORF,TX 78112
USA

Date: 10/16/04
Cust PO#: 14561Q
JOB # PSO067407-3

CALIBRATION RESULTS ARE TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) AND MEET SPECIAL LIMITS DEVIATION TOLERANCES AS DEFINED IN ISA MC96.1 (FORMERLY ANSI) AND ASTM E 230-03. MS-14561Q-OPL.

TEST RESULTS FOR: PMC P/N: KK-FB/FB-24 Total Footage: 3685'

Test Temperature (°F)	Inside End	Outside End
200°	-1.5	-0.6
400°	-1.9	-0.8
600°	-2.0	-1.4
800°	-1.9	-0.8
1000°	+0.1	+1.2

Calibration Certificate Acceptance
Item Fiberglass TC Wire
SN 00565658
NIST Traceability Adequate QA Eng.
As Found / As left Values QA Eng.
Calibration Date Sufficient QA Eng.
Tolerance Range Adequate QA Eng.
Date of Review QA 10-25-04 Eng. 10/26/04
OPL QA/QC Dept. Eng./Dept. Mgr.

REPORTED RESULTS ARE DEVIATIONS FROM TEST TEMPERATURES. FOR CORRECTION FACTORS REVERSE THE SIGNS.

THE MATERIAL REFERENCED ABOVE HAS BEEN CALIBRATED UTILIZING TECHNIQUES CONSISTENT WITH THE GUIDELINES SET FORTH IN ANSI Z540-1 AND ASTM E-220-02. THIS IS TO CERTIFY THE MATERIAL FURNISHED ON THIS SHIPMENT ARE IN CONFORMANCE WITH THE REQUIREMENTS, SPECIFICATIONS, AND DRAWINGS OF THE ABOVE REFERENCED CUSTOMER PURCHASE ORDER. INSPECTION AND TEST RECORDS ARE ON FILE AND AVAILABLE FOR CUSTOMER REVIEW.

SECONDARY STANDARD THERMOCOUPLE: TYPE K
REEL # POS LEG: 00534834
REEL # NEG LEG: 00534833
CALIBRATION DATE: 3/17/00

NIST #: 263094C&A
263094B&D
(SINGLE USE THERMOCOUPLE FROM CALIBRATED REEL)

DIGITAL VOLT METER
MODEL: KAYE INSTRUMENTS: X1525S
SERIAL # 306172
CALIBRATION DUE DATE: 01/30/2005

EDC 100RC SERIAL # 15075
NIST # 811/267966-03
DUE : 12/17/2005

ICE POINT THERMOCOUPLE REFERENCE
MODEL, KAYE INSTRUMENTS: K-170-SP
SERIAL #: 306179
CALIBRATION DUE DATE: 01/30/2005

TYPE T STANDARD
REEL # 25926 & 26369
NIST # 258779B

Janice Roberts 10-16-04
QUALITY ASSURANCE TECHNICIAN DATE

PMC A DIVISION OF ROCKBESTOS-SURPRENANT CABLE CORPORATION
680 HAYWARD STREET, MANCHESTER, NH 03103 (603) 622-3500
SPECIALIZING IN WIRE & CABLE FOR THE SENSOR INDUSTRY FAX (800) 639-5701

CERTIFICATE OF CALIBRATION

SPOOL # 00565660

TO: OMEGA POINT LABS, INC.
16015 SHADY FALLS ROAD
ELMENDORF,TX 78112
USA

Date: 10/16/04
Cust PO#: 14561Q
JOB # PSO067407-3

CALIBRATION RESULTS ARE TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) AND MEET SPECIAL LIMITS DEVIATION TOLERANCES AS DEFINED IN ISA MC96.1 (FORMERLY ANSI) AND ASTM E 230-03. MS-14561Q-OPL.

TEST RESULTS FOR: PMC P/N: KK-FB/FB-24 Total Footage: 4400'

Calibration Certificate Acceptance
Item Fiberglass TC Wire
SN 00565660
NIST Traceability Adequate QA [illegible] Eng.
As Found / As left Values QA [illegible] Eng.
Calibration Date Sufficient QA [illegible] Eng.
Tolerance Range Adequate QA [illegible] Eng.
Date of Review QA 10-25-04 Eng. 10/25/04
OPL QA/QC Dept. Eng./Dept. Mgr.

Test Temperature (°F)	Inside End	Outside End
200°	-1.2	-0.4
400°	-1.5	-1.0
600°	-2.1	-1.7
800°	-2.1	-1.0
1000°	+0.5	+1.6

REPORTED RESULTS ARE DEVIATIONS FROM TEST TEMPERATURES. FOR CORRECTION FACTORS REVERSE THE SIGNS.

THE MATERIAL REFERENCED ABOVE HAS BEEN CALIBRATED UTILIZING TECHNIQUES CONSISTENT WITH THE GUIDELINES SET FORTH IN ANSI Z540-1 AND ASTM E-220-02. THIS IS TO CERTIFY THE MATERIAL FURNISHED ON THIS SHIPMENT ARE IN CONFORMANCE WITH THE REQUIREMENTS, SPECIFICATIONS, AND DRAWINGS OF THE ABOVE REFERENCED CUSTOMER PURCHASE ORDER. INSPECTION AND TEST RECORDS ARE ON FILE AND AVAILABLE FOR CUSTOMER REVIEW.

SECONDARY STANDARD THERMOCOUPLE: TYPE K
REEL # POS LEG: 00534834
REEL # NEG LEG: 00534833
CALIBRATION DATE: 3/17/00

NIST #: 263094C&A
263094B&D
(SINGLE USE THERMOCOUPLE FROM CALIBRATED REEL)

DIGITAL VOLT METER
MODEL: KAYE INSTRUMENTS: X1525S
SERIAL # 306172
CALIBRATION DUE DATE: 01/30/2005

EDC 100RC SERIAL # 15075
NIST # 811/267966-03
DUE : 12/17/2005

ICE POINT THERMOCOUPLE REFERENCE
MODEL, KAYE INSTRUMENTS: K-170-SP
SERIAL #: 306179
CALIBRATION DUE DATE: 01/30/2005

TYPE T STANDARD
REEL # 25926 & 26369
NIST # 258779B

[illegible] 10-16-04
QUALITY ASSURANCE TECHNICIAN DATE

PMC Division of RSCC
680 Hayward Street
Manchester, NH 03103
Tel : (603) 622-3500 Fax : (603) 622-7023
SPECIALIZING IN WIRE & CABLE FOR THE SENSOR INDUSTRY

DELIVERY NOTE

DELIVERY TO
OMEGA POINT LABS
16015 SHADY FALLS ROAD
ELMENDORF, TX 78112
USA

Attention: CLEDA

SHIPMENT :	OUR ORDER :	DATE :	CUSTOMER PO :	CONTACT :
0000146332	PSO067407	Oct 18 2004	14561Q	CLEDA
ACCOUNT :	**FOB :**	**SHIP VIA :**	**TRACKER# :**	**PAGE :**
OMEG01	Manchester,NH	UPS GROUND		1

LINE	ITEM	UOM	QTY	QTY SHIPPED	QTY B/O
003	KK-FB/FB-24 Spool #: 00565655 00565656 00565657 00565658 00565660	MFT	12,000	12,475	0
004	CALIBRATION CHARGE Spool #:	EACH	1	1	0

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME Sandia National Labs
CLIENT/PROJECT NUMBER 14790-123263-264+265
RECEIVED FROM Texas Specialty Steel
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 2689 - 14790
DATE RECEIVED 1-5-05
DATE INSPECTED 1-5-05
INSPECTED BY:

ITEM DESCRIPTION	P.O . NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	CON'tD MATL Y/N	CERT REC'D Y/N	SAFETY RELATED Y/N	CONTAINER INTEGRITY	ACCEPTANCE Accept	Hold	Reject	REMARKS
C Channel	146740	30	30	0	C4X5.4	Y	Y	N	GOOD	X			
4X5.4													
C Channel	146740	10	10	0	C5X6.7	Y	X	N	GOOD	X			
4X6.7													
Hot Rolled Steel	146740	12	12	0	10GA X 72.000"	Y	Y	N	GOOD	X			
10ga X (Sheets)													
144"													

