

**LAGCO, INC.**

P.O. Box 12510      1490 Sunshine Lane  
 Lexington, KY 40583      Lexington, KY 40505  
 LIC #5343 • HVAC #M00002

**LETTER OF TRANSMITTAL**

(859) 293-PIPE (7473) Fax (859) 293-7471

DATE	07/18/08	JOB NO.	0803
ATTENTION	Graham Gray		
RE:	University of Kentucky		
<i>Barker Hall</i>			

TO University of Kentucky  
 \_\_\_\_\_  
 215 M Perterson Service Building  
 \_\_\_\_\_  
 Lexington, KY 40506  
 \_\_\_\_\_

WE ARE SENDING YOU  Attached  Under separate cover: via \_\_\_\_\_ the following items:

- Shop drawings       Prints       Plans       Samples       Specifications  
 Copy of letter       Change order       \_\_\_\_\_

COPIES	DATE	NO.	DESCRIPTION
1	07/10/08		Perma-Pipe Engineer Approved Drawings

THESE ARE TRANSMITTED as checked below:

- For approval       Approved as submitted       Resubmit \_\_\_\_\_ copies for approval  
 For your use       Approved as noted       Submit \_\_\_\_\_ copies for distribution  
 As requested       Returned for corrections       Return \_\_\_\_\_ corrected prints  
 For review and comment       \_\_\_\_\_  
 FOR BIDS DUE \_\_\_\_\_       PRINTS RETURNED AFTER LOAN TO US

REMARKS \_\_\_\_\_  
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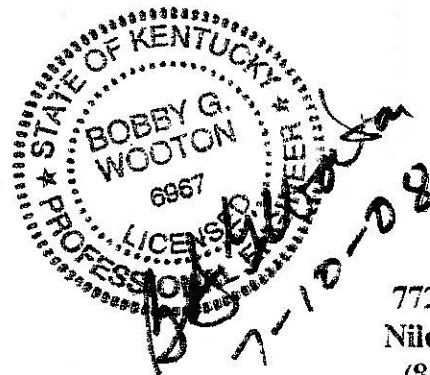
SIGNED: *[Signature]*

*If enclosures are not as noted, kindly notify us at once.*

# PERMA-PIPE

Item: A

APPROVED AS  
NOTED



7720 N. Lehigh  
Niles, IL 60714  
(847) 966-2235

MULTI-THERM 500 GENERAL NOTES

1.0 GENERAL

- 1.1 THE SCALE SHOWN ON THE DRAWINGS IS FOR REFERENCE PURPOSES ONLY. DO NOT SCALE THE DRAWINGS.
- 1.2 THE EXACT LOCATION 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 AND TEMPERATURE 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 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 FRP JACKET.
- 2.2 MULTI-THERM 500 IS FABRICATED TO FIELD DIMENSIONS.

3.0 DESIGN CONDITIONS/CRITERIA

- 3.1 SERVICE PRESSURE AND TEMPERATURE:

SERVICE	PRESSURE (PSIG)	TEMPERATURE (DEG. F)
HIGH PRESSURE STEAM (HPS)	300 PSIG	500° 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 OR WATERSHEDS ARE USED, THE SERVICE PIPE THERMAL EXPANSION WILL BE LIMITED BY THE CONDUIT. THE AMOUNT OF MOVEMENT IS SHOWN ON THE DRAWINGS.

4.0 MATERIALS

MULTI-THERM 500 MATERIALS		
ITEM	SIZE	MATERIAL
SERVICE PIPE	3" SCH 80	ASTM A106, SEAMLESS, GRADE B, CARBON STEEL PIPE
SERVICE PIPE FITTINGS	ALL	BUTTWELD, ASME B16.9, WROUGHT STEEL, LONG RADIUS, ASTM A234 WPB, SEAMLESS
SERVICE PIPE INSULATION	ALL	MINERAL WOOL, DELTA PC SUPPLY DOUBLE LAYER INSULATION WITH STAGGERED JOINTS FOR STEAM LINES
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 FRP JACKET
CONDUIT INSULATION	1" THICK	POLYURETHANE 2.0 LBS/FT <sup>3</sup> NOMINAL DENSITY ≤ 90° CLOSED CELL
OUTER JACKET	OD ≤ 15" .080" MIN. THICK 15" < OD ≤ 24" .120" MIN. THICK	FIBERGLASS REINFORCED PLASTIC (FRP)
ANCHOR, REDUCER & END PLATES	ALL	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 FURNISHED 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 SPRING PROCEDURES.  
  
A WHITE STRIPE ON THE CONDUIT INDICATES COLD SPRING 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.

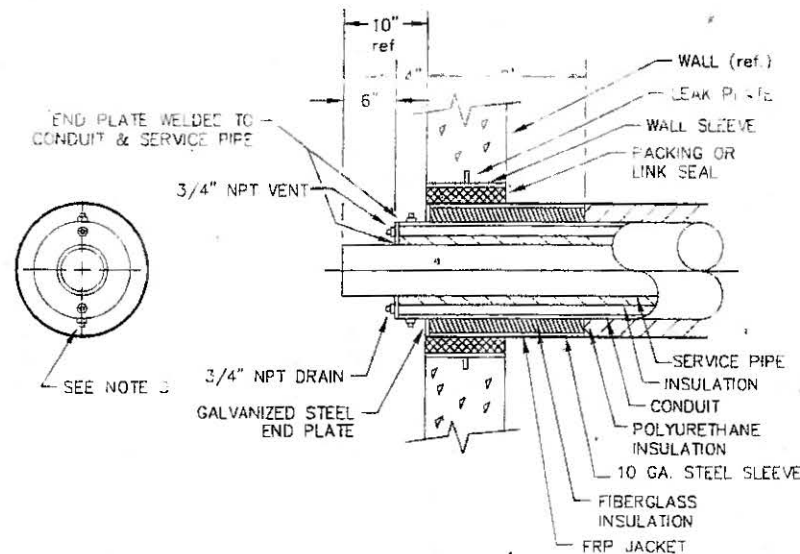
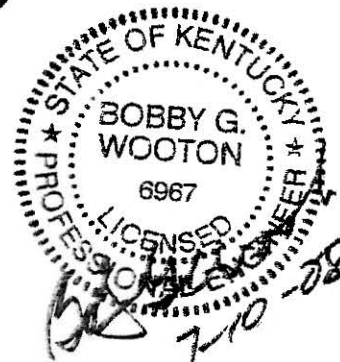
6.0 FACTORY TESTING AND INSPECTION

- 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 APPLYING FRP JACKETING.
- 6.5 FACTORY HYDROTEST ALL CARRIER PIPE WELDS TO 1.5 TIMES DESIGN PRESSURE.

7.0 SPECIAL REQUIREMENTS

- 7.1 STATE OF KENTUCKY BOILER INSPECTOR TO WITNESS FABRICATION AND TESTING
- 7.2 SUPPLY DOUBLE LAYER INSULATION WITH STAGGERED JOINTS FOR STEAM LINES
- 7.3 CHANGES IN DIRECTION MAY BE ACHIEVED WITH THE FOLLOWING BENDING PROCESS IN ACCORDANCE WITH THE INSTALLATION INSTRUCTION MANUAL.
- 7.4 SUPPLY 10' MAXIMUM SPACING ON SUPPORTS.

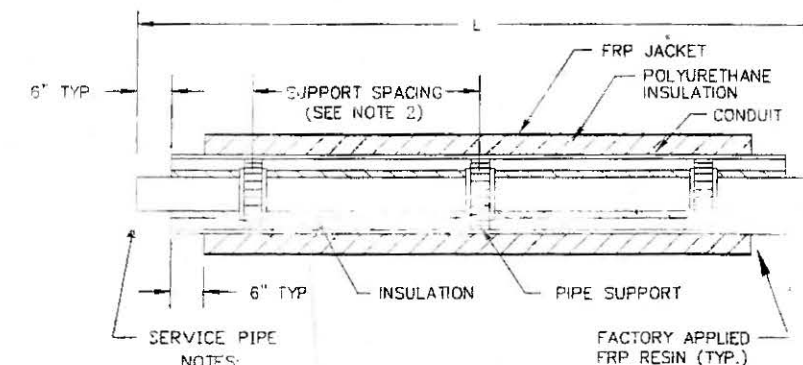
**APPROVED AS NOTED**



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 1  
MULTI-THERM 500  
END SEAL ASSEMBLY



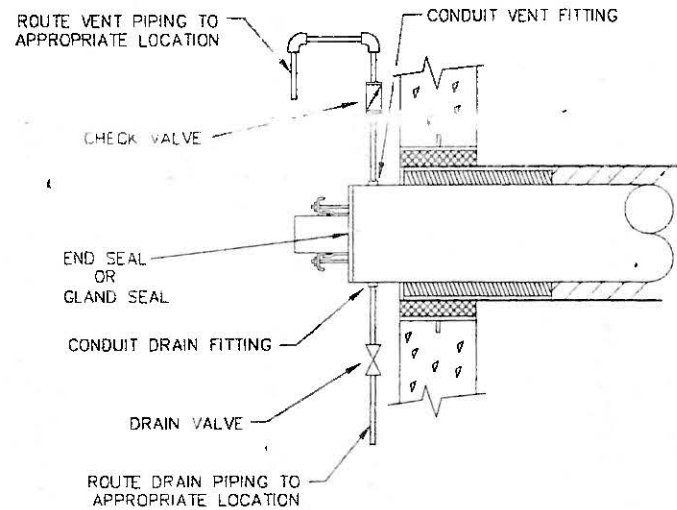
NOTES:

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

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

DETAIL 2  
MULTI-THERM 500  
STRAIGHT ASSEMBLY

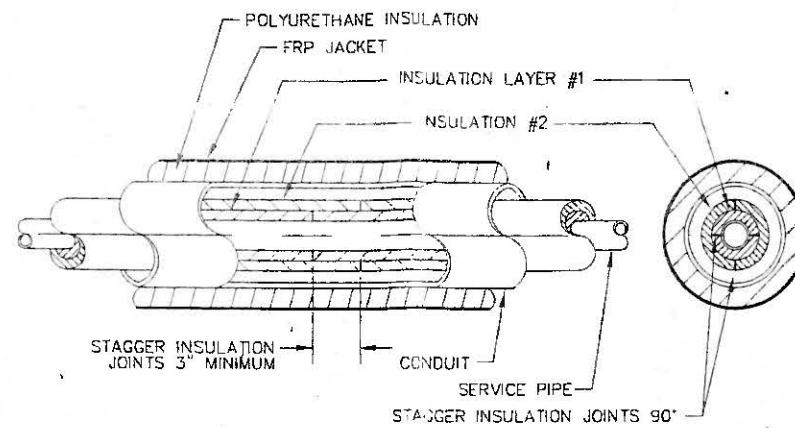
NOTICE			
THIS DRAWING AND THE INFORMATION CONTAINED AND/OR ILLUSTRATED THEREIN, IS THE PROPERTY OF PERMA-PIPE, INC. OF 7720 NORTH LEHIGH AVENUE, NILES, ILLINOIS 60714 AND IS SUBMITTED AND FURNISHED IN CONFIDENCE WITH THE UNDERSTANDING THAT THE RECIPIENT SHALL NOT REPRODUCE, COPY, LOAN, DISPOSE OF, OR DISCLOSE TO ANYONE OUTSIDE RECIPIENT'S ORGANIZATION, DIRECTLY OR INDIRECTLY, OR USE FOR ANY PURPOSE OTHER THAN THAT FOR WHICH IT IS FURNISHED AND SUBMITTED, AND THAT RECIPIENT SHALL RETURN THE SAME TO PERMA-PIPE WHEN REQUESTED.			
<b>PERMA-PIPE / RICWIL</b>			
PERMA-PIPE, INC. A SUBSIDIARY OF MFR, INC. 7720 LEHIGH AVE. NILES, IL 60714 MANUFACTURING FACILITY 1310 QUARLES DR. LEBANON, TN 37087			
<b>ENERGY DISTRIBUTION SYSTEM</b>			
FOR			
UNIVERSITY OF KENTUCKY BARKER HALL			
JOB NUMBER	58843	DRAWING NO.	08-299-3A
SCALE	NONE	SHEET	1 OF 6
CUSTOMER LAGCO, INC			
REV	DATE	REVISION	BY APPR



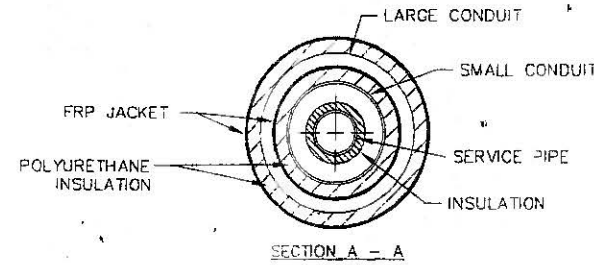
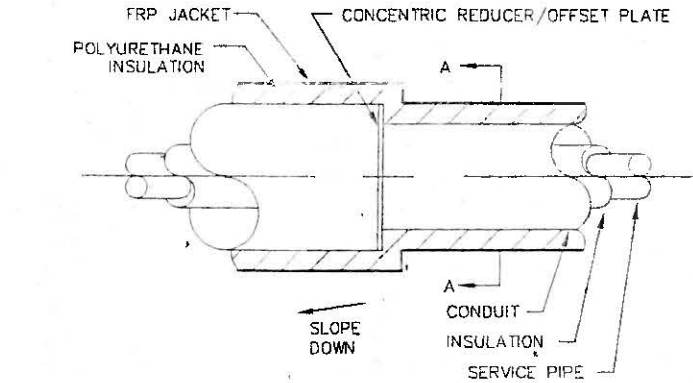
NOTES:

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

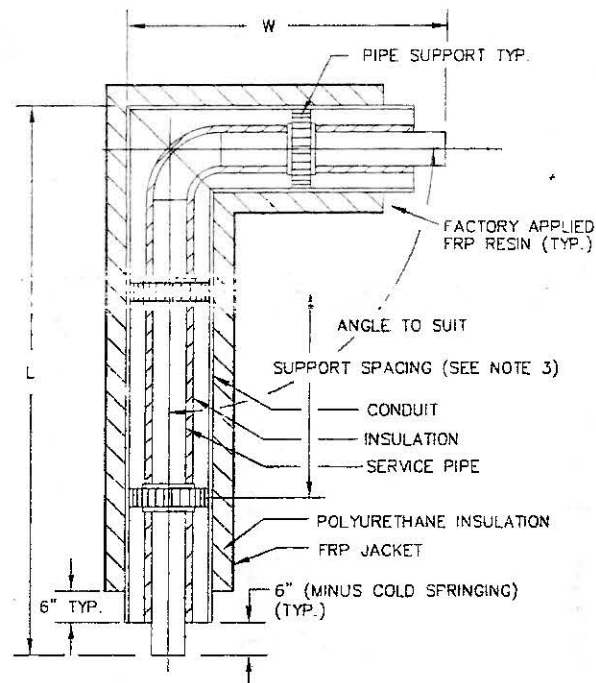
DETAIL 3  
MULTI-THERM 500  
RECOMMENDED CONDUIT  
VENT & DRAIN PIPING



DETAIL 4  
MULTI-THERM 500  
DOUBLE LAYER INSULATION



DETAIL 5  
MULTI-THERM 500  
CONCENTRIC CONDUIT REDUCER

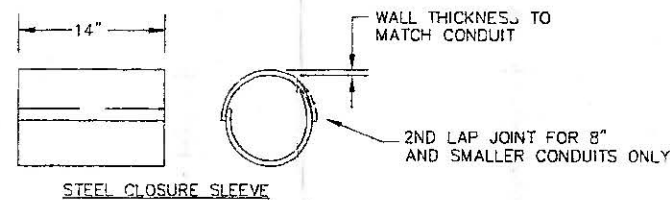
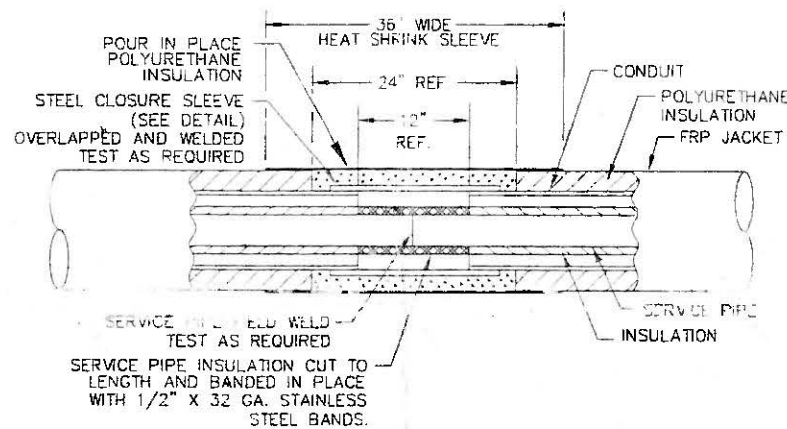


NOTES:

- 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

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

DETAIL 6  
MULTI-THERM 500  
ELBOW ASSEMBLY

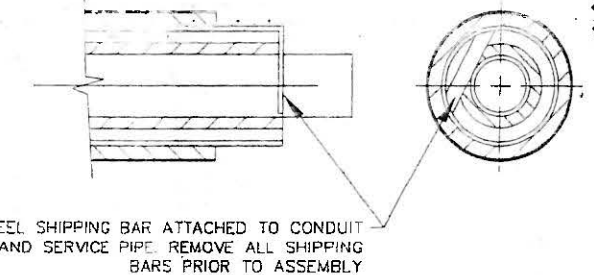


NOTES:

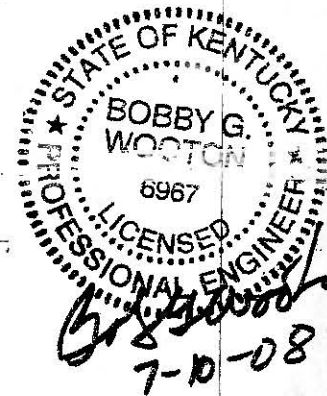
1. SOCKETWELD COUPLINGS, IF REQUIRED, SUPPLIED BY INSTALLER
2. ROLLED SLEEVES NOT AVAILABLE FOR CONDUIT SMALLER THAN 6"
3. MAXIMUM ROLLED SLEEVE THICKNESS: 1/4"
4. STORE ALL CHEMICALS AT 60°F TO 85°F

