AMENDMENT NO. 1

This Amendment supplements and amends the original Plans and Specifications and shall be taken into account in preparing proposals and shall become a part of the Contract Documents.

CLARIFICATIONS

BID CLARIFICATION

1. Any electrical and communication work shall be bid as part of the utilidor/vault support system. Any associated costs shall be applied to the concrete, ladders, etc. listed under item #1.

2. Contractor shall review and include costs associated with removal of all soil contaminates and explosives within the excavation limits. USACE has performed study which is available for review at DPW Environmental Department.

OWNER FUNISHED MATERIAL

1. Most materials have been purchased, however, several items are still in the quoting process. DU furnished material will be on-site in a timely manner as to not impact Contractor's schedule.

2. Contractor shall inspect and approve all prepurchased materials at time of delivery to jobsite. For materials previously received by DU, Contractor shall review and approve no later than 10 days after receipt of Notice to Proceed.

3. All direct buried water (Ductile Iron Class 50) and sanitary piping is currently on-site at Vertex. Cost for Vertex applied insulation of direct buried water and sanitary piping will be by DU. As part of request for possession of the direct buried piping, Contractor shall initiate insulation process on as needed basis. Contractor shall include anticipated date with necessary lead time (per the specs).

4. Amounts of HDS piping materials indicated in Attachment A do not include direct buried piping quantities (see item 5). Contractor is responsible for provision of all additional materials required to complete the project.

5. Direct buried MPS and PCR piping is being furnished by PermaPipe. All documents received to date have been included for reference (see attached approved piping submittals). Additionally, DU Standards UES-DD-H101 through UES-DD-H103 apply.

6. Condensate piping furnished by DU is stainless steel. Contractor shall provide isolation flanges at each connection to the existing carbon steel system (including inside each building).

7. DU will furnish all control panels and fiber panels. Power panels and load panels shall be provided by the Contractor.

8. Proposals have been received for DU utility pole and electric drops installations, however, contracts have not yet been awarded.

DRAWING UES-DD-H003 (DU STANDARD)

1. All hanger and guide components not supplied galvanized shall be painted

DRAWING UES-DD-H004 (DU STANDARD)

1. All hanger and guide components not supplied galvanized shall be painted

DRAWING UES-DD-H005 (DU STANDARD)

1. All hanger and guide components not supplied galvanized shall be painted

DRAWING UES-DD-H006 (DU STANDARD)

1. All hanger and guide components not supplied galvanized shall be painted

DRAWING UES-DD-H206 (DU STANDARD)

1. Bollards shall be fabricated from factory galvanized steel piping and then painted. Vents are fabricated from carbon steel components and then galvanized.

PROJECT DRAWINGS

DRAWING X-03

1. Note F – Structural design for all new vaults shall be provided by the Contractor. Final drawings shall be stamped by Alaska PE.

2. Note I – All new hatches will be furnished for installation by DU. The top of hatch/lid elevation is typically 18" above finished grade. If the vault is located in a drainage ditch/swale, the elevation should be at least 12" above the top edge of the swale (see table for approximate elevations). Final depth of all new vaults shall be coordinated with final location of piping.

APPROXIMATE VAULT ELEVATION		
VAULT	**GRADE**	**TOP OF LID**
H6-3-3	443.00 feet	445.00 feet
H6-9-3	446.00 feet	448.00 feet

DRAWINGS – ALL DISCIPLINES

1. Contractor shall provide a minimum of eight bollards for this project. If additional bollards are required, a cost estimate will be requested from Contractor.

2. No expansion joints are required for this project. Please delete any reference to expansion joints on FTW336A.

3. Contractor shall field verify the actual depth of existing utilidor (some utilidors are only covered with 2 feet of dirt and would therefore not undermine the building construction). The utildor size (approximately 60"x60") should be capable of accommodating the removal of lids away from the building. Final means and methods of construction is the responsibility of the installing contractor.

4. Temporary bracing for the existing piping (specifically 14" deluge line and the 8" DCW) is required. Contractor shall provide sketch of proposed support method based on field conditions.

DRAWING G-01

1. Building sanitary connection has changed location to the south side of the new building. Contractor shall field verify final location of building sanitary cleanout and reroute piping accordingly. Final sanitary tie-in point remains as shown on drawings.

DRAWING M-02

1. All MPS, PCR, and MPR piping shall be installed in a manner to allow anchors to be attached to the utilidor walls.

DRAWING M-04

1. The recirculation pump located in vault G6-9-3 will be furnished by DU. Approved submittals for the pump will be forwarded once they are received.

DRAWING M-05

1. Sanitary piping building tie-in has moved to South side of building. See G-01 Item 1 for more information.

DRAWING M-06

1. Replace building entry pit detail with sketch SKM-1 – Utility Pit Plan and Section

2. Building Utility Service Interface Schematic – Change steam meter reference from STD-H105 to sketch SKM-2 – Steam Meter Detail

DRAWING PC-02

1. Change PIT references to Doyon standard drawing H011 – Detail 1 to PC-08 – Detail 4 (pressure transmitter).

2. Change FIT references to Doyon standard drawing H011 – Detail 1 to PC-09 – Detail 5 (steam flow transmitter).

DRAWING PC-04

1. Change references to Doyon standard drawing H011 – Detail 1 to PC-10 – Detail 6 (all insertion style temperature transmitters).

DRAWING PC-06

1. Replace drawing PC-06 with revised PC-06, Revision 1, (7/21/10).

DRAWING PC-07

1. Replace drawing PC-07 with revised PC-07, Revision 1, (7/21/10).

DRAWING PC-08

1. Add drawing PC-08 to the contract documents.

DRAWING PC-09

1. Add drawing PC-09 to the contract documents.

DRAWING PC-10

1. Add drawing PC-10 to the contract documents.

PROJECT SPECIFICATIONS

SECTION 01330 SUBMITTAL REQUIREMENTS

1. Article 1.7 – Revise so that DU will furnish available AutoCAD formatted drawings to the Successful Contractor prior to signing of Contract Agreement in order to more efficiently meet the requirements of Section 01780 Project Closeout.

SECTION 01520 TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS

1. Contractor shall provide DU with copy of Government approved Construction and Traffic Control Plans including a memo describing any variation from technical specification requirements in Section 01520 provided in the Construction Documents. Traffic control plan shall cover any additional work areas related to utilities portion of Project not currently covered in USACE approved document. Should the Plans as currently exist not meet specified requirements for this Project, Contractor shall include in their proposal costs necessary to develop Plans acceptable to DU.

SECTION 01570 STORM WATER POLLUTION PREVENTION MEASURES

1. Contractor shall provide DU with copy of Government approved SWPPP. SWPPP shall cover additional work areas related to utilities portion of Project not currently covered in USACE approved document. Should the Plan as currently exists not meet specified requirements for this Project, Contractor shall include in their proposal costs necessary to develop SWPPP acceptable to DU.

SECTION 01577 RADIOACTIVE MATERIALS PROCEDURE

1. Contractor shall provide DU with copy of Government approved radioactive materials handling procedures. Procedures shall cover any additional work areas or processes related to utilities portion of Project not currently covered in USACE approved document. Should the Plan as currently exists not meet specified requirements for this Project, Contractor shall include in their proposal costs necessary to develop SWPPP acceptable to DU.

SECTION 02100 FIELD SCREEN OF SOILS FOR POL CONTAMINATION

1. Contractor shall provide DU with copy of Government approved soil testing plan including a memo describing any variation from technical specification requirements in Section 02100 in the Construction Documents. Should the Plan as currently exists not meet specified requirements for this Project, Contractor shall include in their proposal costs necessary to develop Plans acceptable to DU.

2. In the event Contractor encounters previously unknown conditions, they are to immediately notify DU. Contractor may submit a request for an equitable adjustment due to differing site conditions.

SECTION 02200 EARTHWORK

1. Contractor shall dewater excavations as needed. If Contractor anticipates the total amount of dewatering exceeds 250,000 gallons for the Project, they shall acquire an ADEC construction dewatering permit. In the event that contaminated water is discovered onsite, Contractor shall immediately notify DU and the discovery shall then be considered a changed condition of the Project subject to re-negotiation of costs.

2. Contractor shall conduct site excavation (including but not limited to shoring, bracing, and boxing of excavations) according to all applicable safety requirements throughout the entire excavation for this Project. This includes section 02200 of provided technical specifications and EM 385-1-1 Army Corps of Engineers Safety and Health Requirements Manuel and OSHA where applicable.

3. In the event that underground utilities, foundations, etc. not indicated on the Construction Documents are discovered onsite, Contractor shall immediately notify DU and the discovery shall then be considered a changed condition of the Project subject to re-negotiation of costs.

4. It is DU's position that utilidor lids shall be removed per the IFC package as needed to complete necessary work.

SECTION 02560 BITUMINOUS WATERPROOFING/INSULATION

1. All alternate water proofing materials are listed in this specification section.

SECTION 03410 PRECAST CONCRETE

1. Use of precast concrete is not specifically called out in the Construction Documents. Contractor may precast any portion of the concrete work for this Project rather than forming in place. All precast shall comply with this section.

SECTION 05500 MISCELLANEOUS METAL FABRICATIONS

1. Change galvanized reference from ASTM A653 to ASTM A123 Hot Dip Galvanizing of Fabricated Steel Shapes and Plates.

2. All vault supply and exhaust air vents are required to be steel fabricated and then hot dip galvanized. Perform fabrication early in the project to insure that galvanized items are onsite for installation and project completion is not hampered.

SECTION 15010 BASIC MECHANICAL REQUIREMENTS

1. Pressure piping radiographs are required on 10% of all MPS and PCR piping welds.

SECTION 15092 PIPE PENETRATIONS, SLEEVES, AND PLATES

1. Due to the issues involved with having miscellaneous metal fabrications galvanized after fabrication in the State of Alaska (everything must go to the lower 48, usually Seattle area) the requirement for galvanizing pipe penetration sleeves is changed. All pipe sleeves shall be sandblasted after fabrication and epoxy coated as follows prior to insertion in concrete forms:

    - Sandblast to SSSC SP6, Commercial Blast Cleaning
    - Prime with inorganic zinc, minimum 3.5 mils DFT
    - Intermediate coat with epoxy-polyamide paint, 3.0 mils DFT
    - Top coat with aliphatic polyurethane paint, 1.5 mils DFT (this is necessary to handle UV
      degradation of the epoxy).

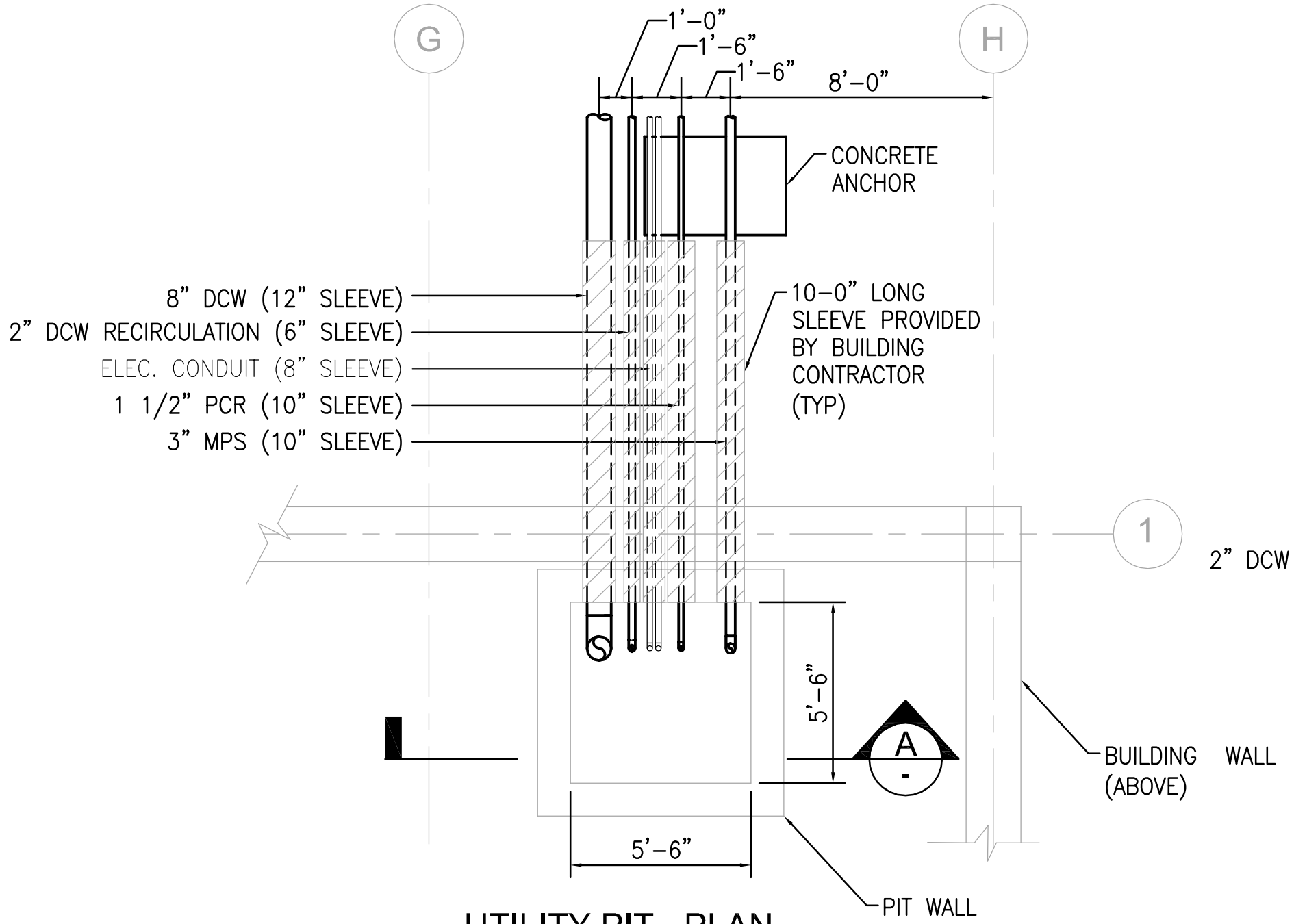
- Ameron Protective Coatings (PPG), Carboline Protective Coatings and Linings, Sherwin Williams, or approved equal.

SECTION 15417 PIPE SYSTEM IDENTIFICATION – UTILIDOR

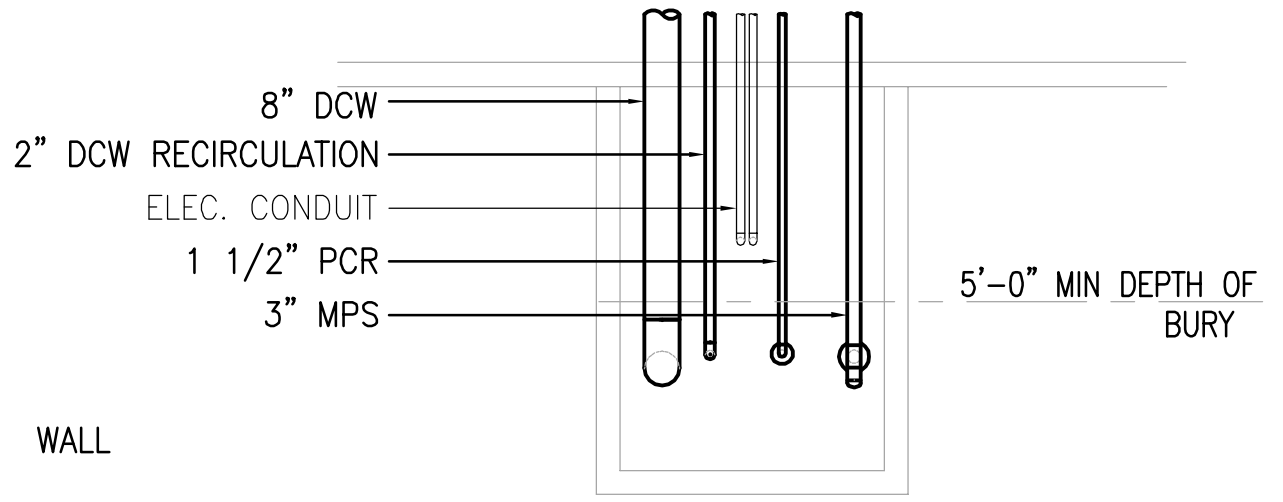
1. Adhesive markers and arrow banding are required per the specifications regardless of previous utilidor projects for USACE.

ATTACHMENTS

1. Sketch SKM-1 – Utility Pit Plan & Section – Mechanical Systems
2. Sketch SKM-2 – Steam Meter Detail
3. Sketch SKE-1 – Utility Pit Plan & Section – Electrical System
4. Drawing PC-06 – Building Meter Interface Details – Revision 1, (7/21/10).
5. Drawing PC-07 – Miscellaneous Utility Monitoring Details – Revision 1, (7/21/10).
6. Drawing PC-08 – Miscellaneous Utility Monitoring Details – (7/21/10).
7. Drawing PC-09 – Miscellaneous Utility Monitoring Details – (7/21/10).
8. Drawing PC-10 – Miscellaneous Utility Monitoring Details – (7/21/10).
9. Manufacturer submitted direct buried MPS & PCR piping system



UTILITY PIT - PLAN



SECTION A

UTILITY PIT PLAN & SECTION - HEATING SYSTEM
UTILITY SERVICE EXTENSION TO AIRCRAFT PARTS STORAGE - FTW 336A

FOSDICK & HILMER CONSULTING ENGINEERS
309 VINE STREET, SUITE 50 CINCINNATI, OHIO 45202
TELEPHONE (513)241-5640 FAX (513)241-3659

DWG. NAME:	SKM-1
AMENDMENT NUMBER: 1	
DATE: 7/16/10	SCALE: 1/4"=1'-0"
REV:	REV BY:

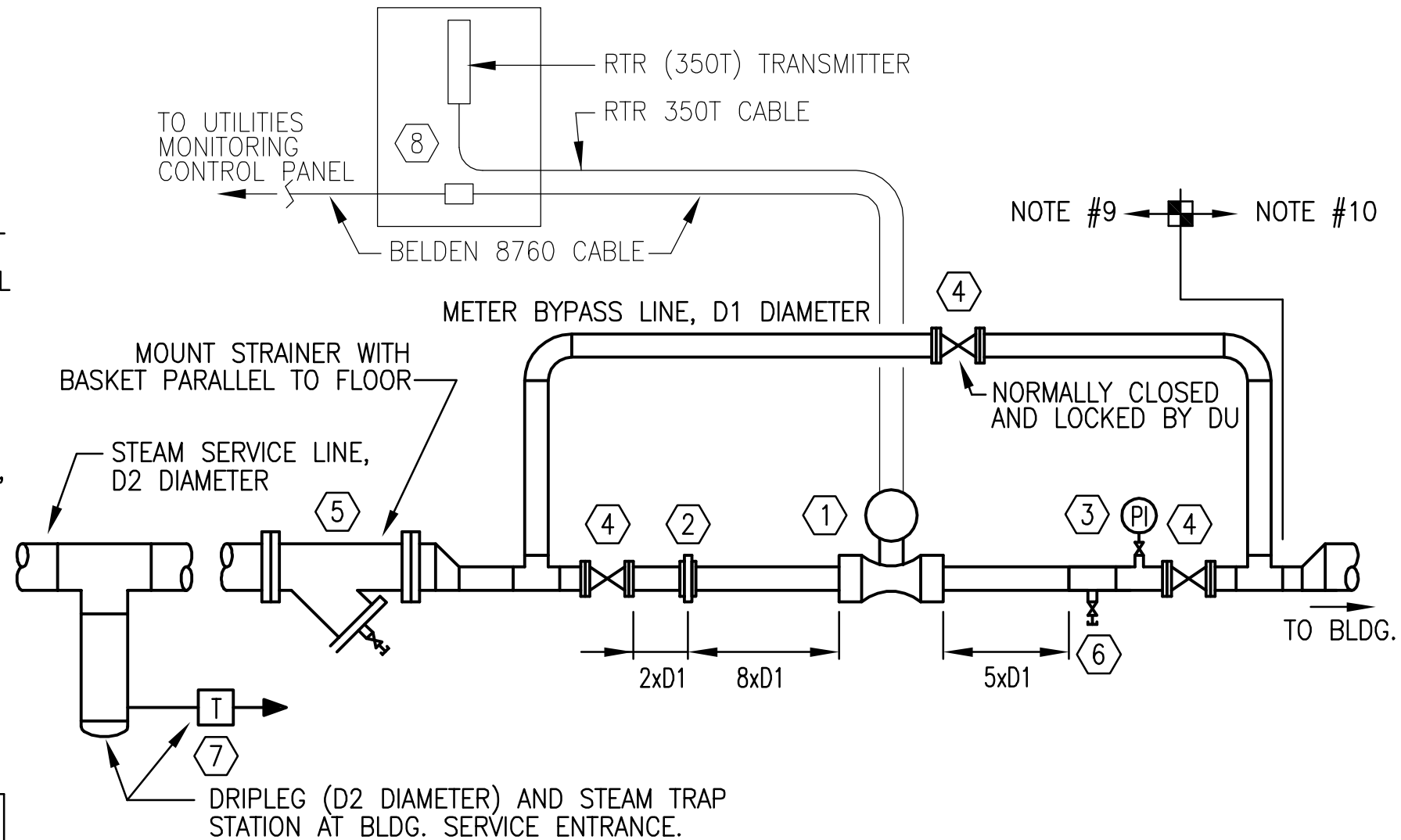
NOTES:

1. D1 = NOMINAL METER & PIPE SIZE, IN INCHES
2. D2 = NOMINAL STEAM SUPPLY PIPE SIZE TO BLDG., IN INCHES.
3. STEAM METER SHALL BE INSTALLED PER MANUFACTURER'S INSTRUCTIONS.
4. STEAM METER SHALL BE MINIMUM 24" AND MAXIMUM 48" A.F.F.
5. STEAM METER SHALL RECEIVE PERMANENT INFORMATION TAG INCLUDING SIZE, MAKE, MODEL & MAXIMUM PERMISSIBLE STEAM CAPACITY IN POUNDS PER HOUR (PPH) AT SERVICE PRESSURE.
6. COORDINATE INSTALLATION OF DU-FURNISHED BUILDING METER INTERFACE PANEL W/ELECTRICAL CONTRACTOR SUPPLYING CONNECTION TO UTILITIES MONITORING CONTROL PANEL.
7. INSULATION NOT SHOWN. ENTIRE STEAM SERVICE METERING STATION SHALL BE INSULATED. STEAM METER, ISOLATION VALVES, BYPASS VALVE & INLET STRAINER SHALL RECEIVE REMOVABLE INSULATION BLANKETS. PIPING SHALL RECEIVE SAME INSULATION TYPE, THICKNESS & JACKETING SPECIFIED FOR BUILDING STEAM PIPING.
8. DRIP LEG AND TRAP STATION TO BE LOCATED AT THE BOTTOM OF THE STEAM RISER IN THE BUILDING UTILITY PIT. PROVIDE ADEQUATE SPACE IN THE PIT FOR ROUTINE MANTANANCE AND REPLACEMENT OF STEAM TRAP STATION COMPONENTS. ROUTE MPR FROM TRAP TO BUILDING FLASH TANK, CONDENSATE SPARGER, OR CONDENSATE RETURN UNIT AS DIRECTED BY UTILITY CUSTOMER.
9. OWNED & MAINTAINED BY DU; INSTALLED BY DU OR DU'S CONTRACTOR, UNLESS OTHERWISE NOTED.
10. OWNED, MAINTAINED AND INSTALLED BY UTILITY CUSTOMER.

MATERIAL LIST:

MATERIALS & EQUIPMENT PER DU STANDARDS.

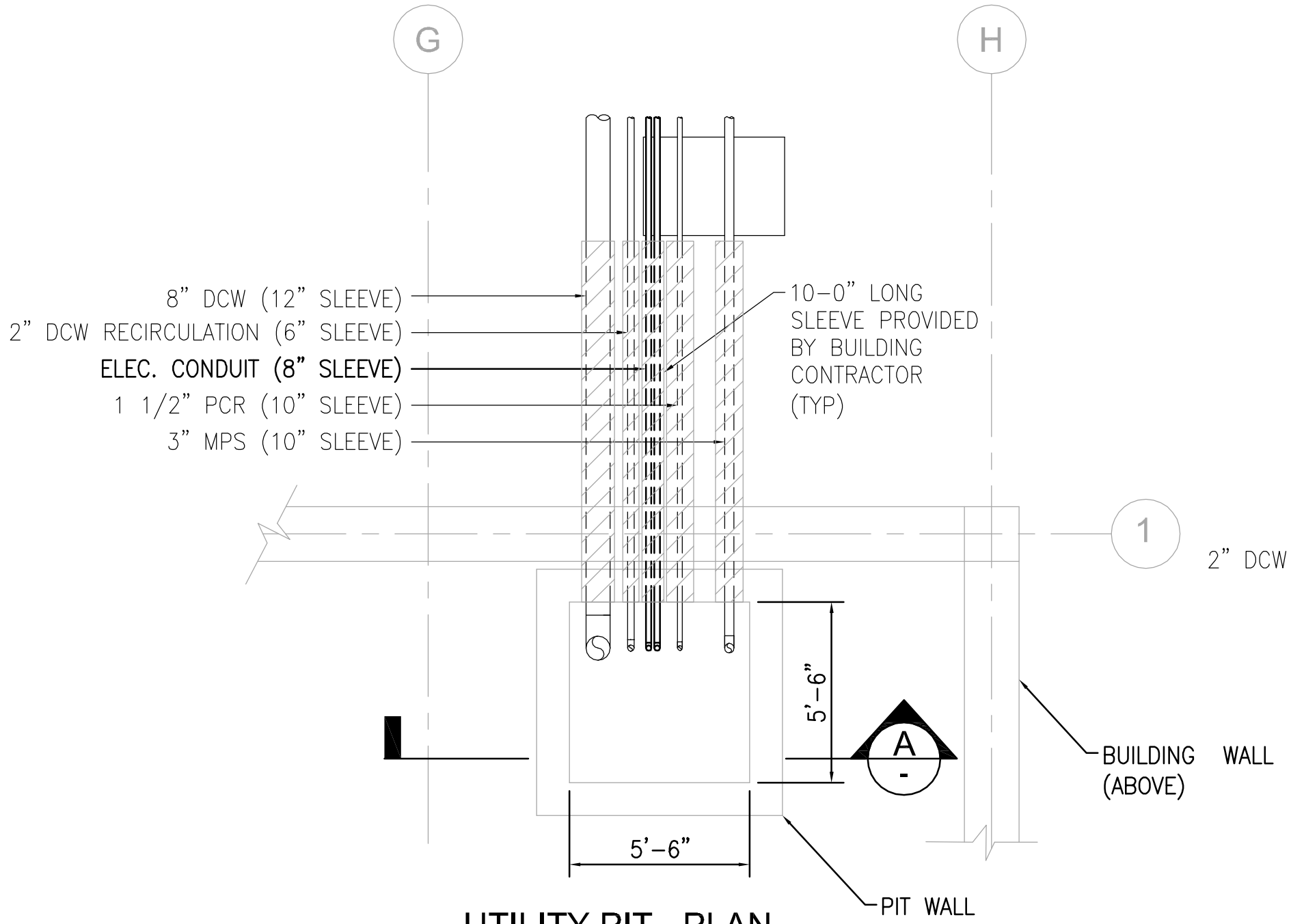
ITEM	DESCRIPTION
1	STEAM METER, D1 DIAMETER
2	PERFORATED PLATE FLOW CONDITIONER, D1 DIAMETER
3	PRESSURE INDICATOR WITH SNUBBER & COCK
4	GATE VALVE, D1 DIAMETER
5	Y-TYPE STRAINER, D2 DIAMETER, W/S.S. BASKET & BLOWOFF VALVE
6	LOW POINT DRAIN: 3/4" BALL VALVE WITH CAP
7	STEAM TRAP STATION & BLOWDOWN VALVE PER DU STANDARDS.
8	BUILDING METER INTERFACE PANEL



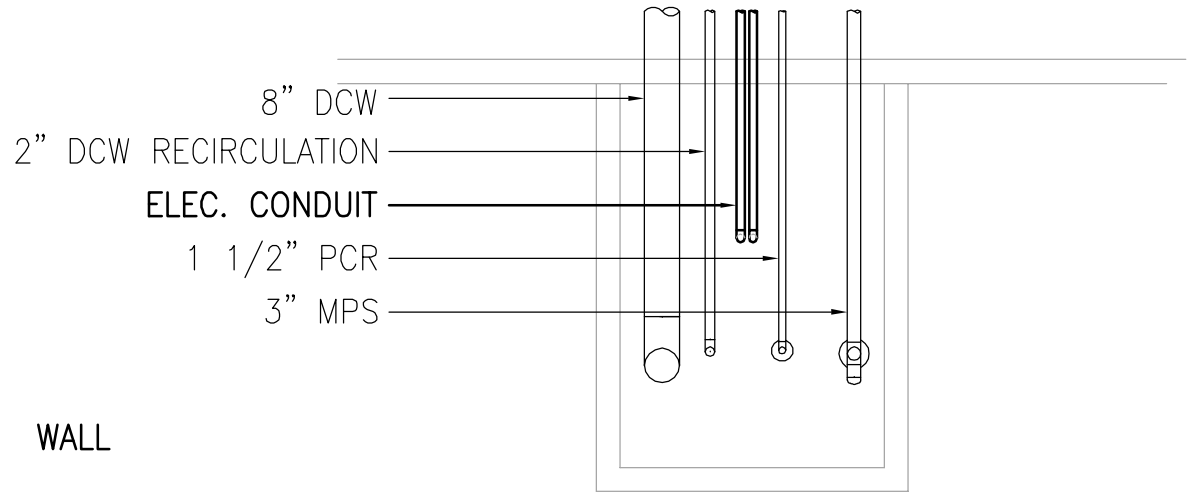
STEAM METER - HEATING SYSTEM
UTILITY SERVICE EXTENSION TO AIRCRAFT PARTS STORAGE - FTW 336A

FOSDICK & HILMER CONSULTING ENGINEERS
309 VINE STREET, SUITE 50 CINCINNATI, OHIO 45202
TELEPHONE (513)241-5640 FAX (513)241-3659

DWG. NAME:	SKM-2
AMENDMENT NUMBER: 1	
DATE: 7/16/10	SCALE: NTS
REV:	REV BY:



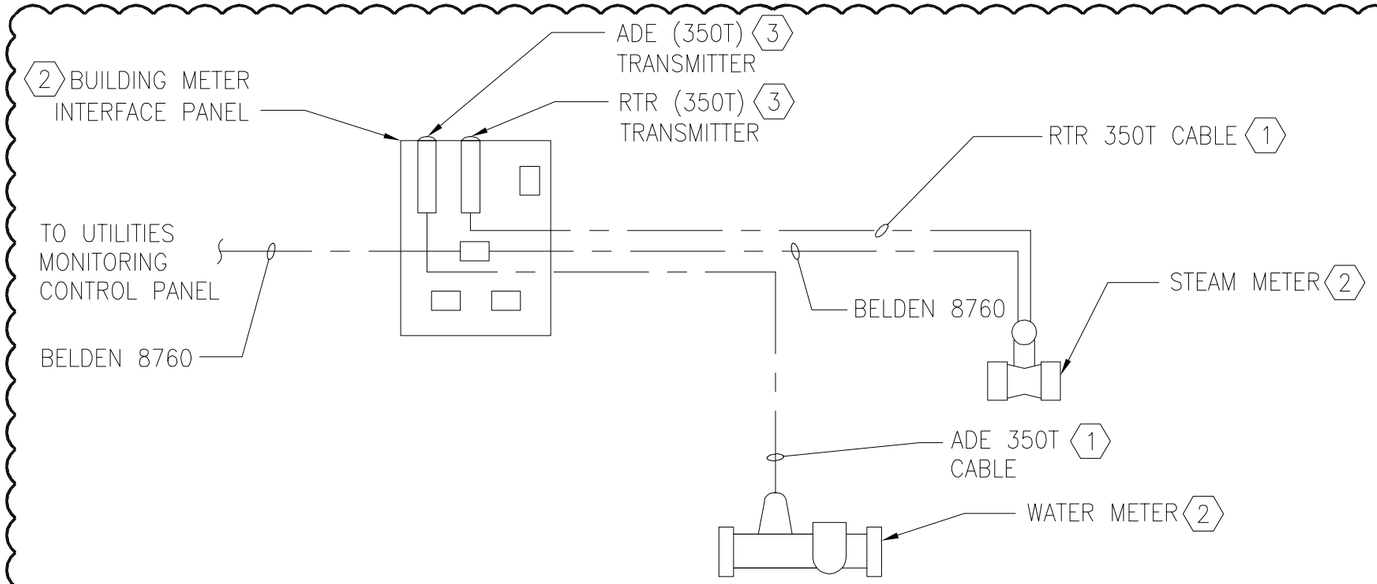
UTILITY PIT - PLAN



SECTION A

UTILITY PIT PLAN & SECTION - HEATING SYSTEM UTILITY SERVICE EXTENSION TO AIRCRAFT PARTS STORAGE - FTW 336A	DWG. NAME: SKE-1
	AMENDMENT NUMBER: 1
	DATE: 7/16/10 / SCALE: 1/4"=1'-0"
	REV: / REV BY:

FOSDICK & HILMER CONSULTING ENGINEERS
309 VINE STREET, SUITE 50 CINCINNATI, OHIO 45202
TELEPHONE (513)241-5640 FAX (513)241-3659



DETAIL NOTES:

1. FURNISHED BY DOYON UTILITIES, INSTALLED BY ELECTRICAL CONTRACTOR. LEAVE REMAINING LENGTH COILED AT ONE END. DO NOT CUT TO FIT.
2. FURNISHED BY DOYON UTILITIES, INSTALLED BY ELECTRICAL CONTRACTOR. PANEL TO BE MOUNTED A MINIMUM OF 36" A.F.F.
3. FURNISHED BY DOYON UTILITIES, INSTALLED BY ELECTRICAL CONTRACTOR.
4. EXACT LOCATION OF THE BUILDING INTERFACE CONTROL PANEL SHALL BE ITERATIVELY DETERMINED (IE., TEST, RELOCATE IF NECESSARY, RETEST), AS THE POINT AT WHICH RECEPTION BY THE TANTALUS ELECTRIC METER IS OPTIMALLY ACHIEVED. IF FINAL LOCATION IS NOT ACCEPTABLE TO THE ENGINEER, TRANSMITTERS CAN BE REMOTE MOUNTED FROM THE PANEL.

DEVICE TAGS

BUILDING CODE	BUILDING NAME	BUILDING METER INTERFACE PANEL	STEAM METER	WATER METER	PUMP	UTILITIES MONITORING CONTROL PANEL
336A	AIRCRAFT PARTS STORAGE	CP-336AM	FIT-336A-MPS	FT-336A-DCW	NONE	CP-G693

1 DETAIL 1 BUILDING METER INTERFACE

N.T.S. PC-05

REV. NO.	DATE	DESCRIPTION
	4/09/10	ISSUED FOR CONSTRUCTION
1	7/21/10	AMENDMENT NO. 1

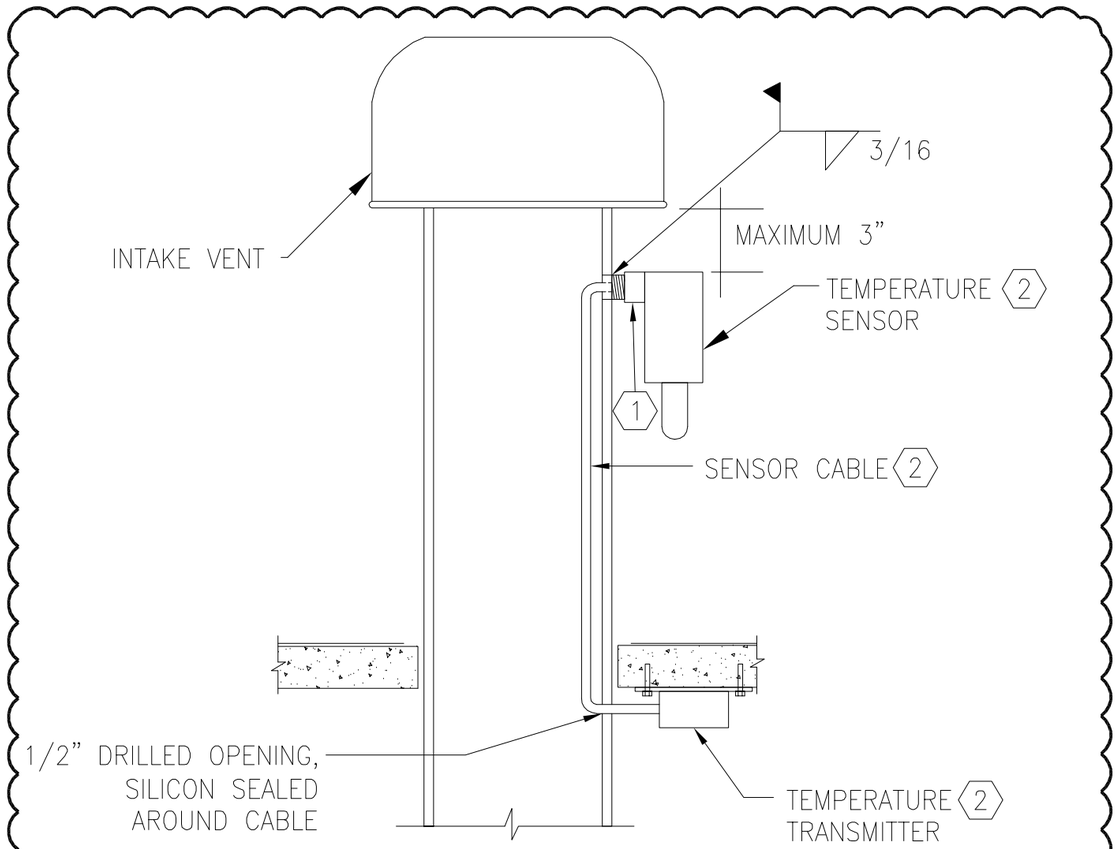
FOSDICK & HILMER CONSULTING ENGINEERS
309 VINE STREET, SUITE 50 CINCINNATI, OHIO 45202
TELEPHONE (513)241-5640 WWW.FHENG.COM

DOYON UTILITIES LLC
Jimmy Huntington Building
714 Fourth Avenue, Suite 201
Fairbanks, Alaska 99701
Telephone (907) 455-1500
Fax (907) 455-6788

Date:	04/09/10
Scale:	NTS
Designed By:	J.T.
Drawn By:	G.N.
Checked By:	J.T.

UTILITY SERVICE EXTENSION TO AIRCRAFT PARTS STORAGE
BUILDING METER INTERFACE DETAIL
FORT WAINWRIGHT, AK.
DU PROJECT NO. J101395, 101396, 101397

Drawing No.
PC-06



DETAIL GENERAL NOTES:

A. SEE DOYON UTILITIES STANDARD DRAWING UES-DD-H206 FOR VENT INSTALLATION DETAILS.

DETAIL NOTES:

1. WELD 1/2" HALF NIPPLE TO VENT PIPE FOR SENSOR INSTALLATION.
2. FURNISHED BY DOYON UTILITIES, INSTALLED BY ELECTRICAL CONTRACTOR.

1 DETAIL 2 OUTDOOR AIR TEMPERATURE TRANSMITTER

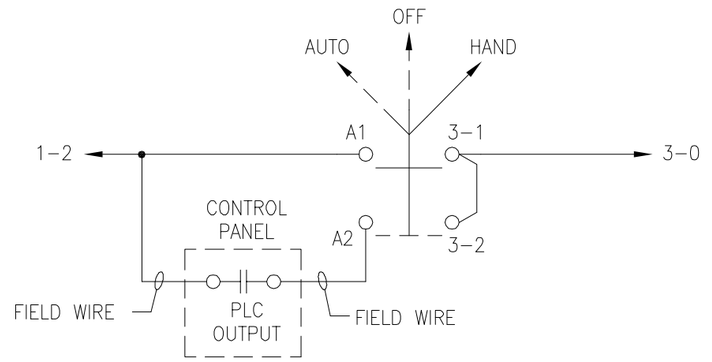
N.T.S. PC-04

DETAIL GENERAL NOTE:

A. SEE DOYON UTILITIES STANDARD DRAWING UES-DD-H206 FOR VENT INSTALLATION DETAILS.

DETAIL NOTES:

1. DRILL AND TAP INTAKE VENT PIPE FOR CONNECTION OF DEVICE.



DETAIL 3 HYDRANT WATER RECIRCULATING PUMP H-O-A CONTROL

N.T.S. PC-04

REV. NO.	DATE	DESCRIPTION
	4/09/10	ISSUED FOR CONSTRUCTION
1	7/21/10	AMENDMENT NO. 1

FOSDICK & HILMER CONSULTING ENGINEERS
309 VINE STREET, SUITE 50 CINCINNATI, OHIO 45202
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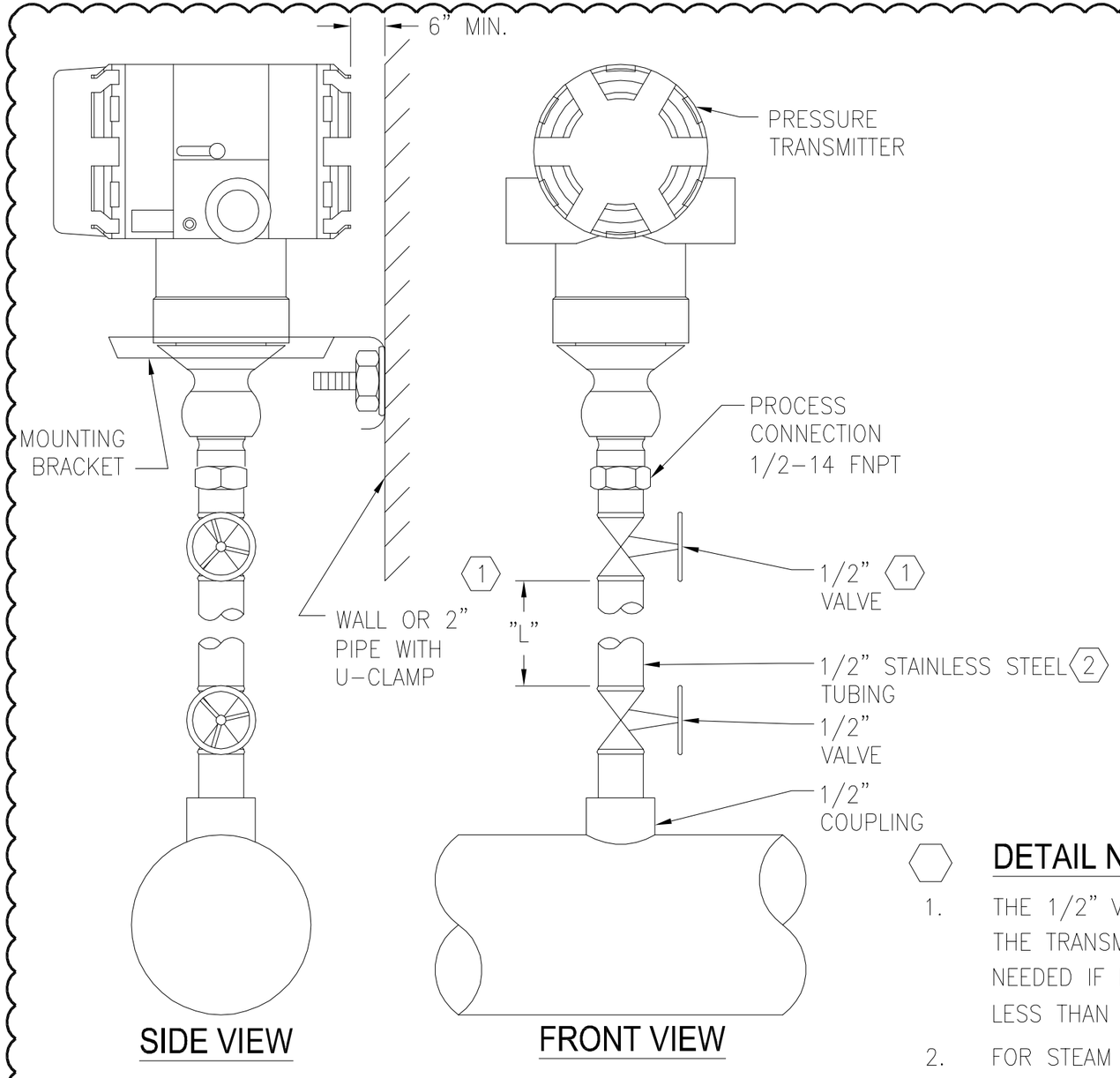
DOYON UTILITIES LLC
Jimmy Huntington Building
714 Fourth Avenue, Suite 20
Fairbanks, Alaska 99701
Telephone (907) 455-1500
Fax (907) 455-6788

Date:	04/09/10
Scale:	NTS
Designed By:	J.T.
Drawn By:	G.N.
Checked By:	J.T.

UTILITY SERVICE EXTENSION TO AIRCRAFT PARTS STORAGE
MISCELLANEOUS UTILITY MONITORING DETAILS
FORT WAINWRIGHT, AK.
DU PROJECT NO. J101395, 101396, 101397

Drawing No.
PC-07



DETAIL NOTES:

1. THE 1/2" VALVE CLOSEST TO THE TRANSMITTER IS NOT NEEDED IF DIMENSION "L" IS LESS THAN 15'-0".
2. FOR STEAM INSTALLATION, INSTALL A PIGTAIL IN THIS SECTION FOR HEAT REDUCTION.

1 DETAIL 4 PRESSURE TRANSMITTER

N.T.S. PC-02

REV. NO.	DATE	DESCRIPTION
1	7/21/10	AMENDMENT NO. 1

FOSDICK & HILMER CONSULTING ENGINEERS
309 VINE STREET, SUITE 50 CINCINNATI, OHIO 45202
TELEPHONE (513)241-5640 WWW.FHENG.COM

DOYON UTILITIES LLC
Jimmy Huntington Building
714 Fourth Avenue, Suite 201
Fairbanks, Alaska 99701
Telephone (907) 455-1500
Fax (907) 455-6788

Date:	7/21/10
Scale:	NTS
Designed By:	J.T.
Drawn By:	G.N.
Checked By:	J.T.

UTILITY SERVICE EXTENSION TO AIRCRAFT PARTS STORAGE
UTILITY MONITORING
FORT WAINWRIGHT, AK.
DU PROJECT NO. J101395, 101396, 101397

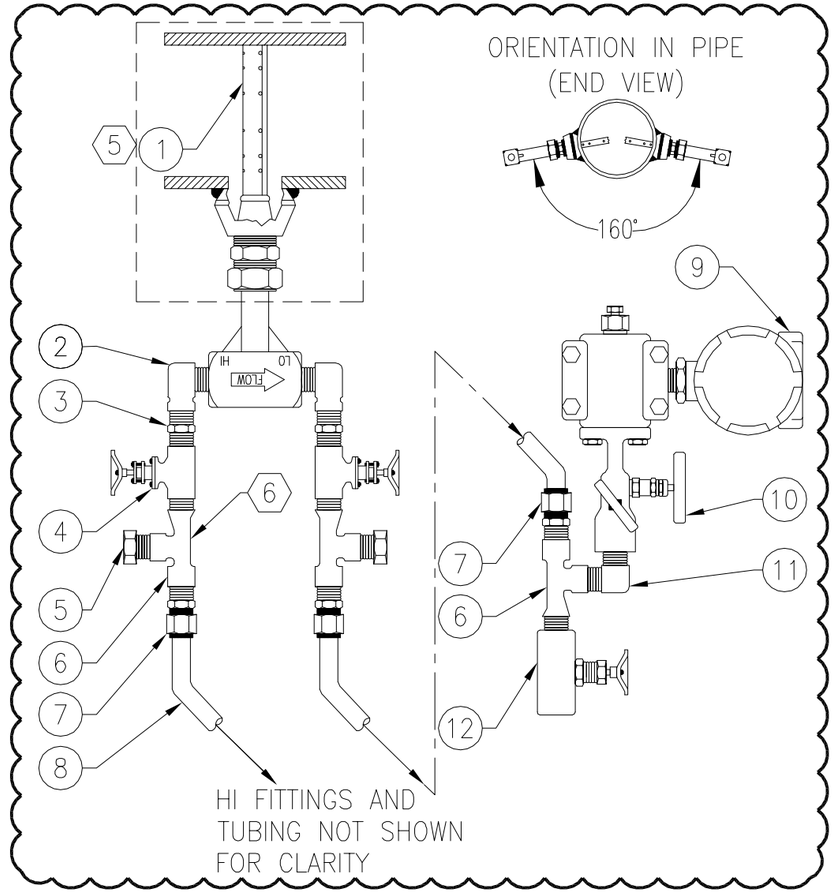
Drawing No.
PC-08

ITEM DESCRIPTION:

1.	QTY: 1	FLOW SENSOR WITH PIPE MOUNTING HARDWARE
2.	QTY: 2	1/2" STREET ELBOW
3.	QTY: 2	1/2" NPT HEX NIPPLE
4.	QTY: 2	1/2" FNPT GATE VALVE (FULL PORT)
5.	QTY: 2	1/2" MNPT PLUG
6.	QTY: 4	1/2" STREET TEE
7.	QTY: 4	1/2" MNPT X 1/2" OD TUBE FILLING
8.	QTY: AS REQ.	1/2" OD TUBING
9.	QTY: 1	DIFFRENTIAL PRESSURE TRANSMITTER, TRADITIONAL STYLE.
10.	QTY: 1	3 OR 5 VALVE MANIFOLD (1/2" FNPT X FLANGED)
11.	QTY: 2	1/2" MALE ELBOW
12.	QTY: 2	1/2" FNPT NEEDLE VALVE

DRAWING NOTES:

1. MOUNTING ON THE BOTTOM OF THE PIPE AS SHOWN IS RECOMMENDED. CONTACT VERIS IF AN ALTERNATE INSTALLATION IS REQUIRED.
2. DP TRANSMITTER TO BE LOCATED AT SUFFICIENT DISTANCE TO ALLOW FOR COOLING TO MEET TRANSMITTER SPECIFICATION. TYPICAL COLLING RATE IS 100°F PER FOOT (55°C PER 300MM). DP TRANSMITTER TO BE LOCATED AT LEAST 18IN. (450MM) BELOW THE FILL TEES. THE VENT VALVES ARE TO POINT UP IF TRADITIONAL STYLE TRANSMITTER.
3. TUBING TO SLOPE CONTINUOUSLY DOWNWARD TO THE DP TRANSMITTER AT LEAST 4IN. (100MM) PER FOOT (300MM) AND SHALL BE FREE OF PEAKS, DIPS, OR SHARP BENDS THAT WOULD ALLOW ENTRAPPED AIR TO ACCUMULATE.
4. TUBING BENDS TO BE MADE WITH A TUBE BENDER AND SHALL HAVE A MINIMUM RADIUS OF THREE TIMES THE TUBING OD.
5. VERABAR MODEL V100 SHOWN, OTHER MODELS AVAILABLE.
6. FILL TEES TO BE AT THE SAME HEIGHT.



1 DETAIL 5 FLOW TRANSMITTER

N.T.S. PC-02

REV. NO.	DATE	DESCRIPTION
1	7/21/10	AMENDMENT NO. 1

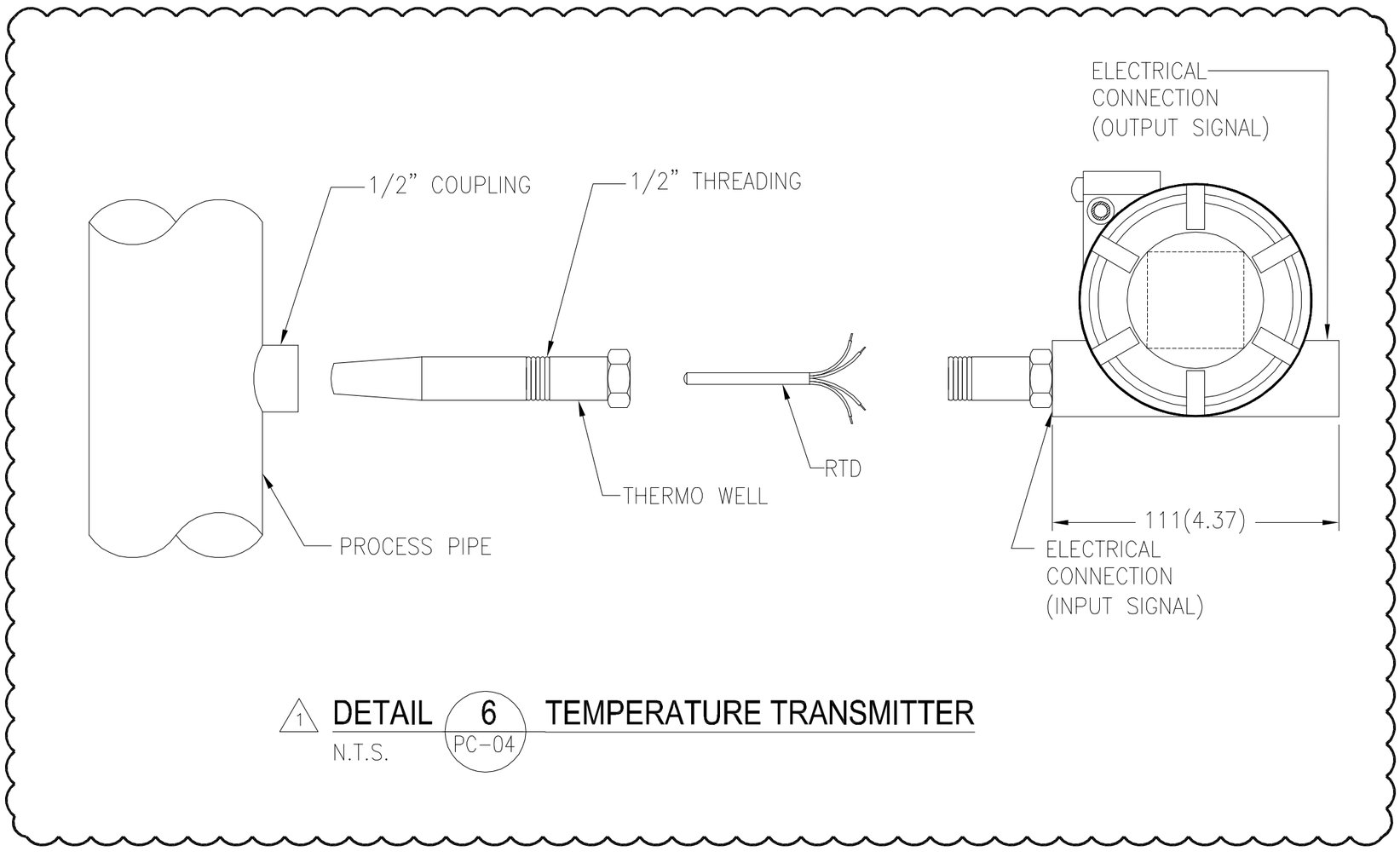
FOSDICK & HILMER CONSULTING ENGINEERS
309 VINE STREET, SUITE 50 CINCINNATI, OHIO 45202
TELEPHONE (513)241-5640 WWW.FHENG.COM

DOYON UTILITIES LLC
Jimmy Huntington Building
714 Fourth Avenue, Suite 20
Fairbanks, Alaska 99701
Telephone (907) 455-1500
Fax (907) 455-6788

Date:	7/21/10
Scale:	NTS
Designed By:	J.T.
Drawn By:	G.N.
Checked By:	J.T.

UTILITY SERVICE EXTENSION TO AIRCRAFT PARTS STORAGE
UTILITY MONITORING
FORT WAINWRIGHT, AK.
DU PROJECT NO. J101395, 101396, 101397

Drawing No.
PC-09



1 DETAIL 6 TEMPERATURE TRANSMITTER

PC-04

N.T.S.

REV. NO.	DATE	DESCRIPTION
1	7/21/10	AMENDMENT NO. 1

FOSDICK & HILMER CONSULTING ENGINEERS
309 VINE STREET, SUITE 50 CINCINNATI, OHIO 45202
TELEPHONE (513)241-5640 WWW.FHENG.COM

DOYON UTILITIES LLC
Jimmy Huntington Building
714 Fourth Avenue, Suite 20
Fairbanks, Alaska 99701
Telephone (907) 455-1500
Fax (907) 455-6788

Date:	7/21/10
Scale:	NTS
Designed By:	J.T.
Drawn By:	G.N.
Checked By:	J.T.

UTILITY SERVICE EXTENSION TO AIRCRAFT PARTS STORAGE
UTILITY MONITORING
FORT WAINWRIGHT, AK.
DU PROJECT NO. J101395, 101396, 101397

Drawing No.
PC-10

FOSDICK & HILMER, INC.
CONSULTING ENGINEERS
309 VINE STREET, SUITE 50
CINCINNATI, OHIO 45202
(513) 241-5640

FILE COPY
mool

TO: **Perma Pipe**

ATTN: **nowakowskim@permapipe.com**

DATE **5/14/10**
CLIENT **Doyon Utilities**
PROJECT **Util Extension to Aircraft Parts Storage**
FTW336A
PROJECT # **DOY01.233700**

WE ARE SENDING VIA:

___	U.S. MAIL	X	SHOP DRAWINGS	___	FOR YOUR USE
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___	HAND DELIVERED	___	PRINTED MATERIAL	___	FOR YOUR REVIEW
___	COURIER	___	SPECIFICATIONS		
___	FAX	___	OTHER		
___	PICK UP				
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RECEIVED WITH: _____

YOUR LETTER OF _____

COPIES	SPEC/DWG NO.	DATE/REV.	DESCRIPTION
1			**Direct Buried Steam & Condensate Piping Submittal (NEN)**

REMARKS:

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FOSDICK & HILMER, INC.

BY **Eric Erpenbeck**

Doyo1.233700
M001

PERMA-PIPE®

RECEIVED MAY 10 2010

NO EXCEPTIONS NOTED
EXCEPTIONS NOTED
REVISE AND SUBMIT FILE COPY
RETURN FOR CORRECTION
REVISE AND RESUBMIT
BY SAE DATE 5/14/10
REVIEW DOES NOT RELIEVE THE CONTRACTOR FROM RESPONSIBILITY FOR ERRORS OR DEVIATIONS FROM CONTRACT REQUIREMENTS
FOSDICK & HILMER, INC.
309 VINE STREET, SUITE 50
CINCINNATI, OHIO 45202

PERMA-PIPE, INC.
A Subsidiary of MFRI, Inc.
7720 North Lehigh Avenue
Niles, Illinois 60714-3491
Phone (847) 966-2235
Fax (847) 470-1204

May 6, 2010

Doyon Utilities
PO Box 74040
Fairbanks, AK 99707

Email to tcrompton@fosdickandhilmer.com

RE: Ft. Wainwright – FTW – 336A AND 336B
PERMA-PIPE's Customer Order No. D0878

Gentlemen:

Enclosed is PERMA-PIPE's design package for the "Preinsulated Distribution System" for the referenced project. This package includes the following:

Item	No. of Copies	Description
A	1	Design Layout Drawing No. 10-217-B, sheets 1 through 6 of 6, initial submittal
B	1	Computer Aided Pipe Stress Analysis
C	1	Heat Transfer Analysis
D	1	Material Product Data Sheets
E	1	Multi-Therm 500 Installation Instructions
F	1	Product Installation and Use
G	1	Field Dimension Checklist

Upon reviewing our drawings, you will note the following:

1. The dimensions shown were scaled from the contact drawings.
2. The materials of construction shall be as follows:
   Service Line –
   Steam: Standard Weight, ASTM A106, Seamless, Grade B, black steel pipe
   Condensate: Schedule 10S, ASTM A312, Type 316L, Seamless, stainless steel
   Insulation – Mineral Wool
   Conduit – 10 gauge spiral weld steel conduit with polyurethane foam and HDPE jacket

We would like to remind you that it is the contractor's responsibility for verifying true field dimensions. PERMA-PIPE assumes no responsibility for modifications that may be required different from those shown on the above drawings. Additionally, please provide the fabrication starting point and shipping sequence to facilitate the delivery of this project to your jobsite.

One copy of this submittal package, marked "Approved and Released for Fabrication", must be returned in order for this project to be entered into our production schedule.

If we can be of further assistance, please do not hesitate to call.

Thank you,

MARY ANNE CH NOWAKOWSKI
Senior Project Engineer
847-929-1831 Email: nowakowskim@permapipe.com

cc: Engineered Equipment Co. AK
T. Hustak
J. Carusiello/Job File

Heat Transfer Calculations
Single Service Pipe Conduit (Air Space) System
Perma-Pipe ES-4010 Rev. 0

Project: D0878
By / Date: MACHN 4/16/2010 Sheet 1
STEAM PIPE
AMBIENT BARRACKS

Input Data

Aboveground or Belowground	Belowground
Design Temperature (deg. F)	350
Ground Temperature (deg. F)	20
Depth of Cover (ft.)	5.0
Soil Thermal Cond. (Btu-in./hr.-ft.**2- F)	16.56
Service Pipe Type	Steel Pipe
Air Space Required	5/8" minimum
Service Pipe Insulation	Mineral Wool (Delta)
Conduit Insulation	Polyurethane (Nominal 2.0 lb/ft**3)

Cross Sections

Service Pipe Nominal Size (in.)	16.00	10.00
Service Pipe Insulation Thickness (in.)	2.00	1.50
Actual Conduit OD (in.)	22.00	16.00
Conduit Wall Thickness(in.)	0.134	0.134
Calculated Air Space (in.)	0.87	0.87
Conduit Insulation Thickness (in.)	1.00	1.00

Heat Transfer Calculation Results

Heat Loss (Btu/hr.-ft.)	125.1	101.2
Insulation Surface Temperature (deg. F)	193	202
Conduit Temperature (deg. F)	180	187
Jacket Temperature (deg. F)	56	52

Notes:

1. Insulation thermal conductivity at the calculated mean insulation temperature.
2. Calculations in accordance with ASTM C680 "Determination of Heat Gain or Loss and the Surface Temperature of Insulated Pipe and Equipment Systems by the Use of a Computer Program.", ASHRAE Handbook 2000 HVAC Systems and Equipment, and the Federal Construction Guide Specification 15705.
3. The effects of other hot or cold piping, if any, in the same trench are negligable.
4. The thermal conductivity / resistance of the service pipe, conduit and conduit insulation jacket are negligable.
5. Service pipe insulation pre-formed, thickness per ASTM C585 'Inner and Outer Dimensions of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing.'
6. Conduit insulation thickness is actual thickness input above.