OMEGA POINT LABORATORIES

16015 SHADY FALLS RD.
ELMENDORF, TEXAS 78112
PH. (210) 635-8100
FAX (210) 635-8101

PURCHASE ORDER
14674Q

Date: 01/04/2005

Order From: Texas Specialty Steel
12270 Hwy. 181 S
San Antonio
TX 78223
210-633-0047

Deliver to: Omega Point Laboratories, Inc
16015 Shady Falls Road
Elmendorf
TX 78112
(210) 635-8100

Vendor No:

Your Item Number / Item Description	Our Reference	Qty Ordered	Units	Unit Cost	Extension
C Channel C4x5.4x20'	001	10	Each	$44.55	$445.50
C Channel C5x6.7x20'	002	30	Each	$55.28	$1,658.40
10 ga.72" x 144" HR Sheets	003	12	Each	$243.00	$2,916.00

"See Special Instructions Regarding Purchasing Specifications for Quality Assurance Requirements."
QA Approval
Date 1-4-05

Please Quote Purchase Order Number on all correspondence.
Please certify that the items supplied conform to applicable standards and specifications.

Subtotal:	$5,019.90
Freight:	0.00
Tax Amount:	338.84
Total Value:	$5,358.74

TEXAS SPECIALTY STEEL
12270 Hwy 181 So.
San Antonio, Texas 78223
(210) 633-0047
Fax 633-2344

SALES ORDER 5960

Omega Point Lab

DELIVER TO: Sam

Cleta

DATE ORDERED	PO #	DATE SHIPPED	SHIPPED VIA	F.O.B.	SALESMAN
1-4-05	14674 Q		OT		TS

QUANTITY	DESCRIPTION	WEIGHT	PRICE	TOTAL
30	4x5¼ Chan 20'	108# ea	44.55 ea	1336.50
10	5x6⅞ Chan 20'	134# ea	55.28 ea	552.80
12	10ga 6 x 12 NR Sheets	405# ea	243.00 ea	2916.00
				4805.30
			TAX	324.36
	MTR required			5129.66
	$25.00 Service Charge For Returned Checks			
	☒ TAXABLE ☐ NON-TAXABLE			

BAYOU STEEL CORPORATION
RIVER ROAD P.O. BOX 5000
LA PLACE, LOUISIANA 70069-1156
Telephone (985) 652-4900

MATERIAL CERTIFICATION REPORT

TESTED IN ACCORDANCE WITH ASTM A6

INVOICE NO.
PRODUCT CHANNELS
HEAT NO. 28136 48 Pcs
Length 20'0"

DATE 11/30/04
Cust O-3300 -0184
GRADE A36 -01
SIZE C 4 X 5.4

PO:0663288 03 24
Prod Id:0126441

CHEMICAL ANALYSIS	
C	.11
Mn	.78
P	.014
S	.02
Si	.21
Cu	.31
Ni	.17
Cr	.17
Mo	.056
Cb	.000
V	.000
B	
Al	
Sn	
N	
Ti	

CI	
CE	

MECHANICAL PROPERTIES	TEST 1 IMPERIAL	TEST 1 METRIC	TEST 2 IMPERIAL	TEST 2 METRIC	TEST 3 IMPERIAL	TEST 3 METRIC
YIELD STRENGTH	46,363 PSI	320 MPa	45,448 PSI	313 MPa	PSI	MPa
TENSILE STRENGTH	66,399 PSI	458 MPa	66,645 PSI	460 MPa	PSI	MPa
ELONGATION	33.0 %	33.0 %	31.0 %	31.0 %	%	%
GUAGE LENGTH	8 in	203 mm	8 in	203 mm	in	mm
BEND TEST DIAMETER	d	d	d	d	d	d
BEND TEST RESULTS						
SPECIMEN AREA	sq in	sq mm	sq in	sq mm	sq in	sq mm
REDUCTION OF AREA	%	%	%	%	%	%
IMPACT STRENGTH	ft-lbs	J	ft-lbs	J	ft-lbs	J

IMPACT STRENGTH	IMPERIAL	METRIC	INTERNAL CLEANLINESS		GRAIN SIZE HARDNESS	
AVERAGE	ft-lbs	J	SEVERITY			
TEST TEMP	F	C	FREQUENCY		GRAIN PRACTICE REDUCTION RATIO	
ORIENTATION			RATING			

Customer Grade & Specs: ASME SA36 A709 GRADE 36
"NO WELD REPAIR"

I HEREBY CERTIFY THAT THE MATERIAL TEST RESULTS PRESENTED HERE ARE FROM THE REPORTED HEAT AND ARE CORRECT. ALL TESTS WERE PERFORMED IN ACCORDANCE TO THE SPECIFICATIONS REPORTED ABOVE. ALL STEEL IS ELECTRIC FURNACE MELTED, MANUFACTURED, PROCESSED, AND TESTED IN THE U.S.A WITH SATISFACTORY RESULTS, AND IS FREE OF MERCURY CONTAMINATION IN THE PROCESS.

NOTARIZED UPON REQUEST:
SWORN TO AND SUBSCRIBED BEFORE ME IN AND FOR ST. JOHN PARISH ON THIS _____ DAY OF _____ , 20____

Jeanne M. Buffington, # 60493, Notary Public

SIGNED Timothy R. White
TIMOTHY R. WHITE, QUALITY ASSURANCE MANAGER

DIRECT ANY QUESTIONS OR NECESSARY CLARIFICATIONS CONCERNING THIS REPORT TO THE SALES DEPARTMENT.

1-800-535-7692 (USA)

BAYOU STEEL CORPORATION
RIVER ROAD P.O. BOX 5000
LA PLACE, LOUISIANA 70069-1156
Telephone (985) 652-4900

MATERIAL CERTIFICATION REPORT

TESTED IN ACCORDANCE WITH: ASTM A6

INVOICE NO.
PRODUCT: CHANNELS
HEAT NO.: 23960 36 Pcs
Length 20'0"

DATE: 06/01/04
Cust O-3300 -0184
GRADE: A36 -01
SIZE: C 5 X 6.7

PO:0661120 03 24
Prod Id:0127721

CHEMICAL ANALYSIS	
C	.12
Mn	.96
P	.018
S	.04
Si	.26
Cu	.41
Ni	.17
Cr	.19
Mo	.056
Cb	.000
V	.018
B	
Al	
Sn	
N	
Ti	

CI	
CE	

MECHANICAL PROPERTIES	TEST 1 IMPERIAL	TEST 1 METRIC	TEST 2 IMPERIAL	TEST 2 METRIC	TEST 3 IMPERIAL	TEST 3 METRIC
YIELD STRENGTH	52,522 PSI	362 MPa	53,298 PSI	367 MPa	PSI	MPa
TENSILE STRENGTH	74,321 PSI	512 MPa	75,257 PSI	519 MPa	PSI	MPa
ELONGATION	31.0 %	31.0 %	26.0 %	26.0 %	%	%
GUAGE LENGTH	8 in	203 mm	8 in	203 mm	in	mm
BEND TEST DIAMETER	d	d	d	d	d	d
BEND TEST RESULTS						
SPECIMEN AREA	sq in	sq mm	sq in	sq mm	sq in	sq mm
REDUCTION OF AREA	%	%	%	%	%	%
IMPACT STRENGTH	ft·lbs	J	ft·lbs	J	ft·lbs	J

IMPACT STRENGTH	IMPERIAL	METRIC	INTERNAL CLEANLINESS		GRAIN SIZE HARDNESS	
AVERAGE	ft·lbs	J	SEVERITY			
TEST TEMP	F	C	FREQUENCY		GRAIN PRACTICE REDUCTION RATIO	
ORIENTATION			RATING			

Customer Grade & Specs: ASME SA36 A709 GRADE 36
"NO WELD REPAIR"

I HEREBY CERTIFY THAT THE MATERIAL TEST RESULTS PRESENTED HERE ARE FROM THE REPORTED HEAT AND ARE CORRECT. ALL TESTS WERE PERFORMED IN ACCORDANCE TO THE SPECIFICATIONS REPORTED ABOVE. ALL STEEL IS ELECTRIC FURNACE MELTED, MANUFACTURED, PROCESSED, AND TESTED IN THE U.S.A WITH SATISFACTORY RESULTS, AND IS FREE OF MERCURY CONTAMINATION IN THE PROCESS.