DETAIL 7  
MULTI-THERM 500  
FIELD JOINT ASSEMBLY  
ROLLED SLEEVE & HEAT SHRINK SLEEVE

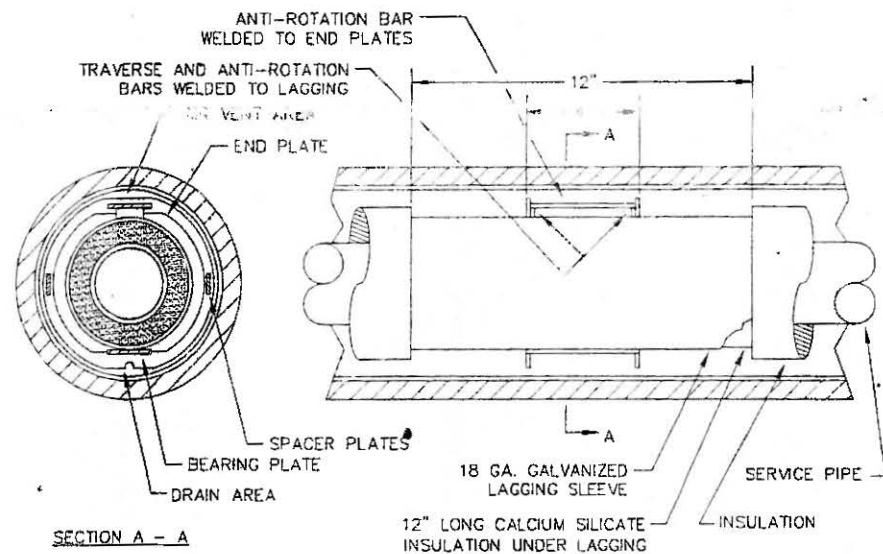
**APPROVED AS NOTED**



DETAIL 8  
MULTI-THERM 500  
SHIPPING BAR

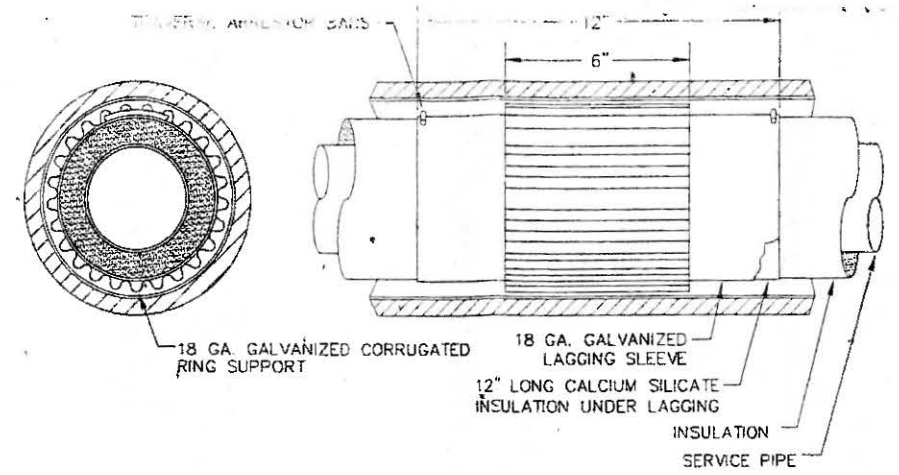


NOTICE			
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D	16-12-08	INITIAL ISSUE	CD VP
<b>PERMA-PIPE / RICWIL</b>			
PERMA-PIPE, INC. A SUBSIDIARY OF MFRIL, INC. 7720 LEHIGH AVE. NILES, IL 60714 MANUFACTURING FACILITY 1310 QUARLES DR. LEBANON, TN 37087			
FOR			
UNIVERSITY OF KENTUCKY BARKER HALL			
JOB NUMBER	58843	DRAWING NO.	08-299-B0
SCALE	NONE	SHEET	2 OF 6
CUSTOMER LAGCO, INC.			
REV	DATE	REVISION	BY APPR



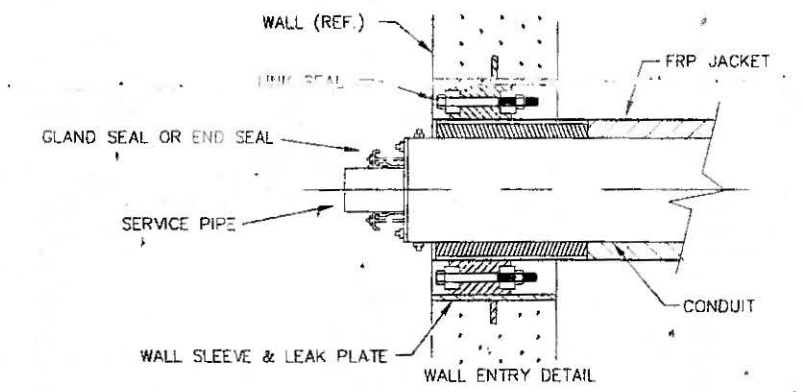
NOTES:  
1. SUPPORT MANUFACTURED FROM 10 GA. GALVANIZED STEEL AND WELDED CONSTRUCTION

DETAIL 9  
MULTI-THERM 500  
OVAL SUPPORT



NOTES:  
1. SUPPORT MANUFACTURED FROM GALVANIZED STEEL AND TACK WELDED CONSTRUCTION

DETAIL 10  
MULTI-THERM 500  
PIPE SUPPORT



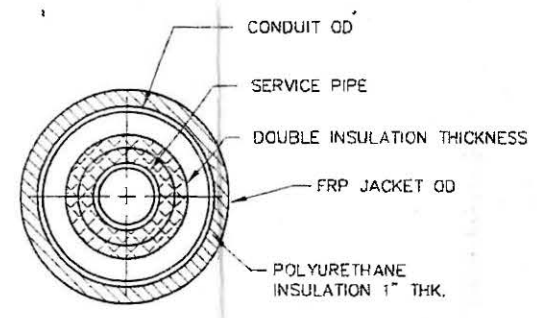
PIPE SIZE	CONDUIT SIZE	FRP JACKET O.D.	WALL SLEEVE PIPE SIZE STD. WT. (.375" WALL)	WALL SLEEVE I.D.	LINK SEAL MODEL	LINK SEAL QTY. PER WALL ENTRY
3"	10 3/4"	12.91"	16"	15.25"	LS-325	14
3"	16"	18.25"	22"	21.25"	LS-425	17

NOTES:  
1) WALL SLEEVES WITH LEAK PLATES SUPPLIED BY OTHERS  
2) LINK SEALS PROVIDED BY OTHERS

DETAIL 11  
MULTI-THERM 500  
LINK SEAL / WALL SLEEVE TABULATION

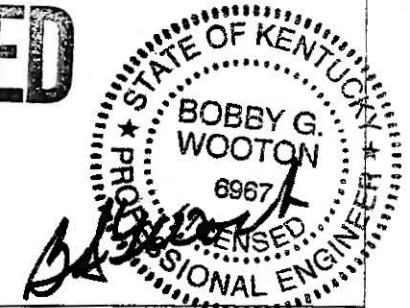
SYMBOL	DESCRIPTION
	OVAL SUPPORTS
	MOMENT GUIDE
	END SEAL
	GLAND SEAL
	ANCHOR W/ ANCHOR BLOCK
	ANCHOR ELBOW W/ ANCHOR BLOCK
	INTERNAL ANCHOR
	FIELD JOINT
OS	OVERSIZE CONDUIT
CS	COLD SPRING
E	ECCENTRIC CONDUIT REDUCER
C	CONCENTRIC CONDUIT REDUCER

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



SERVICE	SERVICE PIPE	INSULATION THICKNESS	CONDUIT OD	FRP JACKET OD (SEE NOTE)
3" STEAM	3" SCH 80 A106 GR B, SMLS C.S.	2"	10 3/4"	13"

**APPROVED AS NOTED** 7-10-08



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0	6-12-08	INITIAL ISSUE	CD VP
A	7-1-08	REV. SERVICE PIPE SCHEDULE	MD
<b>PERMA-PIPE / RICWIL</b>			
PERMA-PIPE, INC. A SUBSIDIARY OF MPRI, INC. 7720 LEHIGH AVE. NILES, IL 60714 MANUFACTURING FACILITY 1310 QUARLES DR. LEBANON, TN 37087			
FOR <b>ENERGY DISTRIBUTION SYSTEM</b>			
UNIVERSITY OF KENTUCKY BARKER HALL			
JOB NUMBER	58843	DRAWING NO.	08-299-BA
SCALE	NONE	SHEET	3 OF 6
CUSTOMER LAGCO, INC.			

POLY-THERM 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 APPROXIMATE FIELD JOINT LOCATIONS AND QUANTITIES ARE SHOWN. THE EXACT LOCATIONS AND QUANTITY OF FIELD JOINTS WILL BE SHOWN ON THE PART DRAWING LAYOUT (PDL) - SEE NOTE 6.0.

2.0 PRODUCT DESCRIPTION

- 2.1 POLY-THERM CONSISTS OF A CUSTOMER SPECIFIED SERVICE PIPE, POLYURETHANE FOAM INSULATION AND A FIBERGLASS REINFORCED POLYESTER (FRP) JACKET.
- 2.2 POLY-THERM IS FABRICATED TO FIELD DIMENSIONS.

3.0 DESIGN CONDITIONS/CRITERIA

3.1 SERVICE PRESSURE AND TEMPERATURE

SERVICE	PRESSURE (PSIG)	TEMPERATURE(DEG. F)
CONDENSATE	150 PSIG	250° F

- 3.2 THE SERVICE PIPING IS DESIGNED AND MANUFACTURED IN ACCORDANCE WITH ASME B31.1.
- 3.3 A STRESS ANALYSIS OF THIS PIPING SYSTEM HAS BEEN MADE ASSUMING THE DIMENSIONS AND DESIGN CONDITIONS SHOWN ON THESE DRAWINGS ARE CORRECT. THE SYSTEM IS WITHIN THE LIMITS SET FORTH FOR ALLOWABLE STRESSES IN THE CODE, BASED UPON THE ASSUMPTIONS HEREIN.
- 3.4 THE SYSTEM IS DESIGNED TO ACCOMMODATE THE SERVICE PIPE THERMAL EXPANSION USING FIELD INSTALLED EXTERNAL FLEXIBLE INSULATION SHEETS IN THE LOCATIONS SHOWN ON THE DRAWINGS.
- 3.5 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.

4.0 MATERIALS

POLY-THERM MATERIALS		
ITEM	SIZE	MATERIAL
SERVICE PIPE	2" SCHEDULE 80 FOR CONDENSATE	ASTM A106, SMLS, GRADE B, CARBON STEEL PIPE
SERVICE PIPE FITTINGS	2" SCHEDULE 80 FOR CONDENSATE	SOCKETWELD, ASME B16.11, FORGED STEEL, ASTM A105 WPB SEAMLESS
SERVICE PIPE INSULATION	ALL	POLYURETHANE FOAM NOMINAL 1.5 IN. R / 1.01 FT. DENSITY 90% TO 95% CLOSED CELL
INSULATION JACKET	OD ≤ 15" 0.080" THICK	FIBERGLASS REINFORCED POLYESTER (FRP)
ANCHOR PLATES	ALL	ASTM A36

5.0 APPROVAL STATUS

- 5.1 THE PURCHASER MUST FURNISH AND/OR VERIFY THE FOLLOWING INFORMATION BEFORE MANUFACTURING OF THE INSULATION DESIGN.
  - 5.1.1 FIELD MEASUREMENTS - THE ACCURACY OF FIELD MEASUREMENTS, INCLUDING WALL THICKNESS AT ALL POINTS OF ENTRY, ARE ENTIRELY THE RESPONSIBILITY OF THE PURCHASER. THIS INFORMATION MUST BE SHOWN ON AN APPROVED FOR FABRICATION DRAWING RETURNED TO PERMA-PIPE.
  - 5.1.2 DESIGN CONDITIONS - THE DESIGN PRESSURE AND TEMPERATURE MUST BE VERIFIED BY THE PURCHASER.
  - 5.1.3 SLOPE OF THE SYSTEM - THE SYSTEM SLOPE IS SHOWN ON THE DRAWINGS WHERE APPLICABLE. THE SYSTEM SLOPE MUST BE VERIFIED BY THE PURCHASER.

6.0 INSTALLATION

- 6.1 ALL PIPING SHALL BE INSTALLED AND TESTED IN ACCORDANCE WITH PERMA-PIPE'S INSTALLATION INSTRUCTION MANUAL FOR THE PERMA-PIPE PRODUCT.
- 6.2 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.
- 6.3 PERMA-PIPE STRONGLY RECOMMENDS THAT ALL FIELD JOINTS REMAIN UNINSULATED, UNCOVERED AND EXPOSED FOR TESTING PURPOSES.
 

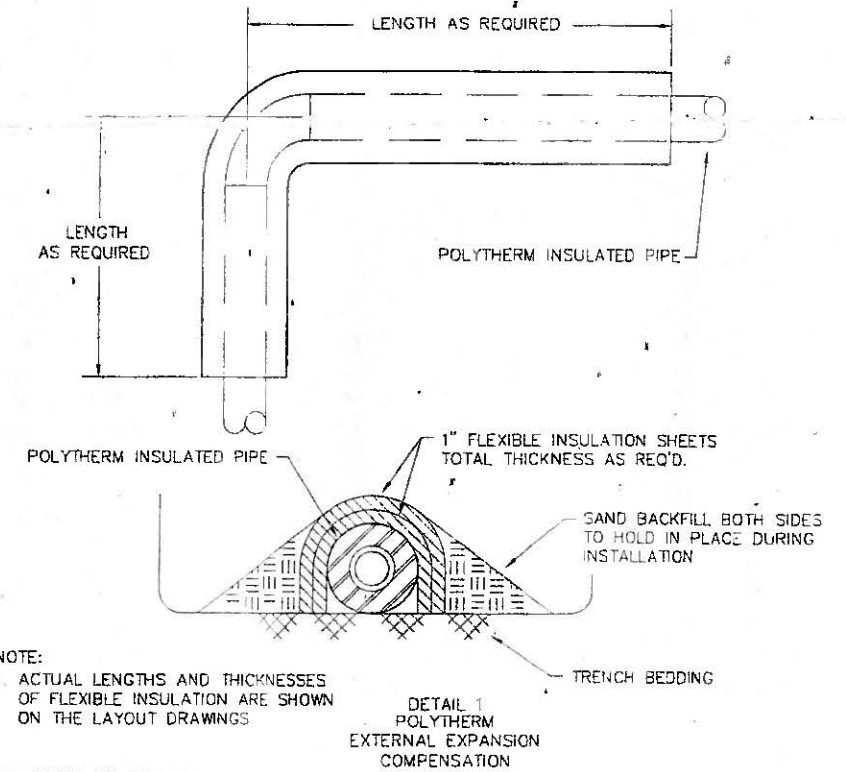
PERMA-PIPE DOES NOT RECOMMEND BACKFILLING PRIOR TO FIELD JOINT TESTING. VIOLATION OF THIS RECOMMENDATION MAY RESULT IN RE-EXCAVATING, REPAIRS AND RE-BACKFILLING AND WILL BE DONE AT THE INSTALLER'S COST AND RISK.
- 6.4 ANCHOR BLOCKS ARE REQUIRED AT ALL ANCHOR LOCATIONS INDICATED ON THE DRAWINGS. ANCHOR BLOCKS SHALL BE FIELD POURED AND KEYED INTO UNDISTURBED SOIL BY THE INSTALLER. ALL ANCHOR BLOCKS SHALL BE COMPLETELY CURED BEFORE OPERATING OR TESTING THE SYSTEM.
- 6.5 SERVICE PIPE COUPLINGS, IF REQUIRED, ARE NOT SUPPLIED BY PERMA-PIPE.

7.0 FACTORY TESTING AND INSPECTION

- 7.1 SERVICE PIPE NDE IN ACCORDANCE WITH ASME B31.1.
- 7.2 VISUALLY INSPECT SPRAYED ON POLYURETHANE FOAM INSULATION FOR VOIDS PRIOR TO FRP JACKETING.
- 7.3 FACTORY HYDROTEST OF CARRIER PIPE WELDS TO 200 PSIG PRESSURE.

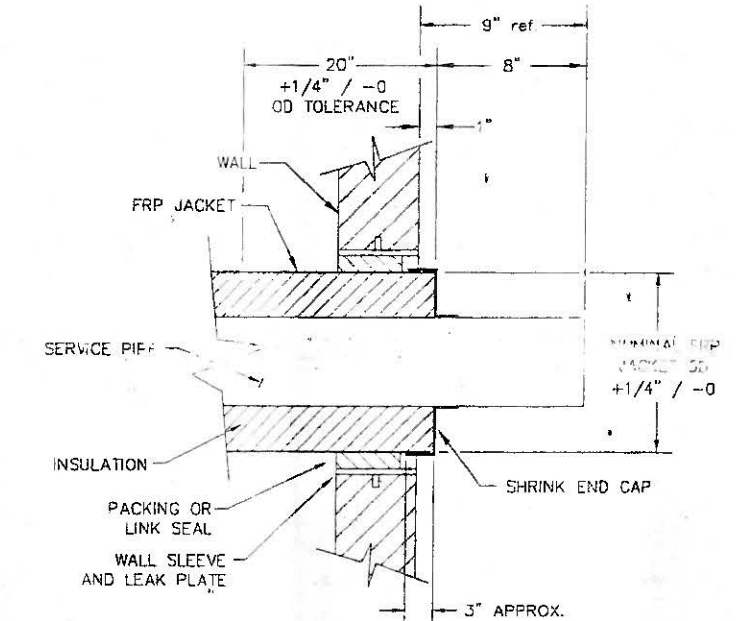
8.0 SPECIAL REQUIREMENTS

- 8.1 FABRICATE PIPING IN ACCORDANCE WITH KENTUCKY BOILER AND PRESSURE VESSEL INSPECTION LAW.
- 8.2 STATE OF KENTUCKY BOILER INSPECTOR TO WITNESS FABRICATION AND TESTING.
- 8.3 CHANGES IN DIRECTION MAY BE ACHIEVED WITH WELDED FITTINGS AND/OR FACTORY COLD BENDING PROCESS IN ACCORDANCE WITH B31.1 CODE FOR PRESSURE PIPING.



NOTE:  
1. ACTUAL LENGTHS AND THICKNESSES OF FLEXIBLE INSULATION ARE SHOWN ON THE LAYOUT DRAWINGS.

DETAIL 1  
POLY THERM  
EXTERNAL EXPANSION  
COMPENSATION



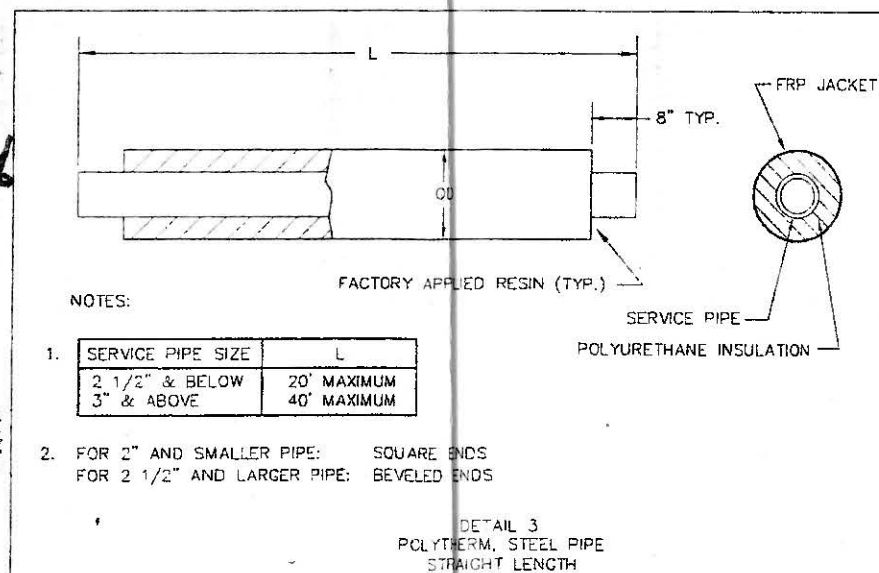
NOTES:  
1. WALL SLEEVES AND LEAK PLATES BY OTHERS  
2. PACKING OR LINK SEAL BY OTHERS

DETAIL 2  
POLY THERM  
SHRINK END CAP

**APPROVED  
NOTED**

**AS**  
7-10-08

STATE OF KENTUCKY  
BOBBY G. WOOTEN  
6967  
LICENSED PROFESSIONAL ENGINEER



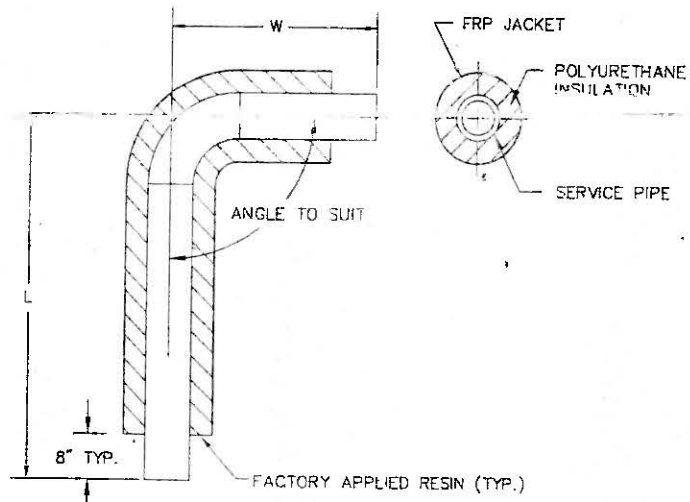
NOTES:

SERVICE PIPE SIZE	L
2 1/2" & BELOW	20' MAXIMUM
3" & ABOVE	40' MAXIMUM

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

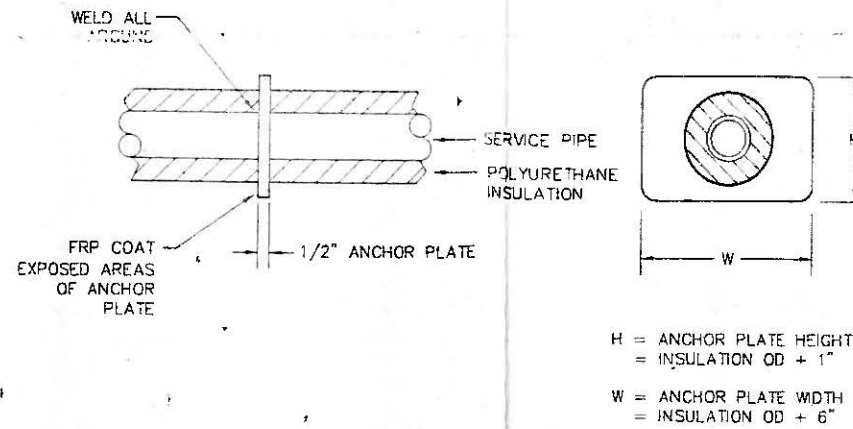
DETAIL 3  
POLY THERM, STEEL PIPE  
STRAIGHT LENGTH

NOTICE			
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0	6-12-08	INITIAL ISSUE	CD VP
<b>PERMA-PIPE / RICWIL</b>			
PERMA-PIPE, INC. A SUBSIDIARY OF MFRI, INC. 7720 LEHIGH AVE. NILES, IL 60714 MANUFACTURING FACILITY 1310 QUARLES DR. LEBANON, TN 37087			
<b>ENERGY DISTRIBUTION SYSTEM</b>			
FOR <b>UNIVERSITY OF KENTUCKY BARKER HALL</b>			
JOB NUMBER	58843	DRAWING NO.	08-299-BC
SCALE	NONE	SHEET	4 OF 6
CUSTOMER	LAGCO, INC.		
REV	DATE	REVISION	BY APPR.