Heat Transfer Calculations
Single Service Pipe Conduit (Air Space) System
Perma-Pipe ES-4010 Rev. 0

Project: D0878

By / Date: MACHN 4/16/2010 Sheet 1

STEAM PIPE

Input Data

Aboveground or Belowground	Belowground
Design Temperature (deg. F)	350
Ground Temperature (deg. F)	50
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Calculated Air Space (in.)	0.87	0.87
Conduit Insulation Thickness (in.)	1.00	1.00

Heat Transfer Calculation Results

Heat Loss (Btu/hr.-ft.)	116.6	94.4
Insulation Surface Temperature (deg. F)	205	213
Conduit Temperature (deg. F)	194	200
Jacket Temperature (deg. F)	83	80

Notes:

1. Insulation thermal conductivity at the calculated mean insulation temperature.
2. Calculations in accordance with ASTM C680 "Determination of Heat Gain or Loss and the Surface Temperature of Insulated Pipe and Equipment Systems by the Use of a Computer Program.", ASHRAE Handbook 2000 HVAC Systems and Equipment, and the Federal Construction Guide Specification 15705.
3. The effects of other hot or cold piping, if any, in the same trench are negligable.
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Heat Transfer Calculations
Single Service Pipe Conduit (Air Space) System
Perma-Pipe ES-4010 Rev. 0

Project: D0878
By / Date: MACHN 4/16/2010 Sheet 1
CONDENSATE PIPE
AVIATION BARRACKS

Input Data

Aboveground or Belowground	Belowground
Design Temperature (deg. F)	350
Ground Temperature (deg. F)	50
Depth of Cover (ft.)	5.0
Soil Thermal Cond. (Btu-in./hr.-ft.**2- F)	16.56
Service Pipe Type	Steel Pipe
Air Space Required	5/8" minimum
Service Pipe Insulation	Mineral Wool (Delta)
Conduit Insulation	Polyurethane (Nominal 2.0 lb/ft**3)

Cross Sections

Service Pipe Nominal Size (in.)	8.00	4.00
Service Pipe Insulation Thickness (in.)	1.50	1.50
Actual Conduit OD (in.)	14.00	10.75
Conduit Wall Thickness(in.)	0.134	0.134
Calculated Air Space (in.)	0.99	1.43
Conduit Insulation Thickness (in.)	1.00	1.00

Heat Transfer Calculation Results

Heat Loss (Btu/hr.-ft.)	82.1	54.0
Insulation Surface Temperature (deg. F)	210	188
Conduit Temperature (deg. F)	197	173
Jacket Temperature (deg. F)	77	69

Notes:

1. Insulation thermal conductivity at the calculated mean insulation temperature.
2. Calculations in accordance with ASTM C680 "Determination of Heat Gain or Loss and the Surface Temperature of Insulated Pipe and Equipment Systems by the Use of a Computer Program.", ASHRAE Handbook 2000 HVAC Systems and Equipment, and the Federal Construction Guide Specification 15705.
3. The effects of other hot or cold piping, if any, in the same trench are negligable.
4. The thermal conductivity / resistance of the service pipe, conduit and conduit insulation jacket are negligable.
5. Service pipe insulation pre-formed, thickness per ASTM C585 'Inner and Outer Dimensions of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing.'
6. Conduit insulation thickness is actual thickness input above.

Heat Transfer Calculations
Single Service Pipe Conduit (Air Space) System
Perma-Pipe ES-4010 Rev. 0

Project: D0878
By / Date: MACHN 4/16/2010 Sheet 1
CONDENSATE PIPE
AVIATION BARRACKS

Input Data

Aboveground or Belowground	Belowground
Design Temperature (deg. F)	350
Ground Temperature (deg. F)	20
Depth of Cover (ft.)	5.0
Soil Thermal Cond. (Btu-in./hr.-ft.**2- F)	16.56
Service Pipe Type	Steel Pipe
Air Space Required	5/8" minimum
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Cross Sections

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Actual Conduit OD (in.)	14.00	10.75
Conduit Wall Thickness(in.)	0.134	0.134
Calculated Air Space (in.)	0.99	1.43
Conduit Insulation Thickness (in.)	1.00	1.00

Heat Transfer Calculation Results

Heat Loss (Btu/hr.-ft.)	88.0	57.8
Insulation Surface Temperature (deg. F)	198	174
Conduit Temperature (deg. F)	183	158
Jacket Temperature (deg. F)	49	40

Notes:

1. Insulation thermal conductivity at the calculated mean insulation temperature.
2. Calculations in accordance with ASTM C680 "Determination of Heat Gain or Loss and the Surface Temperature of Insulated Pipe and Equipment Systems by the Use of a Computer Program.", ASHRAE Handbook 2000 HVAC Systems and Equipment, and the Federal Construction Guide Specification 15705.
3. The effects of other hot or cold piping, if any, in the same trench are negligable.
4. The thermal conductivity / resistance of the service pipe, conduit and conduit insulation jacket are negligable.
5. Service pipe insulation pre-formed, thickness per ASTM C585 'Inner and Outer Dimensions of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing.'
6. Conduit insulation thickness is actual thickness input above.

Heat Transfer Calculations
Single Service Pipe Conduit (Air Space) System
Perma-Pipe ES-4010 Rev. 0

Project: D0878

By / Date: MACHN 4/16/2010

STEAM PIPE

AIRCRAFT STORAGE

Input Data

Aboveground or Belowground	Belowground
Design Temperature (deg. F)	350
Ground Temperature (deg. F)	20
Depth of Cover (ft.)	5.0
Soil Thermal Cond. (Btu-in./hr.-ft.**2- F)	16.56
Service Pipe Type	Steel Pipe
Air Space Required	5/8" minimum
Service Pipe Insulation	Mineral Wool (Delta)
Conduit Insulation	Polyurethane (Nominal 2.0 lb/ft**3)

Cross Sections

Service Pipe Nominal Size (in.)	3.00
Service Pipe Insulation Thickness (in.)	1.00
Actual Conduit OD (in.)	8.62
Conduit Wall Thickness(in.)	0.134
Calculated Air Space (in.)	1.40
Conduit Insulation Thickness (in.)	1.00

Heat Transfer Calculation Results

Heat Loss (Btu/hr.-ft.)	57.3
Insulation Surface Temperature (deg. F)	200
Conduit Temperature (deg. F)	180
Jacket Temperature (deg. F)	41

Notes:

1. Insulation thermal conductivity at the calculated mean insulation temperature.
2. Calculations in accordance with ASTM C680 "Determination of Heat Gain or Loss and the Surface Temperature of Insulated Pipe and Equipment Systems by the Use of a Computer Program.", ASHRAE Handbook 2000 HVAC Systems and Equipment, and the Federal Construction Guide Specification 15705.
3. The effects of other hot or cold piping, if any, in the same trench are negligable.
4. The thermal conductivity / resistance of the service pipe, conduit and conduit insulation jacket are negligable.
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6. Conduit insulation thickness is actual thickness input above.

Heat Transfer Calculations
Single Service Pipe Conduit (Air Space) System
Perma-Pipe ES-4010 Rev. 0

Project: D0878

By / Date: MACHN 4/16/2010

STEAM PIPE

AIRCRAFT STORAGE

Input Data

Aboveground or Belowground	Belowground
Design Temperature (deg. F)	350
Ground Temperature (deg. F)	50
Depth of Cover (ft.)	5.0
Soil Thermal Cond. (Btu-in./hr.-ft.**2- F)	16.56
Service Pipe Type	Steel Pipe
Air Space Required	5/8" minimum
Service Pipe Insulation	Mineral Wool (Delta)
Conduit Insulation	Polyurethane (Nominal 2.0 lb/ft**3)

Cross Sections

Service Pipe Nominal Size (in.)	3.00
Service Pipe Insulation Thickness (in.)	1.00
Actual Conduit OD (in.)	8.62
Conduit Wall Thickness(in.)	0.134
Calculated Air Space (in.)	1.40
Conduit Insulation Thickness (in.)	1.00

Heat Transfer Calculation Results

Heat Loss (Btu/hr.-ft.)	53.5
Insulation Surface Temperature (deg. F)	211
Conduit Temperature (deg. F)	193
Jacket Temperature (deg. F)	70

Notes:

1. Insulation thermal conductivity at the calculated mean insulation temperature.
2. Calculations in accordance with ASTM C680 "Determination of Heat Gain or Loss and the Surface Temperature of Insulated Pipe and Equipment Systems by the Use of a Computer Program.", ASHRAE Handbook 2000 HVAC Systems and Equipment, and the Federal Construction Guide Specification 15705.
3. The effects of other hot or cold piping, if any, in the same trench are negligable.
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5. Service pipe insulation pre-formed, thickness per ASTM C585 'Inner and Outer Dimensions of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing.'
6. Conduit insulation thickness is actual thickness input above.

Heat Transfer Calculations
Single Service Pipe Conduit (Air Space) System
Perma-Pipe ES-4010 Rev. 0

Project: D0878
By / Date: MACHN 4/16/2010
CONDENSATE PIPE

AIRCRAFT STORAGE

Input Data

Aboveground or Belowground	Belowground
Design Temperature (deg. F)	350
Ground Temperature (deg. F)	20
Depth of Cover (ft.)	5.0
Soil Thermal Cond. (Btu-in./hr.-ft.**2- F)	16.56
Service Pipe Type	Steel Pipe
Air Space Required	5/8" minimum
Service Pipe Insulation	Mineral Wool (Delta)
Conduit Insulation	Polyurethane (Nominal 2.0 lb/ft**3)

Cross Sections

Service Pipe Nominal Size (in.)	1.50
Service Pipe Insulation Thickness (in.)	1.00
Actual Conduit OD (in.)	6.62
Conduit Wall Thickness(in.)	0.134
Calculated Air Space (in.)	1.18
Conduit Insulation Thickness (in.)	1.00

Heat Transfer Calculation Results

Heat Loss (Btu/hr.-ft.)	39.5
Insulation Surface Temperature (deg. F)	181
Conduit Temperature (deg. F)	160
Jacket Temperature (deg. F)	35

Notes:

1. Insulation thermal conductivity at the calculated mean insulation temperature.
2. Calculations in accordance with ASTM C680 "Determination of Heat Gain or Loss and the Surface Temperature of Insulated Pipe and Equipment Systems by the Use of a Computer Program.", ASHRAE Handbook 2000 HVAC Systems and Equipment, and the Federal Construction Guide Specification 15705.
3. The effects of other hot or cold piping, if any, in the same trench are negligable.
4. The thermal conductivity / resistance of the service pipe, conduit and conduit insulation jacket are negligable.
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6. Conduit insulation thickness is actual thickness input above.

Heat Transfer Calculations
Single Service Pipe Conduit (Air Space) System
Perma-Pipe ES-4010 Rev. 0

Project: D0878

By / Date: MACHN 4/16/2010

CONDENSATE PIPE

AIRCRAFT STORAGE

Input Data

Aboveground or Belowground	Belowground
Design Temperature (deg. F)	350
Ground Temperature (deg. F)	50
Depth of Cover (ft.)	5.0
Soil Thermal Cond. (Btu-in./hr.-ft.**2- F)	16.56
Service Pipe Type	Steel Pipe
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Conduit Insulation	Polyurethane (Nominal 2.0 lb/ft**3)

Cross Sections

Service Pipe Nominal Size (in.)	1.50
Service Pipe Insulation Thickness (in.)	1.00
Actual Conduit OD (in.)	6.62
Conduit Wall Thickness(in.)	0.134
Calculated Air Space (in.)	1.18
Conduit Insulation Thickness (in.)	1.00

Heat Transfer Calculation Results

Heat Loss (Btu/hr.-ft.)	36.9
Insulation Surface Temperature (deg. F)	194
Conduit Temperature (deg. F)	175
Jacket Temperature (deg. F)	64

Notes:

1. Insulation thermal conductivity at the calculated mean insulation temperature.
2. Calculations in accordance with ASTM C680 "Determination of Heat Gain or Loss and the Surface Temperature of Insulated Pipe and Equipment Systems by the Use of a Computer Program.", ASHRAE Handbook 2000 HVAC Systems and Equipment, and the Federal Construction Guide Specification 15705.
3. The effects of other hot or cold piping, if any, in the same trench are negligable.
4. The thermal conductivity / resistance of the service pipe, conduit and conduit insulation jacket are negligable.
5. Service pipe insulation pre-formed, thickness per ASTM C585 'Inner and Outer Dimensions of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing.'
6. Conduit insulation thickness is actual thickness input above.

MULTI–THERM® 500 PE GENERAL NOTES

1.0 GENERAL

1.1 THE SCALE SHOWN ON THE DRAWINGS IS FOR REFERENCE PURPOSES ONLY. DO NOT SCALE THE DRAWINGS, USE THE DIMENSIONS SHOWN.

1.2 THE EXACT LOCATIONS AND QUANTITY OF FIELD JOINTS WILL BE SHOWN ON THE PART DRAWING LAYOUT (PDL) – SEE NOTE 5.0

1.3 THE PURCHASER MUST FURNISH AND/OR VERIFY THE FOLLOWING INFORMATION BEFORE MANUFACTURING OF THE SYSTEM CAN BEGIN:

1.3.1 FIELD MEASUREMENTS – THE ACCURACY OF FIELD MEASUREMENTS, INCLUDING WALL THICKNESS AT ALL POINTS OF ENTRY, ARE ENTIRELY THE RESPONSIBILITY OF THE PURCHASER.

1.3.2 DESIGN CONDITIONS – THE DESIGN PRESSURE, TEMPERATURE AND ALL OTHER DESIGN CONDITIONS MUST BE VERIFIED BY THE PURCHASER.

1.3.3 SLOPE OF THE SYSTEM – THE SYSTEM SLOPE IS SHOWN ON THE DRAWINGS WHERE APPLICABLE. THE SYSTEM SLOPE MUST BE VERIFIED BY THE PURCHASER.

2.0 PRODUCT DESCRIPTION

2.1 MULTI–THERM 500 PE CONDUIT IS A DRAINABLE, DRYABLE AND PRESSURE TESTABLE STEEL CONDUIT SYSTEM CONSISTING OF A SERVICE PIPE, INSULATION, AIR GAP AND PRESSURE TESTABLE STEEL CONDUIT, WITH POLYURETHANE INSULATION AND OUTER HDPE JACKET.

2.2 MULTI–THERM 500 PE IS FABRICATED TO FIELD DIMENSIONS.

3.0 DESIGN CONDITIONS/CRITERIA

3.1 SERVICE PRESSURE AND TEMPERATURE:

SERVICE	PRESSURE (PSIG)	TEMPERATURE (DEG. F)
STEAM	100 PSIG	350° F
CONDENSATE	100 PSIG	350° F

3.2 THE SERVICE PIPING IS DESIGNED AND MANUFACTURED IN ACCORDANCE WITH ASME B31.1.

3.3 THE PIPING SYSTEM IS DESIGNED FOR THE ABOVE DESIGN CONDITIONS. IT IS THE PURCHASER'S RESPONSIBILITY TO VERIFY THIS INFORMATION IS CORRECT AND OPERATE THE SYSTEM WITHIN THE CONDITIONS DESIGNED FOR.

3.4 A STRESS ANALYSIS OF THIS PIPING SYSTEM HAS BEEN MADE ASSUMING THE DIMENSIONS AND DESIGN CONDITIONS SHOWN ON THESE DRAWINGS ARE CORRECT. THIS SYSTEM IS WITHIN THE LIMITS SET FORTH FOR ALLOWABLE STRESSES IN THE CODE, BASED UPON THE ASSUMPTIONS HEREIN.

3.5 THE SYSTEM IS DESIGNED TO ACCOMMODATE THE SERVICE PIPE THERMAL EXPANSION WITHIN THE CONDUIT ELBOWS AND EXPANSION LOOPS. THE CONDUIT IS SIZED TO ACCOMMODATE THIS MOVEMENT.

WHERE GLAND SEALS, WATERSHEDS OR OPEN CONDUIT ENDS ARE USED, THE SERVICE PIPE THERMAL EXPANSION WILL BE OUTSIDE THE CONDUIT. THE AMOUNT OF MOVEMENT IS SHOWN ON THE DRAWINGS.

4.0 MATERIALS

MULTI–THERM 500 MATERIALS		
ITEM	SIZE	MATERIAL
SERVICE PIPE	3"–16" STANDARD WEIGHT FOR STEAM 1 1/2"–4" SCHEDULE 10 S FOR CONDENSATE	ASTM A106, SEAMLESS, GRADE B, CARBON STEEL PIPE ASTM A312, TYPE 316L, SEAMLESS STAINLESS STEEL
SERVICE PIPE FITTINGS	3"–16" STANDARD WEIGHT FOR STEAM 4" SCHEDULE 10 S FOR CONDENSATE 1 1/2" SCH 10 S FORGED STAIN–LESS STL FOR CONDENSATE	BUTTWELD, ASME B16.9, WROUGHT STEEL, LONG RADIUS, ASTM A234, WPB, SEAMLESS BUTTWELD, ASMTM A403, TYPE 316L, STAINLESS STEEL, LONG RADIUS, WPB, SEAMLESS ASTM A182–F316L, LR ANSI CLASS 3000, ANSI B16.11 SOCKETWELD
SERVICE PIPE INSULATION	ALL	MINERAL WOOL
CONDUIT	6" TO 26" 10 GAUGE 28" TO 36" 6 GAUGE	ASTM A139 SPIRAL WELDED/A135 ERW
CONDUIT COATING–EXTERIOR	ALL	POLYURETHANE INSULATION AND OUTER HDPE/FRP JACKET
CONDUIT INSULATION	1" THICK	POLYURETHANE 2.0 LBS/FT ^{3} MINIMUM DENSITY ≥ 90% CLOSED CELL
OUTER JACKET	CD ≤ 12" .120 MIN. THICK 12" < CD ≤ 24" .150 MIN. THICK CD ≥ 24" .175 MIN. THICK CD=CONDUIT NOMINAL DIAMETER	HIGH DENSITY POLYETHYLENE (HDPE) ASTM D3350, GRADE PE 3408 FIBERGLASS REINFORCED PLASTIC (FRP) CHOP SPRAYED AT FITTINGS
ANCHOR, REDUCER & END PLATES	STEAM AND CONDENSATE	ASTM A36
SUPPORTS	ALL	GALVANIZED STEEL

5.0 INSTALLATION

5.1 ALL PIPING SHALL BE INSTALLED AND TESTED IN ACCORDANCE WITH PERMA–PIPE'S INSTALLATION INSTRUCTION MANUAL FOR THIS PRODUCT.

5.2 A PART DRAWING LAYOUT (PDL) SHALL BE FORWARDED FROM PERMA–PIPE'S FACTORY WITH EACH SHIPMENT. THE PDL INDICATES THE LOCATION OF THE FIELD JOINTS AND THE PART NUMBER OF EACH FACTORY FABRICATED PIECE. THE PDL SHALL BE USED FOR FIELD ASSEMBLY OF THE PIPING SYSTEM.

5.3 PERMA–PIPE STRONGLY RECOMMEND THAT ALL FIELD JOINTS REMAIN UNCOVERED AND EXPOSED FOR TESTING PURPOSES.

PERMA–PIPE DOES NOT RECOMMEND BACKFILLING PRIOR TO FIELD JOINT TESTING. VIOLATION OF THIS RECOMMENDATION MAY RESULT IN RE–EXCAVATION, REPAIRS AND RE–BACKFILLING AND WILL BE DONE AT THE INSTALLER'S COST AND RISK.

PERMA–PIPE WILL MAKE AVAILABLE, UPON REQUEST, TEST CAPS FOR CONDUIT TESTING.

5.4 WHERE REQUIRED, SERVICE PIPING SHALL BE COLD SPRUNG IN THE FIELD DURING INSTALLATION BY THE AMOUNT SHOWN ON THE DRAWINGS. THE AMOUNT OF COLD SPRING IS INDICATED ON THE DRAWINGS BY "CS". REFER TO THE INSTALLATION INSTRUCTION MANUAL FOR COLD SPRINGING PROCEDURES.

A WHITE STRIPE ON THE CONDUIT INDICATES COLD SPRINGING IS REQUIRED AT THE FIELD JOINT.

5.5 A BLUE STRIPE ON THE EXTERIOR OF THE CONDUIT INDICATES OVAL TYPE PIPE SUPPORTS AND MUST BE CONNECTED TO THE ADJACENT COMPENSATING PIECE.

5.6 FACTORY FABRICATED ASSEMBLIES ARE SHIPPED WITH A SHIPPING BAR WELDED TO THE SERVICE PIPE AND CONDUIT. REMOVE ALL SHIPPING BARS PRIOR TO ASSEMBLY. REMOVAL OF SHIPPING BARS IS THE RESPONSIBILITY OF THE INSTALLER.

5.7 ANCHOR BLOCKS ARE REQUIRED AT ALL ANCHOR LOCATIONS INDICATED ON THE DRAWINGS. ANCHOR BLOCKS SHALL BE FIELD POURED AND KEYED INTO UNDISTURBED SOIL BY OTHERS. ALL ANCHOR BLOCKS SHALL BE COMPLETELY CURED BEFORE OPERATING OR TESTING THE SYSTEM.

6.0 FACTORY TESTING AND INSPECTION

6.1 THE SERVICE PIPE SHALL BE HYDROSTATICALLY TESTED AT THE MILL IN ACCORDANCE WITH ITS RESPECTIVE ASTM DESIGNATION.

6.2 SERVICE PIPE NDE IN ACCORDANCE WITH ASME B31.1.

6.3 ALL FACTORY CONDUIT WELDS SHALL BE PNEUMATICALLY (AIR) TESTED TO 10 PSIG.

6.4 VISUALLY INSPECT SPRAY APPLIED POLYURETHANE INSULATION FOR VOIDS PRIOR TO TO HDPE JACKETING.

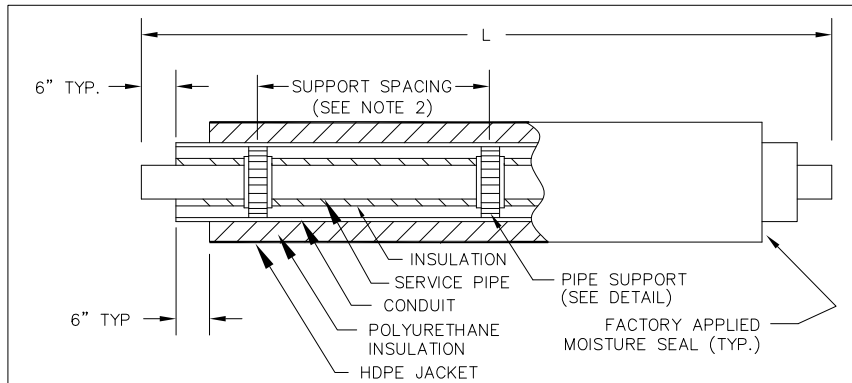
6.5 100% VISUAL INSPECTION OF ALL CARRIER PIPE WELD PASSES.
10% RADIOGRAPHIC INSPECTION OF CARRIER PIPE WELDS.

7.0 SPECIAL REQUIREMENTS

7.1 BUY AMERICAN ACT COMPLIANCE IS REQUIRED FOR THIS PROJECT.

7.2 PLASTIC END CAPS EACH END OF EACH PIECE FOR SHIPPING PROTECTION.

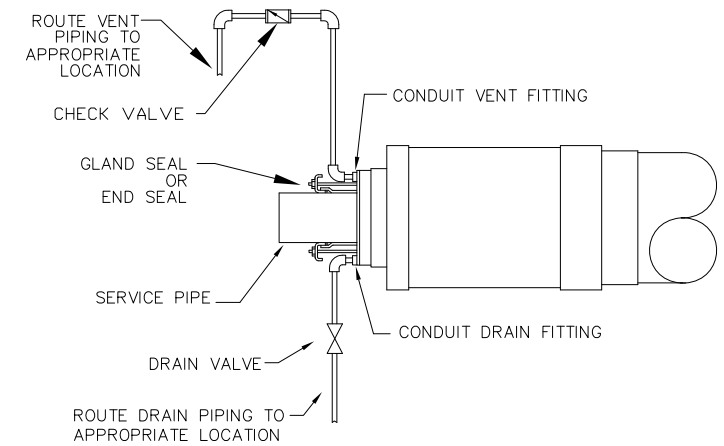
7.3 EXPANSION JOINTS AND ANCHORS WITHIN MANHOLES BY OTHERS.



NOTES:
1. FOR 2" AND SMALLER STEEL PIPE: SQUARE ENDS
   FOR 2 1/2" AND LARGER STEEL PIPE: BEVELED ENDS
2.

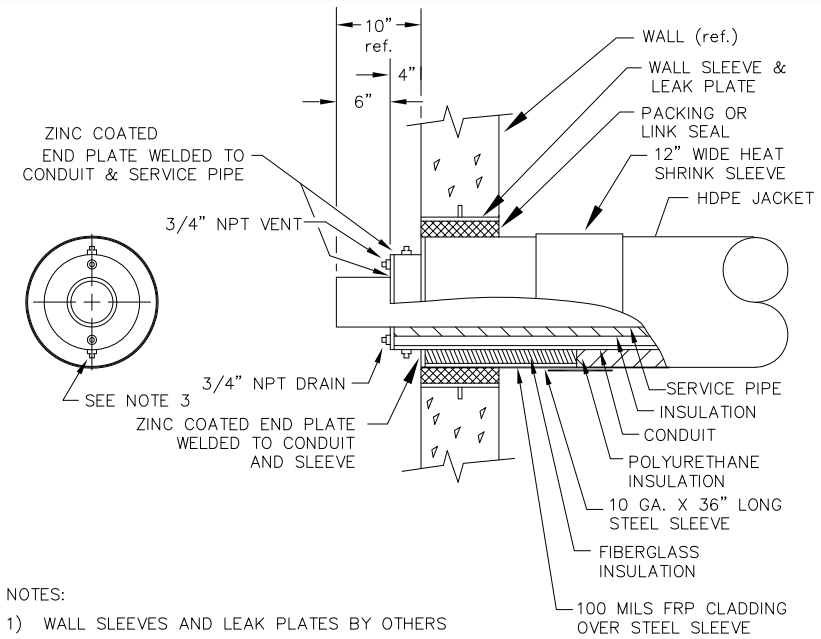
PIPE SIZE & MATERIALS	MAX. SUPPORT SPACING
≥ 4" SCH. 40 STEEL	14'
≤ 3" SCH. 40 STEEL	10'

DETAIL 3
MULTI–THERM 500 PE
STRAIGHT



NOTES:
1. VENT AND DRAIN PIPING, FITTINGS AND VALVES SUPPLIED AND INSTALLED BY OTHERS
2. KEEP DRAIN VALVE IN THE CLOSED POSITION TO PREVENT WATER AND MOISTURE FROM ENTERING THE CONDUIT. ONLY OPEN DRAIN VALVE TO DRAIN LIQUID FROM THE CONDUIT

DETAIL 1
MULTI–THERM 500 PE
RECOMMENDED CONDUIT
VENT & DRAIN PIPING



NOTES:
1) WALL SLEEVES AND LEAK PLATES BY OTHERS
2) PACKING OR LINK SEALS BY OTHERS
3) ALTERNATE VENT AND DRAIN LOCATIONS ON CONDUIT OD WHEN THERE IS INSUFFICIENT ROOM ON THE END PLATE.

DETAIL 2
MULTI–THERM 500 PE
STEEL REINFORCED END SEAL
THROUGH WALL

REV	DATE	REVISION	BY	APPR.
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1310 QUARLES DR. LEBANON, TN 37087

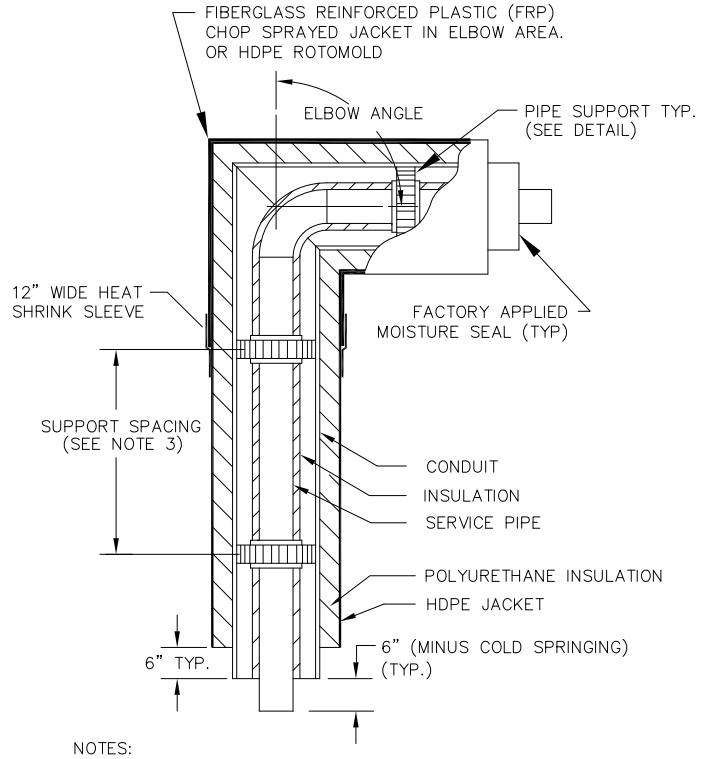
ENERGY DISTRIBUTION SYSTEM

FOR

FORT WAINWRIGHT
FTW 336A AIRCRAFT PARTS STORAGE
FTW 336B AVIATION BARRACKS

JOB NUMBER	DRAWING NO.
D0878	10–217–BO
SCALE: NONE	SHEET 1 OF 6

CUSTOMER: DOYON UTILITIES

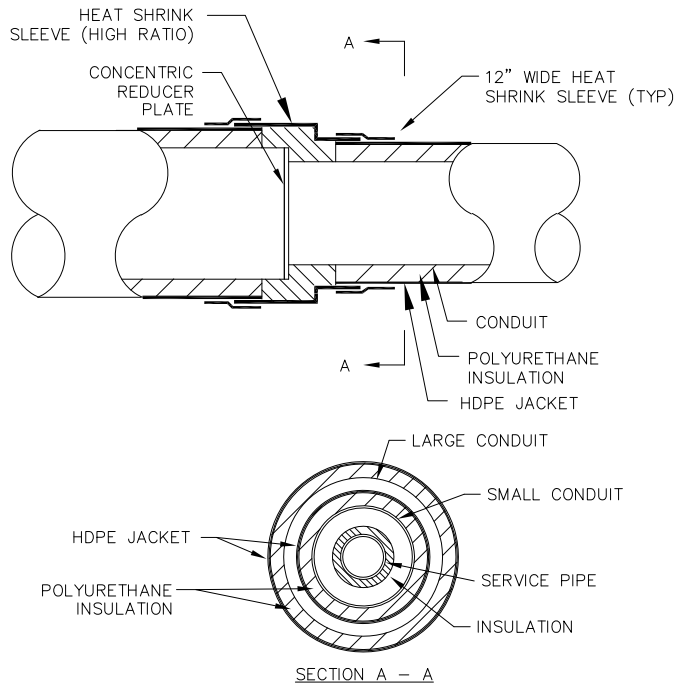


NOTES:

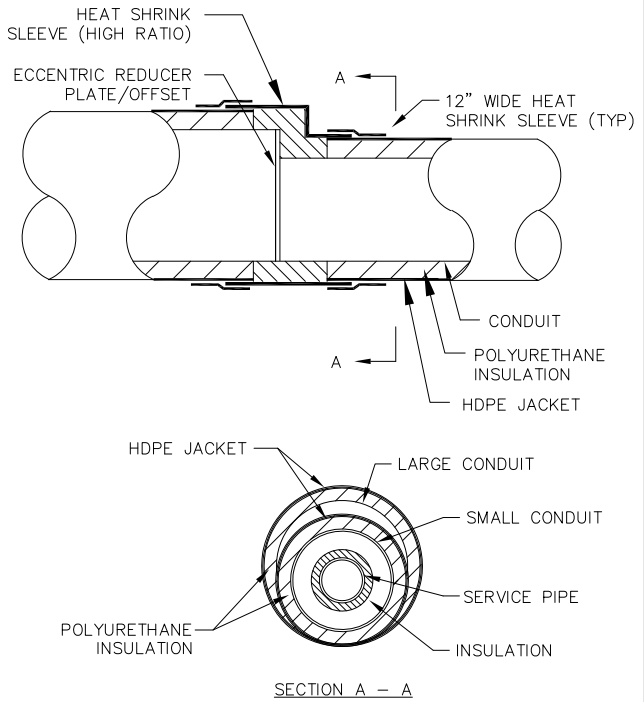
1) FOR 2" AND SMALLER STEEL PIPE: SQUARE ENDS
3000 LB SOCKET WELD FITTINGS
FOR 2 1/2" AND LARGER STEEL PIPE: BEVELED ENDS
BUTTWELD FITTINGS
2) PIPE BENDING IN PLACE OF WELDED ELBOWS MAY BE USED
3)

PIPE SIZE & MATERIALS	MAX. SUPPORT SPACING
≥ 4" SCH. 40 STEEL	14'
≤ 3" SCH. 40 STEEL	10'

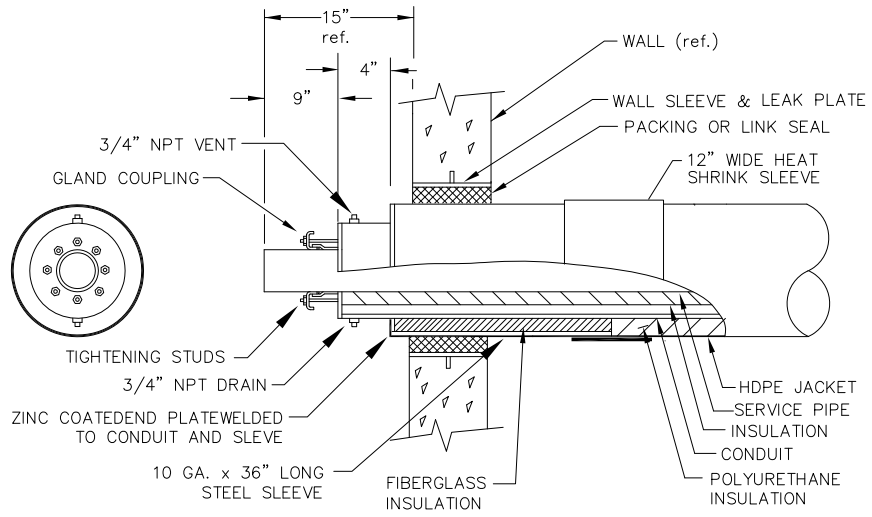
DETAIL 4
MULTI–THERM 500 PE
ELBOW
PE & FRP JACKET



DETAIL 5
MULTI–THERM 500 PE
CONCENTRIC CONDUIT REDUCER



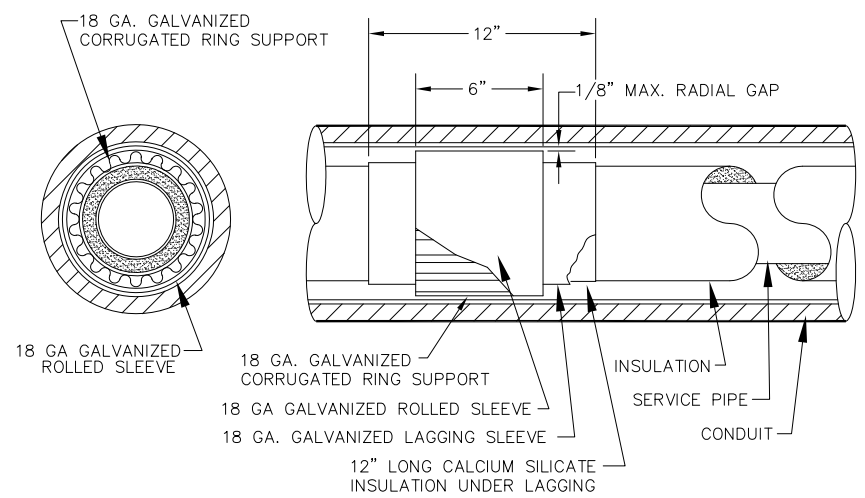
DETAIL 6
MULTI–THERM 500 PE
ECCENTRIC CONDUIT REDUCER



NOTES:

1) WALL SLEEVES AND LEAK PLATES BY OTHERS
2) PACKING OR LINK SEALS BY OTHERS
3) FOR DESIGN TEMPERATURES ABOVE 366° F

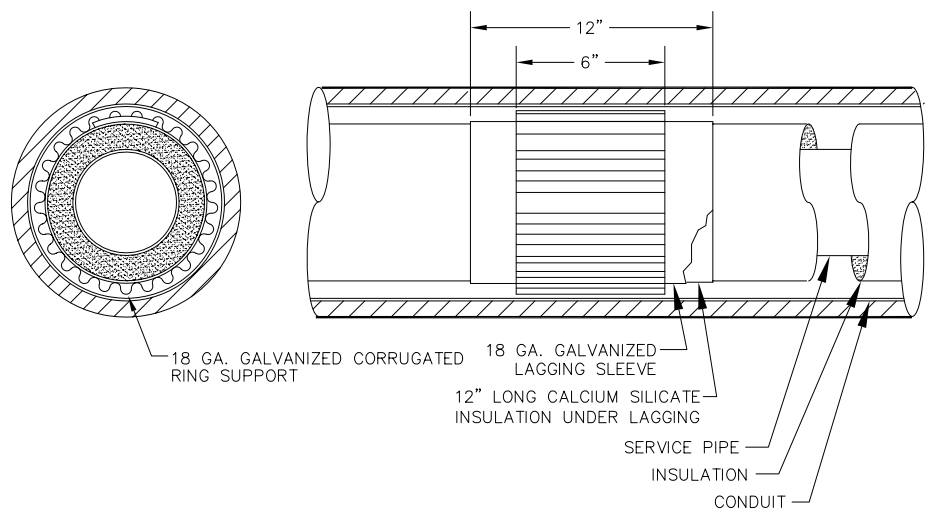
DETAIL 7
MULTI–THERM 500 PE
STEEL REINFORCED GLAND SEAL
THROUGH WALL



NOTES:

1. CORRUGATED RING, LAGGING SLEEVE AND ROLLED SLEEVE WELDED AT EACH CORRUGATION BOTH ENDS.

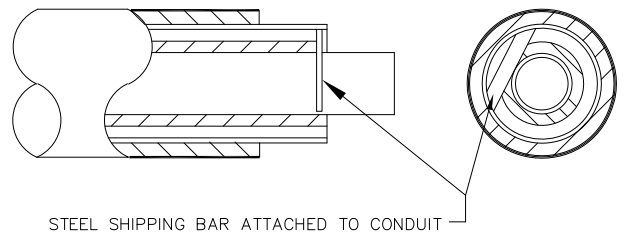
DETAIL 8
MULTI–THERM 500 PE
MOMENT GUIDE



NOTES:

1. SUPPORT MANUFACTURED FROM GALVANIZED STEEL AND TACK WELDED CONSTRUCTION

DETAIL 9
MULTI–THERM 500 PE
STRAIGHT SUPPORT



STEEL SHIPPING BAR ATTACHED TO CONDUIT AND SERVICE PIPE. REMOVE ALL SHIPPING BARS PRIOR TO ASSEMBLY

DETAIL 10
MULTI–THERM 500 PE
SHIPPING BAR

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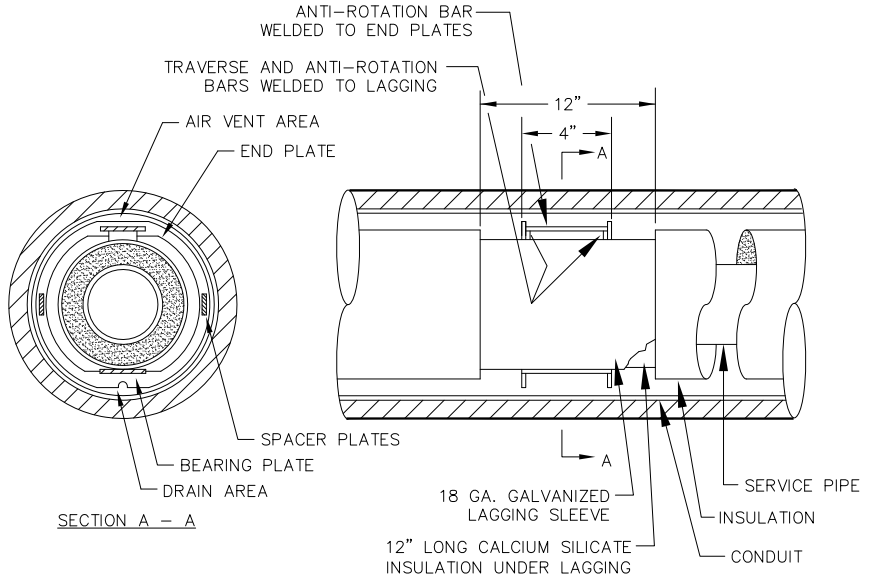
ENERGY DISTRIBUTION SYSTEM

FOR

FORT WAINWRIGHT
FTW 336A AIRCRAFT PARTS STORAGE
FTW 336B AVIATION BARRACKS

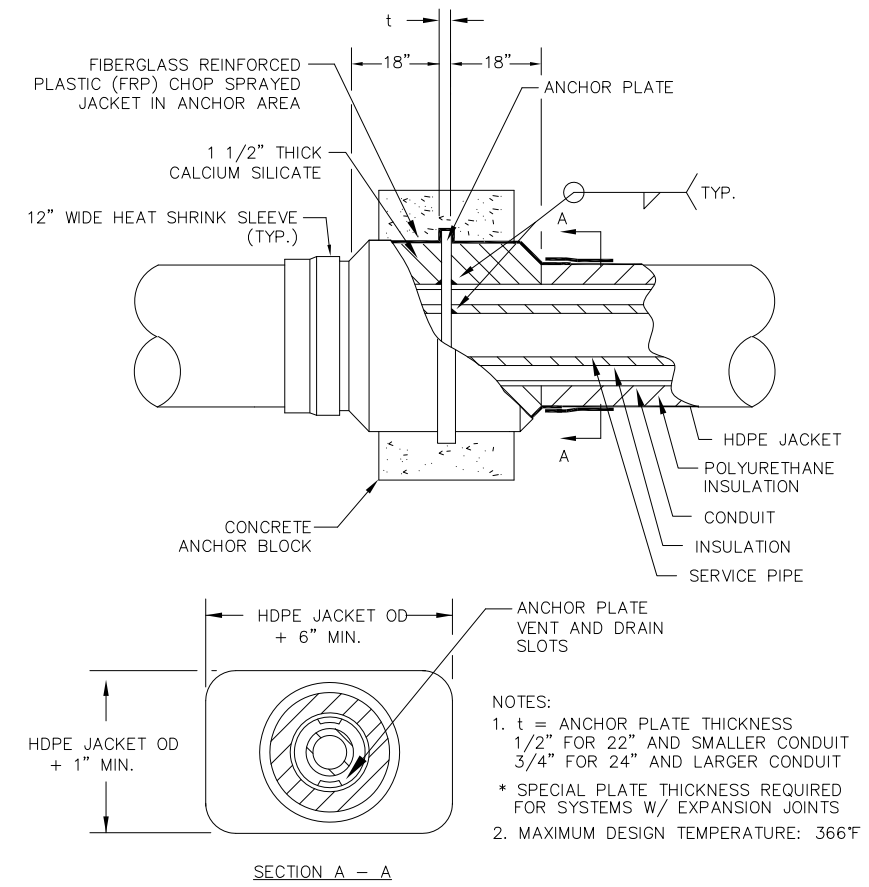
JOB NUMBER D0878
DRAWING NO. 10–217–BO
SCALE NONE
SHEET 2 OF 6
CUSTOMER DOYON UTILITIES



NOTES:

1. SUPPORT MANUFACTURED FROM 10 GA. GALVANIZED STEEL AND WELDED CONSTRUCTION

DETAIL 11
MULTI-THERM 500 PE
OVAL SUPPORT

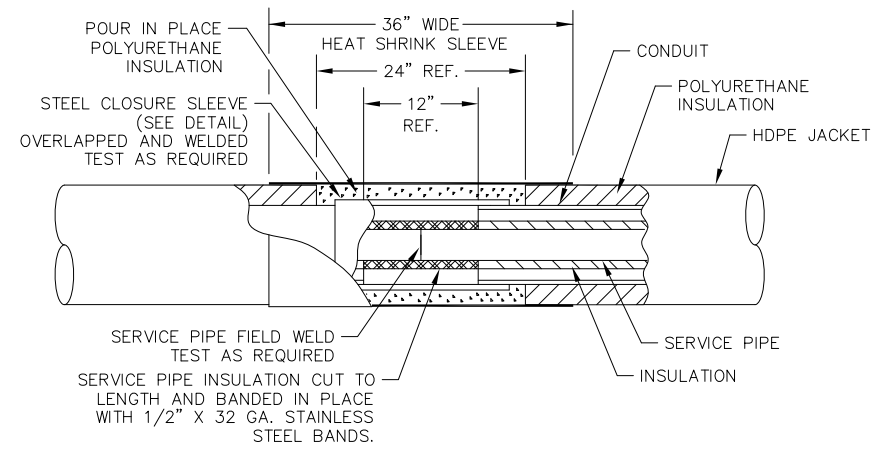


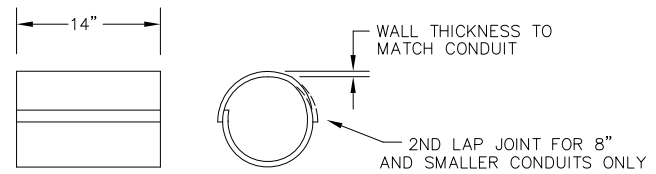
NOTES:

1. t = ANCHOR PLATE THICKNESS
   1/2" FOR 22" AND SMALLER CONDUIT
   3/4" FOR 24" AND LARGER CONDUIT
   * SPECIAL PLATE THICKNESS REQUIRED FOR SYSTEMS W/ EXPANSION JOINTS
2. MAXIMUM DESIGN TEMPERATURE: 366°F

SECTION A - A

DETAIL 12
MULTI-THERM 500 PE
ANCHOR, HI-TEMP
FOR 3" STM AND 1 1/2" PCR



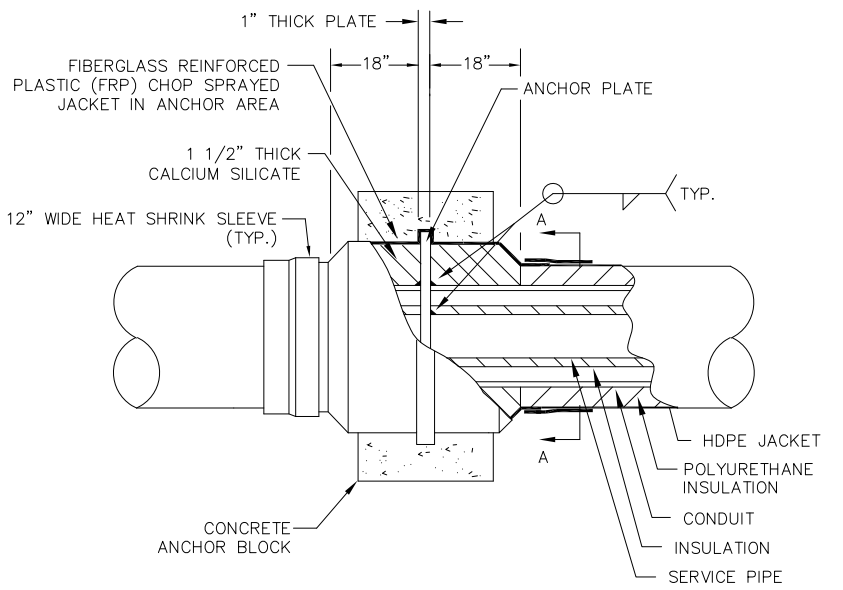


STEEL CLOSURE SLEEVE

NOTES:

1. SOCKETWELD COUPLINGS, IF REQUIRED, SUPPLIED BY INSTALLER
2. ROLLED SLEEVES NOT AVAILABLE FOR CONDUIT SMALLER THAN 6"
3. MAXIMUM ROLLED SLEEVE THICKNESS: 1/4"
4. STORE ALL CHEMICALS AT 60°F TO 85°F

DETAIL 13
MULTI-THERM 500 PE
FIELD JOINT, HEAT SHRINK SLEEVE
ROLLED CONDUIT SLEEVE

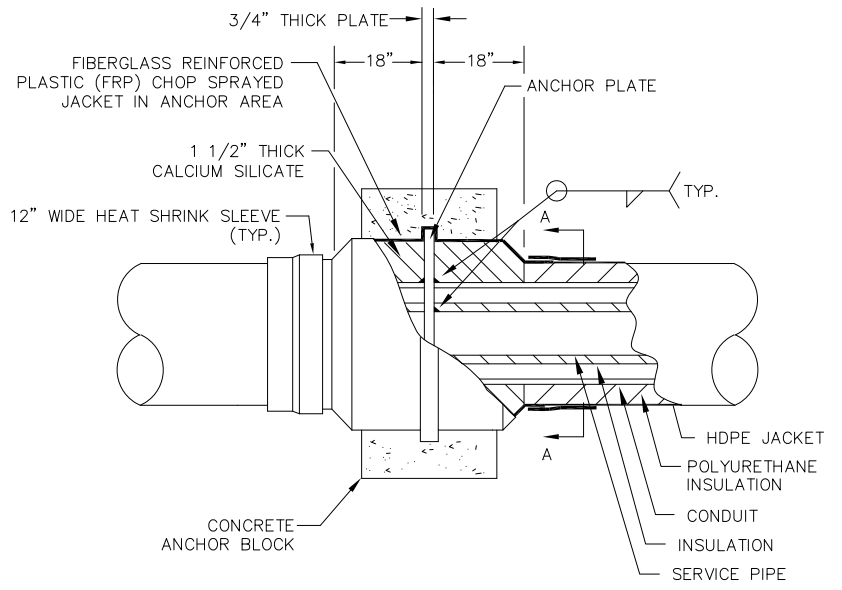


NOTES:

1. MAXIMUM DESIGN TEMPERATURE: 366°F

SECTION A - A

DETAIL 14
MULTI-THERM 500
XTRA HEAVY ANCHOR DETAIL
FOR 10" AND 16" STEAM



NOTES:

1. MAXIMUM DESIGN TEMPERATURE: 366°F

SECTION A - A

DETAIL 15
MULTI-THERM 500
XTRA HEAVY ANCHOR DETAIL
FOR 4" AND 8" CONDENSATE

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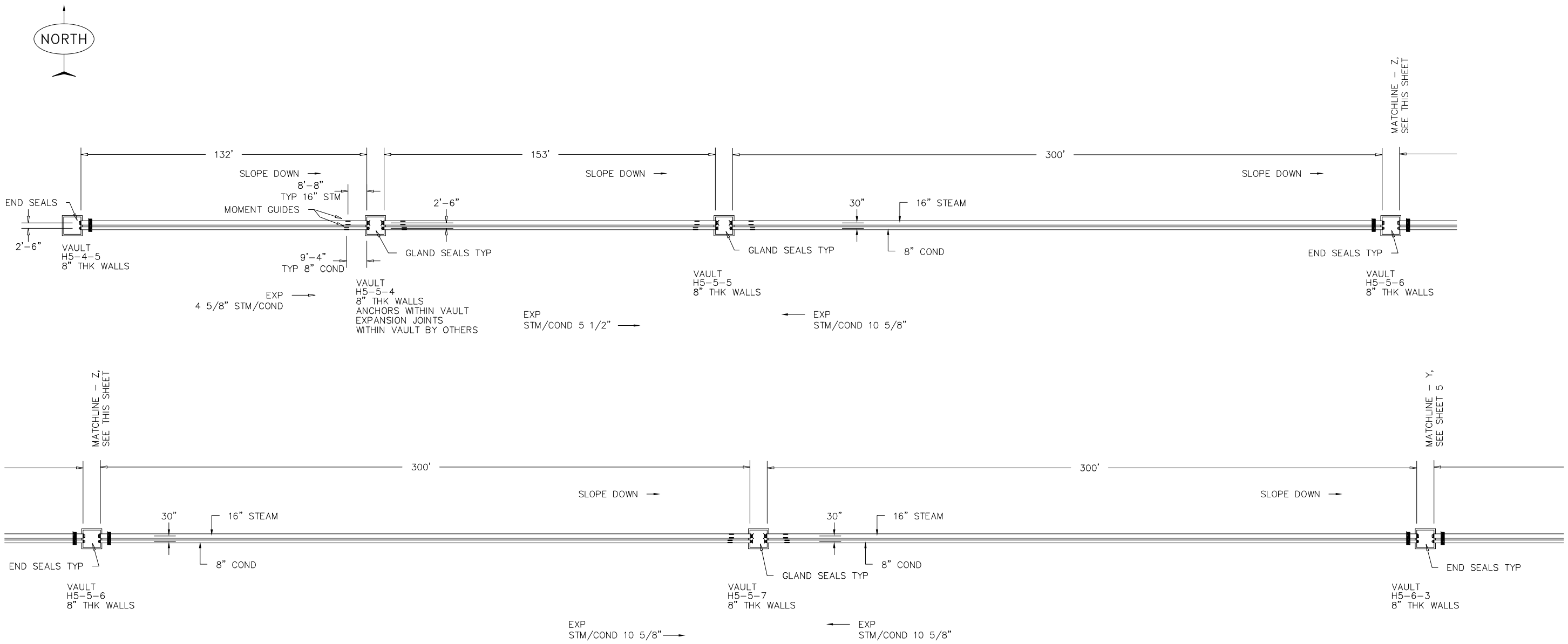
ENERGY DISTRIBUTION SYSTEM

FOR

FORT WAINWRIGHT
FTW 336A AIRCRAFT PARTS STORAGE
FTW 336B AVIATION BARRACKS

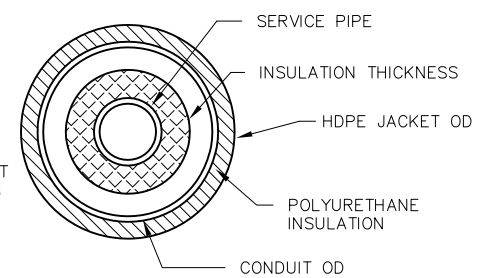
JOB NUMBER	DRAWING NO.
D0878	10-217-BO
SCALE: NONE	SHEET 3 OF 6

CUSTOMER: DOYON UTILITIES



MULTI-THERM 500 PE PIPING SYMBOL LEGEND	
SYMBOL	DESCRIPTION
	OVAL SUPPORTS
	MOMENT GUIDE
	END SEAL
	GLAND SEAL
	ANCHOR W/ ANCHOR BLOCK
	ANCHOR ELBOW W/ ANCHOR BLOCK
	INTERNAL ANCHOR
	FIELD JOINT
OS	OVERSIZE CONDUIT
CS	COLD SPRING
E	ECCENTRIC CONDUIT REDUCER
C	CONCENTRIC CONDUIT REDUCER

NOTES:
1. HDPE JACKET OD MAY BE DIFFERENT AT MULTITHERM 500 PE TERMINATION ENDS (END SEALS AND GLAND SEALS) WHERE PIPING PENETRATES WALLS OR FLOORS. SEE WALL ENTRY DETAILS FOR THE CORRECT OD AT THESE LOCATIONS.



MULTI-THERM 500 PE CROSS SECTION				
SERVICE	SERVICE PIPE	INSULATION THICKNESS	CONDUIT OD	HDPE JACKET OD (SEE NOTE)
16" STEAM	16" STD WT A106 GR B, SMLS C.S.	2"	22"	24.4"
10" STEAM	10" STD WT A106 GR B, SMLS C.S.	1 1/2"	16"	18.30"
3" STEAM	3" STD WT A106 GR B, SMLS C.S.	1"	8 5/8"	8.9"
8" CONDENSATE	8" SCH 10S A312 TYPE 316L SMLS	1 1/2"	14"	16.3"
4" CONDENSATE	4" SCH 10S A312 TYPE 316L SMLS	1 1/2"	10 3/4"	13.1"
1.5" CONDENSATE	1.5" SCH 10S A312 TYPE 316L SMLS	1"	6 5/8"	8.9"

AVIATION BARRACKS SITE
FTW 336B

REV	DATE	REVISION	BY	APPR.
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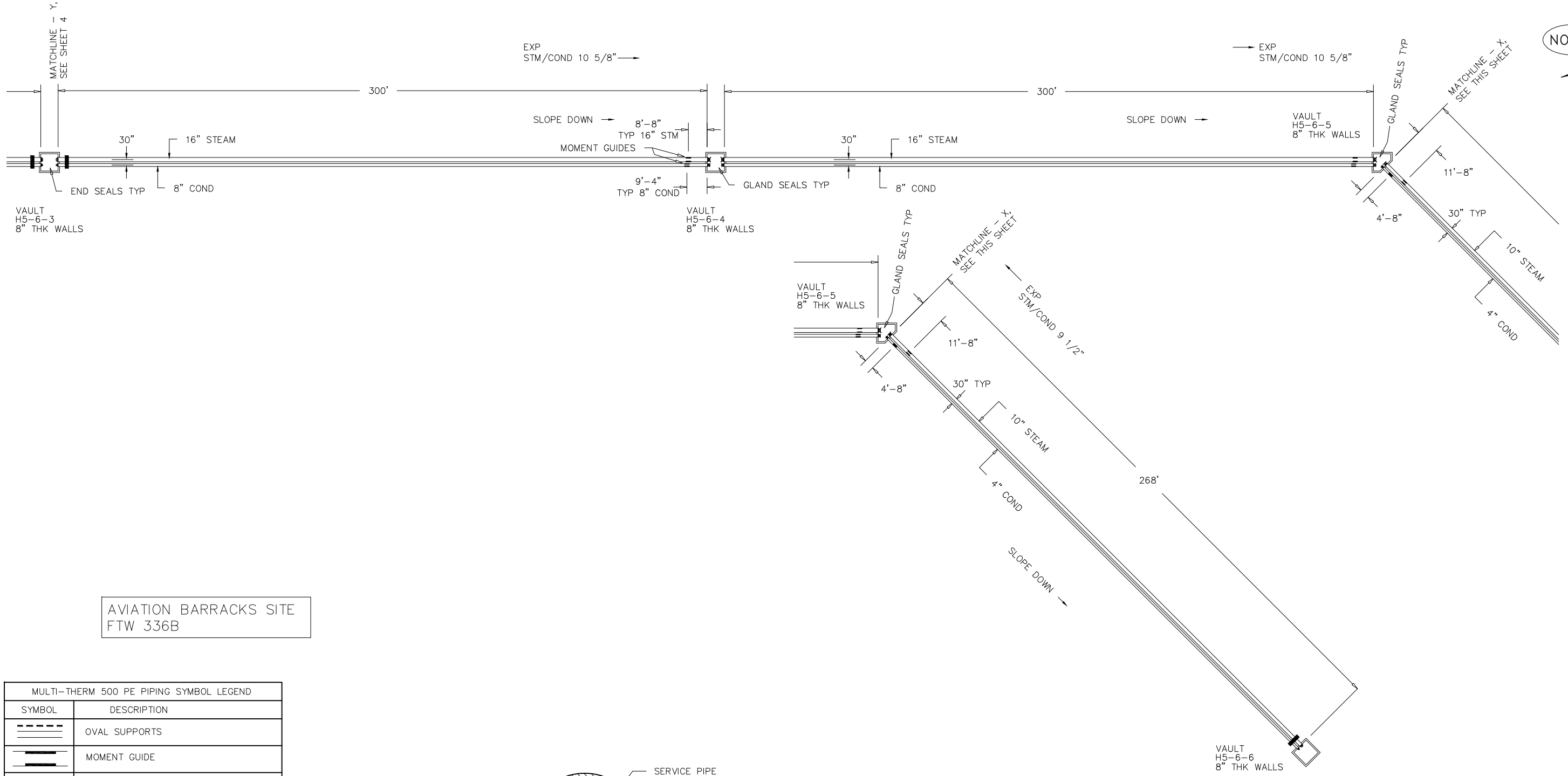
FOR

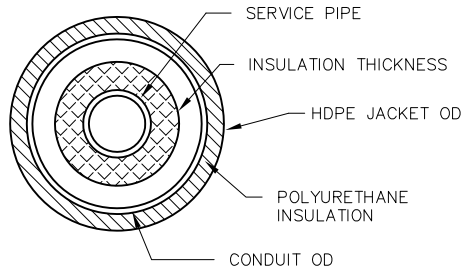
FORT WAINWRIGHT
FTW 336A AIRCRAFT PARTS STORAGE
FTW 336B AVIATION BARRACKS

JOB NUMBER D0878
DRAWING NO. 10-217-BO
SCALE NONE
SHEET 4 OF 6
CUSTOMER DOYON UTILITIES



AVIATION BARRACKS SITE
FTW 336B

MULTI–THERM 500 PE PIPING SYMBOL LEGEND	
SYMBOL	DESCRIPTION
	OVAL SUPPORTS
	MOMENT GUIDE
	END SEAL
	GLAND SEAL
	ANCHOR W/ ANCHOR BLOCK
	ANCHOR ELBOW W/ ANCHOR BLOCK
	INTERNAL ANCHOR
	FIELD JOINT
OS	OVERSIZE CONDUIT
CS	COLD SPRING
E	ECCENTRIC CONDUIT REDUCER
C	CONCENTRIC CONDUIT REDUCER



NOTES:
1. HDPE JACKET OD MAY BE DIFFERENT AT MULTITHERM 500 PE TERMINATION ENDS (END SEALS AND GLAND SEALS) WHERE PIPING PENETRATES WALLS OR FLOORS. SEE WALL ENTRY DETAILS FOR THE CORRECT OD AT THESE LOCATIONS.

