COMPLETE REVISION
October 2007

Process Industry Practices
Piping

PIP PNFJ8000
Jacketed Piping
Fabrication and Installation Details

PURPOSE AND USE OF PROCESS INDUSTRY PRACTICES

In an effort to minimize the cost of process industry facilities, this Practice has been prepared from the technical requirements in the existing standards of major industrial users, contractors, or standards organizations. By harmonizing these technical requirements into a single set of Practices, administrative, application, and engineering costs to both the purchaser and the manufacturer should be reduced. While this Practice is expected to incorporate the majority of requirements of most users, individual applications may involve requirements that will be appended to and take precedence over this Practice. Determinations concerning fitness for purpose and particular matters or application of the Practice to particular project or engineering situations should not be made solely on information contained in these materials. The use of trade names from time to time should not be viewed as an expression of preference but rather recognized as normal usage in the trade. Other brands having the same specifications are equally correct and may be substituted for those named. All Practices or guidelines are intended to be consistent with applicable laws and regulations including OSHA requirements. To the extent these Practices or guidelines should conflict with OSHA or other applicable laws or regulations, such laws or regulations must be followed. Consult an appropriate professional before applying or acting on any material contained in or suggested by the Practice.

This Practice is subject to revision at any time.

PRINTING HISTORY
July 2001 *Issued*
October 2007 *Complete Revision*

Not printed with State funds

Process Industry Practices
Piping

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Table of Contents

1. Introduction

1.1 Purpose

This Practice provides requirements for the design, fabrication, and installation of jacketed piping systems.

1.2 Scope

This Practice describes the requirements for the design, material selection, fabrication, installation, inspection, and testing of jacketed piping systems.

2. References

Applicable parts of the following Practices and industry codes and standards shall be considered an integral part of this Practice. The latest edition in effect at the date of contract award shall be used, except as otherwise noted. Short titles will be used herein where appropriate.

2.1 Process Industry Practices (PIP)

- PIP PNC00004 - *Piping Flexibility Analysis Criteria for ASME B31.3 Metallic Piping*
- PIP PNE00012 - *Piping Examination and Leak Test Guide*
- PIP PNSC0001 - *ASME B31.3 Metallic Piping Fabrication and Examination Specification*
- PIP PNSM0110 – *Procurement of Valves*

2.2 Industry Codes and Standards

- American Society of Mechanical Engineers (ASME)
  - ASME B16.5 - *Pipe Flanges and Flanged Fittings*
  - ASME B31.3 - *Process Piping*

3. Requirements

3.1 General

3.1.1 The fabrication details in this Practice shall be used in the design and fabrication of jacketed piping.

3.1.2 Any substitution to or variance from this Practice shall be approved by purchaser before implementation.

3.1.3 Codes, standards, and specifications referenced in this Practice, the piping line class specifications, valve purchase descriptions, or any referenced document form a part of the requirements of this Practice in the manner and to the extent specified.

3.2 Materials of Construction

3.2.1 Materials shall be in accordance with the PIP Piping Material Specifications or the PIP Valve Descriptions.

3.2.2 All materials shall be new and unused.

3.2.3 Substitution of materials specified in the design or specified in the PIP Valve Descriptions shall not be permitted without written authorization from the purchaser.

3.3 Design

3.3.1 Codes and Standards

3.3.1.1 Jacketed piping design shall be in accordance with the latest revision of the standards noted in the PIP Piping Material Specification or in the PIP Valve Description.

3.3.1.2 Except as otherwise specified in this Practice, jacketed piping shall be in accordance with *PIP PNE00012*.

3.3.1.3 Except as otherwise specified in this Practice, jacketed piping shall be in accordance with *PIP PNSC0001*.

3.3.1.4 Except as otherwise specified in this Practice, jacketed piping, including integrally cast jacketed valves, base valves, and all types of fabricated jackets, shall be in accordance with *PIP PNSM0110*.

3.3.2 Pressure-Temperature Ratings

Comment: Certain types of flanges common in jacketed piping may not be entirely in accordance with *ASME B16.5* pressure-temperature ratings.

If requested, information on the pressure-temperature ratings shall be submitted to the purchaser for approval.

3.3.3 Piping Design

3.3.3.1 The supplier's designer shall ensure that the jacketed piping details shown in this Practice are used in the intended manner.

Comment: Some designs shown in this Practice are not acceptable for all temperature ranges or for large differences in core and jacket pipe. Cautionary notes are provided on details if the large thermal strains on the assembly may cause failure.

3.3.3.2 The appropriate flexibility analysis shall be performed in accordance with *PIP PNC00004*.

3.3.3.3 Additional thermal and mechanical analysis methods may be required to fully qualify the design.

3.3.3.4 The supplier's designer shall ensure that each detail is used with the appropriate heat transfer fluid in accordance with the referenced PIP Piping Material Specification.

Comment: Each design within a detail group (e.g., jacket termination) may not provide the same amount of heat transfer to the core pipe.

3.3.4 Use of Spacers

3.3.4.1 Uniformity of the jacket annulus shall be maintained. Spacers shall be used in accordance with the following requirements:

a. Maximum distance between spacer groups or spacers and jacket end termination shall be 2.1 meters (7 feet) for core NPS 2 and smaller.

b. Maximum distance between spacer groups or spacers and jacket end termination shall be 3.1 meters (10 feet) for core NPS 3 and greater.

c. Spacers or jacket end termination shall be placed within 1.2 meters (4 feet) of the tangent point of elbows or center point of concentric fittings.

d. At least one spacer group or jacket end termination shall be provided for each straight run of pipe.

3.3.4.2 Spacers shall be considered in the flexibility analysis.

3.3.5 Layout Considerations

3.3.5.1 Jacketed piping systems shall be designed to be efficient in transferring heat from the heating medium to the core. This is dependent upon how well fluid flows through the jacket.

3.3.5.2 For liquid-heated jacketed piping, the supply shall be introduced at the lowest (inlet) tapping of the pipe, circuit, or system, and shall exit at the highest point.

3.3.5.3 For jacketed piping heated with a condensing vapor, the inlet shall be at the highest jacket tapping. Condensate shall be drained from the lowest pipe or fitting and may be returned to a common return header.

3.3.5.4 The heating medium shall flow countercurrent to the product flow.

3.3.5.5 Jacketed piping should be designed and installed with a 1% slope to facilitate drainage.

3.3.5.6 The number of jackets included in a circuit should not exceed eight pipe sections, valves, or fittings.

3.4 Testing, Inspection, Examination, and Repair

3.4.1 All jacketed piping and jacketed valves shall be pressure-tested in accordance with *ASME B31.3* and the following additional requirements and restrictions:

a. The internal line shall be leak-tested before closure of the jacket piping.

b. All core pipe welds shall be visible during the leak test.

c. If the test pressure in the jacket is too high for the internal line as an external pressure, the internal line shall be pressurized to minimize the differential pressure, or the wall thickness of the internal line shall be increased to meet test-pressure requirements.

3.4.2 Jacketed valves shall be inspected in accordance with the inspection requirements of *PIP PNSM0110*.

3.4.3 Inspections and/or tests of fabricated jacketed valves may be reviewed and/or witnessed by the purchaser at the supplier's facility.

3.4.4 Jacketed piping examination shall be performed in accordance with *PIP PNSC0001*.

3.4.5 Jacketed valve repairs shall be performed in accordance with the repair requirements of *PIP PNSM0110*.

3.5 Valve Identification

3.5.1 For integrally cast jacketed valves, the valves shall be marked and tagged in accordance with the identification requirements of *PIP PNSM0110*.

3.5.2 Manufacturers of fabricated jackets for valves shall mark and tag valves in accordance with the identification requirements of *PIP PNSM0110*.

3.5.3 If a fabricated jacket is welded to a pre-manufactured base valve, the jacket fabricator shall maintain the base valve manufacturer's markings on the valve tag.

4. Index of Drawings

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PNFJ8050	Jacket Closure	SW-1	Swage
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PNFJ8130	Swaged Jacket Flange Attachment	SJFA-2	Slip-On Flange, Face Groove Weld
PNFJ8140	Swaged Jacket Flange Attachment	SJFA-3	Welding Neck Flange
PNFJ8150	Swaged Jacket Flange Attachment	SJFA-4	Slip-On Flange, Face Fillet Weld
PNFJ8160	Swaged Jacket Flange Attachment	SJFA-5	Plate/Blind Flange
PNFJ8170	Swaged Jacket Flange Attachment	SJFA-6	Socket Weld Flange
PNFJ8220	Full Jacket Termination	FJT-1	Core Size Insert Slip-On Flange
PNFJ8230	Full Jacket Termination	FJT-2	Jacket Size Insert Slip-On Flange
PNFJ8240	Full Jacket Termination	FJT-3	Jacket Size Slip-On Flange
PNFJ8250	Full Jacket Termination	FJT-4	Reducing (Jacket Size) Weld Neck Flange
PNFJ8260	Full Jacket Termination	FJT-5	Reducing (Jacket Size) Slip-On Flange, Face Groove Weld
PNFJ8270	Full Jacket Termination	FJT-6	Reducing (Jacket Size) Slip-On Flange, Face Fillet Weld
PNFJ8320	Jacketed Elbows, 90 Degree	JE-1	Standard LR/SR Combinations, Sizes 1" X 2" through 6" X 8"
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PNFJ8700	Core Taps & Connections	PF-1	Pad Flange

File No.	Detail Title	Detail No.	Notes
PNFJ8720	Weld-In Valves	DSV-1	Flow-Through Drain/Sampling Valve
PNFJ8730	Weld-In Valves	DSV-2	Stab-In Drain/Sampling Valve
PNFJ8740	Weld-In Valves	BWV-1	In-Line Socket Weld or Butt Weld Valve
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PNFJ9040	Jacket Annulus Details	SP-3	Spacer, Type C
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PNFJ9060	Jacket Annulus Details	ST-1	Siphon Tube Assembly
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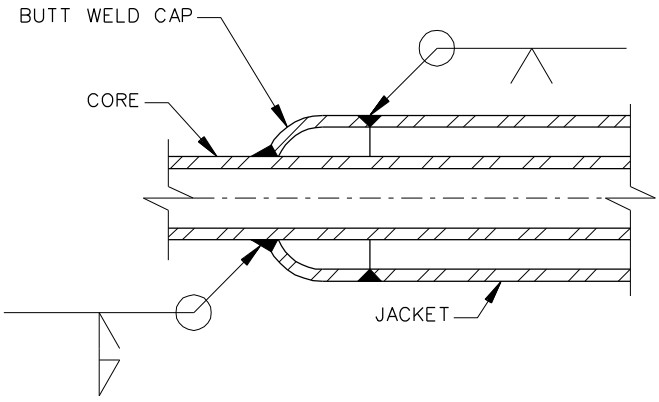
PNFJ9130	Jumpover Details	JMP-2	Tubing Jumpover
PNFJ9140	Jumpover Details	JMP-3	Steam/Condensate Jumpover Assembly
PNFJ9150	Jumpover Details	JMP-4	Piping Jumpover
PNFJ9160	Jumpover Details	JMP-5	Piping Jumpover

PIPE CAP



NOTES:

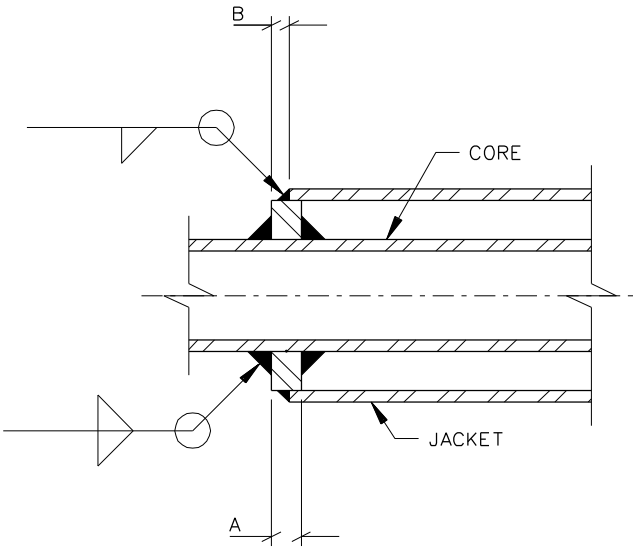
1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

JACKET CLOSURE
CP-1

PNF J8030
ISSUED: MAY 2001
REAFFIRMED: MAY 2007

PIP PNFJ8000

CHEEK PLATE



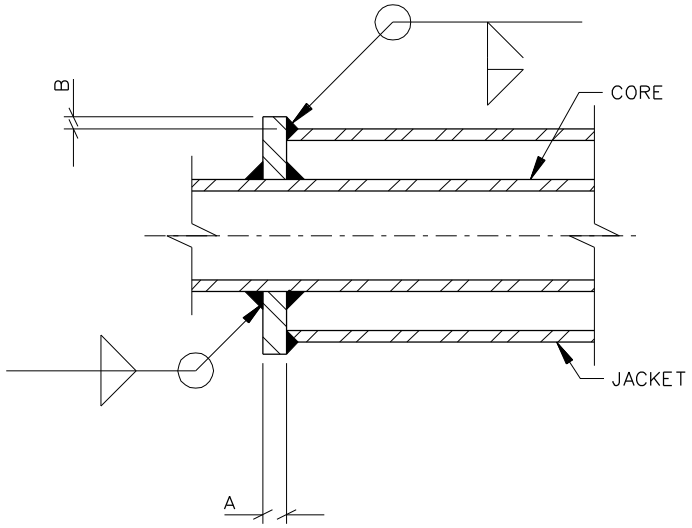
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.
3. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.
4. DIMENSION "A" AND "B" SHALL BE CALCULATED BASED ON FLUID SERVICE AND PROCESS CONDITIONS.

JACKET CLOSURE
CP-2

PNF J8040
ISSUED: MAY 2001
REAFFIRMED: MAY 2007
PAGE 1 OF 1
PIP PNFJ8000

CHEEK PLATE



NOTES:

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2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.
3. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.
4. DIMENSION "A" AND "B" SHALL BE CALCULATED BASED ON FLUID SERVICE AND PROCESS CONDITIONS.