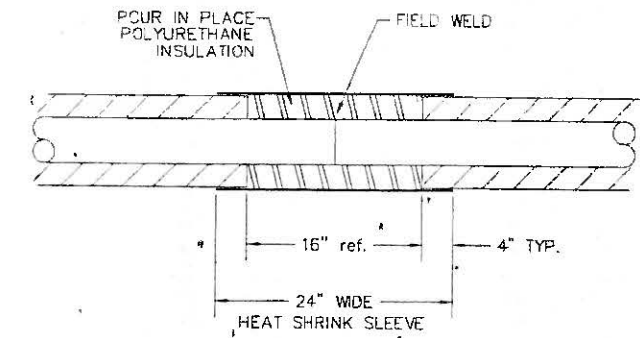
- NOTE:
1. PIPE BENDING IN PLACE OF WELDED ELBOWS MAY BE USED
  2. FOR 2" AND SMALLER PIPE: SQUARE ENDS 3000 lb. SOCKETWELD FITTINGS.  
FOR 2 1/2" AND LARGER PIPE: BEVELED ENDS BUTTWELD FITTINGS

DETAIL 4  
POLYTHERM, STEEL PIPE  
ELBOW ASSEMBLY



H = ANCHOR PLATE HEIGHT  
= INSULATION OD + 1"  
W = ANCHOR PLATE WIDTH  
= INSULATION OD + 6"

DETAIL 5  
POLYTHERM, STEEL PIPE  
STRAIGHT PIPE, RECTANGULAR ANCHOR



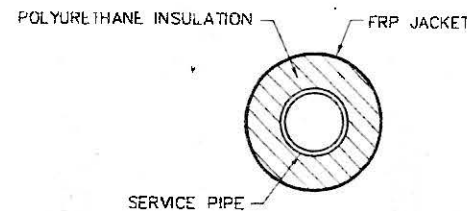
NOTES:

1. SOCKET WELD COUPLINGS, IF REQUIRED SUPPLIED BY INSTALLER
2. THE FOLLOWING FIELD JOINT MATERIAL SUPPLIED BY PERMA-PIPE

POUR IN PLACE POLYURETHANE INSULATION  
MOLD FOR POUR IN PLACE  
HEAT SHRINK SLEEVE

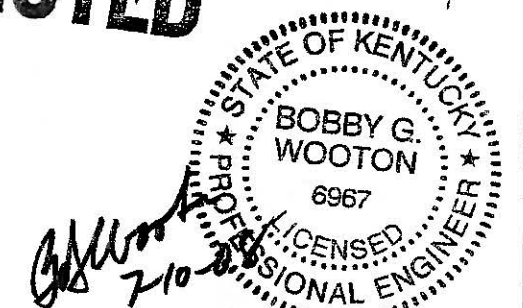
DETAIL 6  
POLYTHERM, STEEL PIPE  
FIELD JOINT, SHRINK SLEEVE

POLYTHERM PIPING SYMBOL LEGEND	
SYMBOL	DESCRIPTION
	EXTERNAL PILLOWS
	END SEAL
	ANCHOR
	ANCHOR ELBOW
	FIELD JOINT

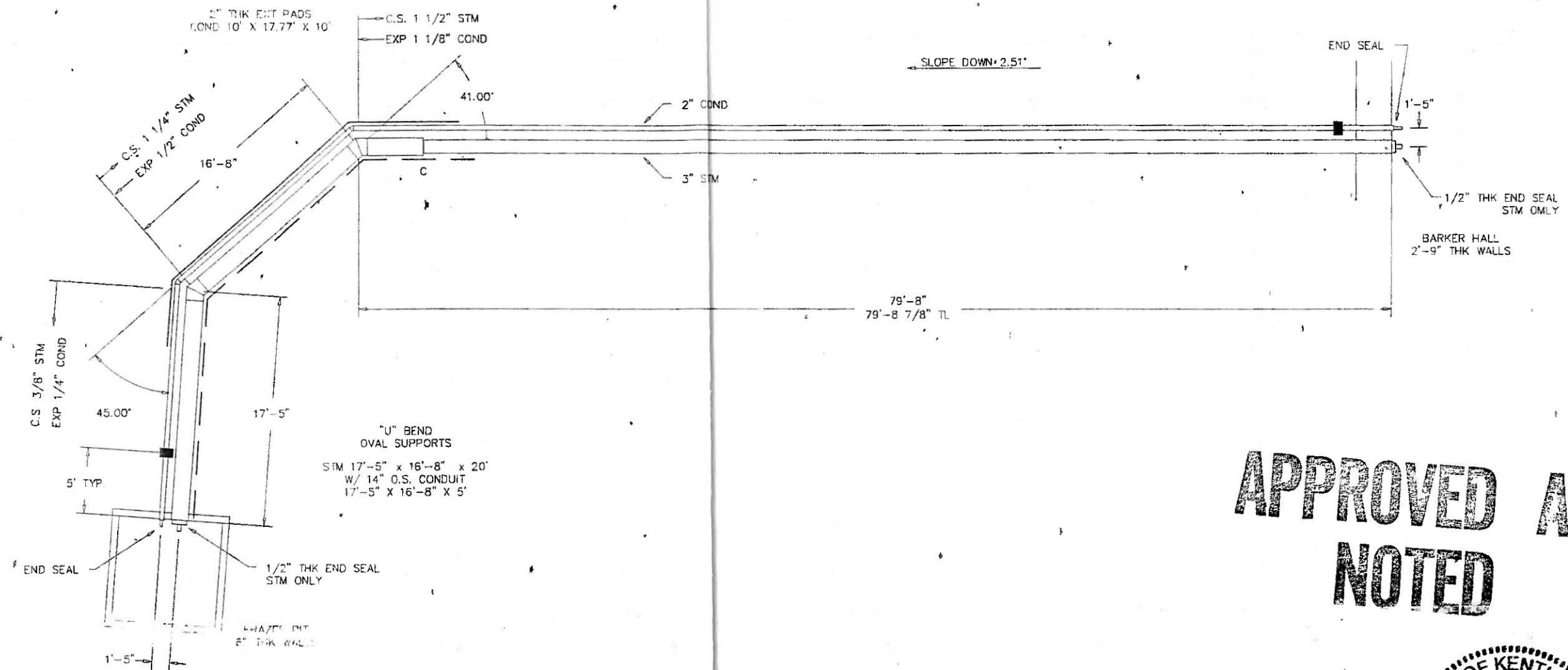


POLYTHERM CROSS SECTION			
SERVICE	SERVICE PIPE	INSULATION THICKNESS	NOMINAL FRP JACKET OD
2" CONDENSATE	2" SCH 80 A106 GR 8, SMLS C.S.	1"	4.53"

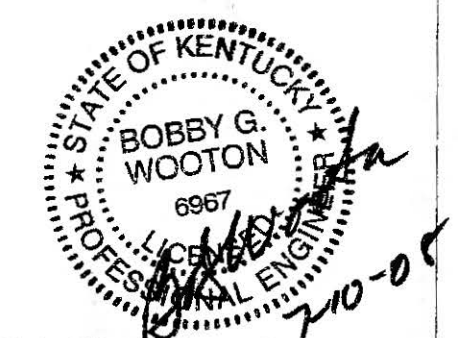
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0	6-12-08	INITIAL ISSUE	CD VP
<b>PERMA-PIPE / RICWIL</b>			
PERMA-PIPE, INC. A SUBSIDIARY OF MFR, INC. 7720 LEHIGH AVE. NILES, IL 60714 MANUFACTURING FACILITY 1310 QUARLES DR. LEBANON, TN 37087			
ENERGY DISTRIBUTION SYSTEM			
FOR			
UNIVERSITY OF KENTUCKY BARKER HALL			
JOB NUMBER	58843	DRAWING NO.	08-299-B0
SCALE	NONE	SHEET	5 OF 6
CUSTOMER			
LAGCO, INC.			
REV	DATE	REVISION	BY APPR



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REFER TO SHEETS 3 & 5 FOR CROSS SECTIONS & LEGENDS

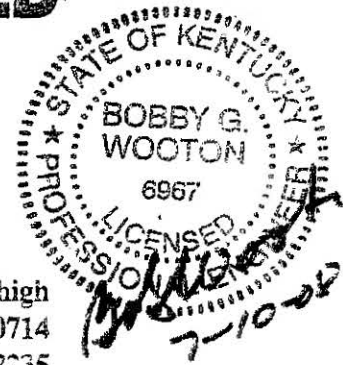
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Q	6-12-08	INITIAL ISSUE	CD VP
A	7-1-08	REV. PER FIELD DIM'S.	MD
<p style="text-align: center;"><b>PERMA-PIPE / RICWIL</b></p> <p style="text-align: center;">PERMA-PIPE, INC. A SUBSIDIARY OF MFR, INC. 7720 LEHIGH AVE. NILES, IL 60714 MANUFACTURING FACILITY 1310 QUARLES DR. LEBANON, TN 37087</p>			
<b>ENERGY DISTRIBUTION SYSTEM</b>			
FOR			
UNIVERSITY OF KENTUCKY BARKER HALL			
JOB NUMBER		DRAWING NO.	
58843		08-299-BA	
SCALE		SHEET	
NONE		6 OF 6	
CUSTOMER			
LAGCO, INC.			
REV	DATE	REVISION	BY APPR



**PERMA-PIPE**

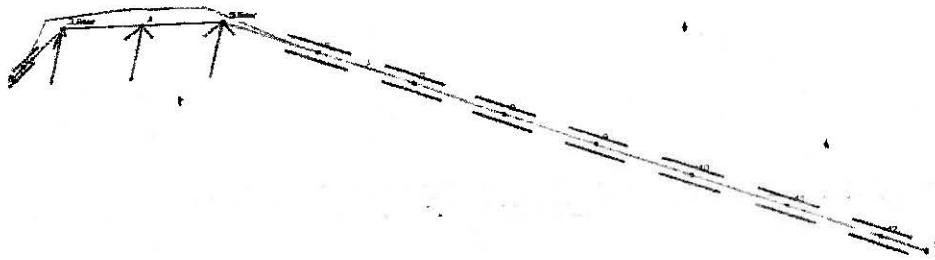
**Item: B**

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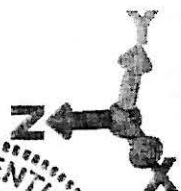
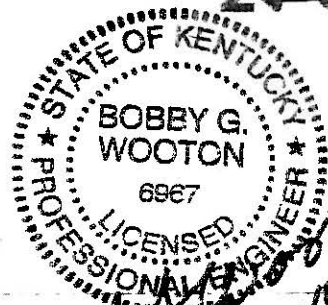


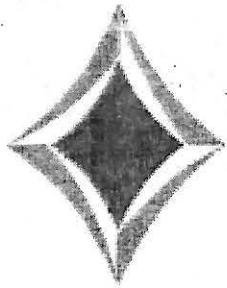
7720 N. Lehigh  
Niles, IL 60714  
(847) 966-2235

Filename: C:\DOCUMENT~1\penar\LOCALS~1\1\empty\fig29.dbs  
Load : Dead Weight + Pressure 1 + Thermal 1  
ASME B31.1 - 2004



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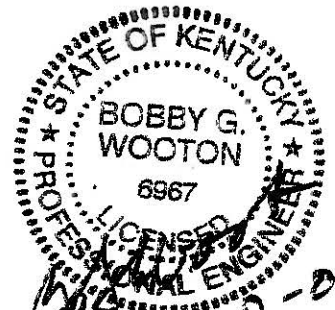
# ALGOR®

## PipePak Report

### Table of Contents

Input+ . . . . .	1
Support Summary . . . . .	7
System Deflections . . . . .	8
System Stresses (ASME B31.1) . . . . .	9
System Maxima . . . . .	10
System Deflections . . . . .	11
System Stresses (ASME B31.1) . . . . .	12
System Maxima . . . . .	13
System Deflections . . . . .	14
System Stresses (ASME B31.1) . . . . .	15
System Maxima . . . . .	16

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7-10-08

PipePak Version 10.00  
UNIVERISTY OF KENTUCKY  
Model File: P:\Algorold 6\_10\_05\58843UBCOND.dbs

PERMA-PIPE

07/01/2008 9:21:16AM

Piping Code: ASME B31.1 - 2004

\*\*\* Input+ \*\*\*

File Name ..... P:\Algorold 6\_10\_05\58843UBCOND  
Project ..... UNIVERISTY OF KENTUCKY  
Department .....  
Contract Number ..... 58843  
Description ..... U BEND CONDENSATE  
Prepared by ..... V.L.P.  
Checked by ..... *sw*

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

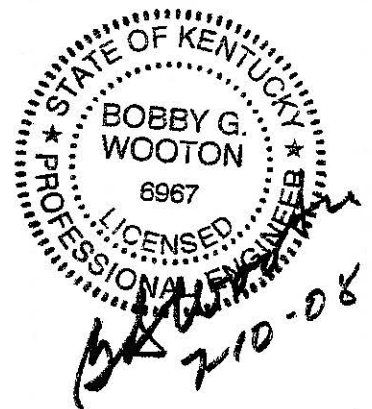
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STATE OF KENTUCKY  
BOBBY G. WOOTON  
6967  
LICENSED PROFESSIONAL ENGINEER  
*7-10-08*

Piping Code: ASME B31.1 - 2004

Frm Point /To name	DX (feet)	DY (feet)	DZ (feet)	Radius (inch)	X (feet)	Y (feet)	Z (feet)
F .1					0.000	0.000	0.000
.2	-2.12	-2.12			-2.120	0.000	-2.120
.3	-7.07	-7.07	Short		-9.190	0.000	-9.190
.4		-8.88			-9.190	0.000	-18.070
.5		-8.88	Short		-9.190	0.000	-26.950
.6	6.56	-7.54			-2.630	0.000	-34.490
.7	6.56	-7.54			3.930	0.000	-42.030
.8	6.56	-7.54			10.490	0.000	-49.570
.9	6.56	-7.54			17.050	0.000	-57.110
.10	6.56	-7.54			23.610	0.000	-64.650
.11	6.56	-7.54			30.170	0.000	-72.190
.12	6.56	-7.54			36.730	0.000	-79.730
.13	3.28	-3.77			40.010	0.000	-83.500

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 BOBBY G.  
 WOOTON  
 6967  
 LICENSED PROFESSIONAL ENGINEER

*B.G. Wooton*  
 7-10-08

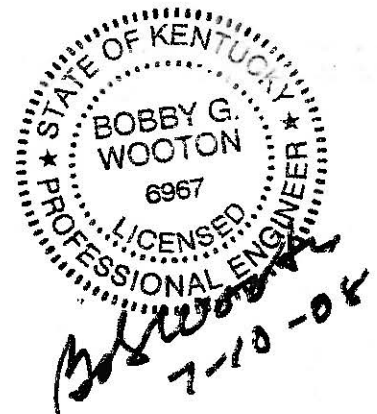
Piping Code: ASME B31.1 - 2004

Point Data Description

```

.1 Pipe Pipe data identifier = 2
      NPS Identifier = 2
      DN Identifier = 50
      Pipe schedule = 80
      Actual pipe O. D. = 2.375 inch
      Wall thickness = 0.218 inch
      Corrosion allowance = 0.03 inch
      Insulation thickness = 1 inch
      Insulation density = 2 lb/cu.ft
      Content S. G. = 1
      Wind area O.D. = Insulation O.D.
Material data identifier = STL
      Low C.S. A106B (Carbon content below .30%)
      Density = 0.2836 lb/cu.inch
      Tempera. Modulus Thermal Strain
      (deg.F) (psi) (inch/inch)
      -325. 30000000 -0.00197
      -150. 29500000 -0.00121
      -50. 29000000 -0.00070
      70. 29500000 0.000000
      200. 28800000 0.000825
      300. 28300000 0.001517
      400. 27700000 0.002250
      500. 27300000 0.003017
      600. 26700000 0.003833
      700. 25500000 0.004692
      800. 24200000 0.005583
      900. 22400000 0.006508
      1000. 20400000 0.007408
      1100. 18000000 0.008367
      Allowable stress code = A53
      Temperature Allowable stresses
      (deg.F) (psi)
      -20.00 14600.00
      550.00 14600.00
      700.00 13300.00
      750.00 11100.00
      800.00 9200.00
      900.00 9200.00
      1000.00 9200.00
Load Load data identifier = CON
      Case Temperature Pressure Expansion
      No. (deg.F) (psig) (inch/inch)
      1 250.000 15.000 0.001171
Anchor Rigid in all directions
.2 Guide Spring Constant = Rigid lb/inch
.3 One way restraint
      Can not move in negative Y direction
      Friction coefficient = 0
.4 One way restraint
      Can not move in negative Y direction
      Friction coefficient = 0
.5 One way restraint
      Can not move in negative Y direction
      Friction coefficient = 0
.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
  
```

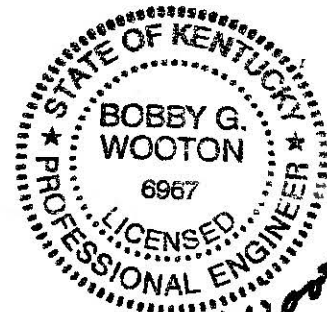
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Piping Code: ASME B31.1 - 2004

Point	Data	Description
.10	Guide	Spring Constant = Rigid lb/inch
.11	Guide	Spring Constant = Rigid lb/inch
.12	Guide	Spring Constant = Rigid lb/inch
.13	Anchor	Rigid in all directions

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*Bobby G. Wooton*  
7-10-08

Piping Code: ASME B31.1 - 2004

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

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STATE OF KENTUCKY  
BOBBY G. WOOTON  
6967  
LICENSED PROFESSIONAL ENGINEER  
*Bobby Wooton*  
7-10-09