MULTI–THERM 500 PE CROSS SECTION				
SERVICE	SERVICE PIPE	INSULATION THICKNESS	CONDUIT OD	HDPE JACKET OD (SEE NOTE)
16" STEAM	16" STD WT A106 GR B, SMLS C.S.	2"	22"	24.4"
10" STEAM	10" STD WT A106 GR B, SMLS C.S.	1 1/2"	16"	18.30"
3" STEAM	3" STD WT A106 GR B, SMLS C.S.	1"	8 5/8"	8.9"
8" CONDENSATE	8" SCH 10S A312 TYPE 316L SMLS	1 1/2"	14"	16.3"
4" CONDENSATE	4" SCH 10S A312 TYPE 316L SMLS	1 1/2"	10 3/4"	13.1"
1.5" CONDENSATE	1.5" SCH 10S A312 TYPE 316L SMLS	1"	6 5/8"	8.9"

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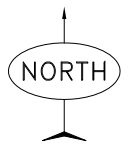
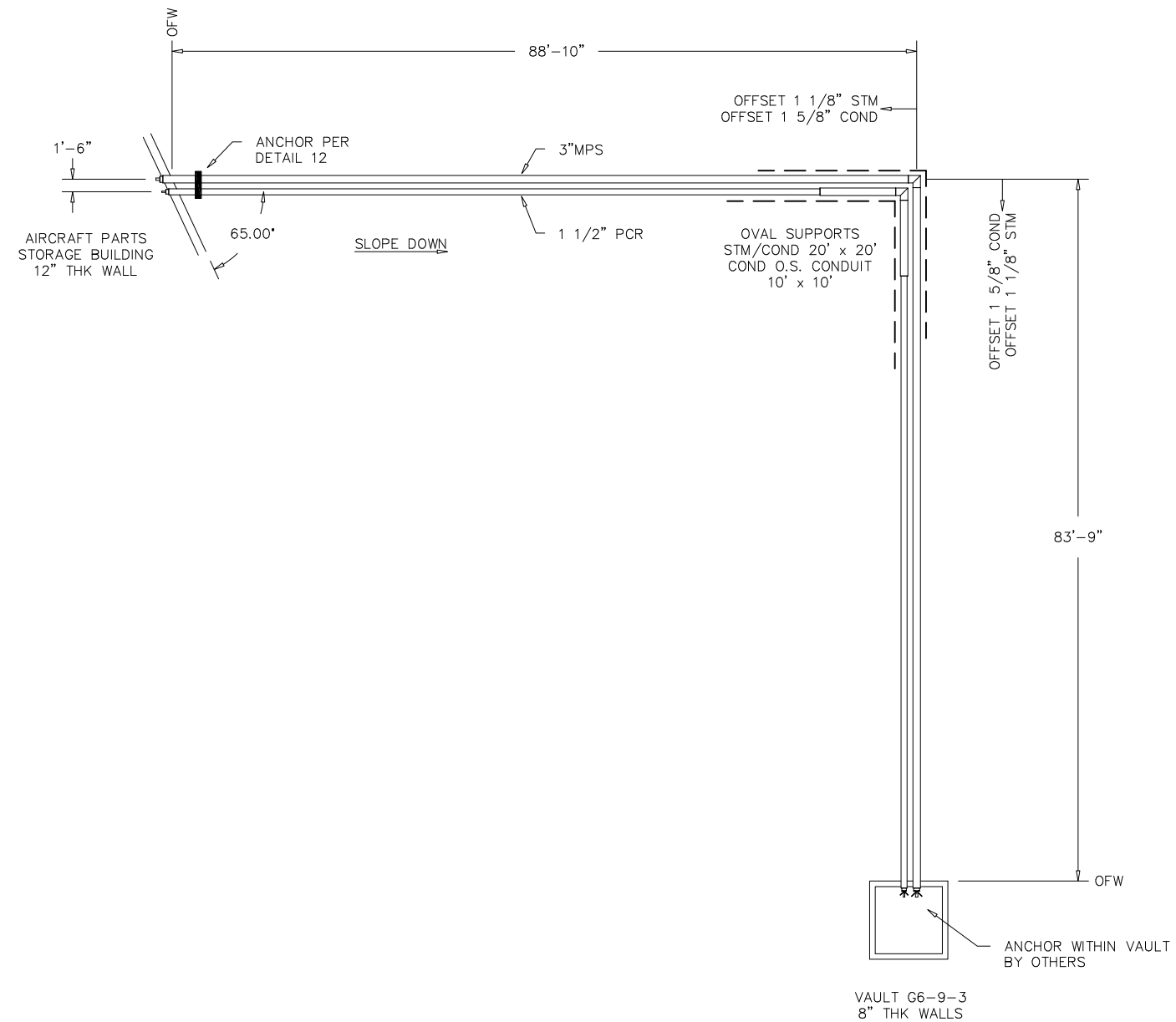
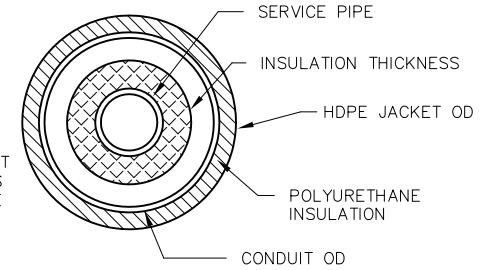
ENERGY DISTRIBUTION SYSTEM

FOR
FORT WAINWRIGHT
FTW 336A AIRCRAFT PARTS STORAGE
FTW 336B AVIATION BARRACKS

JOB NUMBER D0878
DRAWING NO. 10–217–BO
SCALE NONE
SHEET 5 OF 6
CUSTOMER DOYON UTILITIES







NOTES:
1. HDPE JACKET OD MAY BE DIFFERENT AT MULTITHERM 500 PE TERMINATION ENDS (END SEALS AND GLAND SEALS) WHERE PIPING PENETRATES WALLS OR FLOORS. SEE WALL ENTRY DETAILS FOR THE CORRECT OD AT THESE LOCATIONS.

MULTI-THERM 500 PE CROSS SECTION				
SERVICE	SERVICE PIPE	INSULATION THICKNESS	CONDUIT OD	HDPE JACKET OD (SEE NOTE)
16" STEAM	16" STD WT A106 GR B, SMLS C.S.	2"	22"	24.4"
10" STEAM	10" STD WT A106 GR B, SMLS C.S.	1 1/2"	16"	18.30"
3" STEAM	3" STD WT A106 GR B, SMLS C.S.	1"	8 5/8"	8.9"
8" CONDENSATE	8" SCH 10S A312 TYPE 316L SMLS	1 1/2"	14"	16.3"
4" CONDENSATE	4" SCH 10S A312 TYPE 316L SMLS	1 1/2"	10 3/4"	13.1"
1.5" CONDENSATE	1.5" SCH 10S A312 TYPE 316L SMLS	1"	6 5/8"	8.9"

MULTI-THERM 500 PE PIPING SYMBOL LEGEND	
SYMBOL	DESCRIPTION
	OVAL SUPPORTS
	MOMENT GUIDE
	END SEAL
	GLAND SEAL
	ANCHOR W/ ANCHOR BLOCK
	ANCHOR ELBOW W/ ANCHOR BLOCK
	INTERNAL ANCHOR
	FIELD JOINT
OS	OVERSIZE CONDUIT
CS	COLD SPRING
E	ECCENTRIC CONDUIT REDUCER
C	CONCENTRIC CONDUIT REDUCER

AIRCRAFT PARTS STORAGE
SITE FTW 336A

REV	DATE	REVISION	BY	APPR.
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ENERGY DISTRIBUTION SYSTEM

FOR

FORT WAINWRIGHT
FTW 336A AIRCRAFT PARTS STORAGE
FTW 336B AVIATION BARRACKS

JOB NUMBER	DRAWING NO.
D0878	10-217-BO
SCALE: NONE	SHEET 6 OF 6

CUSTOMER: DOYON UTILITIES

PERMA-PIPE Material Data Sheet

A106, Gr. B Carbon Steel Pipe

Material Description: Seamless Carbon steel pipe in accordance with ASTM A106, Grade B.

Typical Uses: General purpose pressure piping or conduit / containment for -20^{O}F to 800^{O}F service.

Chemical Properties

Element	%
Carbon[1]	0.30 % max.
Manganese[1]	0.29 % - 1.06%
Phosphorus	0.035 % max.
Sulfur	0.035 % max.
Silicon	0.10 % max.
Crome[2]	0.40 % max
Copper[2]	0.40 % max.
Nickel[2]	0.40 % max.
Molybdenum[2]	0.15 % max.
Vanadium[2]	0.08 % max.

Mechanical Properties

Property	Minimum
Tensile Strength	60,000 psi
Yield Strength	35,000 psi

(1) For each reduction of 0.01% below the specified carbon maximum, an increase of 0.06% manganese above the specified maximum is allowed up to a maximum of 1.35%.

(2) The combination of these elements shall not exceed 1.00 %

Material P-No.: P-1

Pipe Dimensions: Pipe OD and wall thickness dimensions and tolerances shall be in accordance with ASTM A106.

Inspection & Testing: All pipe inspection and testing shall be in accordance with the applicable requirements of ASTM A106.

Basic Allowable Stresses (psi)

ASME Code	Material Type	Design Temperature (^{O}F)						
		-20 to 400	500	600	650	700	750	800
ASME B31.1	S (seamless)	15,000				14,400	13,000	10,800
ASME B31.3[1]	S (seamless)	20,000	18,900	17,300	17,000	16,500	13,000	10,800

Supplementary Requirements (refer to ASTM A106 for complete details)

- S1 Product Analysis
- S2 Transverse Tension Test
- S3 Flattening Test
- S4 Metal Structure & Etching Test
- S5 Carbon Equivalent
- S6 Heat Treated Test Specimen
- S7 Internal Cleanliness

A139, Gr. B Spiral Welded Carbon Steel Pipe

Material Description: Carbon steel pipe in accordance with ASTM A139, Grade B spiral seam welded (electric fusion welded).

Typical Uses: General purpose conduit / containment piping.

Chemical Properties

Element	Maximum %
Carbon	0.30 %
Manganese	1.20%
Phosphorus	0.035%
Sulfur	0.035%

Mechanical Properties

Property	Minimum
Tensile Strength	60,000 psi
Yield Strength	35,000 psi

Material P-No.: P-1

Pipe Dimensions: Pipe OD and wall thickness dimensions and tolerances shall be in accordance with ASTM A139.

Inspection & Testing: All pipe inspection and testing shall be in accordance with the applicable requirements of ASTM A139.

Basic Allowable Stresses (psi)

ASME Code	Design Temperature (^{O}F)				
	-20 to 366	367 to 650	700	750	800
ASME B31.1	12,800	12,800	11,500	10,400	8,600
ASME B31.3[1]	20,000	-----	----	----	----

(1) Apply basic quality factor as required, Ej = 0.80

A312 Stainless Steel Pipe

Material Description: Austenitic stainless steel pipe in accordance with ASTM A312, seamless and welded.

Typical Uses: High temperature, low temperature, and general corrosive service pressure piping and conduit / containment.

Chemical Requirements

Element	TP304	TP304L	TP304H	TP316	TP316L	TP316H
Carbon	0.08% max.	0.035%[1] max.	0.04 – 0.10%	0.08% max.	0.035%[1] max.	0.04 – 0.10%
Manganese	2.00% max.	2.00% max.	2.00% max.	2.00% max.	2.00% max.	2.00% max.
Phosphorus	0.04% max.	0.04% max.	0.04% max.	0.04% max.	0.04% max.	0.04% max.
Sulfur	0.03% max.	0.03% max.	0.03% max.	0.03% max.	0.03% max.	0.03% max.
Silicon	0.75% max.	0.75% max.	0.75% max.	0.75% max.	0.75% max.	0.75% max.
Nickel	8.00 - 11.0%	8.00 - 13.0%	8.00 - 11.0%	11.0 - 14.0%[2]	10.0 - 15.0%	11.0 - 14.0%[2]
Chromium	18.0 - 20.0%	18.0 - 20.0%	18.0 - 20.0%	16.0 - 18.0%	16.0 - 18.0%	16.0 - 18.0%
Molybdenum	-----	-----	-----	2.0 - 3.0%	2.0 - 3.0%	2.0 - 3.0%

(1) 0.040% carbon allowable for diameters less than 0.500 in. and wall thickness less than 0.049 in. average / 0.044 in. minimum.

(2) For welded TP316, TP316H , the Nickel range shall be 10.0 – 14.0%.

Mechanical Properties

Property	TP304, TP304H TP316, TP316H	TP304L TP316L
Tensile Strength (Min.)	75,000 psi	70,000 psi
Yield Strength (Min.)	30,000 psi	25,000 psi

Material P-No.: P-8

Pipe Dimensions: Pipe OD and wall thickness dimensions and tolerances shall be in accordance with ASTM A312.

Inspection & Testing: All pipe inspection and testing shall be in accordance with the applicable requirements of ASTM A312.

Supplementary Requirements: (refer to ASTM A312 for complete details)

- S1 Product Analysis
- S2 Transverse Tension Tests
- S3 Flattening Test
- S4 Etching Tests
- S5 Radiographic Examination
- S6 Stabilizing Heat Treatment
- S7 Intergranular Corrosion Test
- S8 Minimum Wall Pipe

A312 Stainless Steel Pipe

Basic Allowable Stresses (ksi)

ASME Code	Grade	Design Temperature (^{O}F)																		
		Min. Temp.	Min. Temp. to 100	200	300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
B31.1	TP304 smls TP304H smls	-20	18.8	17.8	16.6	16.2	15.9				15.6	15.2	14.9	14.7	14.4	13.8[1]	12.2[1]	9.8[1]	7.7[1]	6.1[1]
	TP304L[2] smls	-20	15.7		15.3	14.7	14.4	14.0	13.7	13.5	13.3	13.0	---	---	---	---	---	---	---	---
	TP316 smls TP316H smls	-20	18.8		18.4	18.1	18.0	17.0	16.7	16.3	16.1	15.9	15.7	15.6	15.4	15.3[1]	14.5[1]	12.4[1]	9.8[1]	7.4[1]
	TP316L[2] smls	-20	15.7			15.5	14.4	13.5	13.2	12.9	12.6	12.4	12.1	---	---	---	---	---	---	---
	TP304 wld TP304H wld	-20	16.0	15.1	14.1	13.8	13.5				13.2	12.9	12.7	12.5	12.2	11.7	10.4	8.3	6.5	5.2
	TP304L[2] wld	-20	13.3		13.0	12.5	12.3	11.9	11.7	11.5	11.3	11.1	---	---	---	---	---	---	---	---
	TP316 wld TP316H wld	-20	16.0		15.6	15.4	15.3	14.5	14.2	13.9	13.7	13.5	13.4	13.2	13.1	13.0	12.3	10.6	8.4	6.3
	TP316L[2] wld	-20	13.2			13.2	12.3	11.5	11.2	10.9	10.7	10.5	10.3	---	---	---	---	---	---	---
B31.3[3]	TP304[4] TP304H[4]	-425 -325	20.0			18.7	17.5	16.4	16.2	16.0	15.6	15.2	14.9	14.6	14.4	13.8[1]	12.2[1]	9.7[1]	7.7[1]	6.0[1]
	TP304L[4]	-425	16.7			15.8	14.8	14.0	13.7	13.5	13.3	13.0	12.8	11.9	9.9	7.8	6.3	5.1	4.0	3.2
	TP316[4] TP316H[4]	-425 -325	20.0			19.3	17.9	17.0	16.7	16.3	16.1	15.9	15.7	15.5	15.4	15.3	14.5	12.4	9.8	7.4
	TP316L[4]	-325	16.7			15.5	14.4	13.5	13.2	12.9	12.6	12.4	12.1	11.8	11.5	11.2	10.8	10.2	8.8	6.4

(1) For temperatures above 1000^{O}F, the carbon content must be 0.04% or higher.

(2) This material is not acceptable for use on ASME B31.1 boiler external piping.

(3) Apply basic quality factor as required; Ej = 1.0 for smls
Ej = 0.85 for wld, double butt seam
Ej = 0.80 for wld, single butt seam

(4) See ASME B31.3, Table A-1 for temperatures above 1200^{O}F upto 1500^{O}F.

PERMA-PIPE Material Data Sheet

Mineral Wool Pipe Insulation

Material Description: Felted mineral fiber bonded together with a high temperature binder.

Typical Uses: Pipe and tube insulation for commercial and industrial applications for temperatures from -20°F to 1200°F, (-85°C to 650°C)

Specifications:
ASTM C547-(Type II & III)
ASTM C585
UFGS-0255A for Class-A Systems
Federal Agency 96-Hour Conduit Boiling Test
U.S. Federal Specification HH-I558B

Typical Properties:

Property	Value	Test Method
Density	7.0-8.0 lbs./ ft.^{3} (112-128 kg./ m^3)	
Temperature Range	1200^{O}F (659^{O}C) maximum -20^{O}F (-85^{O}C) minimum	ASTM C411-87
Thermal Conductivity, BTU in/hr ft^2 °F (W/m K)	0.23 (0.035) @ 75°F (24°C) meanTemperature 0.29 (0.042) @ 200°F (93°C) mean temperature 0.35 (0.050) @ 300°F (149°C) mean temperature 0.48 (0.069) @ 500°F (260°C) mean temperature 0.55 (0.079) @ 600°F (316°C) mean temperature	ASTM C335-89
Corrosion (Steel, Copper)	None	ASTM C795
Moisture Adsorption (Vapor)	Less than 1% Water wicking resistance Non-Hygroscopic	
Surface Burning Charactaristics	Incombustible Flame Spread Index ≤ 25 Smoke Developed Index ≤ 50	ASTM E 136 ASTM E 84 ASTM E 84

Approved Suppliers:
Rock Wool Manufacturing (Delta PC& PF)
Mineral Product of Texas Inc. (MPT-PC & PF)
IIG (Industrial Insulation Group) (MinWool-1200-MPT)

Polyurethane Foam Insulation - 2.0 lbs./ft.^{3} Nominal Density

Material Description: Two component, HFC (Hydro-Fluoro-Carbon) blown, rigid polyurethane foam insulation.

Typical Uses: Low thermal conductivity insulation for medium to cryogenic service temperatures. Spray applied directly onto a service pipe or injection applied into the annulus between a service pipe and insulation jacket.

Typical Properties:

Property	Value	Test Method
Density (lbs. / ft.^{3})	> 2.0 lbs./ ft.^{3}	ASTM D1622
Temperature Limits (^{O}F)	250 maximum -320 minimum	
Thermal Conductivity, initial @ 73^{O}F (Btu in. / Hr. Ft.^{2} ^{O}F)	0.18	ASTM C177
Closed Cell Content (%)	90	ASTM D2856
Compressive Strength (psi)	40	ASTM D1621
Water Absorption (lbs./ft.^{3})	0.1	ASTM D2842
Dimensional Stability (%) 24hrs, 158^{O}F, 100% RH	2.0	ASTM D2126

HDPE Jacket

Material Description: Extruded or molded high density polyethylene (HDPE) insulation jacket in accordance with ASTM D3350 minimum cell classification PE345444C.

Product Forms: Direct side extrusion onto spray applied polyurethane insulation.
Extruded tube for use with injection applied polyurethane insulation.

Typical Properties:

Property	Value	Test Method
Mechanical Properties		
Density (lbs. / ft.^{3})	$\geq$ 58.7	ASTM D1505
Tensile Strength (psi)	$\geq$ 3000	ASTM D638
Hydrostatic Design Basis (psi)	$\geq$ 1600	ASTM D2837
Flexural Modulus (psi)	$\geq$ 110,000	ASTM D790
Compressive Strength (psi)	$\geq$ 1600	ASTM D695
Modulus of Elasticity (psi) (approximate)	200,000 @ 32^{O}F 165,000 @ 50^{O}F 130,000 @ 75^{O}F 100,000 @ 100^{O}F 55,000 @ 140^{O}F	ASTM D638
Elongation (%)	$\geq$ 500	ASTM D638
Hardness (Shore D)	$\geq$ 62	ASTM D2240
Impact Strength (ft.-lbs./in.)	$\geq$ 8.0	ASTM D256
Thermal Properties		
Melt Index (g / 10 min.)	< 0.15	ASTM D1238
Melting Point (^{O}F)	$\geq$ 260	ASTM D3417
Vicant Softening Temperature (^{O}F)	$\geq$ 250	ASTM D1525
Heat Distortion Temperature (^{O}F)	$\geq$ 170	ASTM D648
Brittleness Temperature (^{O}F)	$\leq$ - 76	ASTM D746
Thermal Expansion (in./in.) (approximate)	1.0 x 10^{-4}	ASTM D790
Thermal Conductivity (Btu in. / Hr. Ft.^{2} ^{O}F)	2-7 – 3.0	ASTM C177
Specific Heat (Btu / Lb. ^{O}F)	0.50	----------
Environmental Properties		
Color	Black (2% carbon black for UV/weather resistance)	ASTM D1603
Environmental Stress Crack Resistance (hrs.)	$\geq$ 1000	ASTM D1693
Notch Test - PENT	$\geq$ 10	ASTM F1473

PipePak Version 22.01 Perma Pipe Inc. 04/19/2010 12:05:31PM
FORT WAINWRIGHT FTW336A
Model File: P:\Algor\D0878\336ASTM.dbs

Piping Code: ASME B31.1 - 2007

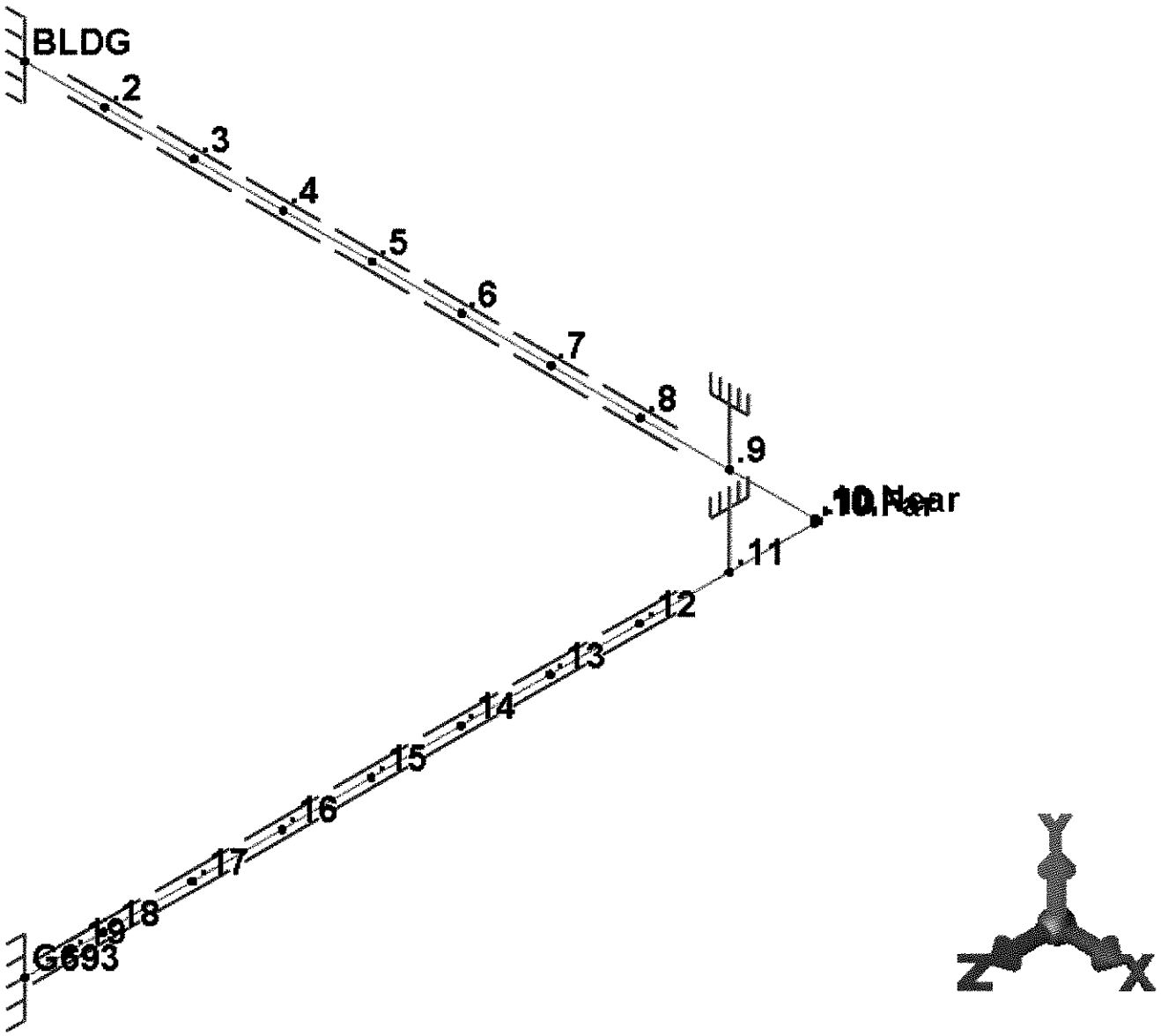
*** Input+ ***

File Name ..... P:\Algor\D0878\336ASTM
Project ..... FORT WAINWRIGHT FTW336A
Department ..... PERMA PIPE
Contract Number D0878
Description ..... 3" STM PIPING
Prepared by ..... MACHN
Checked by .....

ASME code ..... ASME B31.1
Input unit ..... English
Output unit ..... English
Output columns 80
Base temperature 40
F factor 1
E factor 1.33

Number of dynamic modes.. 8
Cut-off frequency ..... 33 Hz
Max no. of iterations ... 12
Convergence tolerance ... 3
Force tolerance ..... 5 lb

FileName: N:\DOCUME~1\nowakm\LOCALS~1\Temp\2\Wg3.dbs
Load : Dead Weight + Pressure 1 + Thermal 1
ASME B31.1 - 2004



Piping Code: ASME B31.1 - 2007

Frm /To	Point name	DX (feet)	DY (feet)	DZ (feet)	Radius (inch)	X (feet)	Y (feet)	Z (feet)
F	BLDG					0.000	0.000	0.000
	.2	9				9.000	0.000	0.000
	.3	10				19.000	0.000	0.000
	.4	10				29.000	0.000	0.000
	.5	10				39.000	0.000	0.000
	.6	10				49.000	0.000	0.000
	.7	10				59.000	0.000	0.000
	.8	10				69.000	0.000	0.000
	.9	10				79.000	0.000	0.000
	.10	10			Long	89.000	0.000	0.000
	.11		10			89.000	0.000	10.000
	.12		10			89.000	0.000	20.000
	.13		10			89.000	0.000	30.000
	.14		10			89.000	0.000	40.000
	.15		10			89.000	0.000	50.000
	.16		10			89.000	0.000	60.000
	.17		10			89.000	0.000	70.000
	.18		10			89.000	0.000	80.000
	.19		3.75			89.000	0.000	83.750
	G693		5			89.000	0.000	88.750

Piping Code: ASME B31.1 - 2007

Point	Data	Description
BLDG	Pipe	Pipe data identifier = 3
		NPS Identifier = 3"1/2
		DN Identifier = 90
		Pipe schedule = 40
		Actual pipe O. D. = 4 inch
		Wall thickness = 0.22 inch
		Corrosion allowance = 0 inch
		Insulation thickness = 1 inch
		Insulation density = 8 lb/cu.ft
		Content S. G. = 0
		Wind area O.D. = 0 inch
	Material	data identifier = LCS
		[B31.1-2004] Group 1 low carbon and low alloy steels <=0.3%
		Density = 0.284 lb/cu.inch

Tempera. (deg.F)	Modulus (psi)	Thermal Strain (inch/inch)
-100	3.02e+007	-0.00104
-50	3e+007	-0.00075
70	2.95e+007	0
200	2.88e+007	0.000833
300	2.83e+007	0.001583
400	2.77e+007	0.002333
500	2.73e+007	0.003083
600	2.67e+007	0.003916
700	2.55e+007	0.00475
800	2.42e+007	0.005666
900	2.24e+007	0.006583
1000	2.04e+007	0.0075
1100	1.8e+007	0.008416

Allowable stress code = 06B

Temperature (deg.F)	Allowable stresses (psi)
-20.00	17100.00
650.00	17100.00
700.00	15600.00
750.00	13000.00
800.00	10800.00

Load data identifier = STM

Case No.	Temperature (deg.F)	Pressure (psig)	Expansion (inch/inch)
1	350	100	0.001958

	Anchor	Rigid in all directions
.2	Guide	Spring Constant = Rigid lb/inch
.3	Guide	Spring Constant = Rigid lb/inch
.4	Guide	Spring Constant = Rigid lb/inch
.5	Guide	Spring Constant = Rigid lb/inch
.6	Guide	Spring Constant = Rigid lb/inch
.7	Guide	Spring Constant = Rigid lb/inch
.8	Guide	Spring Constant = Rigid lb/inch
.9	Vertical rod support	
		Initial displacement:
		Case 1 = 0 inch
		Case 2 = 0 inch
		Case 3 = 0 inch
.10		
.11	Vertical rod support	
		Initial displacement:
		Case 1 = 0 inch
		Case 2 = 0 inch

Piping Code: ASME B31.1 - 2007

Point	Data	Description
		Case 3 = 0 inch
.12	Guide	Spring Constant = Rigid lb/inch
.13	Guide	Spring Constant = Rigid lb/inch
.14	Guide	Spring Constant = Rigid lb/inch
.15	Guide	Spring Constant = Rigid lb/inch
.16	Guide	Spring Constant = Rigid lb/inch
.17	Guide	Spring Constant = Rigid lb/inch
.18	Guide	Spring Constant = Rigid lb/inch
.19	Guide	Spring Constant = Rigid lb/inch
G693	Anchor	Rigid in all directions

Piping Code: ASME B31.1 - 2007

Case number	Combination
1	D.W. + Pres1 + Ther1
2	D.W. + Pres1
3	Ther1

Piping Code: ASME B31.1 - 2007

*** Support Summary ***

Point Name	Global Direction	Forces(lb) or Moments(inch-lb) Sustain	Expansion Max	Expansion Min	Occasional Max	Occasional Min	Total Max	Total Min
BLDG	Fx	0	0	-172	0	0	0	-172
	Fy	-43	0	0	0	0	-43	-43
	Fz	0	0	0	0	0	0	0
	Mx	-251	0	0	0	0	-251	-251
	My	0	0	-4	0	0	0	-4
	Mz	-740	0	0	0	0	-740	-740
.2	Fy	-93	0	0	0	0	-93	-93
	Fz	0	0	-0	0	0	0	-0
.3	Fy	-99	0	0	0	0	-99	-99
	Fz	0	1	0	0	0	1	0
.4	Fy	-97	0	0	0	0	-97	-97
	Fz	0	0	-5	0	0	0	-5
.5	Fy	-99	0	0	0	0	-99	-99
	Fz	0	18	0	0	0	18	0
.6	Fy	-93	0	0	0	0	-93	-93
	Fz	0	0	-68	0	0	0	-68
.7	Fy	-114	0	0	0	0	-114	-114
	Fz	0	256	0	0	0	256	0
.8	Fy	-37	0	0	0	0	-37	-37
	Fz	0	0	-374	0	0	0	-374
.9	Fy	-193	0	0	0	0	-193	-193
.11	Fy	-193	0	0	0	0	-193	-193
.12	Fx	0	374	0	0	0	374	0
	Fy	-37	0	0	0	0	-37	-37
.13	Fx	0	0	-257	0	0	0	-257
	Fy	-114	0	0	0	0	-114	-114
.14	Fx	0	68	0	0	0	68	0
	Fy	-93	0	0	0	0	-93	-93
.15	Fx	0	0	-18	0	0	0	-18
	Fy	-99	0	0	0	0	-99	-99
.16	Fx	0	5	0	0	0	5	0
	Fy	-97	0	0	0	0	-97	-97
.17	Fx	0	0	-1	0	0	0	-1
	Fy	-101	0	0	0	0	-101	-101
.18	Fx	0	1	0	0	0	1	0
	Fy	-80	0	0	0	0	-80	-80
.19	Fx	0	0	-0	0	0	0	-0
	Fy	-23	0	0	0	0	-23	-23
G693	Fx	0	0	0	0	0	0	0
	Fy	-29	0	0	0	0	-29	-29
	Fz	0	172	0	0	0	172	0
	Mx	-340	0	0	0	0	-340	-340
	My	0	0	-1	0	0	0	-1
	Mz	-252	0	0	0	0	-252	-252

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Deflections ***

Point Name	Displacements(inch) X	Y	Z	Rotations(degree) X	Y	Z
BLDG	-0.000	-0.000	0.000	-0.000	-0.000	-0.000
.2	0.231	-0.000	-0.000	-0.015	0.000	-0.001
.3	0.489	-0.000	0.000	-0.031	-0.000	0.000
.4	0.746	-0.000	-0.000	-0.047	0.001	0.000
.5	1.003	-0.000	0.000	-0.063	-0.005	-0.000
.6	1.260	-0.000	-0.000	-0.079	0.020	0.001
.7	1.517	-0.000	0.000	-0.096	-0.073	-0.005
.8	1.775	-0.000	-0.000	-0.112	0.276	0.017
.9	2.032	-0.000	-1.219	-0.128	0.717	-0.065
.10.Near	2.278	-0.258	-2.278	-0.143	0.184	-0.147
.10.Far	2.284	-0.258	-2.271	-0.147	-0.186	-0.143
.11	1.221	-0.000	-2.025	-0.065	-0.718	-0.128
.12	0.000	-0.000	-1.768	0.017	-0.276	-0.112
.13	-0.000	-0.000	-1.511	-0.005	0.073	-0.095
.14	0.000	-0.000	-1.254	0.001	-0.020	-0.079
.15	-0.000	-0.000	-0.997	-0.000	0.005	-0.063
.16	0.000	-0.000	-0.739	-0.000	-0.001	-0.047
.17	-0.000	-0.000	-0.482	0.001	0.000	-0.030
.18	0.000	-0.000	-0.225	-0.003	-0.000	-0.014
.19	-0.000	-0.000	-0.129	0.001	0.000	-0.008
G693	0.000	-0.000	0.000	-0.000	-0.000	-0.000

Load : Dead Weight + Pressure 1 + Thermal 1

*** Forces and Moments acting on Restraints ***

Point Name	Forces(lb) X	Y	Z	Moments(inch-lb) X	Y	Z
BLDG	-172	-43	0	-251	-4	-740
.2	0	-93	-0	0	0	0
.3	0	-99	1	0	0	0
.4	0	-97	-5	0	0	0
.5	0	-99	18	0	0	0
.6	0	-93	-68	0	0	0
.7	0	-114	256	0	0	0
.8	0	-37	-374	0	0	0
.9	0	-193	0	0	0	0
.11	0	-193	0	0	0	0
.12	374	-37	0	0	0	0
.13	-257	-114	0	0	0	0
.14	68	-93	0	0	0	0
.15	-18	-99	0	0	0	0
.16	5	-97	0	0	0	0
.17	-1	-101	0	0	0	0
.18	1	-80	0	0	0	0
.19	-0	-23	0	0	0	0
G693	0	-29	172	-340	-1	-252

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
BLDG	1.00	1.00	2.34	869	632	881	790	42750	1
.2	1.00	1.00	2.34	869	698	885	855	42750	2
.2	1.00	1.00	2.34	869	698	885	855	42750	2
.3	1.00	1.00	2.34	869	743	889	906	42750	2
.3	1.00	1.00	2.34	869	743	889	906	42750	2
.4	1.00	1.00	2.34	869	730	887	922	42750	2
.4	1.00	1.00	2.34	869	730	887	922	42750	2
.5	1.00	1.00	2.34	869	770	893	1050	42750	2
.5	1.00	1.00	2.34	869	770	893	1050	42750	2
.6	1.00	1.00	2.34	869	1010	1028	1431	42750	3
.6	1.00	1.00	2.34	869	1010	1028	1431	42750	3
.7	1.00	1.00	2.34	869	2566	2568	3201	42750	7
.7	1.00	1.00	2.34	869	2566	2568	3201	42750	7
.8	1.00	1.00	2.34	869	8513	8514	8796	42750	20
.8	1.00	1.00	2.34	869	8513	8514	8796	42750	20
.9	1.00	1.00	2.34	869	2740	2741	3402	42750	7
.9	1.00	1.00	2.34	869	2740	2741	3402	42750	7
.10.Near	1.00	1.00	2.34	869	9318	9319	9608	42750	22
.10.Near	1.91	1.91	2.34	869	17515	17515	17869	42750	41
.10.Far	1.91	1.91	2.34	869	17515	17515	17868	42750	41
.10.Far	1.00	1.00	2.34	869	9318	9318	9607	42750	22
.11	1.00	1.00	2.34	869	2738	2740	3395	42750	7
.11	1.00	1.00	2.34	869	2738	2740	3395	42750	7
.12	1.00	1.00	2.34	869	8527	8527	8810	42750	20
.12	1.00	1.00	2.34	869	8527	8527	8810	42750	20
.13	1.00	1.00	2.34	869	2570	2572	3205	42750	7
.13	1.00	1.00	2.34	869	2570	2572	3205	42750	7
.14	1.00	1.00	2.34	869	1011	1029	1432	42750	3
.14	1.00	1.00	2.34	869	1011	1029	1432	42750	3
.15	1.00	1.00	2.34	869	772	893	1052	42750	2
.15	1.00	1.00	2.34	869	772	893	1052	42750	2
.16	1.00	1.00	2.34	869	725	887	917	42750	2
.16	1.00	1.00	2.34	869	725	887	917	42750	2
.17	1.00	1.00	2.34	869	761	891	925	42750	2
.17	1.00	1.00	2.34	869	761	891	925	42750	2
.18	1.00	1.00	2.34	869	629	881	790	42750	1
.18	1.00	1.00	2.34	869	629	881	790	42750	1
.19	1.00	1.00	2.34	869	336	874	565	42750	1
.19	1.00	1.00	2.34	869	336	874	565	42750	1
G693	1.00	1.00	2.34	869	461	876	636	42750	1

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Maxima ***

Maximum X displacement = 2.284 inch at point .10.Far
Maximum Y displacement = -0.258 inch at point .10.Near
Maximum Z displacement = -2.278 inch at point .10.Near

Maximum X rotation = -0.147 degree at point .10.Far
Maximum Y rotation = -0.718 degree at point .11
Maximum Z rotation = -0.147 degree at point .10.Near

Maximum X force = -203 lb at point .12
Maximum Y force = 97 lb at point .9
Maximum Z force = -202 lb at point .7

Maximum X moment = 5502 inch-lb at point .11
Maximum Y moment = -21074 inch-lb at point .10.Near
Maximum Z moment = -5502 inch-lb at point .9

Maximum hoop stress = 869 psi at point BLDG
Maximum longitudinal stress = 17515 psi at point .10.Near
Maximum principal stress = 17515 psi at point .10.Near
Maximum code stress = 17869 psi at point .10.Near
Maximum stress ratio (code/allowable) = 0.42 at point .10.Near

Load : Dead Weight + Pressure 1

*** System Maxima ***

Maximum X displacement = 0.000 inch at point
Maximum Y displacement = -0.258 inch at point .10.Near
Maximum Z displacement = 0.000 inch at point

Maximum X rotation = -0.147 degree at point .10.Far
Maximum Y rotation = 0.000 degree at point
Maximum Z rotation = -0.147 degree at point .10.Near

Maximum X force = 0 lb at point
Maximum Y force = 97 lb at point .9
Maximum Z force = 0 lb at point

Maximum X moment = 5502 inch-lb at point .11
Maximum Y moment = 0 inch-lb at point
Maximum Z moment = -5502 inch-lb at point .9

Maximum hoop stress = 869 psi at point BLDG
Maximum longitudinal stress = 2732 psi at point .9
Maximum principal stress = 2733 psi at point .9
Maximum code stress = 2807 psi at point .9
Maximum stress ratio (code/allowable) = 0.16 at point .9

Load : Thermal 1

*** System Maxima ***

Maximum X displacement = 2.284 inch at point .10.Far
Maximum Y displacement = 0.000 inch at point
Maximum Z displacement = -2.278 inch at point .10.Near

Maximum X rotation = 0.000 degree at point
Maximum Y rotation = -0.718 degree at point .11
Maximum Z rotation = 0.000 degree at point

Maximum X force = -203 lb at point .12
Maximum Y force = 0 lb at point
Maximum Z force = -202 lb at point .7

Maximum X moment = 0 inch-lb at point
Maximum Y moment = -21074 inch-lb at point .10.Near
Maximum Z moment = 0 inch-lb at point

Maximum hoop stress = 0 psi at point
Maximum longitudinal stress = 17264 psi at point .10.Near
Maximum principal stress = 17264 psi at point .10.Near
Maximum code stress = 17199 psi at point .10.Near
Maximum stress ratio (code/allowable) = 0.41 at point .10.Near

PipePak Version 22.01 Perma Pipe Inc. 04/19/2010 12:02:20PM
FORT WAINWRIGHT FTW336A
Model File: P:\Algor\D0878\336ACND.dbs

Piping Code: ASME B31.1 - 2007

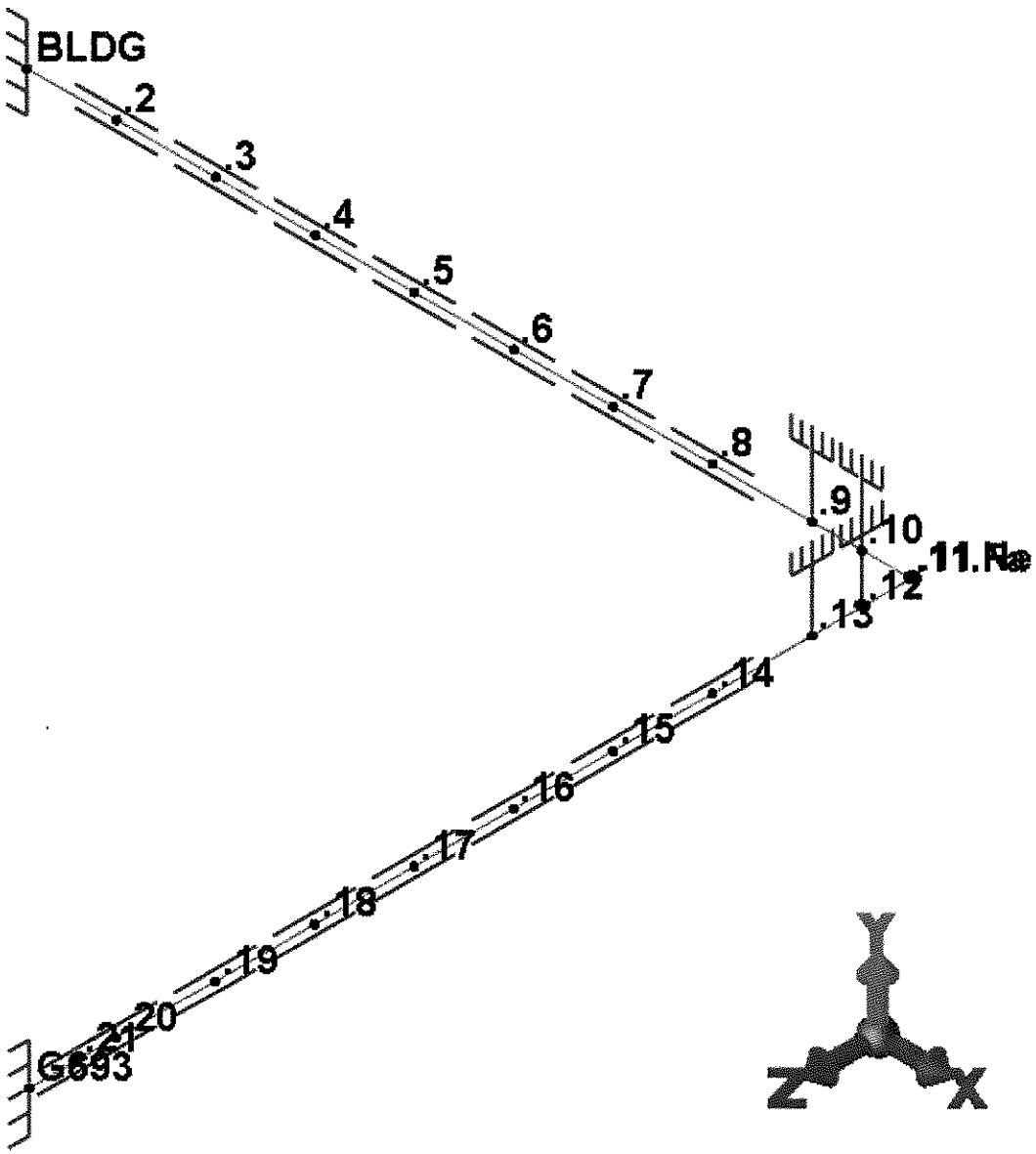
*** Input+ ***

File Name ..... P:\Algor\D0878\336ACND
Project ..... FORT WAINWRIGHT FTW336A
Department ..... PERMA PIPE
Contract Number D0878
Description ..... 1.5" CONDENSATE PIPING
Prepared by ..... MACHN
Checked by .....

ASME code ..... ASME B31.1
Input unit ..... English
Output unit ..... English
Output columns 80
Base temperature 40
F factor 1
E factor 1.33

Number of dynamic modes.. 8
Cut-off frequency ..... 33 Hz
Max no. of iterations ... 12
Convergence tolerance ... 3
Force tolerance ..... 5 lb

FileName: N:\DOCUME~1\nowakm\LOCALS~1\Temp\2\Alg2.dbs
Load : Dead Weight + Pressure 1 + Thermal 1
ASME B31.1 - 2004



Piping Code: ASME B31.1 - 2007

Frm /To	Point name	DX (feet)	DY (feet)	DZ (feet)	Radius (inch)	X (feet)	Y (feet)	Z (feet)
F	BLDG					0.000	0.000	0.000
.2	9					9.000	0.000	0.000
.3	10					19.000	0.000	0.000
.4	10					29.000	0.000	0.000
.5	10					39.000	0.000	0.000
.6	10					49.000	0.000	0.000
.7	10					59.000	0.000	0.000
.8	10					69.000	0.000	0.000
.9	10					79.000	0.000	0.000
.10	5					84.000	0.000	0.000
.11	5				Long	89.000	0.000	0.000
.12			5			89.000	0.000	5.000
.13			5			89.000	0.000	10.000
.14			10			89.000	0.000	20.000
.15			10			89.000	0.000	30.000
.16			10			89.000	0.000	40.000
.17			10			89.000	0.000	50.000
.18			10			89.000	0.000	60.000
.19			10			89.000	0.000	70.000
.20			10			89.000	0.000	80.000
.21			3.75			89.000	0.000	83.750
G693			5			89.000	0.000	88.750

Piping Code: ASME B31.1 - 2007

Point	Data	Description
BLDG	Pipe	Pipe data identifier = 1.5
		NPS Identifier = 1"1/2
		DN Identifier = 40
		Pipe schedule = 10S
		Actual pipe O. D. = 1.9 inch
		Wall thickness = 0.1 inch
		Corrosion allowance = 0 inch
		Insulation thickness = 1 inch
		Insulation density = 8 lb/cu.ft
		Content S. G. = 1
		Wind area O.D. = 0 inch
	Material	Material data identifier = SS
		Austenitic stainless (301-309, 316, 321, 237)
		Density = 0.2899 lb/cu.inch

Tempera. (deg.F)	Modulus (psi)	Thermal Strain (inch/inch)
-325	3.04e+007	-0.00321
-150	2.99e+007	-0.00189
-50	2.94e+007	-0.00103
70	2.83e+007	0
200	2.77e+007	0.00122
300	2.71e+007	0.00218
400	2.66e+007	0.00317
500	2.61e+007	0.00417
600	2.54e+007	0.0052
700	2.48e+007	0.00625
800	2.41e+007	0.00733
900	2.34e+007	0.00843
1000	2.27e+007	0.00957
1100	2.2e+007	0.0107
1200	2.13e+007	0.01183
1300	2.07e+007	0.01297
1400	1.93e+007	0.0141

Allowable stress code = SS2

Temperature (deg.F)	Allowable stresses (psi)
-50.00	16700.00
300.00	16700.00
350.00	16100.00
400.00	15500.00
450.00	14950.00
500.00	14400.00
550.00	13950.00
600.00	13500.00

Load — Load data identifier = CND

Case No.	Temperature (deg.F)	Pressure (psig)	Expansion (inch/inch)
1	350	100	0.002675

Anchor — Rigid in all directions

.2	Guide	Spring Constant = Rigid lb/inch
.3	Guide	Spring Constant = Rigid lb/inch
.4	Guide	Spring Constant = Rigid lb/inch
.5	Guide	Spring Constant = Rigid lb/inch
.6	Guide	Spring Constant = Rigid lb/inch
.7	Guide	Spring Constant = Rigid lb/inch
.8	Guide	Spring Constant = Rigid lb/inch
.9	Vertical rod support	Initial displacement:
		Case 1 = 0 inch

Piping Code: ASME B31.1 - 2007

Point	Data	Description
		Case 2 = 0 inch
		Case 3 = 0 inch
.10	Vertical rod support	
		Initial displacement:
		Case 1 = 0 inch
		Case 2 = 0 inch
		Case 3 = 0 inch
.11		
.12	Vertical rod support	
		Initial displacement:
		Case 1 = 0 inch
		Case 2 = 0 inch
		Case 3 = 0 inch
.13	Vertical rod support	
		Initial displacement:
		Case 1 = 0 inch
		Case 2 = 0 inch
		Case 3 = 0 inch
.14	Guide	Spring Constant = Rigid lb/inch
.15	Guide	Spring Constant = Rigid lb/inch
.16	Guide	Spring Constant = Rigid lb/inch
.17	Guide	Spring Constant = Rigid lb/inch
.18	Guide	Spring Constant = Rigid lb/inch
.19	Guide	Spring Constant = Rigid lb/inch
.20	Guide	Spring Constant = Rigid lb/inch
.21	Guide	Spring Constant = Rigid lb/inch
G693	Anchor	Rigid in all directions

Piping Code: ASME B31.1 - 2007

Case number	Combination
1	D.W. + Pres1 + Ther1
2	D.W. + Pres1
3	Ther1

Piping Code: ASME B31.1 - 2007

Wind Effective Velocity Pressure

Region number	Height (feet)	Pressure (psf)
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	0	0
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0
16	0	0
17	0	0
18	0	0
19	0	0
20	0	0

Piping Code: ASME B31.1 - 2007

*** Support Summary ***

Point Name	Global Direction	Forces(lb) or Moments(inch-lb) Sustain	Expansion Max	Expansion Min	Occasional Max	Occasional Min	Total Max	Total Min
BLDG	Fx	0	0	-12	0	0	0	-12
	Fy	-15	0	0	0	0	-15	-15
	Fz	0	0	0	0	0	0	0
	Mx	-13	0	0	0	0	-13	-13
	My	0	0	-0	0	0	0	-0
	Mz	-262	0	0	0	0	-262	-262
.2	Fy	-33	0	0	0	0	-33	-33
	Fz	0	0	-0	0	0	0	-0
.3	Fy	-35	0	0	0	0	-35	-35
	Fz	0	0	0	0	0	0	0
.4	Fy	-34	0	0	0	0	-34	-34
	Fz	0	0	-0	0	0	0	-0
.5	Fy	-35	0	0	0	0	-35	-35
	Fz	0	1	0	0	0	1	0
.6	Fy	-35	0	0	0	0	-35	-35
	Fz	0	0	-5	0	0	0	-5
.7	Fy	-34	0	0	0	0	-34	-34
	Fz	0	17	0	0	0	17	0
.8	Fy	-37	0	0	0	0	-37	-37
	Fz	0	0	-25	0	0	0	-25
.9	Fy	-19	0	0	0	0	-19	-19
.10	Fy	-31	0	0	0	0	-31	-31
.12	Fy	-31	0	0	0	0	-31	-31
.13	Fy	-19	0	0	0	0	-19	-19
.14	Fx	0	25	0	0	0	25	0
	Fy	-37	0	0	0	0	-37	-37
.15	Fx	0	0	-17	0	0	0	-17
	Fy	-34	0	0	0	0	-34	-34
.16	Fx	0	5	0	0	0	5	0
	Fy	-35	0	0	0	0	-35	-35
.17	Fx	0	0	-1	0	0	0	-1
	Fy	-35	0	0	0	0	-35	-35
.18	Fx	0	0	0	0	0	0	0
	Fy	-34	0	0	0	0	-34	-34
.19	Fx	0	0	-0	0	0	0	-0
	Fy	-36	0	0	0	0	-36	-36
.20	Fx	0	0	0	0	0	0	0
	Fy	-28	0	0	0	0	-28	-28
.21	Fx	0	0	-0	0	0	0	-0
	Fy	-8	0	0	0	0	-8	-8
G693	Fx	0	0	0	0	0	0	0
	Fy	-10	0	0	0	0	-10	-10
	Fz	0	12	0	0	0	12	0
	Mx	-122	0	0	0	0	-122	-122
	My	0	0	-0	0	0	0	-0
	Mz	-13	0	0	0	0	-13	-13

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Deflections ***

Point Name	Displacements(inch) X	Y	Z	Rotations(degree) X	Y	Z
BLDG	-0.000	-0.000	0.000	-0.000	-0.000	-0.000
.2	0.317	-0.000	-0.000	-0.016	0.000	-0.009
.3	0.668	-0.000	0.000	-0.034	-0.001	0.002
.4	1.020	-0.000	-0.000	-0.052	0.002	-0.001
.5	1.372	-0.000	0.000	-0.070	-0.007	0.000
.6	1.724	-0.000	-0.000	-0.088	0.028	-0.001
.7	2.076	-0.000	0.000	-0.106	-0.104	0.004
.8	2.428	-0.000	-0.000	-0.124	0.390	-0.014
.9	2.779	-0.000	-1.710	-0.142	0.994	0.051
.10	2.955	-0.000	-2.650	-0.151	0.738	-0.080
.11.Near	3.125	-0.143	-3.121	-0.159	0.139	-0.161
.11.Far	3.130	-0.143	-3.116	-0.161	-0.142	-0.159
.12	2.655	-0.000	-2.946	-0.080	-0.741	-0.151
.13	1.713	-0.000	-2.771	0.051	-0.997	-0.142
.14	0.000	-0.000	-2.419	-0.014	-0.390	-0.124
.15	-0.000	-0.000	-2.067	0.004	0.104	-0.106
.16	0.000	-0.000	-1.715	-0.001	-0.028	-0.088
.17	-0.000	-0.000	-1.363	0.001	0.007	-0.070
.18	0.000	-0.000	-1.011	-0.002	-0.002	-0.052
.19	-0.000	-0.000	-0.660	0.007	0.001	-0.034
.20	0.000	-0.000	-0.308	-0.026	-0.000	-0.016
.21	-0.000	-0.000	-0.176	0.009	0.000	-0.009
G693	0.000	-0.000	0.000	-0.000	-0.000	-0.000

Load : Dead Weight + Pressure 1 + Thermal 1

*** Forces and Moments acting on Restraints ***

Point Name	Forces(lb) X	Y	Z	Moments(inch-lb) X	Y	Z
BLDG	-12	-15	0	-13	-0	-262
.2	0	-33	-0	0	0	0
.3	0	-35	0	0	0	0
.4	0	-34	-0	0	0	0
.5	0	-35	1	0	0	0
.6	0	-35	-5	0	0	0
.7	0	-34	17	0	0	0
.8	0	-37	-25	0	0	0
.9	0	-19	0	0	0	0
.10	0	-31	0	0	0	0
.12	0	-31	0	0	0	0
.13	0	-19	0	0	0	0
.14	25	-37	0	0	0	0
.15	-17	-34	0	0	0	0
.16	5	-35	0	0	0	0
.17	-1	-35	0	0	0	0
.18	0	-34	0	0	0	0
.19	-0	-36	0	0	0	0
.20	0	-28	0	0	0	0
.21	-0	-8	0	0	0	0
G693	0	-10	12	-122	-0	-13

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
BLDG	1.00	1.00	0.24	910	1462	1464	1559	41000	3
.2	1.00	1.00	0.24	910	1691	1692	1789	41000	4
.2	1.00	1.00	0.24	910	1691	1692	1789	41000	4
.3	1.00	1.00	0.24	910	1842	1843	1945	41000	4
.3	1.00	1.00	0.24	910	1842	1843	1945	41000	4
.4	1.00	1.00	0.24	910	1803	1804	1926	41000	4
.4	1.00	1.00	0.24	910	1803	1804	1926	41000	4
.5	1.00	1.00	0.24	910	1812	1813	2006	41000	4
.5	1.00	1.00	0.24	910	1812	1813	2006	41000	4
.6	1.00	1.00	0.24	910	1873	1873	2300	41000	5
.6	1.00	1.00	0.24	910	1873	1873	2300	41000	5
.7	1.00	1.00	0.24	910	2364	2365	3281	41000	8
.7	1.00	1.00	0.24	910	2364	2365	3281	41000	8
.8	1.00	1.00	0.24	910	5948	5948	7421	41000	18
.8	1.00	1.00	0.24	910	5948	5948	7421	41000	18
.9	1.00	1.00	0.24	910	1295	1297	1759	41000	4
.9	1.00	1.00	0.24	910	1295	1297	1759	41000	4
.10	1.00	1.00	0.24	910	4435	4435	6026	41000	14
.10	1.00	1.00	0.24	910	4435	4435	6026	41000	14
.11.Near	1.00	1.00	0.24	910	6706	6706	6877	41000	16
.11.Near	2.11	2.11	0.24	910	13753	13753	13968	41000	34
.11.Far	2.11	2.11	0.24	910	13753	13753	13968	41000	34
.11.Far	1.00	1.00	0.24	910	6706	6706	6876	41000	16
.12	1.00	1.00	0.24	910	4433	4433	6024	41000	14
.12	1.00	1.00	0.24	910	4433	4433	6024	41000	14
.13	1.00	1.00	0.24	910	1293	1295	1755	41000	4
.13	1.00	1.00	0.24	910	1293	1295	1755	41000	4
.14	1.00	1.00	0.24	910	5956	5956	7429	41000	18
.14	1.00	1.00	0.24	910	5956	5956	7429	41000	18
.15	1.00	1.00	0.24	910	2366	2366	3284	41000	8
.15	1.00	1.00	0.24	910	2366	2366	3284	41000	8
.16	1.00	1.00	0.24	910	1872	1872	2299	41000	5
.16	1.00	1.00	0.24	910	1872	1872	2299	41000	5
.17	1.00	1.00	0.24	910	1817	1818	2011	41000	4
.17	1.00	1.00	0.24	910	1817	1818	2011	41000	4
.18	1.00	1.00	0.24	910	1786	1787	1909	41000	4
.18	1.00	1.00	0.24	910	1786	1787	1909	41000	4
.19	1.00	1.00	0.24	910	1904	1905	2007	41000	4
.19	1.00	1.00	0.24	910	1904	1905	2007	41000	4
.20	1.00	1.00	0.24	910	1459	1461	1558	41000	3
.20	1.00	1.00	0.24	910	1459	1461	1558	41000	3
.21	1.00	1.00	0.24	910	443	912	558	41000	1
.21	1.00	1.00	0.24	910	443	912	558	41000	1
G693	1.00	1.00	0.24	910	885	927	983	41000	2

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Maxima ***

Maximum X displacement = 3.130 inch at point .11.Far
Maximum Y displacement = -0.143 inch at point .11.Near
Maximum Z displacement = -3.121 inch at point .11.Near

Maximum X rotation = -0.161 degree at point .11.Far
Maximum Y rotation = -0.997 degree at point .13
Maximum Z rotation = -0.161 degree at point .11.Near

Maximum X force = -14 lb at point .14
Maximum Y force = 19 lb at point .8
Maximum Z force = -14 lb at point .7

Maximum X moment = 497 inch-lb at point .12
Maximum Y moment = -1530 inch-lb at point .11.Near
Maximum Z moment = -497 inch-lb at point .10

Maximum hoop stress = 910 psi at point BLDG
Maximum longitudinal stress = 13753 psi at point .11.Near
Maximum principal stress = 13753 psi at point .11.Near
Maximum code stress = 13968 psi at point .11.Near
Maximum stress ratio (code/allowable) = 0.34 at point .11.Near

Load : Dead Weight + Pressure 1

*** System Maxima ***

Maximum X displacement = 0.000 inch at point
Maximum Y displacement = -0.143 inch at point .11.Near
Maximum Z displacement = 0.000 inch at point

Maximum X rotation = -0.161 degree at point .11.Far
Maximum Y rotation = 0.000 degree at point
Maximum Z rotation = -0.161 degree at point .11.Near

Maximum X force = 0 lb at point
Maximum Y force = 19 lb at point .8
Maximum Z force = 0 lb at point

Maximum X moment = 497 inch-lb at point .12
Maximum Y moment = 0 inch-lb at point
Maximum Z moment = -497 inch-lb at point .10

Maximum hoop stress = 910 psi at point BLDG
Maximum longitudinal stress = 2457 psi at point .10
Maximum principal stress = 2457 psi at point .10
Maximum code stress = 2531 psi at point .10
Maximum stress ratio (code/allowable) = 0.16 at point .10

Load : Thermal 1

*** System Maxima ***

Maximum X displacement = 3.130 inch at point .11.Far
Maximum Y displacement = 0.000 inch at point
Maximum Z displacement = -3.121 inch at point .11.Near

Maximum X rotation = 0.000 degree at point
Maximum Y rotation = -0.997 degree at point .13
Maximum Z rotation = 0.000 degree at point

Maximum X force = -14 lb at point .14
Maximum Y force = 0 lb at point
Maximum Z force = -14 lb at point .7

Maximum X moment = 0 inch-lb at point
Maximum Y moment = -1530 inch-lb at point .11.Near
Maximum Z moment = 0 inch-lb at point

Maximum hoop stress = 0 psi at point
Maximum longitudinal stress = 13393 psi at point .11.Near
Maximum principal stress = 13393 psi at point .11.Near
Maximum code stress = 13372 psi at point .11.Near
Maximum stress ratio (code/allowable) = 0.33 at point .11.Near

PipePak Version 22.01 Perma Pipe Inc. 04/19/2010 12:39:15PM
FORT WAINWRIGHT
Model File: P:\Algor\D0878\336BCND.dbs

Piping Code: ASME B31.1 - 2007

*** Input+ ***

File Name ..... P:\Algor\D0878\336BCND
Project ..... FORT WAINWRIGHT
Department ..... PERMA PIPE
Contract Number ..... AVAIATION BARRACKS FTW 336B
Description ..... CONDENSATE PIPING
Prepared by ..... MACHN
Checked by .....