JACKET CLOSURE
SW-1

PNF J8050
ISSUED: MAY 2001
REAFFIRMED: MAY 2007
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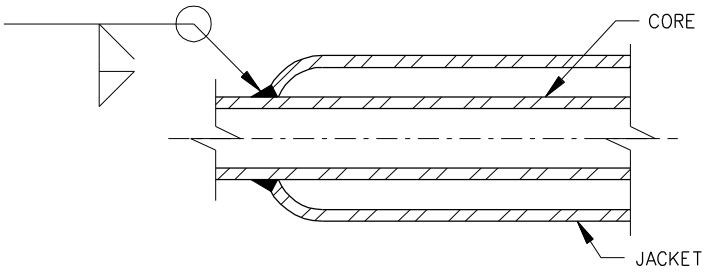
PIP PNFJ8000

SWAGE



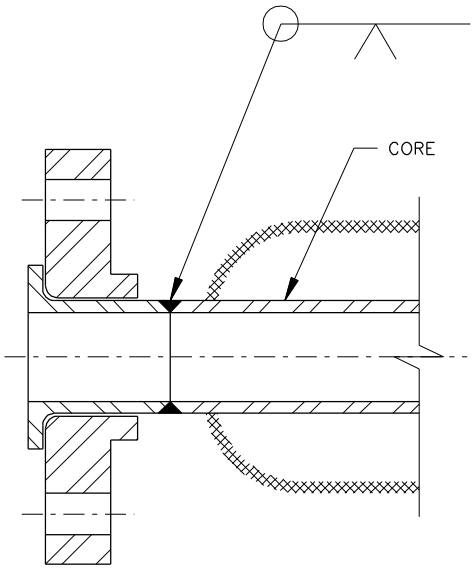
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

SWAGED JACKET FLANGE ATTACHMENT
SJFA-1

PNFJ8120
ISSUED: MAY 2001
REAFFIRMED: MAY 2007
PAGE 1 OF 1
PIP PNFJ8000

STUB END WITH LAP JOINT FLANGE



NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

SWAGED JACKET FLANGE ATTACHMENT
SJFA-2

PNF J8130
ISSUED: MAY 2001
REAFFIRMED: MAY 2007
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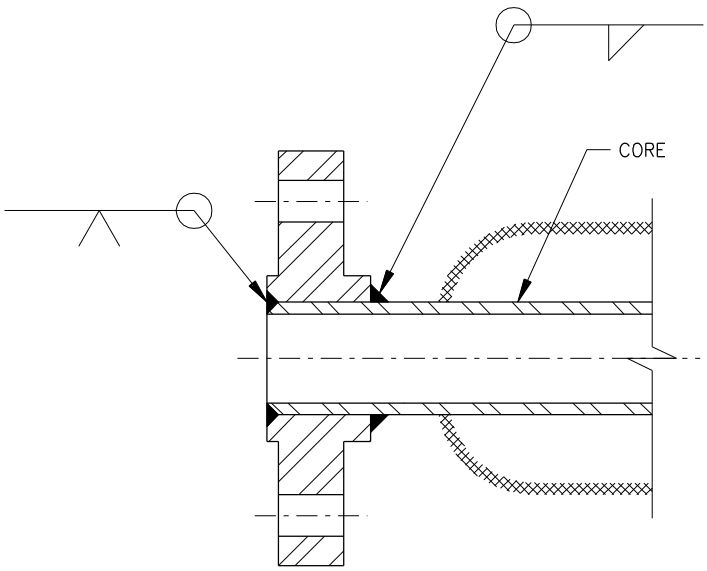
PIP PNFJ8000

SLIP-ON FLANGE, FACE GROOVE WELD



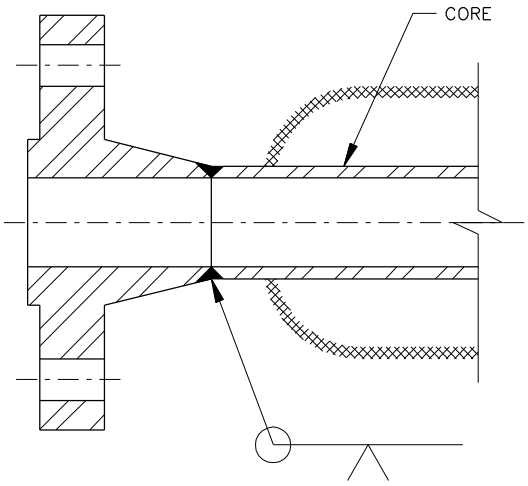
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

SWAGED JACKET FLANGE ATTACHMENT
SJFA-3

PNF J8140
ISSUED: MAY 2001
REAFFIRMED: MAY 2007
PAGE 1 OF 1
PIP PNFJ8000

WELDING NECK FLANGE



NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

SWAGED JACKET FLANGE ATTACHMENT
SJFA-4

PNFJ8150
ISSUED: MAY 2001
REAFIRRMED: MAY 2007
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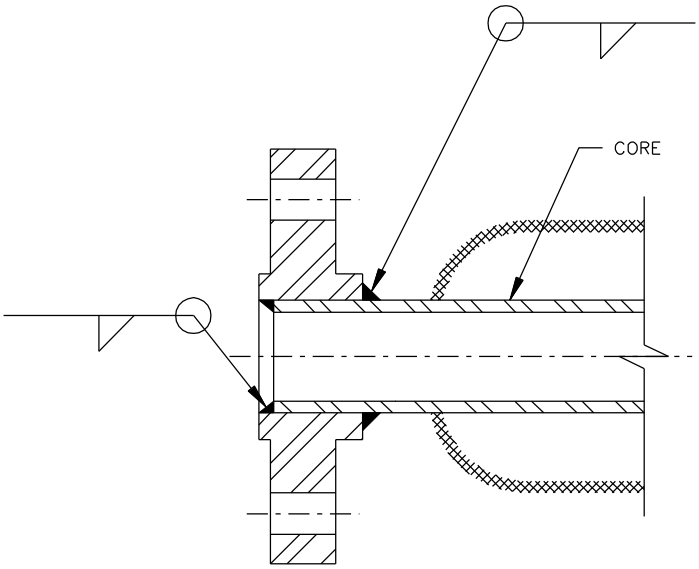
PIP PNFJ8000

SLIP-ON FLANGE, FACE FILLET WELD



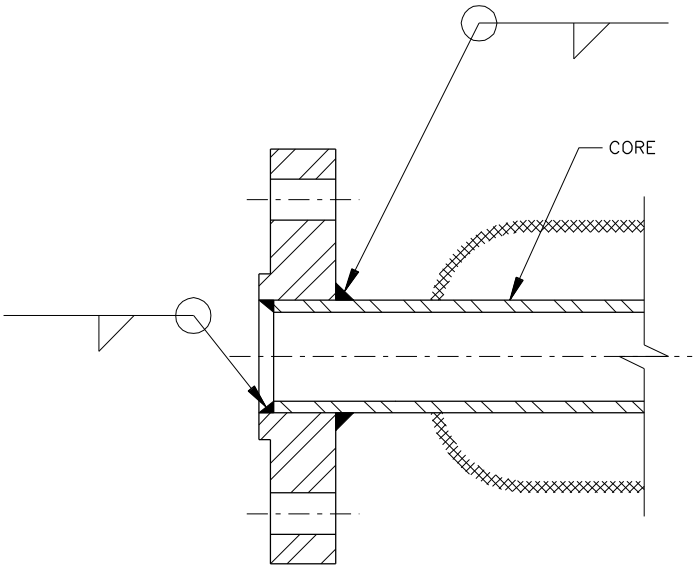
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

SWAGED JACKET FLANGE ATTACHMENT
SJFA-5

PNF J8160
ISSUED: MAY 2007
REAFFIRMED: NA
PAGE 1 OF 1
PIP PNFJ8000

PLATE/BLIND FLANGE



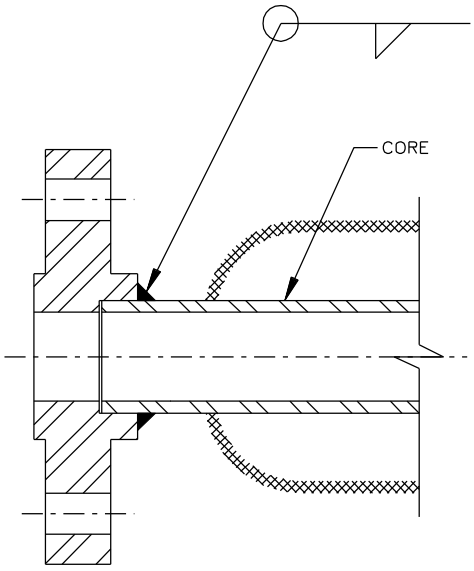
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.

SWAGED JACKET FLANGE ATTACHMENT
SJFA-6

PNF J8170
ISSUED: MAY 2007
REAFFIRMED: NA
PAGE 1 OF 1
PIP PNFJ8000

SOCKET WELD FLANGE



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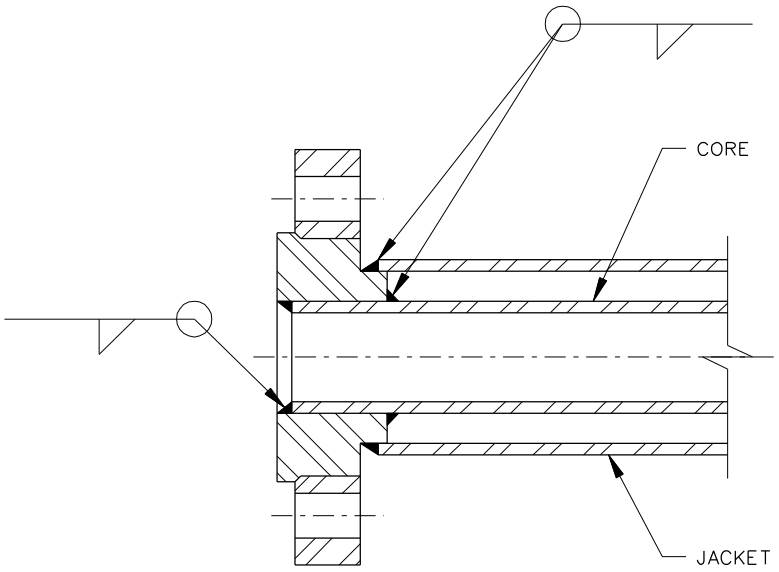
FULL JACKET TERMINATION
FJT-1

PNF J8220
ISSUED: MAY 2001
REAFFIRMED: MAY 2007
PAGE 1 OF 1
PIP PNFJ8000

CORE SIZE INSERT SLIP-ON FLANGE



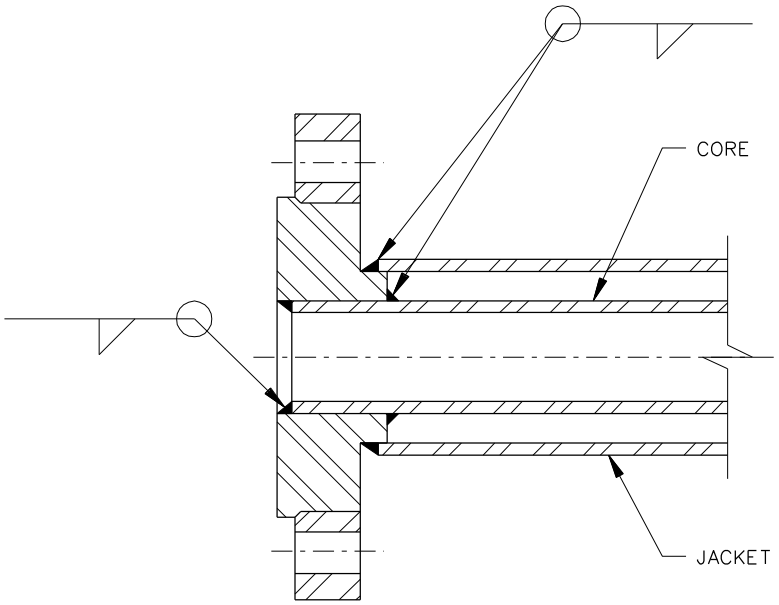
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. INSERT MATERIAL TO MATCH CORE PIPE
3. FLANGE MATERIAL - ASTM A105 CS

FULL JACKET TERMINATION
FJT-2

PNF J8230
ISSUED: MAY 2001
REAFFIRMED: MAY 2007
PAGE 1 OF 1
PIP PNFJ8000

JACKET SIZE INSERT SLIP-ON FLANGE



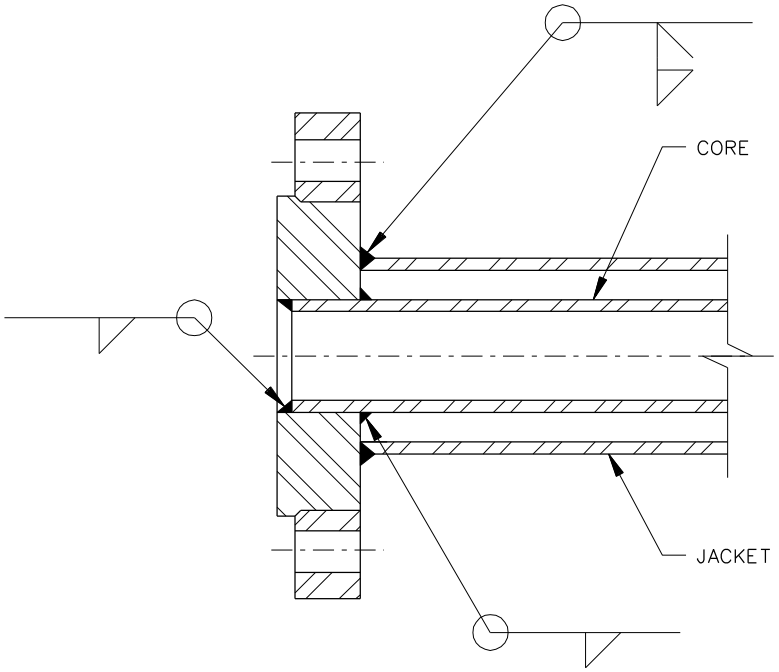
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. INSERT MATERIAL TO MATCH CORE PIPE
3. FLANGE MATERIAL - ASTM A105 CS

FULL JACKET TERMINATION
FJT-3

PNFJ8240
ISSUED: MAY 2007
REAFFIRMED: NA
PAGE 1 OF 1
PIP PNFJ8000

JACKET SIZE SLIP-ON FLANGE



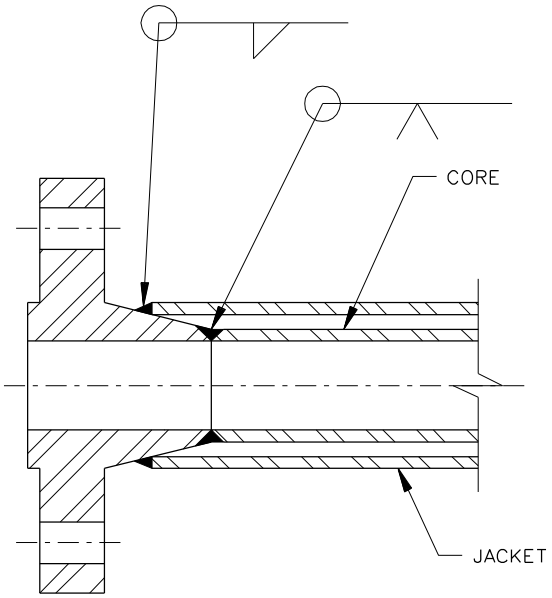
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.
3. INSERT MATERIAL TO MATCH CORE PIPE
4. FLANGE MATERIAL - ASTM A105 CS