Piping Code: ASME B31.1 - 2004

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

**APPROVED AS NOTED**

STATE OF KENTUCKY  
BOBBY G. WOOTON  
6967  
LICENSED PROFESSIONAL ENGINEER  
*Bobby G. Wooton*  
7-10-08

Piping Code: ASME B31.1 - 2004

\*\*\* Support Summary \*\*\*

Point Name	Global Direction	Forces (lb) or Moments (inch-lb)						
		Sustain	Expansion		Occasional		Total	
			Max	Min	Max	Min	Max	Min
.1	Fx	0	188	0	0	0	188	0
	Fy	18	0	0	0	0	18	18
	Fz	0	0	-117	0	0	0	-117
	Mx	90	0	0	0	0	90	90
	My	0	0	-2547	0	0	0	-2547
	Mz	-297	0	0	0	0	-297	-297
.2	Fx	0	0	-192	0	0	0	-192
	Fy	-75	0	0	0	0	-75	-75
	Fz	0	192	0	0	0	192	0
.3.Near	Fy	-51	0	0	0	0	-51	-51
.4	Fy	-67	0	0	0	0	-67	-67
.5.Near	Fy	-50	0	0	0	0	-50	-50
.6	Fx	0	0	-61	0	0	0	-61
	Fy	-72	0	0	0	0	-72	-72
	Fz	0	0	-53	0	0	0	-53
.7	Fx	0	33	0	0	0	33	0
	Fy	-63	0	0	0	0	-63	-63
	Fz	0	28	0	0	0	28	0
.8	Fx	0	0	-9	0	0	0	-9
	Fy	-65	0	0	0	0	-65	-65
	Fz	0	0	-8	0	0	0	-8
.9	Fx	0	2	0	0	0	2	0
	Fy	-65	0	0	0	0	-65	-65
	Fz	0	2	0	0	0	2	0
.10	Fx	0	0	-1	0	0	0	-1
	Fy	-64	0	0	0	0	-64	-64
	Fz	0	0	-1	0	0	0	-1
.11	Fx	0	0	0	0	0	0	0
	Fy	-66	0	0	0	0	-66	-66
	Fz	0	0	0	0	0	0	0
.12	Fx	0	0	0	0	0	0	0
	Fy	-55	0	0	0	0	-55	-55
	Fz	0	0	-0	0	0	0	-0
.13	Fx	0	39	0	0	0	39	0
	Fy	-8	0	0	0	0	-8	-8
	Fz	0	0	-45	0	0	0	-45
	Mx	17	0	0	0	0	17	17
	My	0	1	0	0	0	1	0
	Mz	-29	0	0	0	0	-29	-29

APPROVED AS  
NOTED

BKW  
7-10-97

STATE OF KENTUCKY  
 BOBBY G. WOOTON  
 6967  
 LICENSED PROFESSIONAL ENGINEER

Load : Dead Weight + Pressure 1 + Thermal 1

\*\*\* System Deflections \*\*\*

Point Name	Displacements (inch)			Rotations (degree)		
	X	Y	Z	X	Y	Z
.1	0.000	0.000	-0.000	0.000	-0.000	-0.000
.2	-0.034	-0.000	-0.034	-0.021	0.107	-0.001
.3.Near	-0.892	-0.000	0.597	-0.018	0.607	-0.076
.3.Far	-0.908	0.000	0.602	-0.020	0.584	-0.076
.4	-1.621	-0.000	0.459	-0.001	0.173	-0.085
.5.Near	-1.484	-0.000	0.317	0.024	-0.337	-0.094
.5.Far	-1.475	-0.000	0.318	0.023	-0.371	-0.094
.6	-0.688	-0.000	0.791	0.058	-0.251	-0.049
.7	-0.582	-0.000	0.669	0.039	0.067	-0.050
.8	-0.476	-0.000	0.547	0.035	-0.018	-0.038
.9	-0.370	-0.000	0.426	0.026	0.005	-0.031
.10	-0.265	-0.000	0.304	0.020	-0.001	-0.021
.11	-0.159	-0.000	0.182	0.009	0.000	-0.015
.12	-0.053	-0.000	0.061	0.012	-0.000	0.003
.13	0.000	-0.000	-0.000	0.000	0.000	-0.000

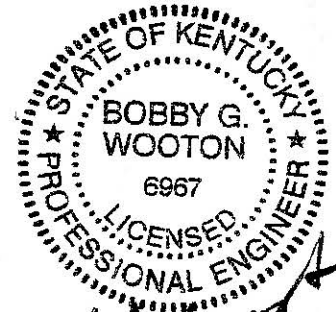
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Load : Dead Weight + Pressure 1 + Thermal 1

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

Point Name	In-Plane SIF	Out-Plane SIF	Section Modulus	Stresses (psi)			Code	Allow.	%
				Hoop	Longitu.	Principal			
.1	1.00	1.00	0.66	89	3913	3916	4409	36500	12
.2	1.00	1.00	0.66	89	8024	8025	9134	36500	25
.2	1.00	1.00	0.66	89	8024	8025	9134	36500	25
.3.Near	1.00	1.00	0.66	89	2258	2264	2589	36500	7
.3.Near	1.95	1.95	0.66	89	4392	4395	4850	36500	13
.3.Far	1.95	1.95	0.66	89	4567	4567	4927	36500	13
.3.Far	1.00	1.00	0.66	89	2357	2357	2616	36500	7
.4	1.00	1.00	0.66	89	3158	3158	4051	36500	11
.4	1.00	1.00	0.66	89	3158	3158	4051	36500	11
.5.Near	1.00	1.00	0.66	89	3616	3616	3802	36500	10
.5.Near	1.95	1.95	0.66	89	7018	7018	7275	36500	19
.5.Far	1.95	1.95	0.66	89	6907	6907	7099	36500	19
.5.Far	1.00	1.00	0.66	89	3553	3553	3697	36500	10
.6	1.00	1.00	0.66	89	5067	5067	6171	36500	16
.6	1.00	1.00	0.66	89	5067	5067	6171	36500	16
.7	1.00	1.00	0.66	89	1615	1615	2285	36500	6
.7	1.00	1.00	0.66	89	1615	1615	2285	36500	6
.8	1.00	1.00	0.66	89	1069	1069	1399	36500	3
.8	1.00	1.00	0.66	89	1069	1069	1399	36500	3
.9	1.00	1.00	0.66	89	998	999	1127	36500	3
.9	1.00	1.00	0.66	89	998	999	1127	36500	3
.10	1.00	1.00	0.66	89	979	980	1043	36500	2
.10	1.00	1.00	0.66	89	979	980	1043	36500	2
.11	1.00	1.00	0.66	89	1053	1054	1099	36500	3
.11	1.00	1.00	0.66	89	1053	1054	1099	36500	3
.12	1.00	1.00	0.66	89	770	771	812	36500	2
.12	1.00	1.00	0.66	89	770	771	812	36500	2
.13	1.00	1.00	0.66	89	19	97	100	36500	0

APPROVED AS  
NOTED



*B.G. Wooton*  
7-10-08

Load : Dead Weight + Pressure 1 + Thermal 1

\*\*\* System Maxima \*\*\*

Maximum X displacement = -1.621 inch at point .4  
Maximum Y displacement = 0.000 inch at point .3.Far  
Maximum Z displacement = 0.791 inch at point .6

Maximum X rotation = 0.058 degree at point .6  
Maximum Y rotation = 0.607 degree at point .3.Near  
Maximum Z rotation = -0.094 degree at point .5.Far

Maximum X force = -188 lb at point .1  
Maximum Y force = 38 lb at point .6  
Maximum Z force = 117 lb at point .1

Maximum X moment = -685 inch-lb at point .4  
Maximum Y moment = 5203 inch-lb at point .2  
Maximum Z moment = -497 inch-lb at point .6

Maximum hoop stress = 89 psi at point .1  
Maximum longitudinal stress = 8024 psi at point .2  
Maximum principal stress = 8025 psi at point .2  
Maximum code stress = 9134 psi at point .2  
Maximum stress ratio (code/allowable) = 0.25 at point .2

**APPROVED AS NOTED**

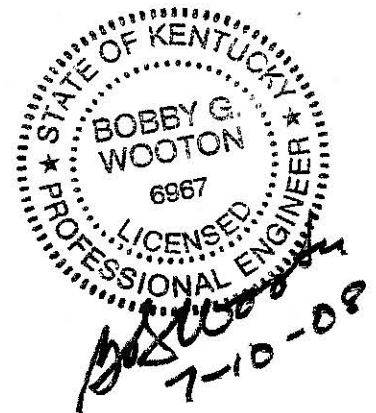
STATE OF KENTUCKY  
BOBBY G. WOOTON  
6967  
LICENSED PROFESSIONAL ENGINEER  
B.G. Wooton  
2-10-08

Load : Dead Weight + Pressure 1

\*\*\* System Deflections \*\*\*

Point Name	Displacements (inch)			Rotations (degree)		
	X	Y	Z	X	Y	Z
.1	0.000	0.000	0.000	0.000	0.000	-0.000
.2	0.000	-0.000	0.000	-0.021	0.000	-0.001
.3.Near	0.000	-0.000	0.000	-0.018	0.000	-0.076
.3.Far	0.000	0.000	0.000	-0.020	0.000	-0.076
.4	0.000	-0.000	0.000	-0.001	0.000	-0.085
.5.Near	0.000	-0.000	0.000	0.024	0.000	-0.094
.5.Far	0.000	-0.000	0.000	0.023	0.000	-0.094
.6	0.000	-0.000	0.000	0.058	0.000	-0.049
.7	0.000	-0.000	0.000	0.039	0.000	-0.050
.8	0.000	-0.000	0.000	0.035	0.000	-0.038
.9	0.000	-0.000	0.000	0.026	0.000	-0.031
.10	0.000	-0.000	0.000	0.020	0.000	-0.021
.11	0.000	-0.000	0.000	0.009	0.000	-0.015
.12	0.000	-0.000	0.000	0.012	0.000	0.003
.13	0.000	-0.000	0.000	0.000	0.000	-0.000

APPROVED AS  
NOTED

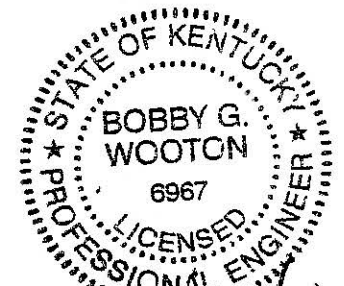

  
 BOBBY G. WOOTON  
 6967  
 LICENSED PROFESSIONAL ENGINEER  
*Bobby G. Wooton*  
 7-10-08

Load : Dead Weight \* Pressure 1

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

Point Name	In-Plane SIF	Out-Plane SIF	Section Modulus	Stresses (psi)		Principal	Code	Allow.	%
				Hoop	Longitu.				
.1	1.00	1.00	0.66	89	454	485	521	14600	3
.2	1.00	1.00	0.66	89	1158	1170	1191	14600	8
.2	1.00	1.00	0.66	89	1158	1170	1191	14600	8
.3.Near	1.00	1.00	0.66	89	228	290	342	14600	2
.3.Near	1.95	1.95	0.66	89	409	444	477	14600	3
.3.Far	1.95	1.95	0.66	89	507	508	406	14600	2
.3.Far	1.00	1.00	0.66	89	278	281	293	14600	2
.4	1.00	1.00	0.66	89	1083	1083	1094	14600	7
.4	1.00	1.00	0.66	89	1083	1083	1094	14600	7
.5.Near	1.00	1.00	0.66	89	194	198	211	14600	1
.5.Near	1.95	1.95	0.66	89	343	345	286	14600	1
.5.Far	1.95	1.95	0.66	89	222	226	204	14600	1
.5.Far	1.00	1.00	0.66	89	132	143	155	14600	1
.6	1.00	1.00	0.66	89	1249	1249	1261	14600	8
.6	1.00	1.00	0.66	89	1249	1249	1261	14600	8
.7	1.00	1.00	0.66	89	960	961	972	14600	6
.7	1.00	1.00	0.66	89	960	961	972	14600	6
.8	1.00	1.00	0.66	89	1036	1036	1048	14600	7
.8	1.00	1.00	0.66	89	1036	1036	1048	14600	7
.9	1.00	1.00	0.66	89	1021	1021	1033	14600	7
.9	1.00	1.00	0.66	89	1021	1021	1033	14600	7
.10	1.00	1.00	0.66	89	1006	1006	1018	14600	6
.10	1.00	1.00	0.66	89	1006	1006	1018	14600	6
.11	1.00	1.00	0.66	89	1080	1081	1092	14600	7
.11	1.00	1.00	0.66	89	1080	1081	1092	14600	7
.12	1.00	1.00	0.66	89	797	798	809	14600	5
.12	1.00	1.00	0.66	89	797	798	809	14600	5
.13	1.00	1.00	0.66	89	46	100	98	14600	0

APPROVED AS  
NOTED

  
*Bobby G. Wooton*  
 7-10-08

Load : Dead Weight + Pressure 1

\*\*\* System Maxima \*\*\*

Maximum X displacement = 0.000 inch at point  
Maximum Y displacement = 0.000 inch at point .3.Far  
Maximum Z displacement = 0.000 inch at point

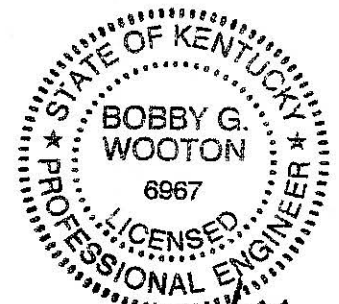
Maximum X rotation = 0.058 degree at point .6  
Maximum Y rotation = 0.000 degree at point  
Maximum Z rotation = -0.094 degree at point .5.Far

Maximum X force = 0 lb at point  
Maximum Y force = 38 lb at point .6  
Maximum Z force = 0 lb at point

Maximum X moment = -685 inch-lb at point .4  
Maximum Y moment = 0 inch-lb at point  
Maximum Z moment = -497 inch-lb at point .6

Maximum hoop stress = 89 psi at point .1  
Maximum longitudinal stress = 1249 psi at point .6  
Maximum principal stress = 1249 psi at point .6  
Maximum code stress = 1261 psi at point .6  
Maximum stress ratio (code/allowable) = 0.09 at point .6

APPROVED AS  
NOTED



B.G. Wooton  
7-10-08



Load : Thermal 1

\*\*\* System Deflections \*\*\*

Point Name	Displacements (inch)			Rotations (degree)		
	X	Y	Z	X	Y	Z
.1	0.000	-0.000	-0.000	0.000	-0.000	0.000
.2	-0.034	0.000	-0.034	0.000	0.107	-0.000
.3.Near	-0.892	0.000	0.597	-0.000	0.607	-0.000
.3.Far	-0.908	0.000	0.602	-0.000	0.584	0.000
.4	-1.621	-0.000	0.459	-0.000	0.173	0.000
.5.Near	-1.484	0.000	0.317	0.000	-0.337	-0.000
.5.Far	-1.475	-0.000	0.318	0.000	-0.371	-0.000
.6	-0.688	-0.000	0.791	-0.000	-0.251	0.000
.7	-0.582	0.000	0.669	0.000	0.067	-0.000
.8	-0.476	0.000	0.547	0.000	-0.018	0.000
.9	-0.370	-0.000	0.426	0.000	0.005	0.000
.10	-0.265	0.000	0.304	0.000	-0.001	-0.000
.11	-0.159	0.000	0.182	-0.000	0.000	0.000
.12	-0.053	-0.000	0.061	0.000	-0.000	-0.000
.13	0.000	0.000	-0.000	-0.000	0.000	0.000

APPROVED AS  
NOTED

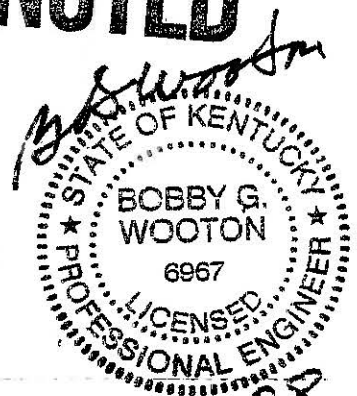
STATE OF KENTUCKY  
 BOBBY G. WOOTON  
 6967  
 LICENSED PROFESSIONAL ENGINEER  
*B.G. Wooton*  
 7-10-08

Load : Thermal 1

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

Point Name	In-Plane SIF	Out-Plane SIF	Section Modulus	Stresses (psi)			Code	Allow.	%
				Hoop	Longitu.	Principal			
.1	1.00	1.00	0.66	0	3927	3927	3888	35979	10
.2	1.00	1.00	0.66	0	7981	7981	7942	35309	22
.2	1.00	1.00	0.66	0	7981	7981	7942	35309	22
.3.Near	1.00	1.00	0.66	0	2286	2286	2247	36158	6
.3.Near	1.95	1.95	0.66	0	4413	4413	4373	36023	12
.3.Far	1.95	1.95	0.66	0	4579	4579	4521	36094	12
.3.Far	1.00	1.00	0.66	0	2381	2381	2323	36207	6
.4	1.00	1.00	0.66	0	3015	3015	2957	35406	8
.4	1.00	1.00	0.66	0	3015	3015	2957	35406	8
.5.Near	1.00	1.00	0.66	0	3649	3649	3591	36289	9
.5.Near	1.95	1.95	0.66	0	7048	7048	6989	36214	19
.5.Far	1.95	1.95	0.66	0	6941	6941	6895	36296	18
.5.Far,	1.00	1.00	0.66	0	3588	3588	3542	36345	9
.6	1.00	1.00	0.66	0	4956	4956	4910	35239	13
.6	1.00	1.00	0.66	0	4956	4956	4910	35239	13
.7	1.00	1.00	0.66	0	1359	1359	1313	35528	3
.7	1.00	1.00	0.66	0	1359	1359	1313	35528	3
.8	1.00	1.00	0.66	0	397	397	351	35452	0
.8	1.00	1.00	0.66	0	397	397	351	35452	0
.9	1.00	1.00	0.66	0	140	140	94	35467	0
.9	1.00	1.00	0.66	0	140	140	94	35467	0
.10	1.00	1.00	0.66	0	71	71	25	35482	0
.10	1.00	1.00	0.66	0	71	71	25	35482	0
.11	1.00	1.00	0.66	0	53	53	7	35408	0
.11	1.00	1.00	0.66	0	53	53	7	35408	0
.12	1.00	1.00	0.66	0	48	48	2	35691	0
.12	1.00	1.00	0.66	0	48	48	2	35691	0
.13	1.00	1.00	0.66	0	47	47	1	36402	0

APPROVED AS  
NOTED



7-10-08

Load : Thermal 1

\*\*\* System Maxima \*\*\*

Maximum X displacement = -1.521 inch at point .4  
Maximum Y displacement = -0.000 inch at point .5.Far  
Maximum Z displacement = 0.791 inch at point .6

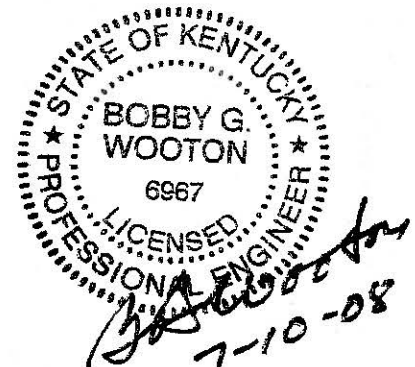
Maximum X rotation = 0.000 degree at point .8  
Maximum Y rotation = 0.607 degree at point .3.Near  
Maximum Z rotation = -0.000 degree at point .5.Near

Maximum X force = -188 lb at point .1  
Maximum Y force = 0 lb at point  
Maximum Z force = 117 lb at point .1

Maximum X moment = 0 inch-lb at point  
Maximum Y moment = 5203 inch-lb at point .2  
Maximum Z moment = 0 inch-lb at point

Maximum hoop stress = 0 psi at point  
Maximum longitudinal stress = 7981 psi at point .2  
Maximum principal stress = 7981 psi at point .2  
Maximum code stress = 7942 psi at point .2  
Maximum stress ratio (code/allowable) = 0.22 at point .2

**APPROVED AS NOTED**



PROJECT : U/K BARKER HALL  
STEAM / CONDENSATE

OWNER : UNIVERSITY OF KENTUCKY  
347 SCOTT STREET  
LEXINGTON, KY 40506

GENERAL CONTRACTOR : LAGCO, INC.  
1490 SUNSHINE LANE  
LEXINGTON, KY 40505  
(859) 293-7473

ARCHITECT :

ENGINEER : UNIVERSITY OF KENTUCKY  
347 SCOTT STREET  
LEXINGTON, KY 40506  
(937) 435-0500

SITE EXCAVATOR: LAGCO, INC.  
1490 SUNSHINE LANE  
LEXINGTON, KY 40505  
(859) 293-7473

MANUFACTURER : VOGT EDWARDS VALVES

SUPPLIER : PLUMBERS SUPPLY

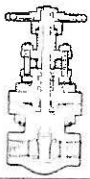

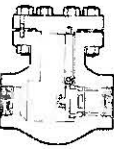
SPECIFICATIONS : \_\_\_\_\_

LAGCO, INC.  
SHOP DRAWINGS

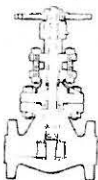

MAY 30 2008

REVIEWED  NOTE MARKING

Threaded/Socket Weld Valves

Description	Pressure/Size Designation	Material		Series Number	
		Body/Bonnet	Trim	Threaded	Socket Weld
 <p><b>Bolted Bonnet</b> Outside screw and yoke Gate Valve</p>	Class 800 Full Port, 1975 psi @ 100°F Sizes 1/2-3 ▲	A105	13% Cr. *	11103	SW 11103
	Class 1500 Full Port, 3705 psi @ 100°F Sizes 1/2-2	A105	13% Cr. *	1033	SW 1033
		A105	13% Cr. *	1043	SW 1043
 <p><b>Bolted Bonnet</b> Outside screw and yoke</p>	Class 800, 1975 psi @ 100°F Sizes 1/2-3	A105	13% Cr.	10103	SW 10103
	Class 1500 Full Port, 3705 psi @ 100°F Sizes 1/2-2	A105	13% Cr.	1023	SW 1023
		A105	13% Cr.	1003	SW 1003
 <p><b>Bolted Bonnet</b> Horizontal-type Swing-type Check Valve</p>	Class 800, 1975 psi @ 100°F Sizes 1/2-2	A105	13% Cr.	4835	SW 4835

Flanged Valves

Description	Pressure/Size Designation	Material		Series Number	
		Body/Bonnet	Trim	Flanged	
 <p><b>Bolted Bonnet</b> Outside screw and yoke Gate Valve</p>	Class 600 Full Port, 1480 psi @ 100°F Sizes 1/2-3 ▲	A105	13% Cr. *	11403 (1/4" Raised Faces)	
	Class 1500 Full Port, 3705 psi @ 100°F Flanged 1/4" Raised Faces and Flanged Ring Joint Faces Sizes 1/2-2	A105	13% Cr. *	11603 (1/4" Raised Faces)	
		A105	13% Cr. *	11683 (Ring Joint Faces)	
 <p><b>Bolted Bonnet</b></p>	Class 600, 1480 psi @ 100°F Flanged 1/4" R.F. Sizes 1/2-3	A105	13% Cr.	10403 (1/4" Raised Faces)	
	Class 1500 Full Port, 3705 psi @ 100°F Flanged 1/4" Raised Faces and Flanged Ring Joint Faces Sizes 1/2-2	A105	13% Cr.	10603 (1/4" Raised Faces)	
		A105	13% Cr.	10683 (Ring Joint Faces)	

Flanged valve flanges conform to ASME Standard B16.5; end-to-end dimensions conform to ASME Standard B16.10.