ASME code ..... ASME B31.1
Input unit ..... English
Output unit ..... English
Output columns 80
Base temperature 40
F factor 1
E factor 1.33

Number of dynamic modes.. 8
Cut-off frequency ..... 33 Hz
Max no. of iterations ... 12
Convergence tolerance ... 3
Force tolerance ..... 5 lb

Piping Code: ASME B31.1 - 2007

Frm /To	Point name	DX (feet)	DY (feet)	DZ (feet)	Radius (inch)	X (feet)	Y (feet)	Z (feet)
F	.1					0.000	0.000	0.000
	VH545 1					1.000	0.000	0.000
	.3 3.7					4.700	0.000	0.000
	.4 5					9.700	0.000	0.000
	.5 2					11.700	0.000	0.000
	.6 10					21.700	0.000	0.000
	.7 10					31.700	0.000	0.000
	.8 10					41.700	0.000	0.000
	.9 10					51.700	0.000	0.000
	.10 10					61.700	0.000	0.000
	.11 10					71.700	0.000	0.000
	.12 10					81.700	0.000	0.000
	.13 10					91.700	0.000	0.000
	.14 10					101.700	0.000	0.000
	.15 10					111.700	0.000	0.000
	.16 10					121.700	0.000	0.000
	.17 10					131.700	0.000	0.000
	VH554 10					141.700	0.000	0.000
	.19 3					144.700	0.000	0.000
	.20 10					154.700	0.000	0.000
	.21 10					164.700	0.000	0.000
	.22 10					174.700	0.000	0.000
	.23 10					184.700	0.000	0.000
	.24 10					194.700	0.000	0.000
	.25 10					204.700	0.000	0.000
	.26 10					214.700	0.000	0.000
	.27 10					224.700	0.000	0.000
	.28 10					234.700	0.000	0.000
	.29 10					244.700	0.000	0.000
	.30 10					254.700	0.000	0.000
	.31 10					264.700	0.000	0.000
	.32 10					274.700	0.000	0.000
	.33 10					284.700	0.000	0.000
	.34 10					294.700	0.000	0.000
	.35 3.7					298.400	0.000	0.000
	VH555 1					299.400	0.000	0.000
	.37 3.7					303.100	0.000	0.000
	.38 4					307.100	0.000	0.000
	.39 10					317.100	0.000	0.000
	.40 10					327.100	0.000	0.000
	.41 10					337.100	0.000	0.000
	.42 10					347.100	0.000	0.000
	.43 10					357.100	0.000	0.000
	.44 10					367.100	0.000	0.000
	.45 10					377.100	0.000	0.000
	.46 10					387.100	0.000	0.000
	.47 10					397.100	0.000	0.000
	.48 10					407.100	0.000	0.000
	.49 10					417.100	0.000	0.000
	.50 10					427.100	0.000	0.000
	.51 10					437.100	0.000	0.000
	.52 10					447.100	0.000	0.000
	.53 10					457.100	0.000	0.000
	.54 10					467.100	0.000	0.000
	.55 10					477.100	0.000	0.000
	.56 10					487.100	0.000	0.000
	.57 10					497.100	0.000	0.000
	.58 10					507.100	0.000	0.000

Piping Code: ASME B31.1 - 2007

Frm /To	Point name	DX (feet)	DY (feet)	DZ (feet)	Radius (inch)	X (feet)	Y (feet)	Z (feet)
.59	10					517.100	0.000	0.000
.60	10					527.100	0.000	0.000
.61	10					537.100	0.000	0.000
.62	10					547.100	0.000	0.000
.63	10					557.100	0.000	0.000
.64	10					567.100	0.000	0.000
.65	10					577.100	0.000	0.000
.66	10					587.100	0.000	0.000
.67	10					597.100	0.000	0.000
VH556	10					607.100	0.000	0.000
.69	10					617.100	0.000	0.000
.70	10					627.100	0.000	0.000
.71	10					637.100	0.000	0.000
.72	10					647.100	0.000	0.000
.73	10					657.100	0.000	0.000
.74	10					667.100	0.000	0.000
.75	10					677.100	0.000	0.000
.76	10					687.100	0.000	0.000
.77	10					697.100	0.000	0.000
.78	10					707.100	0.000	0.000
.79	10					717.100	0.000	0.000
.80	10					727.100	0.000	0.000
.81	10					737.100	0.000	0.000
.82	10					747.100	0.000	0.000
.83	10					757.100	0.000	0.000
.84	10					767.100	0.000	0.000
.85	10					777.100	0.000	0.000
.86	10					787.100	0.000	0.000
.87	10					797.100	0.000	0.000
.88	10					807.100	0.000	0.000
.89	10					817.100	0.000	0.000
.90	10					827.100	0.000	0.000
.91	10					837.100	0.000	0.000
.92	10					847.100	0.000	0.000
.93	10					857.100	0.000	0.000
.94	10					867.100	0.000	0.000
.95	10					877.100	0.000	0.000
.96	10					887.100	0.000	0.000
.97	10					897.100	0.000	0.000
.98	10					907.100	0.000	0.000
.99	3.7					910.800	0.000	0.000
VH557	1					911.800	0.000	0.000
.101	3.7					915.500	0.000	0.000
.102	10					925.500	0.000	0.000
.103	10					935.500	0.000	0.000
.104	10					945.500	0.000	0.000
.105	10					955.500	0.000	0.000
.106	10					965.500	0.000	0.000
.107	10					975.500	0.000	0.000
.108	10					985.500	0.000	0.000
.109	10					995.500	0.000	0.000
.110	10					1005.500	0.000	0.000
.111	10					1015.500	0.000	0.000
.112	10					1025.500	0.000	0.000
.113	10					1035.500	0.000	0.000
.114	10					1045.500	0.000	0.000
.115	10					1055.500	0.000	0.000
.116	10					1065.500	0.000	0.000

Piping Code: ASME B31.1 - 2007

Frm /To	Point name	DX (feet)	DY (feet)	DZ (feet)	Radius (inch)	X (feet)	Y (feet)	Z (feet)
	.117	10				1075.500	0.000	0.000
	.118	10				1085.500	0.000	0.000
	.119	10				1095.500	0.000	0.000
	.120	10				1105.500	0.000	0.000
	.121	10				1115.500	0.000	0.000
	.122	10				1125.500	0.000	0.000
	.123	10				1135.500	0.000	0.000
	.124	10				1145.500	0.000	0.000
	.125	10				1155.500	0.000	0.000
	.126	10				1165.500	0.000	0.000
	.127	10				1175.500	0.000	0.000
	.128	10				1185.500	0.000	0.000
	.129	10				1195.500	0.000	0.000
	.130	10				1205.500	0.000	0.000
	vh563	10				1215.500	0.000	0.000
	.132	10				1225.500	0.000	0.000
	.133	10				1235.500	0.000	0.000
	.134	10				1245.500	0.000	0.000
	.135	10				1255.500	0.000	0.000
	.136	10				1265.500	0.000	0.000
	.137	10				1275.500	0.000	0.000
	.138	10				1285.500	0.000	0.000
	.139	10				1295.500	0.000	0.000
	.140	10				1305.500	0.000	0.000
	.141	10				1315.500	0.000	0.000
	.142	10				1325.500	0.000	0.000
	.143	10				1335.500	0.000	0.000
	.144	10				1345.500	0.000	0.000
	.145	10				1355.500	0.000	0.000
	.146	10				1365.500	0.000	0.000
	.147	10				1375.500	0.000	0.000
	.148	10				1385.500	0.000	0.000
	.149	10				1395.500	0.000	0.000
	.150	10				1405.500	0.000	0.000
	.151	10				1415.500	0.000	0.000
	.152	10				1425.500	0.000	0.000
	.153	10				1435.500	0.000	0.000
	.154	10				1445.500	0.000	0.000
	.155	10				1455.500	0.000	0.000
	.156	10				1465.500	0.000	0.000
	.157	10				1475.500	0.000	0.000
	.158	10				1485.500	0.000	0.000
	.159	10				1495.500	0.000	0.000
	.160	10				1505.500	0.000	0.000
	.161	10				1515.500	0.000	0.000
	.162	3.7				1519.200	0.000	0.000
	VH564	1				1520.200	0.000	0.000
	.164	3.7				1523.900	0.000	0.000
	.165	10				1533.900	0.000	0.000
	.166	10				1543.900	0.000	0.000
	.167	10				1553.900	0.000	0.000
	.168	10				1563.900	0.000	0.000
	.169	10				1573.900	0.000	0.000
	.170	10				1583.900	0.000	0.000
	.171	10				1593.900	0.000	0.000
	.172	10				1603.900	0.000	0.000
	.173	10				1613.900	0.000	0.000
	.174	10				1623.900	0.000	0.000

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Frm /To	Point name	DX (feet)	DY (feet)	DZ (feet)	Radius (inch)	X (feet)	Y (feet)	Z (feet)
	.175 10					1633.900	0.000	0.000
	.176 10					1643.900	0.000	0.000
	.177 10					1653.900	0.000	0.000
	.178 10					1663.900	0.000	0.000
	.179 10					1673.900	0.000	0.000
	.180 10					1683.900	0.000	0.000
	.181 10					1693.900	0.000	0.000
	.182 10					1703.900	0.000	0.000
	.183 10					1713.900	0.000	0.000
	.184 10					1723.900	0.000	0.000
	.185 10					1733.900	0.000	0.000
	.186 10					1743.900	0.000	0.000
	.187 10					1753.900	0.000	0.000
	.188 10					1763.900	0.000	0.000
	.189 10					1773.900	0.000	0.000
	.190 10					1783.900	0.000	0.000
	.191 10					1793.900	0.000	0.000
	.192 10					1803.900	0.000	0.000
	.193 10					1813.900	0.000	0.000
	.194 10					1823.900	0.000	0.000
F	.196			100		0.000	0.000	100.000
	.197			3.5		0.000	0.000	103.500
	.198			8		0.000	0.000	111.500
	.199			10		0.000	0.000	121.500
	.200			10		0.000	0.000	131.500
	.201			10		0.000	0.000	141.500
	.202			10		0.000	0.000	151.500
	.203			10		0.000	0.000	161.500
	.204			10		0.000	0.000	171.500
	.205			10		0.000	0.000	181.500
	.206			10		0.000	0.000	191.500
	.207			10		0.000	0.000	201.500
	.208			10		0.000	0.000	211.500
	.209			10		0.000	0.000	221.500
	.210			10		0.000	0.000	231.500
	.211			10		0.000	0.000	241.500
	.212			10		0.000	0.000	251.500
	.213			10		0.000	0.000	261.500
	.214			10		0.000	0.000	271.500
	.215			10		0.000	0.000	281.500
	.216			10		0.000	0.000	291.500
	.217			10		0.000	0.000	301.500
	.218			10		0.000	0.000	311.500
	.219			10		0.000	0.000	321.500
	.220			10		0.000	0.000	331.500
	.221			10		0.000	0.000	341.500
	.222			10		0.000	0.000	351.500
	.223			10		0.000	0.000	361.500

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Point	Data	Description
.1	Pipe	Pipe data identifier = 8
		NPS Identifier = 8
		DN Identifier = 200
		Pipe schedule = 10S
		Actual pipe O. D. = 8.625 inch
		Wall thickness = 0.14 inch
		Corrosion allowance = 0 inch
		Insulation thickness = 1.5 inch
		Insulation density = 8 lb/cu.ft
		Content S. G. = 1
		Wind area O.D. = 0 inch
	Material	Material data identifier = SS
		Austenitic stainless (301-309, 316, 321, 237)
		Density = 0.2899 lb/cu.inch

Tempera. (deg.F)	Modulus (psi)	Thermal Strain (inch/inch)
-325	3.04e+007	-0.00321
-150	2.99e+007	-0.00189
-50	2.94e+007	-0.00103
70	2.83e+007	0
200	2.77e+007	0.00122
300	2.71e+007	0.00218
400	2.66e+007	0.00317
500	2.61e+007	0.00417
600	2.54e+007	0.0052
700	2.48e+007	0.00625
800	2.41e+007	0.00733
900	2.34e+007	0.00843
1000	2.27e+007	0.00957
1100	2.2e+007	0.0107
1200	2.13e+007	0.01183
1300	2.07e+007	0.01297
1400	1.93e+007	0.0141

Allowable stress code = SS2

Temperature (deg.F)	Allowable stresses (psi)
-50.00	16700.00
300.00	16700.00
350.00	16100.00
400.00	15500.00
450.00	14950.00
500.00	14400.00
550.00	13950.00
600.00	13500.00

Load — Load data identifier = CND

Case No.	Temperature (deg.F)	Pressure (psig)	Expansion (inch/inch)
1	350	100	0.002675

	Anchor	Rigid in all directions
VH545	Bellows	Weight = 275.0000 lb
		Pressure thrust area = 325 sq.inch
		Longitudinal stiffness = 80.5 lb/inch
		Lateral stiffness (H) = Rigid lb/inch
		Lateral stiffness (V) = Rigid lb/inch
		Rotational stiff. (H) = Rigid lb-inch/deg
		Rotational stiff. (V) = Rigid lb-inch/deg
		Torsional stiffness = Rigid lb-inch/deg
.3	Guide	Spring Constant = Rigid lb/inch
.4	Guide	Spring Constant = Rigid lb/inch

Piping Code: ASME B31.1 - 2007

Point	Data	Description
.5	Guide	Spring Constant = Rigid lb/inch
.6	Guide	Spring Constant = Rigid lb/inch
.7	Guide	Spring Constant = Rigid lb/inch
.8	Guide	Spring Constant = Rigid lb/inch
.9	Guide	Spring Constant = Rigid lb/inch
.10	Guide	Spring Constant = Rigid lb/inch
.11	Guide	Spring Constant = Rigid lb/inch
.12	Guide	Spring Constant = Rigid lb/inch
.13	Guide	Spring Constant = Rigid lb/inch
.14	Guide	Spring Constant = Rigid lb/inch
.15	Guide	Spring Constant = Rigid lb/inch
.16	Guide	Spring Constant = Rigid lb/inch
.17	Guide	Spring Constant = Rigid lb/inch
VH554	Anchor	Rigid in all directions
.19	Guide	Spring Constant = Rigid lb/inch
.20	Guide	Spring Constant = Rigid lb/inch
.21	Guide	Spring Constant = Rigid lb/inch
.22	Guide	Spring Constant = Rigid lb/inch
.23	Guide	Spring Constant = Rigid lb/inch
.24	Guide	Spring Constant = Rigid lb/inch
.25	Guide	Spring Constant = Rigid lb/inch
.26	Guide	Spring Constant = Rigid lb/inch
.27	Guide	Spring Constant = Rigid lb/inch
.28	Guide	Spring Constant = Rigid lb/inch
.29	Guide	Spring Constant = Rigid lb/inch
.30	Guide	Spring Constant = Rigid lb/inch
.31	Guide	Spring Constant = Rigid lb/inch
.32	Guide	Spring Constant = Rigid lb/inch
.33	Guide	Spring Constant = Rigid lb/inch
.34	Guide	Spring Constant = Rigid lb/inch
.35	Bellows	Weight = 275.0000 lb
		Pressure thrust area = 325 sq.inch
		Longitudinal stiffness = 80.5 lb/inch
		Lateral stiffness (H) = Rigid lb/inch
		Lateral stiffness (V) = Rigid lb/inch
		Rotational stiff. (H) = Rigid lb-inch/deg
		Rotational stiff. (V) = Rigid lb-inch/deg
		Torsional stiffness = Rigid lb-inch/deg
VH555	Anchor	Rigid in all directions
.37	Bellows	Weight = 275.0000 lb
		Pressure thrust area = 325 sq.inch
		Longitudinal stiffness = 80.5 lb/inch
		Lateral stiffness (H) = Rigid lb/inch
		Lateral stiffness (V) = Rigid lb/inch
		Rotational stiff. (H) = Rigid lb-inch/deg
		Rotational stiff. (V) = Rigid lb-inch/deg
		Torsional stiffness = Rigid lb-inch/deg
.38	Guide	Spring Constant = Rigid lb/inch
.39	Guide	Spring Constant = Rigid lb/inch
.40	Guide	Spring Constant = Rigid lb/inch
.41	Guide	Spring Constant = Rigid lb/inch
.42	Guide	Spring Constant = Rigid lb/inch
.43	Guide	Spring Constant = Rigid lb/inch
.44	Guide	Spring Constant = Rigid lb/inch
.45	Guide	Spring Constant = Rigid lb/inch
.46	Guide	Spring Constant = Rigid lb/inch
.47	Guide	Spring Constant = Rigid lb/inch
.48	Guide	Spring Constant = Rigid lb/inch
.49	Guide	Spring Constant = Rigid lb/inch

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Point	Data	Description
.50	Guide	Spring Constant = Rigid lb/inch
.51	Guide	Spring Constant = Rigid lb/inch
.52	Guide	Spring Constant = Rigid lb/inch
.53	Guide	Spring Constant = Rigid lb/inch
.54	Guide	Spring Constant = Rigid lb/inch
.55	Guide	Spring Constant = Rigid lb/inch
.56	Guide	Spring Constant = Rigid lb/inch
.57	Guide	Spring Constant = Rigid lb/inch
.58	Guide	Spring Constant = Rigid lb/inch
.59	Guide	Spring Constant = Rigid lb/inch
.60	Guide	Spring Constant = Rigid lb/inch
.61	Guide	Spring Constant = Rigid lb/inch
.62	Guide	Spring Constant = Rigid lb/inch
.63	Guide	Spring Constant = Rigid lb/inch
.64	Guide	Spring Constant = Rigid lb/inch
.65	Guide	Spring Constant = Rigid lb/inch
.66	Guide	Spring Constant = Rigid lb/inch
.67	Guide	Spring Constant = Rigid lb/inch
VH556	Anchor	Rigid in all directions
.69	Guide	Spring Constant = Rigid lb/inch
.70	Guide	Spring Constant = Rigid lb/inch
.71	Guide	Spring Constant = Rigid lb/inch
.72	Guide	Spring Constant = Rigid lb/inch
.73	Guide	Spring Constant = Rigid lb/inch
.74	Guide	Spring Constant = Rigid lb/inch
.75	Guide	Spring Constant = Rigid lb/inch
.76	Guide	Spring Constant = Rigid lb/inch
.77	Guide	Spring Constant = Rigid lb/inch
.78	Guide	Spring Constant = Rigid lb/inch
.79	Guide	Spring Constant = Rigid lb/inch
.80	Guide	Spring Constant = Rigid lb/inch
.81	Guide	Spring Constant = Rigid lb/inch
.82	Guide	Spring Constant = Rigid lb/inch
.83	Guide	Spring Constant = Rigid lb/inch
.84	Guide	Spring Constant = Rigid lb/inch
.85	Guide	Spring Constant = Rigid lb/inch
.86	Guide	Spring Constant = Rigid lb/inch
.87	Guide	Spring Constant = Rigid lb/inch
.88	Guide	Spring Constant = Rigid lb/inch
.89	Guide	Spring Constant = Rigid lb/inch
.90	Guide	Spring Constant = Rigid lb/inch
.91	Guide	Spring Constant = Rigid lb/inch
.92	Guide	Spring Constant = Rigid lb/inch
.93	Guide	Spring Constant = Rigid lb/inch
.94	Guide	Spring Constant = Rigid lb/inch
.95	Guide	Spring Constant = Rigid lb/inch
.96	Guide	Spring Constant = Rigid lb/inch
.97	Guide	Spring Constant = Rigid lb/inch
.98	Guide	Spring Constant = Rigid lb/inch
.99	Bellows	Weight = 275.0000 lb
		Pressure thrust area = 325 sq.inch
		Longitudinal stiffness = 80.5 lb/inch
		Lateral stiffness (H) = Rigid lb/inch
		Lateral stiffness (V) = Rigid lb/inch
		Rotational stiff. (H) = Rigid lb-inch/deg
		Rotational stiff. (V) = Rigid lb-inch/deg
		Torsional stiffness = Rigid lb-inch/deg

Piping Code: ASME B31.1 - 2007

Point	Data	Description
VH557	Anchor	Rigid in all directions
.101	Bellows	Weight = 275.0000 lb
		Pressure thrust area = 325 sq.inch
		Longitudinal stiffness = 80.5 lb/inch
		Lateral stiffness (H) = Rigid lb/inch
		Lateral stiffness (V) = Rigid lb/inch
		Rotational stiff. (H) = Rigid lb-inch/deg
		Rotational stiff. (V) = Rigid lb-inch/deg
		Torsional stiffness = Rigid lb-inch/deg
.102	Guide	Spring Constant = Rigid lb/inch
.103	Guide	Spring Constant = Rigid lb/inch
.104	Guide	Spring Constant = Rigid lb/inch
.105	Guide	Spring Constant = Rigid lb/inch
.106	Guide	Spring Constant = Rigid lb/inch
.107	Guide	Spring Constant = Rigid lb/inch
.108	Guide	Spring Constant = Rigid lb/inch
.109	Guide	Spring Constant = Rigid lb/inch
.110	Guide	Spring Constant = Rigid lb/inch
.111	Guide	Spring Constant = Rigid lb/inch
.112	Guide	Spring Constant = Rigid lb/inch
.113	Guide	Spring Constant = Rigid lb/inch
.114	Guide	Spring Constant = Rigid lb/inch
.115	Guide	Spring Constant = Rigid lb/inch
.116	Guide	Spring Constant = Rigid lb/inch
.117	Guide	Spring Constant = Rigid lb/inch
.118	Guide	Spring Constant = Rigid lb/inch
.119	Guide	Spring Constant = Rigid lb/inch
.120	Guide	Spring Constant = Rigid lb/inch
.121	Guide	Spring Constant = Rigid lb/inch
.122	Guide	Spring Constant = Rigid lb/inch
.123	Guide	Spring Constant = Rigid lb/inch
.124	Guide	Spring Constant = Rigid lb/inch
.125	Guide	Spring Constant = Rigid lb/inch
.126	Guide	Spring Constant = Rigid lb/inch
.127	Guide	Spring Constant = Rigid lb/inch
.128	Guide	Spring Constant = Rigid lb/inch
.129	Guide	Spring Constant = Rigid lb/inch
.130	Guide	Spring Constant = Rigid lb/inch
vh563	Anchor	Rigid in all directions
.132	Guide	Spring Constant = Rigid lb/inch
.133	Guide	Spring Constant = Rigid lb/inch
.134	Guide	Spring Constant = Rigid lb/inch
.135	Guide	Spring Constant = Rigid lb/inch
.136	Guide	Spring Constant = Rigid lb/inch
.137	Guide	Spring Constant = Rigid lb/inch
.138	Guide	Spring Constant = Rigid lb/inch
.139	Guide	Spring Constant = Rigid lb/inch
.140	Guide	Spring Constant = Rigid lb/inch
.141	Guide	Spring Constant = Rigid lb/inch
.142	Guide	Spring Constant = Rigid lb/inch
.143	Guide	Spring Constant = Rigid lb/inch
.144	Guide	Spring Constant = Rigid lb/inch
.145	Guide	Spring Constant = Rigid lb/inch
.146	Guide	Spring Constant = Rigid lb/inch
.147	Guide	Spring Constant = Rigid lb/inch
.148	Guide	Spring Constant = Rigid lb/inch
.149	Guide	Spring Constant = Rigid lb/inch
.150	Guide	Spring Constant = Rigid lb/inch
.151	Guide	Spring Constant = Rigid lb/inch

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Point	Data	Description
.152	Guide	Spring Constant = Rigid lb/inch
.153	Guide	Spring Constant = Rigid lb/inch
.154	Guide	Spring Constant = Rigid lb/inch
.155	Guide	Spring Constant = Rigid lb/inch
.156	Guide	Spring Constant = Rigid lb/inch
.157	Guide	Spring Constant = Rigid lb/inch
.158	Guide	Spring Constant = Rigid lb/inch
.159	Guide	Spring Constant = Rigid lb/inch
.160	Guide	Spring Constant = Rigid lb/inch
.161	Guide	Spring Constant = Rigid lb/inch
.162	Bellows	Weight = 275.0000 lb
		Pressure thrust area = 325 sq.inch
		Longitudinal stiffness = 80.5 lb/inch
		Lateral stiffness (H) = Rigid lb/inch
		Lateral stiffness (V) = Rigid lb/inch
		Rotational stiff. (H) = Rigid lb-inch/deg
		Rotational stiff. (V) = Rigid lb-inch/deg
		Torsional stiffness = Rigid lb-inch/deg
VH564	Anchor	Rigid in all directions
.164	Bellows	Weight = 275.0000 lb
		Pressure thrust area = 325 sq.inch
		Longitudinal stiffness = 80.5 lb/inch
		Lateral stiffness (H) = Rigid lb/inch
		Lateral stiffness (V) = Rigid lb/inch
		Rotational stiff. (H) = Rigid lb-inch/deg
		Rotational stiff. (V) = Rigid lb-inch/deg
		Torsional stiffness = Rigid lb-inch/deg
.165	Guide	Spring Constant = Rigid lb/inch
.166	Guide	Spring Constant = Rigid lb/inch
.167	Guide	Spring Constant = Rigid lb/inch
.168	Guide	Spring Constant = Rigid lb/inch
.169	Guide	Spring Constant = Rigid lb/inch
.170	Guide	Spring Constant = Rigid lb/inch
.171	Guide	Spring Constant = Rigid lb/inch
.172	Guide	Spring Constant = Rigid lb/inch
.173	Guide	Spring Constant = Rigid lb/inch
.174	Guide	Spring Constant = Rigid lb/inch
.175	Guide	Spring Constant = Rigid lb/inch
.176	Guide	Spring Constant = Rigid lb/inch
.177	Guide	Spring Constant = Rigid lb/inch
.178	Guide	Spring Constant = Rigid lb/inch
.179	Guide	Spring Constant = Rigid lb/inch
.180	Guide	Spring Constant = Rigid lb/inch
.181	Guide	Spring Constant = Rigid lb/inch
.182	Guide	Spring Constant = Rigid lb/inch
.183	Guide	Spring Constant = Rigid lb/inch
.184	Guide	Spring Constant = Rigid lb/inch
.185	Guide	Spring Constant = Rigid lb/inch
.186	Guide	Spring Constant = Rigid lb/inch
.187	Guide	Spring Constant = Rigid lb/inch
.188	Guide	Spring Constant = Rigid lb/inch
.189	Guide	Spring Constant = Rigid lb/inch
.190	Guide	Spring Constant = Rigid lb/inch
.191	Guide	Spring Constant = Rigid lb/inch
.192	Guide	Spring Constant = Rigid lb/inch
.193	Guide	Spring Constant = Rigid lb/inch

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Point	Data	Description
.194	Anchor	Rigid in all directions
.196	Pipe	Pipe data identifier = 10 NPS Identifier = 10 DN Identifier = 250 Pipe schedule = STD Actual pipe O. D. = 10.75 inch Wall thickness = 0.36 inch Corrosion allowance = 0 inch Insulation thickness = 1.5 inch Insulation density = 8 lb/cu.ft Content S. G. = 1 Wind area O.D. = 0 inch
	Anchor	Rigid in all directions
.197	Bellows	Weight = 275.0000 lb Pressure thrust area = 325 sq.inch Longitudinal stiffness = 80.5 lb/inch Lateral stiffness (H) = Rigid lb/inch Lateral stiffness (V) = Rigid lb/inch Rotational stiff. (H) = Rigid lb-inch/deg Rotational stiff. (V) = Rigid lb-inch/deg Torsional stiffness = Rigid lb-inch/deg
.198	Guide	Spring Constant = Rigid lb/inch
.199	Guide	Spring Constant = Rigid lb/inch
.200	Guide	Spring Constant = Rigid lb/inch
.201	Guide	Spring Constant = Rigid lb/inch
.202	Guide	Spring Constant = Rigid lb/inch
.203	Guide	Spring Constant = Rigid lb/inch
.204	Guide	Spring Constant = Rigid lb/inch
.205	Guide	Spring Constant = Rigid lb/inch
.206	Guide	Spring Constant = Rigid lb/inch
.207	Guide	Spring Constant = Rigid lb/inch
.208	Guide	Spring Constant = Rigid lb/inch
.209	Guide	Spring Constant = Rigid lb/inch
.210	Guide	Spring Constant = Rigid lb/inch
.211	Guide	Spring Constant = Rigid lb/inch
.212	Guide	Spring Constant = Rigid lb/inch
.213	Guide	Spring Constant = Rigid lb/inch
.214	Guide	Spring Constant = Rigid lb/inch
.215	Guide	Spring Constant = Rigid lb/inch
.216	Guide	Spring Constant = Rigid lb/inch
.217	Guide	Spring Constant = Rigid lb/inch
.218	Guide	Spring Constant = Rigid lb/inch
.219	Guide	Spring Constant = Rigid lb/inch
.220	Guide	Spring Constant = Rigid lb/inch
.221	Guide	Spring Constant = Rigid lb/inch
.222	Guide	Spring Constant = Rigid lb/inch
.223	Anchor	Rigid in all directions

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Case number	Combination
1	D.W. + Pres1 + Ther1
2	D.W. + Pres1
3	Ther1

Piping Code: ASME B31.1 - 2007

*** Support Summary ***

Point Name	Global Direction	Forces(lb) or Moments(inch-lb) Sustain	Expansion Max	Expansion Min	Occasional Max	Occasional Min	Total Max	Total Min
.1	Fx	-32459	0	-390	0	0	-32459	-32850
	Fy	-130	0	0	0	0	-130	-130
	Mz	-575	0	0	0	0	-575	-575
.3	Fy	-297	0	0	0	0	-297	-297
.4	Fy	-12	0	0	0	0	-12	-12
.5	Fy	-338	0	0	0	0	-338	-338
.6	Fy	-405	0	0	0	0	-405	-405
.7	Fy	-391	0	0	0	0	-391	-391
.8	Fy	-394	0	0	0	0	-394	-394
.9	Fy	-393	0	0	0	0	-393	-393
.10	Fy	-394	0	0	0	0	-394	-394
.11	Fy	-393	0	0	0	0	-393	-393
.12	Fy	-393	0	0	0	0	-393	-393
.13	Fy	-393	0	0	0	0	-393	-393
.14	Fy	-393	0	0	0	0	-393	-393
.15	Fy	-393	0	0	0	0	-393	-393
.16	Fy	-393	0	0	0	0	-393	-393
.17	Fy	-393	0	0	0	0	-393	-393
VH554	Fx	5	0	-53	0	0	5	-47
	Fy	-155	0	0	0	0	-155	-155
	Mz	4532	0	0	0	0	4532	4532
.19	Fy	-348	0	0	0	0	-348	-348
.20	Fy	-405	0	0	0	0	-405	-405
.21	Fy	-390	0	0	0	0	-390	-390
.22	Fy	-394	0	0	0	0	-394	-394
.23	Fy	-393	0	0	0	0	-393	-393
.24	Fy	-394	0	0	0	0	-394	-394
.25	Fy	-393	0	0	0	0	-393	-393
.26	Fy	-393	0	0	0	0	-393	-393
.27	Fy	-393	0	0	0	0	-393	-393
.28	Fy	-393	0	0	0	0	-393	-393
.29	Fy	-394	0	0	0	0	-394	-394
.30	Fy	-393	0	0	0	0	-393	-393
.31	Fy	-394	0	0	0	0	-394	-394
.32	Fy	-390	0	0	0	0	-390	-390
.33	Fy	-406	0	0	0	0	-406	-406
.34	Fy	-338	0	0	0	0	-338	-338
VH555	Fx	43	0	-415	0	0	43	-372
	Fy	-430	0	0	0	0	-430	-430
	Mz	-1067	0	0	0	0	-1067	-1067
.38	Fy	-461	0	0	0	0	-461	-461
.39	Fy	-389	0	0	0	0	-389	-389
.40	Fy	-395	0	0	0	0	-395	-395
.41	Fy	-393	0	0	0	0	-393	-393
.42	Fy	-394	0	0	0	0	-394	-394
.43	Fy	-393	0	0	0	0	-393	-393
.44	Fy	-393	0	0	0	0	-393	-393
.45	Fy	-393	0	0	0	0	-393	-393
.46	Fy	-393	0	0	0	0	-393	-393
.47	Fy	-393	0	0	0	0	-393	-393
.48	Fy	-393	0	0	0	0	-393	-393
.49	Fy	-393	0	0	0	0	-393	-393
.50	Fy	-393	0	0	0	0	-393	-393

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*** Support Summary ***

Point Name	Global Direction	Forces(lb) or Moments(inch-lb) Sustain	Expansion Max	Expansion Min	Occasional Max	Occasional Min	Total Max	Total Min
.51	Fy	-393	0	0	0	0	-393	-393
.52	Fy	-393	0	0	0	0	-393	-393
.53	Fy	-393	0	0	0	0	-393	-393
.54	Fy	-393	0	0	0	0	-393	-393
.55	Fy	-393	0	0	0	0	-393	-393
.56	Fy	-393	0	0	0	0	-393	-393
.57	Fy	-393	0	0	0	0	-393	-393
.58	Fy	-393	0	0	0	0	-393	-393
.59	Fy	-393	0	0	0	0	-393	-393
.60	Fy	-393	0	0	0	0	-393	-393
.61	Fy	-393	0	0	0	0	-393	-393
.62	Fy	-393	0	0	0	0	-393	-393
.63	Fy	-393	0	0	0	0	-393	-393
.64	Fy	-393	0	0	0	0	-393	-393
.65	Fy	-393	0	0	0	0	-393	-393
.66	Fy	-393	0	0	0	0	-393	-393
.67	Fy	-393	0	0	0	0	-393	-393
VH556	Fx	0	0	-0	0	0	0	-0
	Fy	-393	0	0	0	0	-393	-393
.69	Fy	-393	0	0	0	0	-393	-393
.70	Fy	-393	0	0	0	0	-393	-393
.71	Fy	-393	0	0	0	0	-393	-393
.72	Fy	-393	0	0	0	0	-393	-393
.73	Fy	-393	0	0	0	0	-393	-393
.74	Fy	-393	0	0	0	0	-393	-393
.75	Fy	-393	0	0	0	0	-393	-393
.76	Fy	-393	0	0	0	0	-393	-393
.77	Fy	-393	0	0	0	0	-393	-393
.78	Fy	-393	0	0	0	0	-393	-393
.79	Fy	-393	0	0	0	0	-393	-393
.80	Fy	-393	0	0	0	0	-393	-393
.81	Fy	-393	0	0	0	0	-393	-393
.82	Fy	-393	0	0	0	0	-393	-393
.83	Fy	-393	0	0	0	0	-393	-393
.84	Fy	-393	0	0	0	0	-393	-393
.85	Fy	-393	0	0	0	0	-393	-393
.86	Fy	-393	0	0	0	0	-393	-393
.87	Fy	-393	0	0	0	0	-393	-393
.88	Fy	-393	0	0	0	0	-393	-393
.89	Fy	-393	0	0	0	0	-393	-393
.90	Fy	-393	0	0	0	0	-393	-393
.91	Fy	-393	0	0	0	0	-393	-393
.92	Fy	-393	0	0	0	0	-393	-393
.93	Fy	-394	0	0	0	0	-394	-394
.94	Fy	-393	0	0	0	0	-393	-393
.95	Fy	-394	0	0	0	0	-394	-394
.96	Fy	-390	0	0	0	0	-390	-390
.97	Fy	-406	0	0	0	0	-406	-406
.98	Fy	-338	0	0	0	0	-338	-338
VH557	Fx	-3	28	0	0	0	25	-3
	Fy	-493	0	0	0	0	-493	-493
	Mz	-2505	0	0	0	0	-2505	-2505
.102	Fy	-397	0	0	0	0	-397	-397

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*** Support Summary ***

Point Name	Global Direction	Forces(lb) or Moments(inch-lb) Sustain	Expansion Max	Expansion Min	Occasional Max	Occasional Min	Total Max	Total Min
.103	Fy	-390	0	0	0	0	-390	-390
.104	Fy	-394	0	0	0	0	-394	-394
.105	Fy	-393	0	0	0	0	-393	-393
.106	Fy	-394	0	0	0	0	-394	-394
.107	Fy	-393	0	0	0	0	-393	-393
.108	Fy	-393	0	0	0	0	-393	-393
.109	Fy	-393	0	0	0	0	-393	-393
.110	Fy	-393	0	0	0	0	-393	-393
.111	Fy	-393	0	0	0	0	-393	-393
.112	Fy	-393	0	0	0	0	-393	-393
.113	Fy	-393	0	0	0	0	-393	-393
.114	Fy	-393	0	0	0	0	-393	-393
.115	Fy	-393	0	0	0	0	-393	-393
.116	Fy	-393	0	0	0	0	-393	-393
.117	Fy	-393	0	0	0	0	-393	-393
.118	Fy	-393	0	0	0	0	-393	-393
.119	Fy	-393	0	0	0	0	-393	-393
.120	Fy	-393	0	0	0	0	-393	-393
.121	Fy	-393	0	0	0	0	-393	-393
.122	Fy	-393	0	0	0	0	-393	-393
.123	Fy	-393	0	0	0	0	-393	-393
.124	Fy	-393	0	0	0	0	-393	-393
.125	Fy	-393	0	0	0	0	-393	-393
.126	Fy	-393	0	0	0	0	-393	-393
.127	Fy	-393	0	0	0	0	-393	-393
.128	Fy	-393	0	0	0	0	-393	-393
.129	Fy	-393	0	0	0	0	-393	-393
.130	Fy	-393	0	0	0	0	-393	-393
vh563	Fx	3	0	-28	0	0	3	-25
	Fy	-393	0	0	0	0	-393	-393
.132	Fy	-393	0	0	0	0	-393	-393
.133	Fy	-393	0	0	0	0	-393	-393
.134	Fy	-393	0	0	0	0	-393	-393
.135	Fy	-393	0	0	0	0	-393	-393
.136	Fy	-393	0	0	0	0	-393	-393
.137	Fy	-393	0	0	0	0	-393	-393
.138	Fy	-393	0	0	0	0	-393	-393
.139	Fy	-393	0	0	0	0	-393	-393
.140	Fy	-393	0	0	0	0	-393	-393
.141	Fy	-393	0	0	0	0	-393	-393
.142	Fy	-393	0	0	0	0	-393	-393
.143	Fy	-393	0	0	0	0	-393	-393
.144	Fy	-393	0	0	0	0	-393	-393
.145	Fy	-393	0	0	0	0	-393	-393
.146	Fy	-393	0	0	0	0	-393	-393
.147	Fy	-393	0	0	0	0	-393	-393
.148	Fy	-393	0	0	0	0	-393	-393
.149	Fy	-393	0	0	0	0	-393	-393
.150	Fy	-393	0	0	0	0	-393	-393
.151	Fy	-393	0	0	0	0	-393	-393
.152	Fy	-393	0	0	0	0	-393	-393
.153	Fy	-393	0	0	0	0	-393	-393
.154	Fy	-393	0	0	0	0	-393	-393

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*** Support Summary ***

Point Name	Global Direction	Forces(lb) or Moments(inch-lb) Sustain	Expansion Max	Expansion Min	Occasional Max	Occasional Min	Total Max	Total Min
.155	Fy	-393	0	0	0	0	-393	-393
.156	Fy	-394	0	0	0	0	-394	-394
.157	Fy	-393	0	0	0	0	-393	-393
.158	Fy	-394	0	0	0	0	-394	-394
.159	Fy	-390	0	0	0	0	-390	-390
.160	Fy	-406	0	0	0	0	-406	-406
.161	Fy	-338	0	0	0	0	-338	-338
VH564	Fx	-3	28	0	0	0	25	-3
	Fy	-493	0	0	0	0	-493	-493
	Mz	-2505	0	0	0	0	-2505	-2505
.165	Fy	-397	0	0	0	0	-397	-397
.166	Fy	-390	0	0	0	0	-390	-390
.167	Fy	-394	0	0	0	0	-394	-394
.168	Fy	-393	0	0	0	0	-393	-393
.169	Fy	-394	0	0	0	0	-394	-394
.170	Fy	-393	0	0	0	0	-393	-393
.171	Fy	-393	0	0	0	0	-393	-393
.172	Fy	-393	0	0	0	0	-393	-393
.173	Fy	-393	0	0	0	0	-393	-393
.174	Fy	-393	0	0	0	0	-393	-393
.175	Fy	-393	0	0	0	0	-393	-393
.176	Fy	-393	0	0	0	0	-393	-393
.177	Fy	-393	0	0	0	0	-393	-393
.178	Fy	-393	0	0	0	0	-393	-393
.179	Fy	-393	0	0	0	0	-393	-393
.180	Fy	-393	0	0	0	0	-393	-393
.181	Fy	-393	0	0	0	0	-393	-393
.182	Fy	-393	0	0	0	0	-393	-393
.183	Fy	-393	0	0	0	0	-393	-393
.184	Fy	-393	0	0	0	0	-393	-393
.185	Fy	-393	0	0	0	0	-393	-393
.186	Fy	-393	0	0	0	0	-393	-393
.187	Fy	-393	0	0	0	0	-393	-393
.188	Fy	-393	0	0	0	0	-393	-393
.189	Fy	-393	0	0	0	0	-393	-393
.190	Fy	-393	0	0	0	0	-393	-393
.191	Fy	-393	0	0	0	0	-393	-393
.192	Fy	-393	0	0	0	0	-393	-393
.193	Fy	-393	0	0	0	0	-393	-393
.194	Fx	32414	830	0	0	0	33244	32414
	Fy	-197	0	0	0	0	-197	-197
	Mz	3935	0	0	0	0	3935	3935
.196	Fy	-298	0	0	0	0	-298	-298
	Fz	-32476	0	-718	0	0	-32476	-33194
	Mx	4042	0	0	0	0	4042	4042
.198	Fy	-646	0	0	0	0	-646	-646
.199	Fy	-779	0	0	0	0	-779	-779
.200	Fy	-785	0	0	0	0	-785	-785
.201	Fy	-783	0	0	0	0	-783	-783
.202	Fy	-783	0	0	0	0	-783	-783
.203	Fy	-783	0	0	0	0	-783	-783
.204	Fy	-783	0	0	0	0	-783	-783
.205	Fy	-783	0	0	0	0	-783	-783

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*** Support Summary ***

Point Name	Global Direction	Forces(lb) or Moments(inch-lb) Sustain	Expansion Max	Expansion Min	Occasional Max	Occasional Min	Total Max	Total Min
.206	Fy	-783	0	0	0	0	-783	-783
.207	Fy	-783	0	0	0	0	-783	-783
.208	Fy	-783	0	0	0	0	-783	-783
.209	Fy	-783	0	0	0	0	-783	-783
.210	Fy	-783	0	0	0	0	-783	-783
.211	Fy	-783	0	0	0	0	-783	-783
.212	Fy	-783	0	0	0	0	-783	-783
.213	Fy	-783	0	0	0	0	-783	-783
.214	Fy	-783	0	0	0	0	-783	-783
.215	Fy	-783	0	0	0	0	-783	-783
.216	Fy	-783	0	0	0	0	-783	-783
.217	Fy	-783	0	0	0	0	-783	-783
.218	Fy	-783	0	0	0	0	-783	-783
.219	Fy	-783	0	0	0	0	-783	-783
.220	Fy	-783	0	0	0	0	-783	-783
.221	Fy	-783	0	0	0	0	-783	-783
.222	Fy	-783	0	0	0	0	-783	-783
.223	Fy	-392	0	0	0	0	-392	-392
	Fz	32476	718	0	0	0	33194	32476
	Mx	-7834	0	0	0	0	-7834	-7834

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Deflections ***

Point Name	Displacements (inch) X	Y	Z	Rotations (degree) X	Y	Z
.1	-0.000	-0.000	0.000	0.000	0.000	-0.000
VH545	0.031	-0.000	0.000	0.000	0.000	0.000
.3	-4.315	-0.000	0.000	0.000	0.000	0.000
.4	-4.157	-0.000	0.000	0.000	0.000	0.001
.5	-4.094	-0.000	0.000	0.000	0.000	-0.002
.6	-3.779	-0.000	0.000	0.000	0.000	0.000
.7	-3.464	-0.000	0.000	0.000	0.000	-0.000
.8	-3.149	-0.000	0.000	0.000	0.000	0.000
.9	-2.834	-0.000	0.000	0.000	0.000	-0.000
.10	-2.519	-0.000	0.000	0.000	0.000	0.000
.11	-2.205	-0.000	0.000	0.000	0.000	-0.000
.12	-1.890	-0.000	0.000	0.000	0.000	0.000
.13	-1.575	-0.000	0.000	0.000	0.000	-0.000
.14	-1.260	-0.000	0.000	0.000	0.000	0.000
.15	-0.945	-0.000	0.000	0.000	0.000	-0.000
.16	-0.630	-0.000	0.000	0.000	0.000	-0.000
.17	-0.315	-0.000	0.000	0.000	0.000	0.000
VH554	-0.000	-0.000	0.000	0.000	0.000	0.000
.19	0.094	-0.000	0.000	0.000	0.000	-0.002
.20	0.409	-0.000	0.000	0.000	0.000	0.000
.21	0.724	-0.000	0.000	0.000	0.000	-0.000
.22	1.039	-0.000	0.000	0.000	0.000	0.000
.23	1.354	-0.000	0.000	0.000	0.000	-0.000
.24	1.669	-0.000	0.000	0.000	0.000	0.000
.25	1.984	-0.000	0.000	0.000	0.000	-0.000
.26	2.299	-0.000	0.000	0.000	0.000	0.000
.27	2.614	-0.000	0.000	0.000	0.000	-0.000
.28	2.928	-0.000	0.000	0.000	0.000	0.000
.29	3.243	-0.000	0.000	0.000	0.000	-0.000
.30	3.558	-0.000	0.000	0.000	0.000	0.000
.31	3.873	-0.000	0.000	0.000	0.000	-0.000
.32	4.188	-0.000	0.000	0.000	0.000	0.000
.33	4.503	-0.000	0.000	0.000	0.000	-0.001
.34	4.818	-0.000	0.000	0.000	0.000	0.002
.35	4.934	-0.000	0.000	0.000	0.000	-0.000
VH555	-0.000	-0.000	0.000	0.000	0.000	-0.000
.37	0.116	-0.001	0.000	0.000	0.000	0.001
.38	-9.434	-0.000	0.000	0.000	0.000	0.001
.39	-9.119	-0.000	0.000	0.000	0.000	-0.000
.40	-8.805	-0.000	0.000	0.000	0.000	0.000
.41	-8.490	-0.000	0.000	0.000	0.000	-0.000
.42	-8.176	-0.000	0.000	0.000	0.000	0.000
.43	-7.862	-0.000	0.000	0.000	0.000	-0.000
.44	-7.547	-0.000	0.000	0.000	0.000	0.000
.45	-7.233	-0.000	0.000	0.000	0.000	-0.000
.46	-6.918	-0.000	0.000	0.000	0.000	0.000
.47	-6.604	-0.000	0.000	0.000	0.000	-0.000
.48	-6.289	-0.000	0.000	0.000	0.000	0.000
.49	-5.975	-0.000	0.000	0.000	0.000	-0.000
.50	-5.660	-0.000	0.000	0.000	0.000	0.000
.51	-5.346	-0.000	0.000	0.000	0.000	-0.000
.52	-5.031	-0.000	0.000	0.000	0.000	0.000
.53	-4.717	-0.000	0.000	0.000	0.000	-0.000
.54	-4.402	-0.000	0.000	0.000	0.000	0.000
.55	-4.088	-0.000	0.000	0.000	0.000	-0.000
.56	-3.774	-0.000	0.000	0.000	0.000	0.000

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Deflections ***

Point Name	Displacements(inch) X	Y	Z	Rotations(degree) X	Y	Z
.57	-3.459	-0.000	0.000	0.000	0.000	-0.000
.58	-3.145	-0.000	0.000	0.000	0.000	0.000
.59	-2.830	-0.000	0.000	0.000	0.000	-0.000
.60	-2.516	-0.000	0.000	0.000	0.000	0.000
.61	-2.201	-0.000	0.000	0.000	0.000	-0.000
.62	-1.887	-0.000	0.000	0.000	0.000	-0.000
.63	-1.572	-0.000	0.000	0.000	0.000	0.000
.64	-1.258	-0.000	0.000	0.000	0.000	-0.000
.65	-0.943	-0.000	0.000	0.000	0.000	-0.000
.66	-0.629	-0.000	0.000	0.000	0.000	-0.000
.67	-0.314	-0.000	0.000	0.000	0.000	-0.000
VH556	-0.000	-0.000	0.000	0.000	0.000	-0.000
.69	0.314	-0.000	0.000	0.000	0.000	-0.000
.70	0.629	-0.000	0.000	0.000	0.000	0.000
.71	0.943	-0.000	0.000	0.000	0.000	-0.000
.72	1.258	-0.000	0.000	0.000	0.000	0.000
.73	1.572	-0.000	0.000	0.000	0.000	-0.000
.74	1.887	-0.000	0.000	0.000	0.000	0.000
.75	2.201	-0.000	0.000	0.000	0.000	-0.000
.76	2.516	-0.000	0.000	0.000	0.000	0.000
.77	2.830	-0.000	0.000	0.000	0.000	-0.000
.78	3.145	-0.000	0.000	0.000	0.000	0.000
.79	3.459	-0.000	0.000	0.000	0.000	-0.000
.80	3.774	-0.000	0.000	0.000	0.000	0.000
.81	4.088	-0.000	0.000	0.000	0.000	-0.000
.82	4.402	-0.000	0.000	0.000	0.000	0.000
.83	4.717	-0.000	0.000	0.000	0.000	-0.000
.84	5.031	-0.000	0.000	0.000	0.000	0.000
.85	5.346	-0.000	0.000	0.000	0.000	-0.000
.86	5.660	-0.000	0.000	0.000	0.000	0.000
.87	5.975	-0.000	0.000	0.000	0.000	-0.000
.88	6.289	-0.000	0.000	0.000	0.000	0.000
.89	6.604	-0.000	0.000	0.000	0.000	-0.000
.90	6.918	-0.000	0.000	0.000	0.000	0.000
.91	7.233	-0.000	0.000	0.000	0.000	-0.000
.92	7.547	-0.000	0.000	0.000	0.000	0.000
.93	7.862	-0.000	0.000	0.000	0.000	-0.000
.94	8.176	-0.000	0.000	0.000	0.000	0.000
.95	8.490	-0.000	0.000	0.000	0.000	-0.000
.96	8.805	-0.000	0.000	0.000	0.000	0.000
.97	9.119	-0.000	0.000	0.000	0.000	-0.001
.98	9.434	-0.000	0.000	0.000	0.000	0.002
.99	9.550	-0.000	0.000	0.000	0.000	-0.000
VH557	0.000	-0.000	0.000	0.000	0.000	-0.000
.101	0.116	-0.001	0.000	0.000	0.000	0.001
.102	-9.120	-0.000	0.000	0.000	0.000	0.001
.103	-8.806	-0.000	0.000	0.000	0.000	-0.000
.104	-8.491	-0.000	0.000	0.000	0.000	0.000
.105	-8.177	-0.000	0.000	0.000	0.000	-0.000
.106	-7.862	-0.000	0.000	0.000	0.000	0.000
.107	-7.548	-0.000	0.000	0.000	0.000	-0.000
.108	-7.233	-0.000	0.000	0.000	0.000	0.000
.109	-6.919	-0.000	0.000	0.000	0.000	-0.000
.110	-6.604	-0.000	0.000	0.000	0.000	-0.000
.111	-6.290	-0.000	0.000	0.000	0.000	0.000
.112	-5.975	-0.000	0.000	0.000	0.000	-0.000

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Deflections ***

Point Name	Displacements(inch) X	Y	Z	Rotations(degree) X	Y	Z
.113	-5.661	-0.000	0.000	0.000	0.000	0.000
.114	-5.346	-0.000	0.000	0.000	0.000	-0.000
.115	-5.032	-0.000	0.000	0.000	0.000	0.000
.116	-4.717	-0.000	0.000	0.000	0.000	-0.000
.117	-4.403	-0.000	0.000	0.000	0.000	0.000
.118	-4.088	-0.000	0.000	0.000	0.000	-0.000
.119	-3.774	-0.000	0.000	0.000	0.000	0.000
.120	-3.459	-0.000	0.000	0.000	0.000	-0.000
.121	-3.145	-0.000	0.000	0.000	0.000	0.000
.122	-2.830	-0.000	0.000	0.000	0.000	-0.000
.123	-2.516	-0.000	0.000	0.000	0.000	0.000
.124	-2.201	-0.000	0.000	0.000	0.000	-0.000
.125	-1.887	-0.000	0.000	0.000	0.000	0.000
.126	-1.572	-0.000	0.000	0.000	0.000	-0.000
.127	-1.258	-0.000	0.000	0.000	0.000	0.000
.128	-0.943	-0.000	0.000	0.000	0.000	-0.000
.129	-0.629	-0.000	0.000	0.000	0.000	-0.000
.130	-0.314	-0.000	0.000	0.000	0.000	-0.000
vh563	-0.000	-0.000	0.000	0.000	0.000	-0.000
.132	0.314	-0.000	0.000	0.000	0.000	-0.000
.133	0.629	-0.000	0.000	0.000	0.000	-0.000
.134	0.943	-0.000	0.000	0.000	0.000	-0.000
.135	1.258	-0.000	0.000	0.000	0.000	-0.000
.136	1.572	-0.000	0.000	0.000	0.000	0.000
.137	1.887	-0.000	0.000	0.000	0.000	-0.000
.138	2.201	-0.000	0.000	0.000	0.000	0.000
.139	2.516	-0.000	0.000	0.000	0.000	0.000
.140	2.830	-0.000	0.000	0.000	0.000	-0.000
.141	3.145	-0.000	0.000	0.000	0.000	0.000
.142	3.459	-0.000	0.000	0.000	0.000	-0.000
.143	3.774	-0.000	0.000	0.000	0.000	0.000
.144	4.088	-0.000	0.000	0.000	0.000	-0.000
.145	4.402	-0.000	0.000	0.000	0.000	0.000
.146	4.717	-0.000	0.000	0.000	0.000	-0.000
.147	5.031	-0.000	0.000	0.000	0.000	0.000
.148	5.346	-0.000	0.000	0.000	0.000	-0.000
.149	5.660	-0.000	0.000	0.000	0.000	0.000
.150	5.975	-0.000	0.000	0.000	0.000	-0.000
.151	6.289	-0.000	0.000	0.000	0.000	0.000
.152	6.604	-0.000	0.000	0.000	0.000	-0.000
.153	6.918	-0.000	0.000	0.000	0.000	0.000
.154	7.233	-0.000	0.000	0.000	0.000	-0.000
.155	7.547	-0.000	0.000	0.000	0.000	0.000
.156	7.862	-0.000	0.000	0.000	0.000	-0.000
.157	8.176	-0.000	0.000	0.000	0.000	0.000
.158	8.490	-0.000	0.000	0.000	0.000	-0.000
.159	8.805	-0.000	0.000	0.000	0.000	0.000
.160	9.119	-0.000	0.000	0.000	0.000	-0.001
.161	9.434	-0.000	0.000	0.000	0.000	0.002
.162	9.550	-0.000	0.000	0.000	0.000	-0.000
VH564	0.000	-0.000	0.000	0.000	0.000	-0.000
.164	0.116	-0.001	0.000	0.000	0.000	0.001
.165	-9.120	-0.000	0.000	0.000	0.000	0.001
.166	-8.806	-0.000	0.000	0.000	0.000	-0.000
.167	-8.491	-0.000	0.000	0.000	0.000	0.000
.168	-8.177	-0.000	0.000	0.000	0.000	-0.000

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Deflections ***

Point Name	Displacements (inch) X	Y	Z	Rotations (degree) X	Y	Z
.169	-7.862	-0.000	0.000	0.000	0.000	0.000
.170	-7.548	-0.000	0.000	0.000	0.000	-0.000
.171	-7.233	-0.000	0.000	0.000	0.000	0.000
.172	-6.919	-0.000	0.000	0.000	0.000	-0.000
.173	-6.604	-0.000	0.000	0.000	0.000	0.000
.174	-6.290	-0.000	0.000	0.000	0.000	-0.000
.175	-5.975	-0.000	0.000	0.000	0.000	0.000
.176	-5.661	-0.000	0.000	0.000	0.000	-0.000
.177	-5.346	-0.000	0.000	0.000	0.000	0.000
.178	-5.032	-0.000	0.000	0.000	0.000	-0.000
.179	-4.717	-0.000	0.000	0.000	0.000	0.000
.180	-4.403	-0.000	0.000	0.000	0.000	-0.000
.181	-4.088	-0.000	0.000	0.000	0.000	0.000
.182	-3.774	-0.000	0.000	0.000	0.000	-0.000
.183	-3.459	-0.000	0.000	0.000	0.000	0.000
.184	-3.145	-0.000	0.000	0.000	0.000	-0.000
.185	-2.830	-0.000	0.000	0.000	0.000	0.000
.186	-2.516	-0.000	0.000	0.000	0.000	-0.000
.187	-2.201	-0.000	0.000	0.000	0.000	0.000
.188	-1.887	-0.000	0.000	0.000	0.000	-0.000
.189	-1.572	-0.000	0.000	0.000	0.000	0.000
.190	-1.258	-0.000	0.000	0.000	0.000	-0.000
.191	-0.943	-0.000	0.000	0.000	0.000	0.000
.192	-0.629	-0.000	0.000	0.000	0.000	-0.000
.193	-0.314	-0.000	0.000	0.000	0.000	0.000
.194	0.000	-0.000	0.000	0.000	0.000	0.000
.196	0.000	-0.000	-0.000	0.000	0.000	0.000
.197	0.000	-0.000	0.119	-0.000	0.000	0.000
.198	0.000	-0.000	-8.501	-0.000	0.000	0.000
.199	0.000	-0.000	-8.161	0.000	0.000	0.000
.200	0.000	-0.000	-7.821	-0.000	0.000	0.000
.201	0.000	-0.000	-7.481	0.000	0.000	0.000
.202	0.000	-0.000	-7.141	-0.000	0.000	0.000
.203	0.000	-0.000	-6.801	0.000	0.000	0.000
.204	0.000	-0.000	-6.461	-0.000	0.000	0.000
.205	0.000	-0.000	-6.121	0.000	0.000	0.000
.206	0.000	-0.000	-5.781	-0.000	0.000	0.000
.207	0.000	-0.000	-5.441	0.000	0.000	0.000
.208	0.000	-0.000	-5.101	-0.000	0.000	0.000
.209	0.000	-0.000	-4.761	0.000	0.000	0.000
.210	0.000	-0.000	-4.420	-0.000	0.000	0.000
.211	0.000	-0.000	-4.080	0.000	0.000	0.000
.212	0.000	-0.000	-3.740	-0.000	0.000	0.000
.213	0.000	-0.000	-3.400	0.000	0.000	0.000
.214	0.000	-0.000	-3.060	-0.000	0.000	0.000
.215	0.000	-0.000	-2.720	0.000	0.000	0.000
.216	0.000	-0.000	-2.380	-0.000	0.000	0.000
.217	0.000	-0.000	-2.040	0.000	0.000	0.000
.218	0.000	-0.000	-1.700	-0.000	0.000	0.000
.219	0.000	-0.000	-1.360	0.000	0.000	0.000
.220	0.000	-0.000	-1.020	-0.000	0.000	0.000
.221	0.000	-0.000	-0.680	0.000	0.000	0.000
.222	0.000	-0.000	-0.340	-0.000	0.000	0.000
.223	0.000	-0.000	0.000	-0.000	0.000	0.000

Load : Dead Weight + Pressure 1 + Thermal 1

*** Forces and Moments acting on Restraints ***

Point Name	Forces(lb) X	Y	Z	Moments(inch-lb) X	Y	Z
.1	-32850	-130	0	0	0	-575
.3	0	-297	0	0	0	0
.4	0	-12	0	0	0	0
.5	0	-338	0	0	0	0
.6	0	-405	0	0	0	0
.7	0	-391	0	0	0	0
.8	0	-394	0	0	0	0
.9	0	-393	0	0	0	0
.10	0	-394	0	0	0	0
.11	0	-393	0	0	0	0
.12	0	-393	0	0	0	0
.13	0	-393	0	0	0	0
.14	0	-393	0	0	0	0
.15	0	-393	0	0	0	0
.16	0	-393	0	0	0	0
.17	0	-393	0	0	0	0
VH554	-47	-155	0	0	0	4532
.19	0	-348	0	0	0	0
.20	0	-405	0	0	0	0
.21	0	-390	0	0	0	0
.22	0	-394	0	0	0	0
.23	0	-393	0	0	0	0
.24	0	-394	0	0	0	0
.25	0	-393	0	0	0	0
.26	0	-393	0	0	0	0
.27	0	-393	0	0	0	0
.28	0	-393	0	0	0	0
.29	0	-394	0	0	0	0
.30	0	-393	0	0	0	0
.31	0	-394	0	0	0	0
.32	0	-390	0	0	0	0
.33	0	-406	0	0	0	0
.34	0	-338	0	0	0	0
VH555	-372	-430	0	0	0	-1067
.38	0	-461	0	0	0	0
.39	0	-389	0	0	0	0
.40	0	-395	0	0	0	0
.41	0	-393	0	0	0	0
.42	0	-394	0	0	0	0
.43	0	-393	0	0	0	0
.44	0	-393	0	0	0	0
.45	0	-393	0	0	0	0
.46	0	-393	0	0	0	0
.47	0	-393	0	0	0	0
.48	0	-393	0	0	0	0
.49	0	-393	0	0	0	0
.50	0	-393	0	0	0	0
.51	0	-393	0	0	0	0
.52	0	-393	0	0	0	0
.53	0	-393	0	0	0	0
.54	0	-393	0	0	0	0
.55	0	-393	0	0	0	0
.56	0	-393	0	0	0	0
.57	0	-393	0	0	0	0
.58	0	-393	0	0	0	0
.59	0	-393	0	0	0	0

Load : Dead Weight + Pressure 1 + Thermal 1

*** Forces and Moments acting on Restraints ***

Point Name	Forces(lb) X	Y	Z	Moments(inch-lb) X	Y	Z
.60	0	-393	0	0	0	0
.61	0	-393	0	0	0	0
.62	0	-393	0	0	0	0
.63	0	-393	0	0	0	0
.64	0	-393	0	0	0	0
.65	0	-393	0	0	0	0
.66	0	-393	0	0	0	0
.67	0	-393	0	0	0	0
VH556	-0	-393	0	0	0	-0
.69	0	-393	0	0	0	0
.70	0	-393	0	0	0	0
.71	0	-393	0	0	0	0
.72	0	-393	0	0	0	0
.73	0	-393	0	0	0	0
.74	0	-393	0	0	0	0
.75	0	-393	0	0	0	0
.76	0	-393	0	0	0	0
.77	0	-393	0	0	0	0
.78	0	-393	0	0	0	0
.79	0	-393	0	0	0	0
.80	0	-393	0	0	0	0
.81	0	-393	0	0	0	0
.82	0	-393	0	0	0	0
.83	0	-393	0	0	0	0
.84	0	-393	0	0	0	0
.85	0	-393	0	0	0	0
.86	0	-393	0	0	0	0
.87	0	-393	0	0	0	0
.88	0	-393	0	0	0	0
.89	0	-393	0	0	0	0
.90	0	-393	0	0	0	0
.91	0	-393	0	0	0	0
.92	0	-393	0	0	0	0
.93	0	-394	0	0	0	0
.94	0	-393	0	0	0	0
.95	0	-394	0	0	0	0
.96	0	-390	0	0	0	0
.97	0	-406	0	0	0	0
.98	0	-338	0	0	0	0
VH557	25	-493	0	0	0	-2505
.102	0	-397	0	0	0	0
.103	0	-390	0	0	0	0
.104	0	-394	0	0	0	0
.105	0	-393	0	0	0	0
.106	0	-394	0	0	0	0
.107	0	-393	0	0	0	0
.108	0	-393	0	0	0	0
.109	0	-393	0	0	0	0
.110	0	-393	0	0	0	0
.111	0	-393	0	0	0	0
.112	0	-393	0	0	0	0
.113	0	-393	0	0	0	0
.114	0	-393	0	0	0	0
.115	0	-393	0	0	0	0
.116	0	-393	0	0	0	0
.117	0	-393	0	0	0	0

Load : Dead Weight + Pressure 1 + Thermal 1

*** Forces and Moments acting on Restraints ***

Point Name	Forces(lb) X	Y	Z	Moments(inch-lb) X	Y	Z
.118	0	-393	0	0	0	0
.119	0	-393	0	0	0	0
.120	0	-393	0	0	0	0
.121	0	-393	0	0	0	0
.122	0	-393	0	0	0	0
.123	0	-393	0	0	0	0
.124	0	-393	0	0	0	0
.125	0	-393	0	0	0	0
.126	0	-393	0	0	0	0
.127	0	-393	0	0	0	0
.128	0	-393	0	0	0	0
.129	0	-393	0	0	0	0
.130	0	-393	0	0	0	0
vh563	-25	-393	0	0	0	-0
.132	0	-393	0	0	0	0
.133	0	-393	0	0	0	0
.134	0	-393	0	0	0	0
.135	0	-393	0	0	0	0
.136	0	-393	0	0	0	0
.137	0	-393	0	0	0	0
.138	0	-393	0	0	0	0
.139	0	-393	0	0	0	0
.140	0	-393	0	0	0	0
.141	0	-393	0	0	0	0
.142	0	-393	0	0	0	0
.143	0	-393	0	0	0	0
.144	0	-393	0	0	0	0
.145	0	-393	0	0	0	0
.146	0	-393	0	0	0	0
.147	0	-393	0	0	0	0
.148	0	-393	0	0	0	0
.149	0	-393	0	0	0	0
.150	0	-393	0	0	0	0
.151	0	-393	0	0	0	0
.152	0	-393	0	0	0	0
.153	0	-393	0	0	0	0
.154	0	-393	0	0	0	0
.155	0	-393	0	0	0	0
.156	0	-394	0	0	0	0
.157	0	-393	0	0	0	0
.158	0	-394	0	0	0	0
.159	0	-390	0	0	0	0
.160	0	-406	0	0	0	0
.161	0	-338	0	0	0	0
VH564	25	-493	0	0	0	-2505
.165	0	-397	0	0	0	0
.166	0	-390	0	0	0	0
.167	0	-394	0	0	0	0
.168	0	-393	0	0	0	0
.169	0	-394	0	0	0	0
.170	0	-393	0	0	0	0
.171	0	-393	0	0	0	0
.172	0	-393	0	0	0	0
.173	0	-393	0	0	0	0
.174	0	-393	0	0	0	0
.175	0	-393	0	0	0	0