FULL JACKET TERMINATION
FJT-4

PNF J8250
ISSUED: MAY 2007
REAFFIRMED: NA
PAGE 1 OF 1
PIP PNFJ8000

REDUCING (JACKET SIZE) WELD NECK FLANGE



NOTES:

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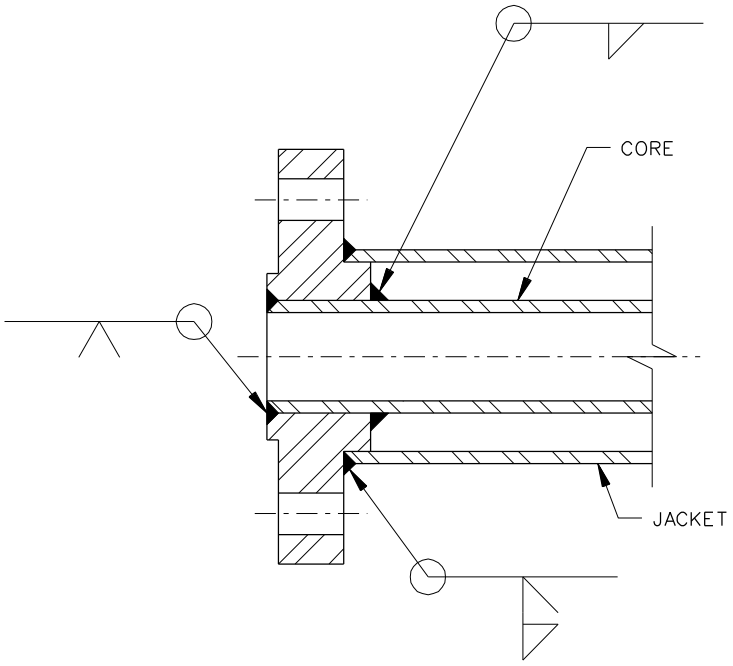
FULL JACKET TERMINATION
FJT-5

PNFJ8260
ISSUED: MAY 2007
REAFFIRMED: NA
PAGE 1 OF 1
PIP PNFJ8000

REDUCING (JACKET SIZE) SLIP-ON FLANGE, FACE GROOVE WELD



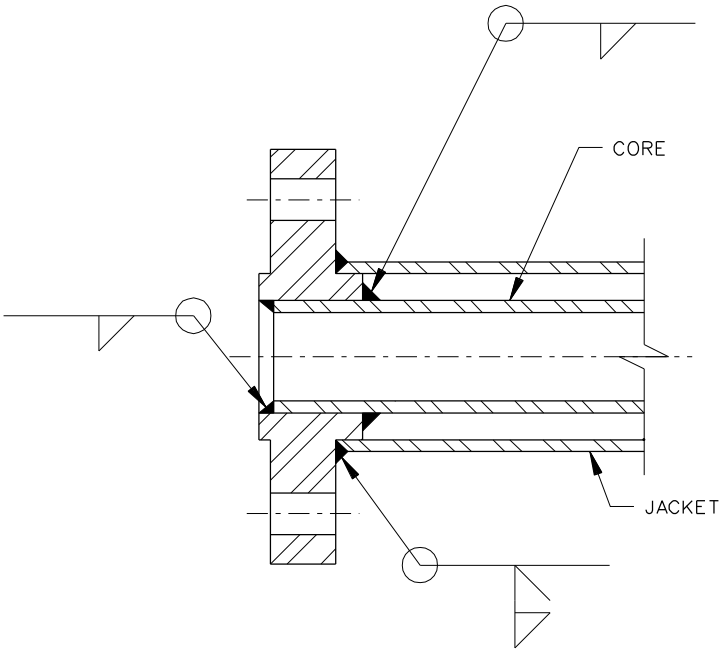
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.

FULL JACKET TERMINATION
FJT-6

PNF J8270
ISSUED: MAY 2007
REAFFIRMED: NA
PAGE 1 OF 1
PIP PNFJ8000

REDUCING (JACKET SIZE) SLIP-ON FLANGE, FACE FILLET WELD



NOTES:

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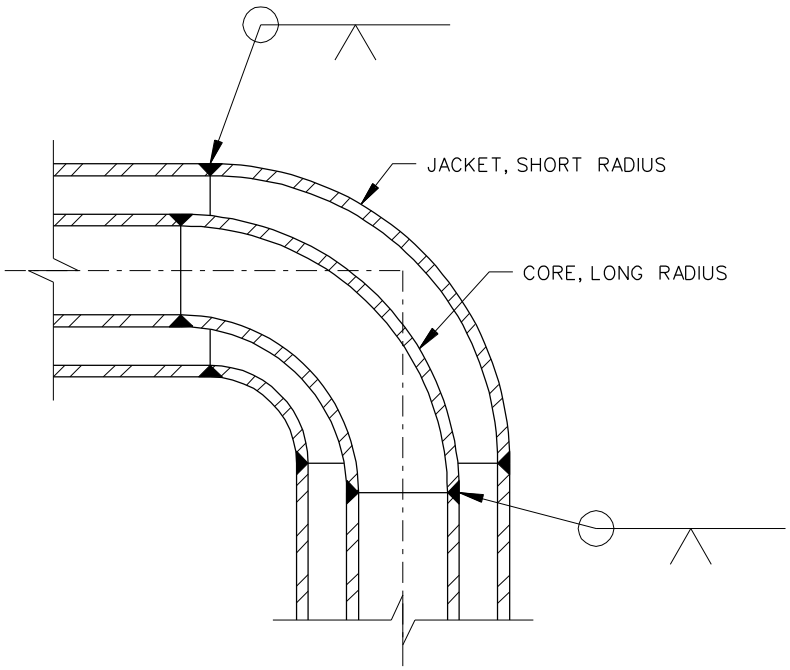
JACKETED ELBOWS, 90 DEGREE
JE-1

PNF J8320
ISSUED: MAY 2007
REAFFIRMED: NA
PAGE 1 OF 1
PIP PNFJ8000

STANDARD LR/SR COMBINATIONS
SIZES 1"x2" THROUGH 6"x8"



NOTES:

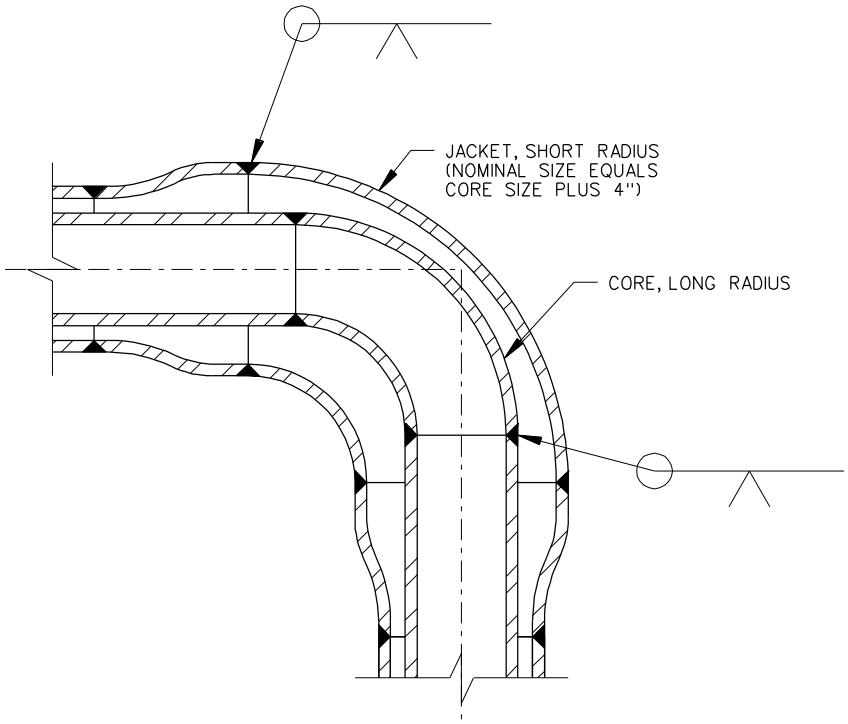
1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

JACKETED ELBOWS, 90 DEGREE
JE-2

PNF J8330
ISSUED: MAY 2001
REAFFIRMED: MAY 2007

PIP PNFJ8000

STANDARD SR/LR COMBINATION
SIZES 8"x12" AND LARGER



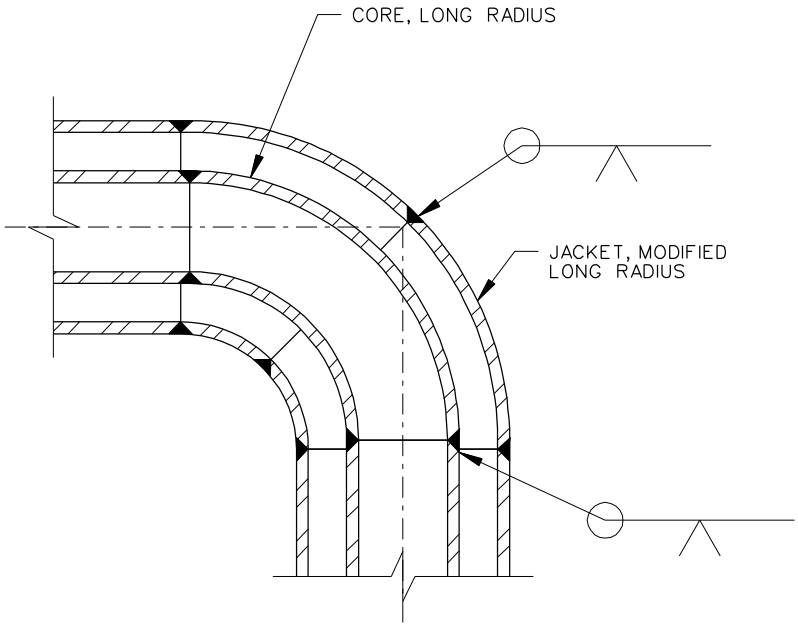
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

JACKETED ELBOWS, 90 DEGREE
JE-3

PNF J8340
ISSUED: MAY 2007
REAFFIRMED: NA
PAGE 1 OF 1
PIP PNFJ8000

MITERED ELBOW, DETAIL A



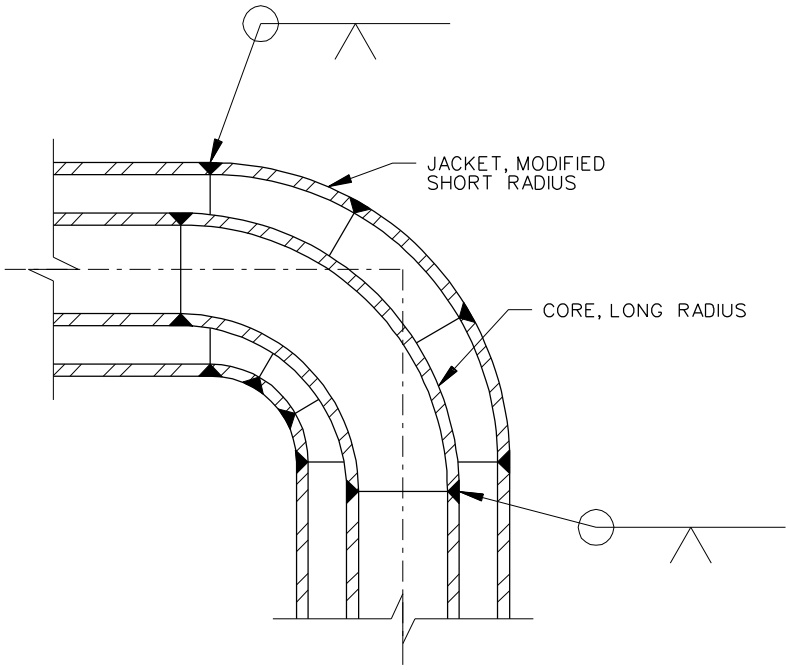
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.

JACKETED ELBOWS, 90 DEGREE
JE-4

PNF J8350
ISSUED: MAY 2007
REAFFIRMED: NA
PAGE 1 OF 1
PIP PNFJ8000

MITERED ELBOW, DETAIL B



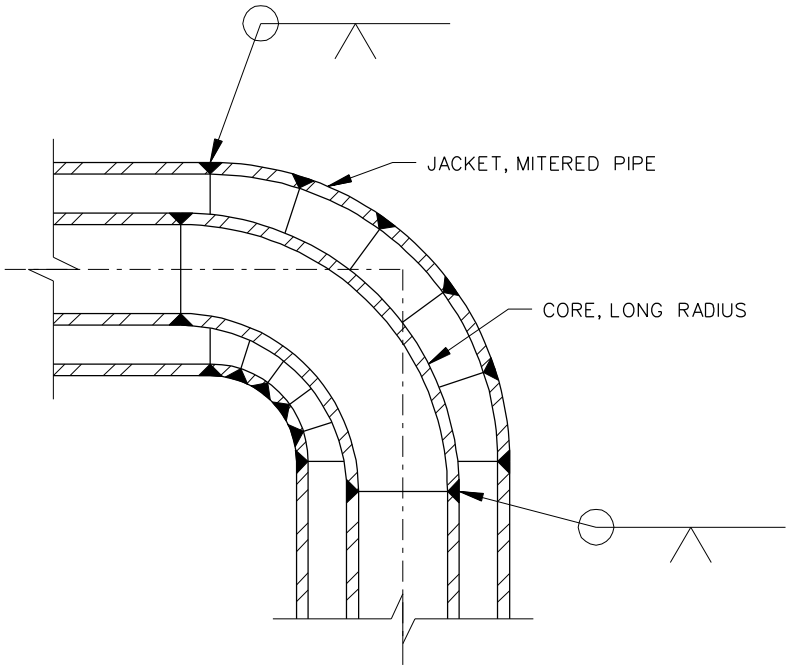
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.

JACKETED ELBOWS, 90 DEGREE
JE-5

PNF J8360
ISSUED: MAY 2007
REAFFIRMED: NA
PAGE 1 OF 1
PIP PNFJ8000

MITERED ELBOW, DETAIL C
SIZES 10''x12'' AND LARGER



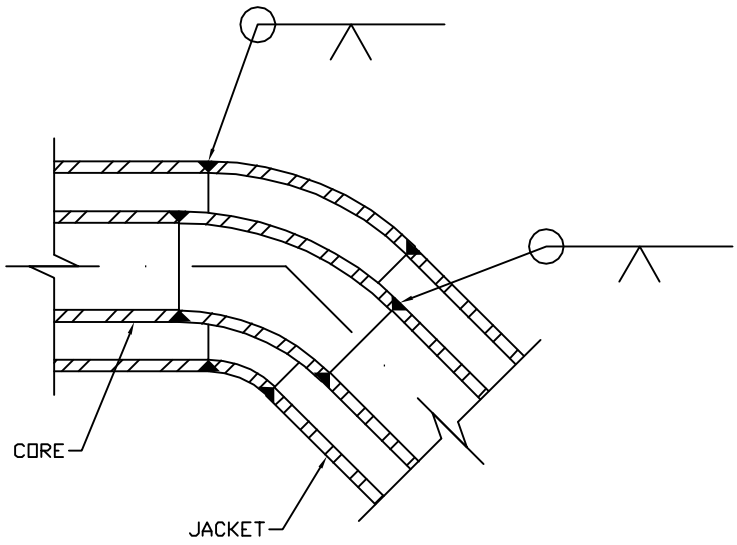
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.