\* Seats are hard faced.

▲ Full Port except Sizes 2 1/2 & 3.

Vogt heavy-duty valves are available with a wide variety of special trims, packing materials and flange facings. For complete specifications on all Vogt valves refer to the Vogt Catalog.

PROJECT : U/K BARKER HALL  
STEAM / CONDENSATE

OWNER : UNIVERSITY OF KENTUCKY  
347 SCOTT STREET  
LEXINGTON, KY 40506

GENERAL CONTRACTOR : LAGCO, INC.  
1490 SUNSHINE LANE  
LEXINGTON, KY 40505  
(859) 293-7473

ARCHITECT :

ENGINEER : UNIVERSITY OF KENTUCKY  
347 SCOTT STREET  
LEXINGTON, KY 40506  
(937) 435-0500

SITE EXCAVATOR: LAGCO, INC.  
1490 SUNSHINE LANE  
LEXINGTON, KY 40505  
(859) 293-7473

MANUFACTURER : POWELL VALVE

SUPPLIER : PLUMBERS SUPPLY

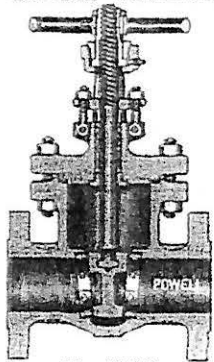
SPECIFICATIONS : \_\_\_\_\_

**LAGCO, INC.**  
SHOP DRAWINGS

MAY 30 2008

REVIEWED  NOTE MARKING

# CAST STEEL GATE VALVES



**Fig. 3003**

Flanged  
Fig. 3003WE - Welding  
Sizes, 2" through 12"

For Sizes, 14" through 42" see page 39

## FEATURES

- \*Flexible Wedge insures pressure tightness and reduces operating torque needed to open the valve. Solid Wedges are furnished in valves-2" and 2 1/2"
- \*Stellite faced Seat Rings are welded into the body. This provides a positive no-leak seal of the ring in the valve body and will resist corrosion, erosion and galling
- \*Bonnet/Yokearm permits easy installation of an actuator, adapto gearing, cylinder or motor
- \*Valves are furnished with a back seat bushing arrangement in the bonnet
- \*Valves, sizes 2" and 2 1/2" have square bonnets and nested gasket

## ORDERING

- \*When ordering Butt Welding End valves, specify schedule of pipe end and give complete data concerning style, figure number and contour of weld end

# CLASS 300 BOLTED FLANGED YOKE-BONNET OUTSIDE SCREW RISING STEM FLANGED and WELDING ENDS

PRESSURE/TEMPERATURE RATINGS  
In accordance with ASME B16.34

## MATERIALS

DESCRIPTION	MATERIAL	ASTM Spec.
Handwheel Nut	Malleable Iron	A-47, Grade 32510
Handwheel	Malleable Iron	A-47, Grade 32510
Handwheel Key	Steel	A-108, Grade 1015/1025
Stem Bushing Locknut (2"-4")	Malleable Iron	A-47, Grade 32510
Bonnet	Carbon Steel	A-216, Grade WCB
Lubricant Fitting	-	Commercial
Stem Bushing	Ductile Ni-Resist	A-439, Type D2
Stem	Stainless Steel	† A-182, Grade F6a
Eyebolt Nuts	Steel	A-563, Grade A or B
Gland Flange	Steel	AISI 1030
Gland	Steel	A-108, Gr. 1015/1025
Groov-Pins	Steel	Commercial
Eyebolts	Steel	A-307, Grade B
Packing	Grafoil	Commercial
Body Nuts	Steel	A-194, Grade 2H
Body Seat Bushing	Stainless Steel	† A-276, Type 410
Body Studs	Steel	A-193, Grade B7
Gasket (Double Jacket)	Soft Iron/Steel *	Commercial
Body	Carbon Steel	A-216, Grade WCB
Seat Ring	Steel/Stellite Facing	A-519, Gr. 1015/1025
Wedge	Stainless Steel or Carbon Steel/13% Chrome Facing	A-217, Grade CA15 A-216, Grade WCB
Cap Screws (6"-12")	Steel	A-449
Bearing Cap (6"-12")	Malleable Iron	A-47, Grade 32510
Yokearm (10"-12")	Carbon Steel	A-216, Grade WCB
Yokearm Nuts (10"-12")	Steel	A-194, Grade 2H
Yokearm Studs (10"-12")	Steel	A-193, Grade B7
Packing Washer	Steel	A-108, Gr. 1015/1025
Packing Spacer	Steel	A-108, Gr. 1015/1025

† Or Equal

\* Non-Asbestos Insert

## SPECIFICATIONS

\*Flanged and Butt Welding End valves conform to ASME B16.5 B16.10, B16.25, B16.34 and API 600

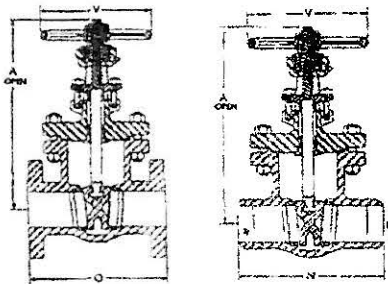
\*Flanged End valves can be furnished with ring joint flanges

## DIMENSIONS (Inches)

Sizes	2	2 1/2	3	4	6	8	10	12
O	8 1/2	9 1/2	11 1/8	12	15 7/8	16 1/2	18	19 3/4
I	8 1/2	9 1/2	11 1/8	12	15 7/8	16 1/2	18	19 3/4
A	15 1/2	16 3/4	19 1/4	23 7/8	33 1/8	41 1/4	50 1/4	57 5/8
V	8	8	9	10	14	16	20	20
D	2.067	2.469	3.068	4.026	6.065	7.981	10.02	12.00

## WEIGHTS (Pounds)

Fig. 3003	57	85	110	165	320	500	800	1200
Fig. 3003WE	45	70	80	120	250	410	690	940



PROJECT :

**U/K BARKER HALL**

OWNER :

UNIVERSITY OF KENTUCKY  
LEXINGTON, KY

GENERAL CONTRACTOR :

LAGCO, INC.  
1490 SUNSHINE LANE  
LEXINGTON, KY 40505  
(859) 293-7473

ARCHITECT :

ENGINEER :

UNIVERSITY OF KENTUCKY  
215 M PETERSON SERVICE BUILDING  
LEXINGTON, KY 40506  
(859) 257-4885

SITE EXCAVATOR:

LAGCO, INC.  
1490 SUNSHINE LANE  
LEXINGTON, KY 40505  
(859) 293-7473

MANUFACTURER :

**TRERICE**

SUPPLIER :

**PLUMBERS SUPPLY**

SPECIFICATIONS :

\_\_\_\_\_

**LAGCO, INC.**  
**SHOP DRAWINGS**

**MAY 30 2008**

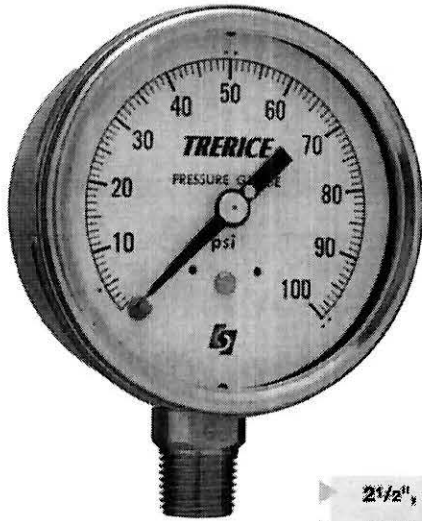
REVIEWED  NOTE MARKING



# 700 Series

## Field Liquid Fillable • Stainless Steel Case

INDUSTRIAL GAUGES



700B shown

- ▶ 2 1/2", 4", 6" Dial Sizes
- ▶ ±1.0% Accuracy
- ▶ Stainless Steel Case
- ▶ Field Liquid Fillable

The Trerice 700 Series Industrial Gauge is designed for the varying needs of the world's industrial applications. This gauge has a stainless steel case and ring. Its sturdy interior design and field liquid-fill capability (no kit required) provide the durability and accuracy required for industrial process environments. Available wetted parts are bronze tube with brass socket, stainless steel tube and socket, or Monel tube and socket.

- Optional features and case style variations available: Please consult the Options & Accessories Section for details.
- For correct use and application of all pressure gauges, please refer to: Pressure Gauge Standard ASME B40.100.

### Specifications

Models	Wetted Parts
700B (dry) 700LFB (liquid-filled)	Bronze tube, brass socket
700SS (dry) 700LFSS (liquid-filled)	316 stainless steel tube and socket
700M (dry) 700LFM (liquid-filled)	Monel tube and socket (meets NACE MR 01.75)

Dial Sizes 2 1/2", 4", 6"

Fill Glycerine. Other fills available. See Options & Accessories.

Movement Stainless steel

Connection 2 1/2" Dial Size: Lower male or center back male, 1/4 NPT  
4", 6" Dial Size: Lower male or lower back male, 1/4 or 1/2 NPT

Case 304 stainless steel, satin finished, stem-mounted flangeless

Ring Bayonet type, 304 stainless steel

Window Laminated safety glass

Pointer 2 1/2" Dial Size: Adjustable, black finished  
4", 6", Dial Size: Micro adjustable, knife edge, black finished

Dial Face Aluminum, white background with black graduations and markings

Accuracy ±1.0% Full Scale, ASME B40.100 Grade 1A

Maximum Temperature  
700SS, 700M: 250°F (121°C)  
700B, 700LFB, 700LFSS, 700LFM: 150°F (65°C)

#### Approximate Shipping Weight

700B, 700SS 2 1/2" Dial Size: 0.4 lbs [0.18 kg]

700LFB, 700LFSS, 700LFM 2 1/2" Dial Size: 0.5 lbs [0.23 kg]

700B, 700SS, 700M 4" Dial Size: 1.3 lbs [0.59 kg]

700LFB, 700LFSS, 700LFM 4" Dial Size: 2.1 lbs [0.95 kg]

700B, 700SS, 700M 6" Dial Size: 2.0 lbs [0.91 kg]

700LFB, 700LFSS, 700LFM 6" Dial Size: 3.8 lbs [1.72 kg]

### HOW TO ORDER

Sample Order Number: 700LFSS 25 02 B A 140

Model	Dial Size	Connection Size	Connection Location	Units of Measure	Range Code
700B	25 2 1/2"	02 1/4 NPT	L Lower	A psi	See Standard Ranges
700LFB	40 4"	04 1/2 NPT	B Back	D psi/kPa	
700SS	60 6"				
700LFSS					
700M					
700LFM					

\* Not available with Monel wetted parts or with 1/2 NPT connection.

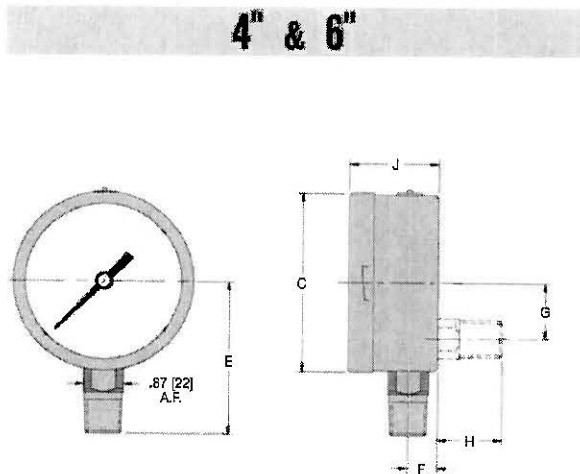
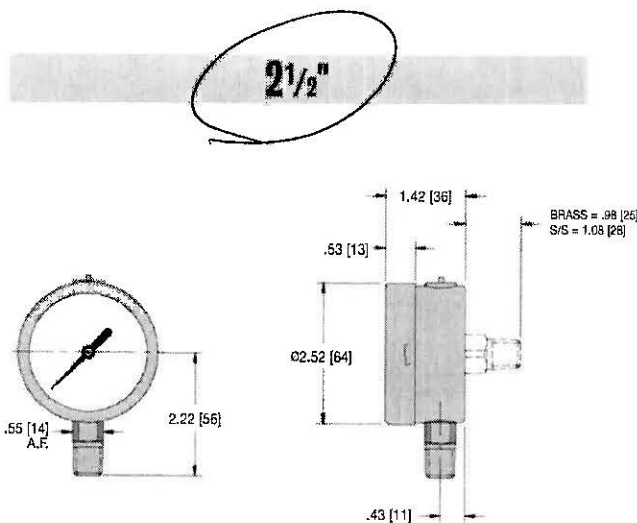
# 700 Series

## Field Liquid Fillable • Stainless Steel Case

All dimensions are nominal. Dimensions in [ ] are in millimeters.

INDUSTRIAL GAUGES

Dial Size	Material	C	E	F	G	H	J
4"	Brass	3.98 [101]	3.39 [86]	0.94 [24]	1.04 [27]	1.44 [37]	2.24 [57]
	SS	3.98 [101]	3.39 [86]	0.94 [24]	1.36 [35]	1.38 [35]	2.24 [57]
6"	Brass	6.34 [161]	4.57 [116]	0.69 [18]	1.04 [27]	1.44 [37]	1.97 [50]
	SS	6.34 [161]	4.57 [116]	0.69 [18]	1.36 [35]	1.38 [35]	1.97 [50]



### Standard Ranges

psi Ranges (A)			
All Sizes			
Range Code	Specific Range (psi)	Figure Intervals	Minor Divisions
010	30" Hg to 0	5	0.5
020	30" Hg to 15 psi	10/5	0.5/0.5
030	30" Hg to 30 psi	10/5	1/1
040	30" Hg to 60 psi	10/10	2/1
050	30" Hg to 100 psi	30/20	2/2
060	30" Hg to 150 psi	30/20	5/2
070	30" Hg to 300 psi	30/50	5/5
080	0 to 15 psi	3	0.2
090	0 to 30 psi	5	0.5
100	0 to 60 psi	10	1
110	0 to 100 psi	10	2
120	0 to 160 psi	20	2
130	0 to 200 psi	20	2
140	0 to 300 psi	50	5
150	0 to 400 psi	50	5
160	0 to 600 psi	100	10
Ranges over 600 psi are not available in 700B or 700LFB in 4" or 6" Dial Sizes.			
180	0 to 1000 psi	100	20
190	0 to 1500 psi	300	20
200	0 to 2000 psi	200	20
210	0 to 3000 psi	500	50
220	0 to 5000 psi	1000	100
230	0 to 10,000 psi	2000	200
Ranges over 10,000 psi are ONLY available in 700SS or 700LFSS in 4" or 6" Dial Sizes.			
240	0 to 10,000 psi	2000	200
250	0 to 20,000 psi	2000	200

For dual scale ranges, specify the appropriate Units of Measure: D (psi/kPa) followed by the corresponding A (psi) Range Code. Other pressure ranges are also available including: Altitude, Ammonia, Refrigerant and Receiver. Consult Special Application Ranges section or factory for availability.

PROJECT : U/K BARKER HALL  
STEAM / CONDENSATE

OWNER : UNIVERSITY OF KENTUCKY  
347 SCOTT STREET  
LEXINGTON, KY 40506

GENERAL CONTRACTOR : LAGCO, INC.  
1490 SUNSHINE LANE  
LEXINGTON, KY 40505  
(859) 293-7473

ARCHITECT :

ENGINEER : UNIVERSITY OF KENTUCKY  
347 SCOTT STREET  
LEXINGTON, KY 40506  
(937) 435-0500

SITE EXCAVATOR: LAGCO, INC.  
1490 SUNSHINE LANE  
LEXINGTON, KY 40505  
(859) 293-7473

MANUFACTURER : SAWHILL TUBULAR

SUPPLIER : PLUMBERS SUPPLY

SPECIFICATIONS :

LAGCO, INC.  
SHOP DRAWINGS

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# Steel Pipe Specifications

Designation	Tensile Requirements		
		Yield Point Min, PSI	Tensile Strength Min, PSI
<b>ASTM A53</b> Continuous Welded (Type F) Electric Resistance Welded (Type E) Seamless (Type S)	Type F	30 000	48 000
	Type E or Type S		
	Grade A Grade B	30 000 35 000	48 000 60 000
<b>ASTM A 106</b> Seamless	Grade A Grade B Grade C	30 000 35 000 40 000	48 000 60 000 70 000
<b>API 5L</b> Continuous Welded Electric Resistance Welded Seamless	CW, ERW or SMLS Grade A25	25 000	45 000
	ERW or SMLS		
	Grade A Grade B	30 000 35 000	48 000 60 000
<b>ASTM A 589</b> Type I Drive Pipe Type II Water Well R&D Pipe Type III Driven Well Pipe Type IV Water Well Casing Pipe Continuous Welded (Types II, III, and IV) Electric Resistance Welded and Seamless (Types I, II, III and IV)	CW	25 000	45 000
	ERW or SMLS		
	Grade A Grade B	30 000 35 000	48 000 60 000

# SAWHILL TUBULAR DIVISION

## Steel Pipe Sizes

Sawhill manufactures standard steel pipe 1/2" through 8" black or galvanized, plain-end, grooved for victaulic, or threaded and coupled. Some sizes are available in electric welded or seamless. Not all sizes shown below are made by or available from Sawhill.