NOTARIZED UPON REQUEST:
SWORN TO AND SUBSCRIBED BEFORE ME IN AND FOR ST. JOHN PARISH ON THIS _____ DAY OF _____, 20____

Jeanne M. Buffington, # 60493, Notary Public

SIGNED Timothy R. White
TIMOTHY R. WHITE, QUALITY ASSURANCE MANAGER

DIRECT ANY QUESTIONS OR NECESSARY CLARIFICATIONS CONCERNING THIS REPORT TO THE SALES DEPARTMENT.

1-800-535-7692 (USA)

Tel: 205-599-8000 Fax: 205 599-8131

CERTIFICATE of ANALYSIS and TESTS

Cert. No: HO 99160
13Oct04

Part No 863826/0617501
HR COIL ASTMA1011 COMM STL
10 GA. X 72.0000"

Pcs	Wgt
26	10,530

Heat Number	Tag No	Pcs	Wgt
61984C	445062		0

MILL=<US STEEL>/VESSL=<MP951019>/CNTRY=<USA>/REV=<04-03>

Heat Number
61984C

*** Chemical Analysis ***
C=0.0500 Mn=0.3400 P=0.0110 S=0.0080 Si=0.0050 Cu=0.0500
Al=0.0540

THIS IS TO CERTIFY THAT THE PRODUCT DESCRIBED HEREIN WAS SAMPLED AND TESTED IN ACCORDANCE WITH THE SPECIFICATION, TO OUR KNOWLEDGE, AND FULFILLS REQUIREMENTS IN SUCH RESPECT.

2042762-36

BAYOU STEEL CORPORATION
RIVER ROAD P.O. BOX 5000
LA PLACE, LOUISIANA 70069-1156
Telephone (985) 652-4900

MATERIAL CERTIFICATION REPORT

20PC- 14674Q

TESTED IN ACCORDANCE WITH ASTM A6

INVOICE NO.
PRODUCT CHANNELS
HEAT NO. 23I49 36 Pcs
Length 40'0"

DATE 03/25/04
Cust O-3300 -0184
GRADE A36 -01
SIZE C 5 X 6.7

PO:0660119 03 24
Prod Id:0128041

CHEMICAL ANALYSIS	
C	.14
Mn	.88
P	.015
S	.04
Si	.25
Cu	.24
Ni	.13
Cr	.14
Mo	.025
Cb	.000
V	.000
B	
Al	
Sn	
N	
Ti	

CI	
CE	

MECHANICAL PROPERTIES	TEST 1 IMPERIAL	TEST 1 METRIC	TEST 2 IMPERIAL	TEST 2 METRIC	TEST 3 IMPERIAL	TEST 3 METRIC
YIELD STRENGTH	48,344 PSI	333 MPa	47,994 PSI	331 MPa	PSI	MPa
TENSILE STRENGTH	70,206 PSI	484 MPa	69,642 PSI	480 MPa	PSI	MPa
ELONGATION	36.0 %	36.0 %	36.0 %	36.0 %	%	%
GUAGE LENGTH	8 in	203 mm	8 in	203 mm	in	mm
BEND TEST DIAMETER	d	d	d	d	d	d
BEND TEST RESULTS						
SPECIMEN AREA	sq in	sq mm	sq in	sq mm	sq in	sq mm
REDUCTION OF AREA	%	%	%	%	%	%
IMPACT STRENGTH	ft-lbs	J	ft-lbs	J	ft-lbs	J

IMPACT STRENGTH	IMPERIAL	METRIC	INTERNAL CLEANLINESS		GRAIN SIZE HARDNESS	
AVERAGE	ft-lbs	J	SEVERITY			
TEST TEMP	F	C	FREQUENCY		GRAIN PRACTICE REDUCTION RATIO	
ORIENTATION			RATING			

Customer Grade & Specs: ASME SA36 A709 GRADE 36
"NO WELD REPAIR"

I HEREBY CERTIFY THAT THE MATERIAL TEST RESULTS PRESENTED HERE ARE FROM THE REPORTED HEAT AND ARE CORRECT. ALL TESTS WERE PERFORMED IN ACCORDANCE TO THE SPECIFICATIONS REPORTED ABOVE. ALL STEEL IS ELECTRIC FURNACE MELTED, MANUFACTURED, PROCESSED, AND TESTED IN THE U.S.A WITH SATISFACTORY RESULTS, AND IS FREE OF MERCURY CONTAMINATION IN THE PROCESS.

NOTARIZED UPON REQUEST:
SWORN TO AND SUBSCRIBED BEFORE ME IN AND FOR ST. JOHN PARISH ON THIS _____ DAY OF _____, 20___

Jeanne M. Bulfington, # 60493, Notary Public

SIGNED Timothy R. White
TIMOTHY R. WHITE, QUALITY ASSURANCE MANAGER

DIRECT ANY QUESTIONS OR NECESSARY CLARIFICATIONS CONCERNING THIS REPORT TO THE SALES DEPARTMENT.

1-800-535-7692 (USA)

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME Sandia Nat'l Labs
CLIENT/PROJECT NUMBER 14790-123263.64+65
RECEIVED FROM Sandia Nat'l Labs
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 2700 - 14790
DATE RECEIVED 3-4-05
DATE INSPECTED 3-4-05
INSPECTED BY: [signature]

ITEM DESCRIPTION	P.O . NO.	QUANTITY Order	QUANTITY Rec'd	QUANTITY B.O.	I.D. NO.	CON'tD MATL Y/N	CERT REC'D Y/N	SAFETY RELATED Y/N	CONTAINER INTEGRITY	ACCEPTANCE Accept	ACCEPTANCE Hold	ACCEPTANCE Reject	REMARKS
Cabletrays 12"	NA	Q	3	Q	24BP09-12-144STR	Y	N	N	Good	X			Receiving Only
cabletrays 36"	NA	Q	3	Q	24BP09-36-144-STR	Y	N	N	Good	X			
90° - 12"	NA	Q	2	Q	4P-1290V124 VRT 1/S	Y	N	N	Good	X			
90° - 36"	NA	Q	2	Q	4P-36-90V124 VRT 1/S	Y	N	N	Good	X			
Splice Plates	NA	Q	~~8~~ 3-4-05	Q	11954A	Y	N	N	Good	X			
Splice Plates	NA	Q	12	Q	113A1D	Y	N	N	Good	X			
									-				

FM 136

PACKING LIST

SHIPPING ORDER NO.
80770500001

COOPER B-Line 509 West Monroe Street, Highland, Illinois 62249-0326, U.S.A. 618-654-2184

024012438

SOLD TO:
BORDER STATES ELECTRIC
PO BOX 2767

FARGO ND 581082767

000072721

SHIP TO:
OMEGA POINT LABS
16015 SHADY FALLS ROAD

ELMENDORF TX 78112

ATTN: RECEIVING

SHIP FROM	SHIP DATE	SHIP VIA	BILL OF LADING	WEIGHT	FREIGHT TERMS
RENO	3/02/05	PRECISION AIR C	01256739	501.00	CHARGE

CST PO: 5500414947

PHONE: 7012935833

ORDERED	DUE	SHIPPED	BACKORDER	UNIT	LINE	DESCRIPTION
						CONTACT IS DEG PRIEST 210 635 8100 CAN SHIP EARLY 3/2 PER KATHY C. SHIP PRECISION AIR PER STEVE AT KH 1-800-842-7472 ACCT #613. INSURE FOR VALUE OF MATL $1516.00. ASK PRECISION TO CONFIRM WITH HOPE AT BORDER 505-344-1313.
3	3	3		PC	1	248P09-12-144 ST SC ✓ 78101162149
3	3	3		PC	2	248P09-36-144 ST SC ✓ 78101162454
2	2	2		PC	3	4P-12-90VI24 VRT I/S ✓ 78101162189
2	2	2		PC	4	4P-36-90VI24 VRT I/S ✓ 78101162491
10	10	10		PR	5	9ZN-8004 SPLICE PLT ✓ 78101126314

ANY SHORTAGE OR DAMAGE MUST BE REPORTED TO CUSTOMER SERVICE AT 618.654.2184 WITHIN TEN (10) DAYS FROM DATE OF SHIPMENT.