JACKETED ELBOWS, 45 DEGREE
JE-6

PNF J8420
ISSUED: MAY 2001
REAFFIRMED: TBD
PAGE 1 OF 1
PIP PNFJ8000

STANDARD CONSTRUCTION



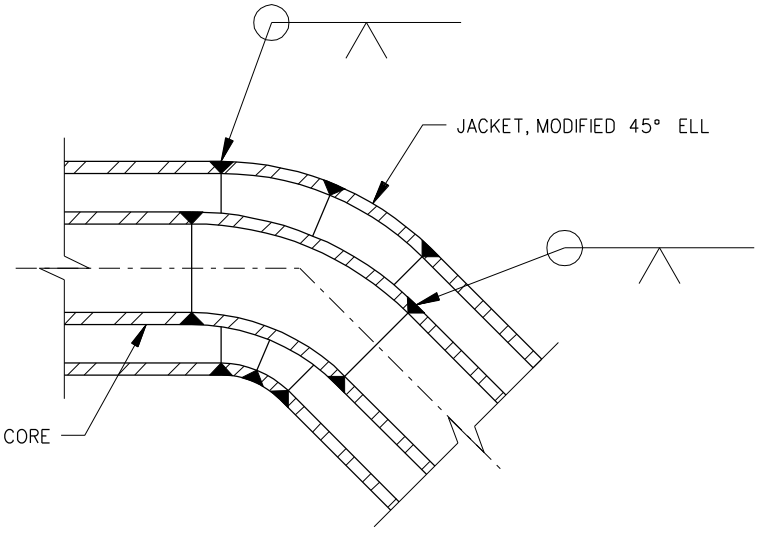
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

JACKETED ELBOWS, 45 DEGREE
JE-7

PNF J8430
ISSUED: MAY 2007
REAFFIRMED: NA
PAGE 1 OF 1
PIP PNFJ8000

MITERED CONSTRUCTION



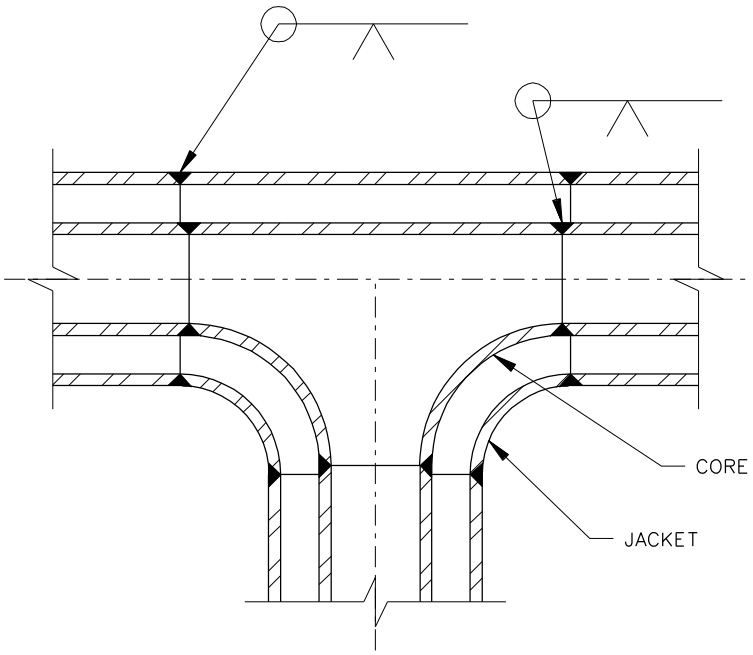
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.

JACKETED TEES, CROSSES AND REDUCERS
JT-1

PNF J8520
ISSUED: MAY 2001
REAFFIRMED: MAY 2007
PAGE 1 OF 1
PIP PNFJ8000

STRAIGHT TEE



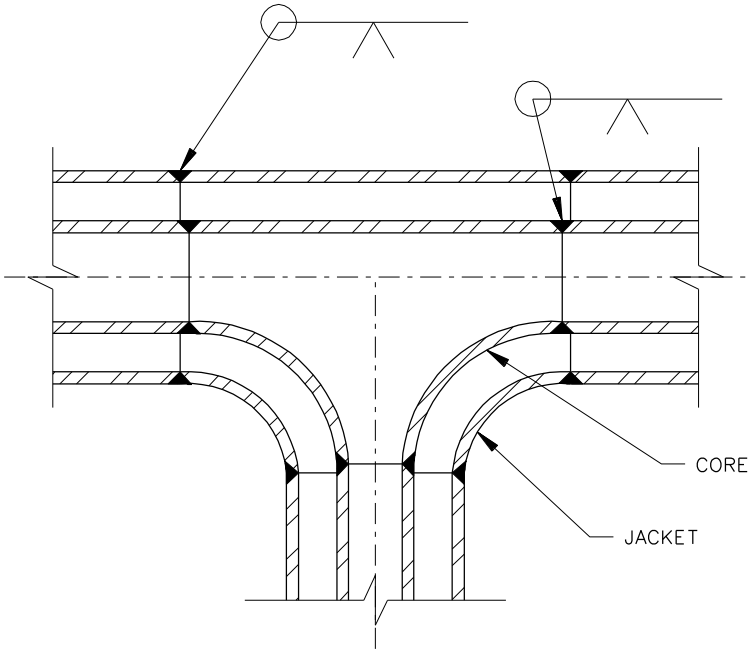
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

JACKETED TEES, CROSSES AND REDUCERS
RT-1

PNF J8530
ISSUED: MAY 2001
REAFFIRMED: MAY 2007
PAGE 1 OF 1
PIP PNFJ8000

REDUCING TEE



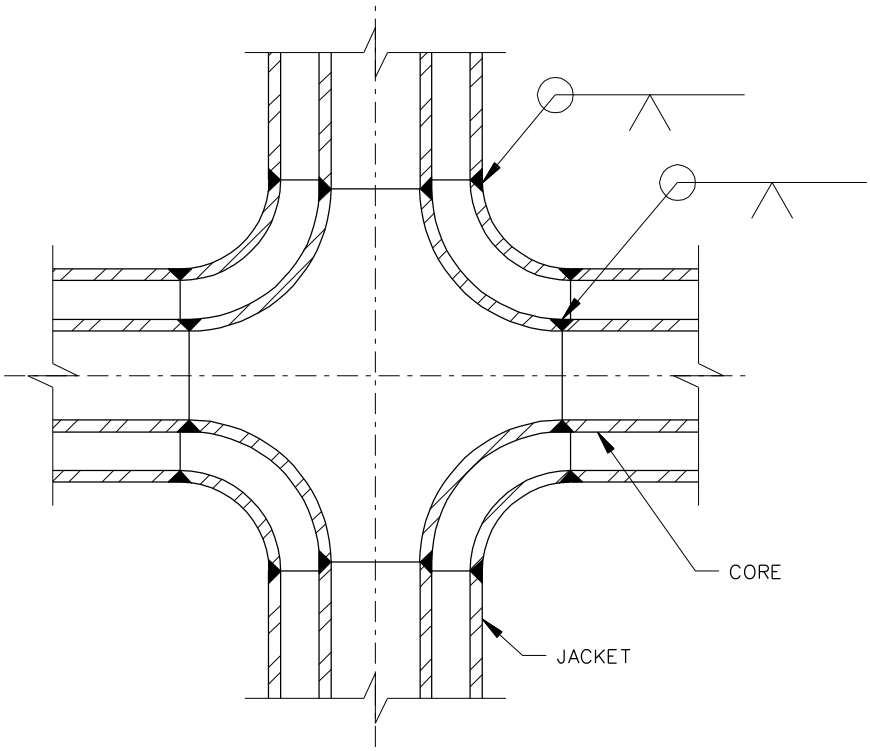
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

JACKETED TEES, CROSSES AND REDUCERS
CR-1

PNF J8540
ISSUED: MAY 2001
REAFFIRMED: MAY 2007
PAGE 1 OF 1
PIP PNFJ8000

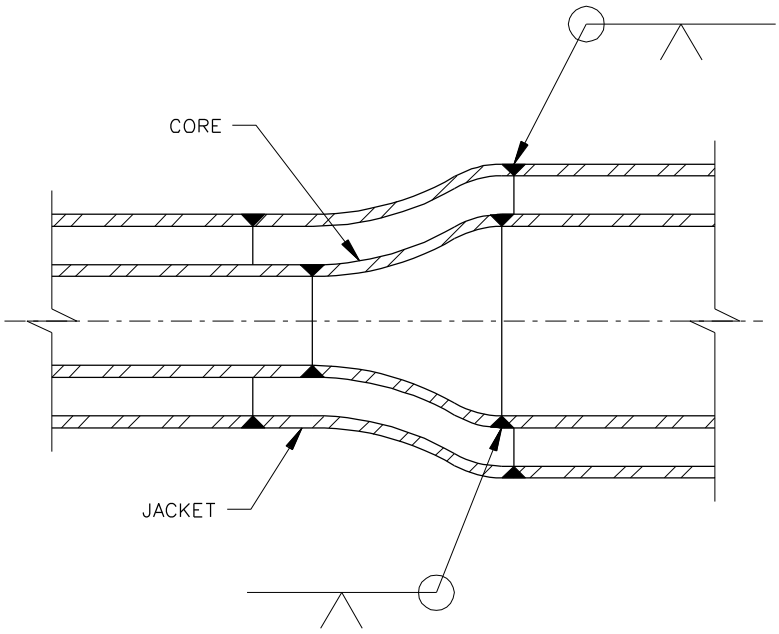
CROSS



NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.

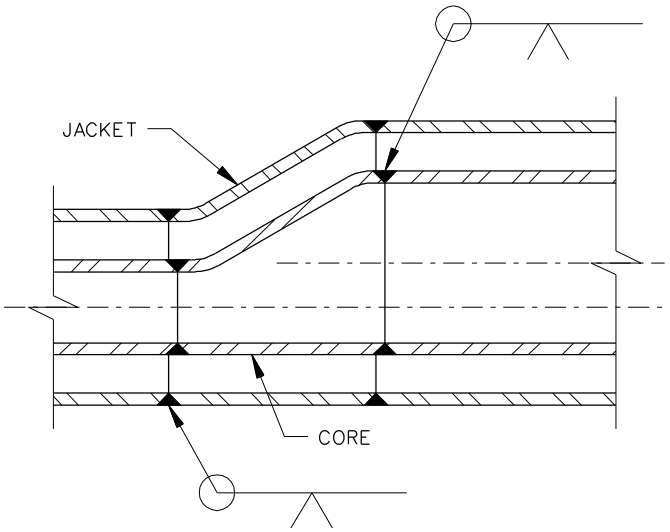
CONCENTRIC REDUCER



NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

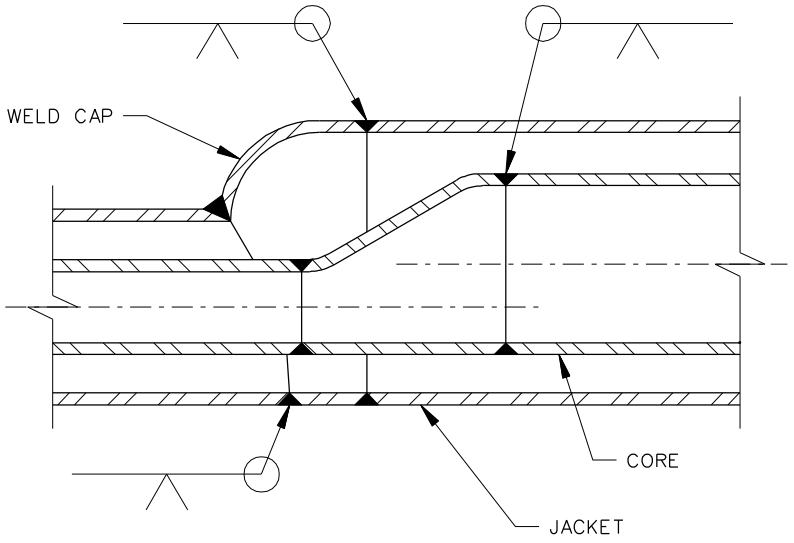
ECCENTRIC REDUCER



NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

ALTERNATE DESIGN FOR ECCENTRIC REDUCERS



NOTES:

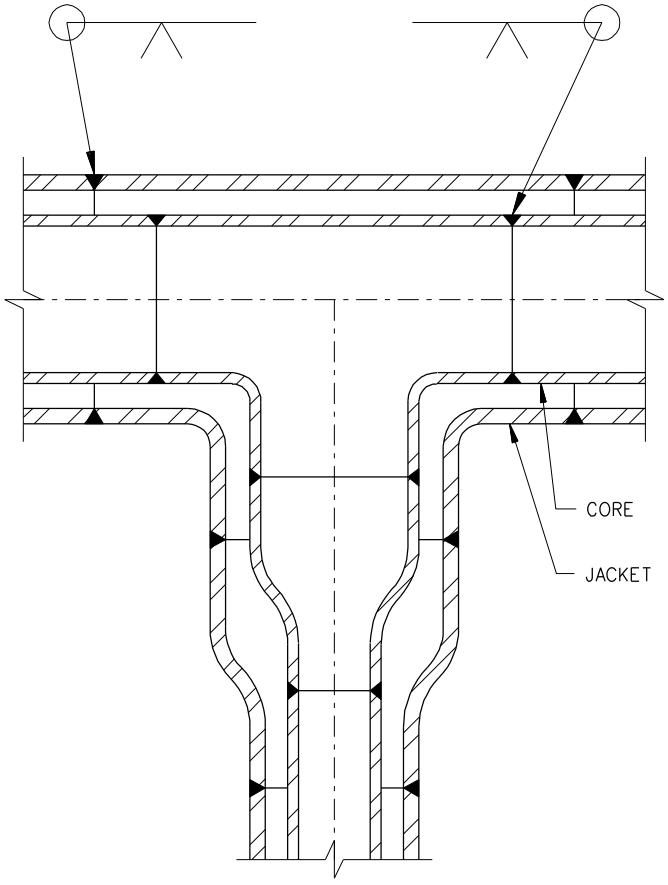
1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.
3. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.