### PIPE SCHEDULES - Including ANSI B36.10

Pipe Size	O.D. (inches)	5	10	20	30	40	Standard	60	80	Extra Strong
1/8	.405	.035 .14	.049 .19			.068 .24	.068 .24		.095 .31	.095 .31
1/4	.540	.049 .26	.065 .33			.088 .42	.088 .42		.119 .54	.119 .54
3/8	.675	.049 .33	.065 .42			.091 .57	.091 .57		.126 .74	.126 .74
1/2	.840	.065 .54	.083 .67			.109 .85	.109 .85		.147 1.09	.147 1.09
3/4	1.050	.065 .69	.083 .86			.113 1.13	.113 1.13		.154 1.47	.154 1.47
1	1.315	.065 .87	.109 1.40			.133 1.58	.133 1.58		.179 2.17	.179 2.17
1-1/4	1.660	.065 1.11	.109 1.81			.140 2.27	.140 2.27		.191 3.00	.191 3.00
1-1/2	1.900	.065 1.28	.109 2.09			.145 2.72	.145 2.72		.200 3.63	.200 3.63
2	2.375	.065 1.61	.109 2.64			.154 3.65	.154 3.65		.218 5.02	.218 5.02
2-1/2	2.875	.083 2.48	.120 3.53			.203 5.79	.203 5.79		.276 7.66	.276 7.66
3	3.500	.083 3.03	.120 4.33			.216 7.58	.216 7.58		.300 10.25	.300 10.25
3-1/2	4.000	.083 3.48	.120 4.97			.226 9.11	.226 9.11		.318 12.50	.318 12.50
4	4.500	.083 3.92	.120 5.61			.237 10.79	.237 10.79		.337 14.98	.337 14.98
4-1/2	5.000						.247 12.53			.355 17.61
5	5.563	.109 3.36	.134 7.77			.258 14.32	.258 14.62		.375 20.78	.375 20.78
6	6.625	.109 7.60	.134 9.29			.280 18.37	.280 18.97		.432 28.57	.432 28.57
7	7.625						.301 23.57			.500 38.05
8	8.625	.109 9.93	.143 13.40	.250 22.36	.277 24.70	.322 28.55	.322 28.55	.406 35.66	.500 43.39	.500 43.39
9	9.625						.342 33.90			.500 48.72
10	10.750	.134 15.19	.165 18.35	.250 28.04	.307 34.24	.365 40.48	.365 40.48	.500 54.74	.594 64.43	.500 54.74
12	12.750	.156 20.98	.180 24.17	.250 33.38	.330 43.77	.406 53.52	.375 49.56	.562 73.15	.688 98.63	.500 66.42
14	14.000	.156 23.07	.250 36.71	.312 45.81	.375 54.57	.438 63.44	.375 54.57	.594 85.35	.750 106.13	.500 72.09
16	16.000	.165 27.90	.250 42.05	.312 52.27	.375 62.58	.500 82.77	.375 62.58	.656 107.50	.844 126.61	.500 32.77

Bold Figures - Wall Thickness in Inches

Colored Figures - Weight Per Foot in Pounds (Plain End)

**\*A Guideline for Maximum Allowable Working Pressures (PSI)  
Based on ASME B31.1 Power Piping Code**

Nominal Pipe Size	Continuous Weld Pipe API 5L Grade A53 ASTM A53 - Type F		ERW Pipe API 5L/ASTM A53 Plain-End		Seamless Pipe API 5L/ASTM A53, A105 Plain-End	
	Plain-End	Threaded	Grade A	Grade B	Grade A	Grade B
<b>STANDARD WEIGHT</b>						
1/4"	2160	860	3280	4120	3860	4630
3/8"	1750	750	2670	3350	3140	3930
1/2"	1670	630	2540	3180	2980	3730
3/4"	1370	550	2080	2610	2450	3060
1"	1270	480	1940	2430	2280	2850
1-1/4"	1050	430	1590	2000	1870	2340
1-1/2"	950	410	1440	1810	1690	2120
2"	800	380	1210	1520	1430	1790
2-1/2"	870	370	1330	1670	1560	1950
3"	760	350	1150	1440	1350	1690
3-1/2"	690	330	1050	1320	1240	1550
4"	640	320	970	1220	1150	1430
5"	-	-	860	1070	1010	1260
6"	-	-	780	980	910	1140
8"	-	-	680	860	810	1010

**EXTRA STRONG**

1/4"	3040	1620	4620	5800	5440	6800
3/8"	2510	1420	3820	4800	4500	5620
1/2"	2350	1230	3570	4480	4200	5250
3/4"	1920	1060	2920	3670	3440	4300
1"	1770	940	2690	3380	3170	3960
1-1/4"	1470	820	2230	2800	2630	3280
1-1/2"	1330	780	2030	2540	2390	2980
2"	1150	710	1750	2200	2060	2580
2-1/2"	1210	690	1840	2310	2170	2710
3"	1070	640	1620	2040	1910	2390
3-1/2"	990	620	1500	1880	1770	2210
4"	930	600	1410	1770	1660	2070
5"	-	-	1250	1580	1480	1860
6"	-	-	1220	1530	1430	1790
8"	-	-	1070	1350	1270	1590

Often, a higher safety factor than the 4 to 1 used in the attached table is required by local codes, specific applications, or accepted industry practice. To determine the maximum safe working pressures at optional safety factors, multiply the values found in the table by the following:

Safety Factor	Multiplier
5	.80
6	.67
7	.57
8	.50
9	.44
10	.40

This safety factor would be appropriate for most applications →

**\*Notes:**

- 1) The pressures listed are based on the Boardman Formula and incorporates:
  - a) The minimum specified tensile strength.
  - b) The minimum wall thickness.
  - c) A joint efficiency factor of 0.50 for CW pipe and 0.85 for ERW pipe.
- 2) No provisions made for abnormal or unusual conditions.
- 3) No allowance made for coupling design or limitations.
- 4) No allowance made for thinning of walls due to bending or corrosion.
- 5) Good for temperatures from (-20) degrees to 400 degrees Fahrenheit.
- 6) The pipe manufacturing method may limit its use for certain applications.

PROJECT : U/K BARKER HALL  
STEAM / CONDENSATE

OWNER : UNIVERSITY OF KENTUCKY  
347 SCOTT STREET  
LEXINGTON, KY 40506

GENERAL CONTRACTOR : LAGCO, INC.  
1490 SUNSHINE LANE  
LEXINGTON, KY 40505  
(859) 293-7473

ARCHITECT :

ENGINEER : UNIVERSITY OF KENTUCKY  
347 SCOTT STREET  
LEXINGTON, KY 40506  
(937) 435-0500

SITE EXCAVATOR: LAGCO, INC.  
1490 SUNSHINE LANE  
LEXINGTON, KY 40505  
(859) 293-7473

MANUFACTURER : ANVIL INTERNATIONAL

SUPPLIER : PLUMBERS SUPPLY

SPECIFICATIONS :

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LAGCO, INC.  
SHOP DRAWINGS

MAY 30 2008

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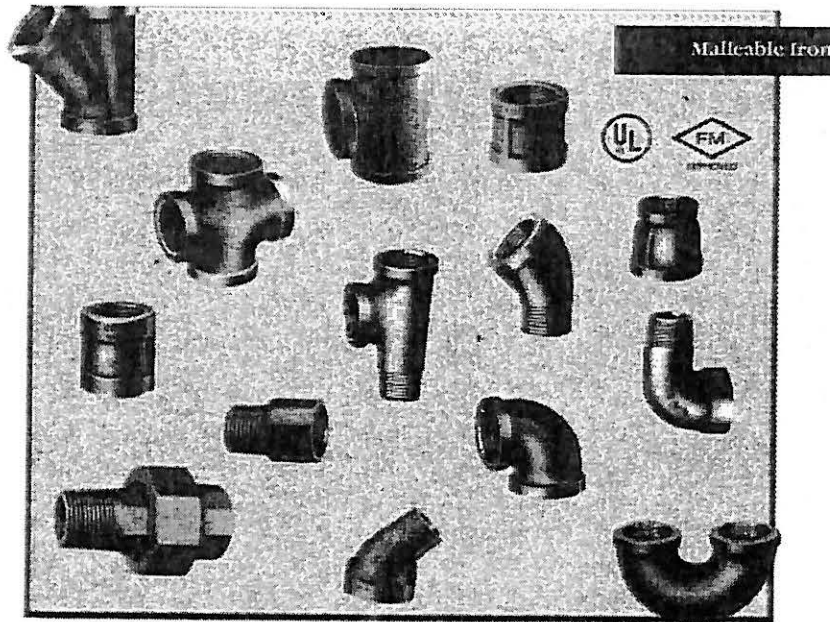
Welcome

Pipe Fittings:

•Oil Country •Cast Iron •Malleable Iron •Steel •Forged Steel •Miscellaneous •General Info.

Pressure - Temperature Ratings

(zoom in)



Temperature (°F) (°C)	Pressure					
	Class 150		Class 250		Class 300	
	psi	bar	psi	bar	psi	bar
20° to 150° -28.9° to 65.6°	300	20.7	500	34.5	600	41.4
200°	33.3	2.3	455	31.4	550	37.9
250°	121.1	8.3	495	34.8	505	34.8
300°	148.9	10.5	360	24.8	460	31.7
350°	176.7	12.5	345	24.1	445	30.8
400°	204.4	14.5	270	18.8	370	25.5
450°	232.2	16.3	225	15.5	325	22.4
500°	260.0	18.0	180	12.4	280	19.3
550°	287.8	20.0	130	9.0	230	15.9

Note: Unions with Copper or Copper Alloy seats are not intended for use where temperature exceeds 450°F

Temperature (°F) (°C)	Class	Pressure							
		Class 150		Class 300					
		Size 1/2" - 1" (6 - 25 mm)		Size 1 1/2" - 2" (32 - 51 mm)		Size 2 1/2" - 3" (64 - 76 mm)			
psi	bar	psi	bar	psi	bar	psi	bar		
-20° to 150° -28.9° to 65.6°	300	20.7	2,000	137.9	1,300	103.4	1,000	68.9	
200°	93.3	6.6	1,785	126.1	1,350	93.1	910	62.8	
250°	121.1	8.6	1,575	108.6	1,200	82.7	825	58.3	
300°	148.9	10.6	1,350	93.8	1,050	72.4	725	50.7	
350°	176.7	12.6	1,150	79.3	900	62.1	650	44.1	
400°	204.4	14.6	935	64.5	750	51.7	660	38.6	
450°	232.2	16.6	725	50.0	600	41.4	475	32.1	
500°	260.0	18.6	540	38.2	450	31.0	385	26.6	
550°	287.8	20.6	390	27.2	390	27.2	390	26.6	

Anvil Class 150 (standard weight) Malleable Iron Fittings conform to ASME B16.3 and Unions conform to ASME B16.39.  
Anvil standard weight flanged pattern fittings in this catalog, sizes 1/2 NPS to 6 NPS (6 to 150 DN) inclusive, are included in the List

of Inspected Fire Protection Equipment and Materials' issued by the Underwriters' Laboratories, Inc.  
ALL ELBOWS & TEES 1/2" (10 DN) and LARGER ARE 100% GAS TESTED A MINIMUM OF 100 PSI (6.9 bar)



PROJECT :

**U/K BARKER HALL  
STEAM / CONDENSATE**

OWNER :

UNIVERSITY OF KENTUCKY  
347 SCOTT STREET  
LEXINGTON, KY 40506

GENERAL CONTRACTOR :

LAGCO, INC.  
1490 SUNSHINE LANE  
LEXINGTON, KY 40505  
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ARCHITECT :

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347 SCOTT STREET  
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(937) 435-0500

SITE EXCAVATOR:

LAGCO, INC.  
1490 SUNSHINE LANE  
LEXINGTON, KY 40505  
(859) 293-7473

MANUFACTURER :

WELDBEND

SUPPLIER :

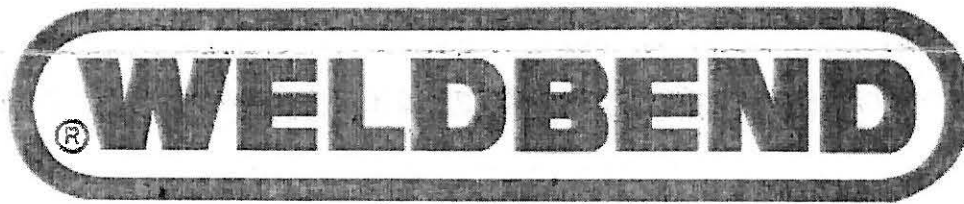
PLUMBERS SUPPLY

SPECIFICATIONS :

**LAGCO, INC.**  
**SHOP DRAWINGS**

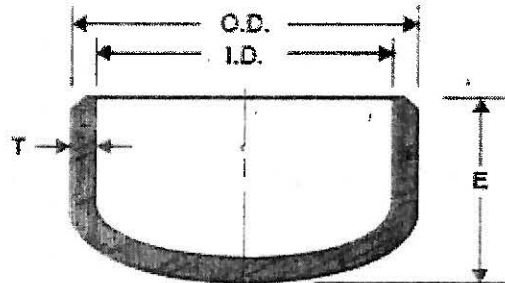
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YOU ARE HERE: Home > Weldbend Catalog > Fittings > Caps

**Caps**  
**EXTRA STRONG**  
 Inches / Pounds



For Metric Units >Click Here

Nominal Pipe Size	Outside Diameter	Inside Diameter	Wall Thickness (T)	Length (E)	Pipe Schedule	Weight in Pounds
1/2	.840	.546	.147	1.00	80	0.1
3/4	1.050	.742	.154	1.25	80	0.16
1	1.315	.957	.179	1.50	80	0.28
1 1/4	1.660	1.273	.191	1.50	80	0.48
1 1/2	1.900	1.500	.200	1.50	80	0.67
2	2.375	1.939	.218	1.50	80	0.92
2 1/2	2.875	2.323	.276	1.50	80	1.3
3	3.500	2.900	.300	2.00	80	2.1
3 1/2	4.000	3.364	.318	2.50	80	3
4	4.500	3.826	.337	2.50	80	3.5
5	5.563	4.313	.375	3.00	80	5.3
6	6.625	5.761	.432	3.50	80	9.3
8	8.625	7.625	.500	4.00	80	16
10	10.750	9.750	.500	5.00	60	26
12	12.750	11.750	.500	6.00	*	38
14	14.000	13.000	.500	6.50	*	47
16	16.000	15.000	.500	7.00	40	57
18	18.000	17.000	.500	8.00	*	78
20	20.000	19.000	.500	9.00	30	100
24	24.000	23.000	.500	10.50	*	145
30	30.000	29.000	.500	10.50	20	634
36	36.000	35.000	.500	10.50	20	913
42	42.000	41.000	.500	12.00	*	1,300
48	48.000	47.000	.500	13.50	*	1,675

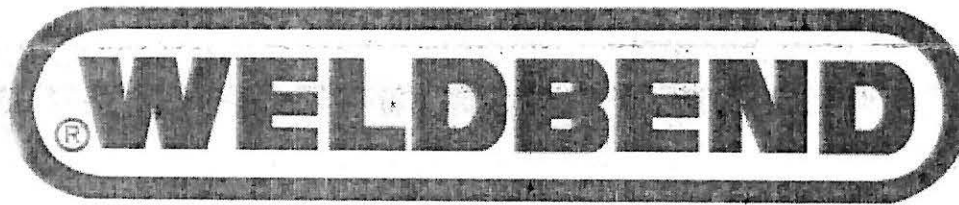
< Standard

\* This size and thickness does not correspond to any pipe schedule

1. Dimensions conform to ASME B13.9 & material conforms to ASTM A-234 Grade B
2. For bevel detail see page 50.
3. For dimensional tolerances see page 51.

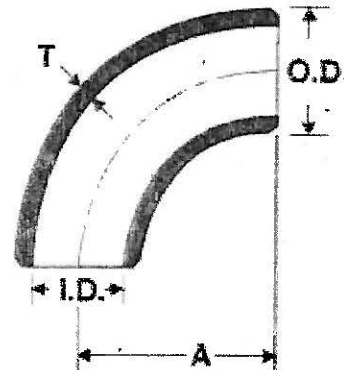
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**Long Radius 90° Elbows**  
EXTRA STRONG  
Inches / Pounds



For Metric Units >Click Here

Nominal Pipe Size	Outside Diameter	Inside Diameter	Wall Thickness (T)	Center To End (A)	Pipe Schedule	Weight in Pounds
1/2	0.84	.546	.147	1.50	80	0.26
3/4	1.05	.742	.154	1.50	80	0.29
1	1.32	.957	.179	1.50	80	0.48
1 1/4	1.66	1.27	.191	1.88	80	0.79
1 1/2	1.90	1.50	.200	2.25	80	1.2
2	2.37	1.93	.218	3.00	80	2.1
2 1/2	2.88	2.32	.276	3.75	80	3.8
3	3.50	2.90	.300	4.50	80	6.3
3 1/2	4.00	3.36	.318	5.25	80	8.6
4	4.50	3.82	.337	6.00	80	12.5
5	5.56	4.81	.375	7.50	80	21.2
6	6.63	5.76	.432	9.00	80	34.4
8	7.83	7.63	.500	12.00	80	71.3
10	10.75	9.75	.500	15.00	60	111
12	12.75	11.75	.500	18.00	*	158
14	14.00	13.00	.500	21.00	*	201
16	16.00	15.00	.500	24.00	40	270
18	18.00	17.00	.500	27.00	*	348
20	20.00	19.00	.500	30.00	30	422
24	24.00	23.00	.500	36.00	*	604
30	30.00	29.00	.500	45.00	20	997
36	36.00	35.00	.500	54.00	20	1,380
42	42.00	41.00	.500	63.00	*	1,380
48	48.00	47.00	.500	72.00	*	2,502

< Standard

\* This Size and thickness does not correspond to any pipe schedule number.

1. Dimensions conform to ASME B16.9 & material conforms to ASTM A-204 Grade B
2. For bevel detail see page 50.
3. For dimensional tolerances see page 51.

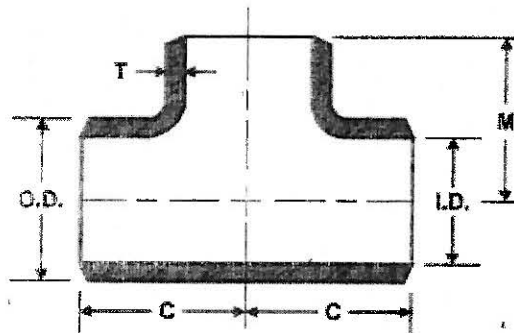
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**Straight Tees**  
EXTRA STRONG  
Inches / Pounds



For Metric Units >Click Here

Nominal Pipe Size	Outside Diameter	Inside Diameter	Wall Thickness (T)	Center To End (C)	Center To End (M)	Pipe Schedule	Weight In Pounds
1/2	.340	.546	.147	1.00	1.00	80	.37
3/4	1.050	.742	.154	1.12	1.12	80	.58
1	1.315	.957	.179	1.50	1.50	80	.87
1 1/4	1.660	1.278	.191	1.88	1.88	80	1.6
1 1/2	1.900	1.500	.200	2.25	2.25	80	2.3
2	2.375	1.939	.218	2.50	2.50	80	3.9
2 1/2	2.875	2.323	.276	3.00	3.00	80	6.5
3	3.500	2.900	.300	3.38	3.38	90	9
3 1/2	4.000	3.364	.318	3.75	3.75	80	12.2
4	4.500	3.826	.337	4.12	4.12	80	16.2
5	5.563	4.813	.375	4.88	4.88	80	26.6
6	6.625	5.761	.432	5.62	5.62	80	41.8
8	8.625	7.625	.500	7.00	7.00	80	76.2
10	10.75	9.750	.500	8.50	8.50	60	115
12	12.75	11.75	.500	10.00	10.00	*	169
14	14.00	13.00	.500	11.00	11.00	*	237
16	16.00	15.00	.500	12.00	12.00	40	284
18	18.00	17.00	.500	13.50	13.50	*	353
20	20.00	19.00	.500	15.00	15.00	30	442
24	24.00	23.00	.500	17.00	17.00	*	625
30	30.00	29.00	.500	22.00	22.00	*	1,065
36	36.00	35.00	.500	26.50	26.50	*	1,610
42	42.00	41.00	.500	30.00	29.00	*	1,788
48	48.00	47.00	.500	35.00	33.00	*	2,300

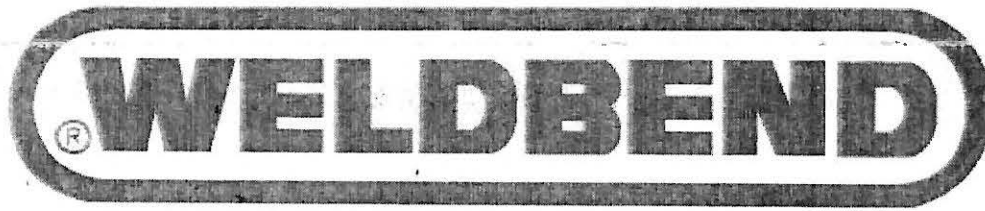
< Standard

\* This Size and thickness does not correspond to any pipe schedule number.