THIS MEMORANDUM

is an acknowledgment that a Bill of Lading has been issued and is not the Original Bill of Lading nor a copy or duplicate, covering the property named herein, and is intended solely for filing or record.

RECEIVED, subject to the classifications and tariffs in effect on the date of the receipt by the carrier of the property described in the Original Bill of Lading, the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked consigned, and destined as indicated below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Official, Southern, Western and Illinois Freight Classifications in effect on the date hereof, if this is a rail or a rail-water shipment or (2) in the applicable motor carrier classification or tariff if this is a motor carrier shipment.

Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, including those on the back thereof, set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

4

B/L NO. 0139-6739

SHIPPER'S NO. 907705 00 001

Page 460

AT RENO FROM **COOPER B-Line** 3/02/05 NAME OF CARRIER

(Mail or street address of consignee – For purposes of notification only.)

Consigned To OMEGA POINT LABS
19015 SHADY FALLS ROAD
KIMENDORF TX 78112

PO# 5500414947
MARK: RECEIVING

Dest'n

Route

Del'ng Carr. PRECISION AIR C

Car or Vehicle Initials

No.

NUMBER OF PACKAGES	KIND OF PACKAGE, DESCRIPTION OF ARTICLES, SPECIAL MARKS, AND EXCEPTIONS		*WEIGHT (SUBJECT TO CORRECTION)	CLASS OR RATE
	Bundles of _____ Pcs. Single Pcs. Carton _____ Pcs.	Channels, NOI Iron or Steel Item No. 104850		
1	Crates Skids Cartons	Braces, Brackets NOI, Iron or Steel 3/16" Thick or Thicker Item No. 104600	25#	50
	Bundle of _____ Pcs. Single Pcs. {Bundles of _____ Pcs. Curved Fitting Single Pcs. Curved Fitting}	Cable Racks; Trays Troughs or Cable Way Aluminum Straight Section and Curved Fittings. Item No. 61220 - Sub 2		
3 4	Bundles of _____ Pcs. Single Pcs. {Bundles of _____ Pcs. Curved Fittings Single Pcs. Curved Fitting}	Cable Racks, Trays Troughs or Cable Way Steel 16 Gauge or Thicker Straight Sections and Curved Fittings Item No. 61220 - Sub 1	476#	60
	Crates Skids Cartons	Clips, Fasteners or Mounts, Steel, 94230		
	7 TOTAL PCS.- 501#			

DELIVERY DATE 03/04
CONTACT IS DEC PRIEST 210-635-8100
$1516.00 INSURANCE
****
SEND FREIGHT BILL WITH B/L TO:
BILL ACCT# 613
X
X
X XX 00001
****

Subject to Section 7 of conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

COOPER B-Line

(Signature of Consignor)

If charges are to be prepaid, write or stamp here, "To be Prepaid."

THIRD PARTY

Received $ to

apply in prepayment of the charges on the property described hereon.

Agent or Cashier.

Per

(The signature here acknowledges only the amount prepaid.)

Charges Advanced:
$

Collect On Delivery $ and Remit to

Street City State

C.O.D. CHARGES TO BE PAID BY
Shipper ☐ Consignee ☐

* If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight."
NOTE–Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property. The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

per Shattuck, Tom

The Fibre Boxes used for this shipment conform to the specifications set forth in the box maker's certificate thereon, and all other requirements of Consolidated Freight Classification.

COOPER B-Line Shipper, Per

Agent, Per

Permanent postoffice address of shipper, **P.O. Box 326, Highland, Illinois 62249**

Form 103 Rev. 05/01

PACKING LIST COPY

Airgroup - DFW
PO Box 3627
Bellevue, WA 98009-3627
Tel: 817-481-0970 Fax: 817-488-6583
www.airgroup.com

HAWB #	: 129000584
Origin	: DFW
Destination	: AUS
Pick Up Date	: 03/03/2005
Deliv Date	: BY 03/04/2005
COD	:
Charges	: Third Party
Shipment #	:

Domestic HAWB

Shipper	Consignee	Billing Party
AA C/O QLS 3801 PINNACLE POINT COCKRELL, TX 75211 **Attn:** **Tel:** **Ref #**	AA C/O LSG SKY CHEFS 18950 COLONEL FISCHER DR. HOUSTON, TX 77032 **Attn:** CECELIA **Tel:** 281-443-8560 **Ref #**	WORLDWIDE FLIGHT E BUSINESS 1925 W JOHN CARPENTER FRWY STE 450 IRVING, TX 75063 **Attn:** **Tel:** **Ref #**

Pick Up Ready	Between	Closing	Deliver By	Between	Closing
03/03/2005	-		03/04/2005	-	

TSA	U

Special Instructions

Pieces	Actual Weight	Corrected Weight	Description	Length	Width	Height
1	266.00 LB			48.00	40.00	19.00

SHIPMENT TOTALS

1	266.00 LB			188.04 LB

Charge	Description	Qty	Rate	Amount

TOTAL CHARGES $0.00

Total Declared Value

Shipper Signature			Pick-Up Driver Signature			Consignee Signature		
Date	Time	Pcs	Date	Time	Pcs	Date	Time	Pcs
Exceptions (Shipment received in good order unless noted)			Exceptions (Shipment received in good order unless noted)			Exceptions (Shipment received in good order unless noted)		

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME Sandia National Labs
CLIENT/PROJECT NUMBER 14790-123263-264+265
RECEIVED FROM Sandia Nat'l Labs
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 2691 - 14790
DATE RECEIVED 1-14-05
DATE INSPECTED 1-14-05
INSPECTED BY: [signature] [date]

ITEM DESCRIPTION	P.O . NO.	QUANTITY			I.D. NO.	CON'tD MATL Y/N	CERT REC'D Y/N	SAFETY RELATED Y/N	CONTAINER INTEGRITY	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
12" wide cable tray	NA	0	4	0	09-1D79-0012-12	Y		N	Good	X			Receiving Only
12" inside curve cable tray	NA	0	3	0	09-1D79-9124-12								
36" inside curve cable tray	NA	0	3	0	09-1D79-9124-36								
Unistrut super strut	NA	0	13	0	A-1200-AS								
2" square steel tube	NA	0	2	0									
Box of hardware - cable trays	NA	0	1	0	NA								
36" cable tray	NA	0	4	0	09-1D79-0012-36								
Bare #8 Copper	NA	0	36	0	#3500 NAED 050-4000								

Q/A RECEIVING REPORT

CLIENT/PROJECT NAME Sandia National Labs
CLIENT/PROJECT NUMBER 14790 - 123263-264 & 265
RECEIVED FROM Sandia Nat'l Labs
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 2691 - 14790
DATE RECEIVED 1-14-05
DATE INSPECTED 1-14-05
INSPECTED BY: [signature]