JACKETED TEES, CROSSES AND REDUCERS
TR-1

PNF J8580
ISSUED: MAY 2001
REAFFIRMED: MAY 2007

PIP PNFJ8000

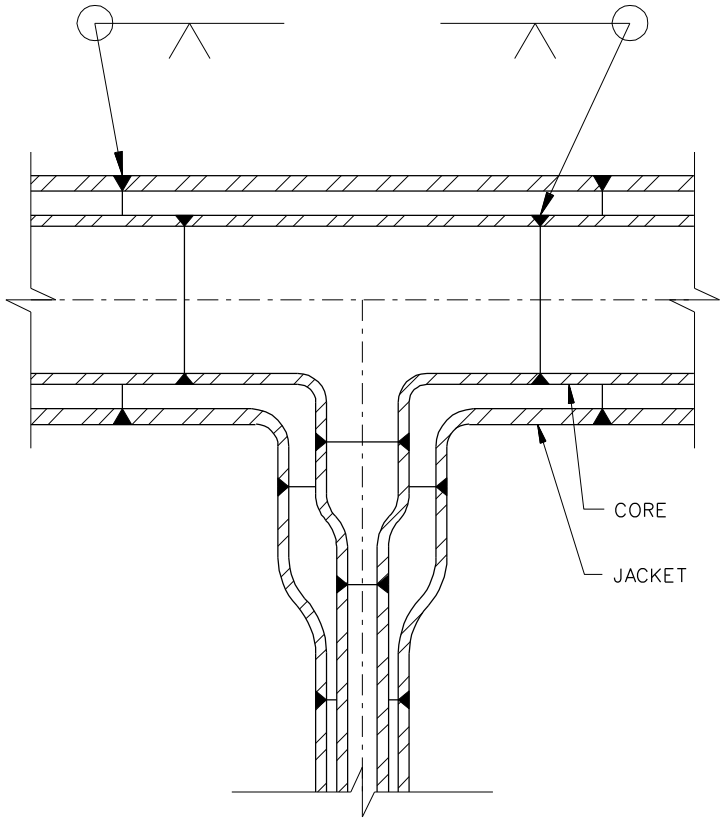
STRAIGHT TEE AND REDUCER



NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

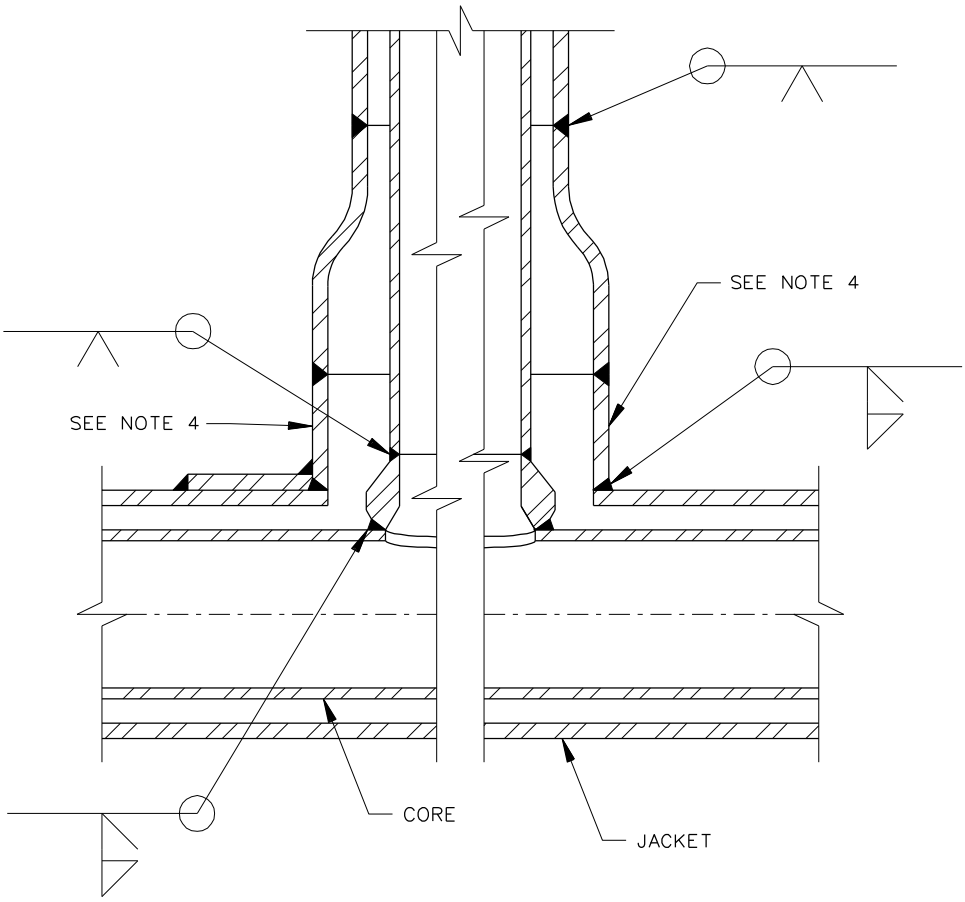
REDUCING TEE AND REDUCER



NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

CORE PIPING WITH INTEGRALLY REINFORCED BRANCH CONNECTION AND JACKET WITH CONCENTRIC REDUCER



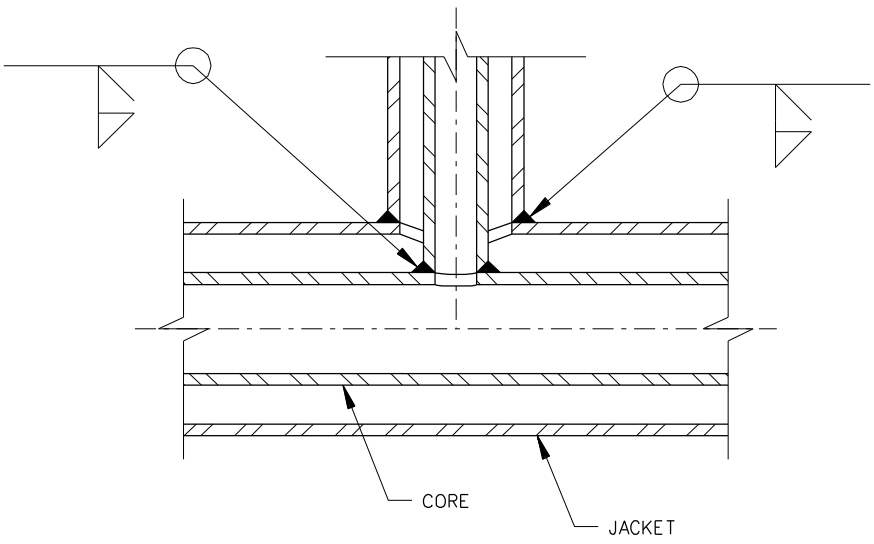
(A)
WITH REINFORCING PAD

(B)
WITHOUT REINFORCING PAD

NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.
3. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.
4. INCREASE BRANCH JACKET SIZE 1 OR 2 NPS SIZES LARGER THAN CORE BRANCH. SEE BRANCH CONNECTION CHART IN PIPING MATERIAL SPECIFICATION LINE CLASS.

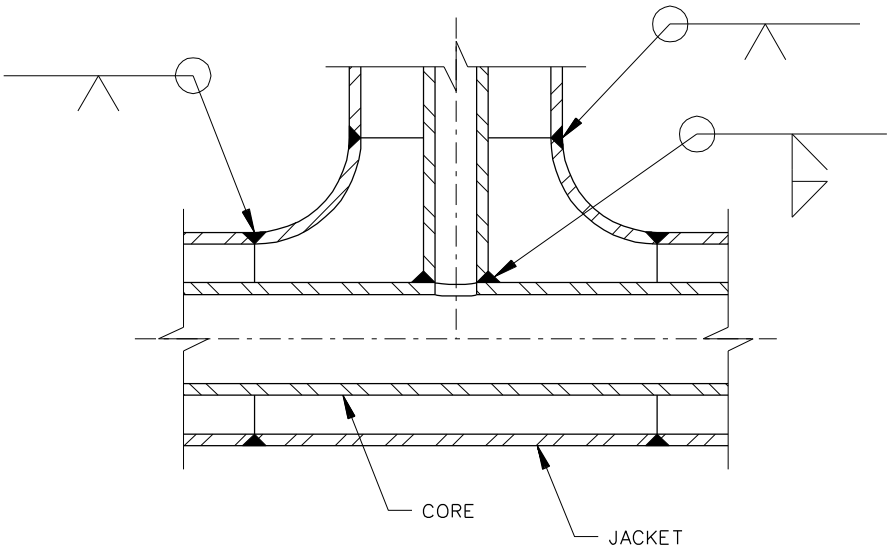
CORE AND JACKET PIPING SADDLE-ON



NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.

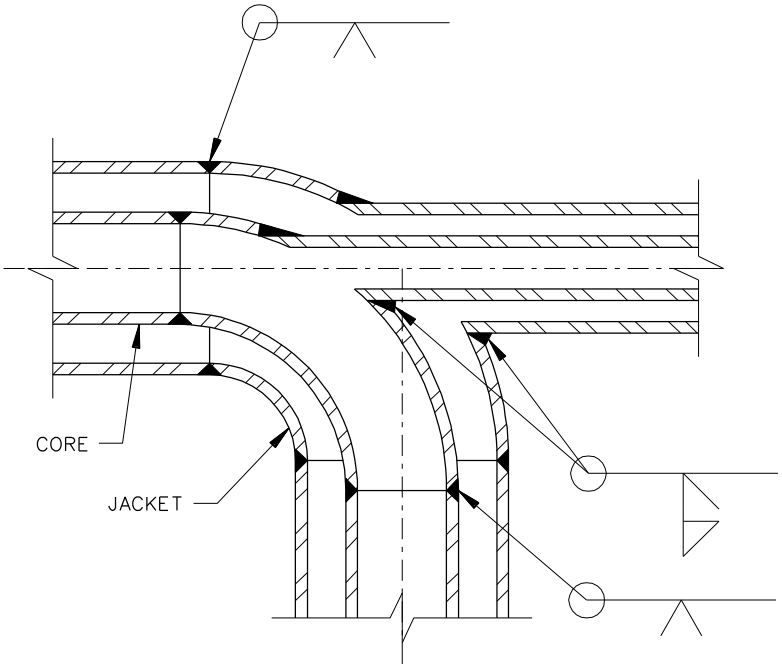
CORE PIPING SADDLE-ON WITH STANDARD TEE JACKET



NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.

PIPING STAB-IN ON HEEL OF CORE AND JACKET ELBOW



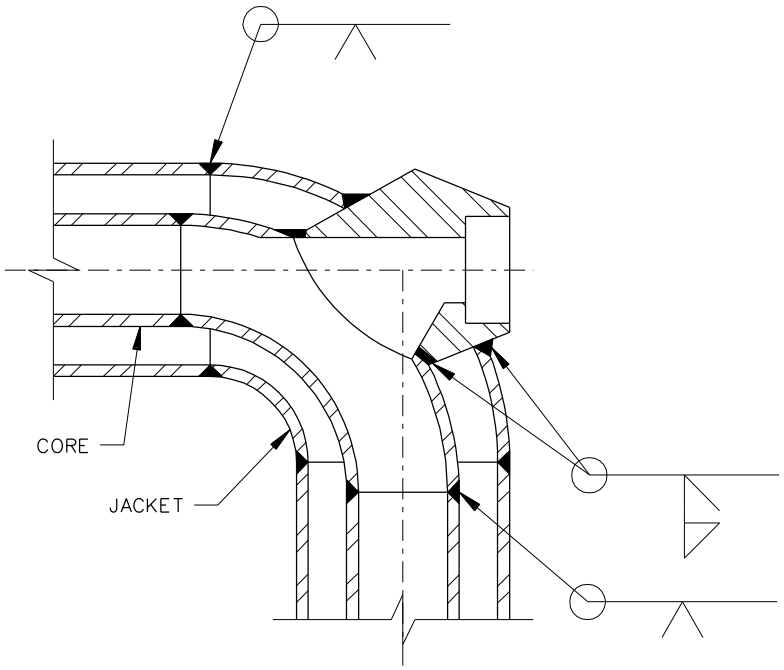
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.

CORE TAPS & CONNECTIONS
SWE-1

PNF J8650
ISSUED: MAY 2007
REAFFIRMED: NA

SOCKET WELD ELBOLETT*

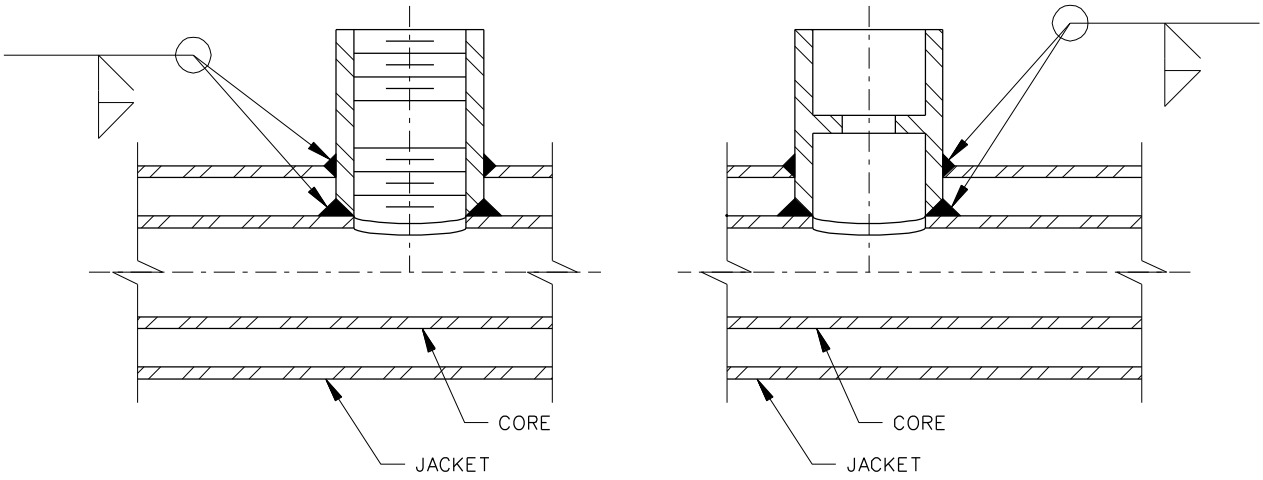


NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.
3. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.