Load : Dead Weight + Pressure 1 + Thermal 1

*** Forces and Moments acting on Restraints ***

Point Name	Forces(lb) X	Y	Z	Moments(inch-lb) X	Y	Z
.176	0	-393	0	0	0	0
.177	0	-393	0	0	0	0
.178	0	-393	0	0	0	0
.179	0	-393	0	0	0	0
.180	0	-393	0	0	0	0
.181	0	-393	0	0	0	0
.182	0	-393	0	0	0	0
.183	0	-393	0	0	0	0
.184	0	-393	0	0	0	0
.185	0	-393	0	0	0	0
.186	0	-393	0	0	0	0
.187	0	-393	0	0	0	0
.188	0	-393	0	0	0	0
.189	0	-393	0	0	0	0
.190	0	-393	0	0	0	0
.191	0	-393	0	0	0	0
.192	0	-393	0	0	0	0
.193	0	-393	0	0	0	0
.194	33244	-197	0	0	0	3935
.196	0	-298	-33194	4042	0	0
.198	0	-646	0	0	0	0
.199	0	-779	0	0	0	0
.200	0	-785	0	0	0	0
.201	0	-783	0	0	0	0
.202	0	-783	0	0	0	0
.203	0	-783	0	0	0	0
.204	0	-783	0	0	0	0
.205	0	-783	0	0	0	0
.206	0	-783	0	0	0	0
.207	0	-783	0	0	0	0
.208	0	-783	0	0	0	0
.209	0	-783	0	0	0	0
.210	0	-783	0	0	0	0
.211	0	-783	0	0	0	0
.212	0	-783	0	0	0	0
.213	0	-783	0	0	0	0
.214	0	-783	0	0	0	0
.215	0	-783	0	0	0	0
.216	0	-783	0	0	0	0
.217	0	-783	0	0	0	0
.218	0	-783	0	0	0	0
.219	0	-783	0	0	0	0
.220	0	-783	0	0	0	0
.221	0	-783	0	0	0	0
.222	0	-783	0	0	0	0
.223	0	-392	33194	-7834	0	0

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
.1	1.00	1.00	7.79	3040	7411	7411	1614	41000	3
VH545	1.00	1.00	7.79	3040	7434	7434	1637	41000	3
.3	1.00	1.00	7.79	3040	7505	7505	1708	41000	4
.4	1.00	1.00	7.79	3040	7391	7391	1595	41000	3
.4	1.00	1.00	7.79	3040	7391	7391	1595	41000	3
.5	1.00	1.00	7.79	3040	7734	7734	1937	41000	4
.5	1.00	1.00	7.79	3040	7734	7734	1937	41000	4
.6	1.00	1.00	7.79	3040	7870	7870	2073	41000	5
.6	1.00	1.00	7.79	3040	7870	7870	2073	41000	5
.7	1.00	1.00	7.79	3040	7835	7835	2038	41000	4
.7	1.00	1.00	7.79	3040	7835	7835	2038	41000	4
.8	1.00	1.00	7.79	3040	7844	7844	2047	41000	4
.8	1.00	1.00	7.79	3040	7844	7844	2047	41000	4
.9	1.00	1.00	7.79	3040	7841	7841	2045	41000	4
.9	1.00	1.00	7.79	3040	7841	7841	2045	41000	4
.10	1.00	1.00	7.79	3040	7842	7842	2045	41000	4
.10	1.00	1.00	7.79	3040	7842	7842	2045	41000	4
.11	1.00	1.00	7.79	3040	7842	7842	2045	41000	4
.11	1.00	1.00	7.79	3040	7842	7842	2045	41000	4
.12	1.00	1.00	7.79	3040	7842	7842	2045	41000	4
.12	1.00	1.00	7.79	3040	7842	7842	2045	41000	4
.13	1.00	1.00	7.79	3040	7842	7842	2045	41000	4
.13	1.00	1.00	7.79	3040	7842	7842	2045	41000	4
.14	1.00	1.00	7.79	3040	7842	7842	2045	41000	4
.14	1.00	1.00	7.79	3040	7842	7842	2045	41000	4
.15	1.00	1.00	7.79	3040	7842	7842	2045	41000	4
.15	1.00	1.00	7.79	3040	7842	7842	2045	41000	4
.16	1.00	1.00	7.79	3040	7842	7842	2045	41000	4
.16	1.00	1.00	7.79	3040	7842	7842	2045	41000	4
.17	1.00	1.00	7.79	3040	7842	7842	2045	41000	4
.17	1.00	1.00	7.79	3040	7842	7842	2045	41000	4
VH554	1.00	1.00	7.79	3040	7842	7842	2045	41000	4
VH554	1.00	1.00	7.79	3040	7426	7426	1617	41000	3
.19	1.00	1.00	7.79	3040	7741	7741	1931	41000	4
.19	1.00	1.00	7.79	3040	7741	7741	1931	41000	4
.20	1.00	1.00	7.79	3040	7884	7884	2075	41000	5
.20	1.00	1.00	7.79	3040	7884	7884	2075	41000	5
.21	1.00	1.00	7.79	3040	7847	7847	2038	41000	4
.21	1.00	1.00	7.79	3040	7847	7847	2038	41000	4
.22	1.00	1.00	7.79	3040	7857	7857	2047	41000	4
.22	1.00	1.00	7.79	3040	7857	7857	2047	41000	4
.23	1.00	1.00	7.79	3040	7854	7854	2045	41000	4
.23	1.00	1.00	7.79	3040	7854	7854	2045	41000	4
.24	1.00	1.00	7.79	3040	7855	7855	2045	41000	4
.24	1.00	1.00	7.79	3040	7855	7855	2045	41000	4
.25	1.00	1.00	7.79	3040	7855	7855	2045	41000	4
.25	1.00	1.00	7.79	3040	7855	7855	2045	41000	4
.26	1.00	1.00	7.79	3040	7855	7855	2045	41000	4
.26	1.00	1.00	7.79	3040	7855	7855	2045	41000	4
.27	1.00	1.00	7.79	3040	7855	7855	2045	41000	4
.27	1.00	1.00	7.79	3040	7855	7855	2045	41000	4
.28	1.00	1.00	7.79	3040	7855	7855	2045	41000	4
.28	1.00	1.00	7.79	3040	7855	7855	2045	41000	4
.29	1.00	1.00	7.79	3040	7855	7855	2045	41000	4
.29	1.00	1.00	7.79	3040	7855	7855	2045	41000	4

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
.30	1.00	1.00	7.79	3040	7854	7854	2045	41000	4
.30	1.00	1.00	7.79	3040	7854	7854	2045	41000	4
.31	1.00	1.00	7.79	3040	7857	7857	2047	41000	4
.31	1.00	1.00	7.79	3040	7857	7857	2047	41000	4
.32	1.00	1.00	7.79	3040	7847	7847	2037	41000	4
.32	1.00	1.00	7.79	3040	7847	7847	2037	41000	4
.33	1.00	1.00	7.79	3040	7886	7886	2076	41000	5
.33	1.00	1.00	7.79	3040	7886	7886	2076	41000	5
.34	1.00	1.00	7.79	3040	7735	7735	1926	41000	4
.34	1.00	1.00	7.79	3040	7735	7735	1926	41000	4
.35	1.00	1.00	7.79	3040	7407	7407	1598	41000	3
VH555	1.00	1.00	7.79	3040	7733	7733	1824	41000	4
.37	1.00	1.00	7.79	3040	7661	7661	1753	41000	4
.38	1.00	1.00	7.79	3040	7996	7996	2087	41000	5
.39	1.00	1.00	7.79	3040	7943	7943	2034	41000	4
.39	1.00	1.00	7.79	3040	7943	7943	2034	41000	4
.40	1.00	1.00	7.79	3040	7957	7957	2048	41000	4
.40	1.00	1.00	7.79	3040	7957	7957	2048	41000	4
.41	1.00	1.00	7.79	3040	7953	7953	2045	41000	4
.41	1.00	1.00	7.79	3040	7953	7953	2045	41000	4
.42	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.42	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.43	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.43	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.44	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.44	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.45	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.45	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.46	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.46	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.47	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.47	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.48	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.48	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.49	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.49	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.50	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.50	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.51	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.51	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.52	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.52	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.53	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.53	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.54	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.54	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.55	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.55	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.56	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.56	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.57	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.57	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.58	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.58	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.59	1.00	1.00	7.79	3040	7954	7954	2045	41000	4

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
.59	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.60	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.60	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.61	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.61	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.62	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.62	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.63	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.63	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.64	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.64	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.65	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.65	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.66	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.66	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.67	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.67	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
VH556	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
VH556	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.69	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.69	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.70	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.70	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.71	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.71	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.72	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.72	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.73	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.73	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.74	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.74	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.75	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.75	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.76	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.76	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.77	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.77	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.78	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.78	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.79	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.79	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.80	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.80	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.81	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.81	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.82	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.82	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.83	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.83	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.84	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.84	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.85	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.85	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.86	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.86	1.00	1.00	7.79	3040	7954	7954	2045	41000	4

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
.87	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.87	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.88	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.88	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.89	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.89	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.90	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.90	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.91	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.91	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.92	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.92	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.93	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.93	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.94	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.94	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.95	1.00	1.00	7.79	3040	7956	7956	2047	41000	4
.95	1.00	1.00	7.79	3040	7956	7956	2047	41000	4
.96	1.00	1.00	7.79	3040	7946	7946	2037	41000	4
.96	1.00	1.00	7.79	3040	7946	7946	2037	41000	4
.97	1.00	1.00	7.79	3040	7985	7985	2076	41000	5
.97	1.00	1.00	7.79	3040	7985	7985	2076	41000	5
.98	1.00	1.00	7.79	3040	7835	7835	1926	41000	4
.98	1.00	1.00	7.79	3040	7835	7835	1926	41000	4
.99	1.00	1.00	7.79	3040	7507	7507	1598	41000	3
VH557	1.00	1.00	7.79	3040	7911	7911	2008	41000	4
.101	1.00	1.00	7.79	3040	7829	7829	1927	41000	4
.102	1.00	1.00	7.79	3040	7983	7983	2081	41000	5
.103	1.00	1.00	7.79	3040	7938	7938	2036	41000	4
.103	1.00	1.00	7.79	3040	7938	7938	2036	41000	4
.104	1.00	1.00	7.79	3040	7950	7950	2048	41000	4
.104	1.00	1.00	7.79	3040	7950	7950	2048	41000	4
.105	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.105	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.106	1.00	1.00	7.79	3040	7948	7948	2045	41000	4
.106	1.00	1.00	7.79	3040	7948	7948	2045	41000	4
.107	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.107	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.108	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.108	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.109	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.109	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.110	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.110	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.111	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.111	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.112	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.112	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.113	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.113	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.114	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.114	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.115	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.115	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.116	1.00	1.00	7.79	3040	7947	7947	2045	41000	4

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
.116	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.117	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.117	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.118	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.118	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.119	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.119	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.120	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.120	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.121	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.121	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.122	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.122	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.123	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.123	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.124	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.124	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.125	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.125	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.126	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.126	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.127	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.127	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.128	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.128	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.129	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.129	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.130	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.130	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
vh563	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
vh563	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.132	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.132	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.133	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.133	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.134	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.134	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.135	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.135	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.136	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.136	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.137	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.137	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.138	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.138	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.139	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.139	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.140	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.140	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.141	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.141	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.142	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.142	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.143	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.143	1.00	1.00	7.79	3040	7954	7954	2045	41000	4

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
.144	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.144	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.145	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.145	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.146	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.146	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.147	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.147	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.148	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.148	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.149	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.149	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.150	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.150	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.151	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.151	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.152	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.152	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.153	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.153	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.154	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.154	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.155	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.155	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.156	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.156	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.157	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.157	1.00	1.00	7.79	3040	7954	7954	2045	41000	4
.158	1.00	1.00	7.79	3040	7956	7956	2047	41000	4
.158	1.00	1.00	7.79	3040	7956	7956	2047	41000	4
.159	1.00	1.00	7.79	3040	7946	7946	2037	41000	4
.159	1.00	1.00	7.79	3040	7946	7946	2037	41000	4
.160	1.00	1.00	7.79	3040	7985	7985	2076	41000	5
.160	1.00	1.00	7.79	3040	7985	7985	2076	41000	5
.161	1.00	1.00	7.79	3040	7835	7835	1926	41000	4
.161	1.00	1.00	7.79	3040	7835	7835	1926	41000	4
.162	1.00	1.00	7.79	3040	7507	7507	1598	41000	3
VH564	1.00	1.00	7.79	3040	7910	7910	2008	41000	4
.164	1.00	1.00	7.79	3040	7829	7829	1927	41000	4
.165	1.00	1.00	7.79	3040	7983	7983	2081	41000	5
.166	1.00	1.00	7.79	3040	7938	7938	2036	41000	4
.166	1.00	1.00	7.79	3040	7938	7938	2036	41000	4
.167	1.00	1.00	7.79	3040	7950	7950	2048	41000	4
.167	1.00	1.00	7.79	3040	7950	7950	2048	41000	4
.168	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.168	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.169	1.00	1.00	7.79	3040	7948	7948	2045	41000	4
.169	1.00	1.00	7.79	3040	7948	7948	2045	41000	4
.170	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.170	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.171	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.171	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.172	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.172	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.173	1.00	1.00	7.79	3040	7947	7947	2045	41000	4

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
.173	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.174	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.174	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.175	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.175	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.176	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.176	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.177	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.177	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.178	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.178	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.179	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.179	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.180	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.180	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.181	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.181	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.182	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.182	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.183	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.183	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.184	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.184	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.185	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.185	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.186	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.186	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.187	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.187	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.188	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.188	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.189	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.189	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.190	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.190	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.191	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.191	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.192	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.192	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.193	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.193	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.194	1.00	1.00	7.79	3040	7947	7947	2045	41000	4
.196	1.00	1.00	29.54	1453	2289	2289	883	41000	2
.197	1.00	1.00	29.54	1453	2245	2245	839	41000	2
.198	1.00	1.00	29.54	1453	2430	2430	1024	41000	2
.199	1.00	1.00	29.54	1453	2415	2415	1009	41000	2
.199	1.00	1.00	29.54	1453	2415	2415	1009	41000	2
.200	1.00	1.00	29.54	1453	2418	2418	1013	41000	2
.200	1.00	1.00	29.54	1453	2418	2418	1013	41000	2
.201	1.00	1.00	29.54	1453	2417	2417	1012	41000	2
.201	1.00	1.00	29.54	1453	2417	2417	1012	41000	2
.202	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.202	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.203	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.203	1.00	1.00	29.54	1453	2418	2418	1012	41000	2

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
.204	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.204	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.205	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.205	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.206	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.206	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.207	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.207	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.208	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.208	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.209	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.209	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.210	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.210	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.211	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.211	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.212	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.212	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.213	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.213	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.214	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.214	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.215	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.215	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
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.217	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.217	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
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.218	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.219	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.219	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.220	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.220	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.221	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.221	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.222	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.222	1.00	1.00	29.54	1453	2418	2418	1012	41000	2
.223	1.00	1.00	29.54	1453	2418	2418	1012	41000	2

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Maxima ***

Maximum X displacement = 9.550 inch at point .99
Maximum Y displacement = -0.001 inch at point .101
Maximum Z displacement = -8.501 inch at point .198

Maximum X rotation = -0.000 degree at point .197
Maximum Y rotation = 0.000 degree at point
Maximum Z rotation = 0.002 degree at point .34

Maximum X force = 33269 lb at point VH555
Maximum Y force = 395 lb at point .198
Maximum Z force = 33194 lb at point .196

Maximum X moment = 8186 inch-lb at point .198
Maximum Y moment = 0 inch-lb at point
Maximum Z moment = -4263 inch-lb at point .38

Maximum hoop stress = 3040 psi at point .1
Maximum longitudinal stress = 7996 psi at point .38
Maximum principal stress = 7996 psi at point .38
Maximum code stress = 2087 psi at point .38
Maximum stress ratio (code/allowable) = 0.05 at point .38

Load : Dead Weight + Pressure 1

*** System Maxima ***

Maximum X displacement = -1.108 inch at point .99
Maximum Y displacement = -0.001 inch at point .101
Maximum Z displacement = 0.290 inch at point .198

Maximum X rotation = -0.000 degree at point .197
Maximum Y rotation = 0.000 degree at point
Maximum Z rotation = 0.002 degree at point .34

Maximum X force = 32459 lb at point .1
Maximum Y force = 395 lb at point .198
Maximum Z force = 32476 lb at point .196

Maximum X moment = 8186 inch-lb at point .198
Maximum Y moment = 0 inch-lb at point
Maximum Z moment = -4263 inch-lb at point .38

Maximum hoop stress = 3040 psi at point .1
Maximum longitudinal stress = 7767 psi at point .33
Maximum principal stress = 7767 psi at point .33
Maximum code stress = 2087 psi at point .38
Maximum stress ratio (code/allowable) = 0.13 at point .38

Load : Thermal 1

*** System Maxima ***

Maximum X displacement = 10.658 inch at point .99
Maximum Y displacement = 0.000 inch at point
Maximum Z displacement = -8.791 inch at point .198

Maximum X rotation = 0.000 degree at point
Maximum Y rotation = 0.000 degree at point
Maximum Z rotation = 0.000 degree at point

Maximum X force = 858 lb at point VH555
Maximum Y force = 0 lb at point
Maximum Z force = 718 lb at point .196

Maximum X moment = 0 inch-lb at point
Maximum Y moment = 0 inch-lb at point
Maximum Z moment = 0 inch-lb at point

Maximum hoop stress not available
Maximum longitudinal stress = 230 psi at point VH555
Maximum principal stress = 230 psi at point VH555
Maximum code stress not available
Maximum stress ratio (code/allowable) = 0.00 at point

PipePak Version 22.01 Perma Pipe Inc. 04/19/2010 12:35:49PM
FORT WAINWRIGHT
Model File: P:\Algor\D0878\336BSTM.dbs

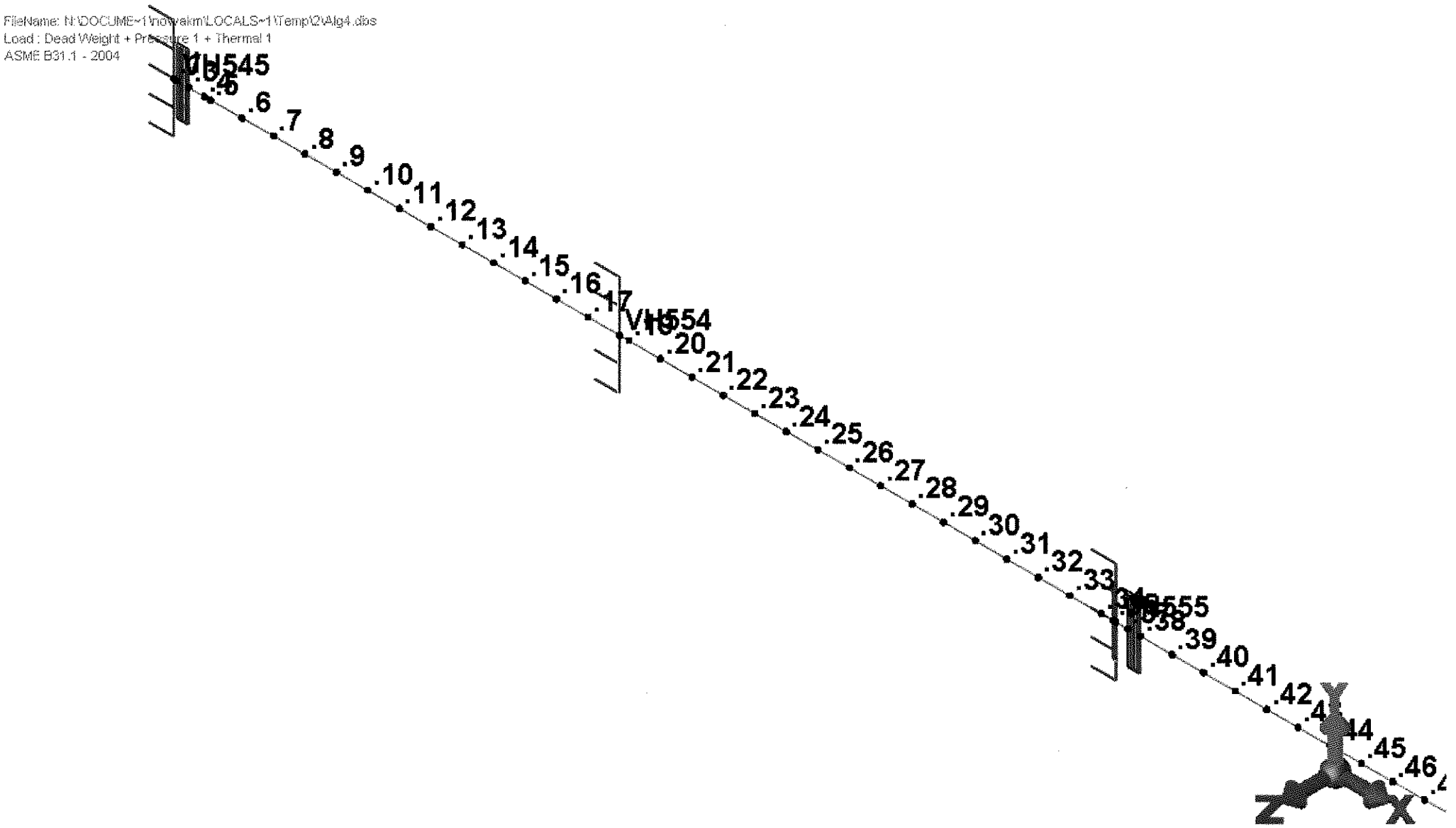
Piping Code: ASME B31.1 - 2007

*** Input+ ***

File Name ..... P:\Algor\D0878\336BSTM
Project ..... FORT WAINWRIGHT
Department ..... PERMA PIPE
Contract Number ..... AVAIATION BARRACKS FTW 336B
Description ..... FTW 336B
Prepared by ..... MACHN
Checked by .....

ASME code ..... ASME B31.1
Input unit ..... English
Output unit ..... English
Output columns 80
Base temperature 40
F factor 1
E factor 1.33

Number of dynamic modes.. 8
Cut-off frequency ..... 33 Hz
Max no. of iterations ... 12
Convergence tolerance ... 3
Force tolerance ..... 5 lb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Load : Dead Weight + Pressure 1 + Thermal 1
ASME B31.1 - 2004
VH545
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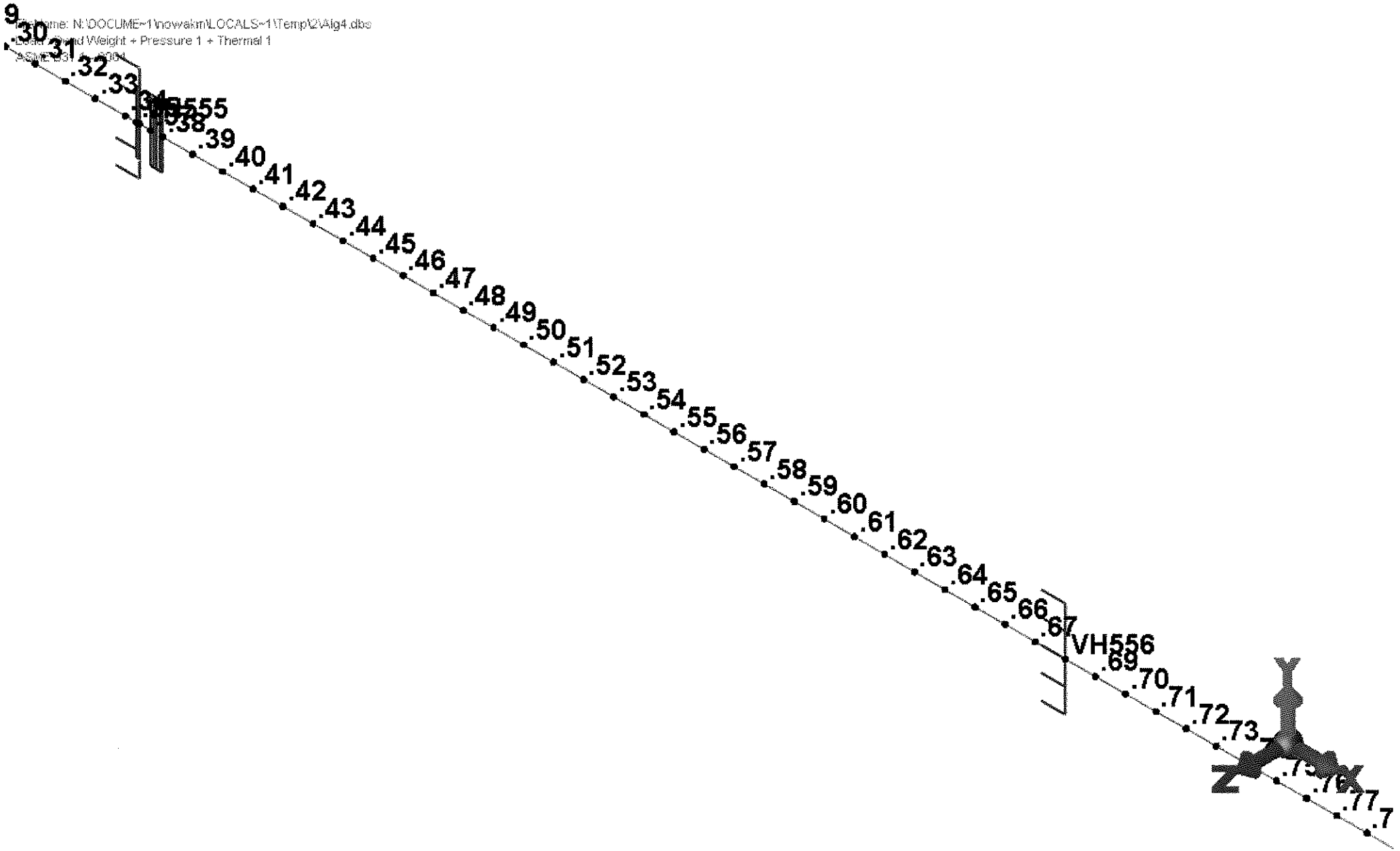
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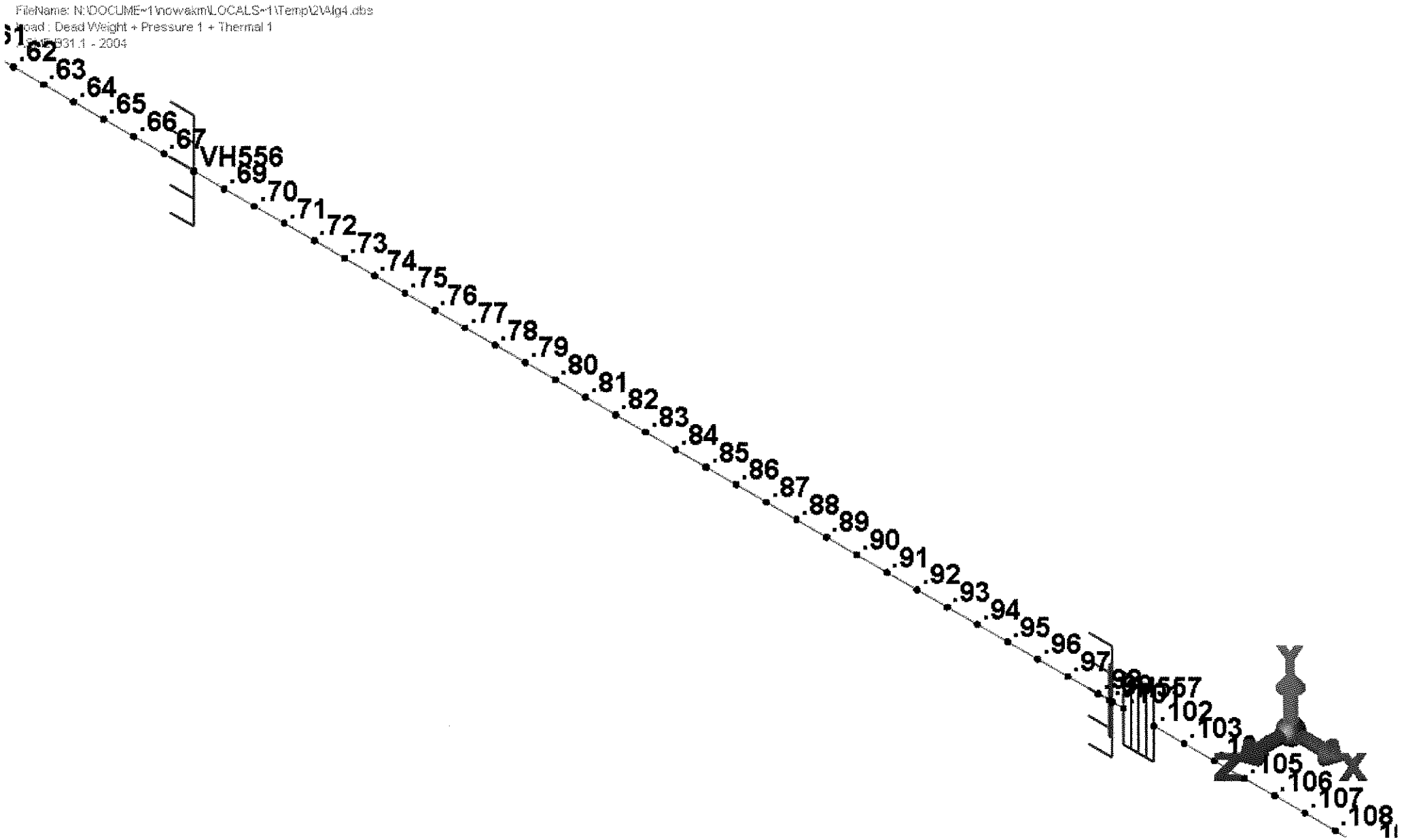
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Load : Dead Weight + Pressure 1 + Thermal 1
ANSYS 931.1 - 2004
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VH556
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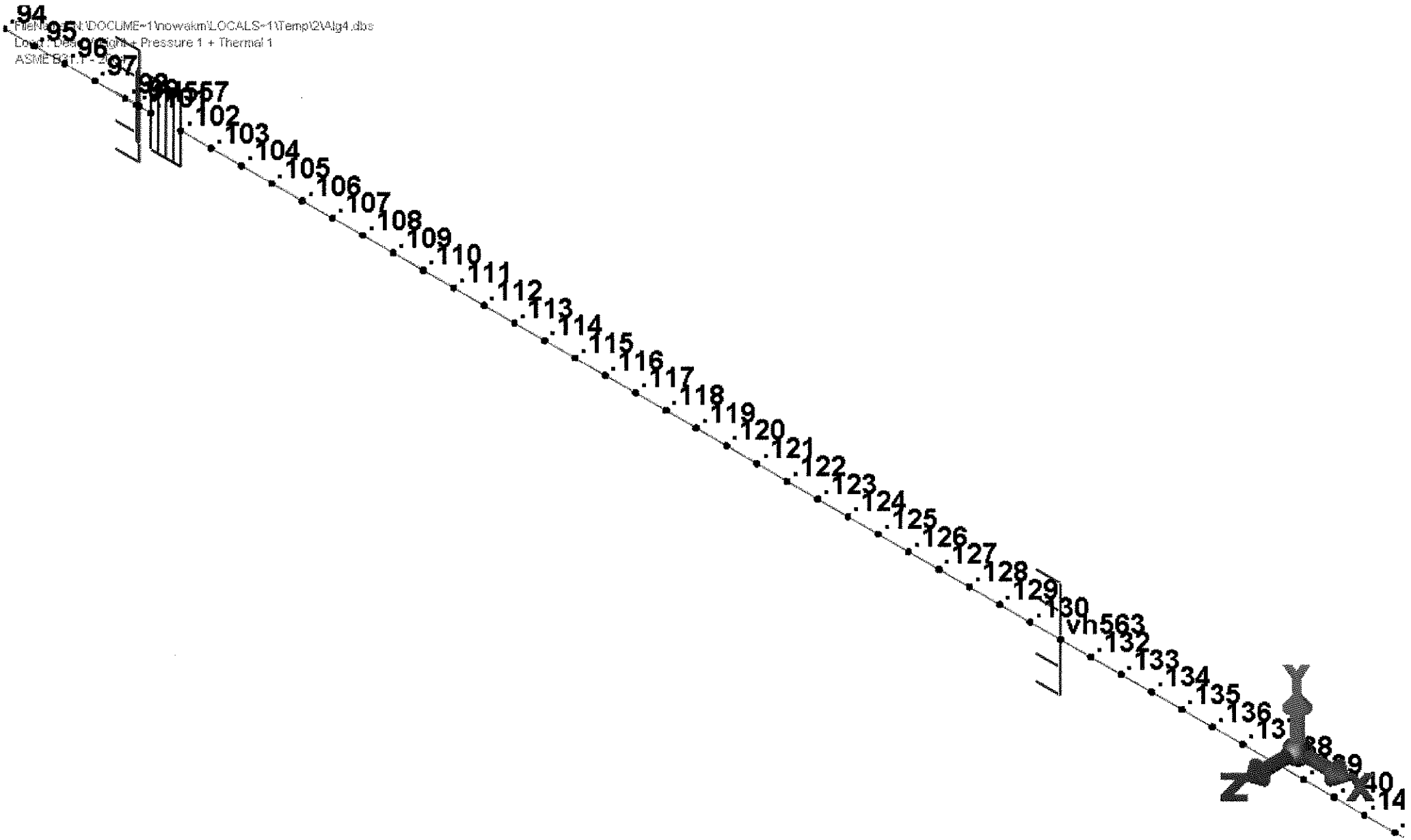
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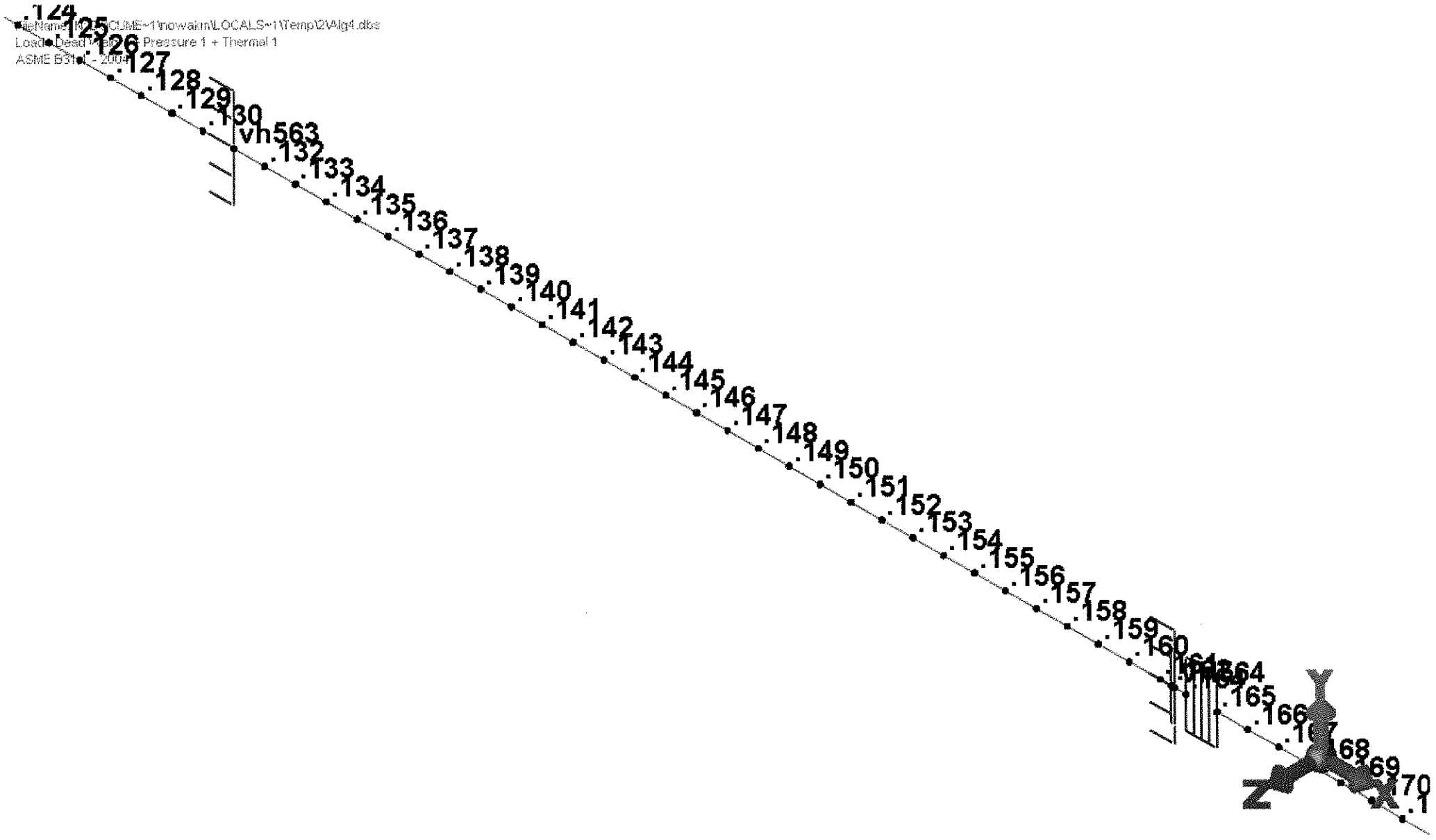
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ASME B31 - 2004
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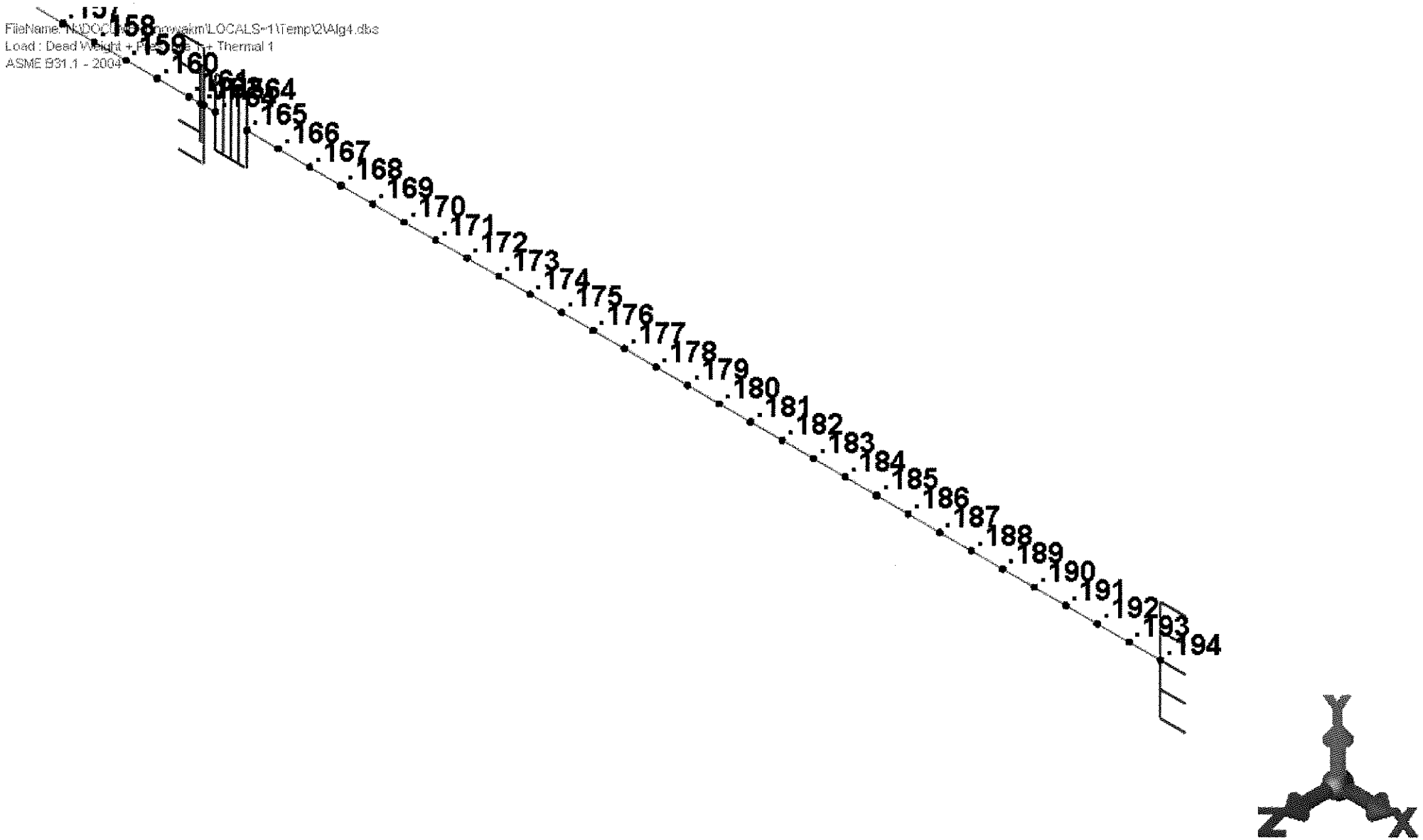
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ASME B31.1 - 2004
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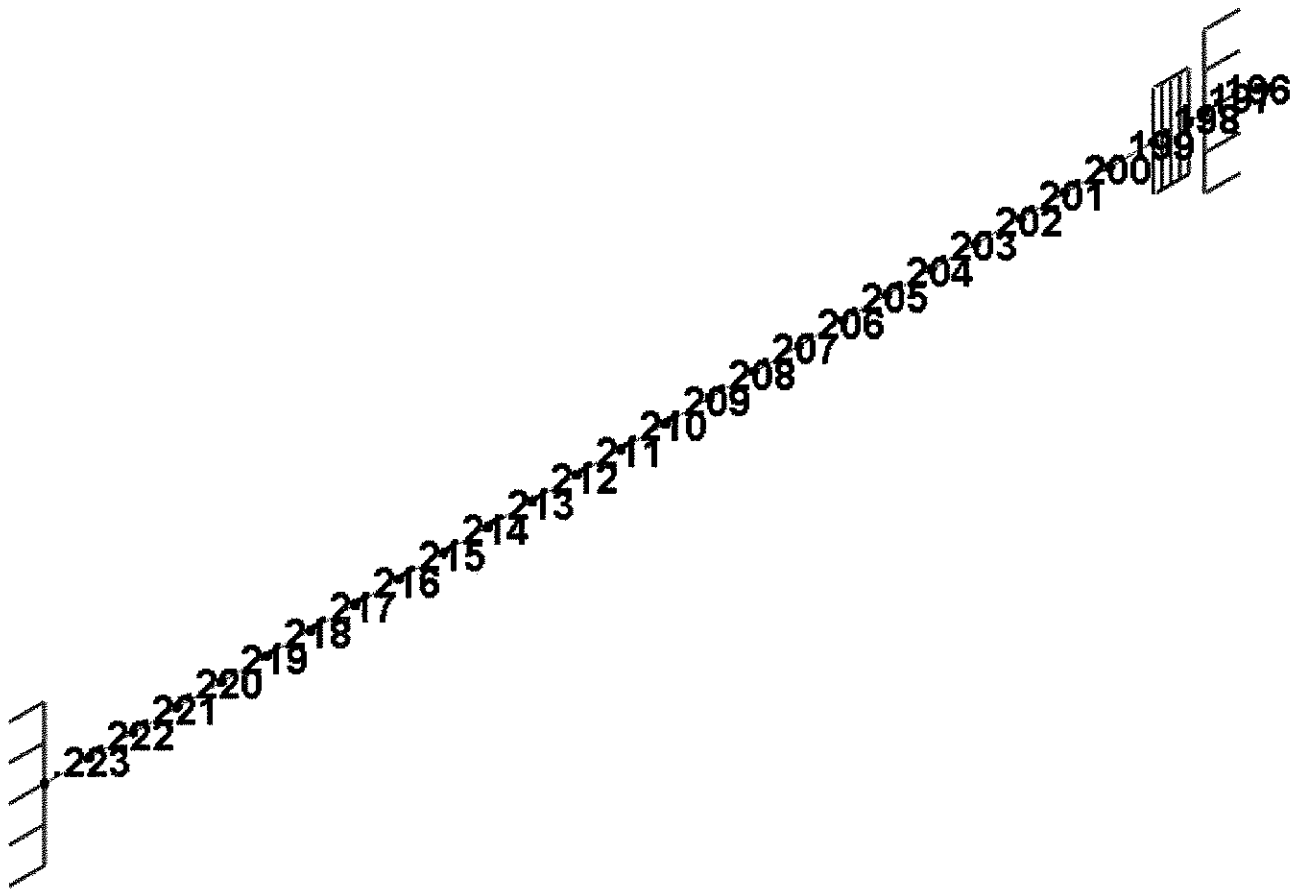
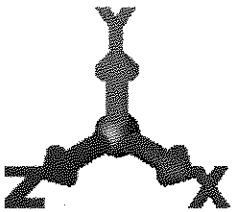
Load : Dead Weight + Pressure 1 + Thermal 1
ASME B31.1 - 2004





Piping Code: ASME B31.1 - 2007

Frm /To	Point name	DX (feet)	DY (feet)	DZ (feet)	Radius (inch)	X (feet)	Y (feet)	Z (feet)
F	.1					0.000	0.000	0.000
	VH545 1					1.000	0.000	0.000
	.3 3.7					4.700	0.000	0.000
	.4 5					9.700	0.000	0.000
	.5 2					11.700	0.000	0.000
	.6 10					21.700	0.000	0.000
	.7 10					31.700	0.000	0.000
	.8 10					41.700	0.000	0.000
	.9 10					51.700	0.000	0.000
	.10 10					61.700	0.000	0.000
	.11 10					71.700	0.000	0.000
	.12 10					81.700	0.000	0.000
	.13 10					91.700	0.000	0.000
	.14 10					101.700	0.000	0.000
	.15 10					111.700	0.000	0.000
	.16 10					121.700	0.000	0.000
	.17 10					131.700	0.000	0.000
	VH554 10					141.700	0.000	0.000
	.19 3					144.700	0.000	0.000
	.20 10					154.700	0.000	0.000
	.21 10					164.700	0.000	0.000
	.22 10					174.700	0.000	0.000
	.23 10					184.700	0.000	0.000
	.24 10					194.700	0.000	0.000
	.25 10					204.700	0.000	0.000
	.26 10					214.700	0.000	0.000
	.27 10					224.700	0.000	0.000
	.28 10					234.700	0.000	0.000
	.29 10					244.700	0.000	0.000
	.30 10					254.700	0.000	0.000
	.31 10					264.700	0.000	0.000
	.32 10					274.700	0.000	0.000
	.33 10					284.700	0.000	0.000
	.34 10					294.700	0.000	0.000
	.35 3.7					298.400	0.000	0.000
	VH555 1					299.400	0.000	0.000
	.37 3.7					303.100	0.000	0.000
	.38 4					307.100	0.000	0.000
	.39 10					317.100	0.000	0.000
	.40 10					327.100	0.000	0.000
	.41 10					337.100	0.000	0.000
	.42 10					347.100	0.000	0.000
	.43 10					357.100	0.000	0.000
	.44 10					367.100	0.000	0.000
	.45 10					377.100	0.000	0.000
	.46 10					387.100	0.000	0.000
	.47 10					397.100	0.000	0.000
	.48 10					407.100	0.000	0.000
	.49 10					417.100	0.000	0.000
	.50 10					427.100	0.000	0.000
	.51 10					437.100	0.000	0.000
	.52 10					447.100	0.000	0.000
	.53 10					457.100	0.000	0.000
	.54 10					467.100	0.000	0.000
	.55 10					477.100	0.000	0.000
	.56 10					487.100	0.000	0.000
	.57 10					497.100	0.000	0.000
	.58 10					507.100	0.000	0.000

Piping Code: ASME B31.1 - 2007

Frm /To	Point name	DX (feet)	DY (feet)	DZ (feet)	Radius (inch)	X (feet)	Y (feet)	Z (feet)
.59	10					517.100	0.000	0.000
.60	10					527.100	0.000	0.000
.61	10					537.100	0.000	0.000
.62	10					547.100	0.000	0.000
.63	10					557.100	0.000	0.000
.64	10					567.100	0.000	0.000
.65	10					577.100	0.000	0.000
.66	10					587.100	0.000	0.000
.67	10					597.100	0.000	0.000
VH556	10					607.100	0.000	0.000
.69	10					617.100	0.000	0.000
.70	10					627.100	0.000	0.000
.71	10					637.100	0.000	0.000
.72	10					647.100	0.000	0.000
.73	10					657.100	0.000	0.000
.74	10					667.100	0.000	0.000
.75	10					677.100	0.000	0.000
.76	10					687.100	0.000	0.000
.77	10					697.100	0.000	0.000
.78	10					707.100	0.000	0.000
.79	10					717.100	0.000	0.000
.80	10					727.100	0.000	0.000
.81	10					737.100	0.000	0.000
.82	10					747.100	0.000	0.000
.83	10					757.100	0.000	0.000
.84	10					767.100	0.000	0.000
.85	10					777.100	0.000	0.000
.86	10					787.100	0.000	0.000
.87	10					797.100	0.000	0.000
.88	10					807.100	0.000	0.000
.89	10					817.100	0.000	0.000
.90	10					827.100	0.000	0.000
.91	10					837.100	0.000	0.000
.92	10					847.100	0.000	0.000
.93	10					857.100	0.000	0.000
.94	10					867.100	0.000	0.000
.95	10					877.100	0.000	0.000
.96	10					887.100	0.000	0.000
.97	10					897.100	0.000	0.000
.98	10					907.100	0.000	0.000
.99	3.7					910.800	0.000	0.000
VH557	1					911.800	0.000	0.000
.101	3.7					915.500	0.000	0.000
.102	10					925.500	0.000	0.000
.103	10					935.500	0.000	0.000
.104	10					945.500	0.000	0.000
.105	10					955.500	0.000	0.000
.106	10					965.500	0.000	0.000
.107	10					975.500	0.000	0.000
.108	10					985.500	0.000	0.000
.109	10					995.500	0.000	0.000
.110	10					1005.500	0.000	0.000
.111	10					1015.500	0.000	0.000
.112	10					1025.500	0.000	0.000
.113	10					1035.500	0.000	0.000
.114	10					1045.500	0.000	0.000
.115	10					1055.500	0.000	0.000
.116	10					1065.500	0.000	0.000

Piping Code: ASME B31.1 - 2007

Frm /To	Point name	DX (feet)	DY (feet)	DZ (feet)	Radius (inch)	X (feet)	Y (feet)	Z (feet)
	.117	10				1075.500	0.000	0.000
	.118	10				1085.500	0.000	0.000
	.119	10				1095.500	0.000	0.000
	.120	10				1105.500	0.000	0.000
	.121	10				1115.500	0.000	0.000
	.122	10				1125.500	0.000	0.000
	.123	10				1135.500	0.000	0.000
	.124	10				1145.500	0.000	0.000
	.125	10				1155.500	0.000	0.000
	.126	10				1165.500	0.000	0.000
	.127	10				1175.500	0.000	0.000
	.128	10				1185.500	0.000	0.000
	.129	10				1195.500	0.000	0.000
	.130	10				1205.500	0.000	0.000
	vh563	10				1215.500	0.000	0.000
	.132	10				1225.500	0.000	0.000
	.133	10				1235.500	0.000	0.000
	.134	10				1245.500	0.000	0.000
	.135	10				1255.500	0.000	0.000
	.136	10				1265.500	0.000	0.000
	.137	10				1275.500	0.000	0.000
	.138	10				1285.500	0.000	0.000
	.139	10				1295.500	0.000	0.000
	.140	10				1305.500	0.000	0.000
	.141	10				1315.500	0.000	0.000
	.142	10				1325.500	0.000	0.000
	.143	10				1335.500	0.000	0.000
	.144	10				1345.500	0.000	0.000
	.145	10				1355.500	0.000	0.000
	.146	10				1365.500	0.000	0.000
	.147	10				1375.500	0.000	0.000
	.148	10				1385.500	0.000	0.000
	.149	10				1395.500	0.000	0.000
	.150	10				1405.500	0.000	0.000
	.151	10				1415.500	0.000	0.000
	.152	10				1425.500	0.000	0.000
	.153	10				1435.500	0.000	0.000
	.154	10				1445.500	0.000	0.000
	.155	10				1455.500	0.000	0.000
	.156	10				1465.500	0.000	0.000
	.157	10				1475.500	0.000	0.000
	.158	10				1485.500	0.000	0.000
	.159	10				1495.500	0.000	0.000
	.160	10				1505.500	0.000	0.000
	.161	10				1515.500	0.000	0.000
	.162	3.7				1519.200	0.000	0.000
	VH564	1				1520.200	0.000	0.000
	.164	3.7				1523.900	0.000	0.000
	.165	10				1533.900	0.000	0.000
	.166	10				1543.900	0.000	0.000
	.167	10				1553.900	0.000	0.000
	.168	10				1563.900	0.000	0.000
	.169	10				1573.900	0.000	0.000
	.170	10				1583.900	0.000	0.000
	.171	10				1593.900	0.000	0.000
	.172	10				1603.900	0.000	0.000
	.173	10				1613.900	0.000	0.000
	.174	10				1623.900	0.000	0.000

Piping Code: ASME B31.1 - 2007

Frm /To	Point name	DX (feet)	DY (feet)	DZ (feet)	Radius (inch)	X (feet)	Y (feet)	Z (feet)
	.175 10					1633.900	0.000	0.000
	.176 10					1643.900	0.000	0.000
	.177 10					1653.900	0.000	0.000
	.178 10					1663.900	0.000	0.000
	.179 10					1673.900	0.000	0.000
	.180 10					1683.900	0.000	0.000
	.181 10					1693.900	0.000	0.000
	.182 10					1703.900	0.000	0.000
	.183 10					1713.900	0.000	0.000
	.184 10					1723.900	0.000	0.000
	.185 10					1733.900	0.000	0.000
	.186 10					1743.900	0.000	0.000
	.187 10					1753.900	0.000	0.000
	.188 10					1763.900	0.000	0.000
	.189 10					1773.900	0.000	0.000
	.190 10					1783.900	0.000	0.000
	.191 10					1793.900	0.000	0.000
	.192 10					1803.900	0.000	0.000
	.193 10					1813.900	0.000	0.000
	.194 10					1823.900	0.000	0.000
F	.196			100		0.000	0.000	100.000
	.197			3.5		0.000	0.000	103.500
	.198			8		0.000	0.000	111.500
	.199			10		0.000	0.000	121.500
	.200			10		0.000	0.000	131.500
	.201			10		0.000	0.000	141.500
	.202			10		0.000	0.000	151.500
	.203			10		0.000	0.000	161.500
	.204			10		0.000	0.000	171.500
	.205			10		0.000	0.000	181.500
	.206			10		0.000	0.000	191.500
	.207			10		0.000	0.000	201.500
	.208			10		0.000	0.000	211.500
	.209			10		0.000	0.000	221.500
	.210			10		0.000	0.000	231.500
	.211			10		0.000	0.000	241.500
	.212			10		0.000	0.000	251.500
	.213			10		0.000	0.000	261.500
	.214			10		0.000	0.000	271.500
	.215			10		0.000	0.000	281.500
	.216			10		0.000	0.000	291.500
	.217			10		0.000	0.000	301.500
	.218			10		0.000	0.000	311.500
	.219			10		0.000	0.000	321.500
	.220			10		0.000	0.000	331.500
	.221			10		0.000	0.000	341.500
	.222			10		0.000	0.000	351.500
	.223			10		0.000	0.000	361.500

Piping Code: ASME B31.1 - 2007

Point	Data	Description
.1	Pipe	Pipe data identifier = 16
		NPS Identifier = 16
		DN Identifier = 400
		Pipe schedule = STD
		Actual pipe O. D. = 16 inch
		Wall thickness = 0.37 inch
		Corrosion allowance = 0 inch
		Insulation thickness = 2 inch
		Insulation density = 8 lb/cu.ft
		Content S. G. = 0
		Wind area O.D. = 0 inch
	Material	Material data identifier = lcs
		[B31.1-2004] Group 1 low carbon and low alloy steels <=0.3%
		Density = 0.284 lb/cu.inch

Tempera. (deg.F)	Modulus (psi)	Thermal Strain (inch/inch)
-100	3.02e+007	-0.00104
-50	3e+007	-0.00075
70	2.95e+007	0
200	2.88e+007	0.000833
300	2.83e+007	0.001583
400	2.77e+007	0.002333
500	2.73e+007	0.003083
600	2.67e+007	0.003916
700	2.55e+007	0.00475
800	2.42e+007	0.005666
900	2.24e+007	0.006583
1000	2.04e+007	0.0075
1100	1.8e+007	0.008416

Allowable stress code = 06B

Temperature (deg.F)	Allowable stresses (psi)
-20.00	17100.00
650.00	17100.00
700.00	15600.00
750.00	13000.00
800.00	10800.00

	Load	Load data identifier = STM

Case No.	Temperature (deg.F)	Pressure (psig)	Expansion (inch/inch)
1	350	100	0.001958

	Anchor	Rigid in all directions
VH545	Bellows	Weight = 515.0000 lb
		Pressure thrust area = 258 sq.inch
		Longitudinal stiffness = 1071 lb/inch
		Lateral stiffness (H) = Rigid lb/inch
		Lateral stiffness (V) = Rigid lb/inch
		Rotational stiff. (H) = Rigid lb-inch/deg
		Rotational stiff. (V) = Rigid lb-inch/deg
		Torsional stiffness = Rigid lb-inch/deg
.3	Guide	Spring Constant = Rigid lb/inch
.4	Guide	Spring Constant = Rigid lb/inch
.5	Guide	Spring Constant = Rigid lb/inch
.6	Guide	Spring Constant = Rigid lb/inch
.7	Guide	Spring Constant = Rigid lb/inch
.8	Guide	Spring Constant = Rigid lb/inch
.9	Guide	Spring Constant = Rigid lb/inch
.10	Guide	Spring Constant = Rigid lb/inch
.11	Guide	Spring Constant = Rigid lb/inch

Piping Code: ASME B31.1 - 2007

Point	Data	Description
.12	Guide	Spring Constant = Rigid lb/inch
.13	Guide	Spring Constant = Rigid lb/inch
.14	Guide	Spring Constant = Rigid lb/inch
.15	Guide	Spring Constant = Rigid lb/inch
.16	Guide	Spring Constant = Rigid lb/inch
.17	Guide	Spring Constant = Rigid lb/inch
VH554	Anchor	Rigid in all directions
.19	Guide	Spring Constant = Rigid lb/inch
.20	Guide	Spring Constant = Rigid lb/inch
.21	Guide	Spring Constant = Rigid lb/inch
.22	Guide	Spring Constant = Rigid lb/inch
.23	Guide	Spring Constant = Rigid lb/inch
.24	Guide	Spring Constant = Rigid lb/inch
.25	Guide	Spring Constant = Rigid lb/inch
.26	Guide	Spring Constant = Rigid lb/inch
.27	Guide	Spring Constant = Rigid lb/inch
.28	Guide	Spring Constant = Rigid lb/inch
.29	Guide	Spring Constant = Rigid lb/inch
.30	Guide	Spring Constant = Rigid lb/inch
.31	Guide	Spring Constant = Rigid lb/inch
.32	Guide	Spring Constant = Rigid lb/inch
.33	Guide	Spring Constant = Rigid lb/inch
.34	Guide	Spring Constant = Rigid lb/inch
.35	Bellows	Weight = 515.0000 lb
		Pressure thrust area = 258 sq.inch
		Longitudinal stiffness = 1071 lb/inch
		Lateral stiffness (H) = Rigid lb/inch
		Lateral stiffness (V) = Rigid lb/inch
		Rotational stiff. (H) = Rigid lb-inch/deg
		Rotational stiff. (V) = Rigid lb-inch/deg
		Torsional stiffness = Rigid lb-inch/deg
VH555	Anchor	Rigid in all directions
.37	Bellows	Weight = 515.0000 lb
		Pressure thrust area = 258 sq.inch
		Longitudinal stiffness = 1071 lb/inch
		Lateral stiffness (H) = Rigid lb/inch
		Lateral stiffness (V) = Rigid lb/inch
		Rotational stiff. (H) = Rigid lb-inch/deg
		Rotational stiff. (V) = Rigid lb-inch/deg
		Torsional stiffness = Rigid lb-inch/deg
.38	Guide	Spring Constant = Rigid lb/inch
.39	Guide	Spring Constant = Rigid lb/inch
.40	Guide	Spring Constant = Rigid lb/inch
.41	Guide	Spring Constant = Rigid lb/inch
.42	Guide	Spring Constant = Rigid lb/inch
.43	Guide	Spring Constant = Rigid lb/inch
.44	Guide	Spring Constant = Rigid lb/inch
.45	Guide	Spring Constant = Rigid lb/inch
.46	Guide	Spring Constant = Rigid lb/inch
.47	Guide	Spring Constant = Rigid lb/inch
.48	Guide	Spring Constant = Rigid lb/inch
.49	Guide	Spring Constant = Rigid lb/inch
.50	Guide	Spring Constant = Rigid lb/inch
.51	Guide	Spring Constant = Rigid lb/inch
.52	Guide	Spring Constant = Rigid lb/inch
.53	Guide	Spring Constant = Rigid lb/inch
.54	Guide	Spring Constant = Rigid lb/inch
.55	Guide	Spring Constant = Rigid lb/inch
.56	Guide	Spring Constant = Rigid lb/inch