ITEM DESCRIPTION	P.O . NO.	QUANTITY Order	Rec'd	B.O.	I.D. NO.	CON'tD MATL Y/N	CERT REC'D Y/N	SAFETY RELATED Y/N	CONTAINER INTEGRITY	ACCEPTANCE Accept	Hold	Reject	REMARKS
1" galv. conduit	NA	Q	12	Q	3WA8 1" 1"X10PGRC	Y		N	GOOD	X			Receiving only
1" conduit bodies	NA	Q	5	Q	APA LB77 1" FM7								
1" conduit gaskets	NA	Q	5	Q	NA								
1" steel covers	NA	Q	5	Q	1" APP FM7 370								
2.5" galv. Conduit	NA	Q	12	Q	3WA0 2½" E-104582S	Y							
2.5" conduit bodies	NA	Q	5	Q	APP LB77 2-½" FM7								
2.5" conduit gaskets	NA	Q	5	Q	NA								
2.5" steel covers	NA	Q	5	Q	Form 7 o/z Godnay 870 2½"-3"								
4" galv. conduit	NA	Q	12	Q	3WA6 4" E-104582S								
4" conduit bodies	NA	Q	5	Q	APP 4" LB 107								
4" conduit gaskets	NA	Q	5	Q	NA								
4" steel covers	NA	Q	5	Q	APP 970 3½"-4" FM7								
18"X24"X8" Junction boxes	NA	Q	4	Q	~~000351850879~~ 1-14-05 ASE24X18X8NK								
90°-1" conduit elbow	NA	Q	5	Q	E-32152H 1-90-STD RAD								
90°-2.5" Conduit elbow	NA	Q	5	Q	2X½X90 Deg								
90°-4" conduit elbow	NA	Q	5	Q	E-32152-H 3WA8 4"90DEG	Y		N	GOOD	X			

09-016-11/02

RR#2691

Cleda

Rec. 1-12-05

Fri shipment is due

Sandia National Laboratories
For the U.S. Department of Energy
1515 Eubank SE
Albuquerque, NM, 87123

SHIPPER **44885**

Commercial Invoice

Status: Approved

Ship to:

Omega Point Laboratories
16015 Shady Falls Road

Elmendorf TX 78112
United States

RMA# or RGA#	
Deliver to:	Deg Priest
Phone:	(210) 635-8100
Building:	Room:
Mail Stop:	
Company:	Omega Point Laboratories
Department:	
Address Type:	Unclassified
Date Due at Destination:	1/16/2005
Production Related:	No

Origination Site:	SA
Form filled out by:	WYANT,FRANCIS J.
Phone:	5058445682
Date Prepared:	2005-1-10
Requester:	WYANT,FRANCIS J. (FRANK)
Phone:	5058445682
Org. #:	06861

For Shipment Processing Use

Date Shipped:	
Carrier:	None Selected
Mode:	None Selected
Bill of Lading No.:	
Total # of Pkgs:	0
Total Weight:	0.0 lbs
Total Cubic Dim:	0.0
Advance Notification	**Contacted** Yes No
Name and Phone:	
741 Number:	
ATS:	
TID Numbers:	
RCT Initial/Dates	

Reason/Authority: To be Consumed in Testing / Incorporate into End Product
Return Date: NONE
Authority Number:
Freight Charge Payment: Sandia Pays
Project: 73766
Task: 01.08
Carrier: NONE
Account:

If shipping controlled property to a new Sandia location
Destination Bldg: **Room:**

If shipping to international destination:
Import duties and taxes will be paid by my project/task: I
Export Authorization:

No freight charge reason: NONE
Is material being shipped from the Shipping Department building or the 6000 Igloo? No
Shipment Comments: Shipping container located at the TEAMS (old TOSI Site). Contact Chuck Girard (cell: 459-8181) for pick
Transportation Pickup Requested: Yes
Questions about pickup call Dispatcher 844-1448 non-hazardous materials, 844-2556 hazardous materials.

Shipper's Export Declaration prepared:

Landstar Inway
805-8828
or
646-0412

Total Shipment Quantity and Value:	1	$6,000.00

LINE ITEM LIST FOR SHIPPER NUMBER 44885

Line Item #	Description/Comments For temporary transfer of items to international destinations, include item Manufacturer's Name, Category Domestic or Foreign, and Serial Number.	Classification Category/ level	Qty	Unit	Unit Value	T
1	Description: One shipping container containing the following items: 120 ft 1-in galvanized conduit, 5 1-in conduit bodies, 5 1-in conduit gaskets, 5 1-in steel covers; 120 ft 2.5-in galvanized conduit, 5 2.5-in conduit bodies, 5 2.5-in conduit gaskets, 5 2.5-in steel covers; 120 ft 4-in galvanized conduit, 5 4-in conduit bodies, 5 4-in conduit gaskets, 5 4-in steel covers; 4 18 x 24 x 8 junction boxes; 5 90-degree 1-in conduit elbows; 5 90-degree 2.5-in conduit elbows; 5 90-degree 4-in conduit elbows; 48-ft of 12-in wide cable trays; 48-ft of 36-in wide cable trays; 3 12-in inside curves; 3 36-in inside curves; 130 ft of Unistrut; 20 ft of 2-in square steel tube; Box of hardware for cable trays Comments: These items will be used in a series of destructive tests and will not be returned to Sandia following use.	Unclassified	1	EACH	$6,000.00	$(

PACKAGES

				Dimensions					
Quantity	Type	Contents	Weight		L	W	H	D	Cubic Fe
No Packages Found									

Combination to Lock on Shipping Container:

Turn right 3 times. Stop at 6
Turn left past 6 Stop at 8
Turn right to 26

Sandia National Laboratories
For the U.S. Department of Energy
1515 Eubank SE
Albuquerque, NM, 87123

SHIPPER 45687

Commercial Invoice
Status: Waiting for Approval

Ship to:

Omega Point Laboratories, Inc
16015 Shady Falls Road

Elmendorf TX 78112-9784
United States

RMA# or RGA#

Deliver to:	Deggary N. Priest
Phone:	210-635-8100
Building:	Room:
Mail Stop:	
Company:	Omega Point Laboratories
Department:	
Address Type:	Unclassified
Date Due at Destination:	2/27/2005
Production Related:	No

Origination Site:	SA
Form filled out by:	WALLACE,SAMUEL T.
Phone:	5058440225
Date Prepared:	2005-1-27
Requester:	WALLACE,SAMUEL T.
Phone:	5058440225
Org. #:	06113

For Shipment Processing Use

Date Shipped:	
Carrier:	None Selected
Mode:	None Selected
Bill of Lading No.:	
Total # of Pkgs:	0
Total Weight:	0.0 lbs
Total Cubic Dim:	0.0
Advance Notification	**Contacted** Yes No
Name and Phone:	
741 Number:	
ATS:	
TID Numbers:	
RCT Initial/Dates	

Reason/Authority: Analysis / Evaluation / Testing
Return Date: NONE
Authority Number:
Freight Charge Payment: Sandia Pays
Project: 73766
Task: 01.03
Carrier: NONE
Account:

If shipping controlled property to a new Sandia location
Destination Bldg: **Room:**

If shipping to international destination:
Import duties and taxes will be paid by my project/task:
Export Authorization:

No freight charge reason: NONE
Is material being shipped from the Shipping Department building or the 6000 Igloo? Yes
Shipment Comments: my repack items, if needed
Transportation Pickup Requested: Yes
Questions about pickup call Dispatcher 844-1448 non-hazardous materials, 844-2556 hazardous materials.

Shipper's Export Declaration prepared:

Total Shipment Quantity and Value:	46	$9,200.00

LINE ITEM LIST FOR SHIPPER NUMBER 45687						
Line Item #	Description/Comments For temporary transfer of items to international destinations, include item Manufacturer's Name, Category Domestic or Foreign, and Serial Number.	Classification Category/level	Qty	Unit	Unit Value	Total $
1	Description: Thermocouples Comments:	Unclassified	46	EACH	$200.00	$9,200.00

PACKAGES									
				Dimensions					
Quantity	Type	Contents	Weight		L	W	H	D	Cubic Feet
No Packages Found									

Sandia National Laboratories

Operated for the U.S. Department of Energy by
Sandia Corporation

Albuquerque, New Mexico 87185-0706

Tel (505) 844-2464, FAX (505) 844-0240
Internet: bllevin@sandia.gov

January 27, 2005

Deggary N. Priest, President
Omega Point Laboratories, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112-9784
(210) 635-8100

Re: Quick Disconnect Thermocouples

Dear Deg,

Please find the forty-six thermocouples enclosed for installation and insulation thermal testing of the junction boxes. The Primary Standards Laboratory at SNL verified calibration of each of the thermocouples and have provided a certificate of uncertainty over a range of 70°F to 1000°F for each thermocouple. Please find enclosed copies of these certificates along with calibration stickers. Each sticker can be attached to its associated thermocouple near the connector end following the test to minimize interference during assembly and testing.