* = TRADEMARK

FULL COUPLING (THREADED OR SOCKET WELD)



(A)
THREADED FULL COUPLING

(B)
SOCKET WELD COUPLING

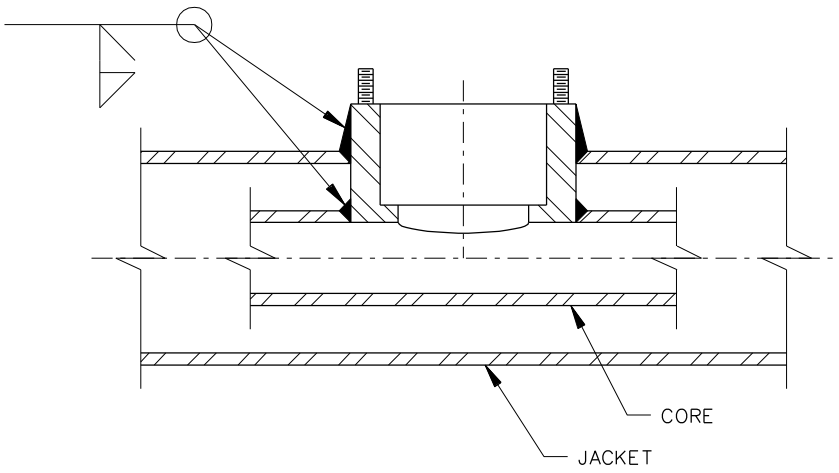
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.
3. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.

CORE TAPS & CONNECTIONS
RD-1

PNF J8670
ISSUED: MAY 2001
REAFFIRMED: MAY 2007
PAGE 1 OF 1
PIP PNFJ8000

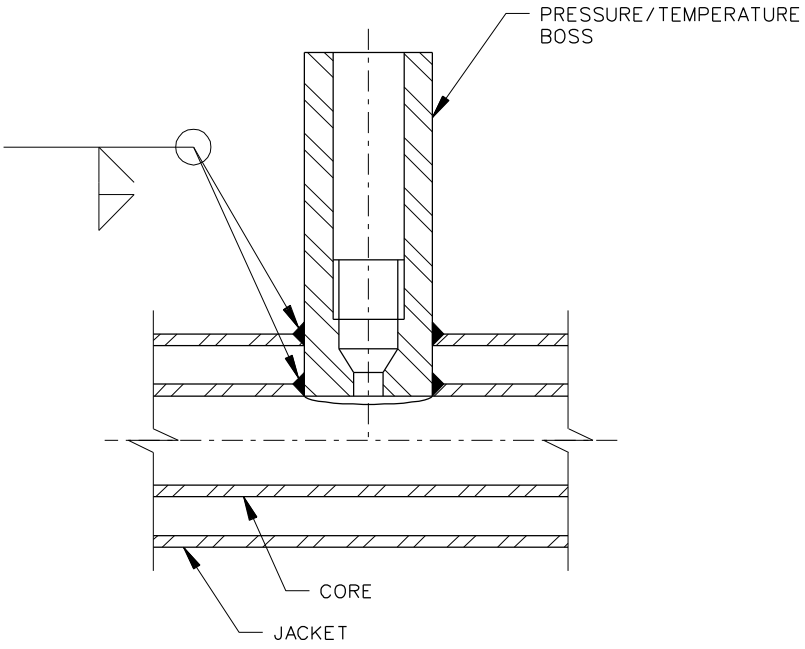
RUPTURE DISC/PRESSURE TRANSDUCER SADDLED ONTO CORE



NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.

CORE TAP



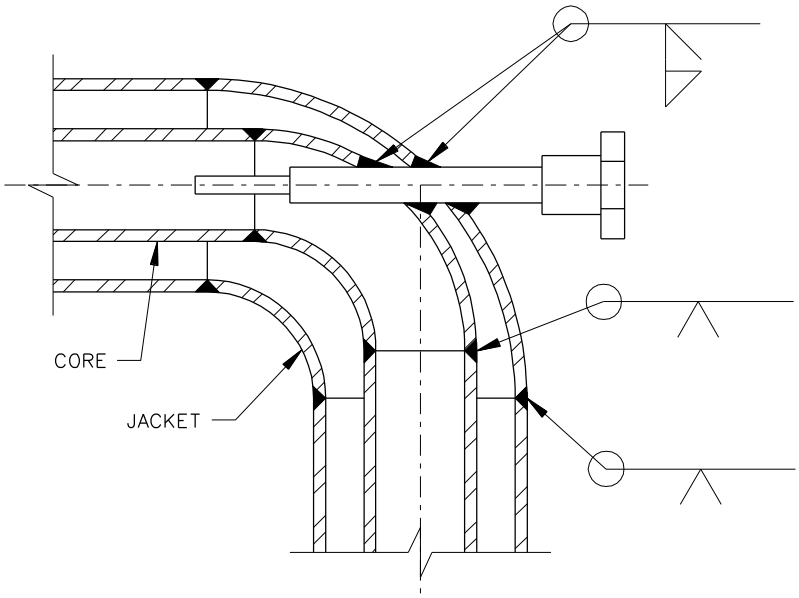
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.
3. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.

CORE TAPS & CONNECTIONS
TWE-1

PNF J8690
ISSUED: MAY 2007
REAFFIRMED: NA
PAGE 1 OF 1
PIP PNFJ8000

THERMOWELL ON CORE ELBOW



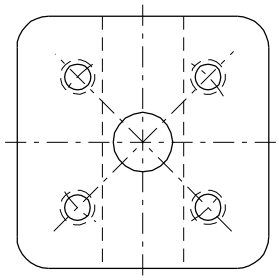
NOTES:

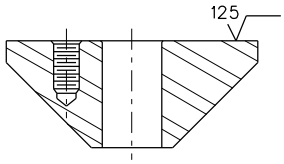
1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.
3. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.

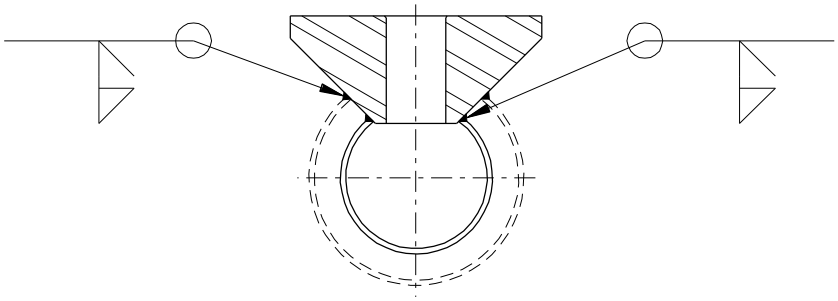
CORE TAPS & CONNECTIONS
PF-1

PNF J8700
ISSUED: MAY 2001
REAFFIRMED: MAY 2007
PAGE 1 OF 1
PIP PNFJ8000

PAD FLANGE







MOUNTING DETAIL

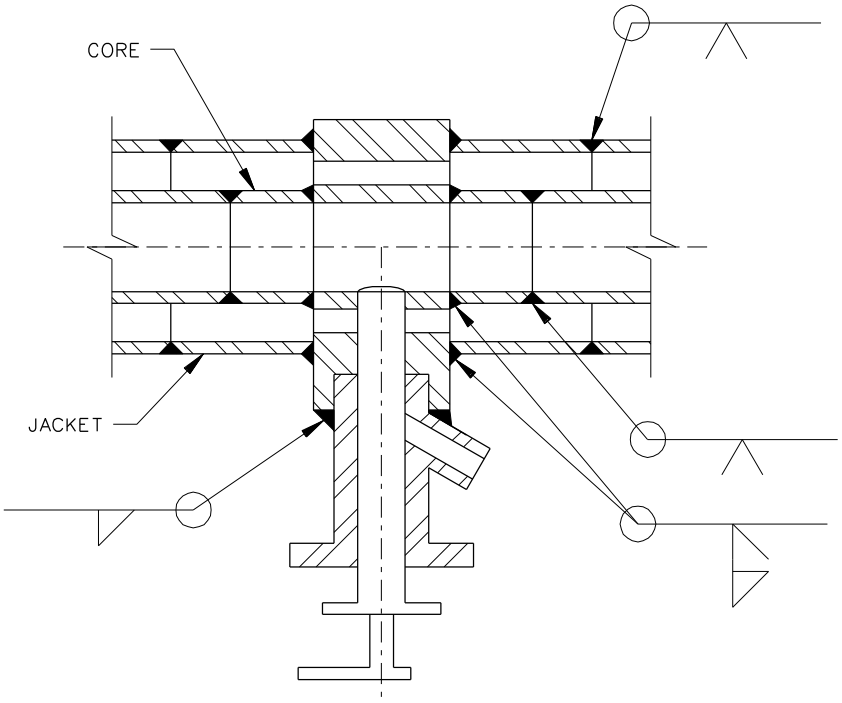
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.
3. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.

WELD-IN VALVES
DSV-1

PNF J8720
ISSUED: MAY 2001
REAFFIRMED: MAY 2007
PAGE 1 OF 1
PIP PNFJ8000

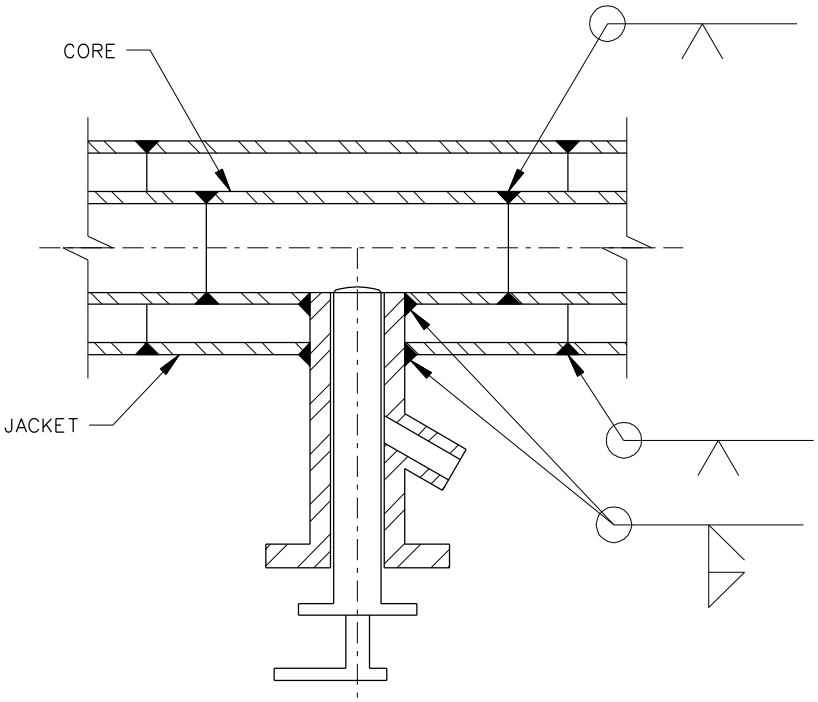
FLOW-THROUGH DRAIN/SAMPLING VALVE



NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

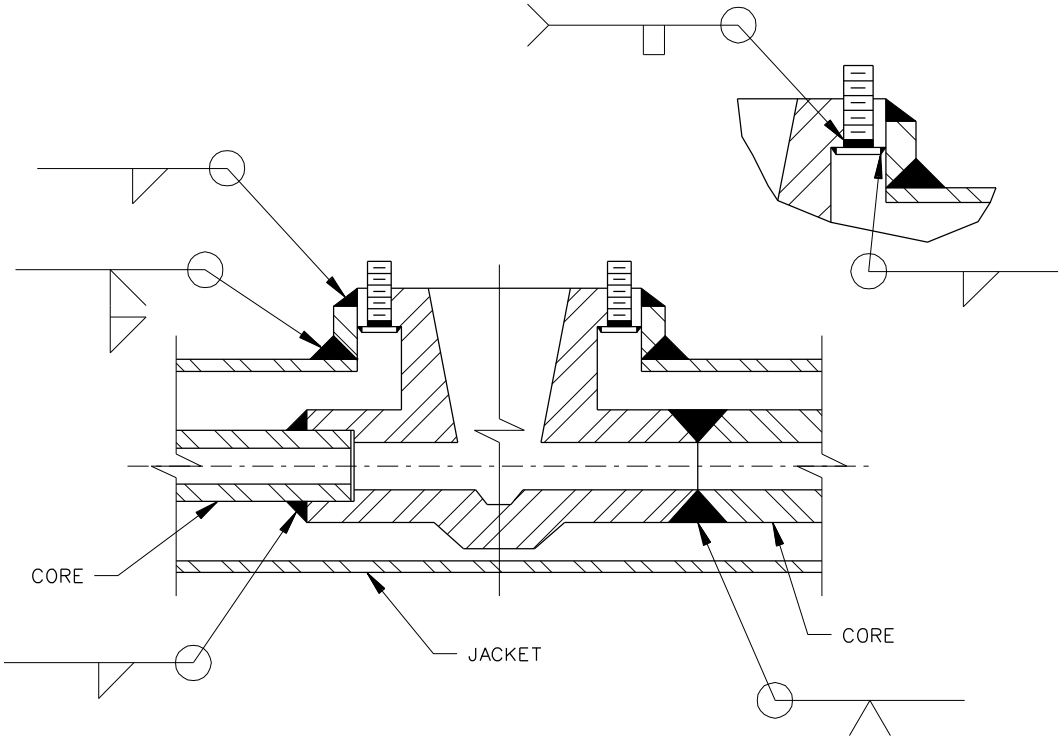
STAB-IN DRAIN/SAMPLING VALVE



NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.