Piping Code: ASME B31.1 - 2007

Point	Data	Description
.57	Guide	Spring Constant = Rigid lb/inch
.58	Guide	Spring Constant = Rigid lb/inch
.59	Guide	Spring Constant = Rigid lb/inch
.60	Guide	Spring Constant = Rigid lb/inch
.61	Guide	Spring Constant = Rigid lb/inch
.62	Guide	Spring Constant = Rigid lb/inch
.63	Guide	Spring Constant = Rigid lb/inch
.64	Guide	Spring Constant = Rigid lb/inch
.65	Guide	Spring Constant = Rigid lb/inch
.66	Guide	Spring Constant = Rigid lb/inch
.67	Guide	Spring Constant = Rigid lb/inch
VH556	Anchor	Rigid in all directions
.69	Guide	Spring Constant = Rigid lb/inch
.70	Guide	Spring Constant = Rigid lb/inch
.71	Guide	Spring Constant = Rigid lb/inch
.72	Guide	Spring Constant = Rigid lb/inch
.73	Guide	Spring Constant = Rigid lb/inch
.74	Guide	Spring Constant = Rigid lb/inch
.75	Guide	Spring Constant = Rigid lb/inch
.76	Guide	Spring Constant = Rigid lb/inch
.77	Guide	Spring Constant = Rigid lb/inch
.78	Guide	Spring Constant = Rigid lb/inch
.79	Guide	Spring Constant = Rigid lb/inch
.80	Guide	Spring Constant = Rigid lb/inch
.81	Guide	Spring Constant = Rigid lb/inch
.82	Guide	Spring Constant = Rigid lb/inch
.83	Guide	Spring Constant = Rigid lb/inch
.84	Guide	Spring Constant = Rigid lb/inch
.85	Guide	Spring Constant = Rigid lb/inch
.86	Guide	Spring Constant = Rigid lb/inch
.87	Guide	Spring Constant = Rigid lb/inch
.88	Guide	Spring Constant = Rigid lb/inch
.89	Guide	Spring Constant = Rigid lb/inch
.90	Guide	Spring Constant = Rigid lb/inch
.91	Guide	Spring Constant = Rigid lb/inch
.92	Guide	Spring Constant = Rigid lb/inch
.93	Guide	Spring Constant = Rigid lb/inch
.94	Guide	Spring Constant = Rigid lb/inch
.95	Guide	Spring Constant = Rigid lb/inch
.96	Guide	Spring Constant = Rigid lb/inch
.97	Guide	Spring Constant = Rigid lb/inch
.98	Guide	Spring Constant = Rigid lb/inch
.99	Bellows	Weight = 515.0000 lb
		Pressure thrust area = 258 sq.inch
		Longitudinal stiffness = 1071 lb/inch
		Lateral stiffness (H) = Rigid lb/inch
		Lateral stiffness (V) = Rigid lb/inch
		Rotational stiff. (H) = Rigid lb-inch/deg
		Rotational stiff. (V) = Rigid lb-inch/deg
		Torsional stiffness = Rigid lb-inch/deg
VH557	Anchor	Rigid in all directions
.101	Bellows	Weight = 515.0000 lb
		Pressure thrust area = 258 sq.inch
		Longitudinal stiffness = 1071 lb/inch
		Lateral stiffness (H) = Rigid lb/inch
		Lateral stiffness (V) = Rigid lb/inch
		Rotational stiff. (H) = Rigid lb-inch/deg
		Rotational stiff. (V) = Rigid lb-inch/deg
		Torsional stiffness = Rigid lb-inch/deg

Piping Code: ASME B31.1 - 2007

Point	Data	Description
.102	Guide	Spring Constant = Rigid lb/inch
.103	Guide	Spring Constant = Rigid lb/inch
.104	Guide	Spring Constant = Rigid lb/inch
.105	Guide	Spring Constant = Rigid lb/inch
.106	Guide	Spring Constant = Rigid lb/inch
.107	Guide	Spring Constant = Rigid lb/inch
.108	Guide	Spring Constant = Rigid lb/inch
.109	Guide	Spring Constant = Rigid lb/inch
.110	Guide	Spring Constant = Rigid lb/inch
.111	Guide	Spring Constant = Rigid lb/inch
.112	Guide	Spring Constant = Rigid lb/inch
.113	Guide	Spring Constant = Rigid lb/inch
.114	Guide	Spring Constant = Rigid lb/inch
.115	Guide	Spring Constant = Rigid lb/inch
.116	Guide	Spring Constant = Rigid lb/inch
.117	Guide	Spring Constant = Rigid lb/inch
.118	Guide	Spring Constant = Rigid lb/inch
.119	Guide	Spring Constant = Rigid lb/inch
.120	Guide	Spring Constant = Rigid lb/inch
.121	Guide	Spring Constant = Rigid lb/inch
.122	Guide	Spring Constant = Rigid lb/inch
.123	Guide	Spring Constant = Rigid lb/inch
.124	Guide	Spring Constant = Rigid lb/inch
.125	Guide	Spring Constant = Rigid lb/inch
.126	Guide	Spring Constant = Rigid lb/inch
.127	Guide	Spring Constant = Rigid lb/inch
.128	Guide	Spring Constant = Rigid lb/inch
.129	Guide	Spring Constant = Rigid lb/inch
.130	Guide	Spring Constant = Rigid lb/inch
vh563	Anchor	Rigid in all directions
.132	Guide	Spring Constant = Rigid lb/inch
.133	Guide	Spring Constant = Rigid lb/inch
.134	Guide	Spring Constant = Rigid lb/inch
.135	Guide	Spring Constant = Rigid lb/inch
.136	Guide	Spring Constant = Rigid lb/inch
.137	Guide	Spring Constant = Rigid lb/inch
.138	Guide	Spring Constant = Rigid lb/inch
.139	Guide	Spring Constant = Rigid lb/inch
.140	Guide	Spring Constant = Rigid lb/inch
.141	Guide	Spring Constant = Rigid lb/inch
.142	Guide	Spring Constant = Rigid lb/inch
.143	Guide	Spring Constant = Rigid lb/inch
.144	Guide	Spring Constant = Rigid lb/inch
.145	Guide	Spring Constant = Rigid lb/inch
.146	Guide	Spring Constant = Rigid lb/inch
.147	Guide	Spring Constant = Rigid lb/inch
.148	Guide	Spring Constant = Rigid lb/inch
.149	Guide	Spring Constant = Rigid lb/inch
.150	Guide	Spring Constant = Rigid lb/inch
.151	Guide	Spring Constant = Rigid lb/inch
.152	Guide	Spring Constant = Rigid lb/inch
.153	Guide	Spring Constant = Rigid lb/inch
.154	Guide	Spring Constant = Rigid lb/inch
.155	Guide	Spring Constant = Rigid lb/inch
.156	Guide	Spring Constant = Rigid lb/inch
.157	Guide	Spring Constant = Rigid lb/inch
.158	Guide	Spring Constant = Rigid lb/inch
.159	Guide	Spring Constant = Rigid lb/inch
.160	Guide	Spring Constant = Rigid lb/inch

Piping Code: ASME B31.1 - 2007

Point	Data	Description
.161	Guide	Spring Constant = Rigid lb/inch
.162	Bellows	Weight = 515.0000 lb
		Pressure thrust area = 258 sq.inch
		Longitudinal stiffness = 1071 lb/inch
		Lateral stiffness (H) = Rigid lb/inch
		Lateral stiffness (V) = Rigid lb/inch
		Rotational stiff. (H) = Rigid lb-inch/deg
		Rotational stiff. (V) = Rigid lb-inch/deg
		Torsional stiffness = Rigid lb-inch/deg
VH564	Anchor	Rigid in all directions
.164	Bellows	Weight = 515.0000 lb
		Pressure thrust area = 258 sq.inch
		Longitudinal stiffness = 1071 lb/inch
		Lateral stiffness (H) = Rigid lb/inch
		Lateral stiffness (V) = Rigid lb/inch
		Rotational stiff. (H) = Rigid lb-inch/deg
		Rotational stiff. (V) = Rigid lb-inch/deg
		Torsional stiffness = Rigid lb-inch/deg
.165	Guide	Spring Constant = Rigid lb/inch
.166	Guide	Spring Constant = Rigid lb/inch
.167	Guide	Spring Constant = Rigid lb/inch
.168	Guide	Spring Constant = Rigid lb/inch
.169	Guide	Spring Constant = Rigid lb/inch
.170	Guide	Spring Constant = Rigid lb/inch
.171	Guide	Spring Constant = Rigid lb/inch
.172	Guide	Spring Constant = Rigid lb/inch
.173	Guide	Spring Constant = Rigid lb/inch
.174	Guide	Spring Constant = Rigid lb/inch
.175	Guide	Spring Constant = Rigid lb/inch
.176	Guide	Spring Constant = Rigid lb/inch
.177	Guide	Spring Constant = Rigid lb/inch
.178	Guide	Spring Constant = Rigid lb/inch
.179	Guide	Spring Constant = Rigid lb/inch
.180	Guide	Spring Constant = Rigid lb/inch
.181	Guide	Spring Constant = Rigid lb/inch
.182	Guide	Spring Constant = Rigid lb/inch
.183	Guide	Spring Constant = Rigid lb/inch
.184	Guide	Spring Constant = Rigid lb/inch
.185	Guide	Spring Constant = Rigid lb/inch
.186	Guide	Spring Constant = Rigid lb/inch
.187	Guide	Spring Constant = Rigid lb/inch
.188	Guide	Spring Constant = Rigid lb/inch
.189	Guide	Spring Constant = Rigid lb/inch
.190	Guide	Spring Constant = Rigid lb/inch
.191	Guide	Spring Constant = Rigid lb/inch
.192	Guide	Spring Constant = Rigid lb/inch
.193	Guide	Spring Constant = Rigid lb/inch
.194	Anchor	Rigid in all directions
.196	Pipe	Pipe data identifier = 10
		NPS Identifier = 10
		DN Identifier = 250
		Pipe schedule = STD
		Actual pipe O. D. = 10.75 inch
		Wall thickness = 0.36 inch
		Corrosion allowance = 0 inch
		Insulation thickness = 1.5 inch
		Insulation density = 8 lb/cu.ft
		Content S. G. = 1
		Wind area O.D. = 0 inch

Piping Code: ASME B31.1 - 2007

Point	Data	Description
	Anchor	Rigid in all directions
.197	Bellows	Weight = 275.0000 lb
		Pressure thrust area = 325 sq.inch
		Longitudinal stiffness = 80.5 lb/inch
		Lateral stiffness (H) = Rigid lb/inch
		Lateral stiffness (V) = Rigid lb/inch
		Rotational stiff. (H) = Rigid lb-inch/deg
		Rotational stiff. (V) = Rigid lb-inch/deg
		Torsional stiffness = Rigid lb-inch/deg
.198	Guide	Spring Constant = Rigid lb/inch
.199	Guide	Spring Constant = Rigid lb/inch
.200	Guide	Spring Constant = Rigid lb/inch
.201	Guide	Spring Constant = Rigid lb/inch
.202	Guide	Spring Constant = Rigid lb/inch
.203	Guide	Spring Constant = Rigid lb/inch
.204	Guide	Spring Constant = Rigid lb/inch
.205	Guide	Spring Constant = Rigid lb/inch
.206	Guide	Spring Constant = Rigid lb/inch
.207	Guide	Spring Constant = Rigid lb/inch
.208	Guide	Spring Constant = Rigid lb/inch
.209	Guide	Spring Constant = Rigid lb/inch
.210	Guide	Spring Constant = Rigid lb/inch
.211	Guide	Spring Constant = Rigid lb/inch
.212	Guide	Spring Constant = Rigid lb/inch
.213	Guide	Spring Constant = Rigid lb/inch
.214	Guide	Spring Constant = Rigid lb/inch
.215	Guide	Spring Constant = Rigid lb/inch
.216	Guide	Spring Constant = Rigid lb/inch
.217	Guide	Spring Constant = Rigid lb/inch
.218	Guide	Spring Constant = Rigid lb/inch
.219	Guide	Spring Constant = Rigid lb/inch
.220	Guide	Spring Constant = Rigid lb/inch
.221	Guide	Spring Constant = Rigid lb/inch
.222	Guide	Spring Constant = Rigid lb/inch
.223	Anchor	Rigid in all directions

Piping Code: ASME B31.1 - 2007

Case number	Combination
1	D.W. + Pres1 + Ther1
2	D.W. + Pres1
3	Ther1

Piping Code: ASME B31.1 - 2007

*** Support Summary ***

Point Name	Global Direction	Forces(lb) or Moments(inch-lb) Sustain	Expansion Max	Expansion Min	Occasional Max	Occasional Min	Total Max	Total Min
.1	Fx	-25715	0	-3793	0	0	-25715	-29508
	Fy	-236	0	0	0	0	-236	-236
	Mz	-596	0	0	0	0	-596	-596
.3	Fy	-531	0	0	0	0	-531	-531
.4	Fy	-74	0	0	0	0	-74	-74
.5	Fy	-542	0	0	0	0	-542	-542
.6	Fy	-705	0	0	0	0	-705	-705
.7	Fy	-676	0	0	0	0	-676	-676
.8	Fy	-683	0	0	0	0	-683	-683
.9	Fy	-682	0	0	0	0	-682	-682
.10	Fy	-682	0	0	0	0	-682	-682
.11	Fy	-682	0	0	0	0	-682	-682
.12	Fy	-682	0	0	0	0	-682	-682
.13	Fy	-682	0	0	0	0	-682	-682
.14	Fy	-682	0	0	0	0	-682	-682
.15	Fy	-682	0	0	0	0	-682	-682
.16	Fy	-682	0	0	0	0	-682	-682
.17	Fy	-682	0	0	0	0	-682	-682
VH554	Fx	11	0	-512	0	0	11	-501
	Fy	-312	0	0	0	0	-312	-312
	Mz	6622	0	0	0	0	6622	6622
.19	Fy	-555	0	0	0	0	-555	-555
.20	Fy	-706	0	0	0	0	-706	-706
.21	Fy	-676	0	0	0	0	-676	-676
.22	Fy	-683	0	0	0	0	-683	-683
.23	Fy	-682	0	0	0	0	-682	-682
.24	Fy	-682	0	0	0	0	-682	-682
.25	Fy	-682	0	0	0	0	-682	-682
.26	Fy	-682	0	0	0	0	-682	-682
.27	Fy	-682	0	0	0	0	-682	-682
.28	Fy	-682	0	0	0	0	-682	-682
.29	Fy	-682	0	0	0	0	-682	-682
.30	Fy	-682	0	0	0	0	-682	-682
.31	Fy	-683	0	0	0	0	-683	-683
.32	Fy	-676	0	0	0	0	-676	-676
.33	Fy	-706	0	0	0	0	-706	-706
.34	Fy	-556	0	0	0	0	-556	-556
VH555	Fx	90	0	-4009	0	0	90	-3920
	Fy	-815	0	0	0	0	-815	-815
	Mz	-272	0	0	0	0	-272	-272
.38	Fy	-835	0	0	0	0	-835	-835
.39	Fy	-671	0	0	0	0	-671	-671
.40	Fy	-685	0	0	0	0	-685	-685
.41	Fy	-681	0	0	0	0	-681	-681
.42	Fy	-682	0	0	0	0	-682	-682
.43	Fy	-682	0	0	0	0	-682	-682
.44	Fy	-682	0	0	0	0	-682	-682
.45	Fy	-682	0	0	0	0	-682	-682
.46	Fy	-682	0	0	0	0	-682	-682
.47	Fy	-682	0	0	0	0	-682	-682
.48	Fy	-682	0	0	0	0	-682	-682
.49	Fy	-682	0	0	0	0	-682	-682
.50	Fy	-682	0	0	0	0	-682	-682

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*** Support Summary ***

Point Name	Global Direction	Forces(lb) or Moments(inch-lb) Sustain	Expansion Max	Expansion Min	Occasional Max	Occasional Min	Total Max	Total Min
.51	Fy	-682	0	0	0	0	-682	-682
.52	Fy	-682	0	0	0	0	-682	-682
.53	Fy	-682	0	0	0	0	-682	-682
.54	Fy	-682	0	0	0	0	-682	-682
.55	Fy	-682	0	0	0	0	-682	-682
.56	Fy	-682	0	0	0	0	-682	-682
.57	Fy	-682	0	0	0	0	-682	-682
.58	Fy	-682	0	0	0	0	-682	-682
.59	Fy	-682	0	0	0	0	-682	-682
.60	Fy	-682	0	0	0	0	-682	-682
.61	Fy	-682	0	0	0	0	-682	-682
.62	Fy	-682	0	0	0	0	-682	-682
.63	Fy	-682	0	0	0	0	-682	-682
.64	Fy	-682	0	0	0	0	-682	-682
.65	Fy	-682	0	0	0	0	-682	-682
.66	Fy	-682	0	0	0	0	-682	-682
.67	Fy	-682	0	0	0	0	-682	-682
VH556	Fx	0	0	-0	0	0	0	-0
	Fy	-682	0	0	0	0	-682	-682
.69	Fy	-682	0	0	0	0	-682	-682
.70	Fy	-682	0	0	0	0	-682	-682
.71	Fy	-682	0	0	0	0	-682	-682
.72	Fy	-682	0	0	0	0	-682	-682
.73	Fy	-682	0	0	0	0	-682	-682
.74	Fy	-682	0	0	0	0	-682	-682
.75	Fy	-682	0	0	0	0	-682	-682
.76	Fy	-682	0	0	0	0	-682	-682
.77	Fy	-682	0	0	0	0	-682	-682
.78	Fy	-682	0	0	0	0	-682	-682
.79	Fy	-682	0	0	0	0	-682	-682
.80	Fy	-682	0	0	0	0	-682	-682
.81	Fy	-682	0	0	0	0	-682	-682
.82	Fy	-682	0	0	0	0	-682	-682
.83	Fy	-682	0	0	0	0	-682	-682
.84	Fy	-682	0	0	0	0	-682	-682
.85	Fy	-682	0	0	0	0	-682	-682
.86	Fy	-682	0	0	0	0	-682	-682
.87	Fy	-682	0	0	0	0	-682	-682
.88	Fy	-682	0	0	0	0	-682	-682
.89	Fy	-682	0	0	0	0	-682	-682
.90	Fy	-682	0	0	0	0	-682	-682
.91	Fy	-682	0	0	0	0	-682	-682
.92	Fy	-682	0	0	0	0	-682	-682
.93	Fy	-682	0	0	0	0	-682	-682
.94	Fy	-682	0	0	0	0	-682	-682
.95	Fy	-683	0	0	0	0	-683	-683
.96	Fy	-676	0	0	0	0	-676	-676
.97	Fy	-706	0	0	0	0	-706	-706
.98	Fy	-556	0	0	0	0	-556	-556
VH557	Fx	-6	272	0	0	0	266	-6
	Fy	-932	0	0	0	0	-932	-932
	Mz	-2964	0	0	0	0	-2964	-2964
.102	Fy	-717	0	0	0	0	-717	-717

Piping Code: ASME B31.1 - 2007

*** Support Summary ***

Point Name	Global Direction	Forces(lb) or Moments(inch-lb) Sustain	Expansion Max	Expansion Min	Occasional Max	Occasional Min	Total Max	Total Min
.103	Fy	-672	0	0	0	0	-672	-672
.104	Fy	-684	0	0	0	0	-684	-684
.105	Fy	-681	0	0	0	0	-681	-681
.106	Fy	-682	0	0	0	0	-682	-682
.107	Fy	-682	0	0	0	0	-682	-682
.108	Fy	-682	0	0	0	0	-682	-682
.109	Fy	-682	0	0	0	0	-682	-682
.110	Fy	-682	0	0	0	0	-682	-682
.111	Fy	-682	0	0	0	0	-682	-682
.112	Fy	-682	0	0	0	0	-682	-682
.113	Fy	-682	0	0	0	0	-682	-682
.114	Fy	-682	0	0	0	0	-682	-682
.115	Fy	-682	0	0	0	0	-682	-682
.116	Fy	-682	0	0	0	0	-682	-682
.117	Fy	-682	0	0	0	0	-682	-682
.118	Fy	-682	0	0	0	0	-682	-682
.119	Fy	-682	0	0	0	0	-682	-682
.120	Fy	-682	0	0	0	0	-682	-682
.121	Fy	-682	0	0	0	0	-682	-682
.122	Fy	-682	0	0	0	0	-682	-682
.123	Fy	-682	0	0	0	0	-682	-682
.124	Fy	-682	0	0	0	0	-682	-682
.125	Fy	-682	0	0	0	0	-682	-682
.126	Fy	-682	0	0	0	0	-682	-682
.127	Fy	-682	0	0	0	0	-682	-682
.128	Fy	-682	0	0	0	0	-682	-682
.129	Fy	-682	0	0	0	0	-682	-682
.130	Fy	-682	0	0	0	0	-682	-682
vh563	Fx	6	0	-272	0	0	6	-266
	Fy	-682	0	0	0	0	-682	-682
.132	Fy	-682	0	0	0	0	-682	-682
.133	Fy	-682	0	0	0	0	-682	-682
.134	Fy	-682	0	0	0	0	-682	-682
.135	Fy	-682	0	0	0	0	-682	-682
.136	Fy	-682	0	0	0	0	-682	-682
.137	Fy	-682	0	0	0	0	-682	-682
.138	Fy	-682	0	0	0	0	-682	-682
.139	Fy	-682	0	0	0	0	-682	-682
.140	Fy	-682	0	0	0	0	-682	-682
.141	Fy	-682	0	0	0	0	-682	-682
.142	Fy	-682	0	0	0	0	-682	-682
.143	Fy	-682	0	0	0	0	-682	-682
.144	Fy	-682	0	0	0	0	-682	-682
.145	Fy	-682	0	0	0	0	-682	-682
.146	Fy	-682	0	0	0	0	-682	-682
.147	Fy	-682	0	0	0	0	-682	-682
.148	Fy	-682	0	0	0	0	-682	-682
.149	Fy	-682	0	0	0	0	-682	-682
.150	Fy	-682	0	0	0	0	-682	-682
.151	Fy	-682	0	0	0	0	-682	-682
.152	Fy	-682	0	0	0	0	-682	-682
.153	Fy	-682	0	0	0	0	-682	-682
.154	Fy	-682	0	0	0	0	-682	-682

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*** Support Summary ***

Point Name	Global Direction	Forces(lb) or Moments(inch-lb) Sustain	Expansion Max	Expansion Min	Occasional Max	Occasional Min	Total Max	Total Min
.155	Fy	-682	0	0	0	0	-682	-682
.156	Fy	-682	0	0	0	0	-682	-682
.157	Fy	-682	0	0	0	0	-682	-682
.158	Fy	-683	0	0	0	0	-683	-683
.159	Fy	-676	0	0	0	0	-676	-676
.160	Fy	-706	0	0	0	0	-706	-706
.161	Fy	-556	0	0	0	0	-556	-556
VH564	Fx	-6	272	0	0	0	266	-6
	Fy	-932	0	0	0	0	-932	-932
	Mz	-2964	0	0	0	0	-2964	-2964
.165	Fy	-717	0	0	0	0	-717	-717
.166	Fy	-672	0	0	0	0	-672	-672
.167	Fy	-684	0	0	0	0	-684	-684
.168	Fy	-681	0	0	0	0	-681	-681
.169	Fy	-682	0	0	0	0	-682	-682
.170	Fy	-682	0	0	0	0	-682	-682
.171	Fy	-682	0	0	0	0	-682	-682
.172	Fy	-682	0	0	0	0	-682	-682
.173	Fy	-682	0	0	0	0	-682	-682
.174	Fy	-682	0	0	0	0	-682	-682
.175	Fy	-682	0	0	0	0	-682	-682
.176	Fy	-682	0	0	0	0	-682	-682
.177	Fy	-682	0	0	0	0	-682	-682
.178	Fy	-682	0	0	0	0	-682	-682
.179	Fy	-682	0	0	0	0	-682	-682
.180	Fy	-682	0	0	0	0	-682	-682
.181	Fy	-682	0	0	0	0	-682	-682
.182	Fy	-682	0	0	0	0	-682	-682
.183	Fy	-682	0	0	0	0	-682	-682
.184	Fy	-682	0	0	0	0	-682	-682
.185	Fy	-682	0	0	0	0	-682	-682
.186	Fy	-682	0	0	0	0	-682	-682
.187	Fy	-682	0	0	0	0	-682	-682
.188	Fy	-682	0	0	0	0	-682	-682
.189	Fy	-682	0	0	0	0	-682	-682
.190	Fy	-682	0	0	0	0	-682	-682
.191	Fy	-682	0	0	0	0	-682	-682
.192	Fy	-682	0	0	0	0	-682	-682
.193	Fy	-682	0	0	0	0	-682	-682
.194	Fx	25620	8042	0	0	0	33662	25620
	Fy	-341	0	0	0	0	-341	-341
	Mz	6820	0	0	0	0	6820	6820
.196	Fy	-296	0	0	0	0	-296	-296
	Fz	-32477	0	-525	0	0	-32477	-33002
	Mx	4021	0	0	0	0	4021	4021
.198	Fy	-641	0	0	0	0	-641	-641
.199	Fy	-770	0	0	0	0	-770	-770
.200	Fy	-776	0	0	0	0	-776	-776
.201	Fy	-775	0	0	0	0	-775	-775
.202	Fy	-775	0	0	0	0	-775	-775
.203	Fy	-775	0	0	0	0	-775	-775
.204	Fy	-775	0	0	0	0	-775	-775
.205	Fy	-775	0	0	0	0	-775	-775

Piping Code: ASME B31.1 - 2007

*** Support Summary ***

Point Name	Global Direction	Forces(lb) or Moments(inch-lb) Sustain	Expansion Max	Expansion Min	Occasional Max	Occasional Min	Total Max	Total Min
.206	Fy	-775	0	0	0	0	-775	-775
.207	Fy	-775	0	0	0	0	-775	-775
.208	Fy	-775	0	0	0	0	-775	-775
.209	Fy	-775	0	0	0	0	-775	-775
.210	Fy	-775	0	0	0	0	-775	-775
.211	Fy	-775	0	0	0	0	-775	-775
.212	Fy	-775	0	0	0	0	-775	-775
.213	Fy	-775	0	0	0	0	-775	-775
.214	Fy	-775	0	0	0	0	-775	-775
.215	Fy	-775	0	0	0	0	-775	-775
.216	Fy	-775	0	0	0	0	-775	-775
.217	Fy	-775	0	0	0	0	-775	-775
.218	Fy	-775	0	0	0	0	-775	-775
.219	Fy	-775	0	0	0	0	-775	-775
.220	Fy	-775	0	0	0	0	-775	-775
.221	Fy	-775	0	0	0	0	-775	-775
.222	Fy	-775	0	0	0	0	-775	-775
.223	Fy	-388	0	0	0	0	-388	-388
	Fz	32477	525	0	0	0	33002	32477
	Mx	-7751	0	0	0	0	-7751	-7751

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Deflections ***

Point Name	Displacements(inch) X	Y	Z	Rotations(degree) X	Y	Z
.1	-0.000	-0.000	0.000	0.000	0.000	-0.000
VH545	0.025	-0.000	0.000	0.000	0.000	0.000
.3	-3.437	-0.000	0.000	0.000	0.000	0.000
.4	-3.312	-0.000	0.000	0.000	0.000	0.000
.5	-3.261	-0.000	0.000	0.000	0.000	-0.000
.6	-3.011	-0.000	0.000	0.000	0.000	0.000
.7	-2.760	-0.000	0.000	0.000	0.000	-0.000
.8	-2.509	-0.000	0.000	0.000	0.000	0.000
.9	-2.258	-0.000	0.000	0.000	0.000	-0.000
.10	-2.007	-0.000	0.000	0.000	0.000	0.000
.11	-1.756	-0.000	0.000	0.000	0.000	-0.000
.12	-1.505	-0.000	0.000	0.000	0.000	0.000
.13	-1.254	-0.000	0.000	0.000	0.000	-0.000
.14	-1.004	-0.000	0.000	0.000	0.000	0.000
.15	-0.753	-0.000	0.000	0.000	0.000	0.000
.16	-0.502	-0.000	0.000	0.000	0.000	-0.000
.17	-0.251	-0.000	0.000	0.000	0.000	0.000
VH554	-0.000	-0.000	0.000	0.000	0.000	0.000
.19	0.075	-0.000	0.000	0.000	0.000	-0.000
.20	0.326	-0.000	0.000	0.000	0.000	0.000
.21	0.577	-0.000	0.000	0.000	0.000	-0.000
.22	0.828	-0.000	0.000	0.000	0.000	0.000
.23	1.078	-0.000	0.000	0.000	0.000	-0.000
.24	1.329	-0.000	0.000	0.000	0.000	0.000
.25	1.580	-0.000	0.000	0.000	0.000	-0.000
.26	1.831	-0.000	0.000	0.000	0.000	0.000
.27	2.081	-0.000	0.000	0.000	0.000	-0.000
.28	2.332	-0.000	0.000	0.000	0.000	0.000
.29	2.583	-0.000	0.000	0.000	0.000	-0.000
.30	2.834	-0.000	0.000	0.000	0.000	0.000
.31	3.084	-0.000	0.000	0.000	0.000	-0.000
.32	3.335	-0.000	0.000	0.000	0.000	0.000
.33	3.586	-0.000	0.000	0.000	0.000	-0.000
.34	3.837	-0.000	0.000	0.000	0.000	0.000
.35	3.930	-0.000	0.000	0.000	0.000	0.000
VH555	-0.000	-0.000	0.000	0.000	0.000	-0.000
.37	0.092	-0.000	0.000	0.000	0.000	0.000
.38	-7.497	-0.000	0.000	0.000	0.000	0.000
.39	-7.247	-0.000	0.000	0.000	0.000	-0.000
.40	-6.997	-0.000	0.000	0.000	0.000	0.000
.41	-6.747	-0.000	0.000	0.000	0.000	-0.000
.42	-6.497	-0.000	0.000	0.000	0.000	0.000
.43	-6.247	-0.000	0.000	0.000	0.000	-0.000
.44	-5.997	-0.000	0.000	0.000	0.000	0.000
.45	-5.748	-0.000	0.000	0.000	0.000	-0.000
.46	-5.498	-0.000	0.000	0.000	0.000	0.000
.47	-5.248	-0.000	0.000	0.000	0.000	-0.000
.48	-4.998	-0.000	0.000	0.000	0.000	0.000
.49	-4.748	-0.000	0.000	0.000	0.000	-0.000
.50	-4.498	-0.000	0.000	0.000	0.000	0.000
.51	-4.248	-0.000	0.000	0.000	0.000	-0.000
.52	-3.998	-0.000	0.000	0.000	0.000	0.000
.53	-3.748	-0.000	0.000	0.000	0.000	-0.000
.54	-3.499	-0.000	0.000	0.000	0.000	0.000
.55	-3.249	-0.000	0.000	0.000	0.000	-0.000
.56	-2.999	-0.000	0.000	0.000	0.000	0.000

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Deflections ***

Point Name	Displacements(inch) X	Y	Z	Rotations(degree) X	Y	Z
.57	-2.749	-0.000	0.000	0.000	0.000	-0.000
.58	-2.499	-0.000	0.000	0.000	0.000	0.000
.59	-2.249	-0.000	0.000	0.000	0.000	-0.000
.60	-1.999	-0.000	0.000	0.000	0.000	0.000
.61	-1.749	-0.000	0.000	0.000	0.000	-0.000
.62	-1.499	-0.000	0.000	0.000	0.000	-0.000
.63	-1.249	-0.000	0.000	0.000	0.000	0.000
.64	-1.000	-0.000	0.000	0.000	0.000	-0.000
.65	-0.750	-0.000	0.000	0.000	0.000	-0.000
.66	-0.500	-0.000	0.000	0.000	0.000	-0.000
.67	-0.250	-0.000	0.000	0.000	0.000	-0.000
VH556	-0.000	-0.000	0.000	0.000	0.000	-0.000
.69	0.250	-0.000	0.000	0.000	0.000	-0.000
.70	0.500	-0.000	0.000	0.000	0.000	-0.000
.71	0.750	-0.000	0.000	0.000	0.000	-0.000
.72	1.000	-0.000	0.000	0.000	0.000	0.000
.73	1.249	-0.000	0.000	0.000	0.000	-0.000
.74	1.499	-0.000	0.000	0.000	0.000	-0.000
.75	1.749	-0.000	0.000	0.000	0.000	-0.000
.76	1.999	-0.000	0.000	0.000	0.000	0.000
.77	2.249	-0.000	0.000	0.000	0.000	-0.000
.78	2.499	-0.000	0.000	0.000	0.000	0.000
.79	2.749	-0.000	0.000	0.000	0.000	-0.000
.80	2.999	-0.000	0.000	0.000	0.000	0.000
.81	3.249	-0.000	0.000	0.000	0.000	-0.000
.82	3.499	-0.000	0.000	0.000	0.000	0.000
.83	3.748	-0.000	0.000	0.000	0.000	-0.000
.84	3.998	-0.000	0.000	0.000	0.000	0.000
.85	4.248	-0.000	0.000	0.000	0.000	-0.000
.86	4.498	-0.000	0.000	0.000	0.000	0.000
.87	4.748	-0.000	0.000	0.000	0.000	-0.000
.88	4.998	-0.000	0.000	0.000	0.000	0.000
.89	5.248	-0.000	0.000	0.000	0.000	-0.000
.90	5.498	-0.000	0.000	0.000	0.000	0.000
.91	5.748	-0.000	0.000	0.000	0.000	-0.000
.92	5.997	-0.000	0.000	0.000	0.000	0.000
.93	6.247	-0.000	0.000	0.000	0.000	-0.000
.94	6.497	-0.000	0.000	0.000	0.000	0.000
.95	6.747	-0.000	0.000	0.000	0.000	-0.000
.96	6.997	-0.000	0.000	0.000	0.000	0.000
.97	7.247	-0.000	0.000	0.000	0.000	-0.000
.98	7.497	-0.000	0.000	0.000	0.000	0.000
.99	7.589	-0.000	0.000	0.000	0.000	-0.000
VH557	0.000	-0.000	0.000	0.000	0.000	-0.000
.101	0.092	-0.000	0.000	0.000	0.000	0.000
.102	-7.249	-0.000	0.000	0.000	0.000	0.000
.103	-6.999	-0.000	0.000	0.000	0.000	-0.000
.104	-6.749	-0.000	0.000	0.000	0.000	0.000
.105	-6.499	-0.000	0.000	0.000	0.000	-0.000
.106	-6.249	-0.000	0.000	0.000	0.000	0.000
.107	-5.999	-0.000	0.000	0.000	0.000	-0.000
.108	-5.749	-0.000	0.000	0.000	0.000	0.000
.109	-5.499	-0.000	0.000	0.000	0.000	-0.000
.110	-5.249	-0.000	0.000	0.000	0.000	-0.000
.111	-4.999	-0.000	0.000	0.000	0.000	0.000
.112	-4.749	-0.000	0.000	0.000	0.000	-0.000

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Deflections ***

Point Name	Displacements(inch) X	Y	Z	Rotations(degree) X	Y	Z
.113	-4.499	-0.000	0.000	0.000	0.000	0.000
.114	-4.249	-0.000	0.000	0.000	0.000	-0.000
.115	-3.999	-0.000	0.000	0.000	0.000	0.000
.116	-3.749	-0.000	0.000	0.000	0.000	-0.000
.117	-3.499	-0.000	0.000	0.000	0.000	0.000
.118	-3.249	-0.000	0.000	0.000	0.000	-0.000
.119	-2.999	-0.000	0.000	0.000	0.000	0.000
.120	-2.750	-0.000	0.000	0.000	0.000	-0.000
.121	-2.500	-0.000	0.000	0.000	0.000	0.000
.122	-2.250	-0.000	0.000	0.000	0.000	-0.000
.123	-2.000	-0.000	0.000	0.000	0.000	0.000
.124	-1.750	-0.000	0.000	0.000	0.000	-0.000
.125	-1.500	-0.000	0.000	0.000	0.000	0.000
.126	-1.250	-0.000	0.000	0.000	0.000	-0.000
.127	-1.000	-0.000	0.000	0.000	0.000	0.000
.128	-0.750	-0.000	0.000	0.000	0.000	-0.000
.129	-0.500	-0.000	0.000	0.000	0.000	-0.000
.130	-0.250	-0.000	0.000	0.000	0.000	-0.000
vh563	-0.000	-0.000	0.000	0.000	0.000	-0.000
.132	0.250	-0.000	0.000	0.000	0.000	-0.000
.133	0.500	-0.000	0.000	0.000	0.000	-0.000
.134	0.750	-0.000	0.000	0.000	0.000	-0.000
.135	1.000	-0.000	0.000	0.000	0.000	-0.000
.136	1.249	-0.000	0.000	0.000	0.000	0.000
.137	1.499	-0.000	0.000	0.000	0.000	-0.000
.138	1.749	-0.000	0.000	0.000	0.000	0.000
.139	1.999	-0.000	0.000	0.000	0.000	-0.000
.140	2.249	-0.000	0.000	0.000	0.000	-0.000
.141	2.499	-0.000	0.000	0.000	0.000	0.000
.142	2.749	-0.000	0.000	0.000	0.000	-0.000
.143	2.999	-0.000	0.000	0.000	0.000	0.000
.144	3.249	-0.000	0.000	0.000	0.000	-0.000
.145	3.499	-0.000	0.000	0.000	0.000	0.000
.146	3.748	-0.000	0.000	0.000	0.000	-0.000
.147	3.998	-0.000	0.000	0.000	0.000	0.000
.148	4.248	-0.000	0.000	0.000	0.000	-0.000
.149	4.498	-0.000	0.000	0.000	0.000	0.000
.150	4.748	-0.000	0.000	0.000	0.000	-0.000
.151	4.998	-0.000	0.000	0.000	0.000	0.000
.152	5.248	-0.000	0.000	0.000	0.000	-0.000
.153	5.498	-0.000	0.000	0.000	0.000	0.000
.154	5.748	-0.000	0.000	0.000	0.000	-0.000
.155	5.997	-0.000	0.000	0.000	0.000	0.000
.156	6.247	-0.000	0.000	0.000	0.000	-0.000
.157	6.497	-0.000	0.000	0.000	0.000	0.000
.158	6.747	-0.000	0.000	0.000	0.000	-0.000
.159	6.997	-0.000	0.000	0.000	0.000	0.000
.160	7.247	-0.000	0.000	0.000	0.000	-0.000
.161	7.497	-0.000	0.000	0.000	0.000	0.000
.162	7.589	-0.000	0.000	0.000	0.000	-0.000
VH564	0.000	-0.000	0.000	0.000	0.000	-0.000
.164	0.092	-0.000	0.000	0.000	0.000	0.000
.165	-7.249	-0.000	0.000	0.000	0.000	0.000
.166	-6.999	-0.000	0.000	0.000	0.000	-0.000
.167	-6.749	-0.000	0.000	0.000	0.000	0.000
.168	-6.499	-0.000	0.000	0.000	0.000	-0.000

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Deflections ***

Point Name	Displacements(inch) X	Y	Z	Rotations(degree) X	Y	Z
.169	-6.249	-0.000	0.000	0.000	0.000	0.000
.170	-5.999	-0.000	0.000	0.000	0.000	-0.000
.171	-5.749	-0.000	0.000	0.000	0.000	0.000
.172	-5.499	-0.000	0.000	0.000	0.000	-0.000
.173	-5.249	-0.000	0.000	0.000	0.000	0.000
.174	-4.999	-0.000	0.000	0.000	0.000	-0.000
.175	-4.749	-0.000	0.000	0.000	0.000	0.000
.176	-4.499	-0.000	0.000	0.000	0.000	-0.000
.177	-4.249	-0.000	0.000	0.000	0.000	0.000
.178	-3.999	-0.000	0.000	0.000	0.000	-0.000
.179	-3.749	-0.000	0.000	0.000	0.000	0.000
.180	-3.499	-0.000	0.000	0.000	0.000	-0.000
.181	-3.249	-0.000	0.000	0.000	0.000	0.000
.182	-2.999	-0.000	0.000	0.000	0.000	-0.000
.183	-2.750	-0.000	0.000	0.000	0.000	0.000
.184	-2.500	-0.000	0.000	0.000	0.000	-0.000
.185	-2.250	-0.000	0.000	0.000	0.000	0.000
.186	-2.000	-0.000	0.000	0.000	0.000	-0.000
.187	-1.750	-0.000	0.000	0.000	0.000	0.000
.188	-1.500	-0.000	0.000	0.000	0.000	-0.000
.189	-1.250	-0.000	0.000	0.000	0.000	0.000
.190	-1.000	-0.000	0.000	0.000	0.000	-0.000
.191	-0.750	-0.000	0.000	0.000	0.000	0.000
.192	-0.500	-0.000	0.000	0.000	0.000	-0.000
.193	-0.250	-0.000	0.000	0.000	0.000	0.000
.194	0.000	-0.000	0.000	0.000	0.000	0.000
.196	0.000	-0.000	-0.000	0.000	0.000	0.000
.197	0.000	-0.000	0.086	-0.000	0.000	0.000
.198	0.000	-0.000	-6.152	-0.000	0.000	0.000
.199	0.000	-0.000	-5.906	0.000	0.000	0.000
.200	0.000	-0.000	-5.660	-0.000	0.000	0.000
.201	0.000	-0.000	-5.414	0.000	0.000	0.000
.202	0.000	-0.000	-5.168	-0.000	0.000	0.000
.203	0.000	-0.000	-4.922	0.000	0.000	0.000
.204	0.000	-0.000	-4.676	-0.000	0.000	0.000
.205	0.000	-0.000	-4.430	0.000	0.000	0.000
.206	0.000	-0.000	-4.183	-0.000	0.000	0.000
.207	0.000	-0.000	-3.937	0.000	0.000	0.000
.208	0.000	-0.000	-3.691	-0.000	0.000	0.000
.209	0.000	-0.000	-3.445	0.000	0.000	0.000
.210	0.000	-0.000	-3.199	-0.000	0.000	0.000
.211	0.000	-0.000	-2.953	0.000	0.000	0.000
.212	0.000	-0.000	-2.707	-0.000	0.000	0.000
.213	0.000	-0.000	-2.461	0.000	0.000	0.000
.214	0.000	-0.000	-2.215	-0.000	0.000	0.000
.215	0.000	-0.000	-1.969	0.000	0.000	0.000
.216	0.000	-0.000	-1.723	-0.000	0.000	0.000
.217	0.000	-0.000	-1.476	0.000	0.000	0.000
.218	0.000	-0.000	-1.230	-0.000	0.000	0.000
.219	0.000	-0.000	-0.984	0.000	0.000	0.000
.220	0.000	-0.000	-0.738	-0.000	0.000	0.000
.221	0.000	-0.000	-0.492	0.000	0.000	0.000
.222	0.000	-0.000	-0.246	-0.000	0.000	0.000
.223	0.000	-0.000	0.000	-0.000	0.000	0.000

Load : Dead Weight + Pressure 1 + Thermal 1

*** Forces and Moments acting on Restraints ***

Point Name	Forces(lb) X	Y	Z	Moments(inch-lb) X	Y	Z
.1	-29508	-236	0	0	0	-596
.3	0	-531	0	0	0	0
.4	0	-74	0	0	0	0
.5	0	-542	0	0	0	0
.6	0	-705	0	0	0	0
.7	0	-676	0	0	0	0
.8	0	-683	0	0	0	0
.9	0	-682	0	0	0	0
.10	0	-682	0	0	0	0
.11	0	-682	0	0	0	0
.12	0	-682	0	0	0	0
.13	0	-682	0	0	0	0
.14	0	-682	0	0	0	0
.15	0	-682	0	0	0	0
.16	0	-682	0	0	0	0
.17	0	-682	0	0	0	0
VH554	-501	-312	0	0	0	6622
.19	0	-555	0	0	0	0
.20	0	-706	0	0	0	0
.21	0	-676	0	0	0	0
.22	0	-683	0	0	0	0
.23	0	-682	0	0	0	0
.24	0	-682	0	0	0	0
.25	0	-682	0	0	0	0
.26	0	-682	0	0	0	0
.27	0	-682	0	0	0	0
.28	0	-682	0	0	0	0
.29	0	-682	0	0	0	0
.30	0	-682	0	0	0	0
.31	0	-683	0	0	0	0
.32	0	-676	0	0	0	0
.33	0	-706	0	0	0	0
.34	0	-556	0	0	0	0
VH555	-3920	-815	0	0	0	-272
.38	0	-835	0	0	0	0
.39	0	-671	0	0	0	0
.40	0	-685	0	0	0	0
.41	0	-681	0	0	0	0
.42	0	-682	0	0	0	0
.43	0	-682	0	0	0	0
.44	0	-682	0	0	0	0
.45	0	-682	0	0	0	0
.46	0	-682	0	0	0	0
.47	0	-682	0	0	0	0
.48	0	-682	0	0	0	0
.49	0	-682	0	0	0	0
.50	0	-682	0	0	0	0
.51	0	-682	0	0	0	0
.52	0	-682	0	0	0	0
.53	0	-682	0	0	0	0
.54	0	-682	0	0	0	0
.55	0	-682	0	0	0	0
.56	0	-682	0	0	0	0
.57	0	-682	0	0	0	0
.58	0	-682	0	0	0	0
.59	0	-682	0	0	0	0

Load : Dead Weight + Pressure 1 + Thermal 1

*** Forces and Moments acting on Restraints ***

Point Name	Forces(lb) X	Y	Z	Moments(inch-lb) X	Y	Z
.60	0	-682	0	0	0	0
.61	0	-682	0	0	0	0
.62	0	-682	0	0	0	0
.63	0	-682	0	0	0	0
.64	0	-682	0	0	0	0
.65	0	-682	0	0	0	0
.66	0	-682	0	0	0	0
.67	0	-682	0	0	0	0
VH556	-0	-682	0	0	0	-0
.69	0	-682	0	0	0	0
.70	0	-682	0	0	0	0
.71	0	-682	0	0	0	0
.72	0	-682	0	0	0	0
.73	0	-682	0	0	0	0
.74	0	-682	0	0	0	0
.75	0	-682	0	0	0	0
.76	0	-682	0	0	0	0
.77	0	-682	0	0	0	0
.78	0	-682	0	0	0	0
.79	0	-682	0	0	0	0
.80	0	-682	0	0	0	0
.81	0	-682	0	0	0	0
.82	0	-682	0	0	0	0
.83	0	-682	0	0	0	0
.84	0	-682	0	0	0	0
.85	0	-682	0	0	0	0
.86	0	-682	0	0	0	0
.87	0	-682	0	0	0	0
.88	0	-682	0	0	0	0
.89	0	-682	0	0	0	0
.90	0	-682	0	0	0	0
.91	0	-682	0	0	0	0
.92	0	-682	0	0	0	0
.93	0	-682	0	0	0	0
.94	0	-682	0	0	0	0
.95	0	-683	0	0	0	0
.96	0	-676	0	0	0	0
.97	0	-706	0	0	0	0
.98	0	-556	0	0	0	0
VH557	266	-932	0	0	0	-2964
.102	0	-717	0	0	0	0
.103	0	-672	0	0	0	0
.104	0	-684	0	0	0	0
.105	0	-681	0	0	0	0
.106	0	-682	0	0	0	0
.107	0	-682	0	0	0	0
.108	0	-682	0	0	0	0
.109	0	-682	0	0	0	0
.110	0	-682	0	0	0	0
.111	0	-682	0	0	0	0
.112	0	-682	0	0	0	0
.113	0	-682	0	0	0	0
.114	0	-682	0	0	0	0
.115	0	-682	0	0	0	0
.116	0	-682	0	0	0	0
.117	0	-682	0	0	0	0

Load : Dead Weight + Pressure 1 + Thermal 1

*** Forces and Moments acting on Restraints ***

Point Name	Forces(lb) X	Y	Z	Moments(inch-lb) X	Y	Z
.118	0	-682	0	0	0	0
.119	0	-682	0	0	0	0
.120	0	-682	0	0	0	0
.121	0	-682	0	0	0	0
.122	0	-682	0	0	0	0
.123	0	-682	0	0	0	0
.124	0	-682	0	0	0	0
.125	0	-682	0	0	0	0
.126	0	-682	0	0	0	0
.127	0	-682	0	0	0	0
.128	0	-682	0	0	0	0
.129	0	-682	0	0	0	0
.130	0	-682	0	0	0	0
vh563	-266	-682	0	0	0	-0
.132	0	-682	0	0	0	0
.133	0	-682	0	0	0	0
.134	0	-682	0	0	0	0
.135	0	-682	0	0	0	0
.136	0	-682	0	0	0	0
.137	0	-682	0	0	0	0
.138	0	-682	0	0	0	0
.139	0	-682	0	0	0	0
.140	0	-682	0	0	0	0
.141	0	-682	0	0	0	0
.142	0	-682	0	0	0	0
.143	0	-682	0	0	0	0
.144	0	-682	0	0	0	0
.145	0	-682	0	0	0	0
.146	0	-682	0	0	0	0
.147	0	-682	0	0	0	0
.148	0	-682	0	0	0	0
.149	0	-682	0	0	0	0
.150	0	-682	0	0	0	0
.151	0	-682	0	0	0	0
.152	0	-682	0	0	0	0
.153	0	-682	0	0	0	0
.154	0	-682	0	0	0	0
.155	0	-682	0	0	0	0
.156	0	-682	0	0	0	0
.157	0	-682	0	0	0	0
.158	0	-683	0	0	0	0
.159	0	-676	0	0	0	0
.160	0	-706	0	0	0	0
.161	0	-556	0	0	0	0
VH564	266	-932	0	0	0	-2964
.165	0	-717	0	0	0	0
.166	0	-672	0	0	0	0
.167	0	-684	0	0	0	0
.168	0	-681	0	0	0	0
.169	0	-682	0	0	0	0
.170	0	-682	0	0	0	0
.171	0	-682	0	0	0	0
.172	0	-682	0	0	0	0
.173	0	-682	0	0	0	0
.174	0	-682	0	0	0	0
.175	0	-682	0	0	0	0

Load : Dead Weight + Pressure 1 + Thermal 1

*** Forces and Moments acting on Restraints ***

Point Name	Forces(lb) X	Y	Z	Moments(inch-lb) X	Y	Z
.176	0	-682	0	0	0	0
.177	0	-682	0	0	0	0
.178	0	-682	0	0	0	0
.179	0	-682	0	0	0	0
.180	0	-682	0	0	0	0
.181	0	-682	0	0	0	0
.182	0	-682	0	0	0	0
.183	0	-682	0	0	0	0
.184	0	-682	0	0	0	0
.185	0	-682	0	0	0	0
.186	0	-682	0	0	0	0
.187	0	-682	0	0	0	0
.188	0	-682	0	0	0	0
.189	0	-682	0	0	0	0
.190	0	-682	0	0	0	0
.191	0	-682	0	0	0	0
.192	0	-682	0	0	0	0
.193	0	-682	0	0	0	0
.194	33662	-341	0	0	0	6820
.196	0	-296	-33002	4021	0	0
.198	0	-641	0	0	0	0
.199	0	-770	0	0	0	0
.200	0	-776	0	0	0	0
.201	0	-775	0	0	0	0
.202	0	-775	0	0	0	0
.203	0	-775	0	0	0	0
.204	0	-775	0	0	0	0
.205	0	-775	0	0	0	0
.206	0	-775	0	0	0	0
.207	0	-775	0	0	0	0
.208	0	-775	0	0	0	0
.209	0	-775	0	0	0	0
.210	0	-775	0	0	0	0
.211	0	-775	0	0	0	0
.212	0	-775	0	0	0	0
.213	0	-775	0	0	0	0
.214	0	-775	0	0	0	0
.215	0	-775	0	0	0	0
.216	0	-775	0	0	0	0
.217	0	-775	0	0	0	0
.218	0	-775	0	0	0	0
.219	0	-775	0	0	0	0
.220	0	-775	0	0	0	0
.221	0	-775	0	0	0	0
.222	0	-775	0	0	0	0
.223	0	-388	33002	-7751	0	0

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
.1	1.00	1.00	69.39	2122	626	2122	1090	42750	2
VH545	1.00	1.00	69.39	2122	644	2122	1107	42750	2
.3	1.00	1.00	69.39	2122	649	2122	1112	42750	2
.4	1.00	1.00	69.39	2122	637	2122	1101	42750	2
.4	1.00	1.00	69.39	2122	637	2122	1101	42750	2
.5	1.00	1.00	69.39	2122	690	2122	1153	42750	2
.5	1.00	1.00	69.39	2122	690	2122	1153	42750	2
.6	1.00	1.00	69.39	2122	722	2122	1186	42750	2
.6	1.00	1.00	69.39	2122	722	2122	1186	42750	2
.7	1.00	1.00	69.39	2122	714	2122	1178	42750	2
.7	1.00	1.00	69.39	2122	714	2122	1178	42750	2
.8	1.00	1.00	69.39	2122	716	2122	1180	42750	2
.8	1.00	1.00	69.39	2122	716	2122	1180	42750	2
.9	1.00	1.00	69.39	2122	716	2122	1179	42750	2
.9	1.00	1.00	69.39	2122	716	2122	1179	42750	2
.10	1.00	1.00	69.39	2122	716	2122	1179	42750	2
.10	1.00	1.00	69.39	2122	716	2122	1179	42750	2
.11	1.00	1.00	69.39	2122	716	2122	1179	42750	2
.11	1.00	1.00	69.39	2122	716	2122	1179	42750	2
.12	1.00	1.00	69.39	2122	716	2122	1179	42750	2
.12	1.00	1.00	69.39	2122	716	2122	1179	42750	2
.13	1.00	1.00	69.39	2122	716	2122	1179	42750	2
.13	1.00	1.00	69.39	2122	716	2122	1179	42750	2
.14	1.00	1.00	69.39	2122	716	2122	1179	42750	2
.14	1.00	1.00	69.39	2122	716	2122	1179	42750	2
.15	1.00	1.00	69.39	2122	716	2122	1179	42750	2
.15	1.00	1.00	69.39	2122	716	2122	1179	42750	2
.16	1.00	1.00	69.39	2122	716	2122	1179	42750	2
.16	1.00	1.00	69.39	2122	716	2122	1179	42750	2
.17	1.00	1.00	69.39	2122	716	2122	1179	42750	2
.17	1.00	1.00	69.39	2122	716	2122	1179	42750	2
VH554	1.00	1.00	69.39	2122	716	2122	1179	42750	2
VH554	1.00	1.00	69.39	2122	648	2122	1084	42750	2
.19	1.00	1.00	69.39	2122	716	2122	1152	42750	2
.19	1.00	1.00	69.39	2122	716	2122	1152	42750	2
.20	1.00	1.00	69.39	2122	750	2122	1186	42750	2
.20	1.00	1.00	69.39	2122	750	2122	1186	42750	2
.21	1.00	1.00	69.39	2122	742	2122	1178	42750	2
.21	1.00	1.00	69.39	2122	742	2122	1178	42750	2
.22	1.00	1.00	69.39	2122	744	2122	1180	42750	2
.22	1.00	1.00	69.39	2122	744	2122	1180	42750	2
.23	1.00	1.00	69.39	2122	743	2122	1179	42750	2
.23	1.00	1.00	69.39	2122	743	2122	1179	42750	2
.24	1.00	1.00	69.39	2122	743	2122	1179	42750	2
.24	1.00	1.00	69.39	2122	743	2122	1179	42750	2
.25	1.00	1.00	69.39	2122	743	2122	1179	42750	2
.25	1.00	1.00	69.39	2122	743	2122	1179	42750	2
.26	1.00	1.00	69.39	2122	743	2122	1179	42750	2
.26	1.00	1.00	69.39	2122	743	2122	1179	42750	2
.27	1.00	1.00	69.39	2122	743	2122	1179	42750	2
.27	1.00	1.00	69.39	2122	743	2122	1179	42750	2
.28	1.00	1.00	69.39	2122	743	2122	1179	42750	2
.28	1.00	1.00	69.39	2122	743	2122	1179	42750	2
.29	1.00	1.00	69.39	2122	743	2122	1179	42750	2
.29	1.00	1.00	69.39	2122	743	2122	1179	42750	2

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
.30	1.00	1.00	69.39	2122	743	2122	1179	42750	2
.30	1.00	1.00	69.39	2122	743	2122	1179	42750	2
.31	1.00	1.00	69.39	2122	744	2122	1180	42750	2
.31	1.00	1.00	69.39	2122	744	2122	1180	42750	2
.32	1.00	1.00	69.39	2122	742	2122	1178	42750	2
.32	1.00	1.00	69.39	2122	742	2122	1178	42750	2
.33	1.00	1.00	69.39	2122	750	2122	1186	42750	2
.33	1.00	1.00	69.39	2122	750	2122	1186	42750	2
.34	1.00	1.00	69.39	2122	716	2122	1152	42750	2
.34	1.00	1.00	69.39	2122	716	2122	1152	42750	2
.35	1.00	1.00	69.39	2122	647	2122	1083	42750	2
VH555	1.00	1.00	69.39	2122	914	2122	1134	42750	2
.37	1.00	1.00	69.39	2122	908	2122	1128	42750	2
.38	1.00	1.00	69.39	2122	972	2122	1192	42750	2
.39	1.00	1.00	69.39	2122	956	2122	1176	42750	2
.39	1.00	1.00	69.39	2122	956	2122	1176	42750	2
.40	1.00	1.00	69.39	2122	960	2122	1180	42750	2
.40	1.00	1.00	69.39	2122	960	2122	1180	42750	2
.41	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.41	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.42	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.42	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.43	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.43	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.44	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.44	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.45	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.45	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.46	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.46	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.47	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.47	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.48	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.48	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.49	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.49	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.50	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.50	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.51	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.51	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.52	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.52	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.53	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.53	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.54	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.54	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.55	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.55	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.56	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.56	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.57	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.57	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.58	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.58	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.59	1.00	1.00	69.39	2122	959	2122	1179	42750	2

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
.59	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.60	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.60	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.61	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.61	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.62	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.62	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.63	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.63	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.64	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.64	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.65	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.65	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.66	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.66	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.67	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.67	1.00	1.00	69.39	2122	959	2122	1179	42750	2
VH556	1.00	1.00	69.39	2122	959	2122	1179	42750	2
VH556	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.69	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.69	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.70	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.70	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.71	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.71	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.72	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.72	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.73	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.73	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.74	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.74	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.75	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.75	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.76	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.76	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.77	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.77	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.78	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.78	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.79	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.79	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.80	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.80	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.81	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.81	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.82	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.82	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.83	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.83	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.84	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.84	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.85	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.85	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.86	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.86	1.00	1.00	69.39	2122	959	2122	1179	42750	2

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
.87	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.87	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.88	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.88	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.89	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.89	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.90	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.90	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.91	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.91	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.92	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.92	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.93	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.93	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.94	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.94	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.95	1.00	1.00	69.39	2122	959	2122	1180	42750	2
.95	1.00	1.00	69.39	2122	959	2122	1180	42750	2
.96	1.00	1.00	69.39	2122	958	2122	1178	42750	2
.96	1.00	1.00	69.39	2122	958	2122	1178	42750	2
.97	1.00	1.00	69.39	2122	966	2122	1186	42750	2
.97	1.00	1.00	69.39	2122	966	2122	1186	42750	2
.98	1.00	1.00	69.39	2122	932	2122	1152	42750	2
.98	1.00	1.00	69.39	2122	932	2122	1152	42750	2
.99	1.00	1.00	69.39	2122	862	2122	1083	42750	2
VH557	1.00	1.00	69.39	2122	938	2122	1173	42750	2
.101	1.00	1.00	69.39	2122	929	2122	1164	42750	2
.102	1.00	1.00	69.39	2122	955	2122	1190	42750	2
.103	1.00	1.00	69.39	2122	942	2122	1177	42750	2
.103	1.00	1.00	69.39	2122	942	2122	1177	42750	2
.104	1.00	1.00	69.39	2122	945	2122	1180	42750	2
.104	1.00	1.00	69.39	2122	945	2122	1180	42750	2
.105	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.105	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.106	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.106	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.107	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.107	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.108	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.108	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.109	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.109	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.110	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.110	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.111	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.111	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.112	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.112	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.113	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.113	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.114	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.114	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.115	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.115	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.116	1.00	1.00	69.39	2122	944	2122	1179	42750	2

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
.116	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.117	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.117	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.118	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.118	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.119	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.119	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.120	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.120	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.121	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.121	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.122	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.122	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.123	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.123	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.124	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.124	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.125	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.125	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.126	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.126	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.127	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.127	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.128	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.128	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.129	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.129	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.130	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.130	1.00	1.00	69.39	2122	944	2122	1179	42750	2
vh563	1.00	1.00	69.39	2122	944	2122	1179	42750	2
vh563	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.132	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.132	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.133	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.133	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.134	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.134	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.135	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.135	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.136	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.136	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.137	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.137	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.138	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.138	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.139	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.139	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.140	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.140	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.141	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.141	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.142	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.142	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.143	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.143	1.00	1.00	69.39	2122	959	2122	1179	42750	2

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
.144	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.144	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.145	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.145	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.146	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.146	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.147	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.147	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.148	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.148	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.149	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.149	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.150	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.150	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.151	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.151	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.152	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.152	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.153	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.153	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.154	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.154	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.155	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.155	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.156	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.156	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.157	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.157	1.00	1.00	69.39	2122	959	2122	1179	42750	2
.158	1.00	1.00	69.39	2122	959	2122	1180	42750	2
.158	1.00	1.00	69.39	2122	959	2122	1180	42750	2
.159	1.00	1.00	69.39	2122	958	2122	1178	42750	2
.159	1.00	1.00	69.39	2122	958	2122	1178	42750	2
.160	1.00	1.00	69.39	2122	966	2122	1186	42750	2
.160	1.00	1.00	69.39	2122	966	2122	1186	42750	2
.161	1.00	1.00	69.39	2122	932	2122	1152	42750	2
.161	1.00	1.00	69.39	2122	932	2122	1152	42750	2
.162	1.00	1.00	69.39	2122	862	2122	1083	42750	2
VH564	1.00	1.00	69.39	2122	938	2122	1173	42750	2
.164	1.00	1.00	69.39	2122	929	2122	1164	42750	2
.165	1.00	1.00	69.39	2122	955	2122	1190	42750	2
.166	1.00	1.00	69.39	2122	942	2122	1177	42750	2
.166	1.00	1.00	69.39	2122	942	2122	1177	42750	2
.167	1.00	1.00	69.39	2122	945	2122	1180	42750	2
.167	1.00	1.00	69.39	2122	945	2122	1180	42750	2
.168	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.168	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.169	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.169	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.170	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.170	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.171	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.171	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.172	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.172	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.173	1.00	1.00	69.39	2122	944	2122	1179	42750	2

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
.173	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.174	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.174	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.175	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.175	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.176	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.176	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.177	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.177	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.178	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.178	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.179	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.179	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.180	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.180	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.181	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.181	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.182	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.182	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.183	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.183	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.184	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.184	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.185	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.185	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.186	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.186	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.187	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.187	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.188	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.188	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.189	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.189	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.190	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.190	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.191	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.191	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.192	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.192	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.193	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.193	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.194	1.00	1.00	69.39	2122	944	2122	1179	42750	2
.196	1.00	1.00	29.54	1453	2272	2272	883	42750	2
.197	1.00	1.00	29.54	1453	2228	2228	839	42750	1
.198	1.00	1.00	29.54	1453	2410	2410	1021	42750	2
.199	1.00	1.00	29.54	1453	2396	2396	1006	42750	2
.199	1.00	1.00	29.54	1453	2396	2396	1006	42750	2
.200	1.00	1.00	29.54	1453	2399	2399	1010	42750	2
.200	1.00	1.00	29.54	1453	2399	2399	1010	42750	2
.201	1.00	1.00	29.54	1453	2398	2398	1009	42750	2
.201	1.00	1.00	29.54	1453	2398	2398	1009	42750	2
.202	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.202	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.203	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.203	1.00	1.00	29.54	1453	2399	2399	1009	42750	2

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Stresses (ASME B31.1) ***

Point Name	In-Plane SIF	Out Plane SIF	Section Modulus	Stresses(psi) Hoop	Longitu.	Principal	Code	Allow.	%
.204	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.204	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.205	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.205	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.206	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.206	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.207	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.207	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.208	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.208	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.209	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.209	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.210	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.210	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.211	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.211	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.212	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.212	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.213	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.213	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.214	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.214	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.215	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.215	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.216	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.216	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.217	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.217	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.218	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.218	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.219	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.219	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.220	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.220	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.221	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.221	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.222	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.222	1.00	1.00	29.54	1453	2399	2399	1009	42750	2
.223	1.00	1.00	29.54	1453	2399	2399	1009	42750	2

Load : Dead Weight + Pressure 1 + Thermal 1

*** System Maxima ***

Maximum X displacement = 7.589 inch at point .99
Maximum Y displacement = -0.000 inch at point .197
Maximum Z displacement = -6.152 inch at point .198

Maximum X rotation = -0.000 degree at point .197
Maximum Y rotation = 0.000 degree at point
Maximum Z rotation = 0.000 degree at point .34

Maximum X force = 33928 lb at point VH555
Maximum Y force = 533 lb at point VH555
Maximum Z force = 33002 lb at point .196

Maximum X moment = 8102 inch-lb at point .198
Maximum Y moment = 0 inch-lb at point
Maximum Z moment = -7684 inch-lb at point .38

Maximum hoop stress = 2122 psi at point .1
Maximum longitudinal stress = 2410 psi at point .198
Maximum principal stress = 2410 psi at point .198
Maximum code stress = 1192 psi at point .38
Maximum stress ratio (code/allowable) = 0.03 at point .38

Load : Dead Weight + Pressure 1

*** System Maxima ***

Maximum X displacement = -0.173 inch at point .99
Maximum Y displacement = -0.000 inch at point .197
Maximum Z displacement = 0.280 inch at point .198

Maximum X rotation = -0.000 degree at point .197
Maximum Y rotation = 0.000 degree at point
Maximum Z rotation = 0.000 degree at point .34

Maximum X force = 25715 lb at point .1
Maximum Y force = 533 lb at point VH555
Maximum Z force = 32477 lb at point .196

Maximum X moment = 8102 inch-lb at point .198
Maximum Y moment = 0 inch-lb at point
Maximum Z moment = -7684 inch-lb at point .38

Maximum hoop stress = 2122 psi at point .1
Maximum longitudinal stress = 2366 psi at point .198
Maximum principal stress = 2366 psi at point .198
Maximum code stress = 1192 psi at point .38
Maximum stress ratio (code/allowable) = 0.07 at point .38

Load : Thermal 1

*** System Maxima ***

Maximum X displacement = 7.763 inch at point .99
Maximum Y displacement = 0.000 inch at point
Maximum Z displacement = -6.432 inch at point .198

Maximum X rotation = 0.000 degree at point
Maximum Y rotation = 0.000 degree at point
Maximum Z rotation = 0.000 degree at point

Maximum X force = 8314 lb at point VH556
Maximum Y force = 0 lb at point
Maximum Z force = 525 lb at point .196

Maximum X moment = 0 inch-lb at point
Maximum Y moment = 0 inch-lb at point
Maximum Z moment = 0 inch-lb at point

Maximum hoop stress not available
Maximum longitudinal stress = 458 psi at point VH556
Maximum principal stress = 458 psi at point VH556
Maximum code stress not available
Maximum stress ratio (code/allowable) = 0.00 at point

PERMA-PIPE®

CHECKLIST OF INFORMATION REQUIRED FOR FIELD DIMENSIONS

NOTE: SLOPE OF THE PIPING SYSTEM MUST BE ACCOUNTED FOR IN THE DIMENSIONS SUPPLIED TO US.