Yours truly,

Bruce

Bruce L. Levin

BLL/bll
Copy: file

PRIMARY STANDARDS LABORATORY

Sandia National Laboratories, Albuquerque, New Mexico 87185-0665

CERTIFICATE

File No. 51536
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	1
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%

Submitted by: Organization 06113
SNL / NM

Certified: January 18, 2005
Expires: January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

TC Type	Range	Uncertainty
K	70 °F to 1000 °F	± (4 °F or 0.75% of reading) (whichever is greater)

NOTES: The tolerance statement applies only to the thermocouple, and does not include any instrument used by the owner to measure it.
The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

Copy to: Submitting organization
Department 02541 file

Date received: 01/14/05
Dates tested: 01/18/05

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PRIMARY STANDARDS LABORATORY

Sandia National Laboratories, Albuquerque, New Mexico 87185-0665

CERTIFICATE

File No. 51537
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	2
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 18, 2005
Expires:	January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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CERTIFICATE

File No. 51538
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	3
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 18, 2005
Expires:	January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

Copy to: Submitting organization
Department 02541 file

Date received: 01/14/05
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CERTIFICATE

File No. 51539
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	4
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 18, 2005
Expires:	January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

Copy to: Submitting organization
Department 02541 file

Date received: 01/14/05
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CERTIFICATE

File No. 51540
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	5
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 18, 2005
Expires:	January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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Approved by: L.J. Azevedo, 02541
Manager

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CERTIFICATE

File No. 51541
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	6
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 18, 2005
Expires:	January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

Copy to: Submitting organization
Department 02541 file

Date received: 01/14/05
Dates tested: 01/18/05

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CERTIFICATE

File No. 51542
LIMITED

THERMOCOUPLE	TYPE K - STD	
Model No.	KQIN-116-144	
Serial No.	7	
Procedure No.	CP – TC (07/22/98)	
Lab Conditions:	Temperature: 23 °C ± 2 °C	Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM	
Certified:	January 18, 2005	
Expires:	January 18, 2006	

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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Date received: 01/14/05
Dates tested: 01/18/05

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CERTIFICATE

File No. 51543
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	8
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 18, 2005
Expires:	January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

Copy to: Submitting organization
Department 02541 file

Date received: 01/14/05
Dates tested: 01/18/05

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Q/A RECEIVING REPORT

CLIENT/PROJECT NAME Sandia Natl Labs/OPL
CLIENT/PROJECT NUMBER 14790-123263, 64465
RECEIVED FROM Sandia Natl Labs
PROJECT LOCATION Omega Point Labs

REPORT NUMBER 2695 - 14790/OPL
DATE RECEIVED ~~2-9~~ 2-1-05
DATE INSPECTED 2-1-05
INSPECTED BY:

ITEM DESCRIPTION	P.O . NO.	QUANTITY			I.D. NO.	CON'tD MATL Y/N	CERT REC'D Y/N	SAFETY RELATED Y/N	CONTAINER INTEGRITY	ACCEPTANCE			REMARKS
		Order	Rec'd	B.O.						Accept	Hold	Reject	
					.								
quick Disconnect Thermocouples	NA	46	46	0	KQIN-116-144-ungrounded SN: 1 through 46	Y	Y	N	Good	X			TC's sent to Sandia for calibration using Transmittal #1126 dated 1/11/05

09-016-11/02

PRIMARY STANDARDS LABORATORY

Sandia National Laboratories, Albuquerque, New Mexico 87185-0665

CERTIFICATE

File No. 51544
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	9
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 18, 2005
Expires:	January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

Copy to: Submitting organization
Department 02541 file

Date received: 01/14/05
Dates tested: 01/18/05

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CERTIFICATE

File No. 51545
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	10
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 18, 2005
Expires:	January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

Copy to: Submitting organization
Department 02541 file

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Dates tested: 01/18/05

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Sandia National Laboratories, Albuquerque, New Mexico 87185-0665

CERTIFICATE

File No. 51546
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	11
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 18, 2005
Expires:	January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

Copy to: Submitting organization
Department 02541 file

Date received: 01/14/05
Dates tested: 01/18/05

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CERTIFICATE

File No. 51547
LIMITED

THERMOCOUPLE	TYPE K - STD	
Model No.	KQIN-116-144	
Serial No.	12	
Procedure No.	CP – TC (07/22/98)	
Lab Conditions:	Temperature: 23 °C ± 2 °C	Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM	
Certified:	January 18, 2005	
Expires:	January 18, 2006	

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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Department 02541 file

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Sandia National Laboratories, Albuquerque, New Mexico 87185-0665

CERTIFICATE

File No. 51548
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	13
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 18, 2005
Expires:	January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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Sandia National Laboratories, Albuquerque, New Mexico 87185-0665

CERTIFICATE

THERMOCOUPLE TYPE K - STD
Model No. KQIN-116-144
Serial No. 14
Procedure No. CP – TC (07/22/98)
Lab Conditions: Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%

File No. 51549
LIMITED

Submitted by: Organization 06113
SNL / NM

Certified: January 18, 2005
Expires: January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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Department 02541 file

Date received: 01/14/05
Dates tested: 01/18/05

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Sandia National Laboratories, Albuquerque, New Mexico 87185-0665

CERTIFICATE

File No. 51550
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	15
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 18, 2005
Expires:	January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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Sandia National Laboratories, Albuquerque, New Mexico 87185-0665

CERTIFICATE

File No. 51551
LIMITED

THERMOCOUPLE	TYPE K - STD	
Model No.	KQIN-116-144	
Serial No.	16	
Procedure No.	CP – TC (07/22/98)	
Lab Conditions:	Temperature: 23 °C ± 2 °C	Humidity: 40% ± 10%

Submitted by: Organization 06113
SNL / NM

Certified: January 18, 2005
Expires: January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

TC Type	Range	Uncertainty
K	70 °F to 1000 °F	± (4 °F or 0.75% of reading) (whichever is greater)

NOTES: The tolerance statement applies only to the thermocouple, and does not include any instrument used by the owner to measure it.
The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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Date received: 01/14/05
Dates tested: 01/18/05

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CERTIFICATE

File No. 51552
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	17
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 18, 2005
Expires:	January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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K	70 °F to 1000 °F	± (4 °F or 0.75% of reading) (whichever is greater)

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Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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CERTIFICATE

File No. 51553
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	18
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 18, 2005
Expires:	January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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K	70 °F to 1000 °F	± (4 °F or 0.75% of reading) (whichever is greater)

NOTES: The tolerance statement applies only to the thermocouple, and does not include any instrument used by the owner to measure it.
The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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CERTIFICATE

File No. 51554
LIMITED

THERMOCOUPLE TYPE K - STD
Model No. KQIN-116-144
Serial No. 19
Procedure No. CP – TC (07/22/98)
Lab Conditions: Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%

Submitted by: Organization 06113
SNL / NM

Certified: January 18, 2005
Expires: January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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K	70 °F to 1000 °F	± (4 °F or 0.75% of reading) (whichever is greater)

NOTES: The tolerance statement applies only to the thermocouple, and does not include any instrument used by the owner to measure it.
The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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Date received: 01/14/05
Dates tested: 01/18/05

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CERTIFICATE

File No. 51555
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	20
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 18, 2005
Expires:	January 18, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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K	70 °F to 1000 °F	± (4 °F or 0.75% of reading) (whichever is greater)