IN-LINE SOCKET WELD OR BUTT WELD VALVE



(A) SOCKET WELD

(B) BUTT WELD

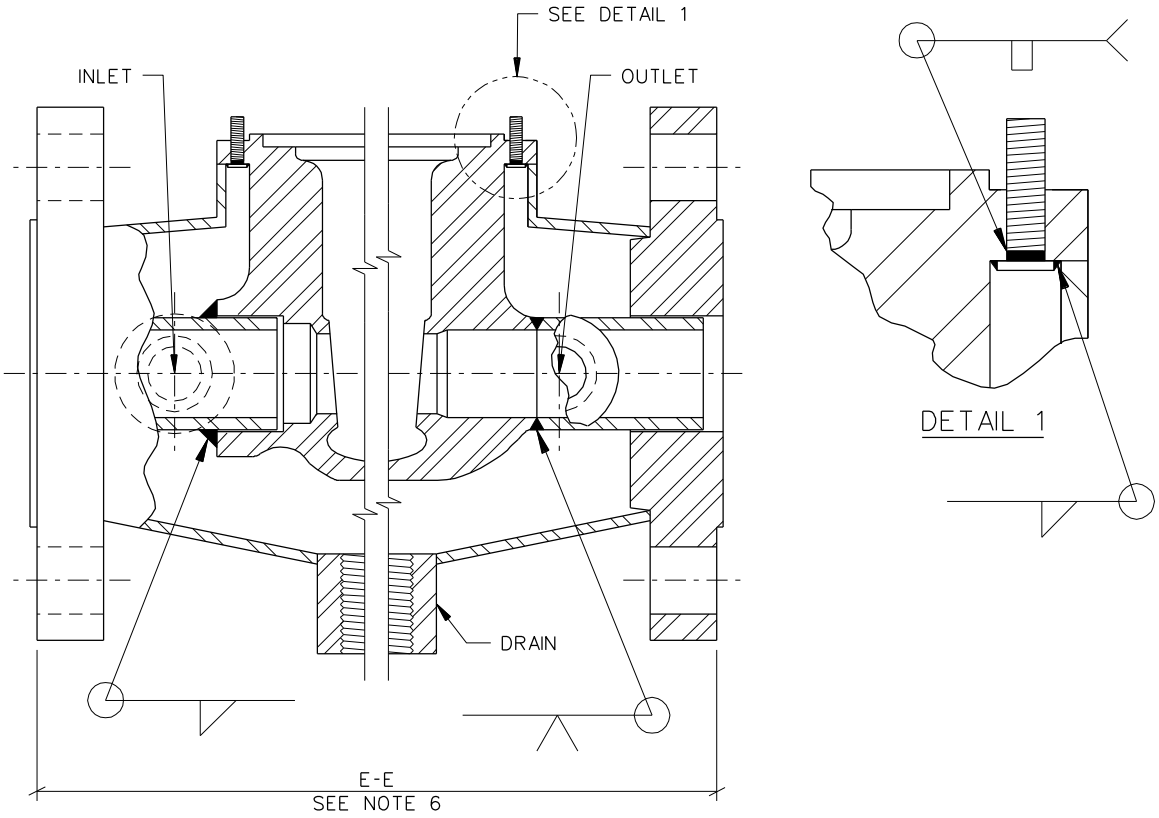
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.

WELD-ON JACKETED VALVES
SJV-1

PNF J8750
ISSUED: MAY 2007
REAFFIRMED: NA
PAGE 1 OF 1
PIP PNFJ8000

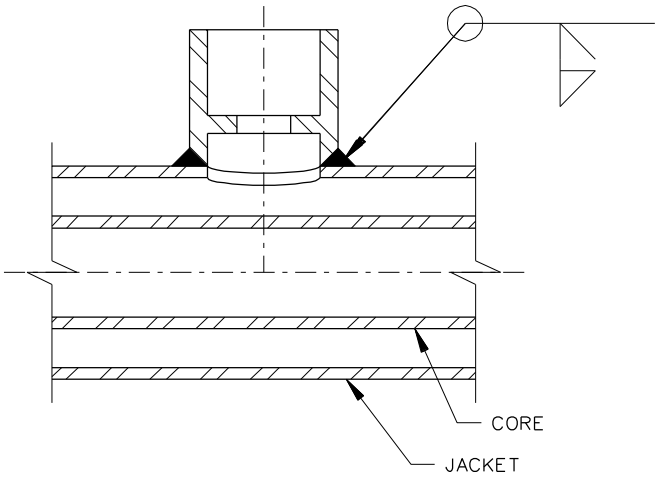
TYPICAL SOCKET WELD OR BUTT WELD VALVE WITH STEAM JACKET



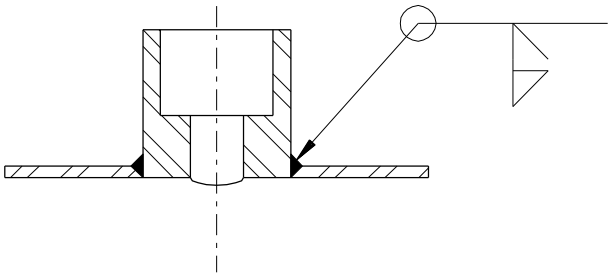
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.
3. BOLT-ON BONNET JACKET 4" AND LARGER VALVE ONLY.
4. BASE VALVE TO BE SOCKET WELD 1/2" THRU 2" NPS. BUTT WELD FOR VALVES GREATER THAN 2" NPS. SCHEDULE TO MATCH PIPE.
5. OVERSIZED FLANGES TO SUPPORT JACKET ARE TO BE MADE FROM UNBORED SLIP-ON (HIGH HUB BLIND) FLANGES.
6. E-E DIMENSION, PER ANSI B16.10 SHORT PATTERN, BASED ON VALVE OF THE LARGER FLANGE SIZE.
7. JACKETS SHALL BE DESIGNED AND FABRICATED WITH FULL PENETRATION WELDS PER CRITERIA OF ASME, SECTION VIII, DIVISION 1.
8. BODY JACKET TO HAVE THREE THREADED 3/4" NPT COUPLING CONNECTIONS. ONE ON EACH SIDE AND ONE ON THE BOTTOM. BONNET JACKET ON 4" AND LARGER VALVE ONLY, TO HAVE TWO THREADED 3/4" NPT COUPLING CONNECTIONS. ONE ON EACH SIDE.
9. JACKET TO HAVE HYDROSTATIC LEAK TEST DETERMINED BY THE OWNER.
10. LIABILITY FOR VALVE IS THE JACKETER'S RESPONSIBILITY.

STANDARD CLASS 3000 SOCKET WELD COUPLINGS



(A)
FULL COUPLING

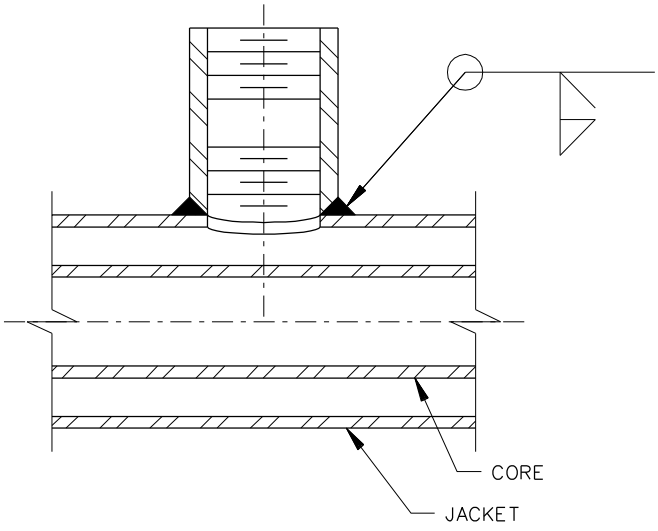


(B)
HALF COUPLING

NOTES:

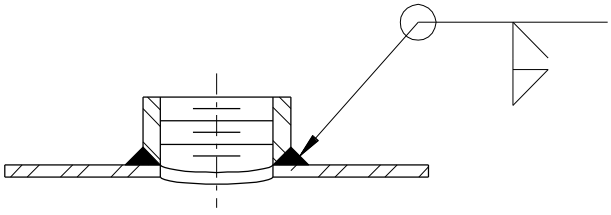
1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

STANDARD CLASS 3000 THREADED COUPLINGS



(A)

FULL COUPLING



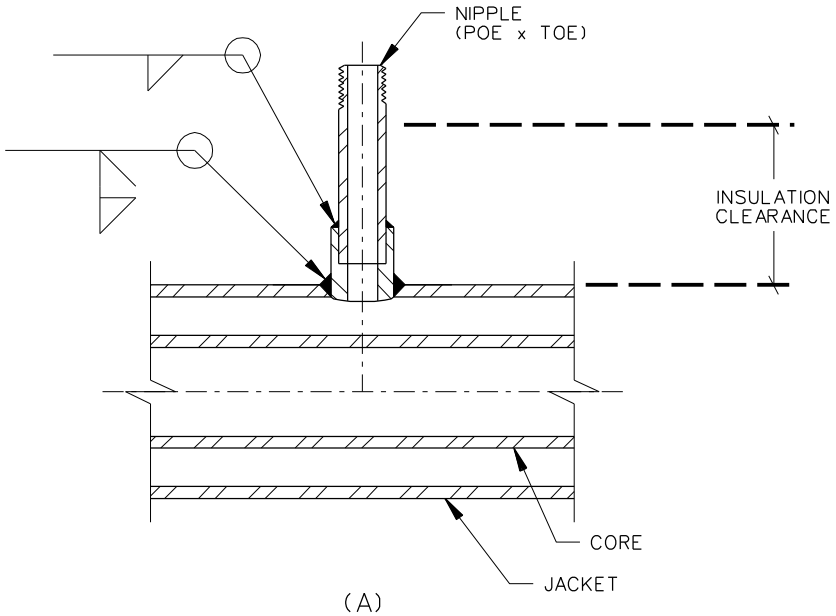
(B)

HALF COUPLING

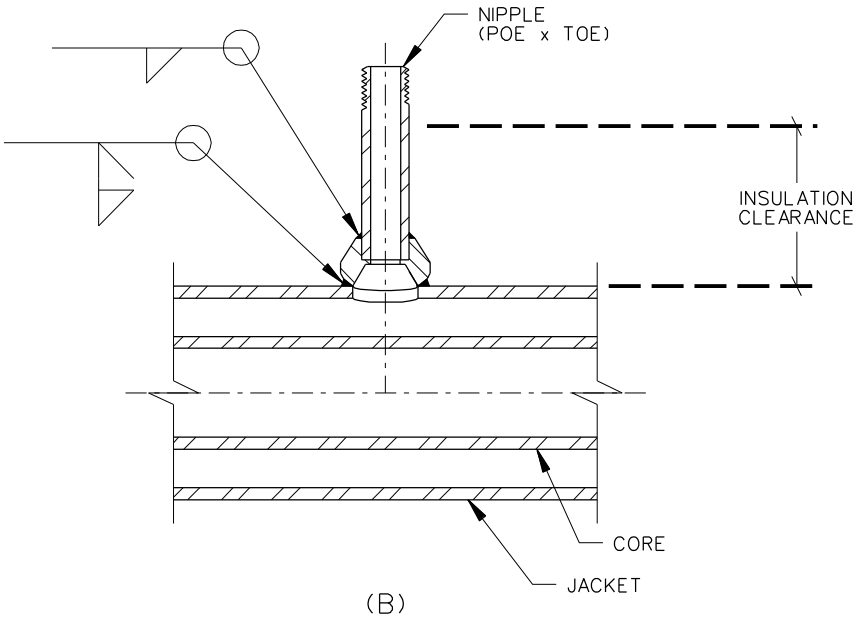
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.

JACKET EXTENSION WITH HALF COUPLING OR SOCKOLET



(A)
HALF COUPLING



(B)
SOCKOLET

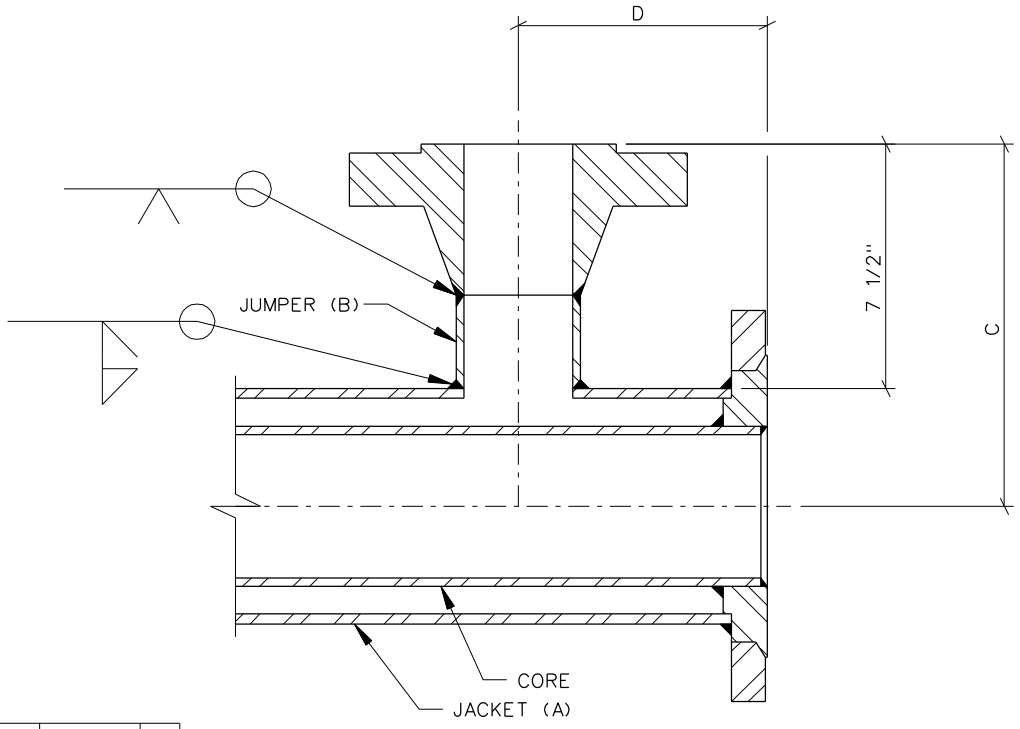
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

JACKET HEATING MEDIA CONNECTIONS
JEF-1

PNF J8850
ISSUED: MAY 2007
REAFFIRMED: NA

JACKET EXTENSION WITH FLANGE



JACKET "A" INCH	JUMPER "B" INCH	C INCH	D INCH
1	3/4	8 3/16	6
1 1/2	1	8 7/16	6
2	1 1/2	8 11/16	6
2 1/2	1 1/2	8 15/16	6
3	2	9 1/4	7
4	2	9 3/4	7
6	3	10 13/16	7
8	3	11 13/16	7
10	4	12 7/8	7
12	4	13 7/8	7
14	4	14 1/2	7

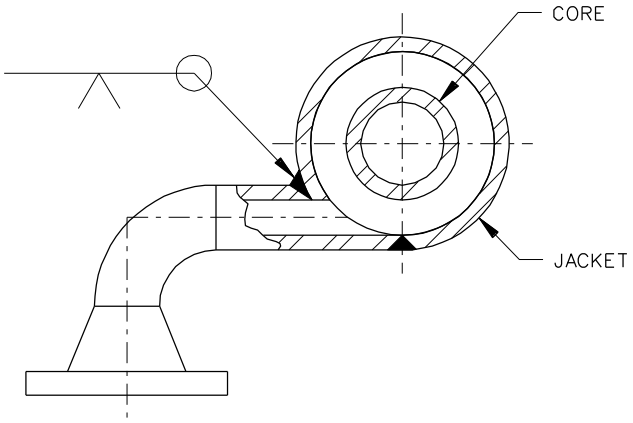
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. SEE BRANCH CONNECTION CHART IN PIPING MATERIAL SPECIFICATION LINE CLASS FOR JACKET BRANCH REINFORCEMENT REQUIREMENTS.