1. Dimensions to outside or inside of all building and manhole walls.
2. Wall thickness of all points of entry of the piping system.
3. Angle of entry of piping system through all walls (other than 90).
4. Centerline to centerline dimension to two or more piping systems running parallel to each other within a common trench.
5. Risers:
    a. Dimensions from the centerline of elbow to top surface of floor.
    b. Desired amount of piping extension beyond floor slab.
    c. Floor slab thickness (if leak plate required in floor).
    d. Distance from inside face to wall to centerline of riser.
6. Angle of deflection of all elbows (other than 90).
7. Dimensions from anchors to the centerline of expansion loops.
8. Location of anchors, tees, "Z" bends with respect to some reference point.
9. Change in elevation at points where the slopes of the piping system changes.

FABRICATION CANNOT BE SCHEDULED OR COMMENCED UNTIL THE ABOVE INFORMATION IS RECEIVED BY THIS OFFICE.

PERMA-PIPE, Inc., a Subsidiary of MFRI, Inc., Niles, Illinois

PERMA-PIPE, Inc.

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IMPORTANT NOTICE
PRODUCT INSTALLATION AND USE

PERMA-PIPE's preinsulated and prefabricated piping products are carefully designed to provide long trouble free operation when properly installed, tested, operated, and maintained. Refer to PERMA-PIPE's Installation Instruction(s) and engineering documentation for important and detailed installation, testing, operating and maintenance instructions and information. Contact PERMA-PIPE for assistance if needed.

Failure to install, test, operate, and maintain PERMA-PIPE's products in accordance with PERMA-PIPE's Installation Instruction(s) and engineering documentation can result in damage to the product, reduced service life, costly repairs, irreparable damage, hazardous conditions, personnel injury, and / or property or equipment damage and will void PERMA-PIPE's warranty.

Many common causes of problems are listed below. This list is not all inclusive, refer to PERMA-PIPE's Installation Instruction(s) and engineering documentation for additional information.

All Systems

- Keep all insulation dry during installation and operation. Wet insulation is thermally inefficient and will degrade with prolonged exposure to water and moisture.
- Operate the piping system within the design temperature, pressure and other design conditions.
- Review alterations to the design of the piping system with PERMA-PIPE or a qualified piping system designer prior to making alterations.
- Conduct periodic maintenance to ensure the system is operating properly, is in good condition and to maximize its service life. Promptly make all necessary repairs to prevent degradation to the system and reduced service life.

Conduit and Containment (Air Space) Systems

- Keep the annular air space dry during installation and operation. If the annular air space becomes wet it must be dried immediately to prevent reduced service life or severe damage to the conduit / containment system. Corrosion of the service pipe, conduit / containment pipe, leak detection pull cable (if the system has cable leak detection) and degradation to the insulation system will occur when the annular space of a conduit / containment system is wet.
- Do not operate a conduit system with a wet annular space at high temperatures. This will cause degradation of the insulation system and conduit coating which can result in costly repairs and in severe cases result in irreparable damage.
- Gland seals must be properly adjusted to provide a seal against the service pipe. Gland seals must be aligned with connecting piping so axial movement of the service pipe is not restricted and binding does not occur.
- Install end seal vent and drain piping in accordance with the Installation Instructions to allow proper venting and draining of the conduit / containment air space while preventing water or moisture from entering the air space.
- Install the system with a proper slope so any fluid accumulation in the air space can be drained.

Insulated and Jacketed Systems

- Keep insulation dry during installation and operation. Water or moisture in the insulation and on the service pipe will cause degradation of the insulation and corrosion of the service pipe.
- Verify field joint jacket closures are properly completed. Poorly completed field joint jacket closures will allow water and moisture into the insulation and onto the service pipe.
- Repair any damage to the insulation jacket that could allow water or moisture into the insulation or onto the service pipe.
- For underground systems, install external expansion pads in accordance with design requirements to prevent overstressing of the piping system due to thermal expansion.

Underground Systems

- Keep trenches dry during installation, dewater open trenches as required. Be aware and plan accordingly for weather conditions.
- Holiday test all direct buried steel coatings to ensure there are no holidays that will result in future corrosion and reduced service life. Repair all holidays and coating damage in accordance with PERMA-PIPE's Installation Instructions before backfilling.
- Do not backfill prior to completing all service pipe and conduit / containment tests. Backfilling prior to testing can result in costly re-excavation and is not PERMA-PIPE's responsibility.
- For direct buried thin coated steel conduit / containment systems install and maintain a cathodic protection system to protect the steel from corrosion.
- Bed the trench, backfill and compact in accordance with PERMA-PIPE's installation Instructions to prevent damage to the piping system coating or jacket or problems caused by soil settlement.
- Keep manholes dry. Install and maintain sump pumps in manholes. Avoid locating manholes at low points where water will drain into them. Do not allow piping system end seals to be below water.

PERMA-PIPE®

Multi-Therm 500
Fiberglass Jacketed Steel Conduit Piping Systems

Installation Manual

ISSUE 1

JULY 15, 1998

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NOTICE

This installation manual and the recommendations it contains are reasonably believed to be accurate and reliable. However, due to variations in environment, application or installation, and because the conditions of use are beyond our control, the user of this manual assumes all risk connected with the use thereof. The installer of these piping products is ultimately responsible for his own work and, thus, the integrity of the system. PERMA-PIPE assumes no responsibility for the use of information presented herein and, hereby, expressly disclaims all liability in regard to such use.

Any technical suggestions or advice with respect to storage, handling, installation or use of Seller's materials by or on behalf of Seller is an accommodation to Purchaser for which Seller shall have no responsibility unless responsibility, therefore, has been expressly assumed in writing by the President or a Vice President of Seller.

PREFACE

The consulting engineer has been provided with information on what to expect from a PERMA-PIPE Multi-Therm 500 system once it is installed. However, the true operating success of the system is greatly dependent upon proper installation. PERMA-PIPE is committed to supporting the installation of a complete and high-quality piping system. This support includes clear and concise installation recommendations and expert field technical assistance.

The objective of this manual is to aid the installer on recommended installation procedures of a Multi-Therm 500 piping system. This booklet contains information on all aspects of the installation process, from initial receiving and storage through final backfill.

The manual has been divided into sections, one section for each phase of the installation process. Each section contains an explanation and illustrations on proper installation procedures.

By following these step-by-step instructions, the installing contractor should achieve a successful installation.

GENERAL PRECAUTIONS

These instructions are for general applicability. If they conflict with contract, specifications or drawings specific to the job, the job-specific documents take precedence. If in doubt, check with your project engineer or PERMA-PIPE field technical representative.

Carefully observe job work sequence to avoid errors and expensive mistakes. **DO NOT skip steps.**

If leak detection or other PermAlert electrical or electronic system is involved, use the appropriate PermAlert installation manual in conjunction with this piping system installation manual.

DO NOT complete backfilling the trench until all testing and inspection is completed and accepted by the appropriate authority.

1.0 INTRODUCTION

Multi-Therm 500 is a versatile fluid transportation system for the distribution of steam, condensate, hot water, process fluid, fuel and heavy oils. Application flexibility is achieved through PERMA-PIPE's integrated engineered system design utilizing state-of-the-art CAD technology.

The Multi-Therm 500 system has been designed with the installer in mind. Multi-Therm 500 arrives at the project site partially assembled. In-plant fabrication means less field work and fewer complications. This significantly reduces the installation cost while maintaining the integrity of the system. The features that make Multi-Therm 500 unique extend beyond the product itself. An expert project design staff tailors each system to meet the needs of the customer. Also, an experienced technical service staff is available to provide assistance that will assure a quick and smooth installation.

A series of factors contribute to a reliable, high-quality piping system, such as design, construction, delivery, installation and testing, with stringent quality control procedures applied at every step. The importance of proper installation practices for any piping system and adherance to this procedure, in particular, cannot be overstated. When installed according to the recommended practices presented in this manual and from PERMA-PIPE technical service, Multi-Therm 500 will provide excellent service, meeting or exceeding expectations.

2.0 SCOPE AND APPLICATION

The scope of this procedure is limited to Multi-Therm 500 piping systems.

This procedure applies to the customer-designated contractor who will perform the installation. A factory-trained, experienced field installation instructor will be present at critical periods during the installation, when required by the specifications, and/or where the furnishing of such service is included as a part of the customer's purchase order.

Trouble-free, efficient operation will result

from close cooperation between the installing contractor and the field installation instructor. PERMA-PIPE is committed to supporting the proper installation of a complete and high quality piping system. Nevertheless, ultimate responsibility for proper installation rests with the installing contractor.

3.0 EQUIPMENT AND MATERIAL

3.01 Equipment and Materials.

In order to install Multi-Therm 500, PERMA-PIPE has furnished the following:

1. Pipe assemblies, fittings and accessories
2. Field joint closure materials (see applicable chapters of Section 7.0)

Installing contractor must furnish the following:

1. Crane and excavation equipment
2. Welding equipment
3. Saws, grinders and wire brushes
4. Other materials as described in applicable chapters of Section 7.0.

3.02 Receiving, Handling and Storage.

3.02.1 Receiving.

The piping was inspected and loaded with due care at the factory. It is the carrier's responsibility to deliver the shipment in good condition. It is the responsibility of the receiver to ensure there has been no loss or damage. The following procedures are suggested to minimize problems:

- It is recommended that the PERMA-PIPE field representative be present during receipt of the shipment.
- Obtain the following from the carrier:
  1. Part Drawing Layout (PDL)
  2. X-Ray Film (if applicable)
  3. Packing slip
  4. Bill of Lading
  5. MSDS Sheets

NOTE: Material Safety Data Sheets (MSDS) for each of the components described in this manual should be reviewed for safety precautions and protective equipment requirements.

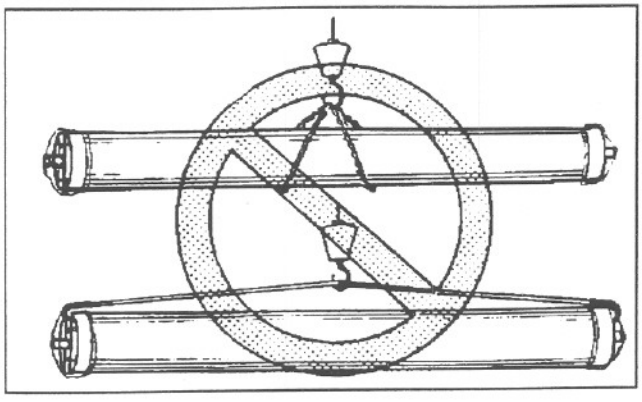
- Check all shipped materials against the packing slip for shortages.
- Visually inspect the materials of shipment as they are unloaded.
- List all damages and/or shortages on the packing slip and the bill of lading. **DO NOT dispose of any damaged material.** The carrier will notify you of the necessary procedure to be followed.
- Submit claims to the carrier. Failure to do so will result in loss of compensation for missing or damaged material.
- Notify your PERMA-PIPE field representative of these claims if assistance is required. PERMA-PIPE terms are F.O.B. our plant, full freight allowed to project site, unless specified differently by contract or purchase order.
- Shortages and damaged materials are normally not reshipped, unless requested to do so. If replacement material is needed, contact a PERMA-PIPE sales representative.

3.02.2 Material Handling.

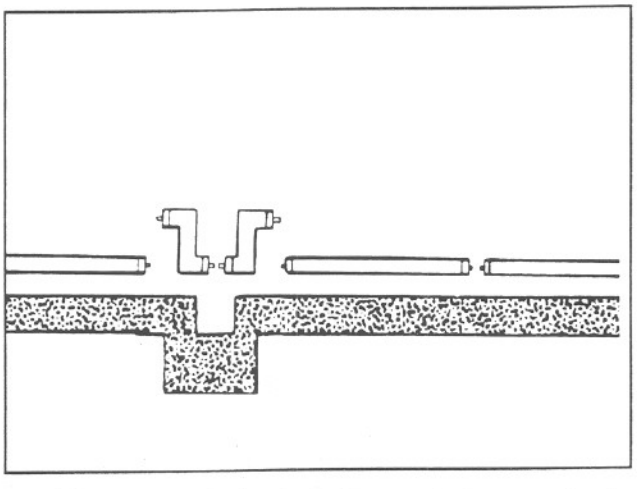
The means by which Multi-Therm 500 is unloaded and handled in the field is the decision and responsibility of the receiver. PERMA-PIPE's FRP jacket is designed to resist corrosion and is strong enough to withstand heavy soil loads and system pressures. The jacket is extremely durable. However, if damage does occur due to improper handling, the jacket must be repaired at the customer's expense. The following procedures are suggested to minimize problems:

- Support each assembly with nylon slings during all phases of handling. The nylon slings prevent severe scratching and/or chipping of the FRP jacket. Nylon slings are provided free of charge by PERMA-PIPE.

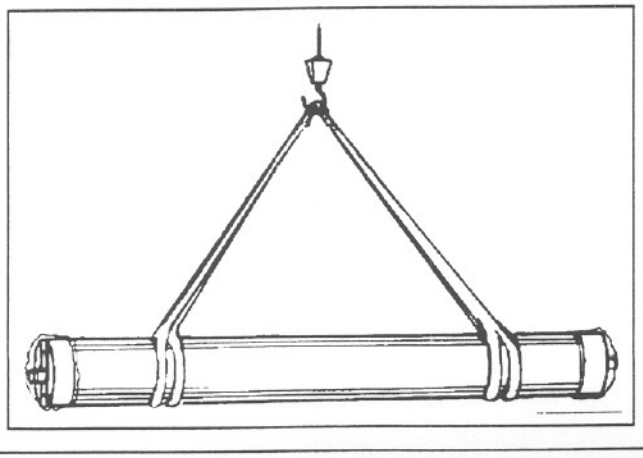
• **DO NOT use steel cables or chains for handling Multi-Therm 500 assemblies.**



• Use two slings where possible. The use of two slings provides much more control of pipe movement. A 40-foot section of pipe suspended by a single line is extremely likely to swing out of control. This greatly increases the chances of personal injury and/or damage to the pipe from contact with the truck, nearby buildings and equipment.



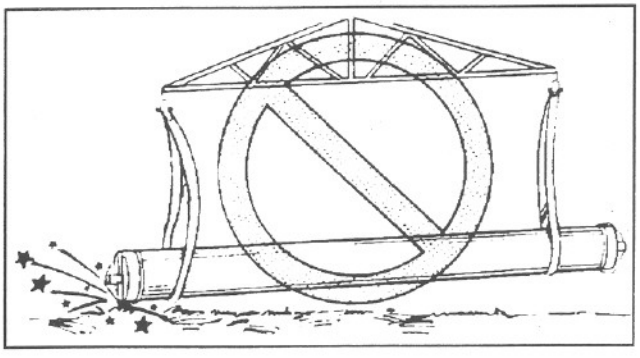
• Use a spreader bar to maximize control of the pipe assemblies during handling.



• If a spreader bar is not available, choke the slings together as shown.

• Space the slings about 20 feet apart. Again, a spreader bar is recommended.

• **DO NOT drop the Multi-Therm 500 assemblies or strike them against hard surfaces at any time.**



• If an accident occurs, inspect the jacket for damages. Repair if necessary (see Section 8.02).

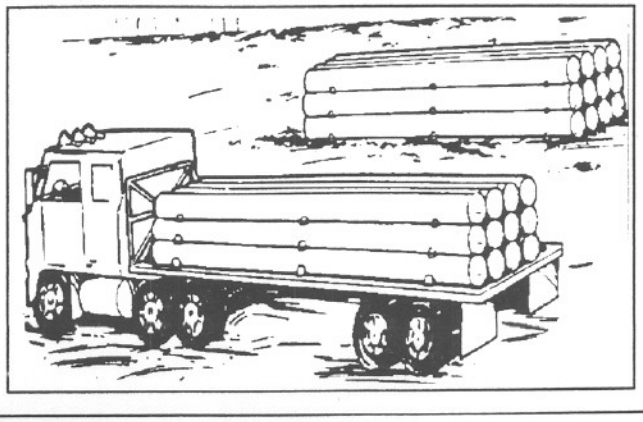
3.02.3 Pipe Storage.

Multi-Therm 500 assemblies can deteriorate and sustain damage if not stored properly. Proper storage of the product is the responsibility of the receiver. The following procedures are suggested to minimize problems:

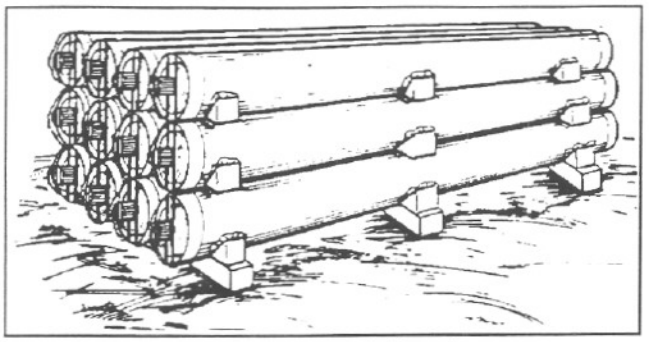
• If possible, store the pipe in a warehouse or heated shelter. If this is not possible, store the pipe on high ground to avoid ingress of water into pipe ends.

• Multi-Therm 500 can be stored during the winter months (or for prolonged periods of time) with minimal special handling.

• When stacking the Multi-Therm 500 for storage, stack it in the same fashion that it was received.

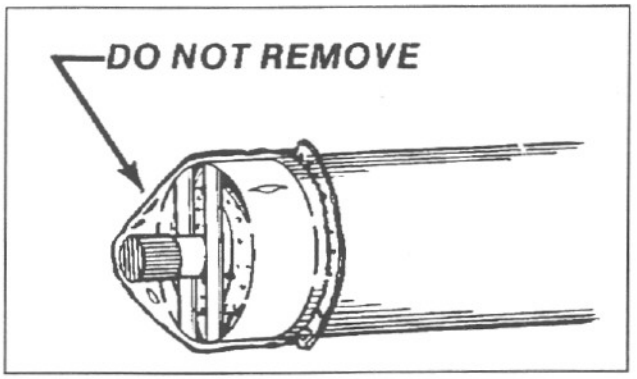


• Wooden shipping braces must be used as runners between the layers of pipe. PERMA-PIPE recommends stacking pipe no more than three tiers high.



• Use foam or other padding between layers.

• **DO NOT remove plastic covers or end caps from the Multi-Therm 500.** All pipe ends are shipped with plastic protective coverings (bagged ends) and must be checked periodically for rips or tears and are to be replaced as necessary.



• Always leave the shipping bars on the assembly ends until the carrier pipes are to be welded.

• PERMA-PIPE recommends using a light-colored or opaque tarpaulin to cover stored pipe. This cover will protect it against ultraviolet (UV) rays that will discolor the FRP jacket.

• Store all field joint materials indoors and in a dry area. Keep the materials in their shipping containers. The recommended storage temperature range is 60°-85°F (18°-29°C).

4.0 PREPARATION AND SET-UP

PERMA-PIPE cannot anticipate every circumstance that might involve hazard. The warnings in this procedure are, therefore, not all inclusive. The installing contractor must satisfy himself that each procedure, tool, work method or operating technique is safe.

PERMA-PIPE recommends that only qualified personnel perform all steps of the installation procedure.

Proper implements, tools and equipment should be used for placement of the pipe in the trench to prevent damage. In no case should pipe or accessories be dropped into the trench. Additional handling and joining procedures are covered elsewhere in this manual. Pipe laying generally should commence at the lowest elevation and terminate at manholes, service branches or clean outs. Use the Pipe Drawing Layout to place the assemblies in correct order.

5.0 EXCAVATION

NOTE: All federal, state and local regulations concerning jobsite safety should be observed.

5.01 Trenching.

All types of flexible pipe derive some of their strength from the passive soil resistance on the sides of the pipe. Therefore, the proper excavation of the trench is very important to ensure a structurally sound system. Usually, the centerline dimensions for the placement of the pipe in the trench can be found in the drawings.

Multi-Therm 500 is designed to handle normal soil and H-20 loading. If PERMA-PIPE's recommended procedures are followed, a minimum burial depth is required at taxiways, runways, railroads and other areas of high surface loading conditions. It is recommended that the customer contact both PERMA-PIPE and the local authority for more specific burial instructions.

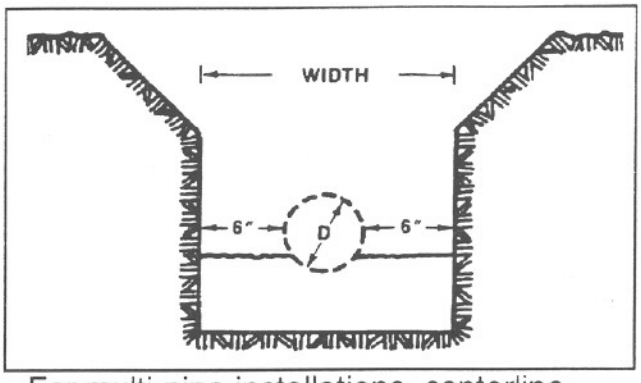
The trench floor should be completely cleared of stones and rocks and covered with a 4-inch compacted bedding. The bedding soil should correspond with the soil description.

During excavation, an unstable soil condition may be encountered, particularly in installations with deep burials. If this occurs, shore the trench walls before lowering the piping assembly into the trench.

Local, state and federal regulations for shoring should be followed where applicable. As the shoring is removed, it should be replaced with backfill soil.

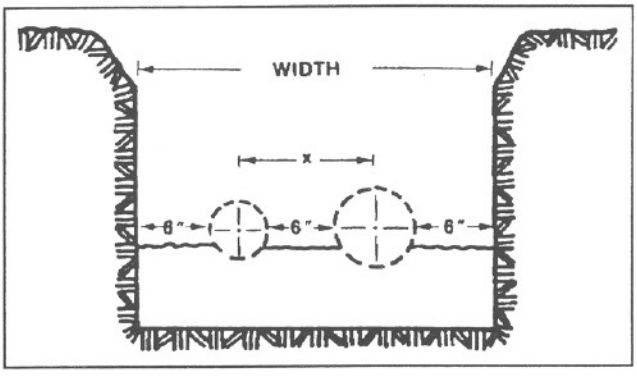
Organic soils or plastic clays and silts with high liquid limits may be encountered that are incapable of supporting the pipe. Remove the poor soil, and replace it with the proper bedding soil to a depth that will provide a firm stable foundation.

The minimum recommended trench width for single pipe is 12 inches plus the diameter of the conduit.

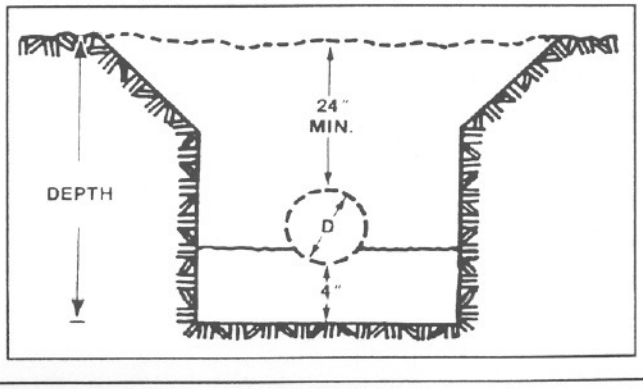


For multi-pipe installations, centerline dimensions can usually be found in the drawings.

If the centerline dimensions are not specified in the drawings, PERMA-PIPE recommends computing the width of a multi-pipe trench by adding 6 inches to the combined radii of each pair of pipes (value X in the figure below) and, then, adding another 12 inches and the combined radii of the two outermost pipes to allow for clearance.



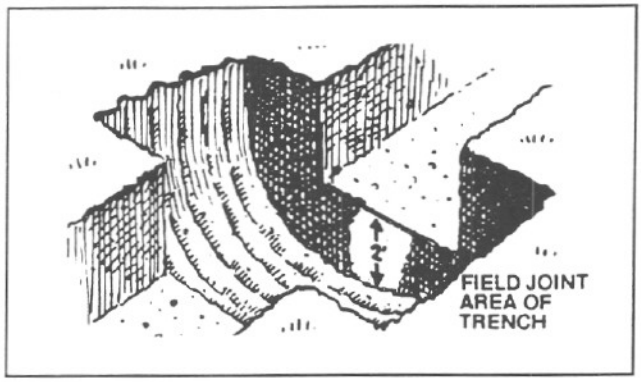
The total trench depth should allow for a 4-inch bedding, the conduit diameter and a minimum 24 inches cover depth above the conduit. See contract drawings for specific pipe burial depths. For depths less than 24 inches, contact PERMA-PIPE.



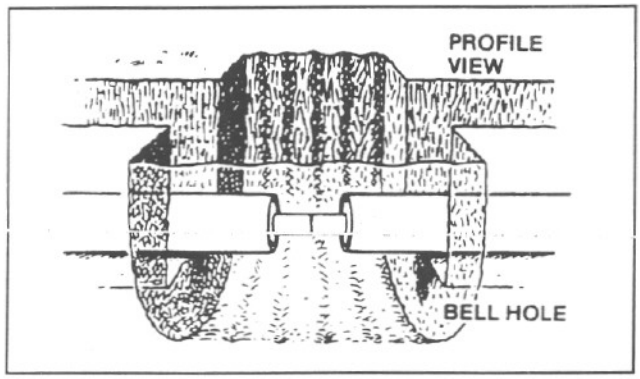
A minimum bedding of 4 inches must be raked uniformly along the entire length of the run. The bed of the run must be graded to a minimum slope of 1 inch per 40 feet. The bedding material should conform with the recommendations in the **Backfill** section of this manual (see Section 9.0).

5.02 Bell Holes.

Digging bell holes at field joint locations allows room for welding, field joint closure and testing. Field joint locations are marked on the part drawing layout (PDL). A common way to dig bell holes is to cut across the trench with a backhoe:



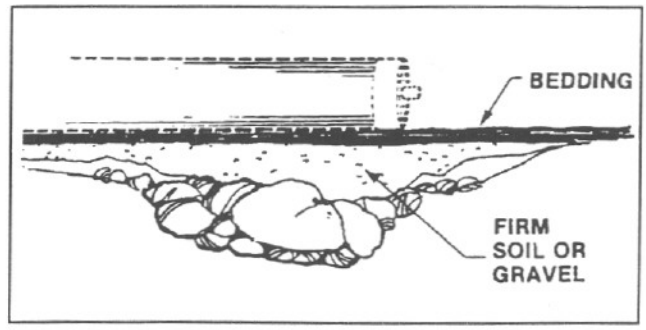
- Cut into the side of the trench and 1½ to 2 feet below the system grade.
- Dig the bell holes before lowering Multi-Therm 500 into the trench.



5.03 Special Trench Conditions.

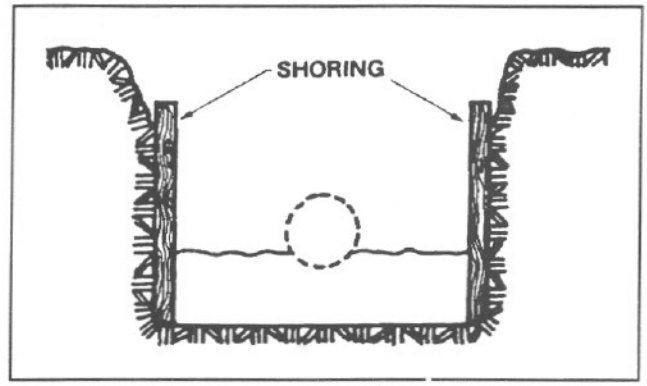
5.03.1 Rock Bottom Trench.

- A rocky or uneven trench foundation should be covered with a firm soil or gravel before bedding is constructed.



5.03.2 Unstable Soil.

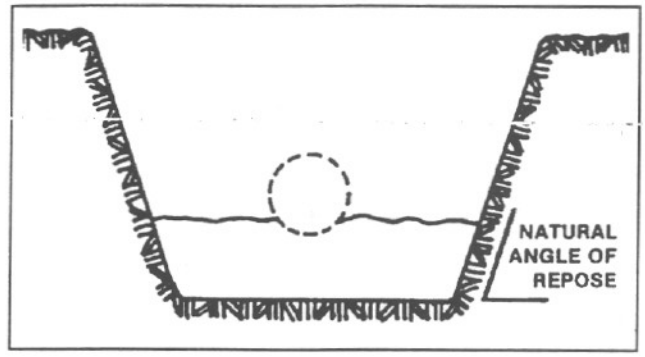
- When trenching in unstable soil, **DO NOT lay any Multi-Therm 500 until the trench walls are stabilized with staybracing or shoring.**



- Replace and compact the soil as the shoring is removed.

5.03.3 Granular Soil.

- In granular soil, the trench wall should be sloped at the natural angle of repose.



5.03.4 Over-excavation.

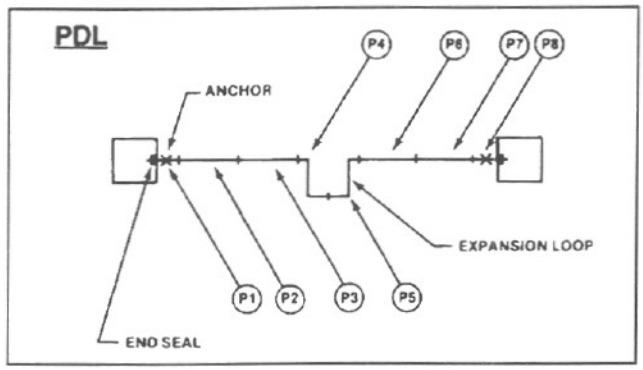
- Any accidental over-excavation should be filled with bedding material and compacted to 90-95% modified proctor.

6.0 PIPE SYSTEM ASSEMBLY

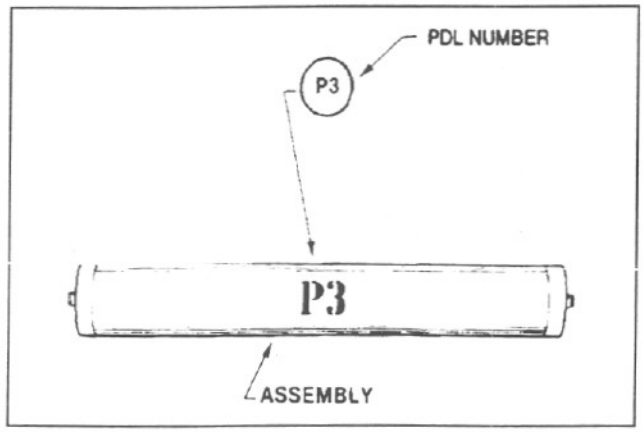
NOTE: When installing pipe in ambient temperatures below 60°F, contact your PERMA-PIPE field representative for special cold weather procedures.

6.01 Layout.

After trench excavation is complete and installation of the pipe is to start, the Multi-Therm 500 assemblies should be distributed along the trench top. Installation can be simplified by laying the assemblies in order along the trench according to the part-drawing layout (PDL).

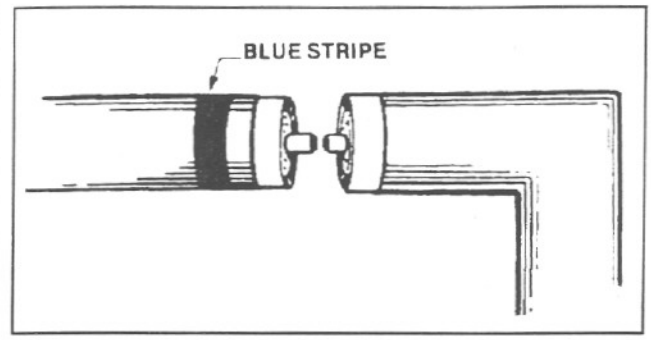


The part-drawing layout shows the location for each Multi-Therm 500 assembly. Each assembly is marked with a number matching the number on the PDL drawing.



Laying assemblies in order next to the trench will simplify installation.

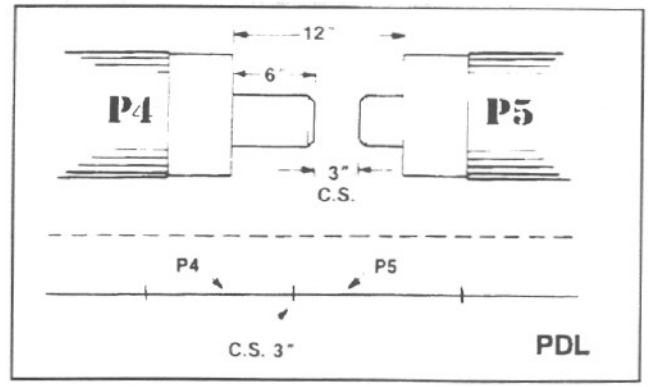
Certain assemblies are marked with a stripe to indicate the specific orientation of the pipe. Straight assemblies with a blue stripe on the end must be placed with that end toward the adjacent elbow.



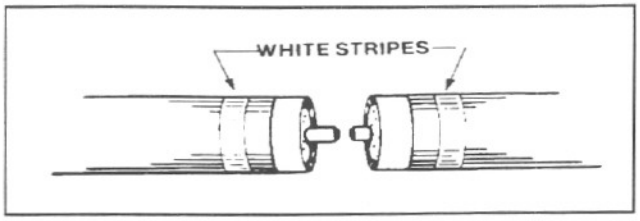
Elbows are sometimes modified to allow for the thermal expansion of the carrier pipe. Part of the elbow expansion movement will be transferred to the straight assembly to which it is connected. PERMA-PIPE utilizes oval supports at one end of the straight assembly to allow for this movement. The blue stripe indicates the location of these oval supports.

The oval supports must be oriented correctly in relation to the adjacent pipe. To ensure proper placement, PERMA-PIPE has marked the word "TOP" on each assembly. The "TOP" label should be facing exactly straight up in the 12 o'clock position. For systems with leak detection, the top marks will be located on the carrier pipe ends.

Assemblies with white stripes should be positioned with the striped ends together. The white stripes indicate a cold spring location. This information is also shown on the PDL as "C.S." **DO NOT complete these joints until this instruction says to do so.** When cold springing is required, the

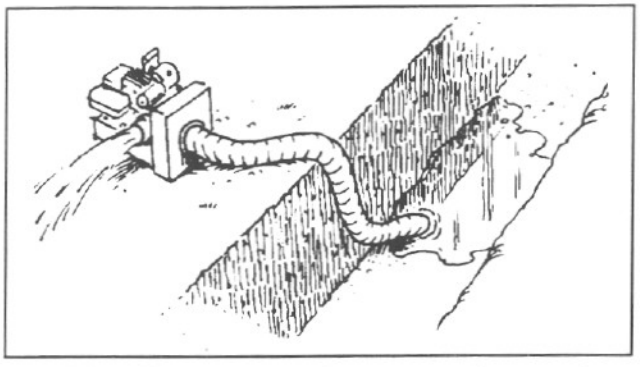


field joints to be sprung are pre-cut to specific lengths. The correct pipe ends must be welded together for the pipe to be sprung correctly. Thus, white stripes are painted on the pipe ends to be positioned together.



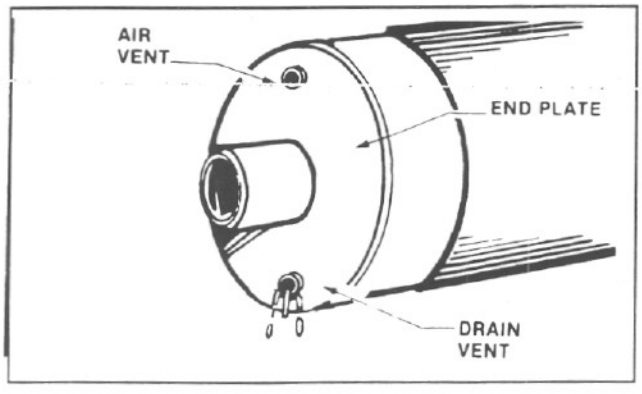
6.02 Lowering of the Conduit.

• Remove free-standing water in the bell hole and trench before lowering assemblies. Bell holes and bedding must be dry during pipe assembly installation.

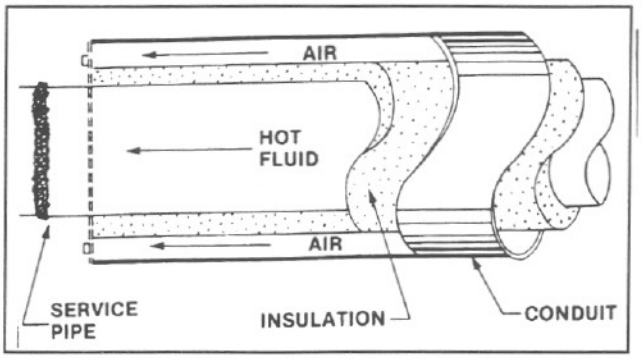


• **DO NOT remove the protective end bags until the carrier pipes are to be welded.**

• Lower Multi-Therm 500 assemblies into the trench. **DO NOT drop piping.** Two cranes may be required (see Section **6.04**).

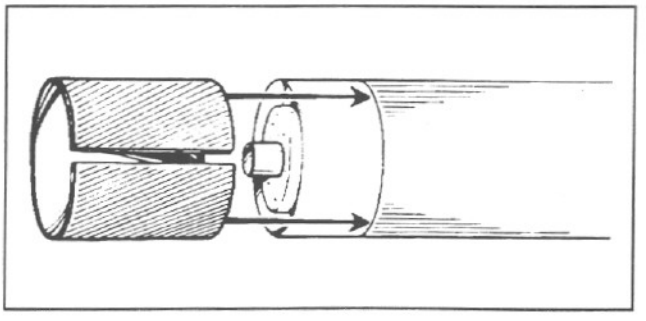


• Position each assembly with the word "TOP" facing up at the 12 o'clock position. For systems with leak detection, "TOP" marks are located on the carrier pipe ends.



6.03 Pipe Connections.

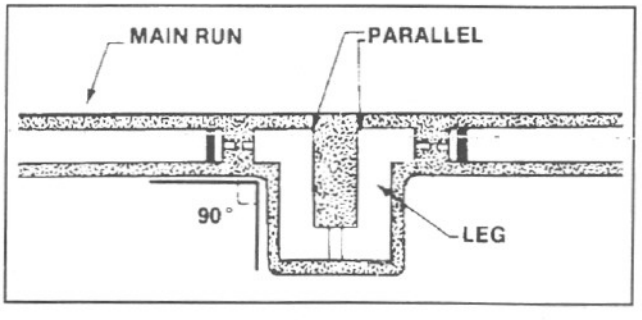
NOTE: If carrier pipe weld is made before conduit closure sleeve is slipped over the



conduit, the closure sleeve must be cut in half, positioned correctly around the conduit, and then welded.

• Ensure the closure sleeves have been placed around the conduit before welding the carrier pipes together.

• Before continuing, verify the legs of the expansion loops are perpendicular to the rest of the run and parallel to each other. If

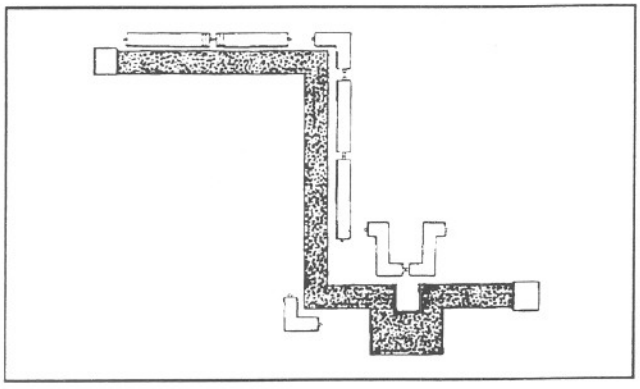


the legs of the loop are not positioned correctly, it will affect the cold springing and/or the length of the run.

6.04 Welding Procedure.

If sufficient lowering equipment is available, it may be easier to complete some field joints outside the trench.

NOTE: Joining sections of pipe outside of the trench may result in the need for two cranes to lower the joined piping into the

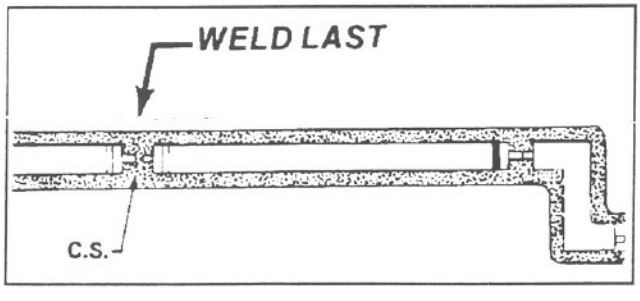


trench. Joining more than two 40' sections in this manner is **NOT** recommended. **DO NOT allow the piping to bow.**

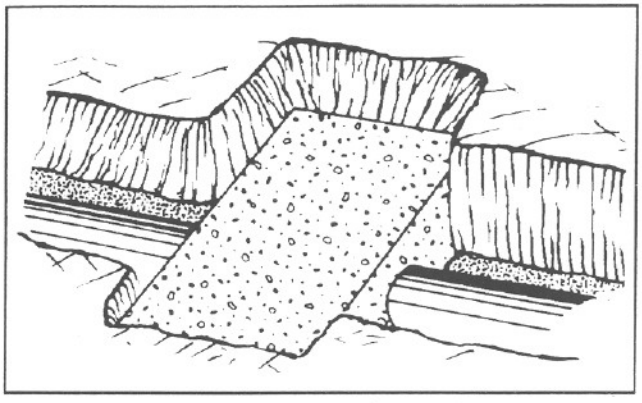
Otherwise, proceed as follows:

- Remove the protective end bags.
- Remove all shipping bars.
- Weld all straight assembly joints.
- Weld all expansion loop joints.
- **DO NOT weld the white-striped joints.**
- If a field joint closure is not completed immediately after the carrier pipe connection, slide the steel closure sleeve over the joint, wrap the joint with plastic and, then, seal with tape to keep moisture, rain and dirt out of the pipe assembly.

NOTE: Commence cold springing only after all other welds are completed and the

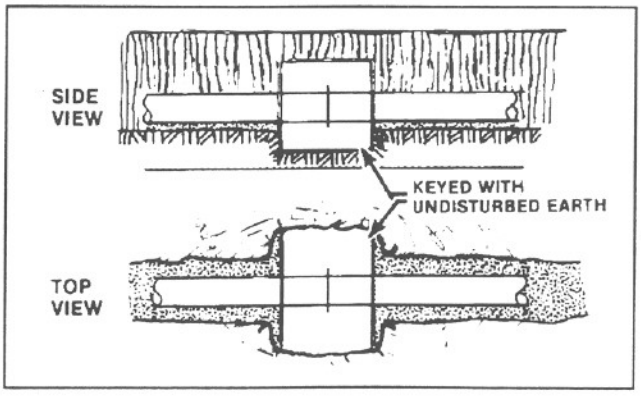


run is solidly fixed at both ends. PERMA-PIPE recommends that concrete anchor blocks be poured around each anchor and allowed to cure before cold springing.



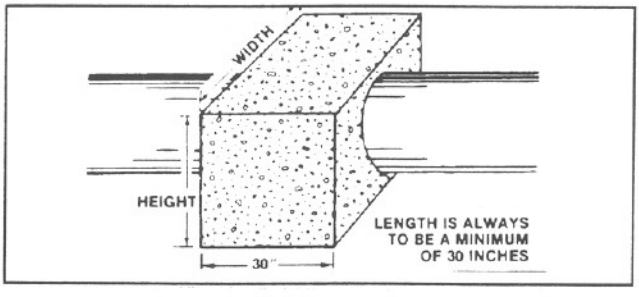
6.05 Concrete Anchor Blocks.

Poured concrete is the preferred method of



anchoring the Multi-Therm 500 assemblies.

- Pour concrete anchor blocks at each anchor point detailed in the PDL.



- Pour the concrete anchor through the bedding material into undisturbed earth in the base foundation or trench walls.
- Refer to Tables A and B for the recommended anchor block dimensions.

TABLE A
MINIMUM CONCRETE ANCHOR DIMENSIONS
SINGLE PIPE

Conduit Size (Inches)	Concrete Dimensions	
	Height	Width
6 5/8	2' 3"	2' 7"
8 5/8	2' 5"	2' 9"
10 3/4	2' 7"	2' 11"
12 3/4	2' 9"	3' 1"
14	2' 10"	3' 2"
16	3' 0"	3' 4"
18	3' 2"	3' 6"
20	3' 4"	3' 8"
22	3' 6"	3' 10"
24	3' 8"	4' 0"

TABLE B
MINIMUM CONCRETE ANCHOR DIMENSIONS
MULTI-PIPE

Conduit Combination (Inches)		Concrete Dimensions	
		Height	Width
6 5/8	+ 6 5/8	2' 2"	3' 8"
8 5/8	+ 6 5/8	2' 4"	3' 10"
	+ 8 5/8		4' 0"
10 3/4	+ 6 5/8	2' 6"	4' 0"
	+ 8 5/8		4' 2"
	+10 3/4		4' 4"
12 3/4	+ 6 5/8	2' 8"	4' 2"
	+ 8 5/8		4" 4"
	+10 3/4		4' 6"
	+12 3/4		4' 8"
14	+ 6 5/8	2' 10"	4' 4"
	+ 8 5/8		4' 6"
	+10 3/4		4' 8"
	+12 3/4		4' 10"
	+14		5' 0"

NOTE: For other combinations of conduit:
Height: Use the height value from Table B for the largest conduit.
Width: For each additional conduit, add 6 inches plus the conduit diameter.

TABLE B
MINIMUM CONCRETE ANCHOR DIMENSIONS
MULTI-PIPE

Conduit Combination (Inches)		Concrete Dimensions	
		Height	Width
16	+ 6 5/8	3' 0"	4' 6"
	+ 8 5/8		4' 8"
	+10 3/4		4' 10"
	+12 3/4		5' 0"
	+14		5' 2"
	+16		5' 4"
18	+ 6 5/8	3' 2"	4' 8"
	+ 8 5/8		4' 10"
	+10 3/4		5' 0"
	+12 3/4		5' 2"
	+14		5' 4"
	+16		5' 6"
	+18		5' 8"
20	+ 6 5/8	3' 4"	4' 10"
	+ 8 5/8		5' 0"
	+10 3/4		5' 2"
	+12 3/4		5' 4"
	+14		5' 6"
	+16		5' 8"
	+18		5' 10"
	+20		6' 0"
22	+ 6 5/8	3' 4"	5' 0"
	+ 8 5/8		5' 2"
	+ 10 3/4		5' 4"
	+ 12 3/4		5' 6"
	+ 14		5' 8"
	+ 16		5' 10"
	+ 18		6' 0"
	+ 20		6' 2"
	+ 22		6' 4"
24	+ 6 5/8	~~3'~~ 4"	5' 2"
	+ 8 5/8		5' 4"
	+ 10 3/4		5' 6"
	+ 12 3/4		5' 8"
	+ 14		5' 10
	+ 16		6' 0"
	+ 18		6' 2"
	+ 20		6' 4"
	+ 22		6' 8"
	+ 24		6' 10"

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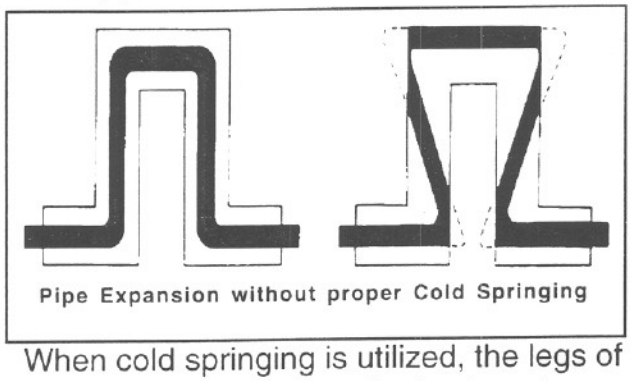
6.06 Cold Springing.

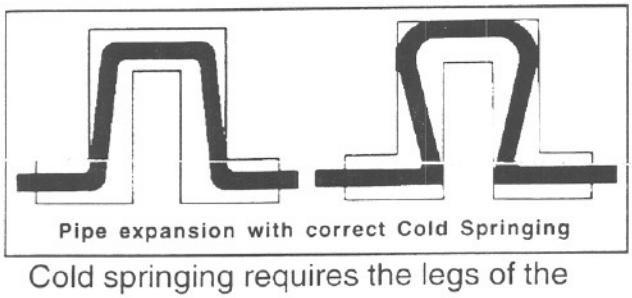
Cold springing is designed into the Multi-Therm 500 system by PERMA-PIPE to reduce the amount of oversized casing needed at elbows to allow for carrier pipe expansion. This significantly reduces installed cost of the system.

If cold springing is done incorrectly, the expansion of the carrier pipe will cause the loop to swell, as shown below, and destroy the insulation properties on that section of carrier pipe.



Pipe Expansion without proper Cold Springing

When cold springing is utilized, the legs of the expansion loop are pulled out as shown below. These carrier pipe ends are then connected to the rest of the run. Although the carrier pipe will now expand just as much when put into service, it will only move out a fraction of what it would without cold springing and, thus, allow the insulation to remain intact.



Pipe expansion with correct Cold Springing

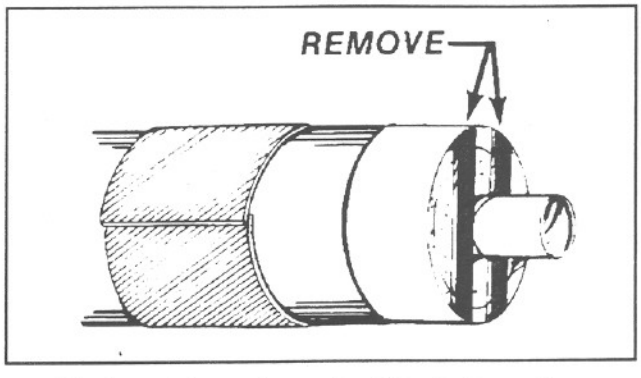
Cold springing requires the legs of the expansion loop not be allowed to pull back into their original positions before the line is put into service. PERMA-PIPE recommends that concrete anchor blocks be poured around each anchor and allowed to cure before cold springing.

PERMA-PIPE realizes there are other ways to cold spring. However, care must be taken to prevent any movement of the carrier pipe back into its original position. The amount that is effectively cold sprung in the field must be exactly the amount calculated and specified by the PERMA-PIPE engineers on the PDL.

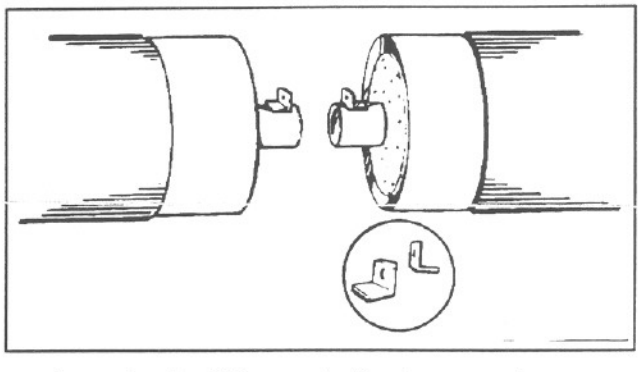
If time is taken to plan the installation, work can proceed at another location while waiting for anchors to be poured and cured.

Once the run has been properly fixed at both ends, either by concrete anchor blocks or by the bridge method of cold springing (see Section 6.07), join the carrier pipe using the following procedure:

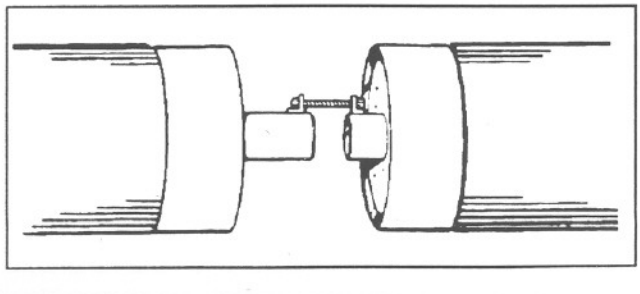
- Remove shipping bars with a cutting torch. **DO NOT damage the carrier pipe.**



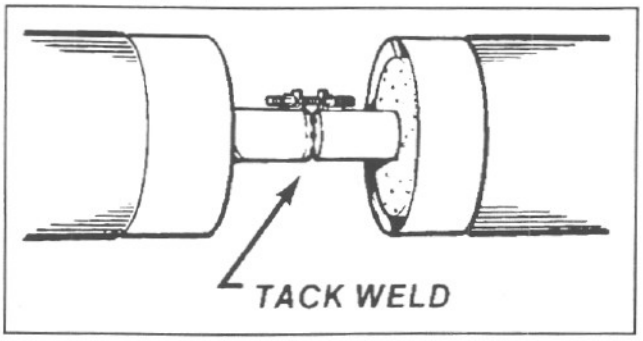
- Tack weld angles a half inch from the outer edge of each carrier pipe. For larger pipe sizes, multiple angles may be required. Angles are supplied by the contractor.



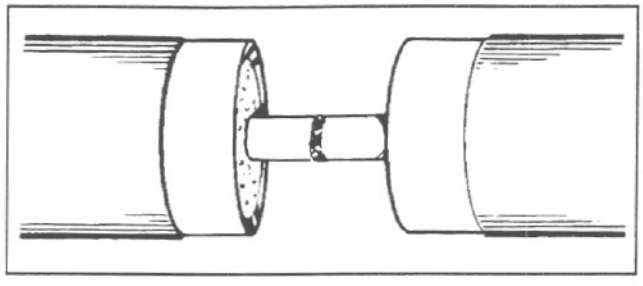
- Insert a bolt through the two angles.



• Place the nut on the bolt and tighten until the two pipes come together. Tack weld the pipe joint.



• Remove the angles. Butt weld the pipe joint.



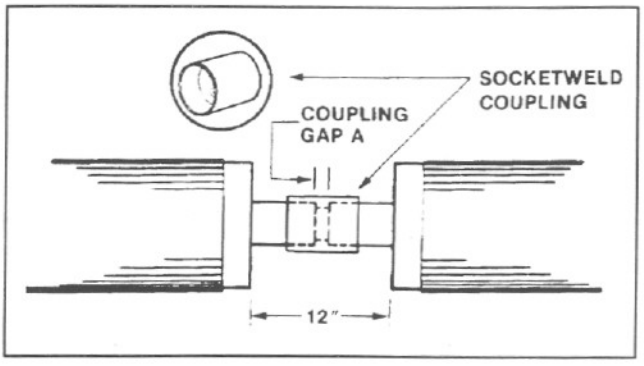
• Inspect surface for damage. Repair if necessary.

For 2-inch diameter and smaller steel pipe, socketweld couplings are required at the field joints. The couplings are supplied by the contractor. Refer to Table C for required coupling gap between carrier pipes.

TABLE C
SOCKETWELD COUPLING GAP (INCHES)

Nom. Pipe Size	Gap A	Nom. Pipe Size	Gap A
1/4"	1/4"	1"	1/2"
3/8"	1/4"	1-1/4"	1/2"
1/2"	3/8"	1-1/2"	1/2"
3/4"	3/8"	2"	3/4"

If a field joint also has a cold springing gap, it should be added to the coupling gap (A). Before doing cold springing, the coupling should be welded to one of the pipes.



• Weld angles to each carrier pipe leaving sufficient space between angle and coupling to allow for cold spring.

• As before, use nut and bolt to draw the carrier pipes together and tack weld the free end of the coupling.

• Remove angles and complete the coupling socketweld.

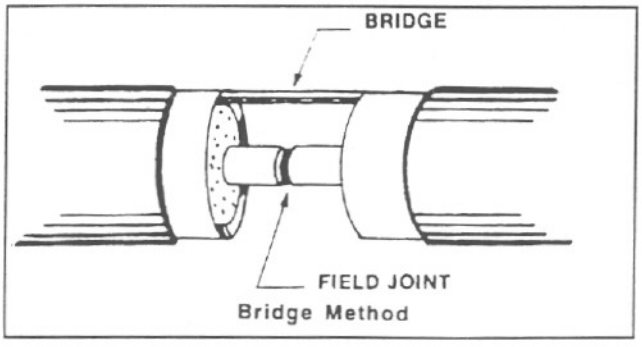
• Inspect surface for damage. Repair if necessary.

6.07 Bridge Method of Cold Springing.

Occasionally, pouring anchors first is not possible or desirable. In this case, the PERMA-PIPE field representative must be consulted. The field representative might provide an alternative recommendation, such as the Bridge Method:

• Cut shipping bars off the ends of the assemblies.

• Position a shipping bar or similar piece of metal, the "bridge," between the two outer conduit casings, and then weld it to the inside edges of the conduit as shown below.



Bridge Method

• Remove the weld scale from the welded joint. Great care must be taken to prevent damage to the carrier pipe. Any damage to the casing or the pipe must be repaired.

• **DO NOT remove the bridge from between the casings.** Complete the field closures with the bridges in place following the regular cold springing steps.

• Repeat this procedure at every field joint on the conduit run.

6.08 Hydrostatic Test of Carrier Pipe.

NOTE: Hydrostatic test of carrier pipe must be performed prior to the installation of containment pipe joints.

• After the carrier pipes are welded together, connect test caps at the ends of the pipe run. Pipe test caps are provided by others.

• Set all valves so the entire line can be tested.

• Completely fill the pipe with water.

• Vent all air from the carrier pipe.

• Bring the hydrostatic pressure up to 1½ times the operating pressure, unless otherwise stated by the pipe line specifications.

• Maintain the pressure for a minimum of two hours, allowing for temperature changes, unless otherwise stated by the pipe line specifications.

• Any faulty welds must be repaired and retested.

7.0 FIELD JOINT CLOSURE

7.01 Overview.

After completion of the hydrostatic test, each field joint will require a systematic application of insulation and welding procedure to properly close the joint. The standard Multi-Therm 500 field closure is completed in four parts:

1. Insulation of the carrier pipe
2. Conduit pipe sleeve installation
3. Insulation of the conduit pipe
4. A final fiberglass jacket hand lay-up or an alternate application of a shrink sleeve outer jacket (both methods of final closure are covered in this instruction manual).

NOTE: Consult the PAL-AT Installation Manual to ensure proper closure of assemblies equipped with leak detection systems.

7.02 Insulation of the Carrier Pipe.

PERMA-PIPE provides the following materials for carrier pipe insulation:

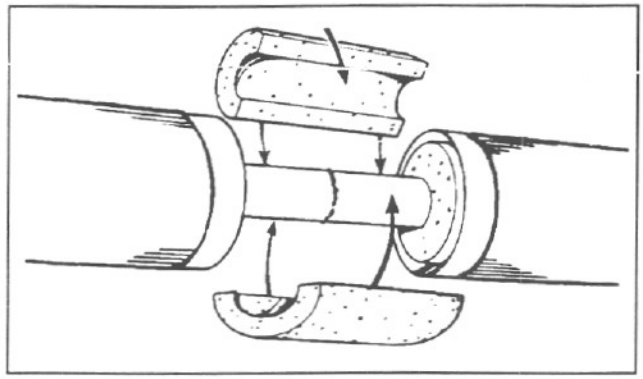
1. Pipe insulation
2. Stainless steel banding and fasteners

Installation contractor provides:

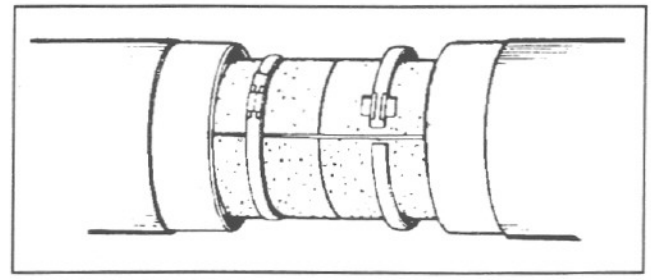
1. Come-along
2. Welding equipment

When all tools and materials have been staged, proceed as follows:

- Half-round pieces of insulation must be cut to length for use at each field closure.
- Press two halves firmly together onto the bare pipe at the field joint.