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The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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CERTIFICATE

File No. 51556
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	21
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

TC Type	Range	Uncertainty
K	70 °F to 1000 °F	± (4 °F or 0.75% of reading) (whichever is greater)

NOTES: The tolerance statement applies only to the thermocouple, and does not include any instrument used by the owner to measure it.
The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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File No. 51557
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	22
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

TC Type	Range	Uncertainty
K	70 °F to 1000 °F	± (4 °F or 0.75% of reading) (whichever is greater)

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The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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Date received: 01/14/05
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File No. 51558
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	23
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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K	70 °F to 1000 °F	± (4 °F or 0.75% of reading) (whichever is greater)

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The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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File No. 51559
LIMITED

THERMOCOUPLE	TYPE K - STD	
Model No.	KQIN-116-144	
Serial No.	24	
Procedure No.	CP – TC (07/22/98)	
Lab Conditions:	Temperature: 23 °C ± 2 °C	Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM	
Certified:	January 26, 2005	
Expires:	January 26, 2006	

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

TC Type	Range	Uncertainty
K	70 °F to 1000 °F	± (4 °F or 0.75% of reading) (whichever is greater)

NOTES: The tolerance statement applies only to the thermocouple, and does not include any instrument used by the owner to measure it.
The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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File No. 51560
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	25
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

TC Type	Range	Uncertainty
K	70 °F to 1000 °F	± (4 °F or 0.75% of reading) (whichever is greater)

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The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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File No. 51561
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	26
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

TC Type	Range	Uncertainty
K	70 °F to 1000 °F	± (4 °F or 0.75% of reading) (whichever is greater)

NOTES: The tolerance statement applies only to the thermocouple, and does not include any instrument used by the owner to measure it.
The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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CERTIFICATE

File No. 51562
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	27
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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CERTIFICATE

File No. 51563
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	28
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

TC Type	Range	Uncertainty
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The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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Sandia National Laboratories, Albuquerque, New Mexico 87185-0665

CERTIFICATE

File No. 51564
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	29
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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CERTIFICATE

File No. 51565
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	30
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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K	70 °F to 1000 °F	± (4 °F or 0.75% of reading) (whichever is greater)

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The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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CERTIFICATE

File No. 51566
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	31
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

TC Type	Range	Uncertainty
K	70 °F to 1000 °F	± (4 °F or 0.75% of reading) (whichever is greater)

NOTES: The tolerance statement applies only to the thermocouple, and does not include any instrument used by the owner to measure it.
The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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CERTIFICATE

File No. 51567
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	32
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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K	70 °F to 1000 °F	± (4 °F or 0.75% of reading) (whichever is greater)

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Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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CERTIFICATE

File No. 51568
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	33
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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K	70 °F to 1000 °F	± (4 °F or 0.75% of reading) (whichever is greater)

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The results relate only to the items tested or calibrated.

Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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Dates tested: 01/26/05

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CERTIFICATE

File No. 51569
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	34
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

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Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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File No. 51570
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	35
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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Approved by: L.J. Azevedo, 02541
Manager

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File No. 51571
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	36
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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File No. 51572
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	37
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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File No. 51573
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	38
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

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File No. 51574
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	39
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

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Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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File No. 51575
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	40
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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Metrologist: A. Sanchez, 02541

Approved by: L.J. Azevedo, 02541
Manager

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File No. 51576
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THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	41
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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File No. 51577
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THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	42
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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File No. 51578
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	43
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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Metrologist: A. Sanchez, 02541

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Manager

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File No. 51579
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	44
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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Approved by: L.J. Azevedo, 02541
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File No. 51580
LIMITED

THERMOCOUPLE	TYPE K - STD
Model No.	KQIN-116-144
Serial No.	45
Procedure No.	CP – TC (07/22/98)
Lab Conditions:	Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%
Submitted by:	Organization 06113 SNL / NM
Certified:	January 26, 2005
Expires:	January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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CERTIFICATE

File No. 51581
LIMITED

THERMOCOUPLE TYPE K - STD
Model No. KQIN-116-144
Serial No. 46
Procedure No. CP – TC (07/22/98)
Lab Conditions: Temperature: 23 °C ± 2 °C Humidity: 40% ± 10%

Submitted by: Organization 06113
SNL / NM

Certified: January 26, 2005
Expires: January 26, 2006

The thermocouple was calibrated over the temperature range of 71 °F to 1000 °F by comparison with a Standard Platinum Resistance Thermometer (SPRT). The thermocouple was calibrated in the 9122 Dry Well, with an immersion of 6 inches. The probe mV output was measured with an 8508A Fluke Multimeter. Both the SPRT and the Multimeter have calibrations that are traceable to the National Institute of Standards and Technology (NIST) or to intrinsic standards. The thermocouple type, temperature range calibrated over and the uncertainty of a confidence level of k=2 is as follows:

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MEASUREMENTS STANDARDS PROGRAM
SANDIA NATIONAL LABORATORIES
Albuquerque, New Mexico

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1. The values of the units (either base or derived) maintained and disseminated by the National Institute of Standards and Technology (United States of America) or, in special cases and where appropriate, to the National Standards Laboratory of another nation;
2. The accepted value(s) of fundamental physical phenomena (intrinsic standards);
3. Ratio(s) or other non-maintained standards established by either a self-calibration and/or a direct calibration technique;
4. Standards maintained and disseminated by the MSP in special cases and where warranted;
5. Values and uncertainties arising from participation in a National Measurement System.

Because of inherent complexity in the calibration process and the uncertainty contribution by both standards and calibrating instruments, traceability always requires evaluation of a "traceability tree." A "traceability tree" analysis can be assembled for a specific calibration and valid for a particular and specific point in time. The "traceability tree" will include copies of relevant certificates and reports, excerpted as appropriate for brevity. However, the cost of preparation of the "traceability tree" will be charged to the requester.

Note 1: This certificate or report shall not be reproduced except in full without the advance written approval of the Measurement Standards Program at Sandia National Laboratories.

Note 2: For National Voluntary Laboratory Accreditation Program (NVLAP) accredited capabilities, the MSP at Sandia National Laboratories is accredited by NVLAP for the specific scope of accreditation under Laboratory Code 105002. This certificate or report shall not be used by the customer to claim product endorsement by NVLAP or any agency of the U. S. Government.

Note 3: The as received condition of the standard, set of standards, or measurement equipment described herein was as expected, unless otherwise noted in the body of the certificate or report.

General.Doc
3/10/96, Revision 2

Appendix H

PHOTOGRAPHS

#1: Deck under construction.

#2: Assembling conduits.

#3: Conduit 1A.

#4: LB on conduit 1A.

#5: LB on conduit 1A.

#6: Conduit 1B.

#7: LB on conduit 1B.

#8: LB on conduit 1B.

#9: Conduit 1C.

#10: LB on conduit 1C.

#11: LB on conduit 1F.

#12: LB on conduit 1C.

#13: Conduit 1D.

#14: LB on conduit 1D.

#15: LB on conduit 1D.

#16: LB on conduit 1D.

#17: Conduit 1E.

#18: LB on conduit 1E.


#19: Conduit 1F.


#20: Support 1G.


#21: Support 1H.


#22: JB attachment welds.

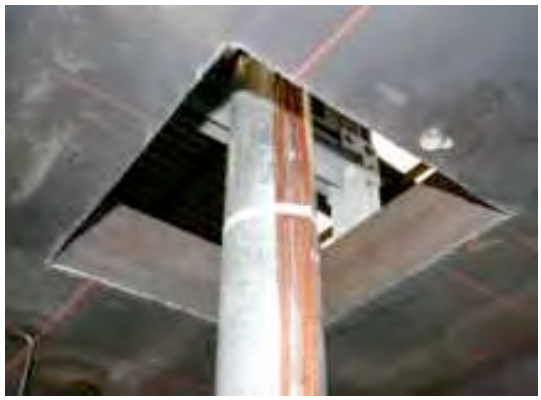

#23: Junction box.