1. Dimensions conform to ASME B16.9 & material conforms to ASTM A-234 Grade B
2. For bevel detail see page 50.
3. For dimensional tolerances see page 51.

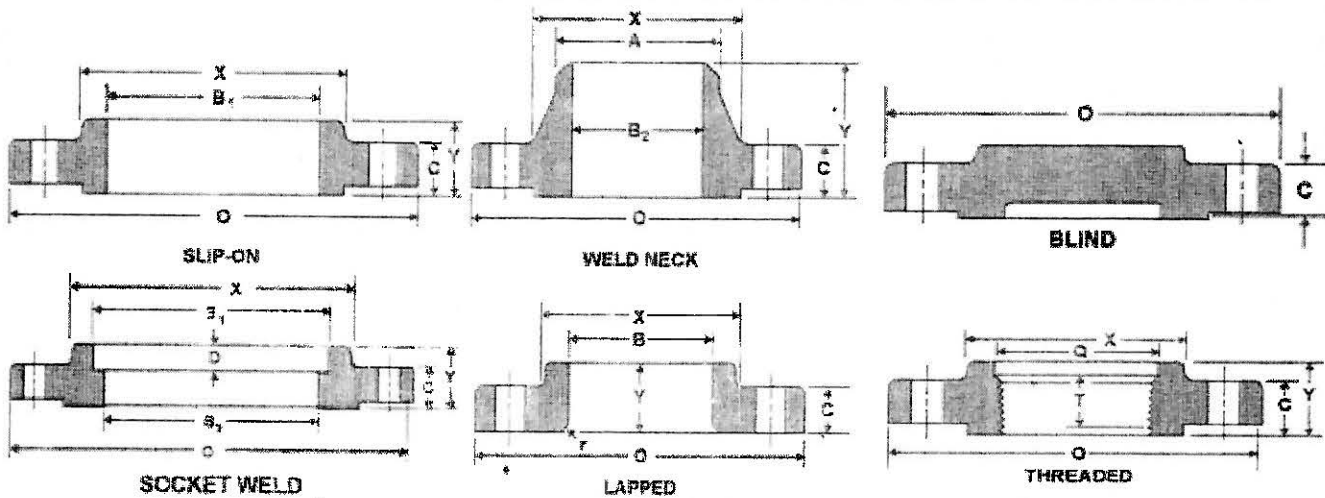
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YOU ARE HERE: Home > Weldbend Catalog > Flanges > Class 300 Dimensional Specifications

## Class 300 Steel Pipe Flanges DIMENSIONAL SPECIFICATIONS



Pipe Size	O	C	X	A	Y	Y	Y	T	B1	B	B2	r	Q
	Outside Diameter of Flange	Thickness of Flange, Minimum	Diameter of Hub	Diameter of Weld Neck	Threaded Slip-On	Lap-Joint	Weld Neck	Thread Length Threaded Flange, Minimum	Slip-On, Minimum	Lap-Joint, Minimum	Weld Neck / Socket Weld	Lap-Joint Flange Radius	Counter-bore Threaded Flange, Minimum
1/2	3.75	0.56	1.50	0.34	0.88	0.88	2.06	0.62	0.88	0.90	0.62	0.12	0.91
3/4	4.62	0.62	1.88	1.05	1.00	1.00	2.25	0.62	1.09	1.11	0.82	0.12	1.14
1	4.88	0.69	2.12	1.32	1.06	1.06	2.44	0.69	1.36	1.38	1.05	0.12	1.41
1 1/4	5.25	0.75	2.50	1.66	1.06	1.06	2.56	0.81	1.70	1.72	1.38	0.19	1.75
1 1/2	6.12	0.81	2.75	1.90	1.19	1.19	2.69	0.88	1.95	1.97	1.61	0.25	1.99
2	6.50	0.88	3.31	2.38	1.31	1.31	2.75	1.12	2.44	2.46	2.07	0.31	2.50
2 1/2	7.50	1.00	3.94	2.88	1.50	1.50	3.00	1.25	2.94	2.97	2.47	0.31	3.00
3	8.25	1.12	4.62	3.50	1.69	1.69	3.12	1.25	3.57	3.60	3.07	0.38	3.63
3 1/2	9.00	1.19	5.25	4.00	1.75	1.75	3.19	1.44	4.07	4.10	3.55	0.38	4.13
4	10.00	1.25	5.75	4.50	1.88	1.88	3.38	1.44	4.57	4.60	4.03	0.44	4.63
5	11.00	1.38	7.00	5.56	2.00	2.00	3.38	1.69	5.66	5.69	5.06	0.44	5.69
6	12.50	1.44	8.12	6.33	2.06	2.06	3.88	1.81	6.72	6.75	6.07	0.50	6.75
8	15.00	1.62	10.25	8.33	2.44	2.44	4.38	2.00	8.72	8.75	7.98	0.50	8.75
10	17.50	1.88	12.32	10.75	2.88	3.75	4.62	2.19	10.88	10.92	10.02	0.50	10.88
12	20.50	2.00	14.75	12.75	2.88	4.00	5.12	2.38	12.88	12.92	12.00	0.50	12.94
14	23.00	2.12	16.75	14.00	3.00	4.33	5.32	2.50	14.14	14.18	13.25	0.50	14.19
16	25.50	2.25	19.00	16.00	3.25	4.75	5.75	2.69	16.16	16.19	15.25	0.50	16.19
18	28.00	2.38	21.00	18.00	3.50	5.12	6.25	2.75	18.18	18.20	17.25	0.50	18.19
20	30.50	2.50	23.12	20.00	3.75	5.50	6.38	2.83	20.20	20.25	19.25	0.50	20.19
24	36.00	2.75	27.32	24.00	4.19	6.00	6.62	3.25	24.25	24.25	23.25	0.50	24.19

Class 300 Series A The flanges below from 30" - 48" conform to ASTM B16.47

Minimum

Nominal Pipe Size	Outside Diameter of Flange	Minimum Thickness Of Flange		Length Through Hub	Diameter of Hub	Hub Diameter Top	Raised Face Diameter	Fillet Radius r1
		Weld Neck	Blind					
30	43.00	3.62	3.75	8.25	32.56	30.00	33.75	0.44
36	50.00	4.12	4.38	9.50	39.00	36.00	40.25	0.50
42	50.75	4.69	4.69	7.88	43.25	42.00	44.75	0.50
48	57.75	5.25	5.25	8.81	49.38	48.00	51.25	0.50

**Class 300 Bolt Patterns & Bolt Lengths >**

\* Should flanges be required with flat face, shipments may be either the full thickness, or a thickness with raised face removed. (Removal of the raised face produces a non-standard length through the hub.)

\*\* A taper shall not exceed 7 degrees on threaded, slip-on, and lap-joint flanges.

**WELDBEND NOTES:**

1. All dimensions are in inches.
2. Calculated flange weights on page 47.
3. Dimensional tolerances on page 70.
4. Standard flange facings on pages 72 & 73.
5. Welding end bevel information on pages 74 & 75.
6. Thread standards on page 76 & 77.
7. Blind flanges may be produced with or without hubs.

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PROJECT :

U/K BARKER HALL  
STEAM / CONDENSATE

OWNER :

UNIVERSITY OF KENTUCKY  
347 SCOTT STREET  
LEXINGTON, KY 40506

GENERAL CONTRACTOR :

LAGCO, INC.  
1490 SUNSHINE LANE  
LEXINGTON, KY 40505  
(859) 293-7473

ARCHITECT :

ENGINEER :

UNIVERSITY OF KENTUCKY  
347 SCOTT STREET  
LEXINGTON, KY 40506  
(937) 435-0500

SITE EXCAVATOR :

LAGCO, INC.  
1490 SUNSHINE LANE  
LEXINGTON, KY 40505  
(859) 293-7473

MANUFACTURER :

KUNKLE

SUPPLIER :

PLUMBERS SUPPLY

SPECIFICATIONS :

LAGCO, INC.  
SHOP DRAWINGS

MAY 30 2008

REVIEWED  NOTE MARKING

Series 6000

# KUNKLE

ASME Section I and VIII, Steam, 'V' and 'UV', ASME Section VIII, Air/Gas 'UV' National Board Certified. Models 6933, 6934, and 6935 are ASME Section IV, 'Steam', 'HV' National Board Certified. PED Certified for Non-Hazardous Gas.

**Features**

- **O-ring seats** available for exceptional leak-free performance, reduced maintenance cost, multiple cycles with tight shutoff, improved seating integrity.
- **Wide hex on valve nozzle** provides wrenching service clearance for easy installation.
- **Dual control rings offer easy adjustability** for precise opening with minimum preopen or simmer and exact blowdown control.
- **Pivot between disc and spring** corrects misalignment and compensates for spring side thrust.
- **Grooved piston model disc** reduces sliding area and friction.

**Model Descriptions**

**Model 6010:** Side outlet. Full nozzle design with bronze/brass trim. Available with O-ring seats. For exceptional leak-free performance.

**Model 6021:** Same as Model 6010 with Teflon® (PFA) disc insert. For exceptional leak-free performance (use on steam only).

**Model 6030:** Same as Model 6010 except SS trim (nozzle and disc). Available with O-ring seats for exceptional leak-free performance.

**Model 6182:** Top outlet. Full nozzle design with bronze/brass trim. O-ring seat available for exceptional leak-free performance.

**Model 6121:** Same as Model 6182 with Teflon® (PFA) disc insert. For exceptional non-leak performance (use on steam only).

**Model 6130:** Same as Model 6182 except SS trim (nozzle and disc). O-ring seat available for exceptional leak-free performance.

**Model 6186:** Top outlet. Full nozzle design with bronze/brass trim. 150 psig [10.3 barg] maximum set pressure. Replaces Model 86 (original equipment only).

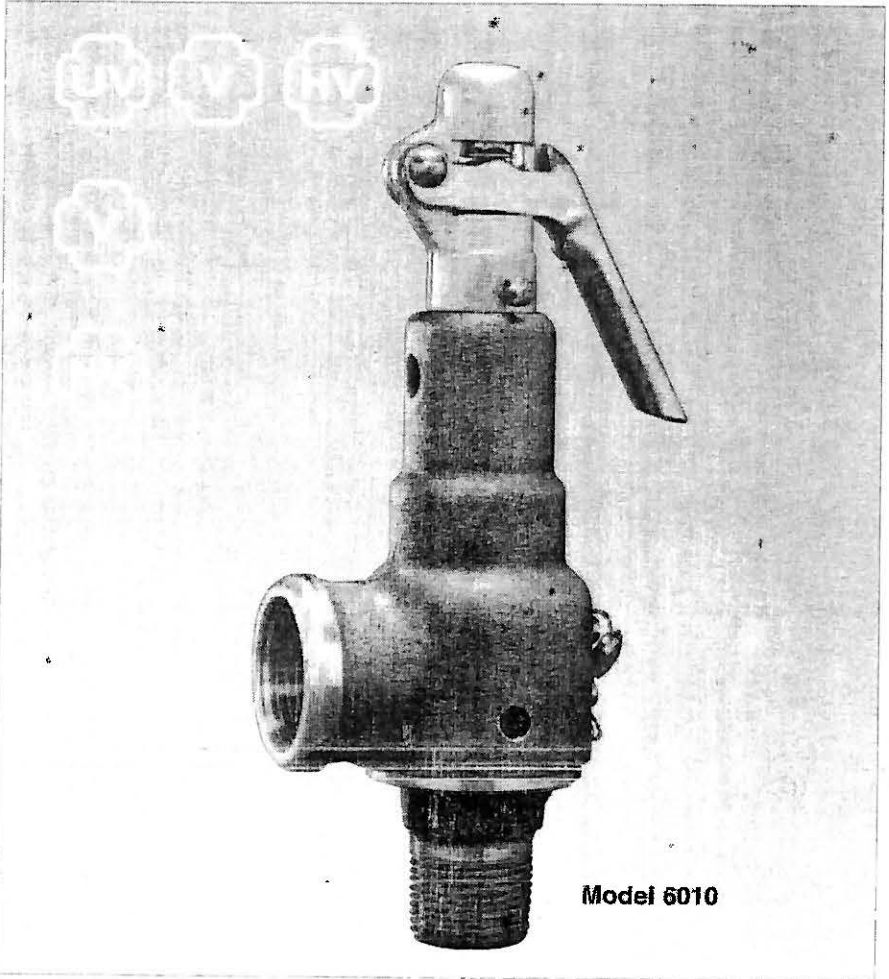
**Model 6283:** Over-sized side outlet. Full nozzle design bronze/brass trim.

**Model 6221:** Same as Model 6283 with Teflon® (PFA) disc insert. For exceptional leak-free performance (use on steam only).

**Model 6230:** Same as Model 6283 except SS trim (nozzle and disc).

**Model 6933:** Same as Model 6010 except certified for ASME code Section IV. Low pressure steam heating boilers set at 15 psig [1.0 barg] only.

**Model 6934:** Same as Model 6021 except certified for ASME code Section IV. Low pressure steam heating boilers set at 15 psig [1.0 barg] only.



Model 6010

**Model 6935:** Same as Model 6030 except certified for ASME code Section IV. Low pressure steam heating boilers set at 15 psig [1.0 barg] only.

**Air/Gas Service**

3 to 300 psig [0.2 to 20.7 barg]  
-60° to 406°F [-51° to 208°C]

**Models 6030, 6130, 6230  
Steam and Air/Gas Service**

3 to 300 psig [0.2 to 20.7 barg]  
-60° to 425 F [-51° to 218°C]

**Applications**

- Steam Boilers and Generators.
- Air/Gas Compressors - reciprocating or rotary - portable or stationary, intercoolers and aftercoolers.
- Pressure Vessels - containing steam, air or non-hazardous gas. Including tanks, receivers, sterilizers and autoclaves.
- Pressure Reducing Stations - protection of the discharge or low pressure side of system.

**Pressure and Temperature Limits**

Models 6010, 6021, 6182, 6283, 6221

**Steam Service**

0 to 250 psig [0.2 to 17.2 barg]  
-50° to 406°F [-51° to 208°C]

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1. Resilient seats determine temperature range. (see page 11)
2. Teflon® is a registered trademark of E. I. du Pont de Nemours Company.

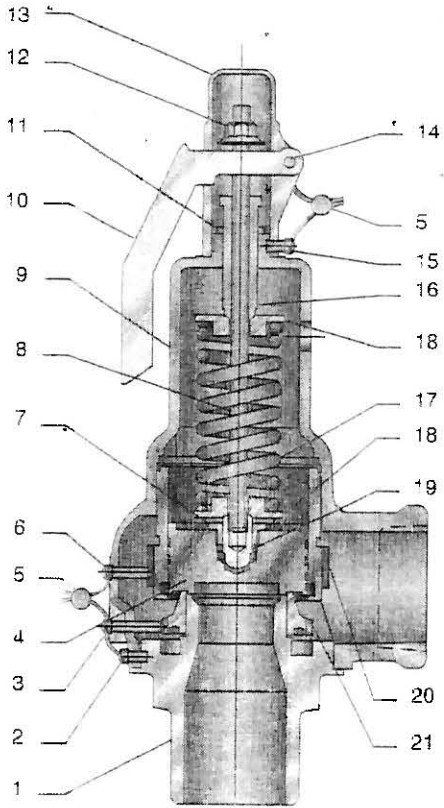
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Total Flow Control Solutions™

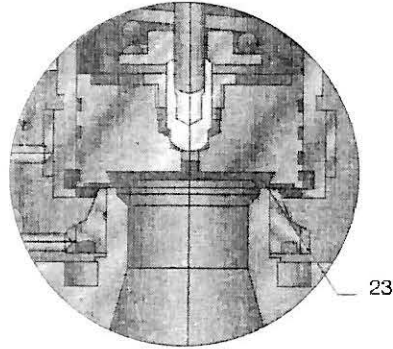


**Series 6000**

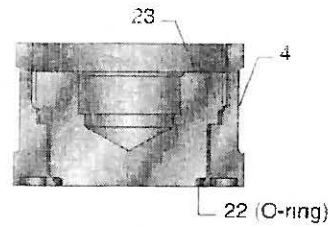
**Parts and Materials**



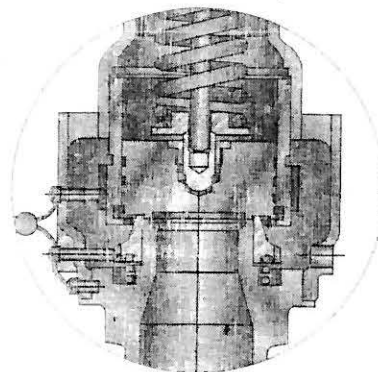
**Models 6010, 6030, 6205,  
6230, 6933, 6935**



**Models 6121, 6221, 6934  
Teflon® Seat Configuration**



**Models 6010, 6030, 6283,  
6230, 6933, 6935  
Optional Soft Seat**



**Models 6182, 6121, 6130, 6186  
Top Outlet Configuration**

# Kunkle Safety and Relief Products

## Series 6000

### Parts and Materials

No.	Part Name	Materials
1	Nozzle	BRS B283-C48500 for D Orifice <sup>d</sup> BRZ SB62 for E thru J Orifice <sup>d</sup>
2	Body Set Screw	SS 18-8
3	Warn Ring Set Screw	SS 18-8
4	Disc	B21 C48500 <sup>d</sup>
5	Wire and Seal	SS Wire and Lead Seal
6	Guide Set Screw	SS 18-8
7	Retainer Nut <sup>e</sup>	Brass B16
8	Stem	SS, A582 TY416
9	Body	BRZ B584-C84400
10	Lever	STL A109 or JIS SPCC Equivalent/ZN Plated Yellow
11	Jam Nut	Brass B16
12	Lift Nut	STL A108-1018/ZN Plated
13	Cap	BRS B176 Alloy 230A
14	Lever Pin	STL A108-12L14
15	Cap Set Screw	SS 18-8
16	Compression Screw	BRS B16
17	Spring	ASTM A-313 TY 631
18	Spring Step	BRS B16
19	Stem Retainer	BRS B16
20	Guide	BRS B16 for D and E Orifice BRZ B584-C84400 for F thru J Orifice
21	Warn Ring	BRS B16
22	Seat	Note 1
23	Seat Retainer	BRS B16 <sup>e</sup>

### Notes

- Models 6021, 6121, 6221 and 6934 Teflon<sup>®</sup>, optional O-ring seat available for all others except Models 6933 and 6935.
- Section IV only.
- Models 6030, 6130, 6230 and 6935 are SS SA351-CF8.
- Models 6030, 6130, 6230 and 6935 are SS SA479-304 (D thru H Orifice) or SS SA479-316 (J Orifice).
- Models 6030, 6130 and 6230 are SS SA479-304.