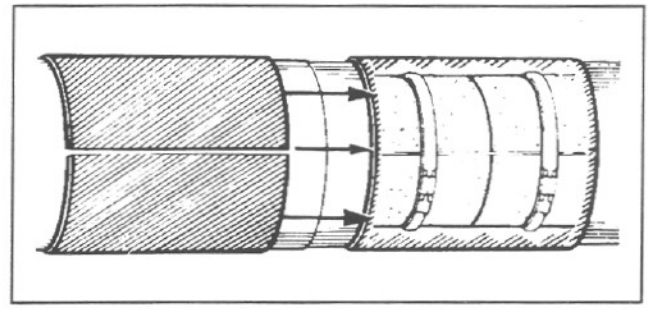
- Tighten the strips of steel banding around the halves of insulation and secure with metal fasteners.



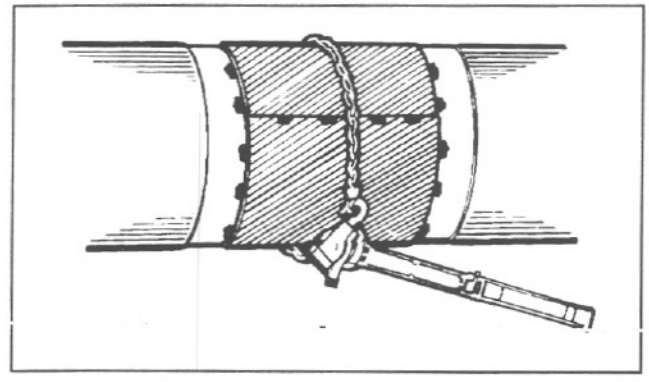
7.03 Conduit Pipe Sleeve Installation.

NOTE: For assemblies equipped with leak detection systems, **DO NOT commence conduit pipe sleeve installation without first consulting Section 4 of the PAL-AT Installation Manual.**

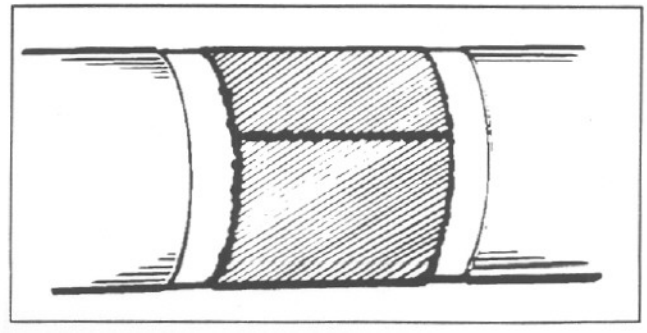
- Center the closure sleeve over the joint.



- Draw the closure sleeve tightly around the pipe using a come-along.



- Tack weld the closure sleeve, then remove the come-along.



• Clean the seam areas using a wire wheel grinder or brush. Lap weld the closure sleeve along the seam and edges. These welds must withstand the conduit pipe air test.

7.03.1 Conduit Pipe Air Test.

To perform a pipe air test, PERMA-PIPE furnishes:

1. Test cap
2. Rubber gasket

The contractor furnishes:

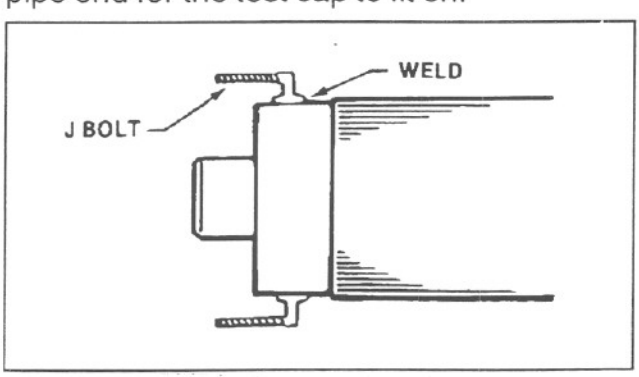
1. Pressure gauge
2. J bolts or threaded rod, nuts, washers

If the end seals are connected, no test caps are needed.

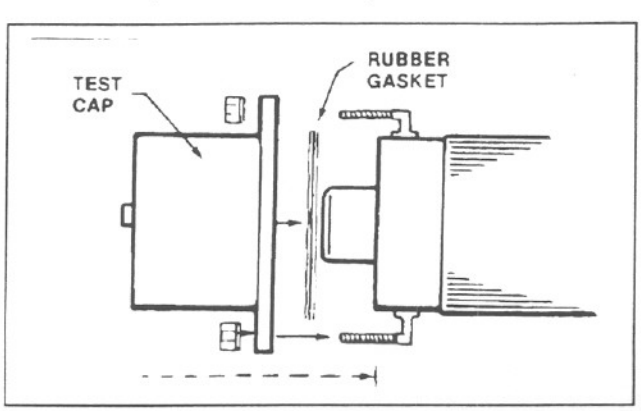
NOTE: The test caps are not designed for performing a pressure drop test. They are designed to permit only soap testing of the field joints.

To install test caps:

• Tack weld the head of a J bolt to the edge of the pipe. Tack weld the head of a similar bolt to the opposite side of the pipe. Leave enough thread extending past the pipe end for the test cap to fit on.



• Place the gasket over the open end of the test cap and lift the cap onto the bolts.

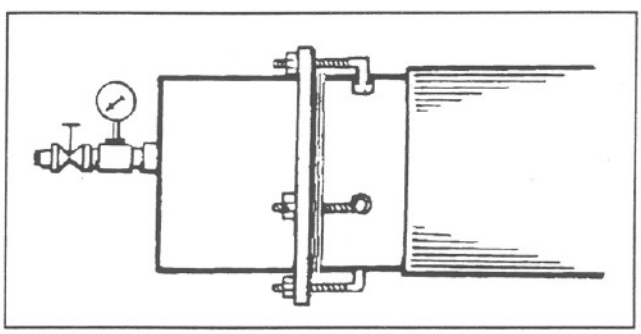


Mount the nuts and washers. Tighten nuts by hand.

• Weld the other bolts onto the pipe to match the test cap holes. Place the nuts and washers on the bolts. Tighten nuts snugly.

• Make a firm weld over the tack welds on the first two bolts.

• Tighten all nuts carefully and evenly so that the test cap and gasket make a firm seal with the pipe.



• Be sure the cap is tightly fastened. Make sure the drain and vent plugs are closed.

At this point, test cap installation is complete. Proceed with the conduit pipe air test:

• Build up the test pressure in the system.

• **DO NOT exceed 15psi air pressure.**

• **DO NOT stand in front of or in line with the test cap while the pressure is on.**

• Maintain test pressure during soap testing of field closure welds.

• Soap test all welds to find pinhole leaks.

• Mark and repair any leaks and re-test.

• Release air pressure before removing the test cap or loosening the bolts.

• Remove the J bolts and grind all rough weld edges.

7.03.2 Manhole Connections.

If the run ends at a manhole, it is necessary to perform the following operations:

• Install a removable drain plug in the end plate drain hole (lower hole).

• Install a venting pipe from the end plate vent hole (upper hole) to the vent ports of the manhole.

7.04 Insulation of the Conduit Pipe.

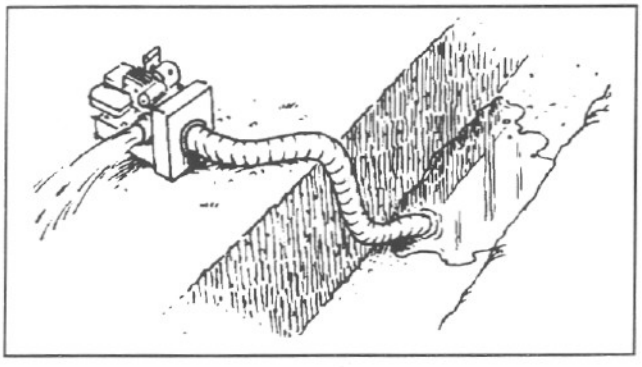
PERMA-PIPE provides the following materials for insulation of the conduit pipe at the field joint:

1. Insulation components A and B
2. Metal mold

The contractor furnishes:

1. Disposal paper mixing pails
2. Heavy duty gloves
3. Dry rags
4. Banding wire or rope
5. Mold release
6. Safety clothing
7. Tin snips
8. Wood rasp
9. Stir sticks

NOTE: DO NOT attempt insulating field closures in wet bell holes. If the bell hole is wet, pump dry before attempting field joint closure.



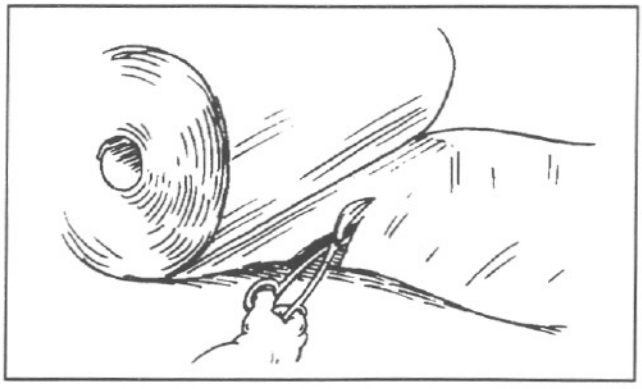
NOTE: Insulating components A and B must be stored in the 60° to 85° range before use. Insulation stored below 60° will not react properly. Insulation stored above 85° may result in spoiling.

The metal molds provided by PERMA-PIPE can be used for insulating at least 10 field joints given proper maintenance.

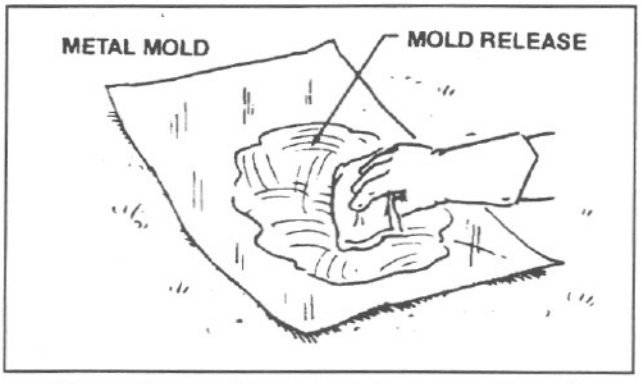
When all tools and materials are staged, proceed as follows:

- Cut the metal mold form material to the correct length from the bulk roll. Measure and cut, using tin snips, the metal mold material to a length (L) equal to 1-¼ times the circumference of the FRP jacket.

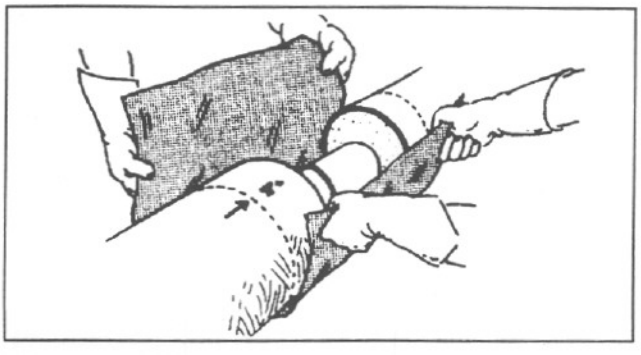
Example: 10-3/4" Dia. FRP Jacket
where: $C = \Pi \times$ Dia.
$L = 1.25 \times C$
$L = 1.25 \times 3.14 \times 10.75" = 42"$



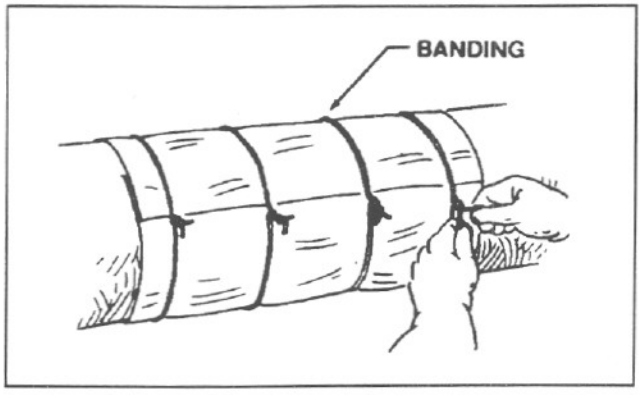
- Prior to each use, coat the mold with a mold release. This is commonly found in fiberglass supply houses. Non-stick coating sprays, such as PAM™, can also be used. The entire inside surface of the mold must be coated. Insulation may stick to uncoated portions of the mold and cause damage to both the insulation and the mold when the mold is removed from the joint.



- Wrap the mold material around the pipe. Center it around the field joint so that the mold extends 4 inches past each edge.

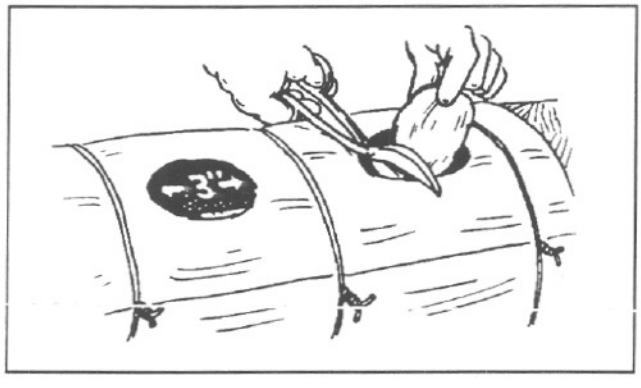


• Tie a wire or rope band around the mold 2 inches from each edge. Use two more bands in the middle, evenly spaced from the first two.



NOTE: It is important to fasten the mold tightly around the field joint. Gaps between the mold and the FRP jacket will allow some of the rising insulation to escape. This could result in an incomplete pour and require mixing another small batch of insulation.

• Using tin snips, cut three holes in the top of the mold between the banding. Make each hole about 3 inches in diameter.



NOTE: Each day before opening a shipping container of foam components, turn them upside down for about 15 minutes. This ensures that each component is properly mixed prior to being used.

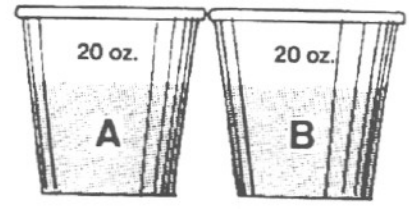
• Refer to Table D for the insulation component amounts.

TABLE D
INSULATION QUANTITIES (OZ) PER COMPONENT

NOMINAL CASING SIZE	INSULATION SIZE 1 INCH
6	6
8	8
10	9
12	11
14	12
16	13
18	15
20	16
22	18
24	19
26	20
28	22
30	23
32	25
34	27
36	29

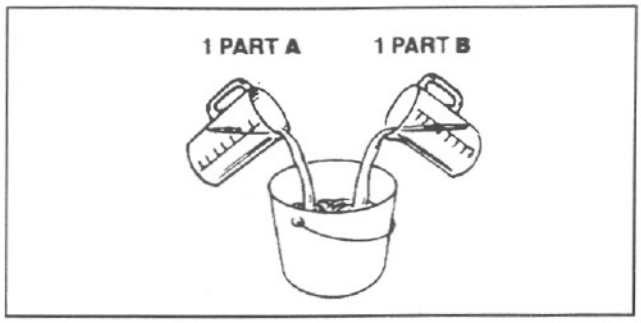
NOTE: Refer to the Material Safety Data Sheets (MSDS) for handling and emergency procedures and for safety precautions and protective equipment requirements.

• Use a 1:1 mixing ratio. For example, if the amount given is 20 ounces. the mixture requires 20 ounces of Type A and 20 ounces of Type B. Two containers, each large enough to hold the given quantity, are required. Mark one "A" and the other "B."

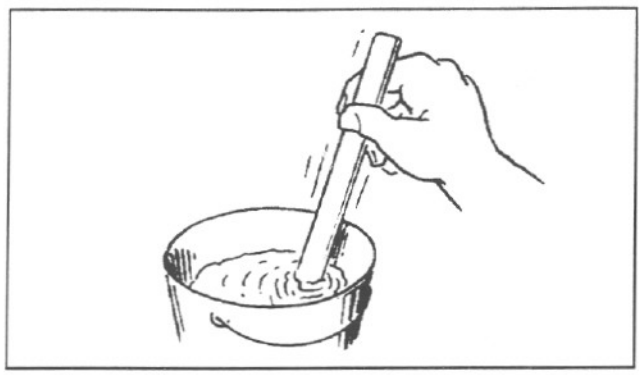


• **DO NOT combine the two mixtures until you are ready to begin insulating the field joint.**

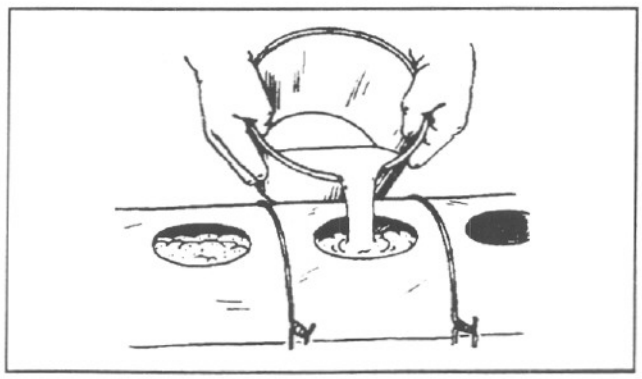
• Pour the required amount of Type A into a measuring cup. Pour an equal amount of Type B into a second measuring cup. Combine the contents of both measuring cups into a mixing pail.



• Immediately begin stirring the mixture. Stir vigorously for about 15 seconds. The insulation will begin rising in 15-30 seconds.

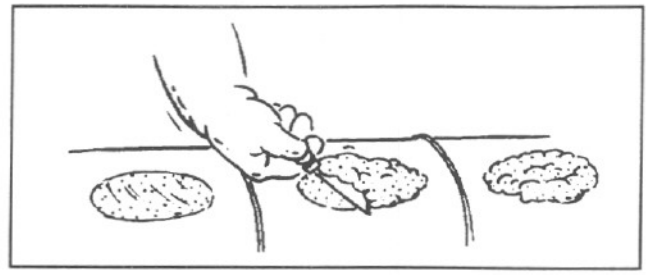


• After 15 seconds of stirring, pour the mixture into the three holes at the top of the mold. The mixture will turn to foam and rise to the top filling the entire mold. The excess foam will push out through the top holes.



• If the mold does not fill completely, remix small amounts of foam until it does. Also, adjust the amount of the mixture now needed for the remaining field closures.

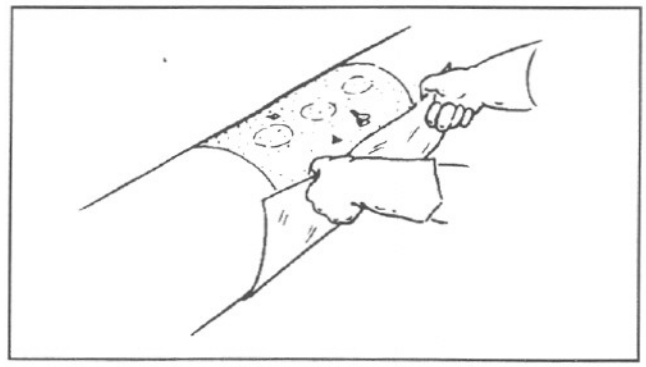
• After the foam stops rising, cut the excess foam from the top of the mold.



• Let the mold cool for about 10 minutes after the foam rises out of the top holes.

• Discard the paper mixing pail.

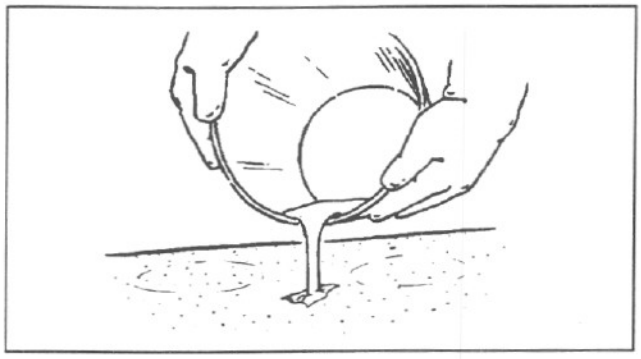
• Remove the banding and carefully peel the mold off the insulation. Tearing the mold off may rip the insulation and require a repair procedure.



NOTE: The mold will be extremely hot. After removing the banding, peel the mold carefully off the insulation. If this is not done with care, the mold and the insulation will probably get damaged. If the mold sticks repeatedly, use additional mold release on the mold for the next pour.

• After each use, clean the inside of the mold with denatured alcohol or a similar cleaning solvent to remove any dirt or insulation.

• Patch any voids in the surface of the insulation by mixing another small batch of foam. As soon as it begins to rise in the container, apply to the void areas.



NOTE: If the fiberglass hand lay-up or shrink sleeve application is not completed immediately after insulating, plastic sheeting should be sealed around the field joint. If any of the insulation in the field joint or pre-insulated assembly becomes wet it must be removed and replaced. Water contaminated insulation cannot be dried out. This may require replacement of the entire assembly at the customer's expense.

7.05 Fiberglass Jacket Hand Lay-up.

PERMA-PIPE provides the following materials to install the fiberglass jacket hand lay-up:

- Fiberglass bi-ply mat
- Un-promoted resin
- Laminating roller
- Catalyst (BFF-50)
- Promoter dispenser
- Catalyst Promoter (DMA)

The installing contractor must furnish the following:

- Grinder and wheel
- Disposable mixing pail (1 gal.)
- Acetone or equivalent cleaner
- Heavy-duty rubber gloves
- Wooden mixing paddles
- Wire brush
- Dry rags
- Plastic drop cloths
- Sheet of plywood
- Paint brushes (3")

NOTE: The following precautions are recommended to ensure the best installation possible.

• Ensure that all field closure kit materials are properly stored.

• Keep all kit materials in their original shipping containers. Store these materials in a trailer or mechanical room. This trailer or mechanical room should be well-ventilated. Keep all materials away from any open flames, sparks or extreme heat.

• Store the resin and catalyst at 60° F to 85° F. **DO NOT store resin and catalyst above 100° F.**

• Take only enough materials to the site for the number of closures that will be made up in one working shift.

When all tools and materials are staged, proceed as follows:

• Cut the fiberglass bi-ply material to the correct length. Measure and cut two lengths (L) of bi-ply equal to 1¼ times the circumference of each FRP jacket.

Example: 10-3/4" Dia. FRP Jacket

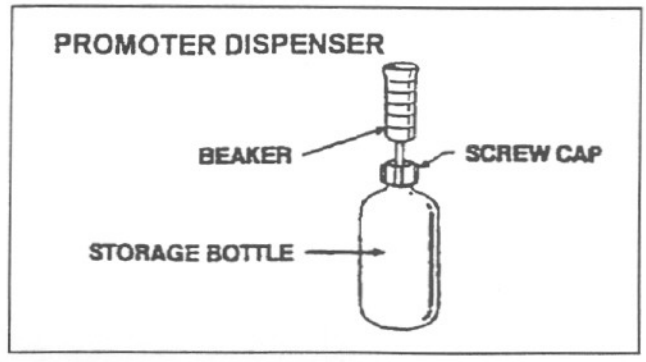
where: $C = \Pi \times \text{Dia.}$

$L = 1.25 \times C$

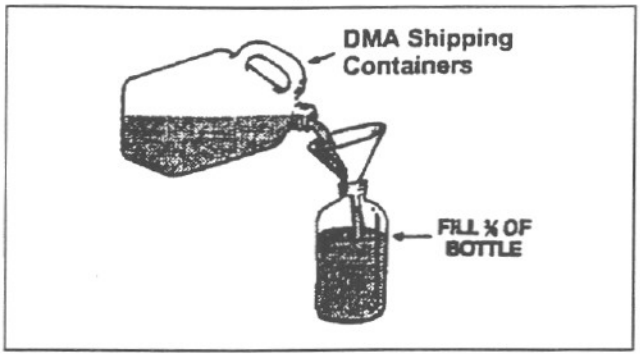
$L = 1.25 \times 3.14 \times 10.75" = 42"$

• Sand the ends of the FRP jacket. Lightly sand down any insulation that is not level with the top of the jacket. Wipe off any rain, dew or other moisture from the ends of the jacket. Use clean, dry, lint-free rags. These surfaces must remain dry during the fiberglass hand lay-up.

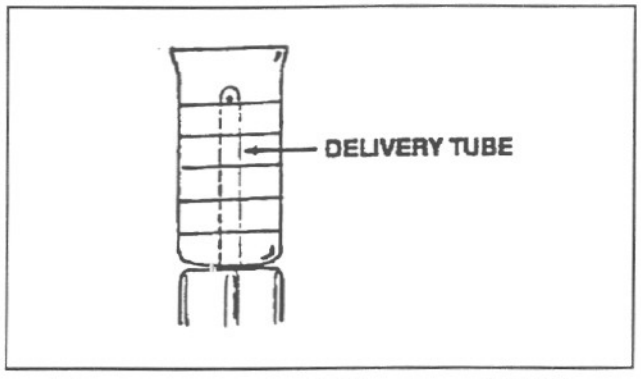
• A Promoter Dispenser is provided for measuring promoter. The resin is shipped un-promoted to increase shelf life.



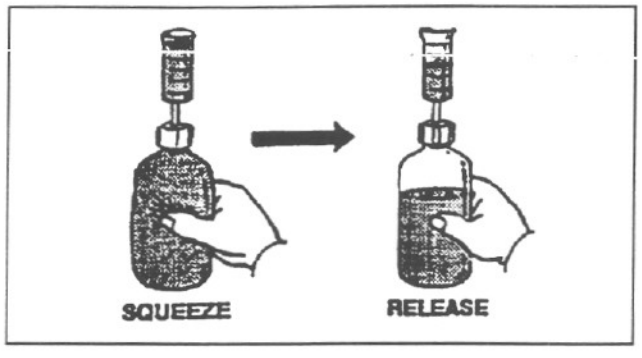
• Unscrew the cap of the storage bottle and replace it with a funnel. Pour DMA into the storage bottle until it is about ¾ full. **DO NOT fill it all the way.**



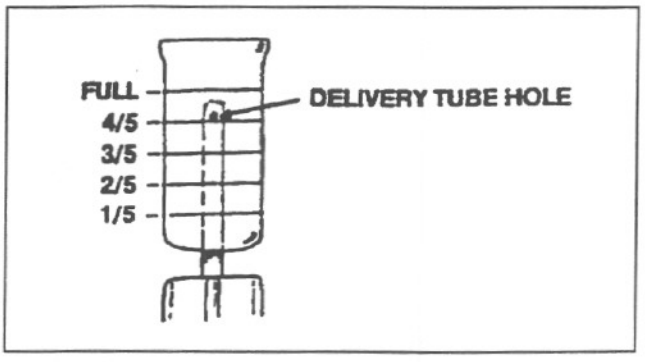
• Remove the funnel and screw the cap back on tightly. Attached to the cap is the delivery tube. Slide the beaker onto the delivery tube.



• To measure out a full beaker of DMA, slide the beaker all the way down. Squeeze the bottle until DMA fills the beaker. Release pressure on the bottle, and the excess DMA will return to the bottle.



• To measure out a fraction of a beaker, slide the beaker so the delivery tube hole is at the desired level. Squeeze and release as described for a full beaker.



• Open the 5-gallon pail of resin.

NOTE: If the resin is milky, jelled, or has dark sediment in the bottom, **DO NOT use**. Contain the PERMA-PIPE field service representative for fresh resin.

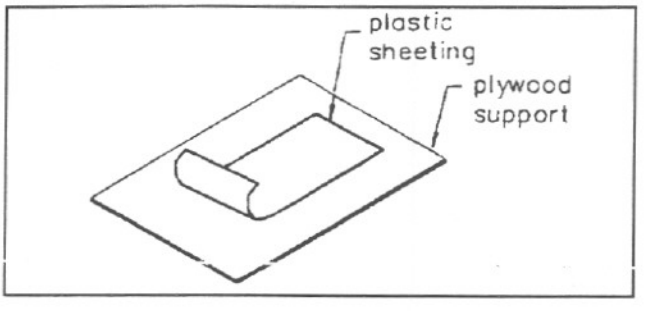
• Add 1 ounce of DMA per gallon of resin (1 oz = 30 cc's). 5 gallons of resin will require 5 ounces of DMA; 3 gallons of resin will require 3 ounces of DMA.

• Thoroughly mix the DMA into the resin.

NOTE: DO NOT add DMA to more resin than will be used in one working shift.

• Abrade 6 inches of the factory-applied fiberglass jacket on each side of the joint.

• Place a sheet of 4 mil thick plastic on a sheet of plywood. The plywood and plastic should be 6 inches longer and wider than the longest cut piece of fiberglass.



• Pour promoted resin from the shipping container into a mixing container (see resin quantities Table E).

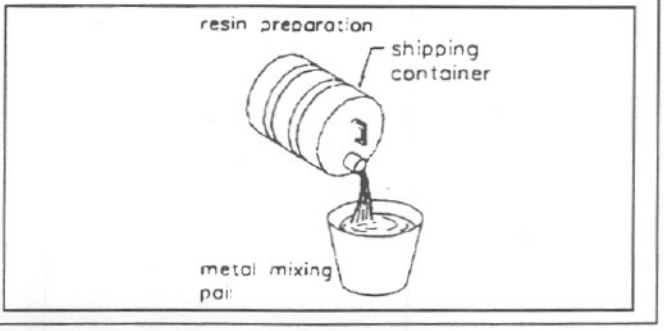


TABLE E RESIN QUANTITIES			
Nominal Conduit Size	**Resin (Qts.)**	**Nominal Conduit Size**	**Resin (Qts.)**
6	3.0	22	9.0
8	3.5	24	10.0
10	4.5	26	11.0
12	5.5	30	12.5
14	6.0	36	14.5
16	7.0	42	17.0
18	7.5	48	19.5
20	8.5	54	22.0

NOTE: The resin should be kept at a minimum of 60° F for several hours prior to use.

• Add the BFF-50 catalyst to the Promoted resin in the mixing container and thoroughly mix. A useful mixing tool is a low-speed drill with a formed wire as a bit (see catalyst quantities Table F).

TABLE F CATALYST QUANTITIES				
	Temperature (Degrees F)			
	60°	70°	80°	90°
Gallon	8 tbsp	6 tbsp	4 tbsp	2 tbsp
2 Cups	1 tbsp	1 tbsp	1/2 tbsp	1/2 tbsp

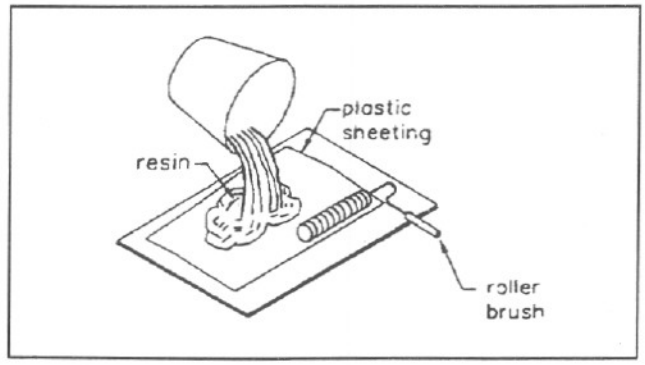
(1 tbsp = 15 cc)

NOTE

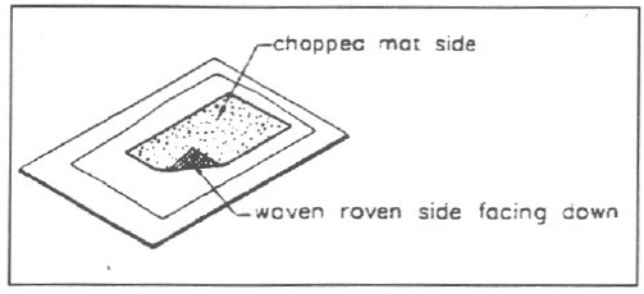
These quantities are approximate. Adjustments should be made as needed. To decrease the gel time, increase the amount of catalyst per gallon. To decrease the gel time, decrease the amount of catalyst per gallon.

The BFF-50 catalyst must be mixed thoroughly into the resin solution for these gel times to be obtained.

• Pour one third of the resin onto the plastic sheet. Spread the resin out so that it is 4 inches longer and 2 inches wider than the bi-ply that is to be wetted out.



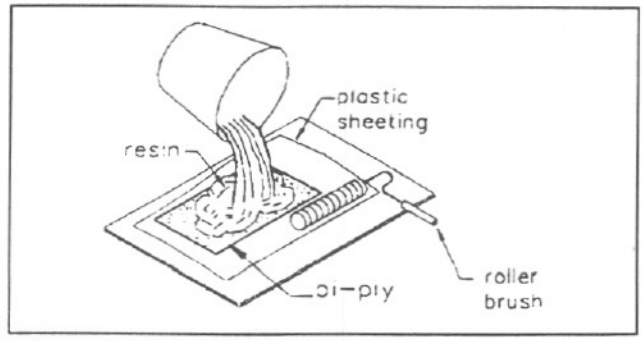
• Lay a piece of bi-ply onto the sheet with woven roving side face down. Center the bi-ply on the sheet.



• Pour half of the remaining resin onto the bi-ply. Spread the resin over the entire bi-ply surface using the metal roller supplied by Perma-Pipe.

NOTE: Use only the finned metal roller to spread the resin. Anything else could damage the bi-ply.

• Move the roller back and forth on the bi-ply until it appears transparent. Lay a second piece of bi-ply onto the first piece, "woven roving" side face down. Pour the remaining resin onto the bi-ply. Roll out the



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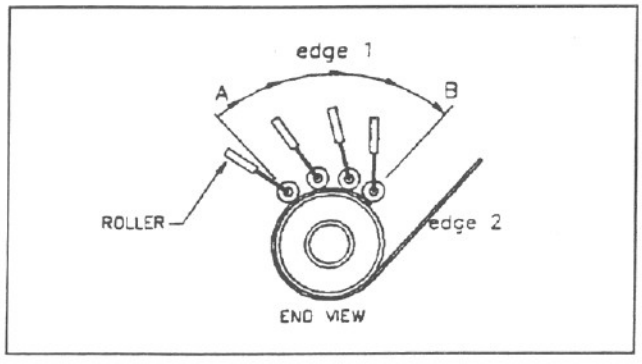
top piece until it appears transparent. Roll all excess resin from the bi-ply.

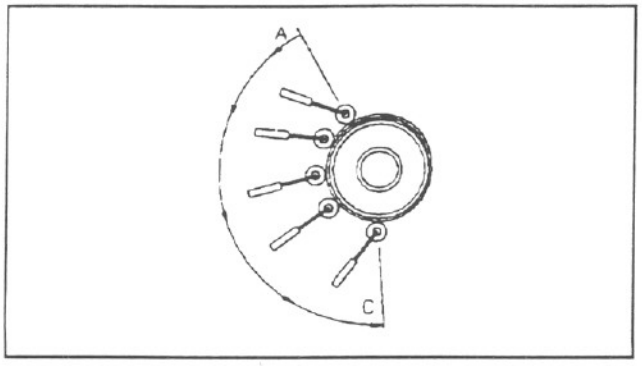
• Place the wetted bi-ply around the closure sleeve. Ensure that the bi-ply is centered so that it overlaps the factory-applied fiberglass jacket equally on both sides. Lay one edge of the hand lay-up onto the sleeve. Continue to hold the other edge. Roll the first edge with the finned metal roller to roll all trapped air out from under the bi-ply wrap. Start at the bottom and roll toward the top. **DO NOT let the bi-ply sag away from the sleeve at the bottom.** Continue to roll the wrap until it begins to set up.

NOTE: Once the glass begins to set up, **DO NOT continue to roll it with the finned metal roller.**

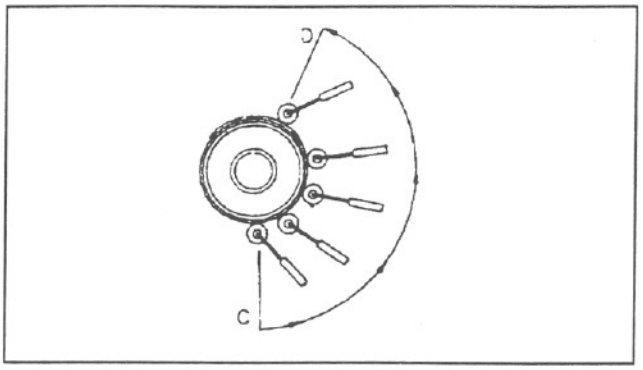
• Move the roller along the hand lay-up from point (A) to (B), pushing out any trapped air. Repeat from (A) to (B) along the entire hand lay-up width. Begin in the middle and move to the edges.



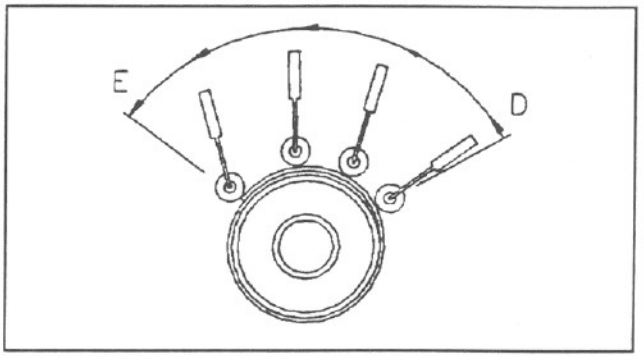
• Lay down edge 2 overlapping edge 1. Move roller down along the hand lay-up from point (A) to (C), pushing any air to the bottom.



• Continue moving roller up from point (C) to (D), pulling any air to the top.



• Move roller from point (D) to (E), pulling any air out of the hand lay-up.



• After the hand lay-up has hardened completely, abrade the complete surface for preparation of the second hand lay-up. Repeat the hand lay-up process. This second layer will create the equivalent protective coating as the factory-installed coating.

• Once the resin reaches its exothermal peak, mix a small amount of promoted resin with BFF-50 catalyst and paint the entire bi-ply wrap. Be sure to paint all seams. This will give the wrap a good clean, smooth finish and will help ensure a watertight seal.

• Let the bi-ply cure for a minimum of 24 hours before backfilling.

• Place the finned metal roller and any other resin-covered tool in a pail of acetone or equivalent cleaner after each field joint closure has been wrapped. Clean all tools thoroughly at the end of each shift.

7.06 Shrink Sleeve Method.

The Multi-Therm 500 system shrink sleeve offers an alternative method of providing complete protection at field joint closures with a minimum amount of labor. The shrink sleeve simultaneously forms a seal in two ways. The recovery (shrinking) of the sleeve is due to the heat that it absorbs. As the sleeve recovers, an adhesive sealant softens and forms a bond with the conduit insulation. The effectiveness of the seal is dependent upon how well these processes are completed.

NOTE: Before the start of shrink sleeve installation, review the following:

- When using the torch, the flame should be kept at least 6 inches away from the shrink sleeve and at an angle to the surface. Holding the torch at an angle allows the flame to bounce off the sleeve and decreases the local intensity of the heat. If the flame is held too close to the surface, the material will burn and the sleeve may tear around the burned areas.
- Stay within the chalk guidelines when wrapping to shrink the sleeve uniformly.
- When wrapping the shrink sleeve, leave a gap of approximately 1 inch between the sleeve and the bottom of the conduit. This gives the sleeve room to shrink properly. If the sleeve is wrapped snugly without a gap, it may pull apart or tear during heating.
- After wrapping the shrink sleeve, the closure strip should be preheated for about 5 seconds. **DO NOT overheat the strip because it will soften too much.** Apply the closure strip directly over the seam of the overlap and press down firmly. **DO NOT try to smooth the patch out.**
- Use your body as a shield to protect the flame from the wind. Keep the torch at an angle to the sleeve and pointed in the direction the wind is blowing to maintain a fairly even flame. **DO NOT increase the size of the flame**--this could overheat the shrink sleeve.

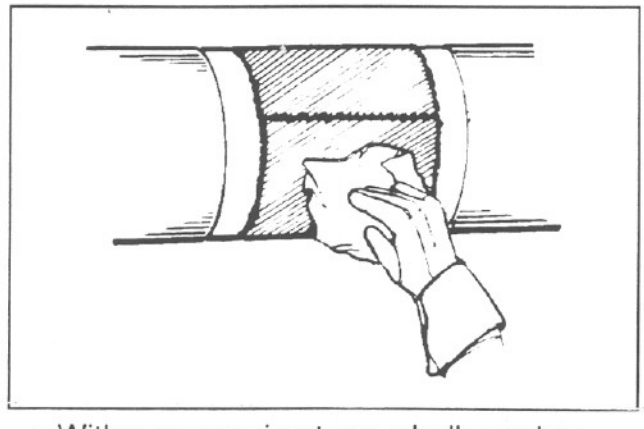
The PERMA-PIPE field representative may be on hand to demonstrate and check the application of the shrink sleeves.

PERMA-PIPE provides the shrink sleeve material. In order to heat the sleeve correctly, the proper propane equipment must be used, and PERMA-PIPE provides the necessary propane torch head, as well. The LP tank, hose fittings, unions, valve regulators, hand roller and gloves are provided by the installing contractor. If the installer supplies the propane torch, it must be approved by PERMA-PIPE field service or meet the following specifications:

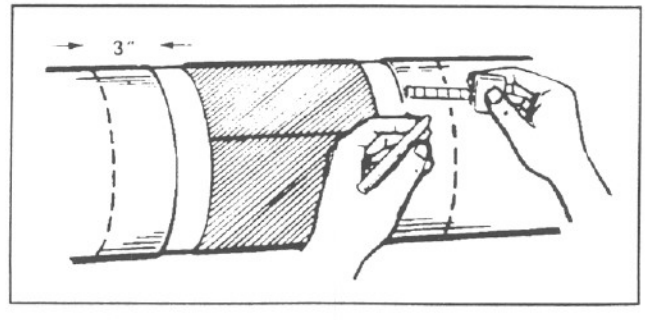
1. Heavy-duty hose for LP torch use
2. High capacity flame nozzle. For applications on outside diameters less than 18 inches, the minimum torch size is 150,000 BTU/hr. For applications on outside diameters greater than 18 inches, the minimum torch size is 300,000 BTU/hr.

When all tools and materials have been staged, proceed as follows:

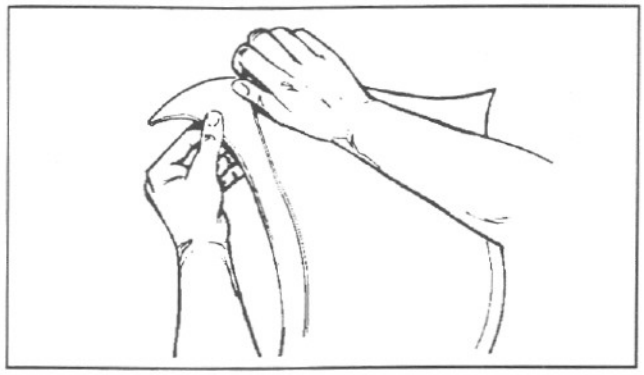
- Wipe off the field joint area.



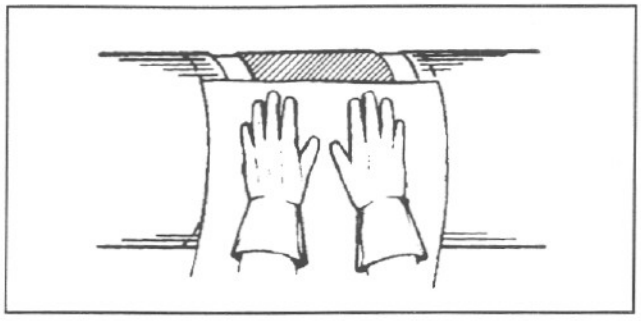
- With a measuring tape, chalk mark a guideline on the FRP jacket 6 inches from each edge of the jacket.



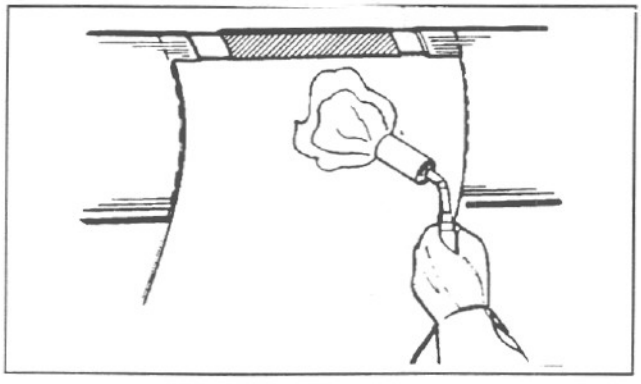
• Identify the correct sleeve size by the conduit size label on the backing material. Length of sleeve should be the circumference of the pipe plus 4 inches. The other edge will measure 32 inches. Hold this starting edge up and remove the first 6-10 inches of backing material.



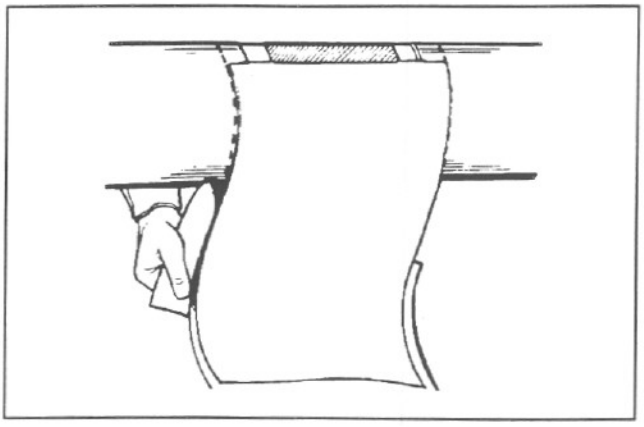
• Continue to hold the shrink sleeve right-side up. Press the top edge into place just below the top of the conduit so that the sleeve is centered between the chalk lines.



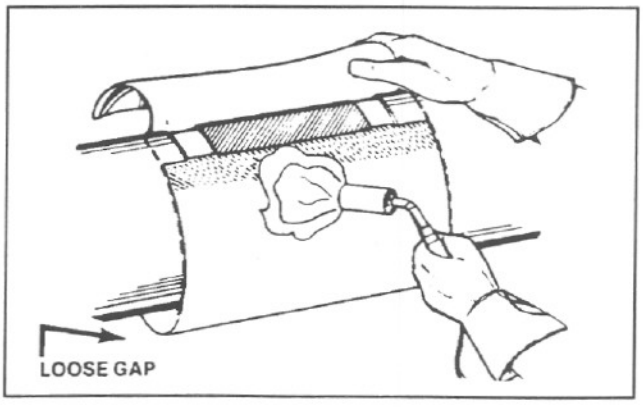
• Heat the top 2 inches of the sleeve with the torch until it becomes soft and adheres to the conduit insulation. Only use the torch provided or an approved substitute.



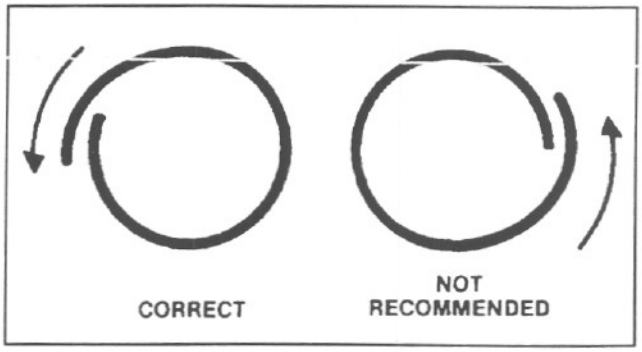
• Pull the remaining backing material off as the sleeve is wrapped around the joint.



• Wrap the sleeve around the conduit so the lower portion forms a loose gap that hangs about 1 inch from the bottom of the conduit. Stay within the chalk guidelines. Reheat the top 2 inches of the sleeve before overlapping. Keep the torch in constant motion. **DO NOT burn the surface.**



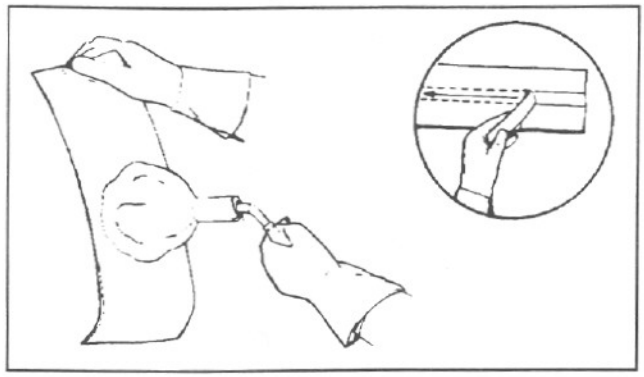
• Be sure to overlap downward.



• Peel the back strip off the closure tape.

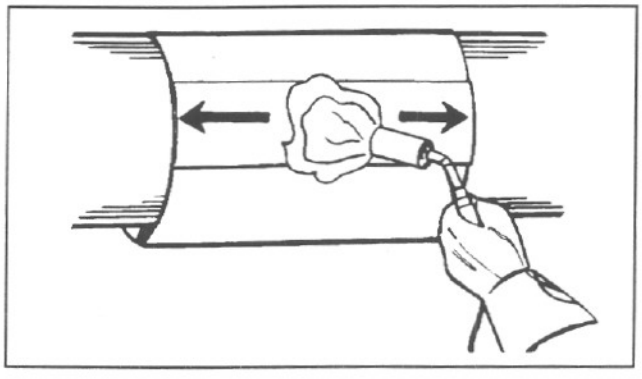
NOTE: To prevent the corners of the closure tape from peeling up after application, cut a 1/2 inch triangle from each corner.

• Preheat the tape until it becomes limp. **DO NOT heat longer than 5 seconds.**

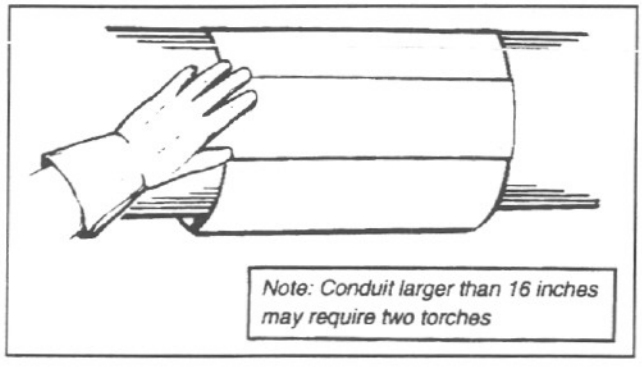


• Apply the tape across the seam made by the overlap. The sticky back strip should be face down.

• Heat the closure tape with a torch until it sticks to the rest of the sleeve. Keep the torch in constant motion. **DO NOT burn the surface.**

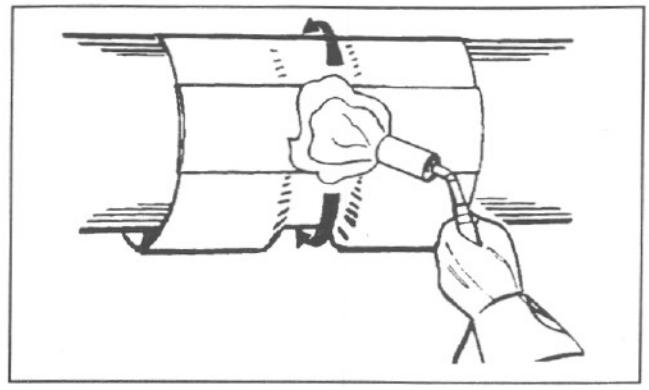


• Pat the tape down to achieve a good bond. Wear hot gloves while performing this operation.

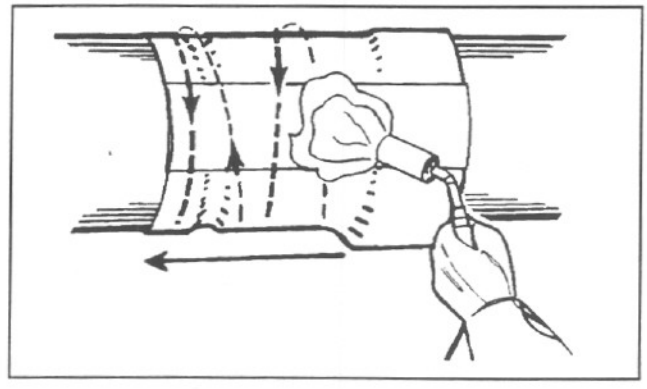


Note: Conduit larger than 16 inches may require two torches

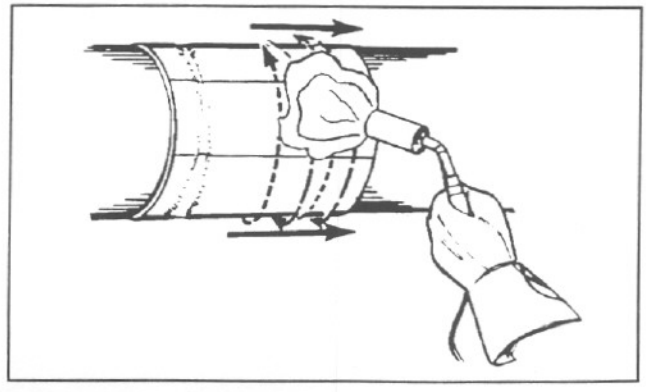
• Heat the center section of the sleeve all the way around until it shrinks. Keep the torch in constant motion. **DO NOT burn the surface.**



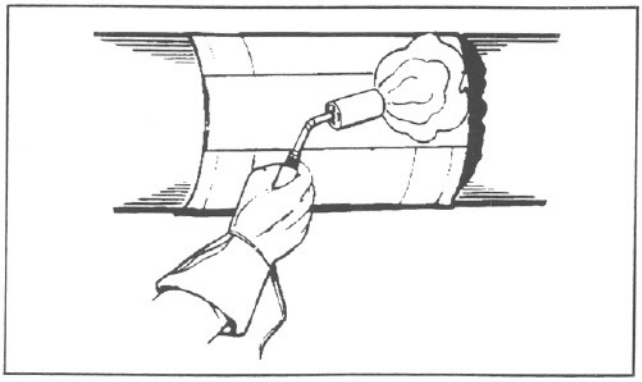
• When the center of the sleeve has shrunk, begin to move the torch with an up-and-down spiral motion around the sleeve toward the left edge.



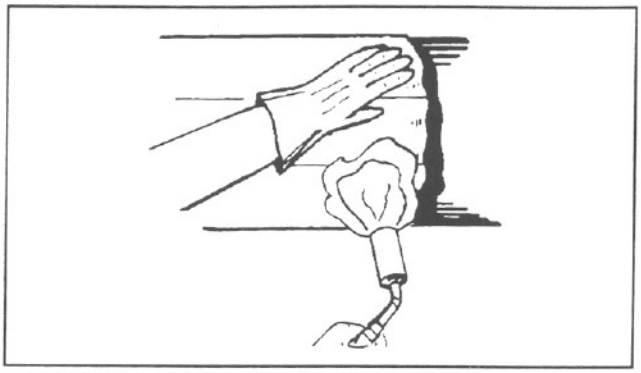
• When the left side has shrunk, heat the right side in the same up-and-down spiral manner. Keep the torch in constant motion. **DO NOT burn the surface.**



• Reduce the flame slightly and shrink the edges of the sleeve onto the conduit. Black adhesive escaping at the edges indicates a good bond.



• If the sleeve edge raises up, reheat and press down firmly. Keep the torch in constant motion. **DO NOT burn the surface.**



• While the sleeve is still hot and soft, use a hand roller to gently roll the sleeve surface and push any trapped air up and out of the sleeve. Reheat, if necessary.

8.0 ALTERATIONS AND REPAIRS

8.01 Alterations.

All field modifications to the Multi-Therm 500 system must be cleared with PERMA-PIPE. Changing the length or direction of the system may result in a faulty installation, requiring costly repairs in the future.

Every installation should have field verification of the submittal drawings. This will eliminate most dimension problems and will also allow PERMA-PIPE engineers time to modify the system design, if needed.

Even with field verification, there will occasionally be an installation that does not run true to plan. If additional materials are required, the PERMA-PIPE field representative should be contacted immediately.

If it is necessary to lengthen or shorten a run, the field representative will specify where to make the modifications. The position of the modification will depend on the nature and location of the problem.

The PERMA-PIPE field representative must also be contacted before altering the direction of a run.

8.02 FRP Jacket Repair.

A casing has been severely scratched if fiberglass strands are exposed or the casing wall has been chipped or penetrated. Consult your PERMA-PIPE field representative, and perform the following repair procedure, if necessary:

• Mark a line 3 inches on either side of the damaged area. Measure the distance between the two lines.

• Mark a line lengthwise on one of the spare shrink sleeves, equal to the required width as determined in the previous step.

• Cut the shrink sleeve along the line.

• Press the top edge into place just below the top of the assembly so that the area to be repaired is in the center of the shrink sleeve. Follow the heating instructions for shrink sleeve application (Section **7.06**).

NOTE: The shrink sleeve must cover the damaged area and extend 360° around the pipe with overlap.

8.03 Wet Carrier Pipe Insulation.

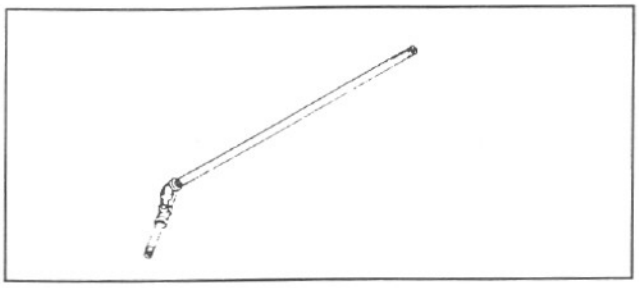
If the Multi-Therm 500 carrier pipe insulation gets wet, it must be dried before system start-up:

• Contact the PERMA-PIPE field representative.

9.0 BACKFILL PROCEDURES

9.01 Materials.

The most crucial part of the backfill process is the compaction of soil underneath and alongside the conduit. A hand tamping device can be constructed easily and economically by joining small diameter pipe. This tool will compact the soil firmly and evenly around the conduit and should be used instead of mechanical tampers when compacting to prevent damage to the conduit coating.



Multi-Therm 500 outer conduit is a flexible pipe capable of withstanding deflections of its geometric shape without structural damage. As the conduit deforms because of surface (live) loads and soil loads, the sides move outward against the soil, developing passive resistance pressure from the soil. This passive soil pressure can be great enough to increase the load-carrying capacity of a flexible conduit significantly. The extent of this increase is dependent on many conditions, particularly the type of soil and the degree of compaction. If PERMA-PIPE's recommended procedures are followed, a minimum burial depth of 2 feet can be established. It should be noted that shallower burial depths slightly increase heat losses.

Special analysis of minimum burial depths is required at taxiways, runways, railways and other areas of high surface loading conditions. It is recommended that the customer contact both PERMA-PIPE and the local authority for more specific instructions.

9.02 Backfill Description.

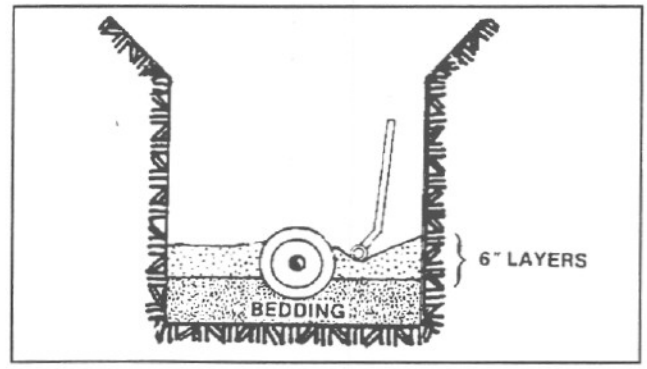
1. Sand or a sand-gravel mixture in which the gravel is either pea gravel or crushed stone without sharp edges.
2. Particles not larger than a half-inch in diameter.
3. 90% of the soil passing a No. 4 sieve.
4. 90% of the remainder retained by a No. 200 sieve.
5. Separate all unsuitable soil from the backfill soil.

9.03 Initial Backfill.

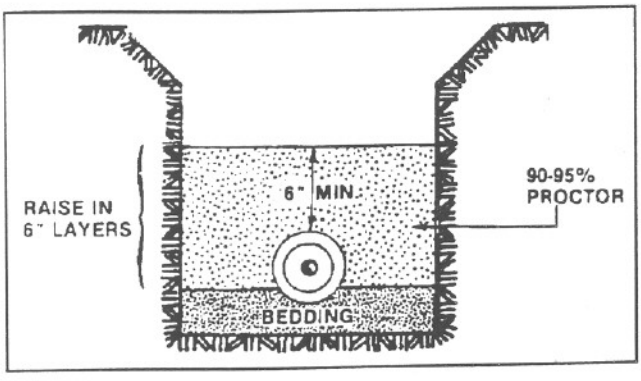
- Prior to backfilling, remove any foreign materials, such as shoring, braces and support blocks.

NOTE: DO NOT use frozen fill, sod, cinders or stones greater than a quarter inch in diameter as primary backfill.

- Carefully compact the area directly around the conduit in 6-inch layers.



- Proper compaction of the haunching materials, that section of the embedment extending from the bottom of the pipe to the springline, should be performed to provide soil densities as specified by the design engineer.
- Primary backfilling of selected earth should be packed and tamped to 6 inches minimum over the top of the jacket.



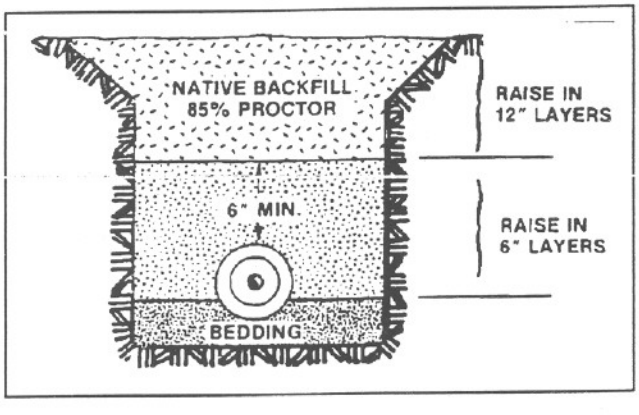
• Compact in 6 inch layers to 90-95% proctor. If surface loading conditions exist, backfill to grade in this manner.

NOTE: DO NOT use wheeled or tracked vehicles for tamping.

9.04 Final Backfill (85%) Compaction.

The backfill operation can now be completed by any convenient means. Remainder of backfill should be free of large boulders, and rocks larger than 6 inches in diameter, frozen earth, or foreign matter.

After placement and compaction of pipe embedment materials, the balance of backfill materials may be machine placed. Provide compaction to required soil densities. Use of mechanical compaction equipment to complete the final backfill is suggested, but **DO NOT use mechanical compactors until the conduit is covered with at least 12 inches of firmly compacted soil.**



Under normal conditions, backfill to grade in 1-foot lifts and compact to 85% proctor. Native soil can be used, provided it is non-organic and all particles are less than 1 inch in size.