#24: Junction box.

#25: JB thermocouples.

#26: JB with supports.

#27: Typical TC attachments.

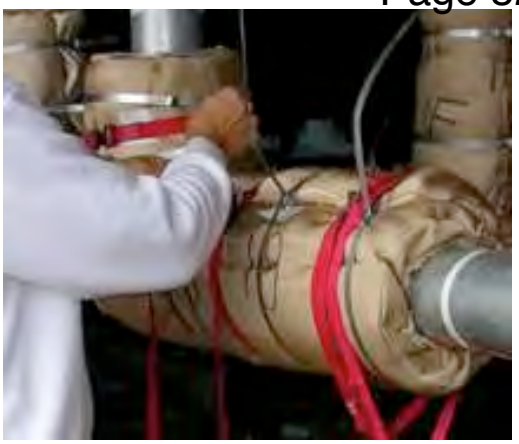


#28: Typical deck penetration.

#29: Joint on conduit 1A.

#30: Cladding conduit 1A.


#31: Cladding conduit 1B.


#32: Cladding the LB on conduit 1B.


#33: Conduit 1B completed.


#34: Conduit 1B joint cover.


#35: Cladding LB on conduit 1C.


#36: Cladding LB on conduit 1C.

#37: Cladding overlap on conduit 1C.


#38: Banding overlap on conduit 1C.


#39: Cladding elbow on conduit 1D.


#40: Cladding LB on conduit 1D.


#41: Conduit 1D completed.


#42: Cladding LB on conduit 1E.


#43: Cladding LB on conduit 1E.


#44: Cladding elbow on conduit 1F.


#45: Cladding elbow on conduit 1F.

#46: Cladding overlap on conduit 1F.


#47: Cladding support 1G.


#48: Stuffing at end of 1G.


#49: Cladding support 1H.


#50: Support 1H completed.


#51: 1H end details.


#52: Cladding Junction Box.


#53: Cladding sides of JB.


#54: Cladding JB supports.


#55: Stitching seams on JB insulation.


#56: Cladding conduit 1A.


#57: Conduits 1A & 1E completed.


#58: Conduits 1A & 1E completed.


#59: Conduits 1B & 1F completed.


#60: Conduits 1B & 1F completed.

#61: Conduit 1B completed.

#62: Conduit 1C completed.

#63: Conduit 1C completed.

#64: Conduit 1D completed.

#65: Bottom view of conduit 1D.

#66: Support 1G completed.

#67: Support 1G completed.

#68: Support 1H completed.


#69: Support 1H completed.


#70: JB completed.


#71: JB completed.


#72: Lifting specimen onto furnace.


#73: Lowering onto furnace.


#74: Lowering onto furnace.


#75: Lowering onto furnace.


#76: Test specimen.


#77: Test specimen.


#78: Test specimen.

#79: Test furnace overhead view.

#80: Top surface of specimen.

#81: Top surface of specimen.

#82: Typical furnace TC.

#83: Furnace TC next to conduit E.

#84: Furnace TCs.

#85: Specimens inside furnace.

#86: Specimens inside furnace.

#87: Top side, conduit 1A.

#88: Top side, conduit 1C.

#89: Top side, conduit 1D.

#90: Top side, conduits 1F & 1B.


#91: Top side, item 1G.


#92: Top side, conduit 1F.


#93: Top side, conduit 1B.


#94: Top side, junction box.


#95: Start of test.


#96: QA team during test.

#97: End of test.

#98: Lifting specimen from furnace.

#99: Specimen after fire test.

#100: Specimen after fire test.

#101: Gap in conduit 1A.

#102: Gap in conduit 1A.


#103: Junction box still hot.


#104: Gap in conduit 1A insulation.


#105: Conduit 1C hot.


#106: Conduit 1C hot.


#107: Opening in conduit 1D.


#108: Item 1G hot.


#109: Item 1H hot.


110: Junction box hot.


#111: JB support cover gap.


#112: Conduits 1B & 1F hot.


#113: Specimen ready for hose stream.


#114: Adjusting nozzle flow.


#115: Hose stream test.


#116: Hose stream test.


#117: Hose stream test.


#118: Items 1A & 1E after hose stream.


#119: Items 1A & 1E after hose stream.


#120: Items 1A & 1E after hose stream.

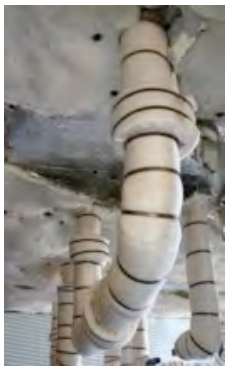

#121: Items 1B & 1F after hose stream.


122: Items 1B & 1F after hose stream.

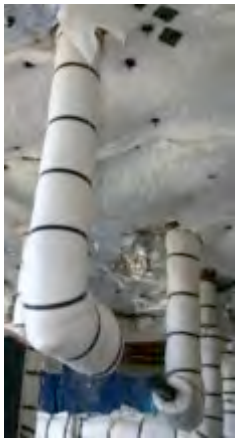

#123: Items 1B & 1F after hose stream.


#124: Items 1B & 1F after hose stream.


#125: Item 1C after hose stream.


#126: Item 1D after hose stream.


#127: Item 1G after hose stream.


#128: Items 1G & 1H after hose stream.

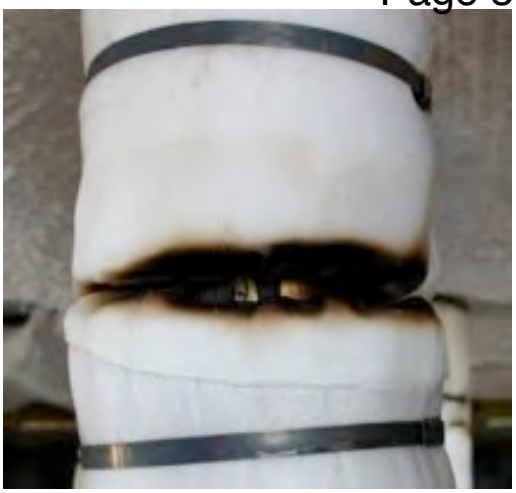

#129: Item 1H after hose stream.


#130: JB after hose stream.


#131: JB supports after hose stream.


#132: JB with insulation removed.


#133: Conduit 1D after hose stream.


#134: Conduit 1A with collar removed.


#135: Conduit 1A gap.


#136: 2.5" gap in conduit 1A after collar was removed.


#137: Gap on 1A with collar removed.


#138: Conduit 1A with insulation off.


#139: Conduit 1A LB with insulation off.


#140: Open joint on conduit 1B.

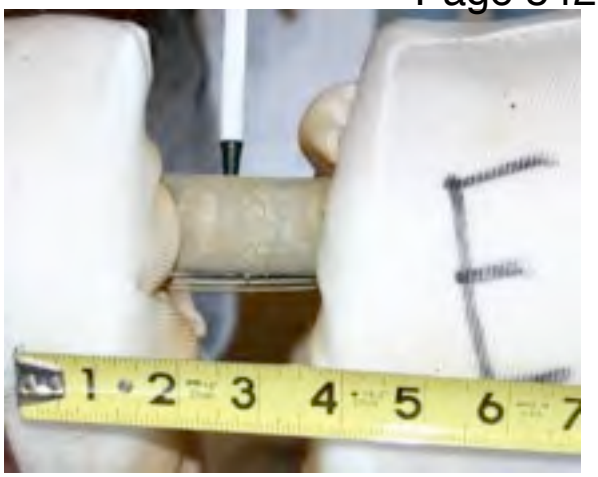

#141: Conduit 1B joint at LB.

#142: Gap under collar on conduit 1B.


#143: Gap in conduit 1C.


#144: Conduit 1C with insulation off.

#145: Open joint in conduit 1D.



#146: Conduit 1E with collar removed.

#147: Conduit 1E with collar removed.

#148: Conduit 1E with insulation removed.

#149: Open overlap joint on 1F.