## Series 6000

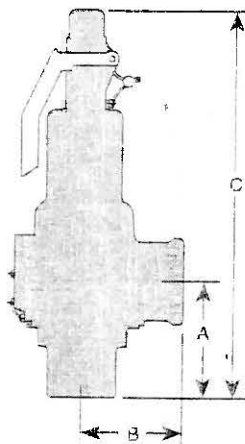
Series 6000 and Models 6933-6935 ASME Section I and VIII, Steam, ASME Section VIII, Air/Gas  
National Board Certified. Models 6933-6935 are ASME Section IV, 'Steam,' National Board Certified

### Specifications

Model Number <sup>1</sup>	Orifice	Connections		Valve Dimensions			Approximate Weight	
		ANSI Standard		A	in [mm]		lb [kg]	[kg]
		Inlet	Outlet		B	C		
		in [mm]	in [mm]					
60**DC#	D	1/2 [12.7]	3/4 [19.0]	2 1/8 [54]	1 5/8 [41]	6 1/2 [165]	1 1/2 [0.7]	
60**DD# <sup>2</sup>	D	3/4 [19.0]	3/4 [19.0]	2 1/8 [54]	1 5/8 [41]	6 1/2 [165]	1 3/4 [0.8]	
61**DC#	D	1/2 [12.7]	—	—	—	6 1/2 [165]	1 1/4 [0.6]	
60**ED#	E	3/4 [19.0]	1 [25.4]	2 3/8 [60]	1 3/4 [44]	7 1/2 [191]	2 1/2 [1.1]	
60**EE# <sup>2</sup>	E	1 [25.4]	1 [25.4]	2 1/2 [64]	1 3/4 [44]	7 5/8 [194]	2 3/4 [1.2]	
61**ED#	E	3/4 [19.0]	—	—	—	7 1/2 [191]	2 1/4 [1.0]	
62**ED#	E	3/4 [19.0]	1 1/4 [31.75]	2 7/8 [73]	1 3/4 [44]	7 1/2 [191]	2 3/4 [1.2]	
60**FE#	F	1 [25.4]	1 1/4 [31.8]	2 5/8 [67]	2 [51]	8 1/2 [216]	3 1/2 [1.6]	
60**FF# <sup>2</sup>	F	1 1/4 [31.8]	1 1/4 [31.8]	2 7/8 [73]	2 [51]	8 3/4 [222]	3 3/4 [1.7]	
61**FE#	F	1 [25.4]	—	—	—	8 1/2 [222]	3 1/4 [1.5]	
62**FE#	F	1 [25.4]	1 1/2 [38.0]	2 7/8 [73]	2 [51]	8 1/2 [222]	3 3/4 [1.7]	
60**GF#	G	1 1/4 [31.8]	1 1/2 [38.0]	3 1/8 [79]	2 3/8 [60]	9 5/8 [244]	5 1/2 [2.5]	
60**GG# <sup>2</sup>	G	1 1/2 [38.0]	1 1/2 [38.0]	3 3/8 [86]	2 3/8 [60]	10 [254]	5 3/4 [2.6]	
61**GF#	G	1 1/4 [31.8]	—	—	—	9 5/8 [244]	5 [2.3]	
62**GF#	G	1 1/4 [31.8]	2 [51.0]	3 3/8 [86]	2 1/4 [57]	9 5/8 [244]	5 3/4 [2.6]	
60**HG#	H	1 1/2 [38.0]	2 [51.0]	3 5/8 [92]	2 3/4 [70]	10 5/8 [270]	7 3/4 [3.5]	
60**HH# <sup>2</sup>	H	2 [51.0]	2 [51.0]	4 1/8 [105]	2 3/4 [70]	11 1/8 [283]	8 [3.6]	
61**HG#	H	1 1/2 [38.0]	—	—	—	10 5/8 [270]	7 1/4 [3.3]	
62**HG#	H	1 1/2 [38.0]	2 1/2 [64.0]	3 7/8 [98]	3 [76]	10 5/8 [270]	8 [3.6]	
60**JH#	J	2 [51.0]	2 1/2 [64.0]	4 1/4 [108]	3 3/8 [86]	13 5/8 [346]	15 1/2 [7.0]	
60**JJ# <sup>2</sup>	J	2 1/2 [64.0]	2 1/2 [64.0]	4 1/2 [114]	3 3/8 [86]	14 [356]	15 3/4 [7.2]	
61**JH#	J	2 [51.0]	—	—	—	13 5/8 [346]	16 [6.8]	
62**JH#	J	2 [51.0]	3 [76.0]	4 5/8 [117]	3 3/8 [86]	13 5/8 [345]	15 1/2 [7.0]	

### Notes

1. Replace asterisks with desired model number. Replace # with desired seat material.
2. Model 6030 available only 1/2 x 3/4-inch [12.7 x 19 mm], 3/4 x 1-inch [19 x 25.4 mm], 1 x 1 1/4-inch [25.4 x 31.8 mm], 1 1/4 x 1 1/2-inch [31.8 x 38 mm], 1 1/2 x 2-inch [38 x 51 mm] and 2 x 2 1/2-inch [51 x 64 mm].
3. Models 6933, 6934 and 6935 have same dimensions as Model 6010.



# Kunkle Safety and Relief Products

## Series 3000

### Capacities

#### Notes

1. No code stamp or 'NB' on nameplate below 15 psig set.

#### Non-code and ASME Section VIII Air (English, SCFM)

Set Pressure (psig)	Orifice Area, in <sup>2</sup>					
	D (0.121)	E (0.216)	F (0.338)	G (0.554)	H (0.863)	J (1.414)
3	28	50	78	127	198	325
4	32	57	89	146	228	374
6	39	70	109	178	278	456
8	45	80	125	205	319	523
10	50	89	139	228	355	582
15	64	114	178	292	454	744
20	73	131	205	336	524	858
25	83	148	232	381	593	972
30	93	166	259	425	663	1086
35	104	185	289	474	739	1211
40	114	204	319	523	815	1336
45	125	223	349	572	892	1461
50	135	242	379	621	968	1586
55	146	261	409	671	1045	1711
60	157	281	439	720	1121	1837
65	168	300	469	769	1197	1962
70	179	319	499	818	1274	2087
75	189	338	529	867	1350	2212
80	200	357	559	916	1426	2337
85	211	376	589	965	1503	2462
90	221	395	619	1014	1579	2588
95	232	414	648	1063	1656	2713
100	243	434	678	1112	1732	2838
105	254	453	708	1161	1808	2963
110	264	472	738	1210	1885	3088
115	275	491	768	1259	1961	3213
120	286	510	798	1308	2038	3339
125	296	529	828	1357	2114	3464
130	307	548	858	1406	2190	3589
135	318	567	888	1455	2267	3714
140	329	586	918	1504	2343	3839
145	339	606	948	1553	2420	3964
150	350	625	978	1602	2496	4090
160	371	663	1037	1700	2649	4340
170	393	701	1097	1798	2802	4590
180	414	739	1157	1897	2954	4841
190	436	778	1217	1995	3107	5091
200	457	816	1277	2093	3260	5341
210	478	854	1337	2191	3413	5592
220	500	892	1396	2289	3566	5842
230	521	931	1456	2387	3718	6092
240	543	969	1516	2485	3871	6343
250	564	1007	1576	2583	4024	6593
260	586	1045	1636	2681	4177	6843
270	607	1084	1696	2779	4329	7094
280	628	1122	1756	2877	4482	7344
290	650	1160	1815	2975	4635	7594
300	671	1198	1875	3074	4788	7845

# Kunkle Safety and Relief Products

## Series 6000

### Capacities

Non-code and ASME Section VIII Air [Metric, Nm<sup>3</sup>/h]

Set Pressure [barg]	Orifice Area, cm <sup>2</sup>					
	D [0.781]	E [1.394]	F [2.180]	G [3.574]	H [5.567]	J [9.123]
0.2	45	81	126	207	322	528
0.3	55	98	154	252	393	644
0.4	63	113	177	290	452	740
0.6	77	138	215	353	549	900
1.0	104	180	281	461	718	1177
1.5	123	220	345	565	880	1443
2.0	146	261	408	669	1042	1708
2.5	171	305	477	782	1218	1996
3.0	196	350	547	896	1396	2288
3.5	221	394	616	1011	1574	2579
4.0	246	439	686	1125	1752	2871
4.5	271	483	756	1239	1930	3163
5.0	296	528	826	1353	2108	3455
5.5	321	572	895	1468	2286	3746
6.0	346	617	965	1582	2464	4038
6.5	371	662	1035	1696	2642	4330
7.0	396	706	1104	1811	2820	4622
7.5	421	751	1174	1925	2998	4913
8.0	446	795	1244	2039	3176	5205
8.5	471	840	1313	2153	3354	5497
9.0	496	884	1383	2268	3532	5788
9.5	521	929	1453	2382	3710	6080
10.0	545	974	1523	2496	3888	6372
10.5	570	1018	1592	2611	4066	6664
11.0	595	1063	1662	2725	4244	6955
11.5	620	1107	1732	2839	4422	7247
12.0	645	1152	1801	2953	4600	7539
12.5	670	1197	1871	3068	4778	7831
13.0	695	1241	1941	3182	4956	8122
13.5	720	1286	2011	3296	5134	8414
14.0	745	1330	2080	3411	5312	8706
14.5	770	1375	2150	3525	5490	8997
15.0	795	1419	2220	3639	5668	9289
16.0	845	1509	2353	3868	6024	9873
17.0	895	1598	2499	4096	6381	10456
18.0	945	1687	2639	4325	6737	11040
19.0	995	1776	2777	4553	7093	11623
20.0	1045	1865	2917	4782	7449	12207

#### Note:

1. No code stamp or 'NB' on nameplate below 1.0 barg set.

# Kunkle Safety and Relief Products

## Series C000

### Capacities

#### Note

1. No code stamp or 'NB' on nameplate below 15 psig set.

#### Non-code and ASME Section VIII Steam (English, lb/h)

Set Pressure (psig)	Orifice Area, in <sup>2</sup>					
	D (0.121)	E (0.216)	F (0.338)	G (0.554)	H (0.863)	J (1.414)
3	87	155	243	398	621	1017
4	100	178	279	457	711	1166
6	121	215	337	552	860	1409
8	137	245	384	629	980	1606
10	152	271	424	695	1083	1775
15	179	319	500	819	1276	2091
20	206	368	576	944	1471	2410
25	234	417	653	1070	1666	2730
30	261	466	729	1195	1861	3050
35	291	520	813	1333	2076	3401
40	321	573	897	1470	2291	3753
45	351	627	981	1608	2505	4105
50	381	681	1065	1746	2720	4456
55	411	734	1149	1884	2934	4808
60	442	788	1233	2022	3149	5160
65	472	842	1317	2159	3364	5511
70	502	896	1401	2297	3578	5863
75	532	949	1486	2435	3793	6215
80	562	1003	1570	2573	4008	6566
85	592	1057	1654	2710	4222	6918
90	622	1110	1738	2848	4437	7270
95	652	1164	1822	2986	4651	7621
100	682	1218	1906	3124	4866	7973
105	712	1272	1990	3262	5081	8325
110	742	1325	2074	3399	5295	8676
115	773	1379	2158	3537	5510	9028
120	803	1433	2242	3675	5725	9380
125	833	1487	2326	3813	5939	9731
130	863	1540	2410	3950	6154	10083
135	893	1594	2494	4088	6368	10434
140	923	1648	2578	4226	6583	10786
145	953	1701	2662	4364	6798	11138
150	983	1755	2746	4502	7012	11489
160	1043	1863	2915	4777	7442	12193
170	1104	1970	3083	5053	7871	12896
180	1164	2077	3251	5328	8300	13599
190	1224	2185	3419	5604	8729	14303
200	1284	2292	3587	5879	9159	15006
210	1344	2400	3755	6155	9588	15709
220	1404	2507	3923	6430	10017	16413
230	1465	2615	4091	6706	10446	17116
240	1525	2722	4259	6981	10876	17819
250	1585	2829	4428	7257	11305	18523
260	1645	2937	4596	7533	11734	19226
270	1705	3044	4764	7808	12163	19929
280	1766	3152	4932	8084	12592	20632
290	1826	3259	5100	8359	13022	21336
300	1886	3367	5268	8635	13451	22039

# Kunkle Safety and Relief Products

## Series 6000

### Capacities

#### Non-code and ASME Section VIII Steam [Metric, kg/h]

Set Pressure [barg]	Orifice Area, cm <sup>2</sup>					
	D [0.781]	E [1.394]	F [2.180]	G [3.574]	H [5.567]	J [9.120]
0.2	39	69	108	177	276	453
0.3	47	84	131	215	335	549
0.4	54	96	150	246	383	628
0.6	65	115	181	296	461	756
1.0	81	144	226	370	576	944
1.5	98	175	273	448	698	1144
2.0	116	207	324	530	826	1354
2.5	135	242	378	620	966	1582
3.0	155	277	433	711	1107	1814
3.5	175	312	489	801	1248	2045
4.0	195	348	544	892	1389	2276
4.5	215	383	599	982	1530	2508
5.0	234	419	654	1073	1671	2739
5.5	254	454	710	1164	1812	2970
6.0	274	489	765	1254	1954	3201
6.5	294	525	820	1345	2095	3433
7.0	314	560	876	1436	2236	3664
7.5	333	596	931	1526	2377	3895
8.0	353	631	986	1617	2518	4127
8.5	373	666	1041	1707	2659	4358
9.0	393	701	1097	1798	2800	4589
9.5	413	737	1152	1888	2942	4820
10.0	432	772	1207	1979	3083	5052
10.5	452	807	1262	2070	3224	5283
11.0	472	843	1318	2161	3365	5514
11.5	492	878	1373	2251	3506	5746
12.0	512	913	1428	2341	3647	5977
12.5	531	949	1483	2432	3788	6208
13.0	551	984	1539	2523	3929	6439
13.5	571	1019	1594	2613	4071	6671
14.0	591	1055	1649	2704	4212	6902
14.5	611	1090	1705	2795	4353	7133
15.0	630	1125	1760	2885	4494	7365
16.0	670	1196	1870	3066	4778	7827
17.0	710	1267	1981	3246	5059	8290
18.0	749	1337	2091	3426	5341	8752
19.0	789	1408	2202	3606	5620	9215
20.0	829	1479	2313	3787	5895	9678

#### Note

1. No code stamp or 'NB' on nameplate below 1.1 barg set.

# Kunkle Safety and Relief Products

## Series 3000

### Capacities

#### ASME Section I Steam (English, lb/h)

Set Pressure (psig)	Orifice Area, in <sup>2</sup>					
	D (0.121)	E (0.216)	F (0.338)	G (0.554)	H (0.863)	J (1.414)
15	173	309	484	793	1236	2025
20	201	358	560	918	1431	2344
25	228	407	637	1044	1626	2664
30	255	456	713	1169	1821	2983
35	283	504	789	1294	2015	3302
40	310	553	866	1419	2210	3622
45	337	602	942	1544	2405	3941
50	365	651	1018	1669	2600	4260
55	392	700	1095	1794	2795	4580
60	419	748	1171	1919	2990	4899
65	447	797	1247	2045	3185	5219
70	474	847	1325	2172	3384	5544
75	503	897	1404	2301	3585	5873
80	531	947	1483	2430	3785	6202
85	559	998	1561	2559	3986	6531
90	587	1048	1640	2688	4187	6860
95	615	1098	1718	2817	4388	7189
100	643	1148	1797	2946	4588	7518
105	671	1199	1876	3074	4789	7847
110	700	1249	1954	3203	4990	8176
115	728	1299	2033	3332	5191	8505
120	756	1349	2112	3461	5392	8834
125	784	1400	2190	3590	5592	9163
130	812	1450	2269	3719	5793	9492
135	840	1500	2348	3848	5994	9821
140	869	1550	2426	3977	6195	10150
145	897	1601	2505	4105	6395	10479
150	925	1651	2583	4234	6596	10808
155	951	1701	2741	4492	6998	11466
160	1007	1852	2898	4750	7399	12123
170	1094	1952	3055	5008	7801	12781
180	1150	2053	3212	5265	8202	13439
190	1206	2153	3370	5523	8604	14097
200	1263	2254	3527	5781	9005	14755
210	1319	2354	3684	6039	9407	15413
220	1375	2455	3842	6297	9808	16071
230	1432	2555	3999	6554	10210	16729
240	1488	2656	4156	6812	10612	17387
250	1544	2756	4313	7070	11013	18045
260	1600	2857	4471	7328	11415	18703
270	1657	2957	4628	7585	11816	19360
280	1715	3058	4785	7843	12218	20018
290	1769	3158	4942	8101	12619	20676



# Kunkle Safety and Relief Products

## Series 6000

### Capacities

ASME Section I Steam [Metric, kg/h]						
Set Pressure [barg]	Orifice Area, cm <sup>2</sup>					
	D [0.781]	E [1.394]	F [2.180]	G [3.574]	H [5.567]	J [9.123]
1.5	95	170	266	436	680	1114
2.0	113	202	316	519	808	1324
2.5	131	234	367	601	936	1534
3.0	149	266	417	683	1064	1744
3.5	167	299	467	765	1192	1954
4.0	185	331	517	848	1320	2164
4.5	203	363	567	930	1449	2374
5.0	222	396	619	1014	1580	2589
5.5	240	429	670	1099	1712	2806
6.0	259	462	722	1184	1844	3022
6.5	277	495	774	1269	1976	3238
7.0	296	528	826	1363	2108	3455
7.5	314	561	877	1458	2240	3671
8.0	333	594	929	1523	2372	3887
8.5	351	627	981	1608	2504	4104
9.0	370	660	1032	1692	2636	4320
9.5	388	693	1084	1777	2768	4537
10.0	407	726	1136	1862	2900	4753
10.5	425	759	1187	1947	3032	4969
11.0	444	792	1239	2031	3164	5186
11.5	462	825	1291	2116	3296	5402
12.0	481	858	1343	2201	3428	5618
12.5	499	892	1394	2286	3560	5835
13.0	518	925	1446	2371	3692	6051
13.5	537	958	1498	2455	3824	6267
14.0	555	991	1549	2540	3957	6484
14.5	574	1024	1601	2625	4089	6700
15.0	592	1057	1653	2710	4221	6917
15.5	611	1090	1704	2794	4353	7133
17.0	629	1123	1756	2879	4485	7349
17.0	666	1189	1860	3049	4749	7782
18.0	703	1255	1963	3218	5013	8215
19.0	740	1321	2066	3388	5277	8647
20.0	777	1387	2170	3557	5541	9080

### Models 6933-6935 ASME Section IV, Low Pressure Steam, 'HV' National Board Certified

Steam Relieving Capacities - Models 6933, 6934, and 6935						
Steam Capacity, lb/h [kg/h]						
Set Pressure (psig) [barg]	Orifice, Area in <sup>2</sup> [cm <sup>2</sup> ]					
	D 0.121 [0.781]	E 0.216 [1.394]	F 0.338 [2.180]	G 0.554 [3.574]	H 0.863 [5.567]	J 1.414 [9.123]
15 [1.0]	190 [86]	338 [153]	530 [240]	869 [394]	1352 [613]	2215 [1005]

# Kunkle Safety and Relief Products

## Series 6000

### Specifications

#### Service Recommendations for Resilient Seat/Seal Materials

Seat/Seal Materials	Service Recommendation
Viton® A (-10 to 406 F) [-23 to 208°C]	Air and Gas
Ethylene Propylene (-70 to 400°F) [-57 to 205°C]	Steam

ASME Section I and VIII, Steam, ASME Section VIII, Air/Gas National Board Certified. Models 6930, 6933, 6935 ASME Section IV, National Board Certified

#### Model Number/Order Guide

Model Number Position

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----

Example

6	0	1	0	H	G	M	0	1	-	A	M	0	1	5	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

#### Model

6010	6130	6220
6021	6196	6933
6030	6283	6934
6102	6221	6935
6121		

#### Orifice

D	G
E	H
F	J

#### Inlet Size

C - 7/8-inch [22.7]	G - 1 1/2-inch [38.1]
D - 1-inch [25.4]	H - 2-inch [50.8]
E - 1 1/8-inch [31.8]	J - 2 1/2-inch [63.5]

#### Seat Material

M - Metal
E - EPR
V - Viton®

#### Variation (01 through 99)

01 - Plain lever
02 - Plain lever with vibration dampener
03 - Plain lever with gag
50 - BSP Threads

#### Design Revision

indicates non-interchangeable revision. Dash (-) if original design.

#### Valve Service

A - Steam ASME Section I
K - Air/Gas ASME Section VIII
L - Steam ASME Section VIII
G - Steam ASME Section IV (Models 6933, 6934, 6935 only)
P - Steam, Non-code
N - Air, Non-code

#### Spring Material

M - SS
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#### Set Pressure

[0.15 - 15 psig [1.0 barg]] only for Models 6933, 6934, 6935

Series 6000

Facility Phone: 828-669-3700

**Tyco Valves & Controls**

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