JACKET HEATING MEDIA CONNECTIONS
TN-1

PNF J8860
ISSUED: MAY 2001
REAFFIRMED: MAY 2007

TANGENTIAL NOZZLES



NOTES:

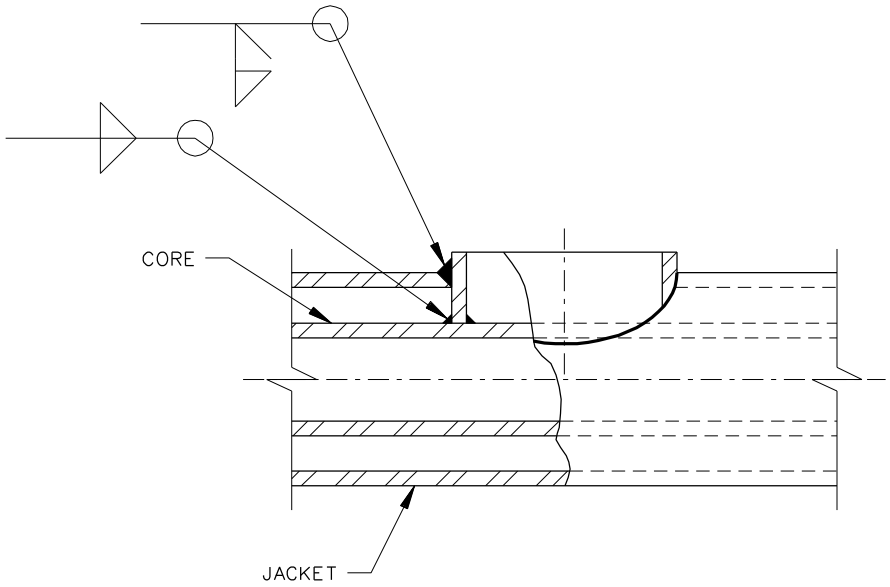
1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.
3. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.

JACKET WINDOW DETAILS
PW-1

PNF J8920
ISSUED: MAY 2001
REAFFIRMED: MAY 2007

PIP PNFJ8000

PIPE WINDOW



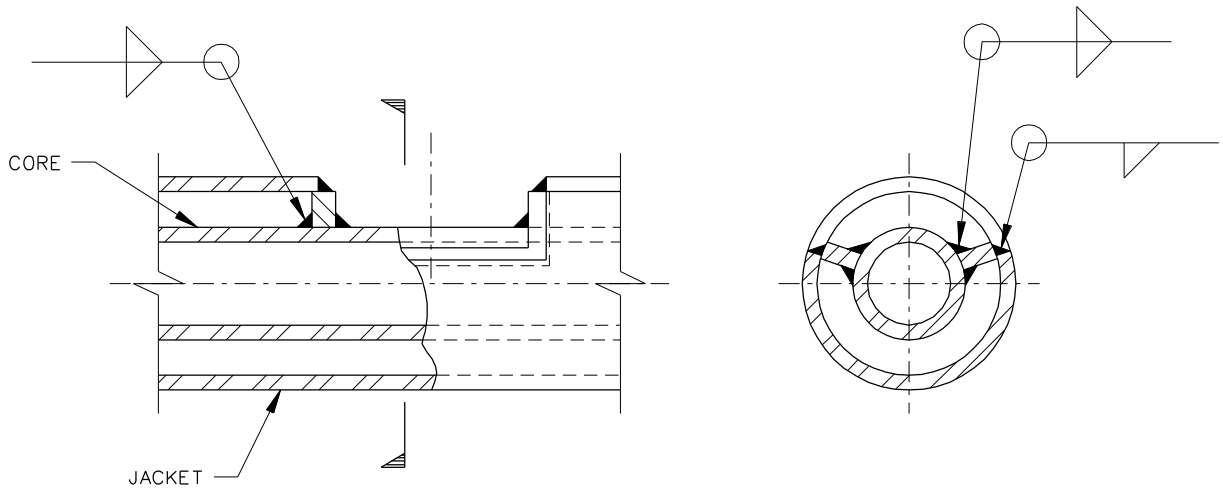
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.

JACKET WINDOW DETAILS
PW-2

PNF J8930
ISSUED: MAY 2001
REAFFIRMED: MAY 2007

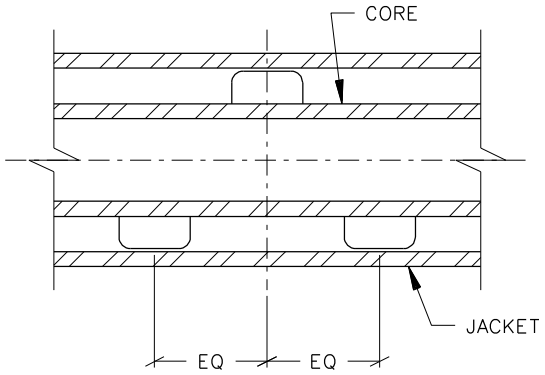
PLATE WINDOW

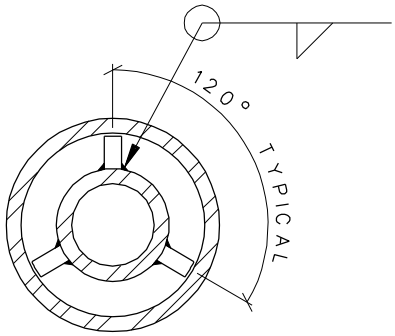


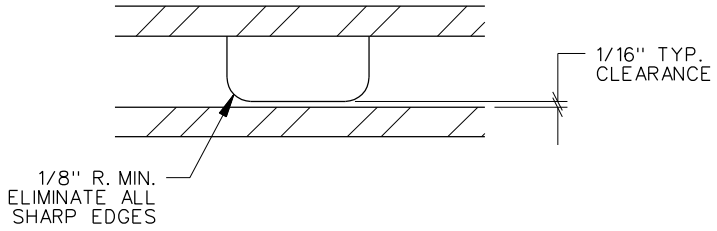
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. THIS DESIGN REQUIRES A REVIEW BY A PIPING FLEXIBILITY ANALYST PRIOR TO USE.

SPACER, TYPE A







SPACER SCHEDULE - INCHES			
CORE PIPE SIZE	JACKET PIPE SIZE	SPACER SIZE FOR SCH 10S JACKET (W X H X L)	SPACER SIZE FOR SCH 40S JACKET (W X H X L)
1/2	1	1/8 X 1/8 X 1	1/8 X 3/32 X 1
3/4	1 1/2	1/8 X 1/4 X 1	1/8 X 1/4 X 1
1	2	1/8 X 3/8 X 1	1/8 X 5/16 X 1
1 1/2	2 1/2	1/8 X 5/16 X 1	1/8 X 1/4 X 1
2	3	1/8 X 3/8 X 1	1/8 X 5/16 X 1
3	4	1/8 X 1/4 X 1	1/8 X 1/4 X 1
4	6	1/4 X 3/4 X 1 1/2	1/4 X 3/4 X 1 1/2
6	8	1/4 X 3/4 X 1 1/2	1/4 X 5/8 X 1 1/2
8	10	1/4 X 3/4 X 1 1/2	1/4 X 5/8 X 1 1/2
10	12	1/4 X 3/4 X 1 1/2	1/4 X 1/2 X 1 1/2
12	14	1/4 X 3/8 X 1 1/2	1/4 X 3/16 X 1 1/2

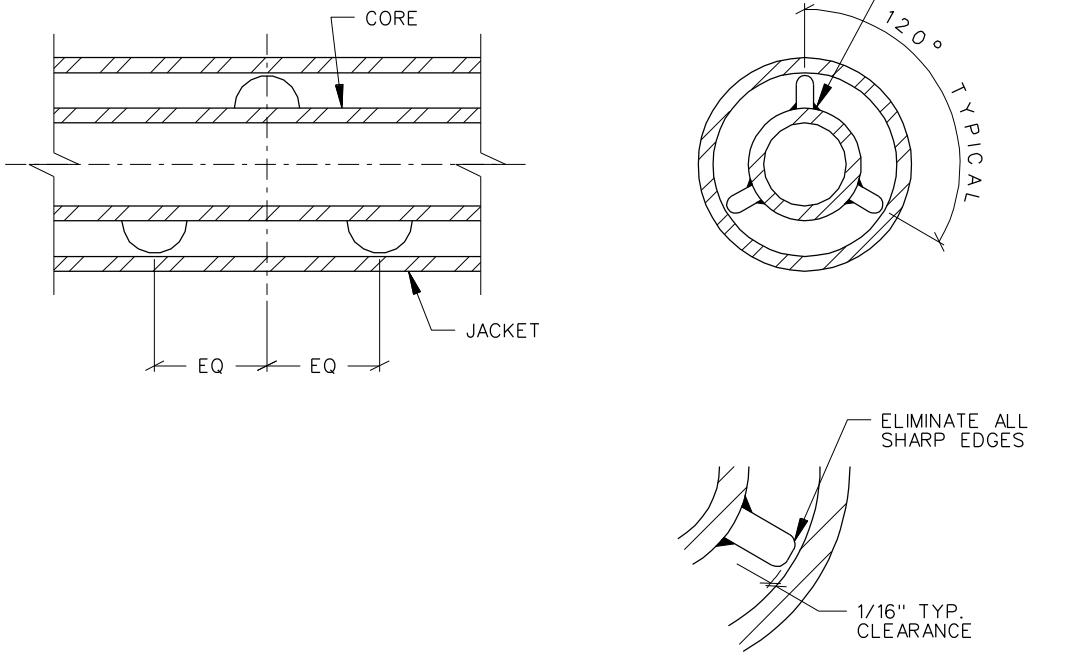
NOTES:

1. SPACER MATERIAL TO MATCH CORE PIPE.

JACKET ANNULUS DETAILS
SP-2

PNF J9030
ISSUED: MAY 2007
REAFFIRMED: NA
PAGE 1 OF 1
PIP PNFJ8000

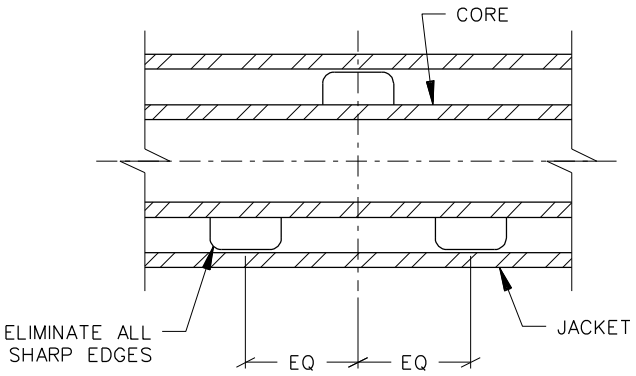
SPACER, TYPE B

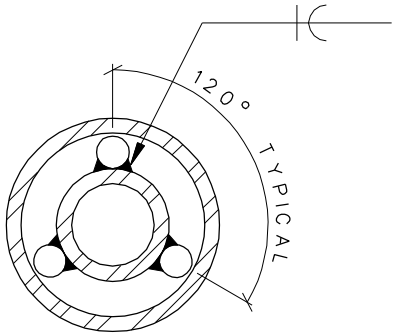


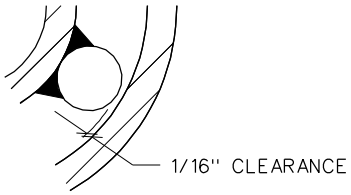
NOTES:

1. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.
2. SPACER MATERIAL TO MATCH CORE PIPE.

SPACER, TYPE C







NOTES:

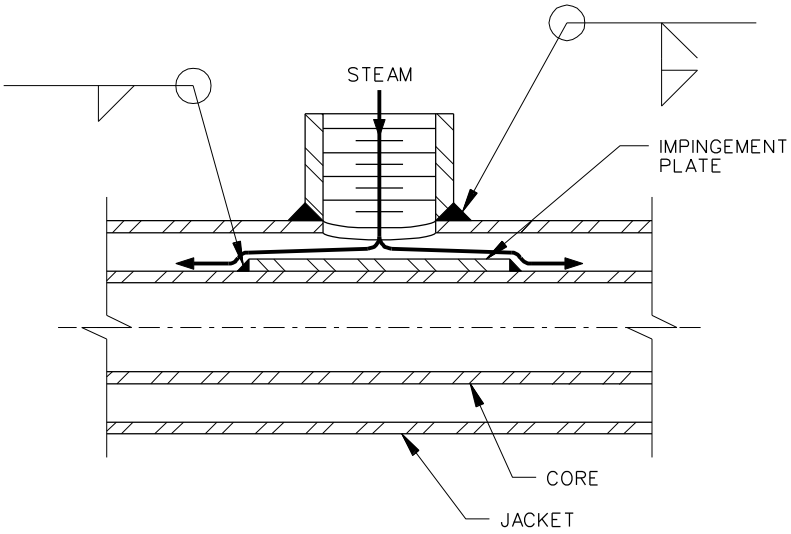
1. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.
2. SPACER MATERIAL TO MATCH CORE PIPE.

JACKET ANNULUS DETAILS
IP-1

PNF J9050
ISSUED: MAY 2001
REAFFIRMED: MAY 2007

PIP PNFJ8000

IMPINGEMENT PLATE



NOTES:

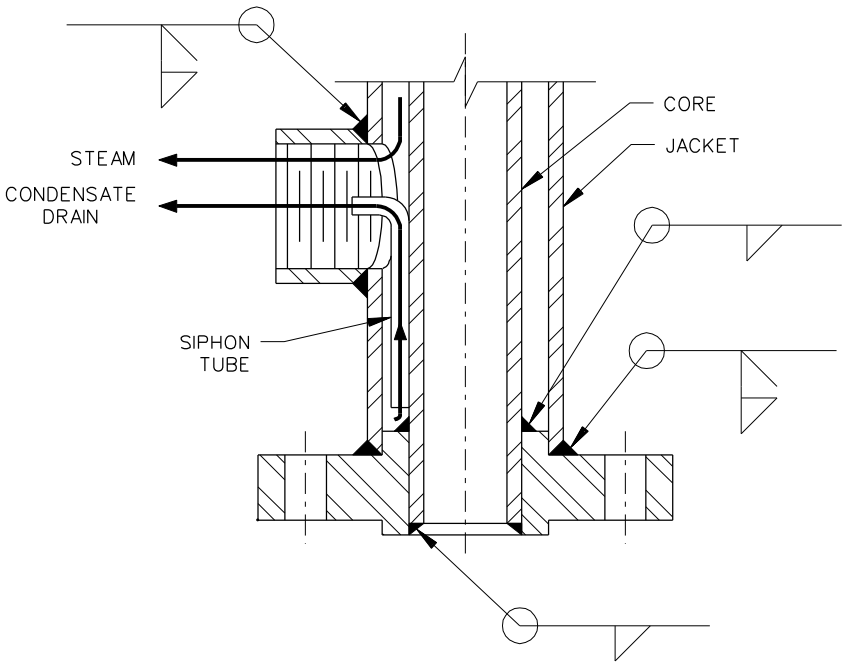
1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

JACKET ANNULUS DETAILS
ST-1

PNF J9060
ISSUED: MAY 2001
REAFFIRMED: MAY 2007

PIP PNFJ8000

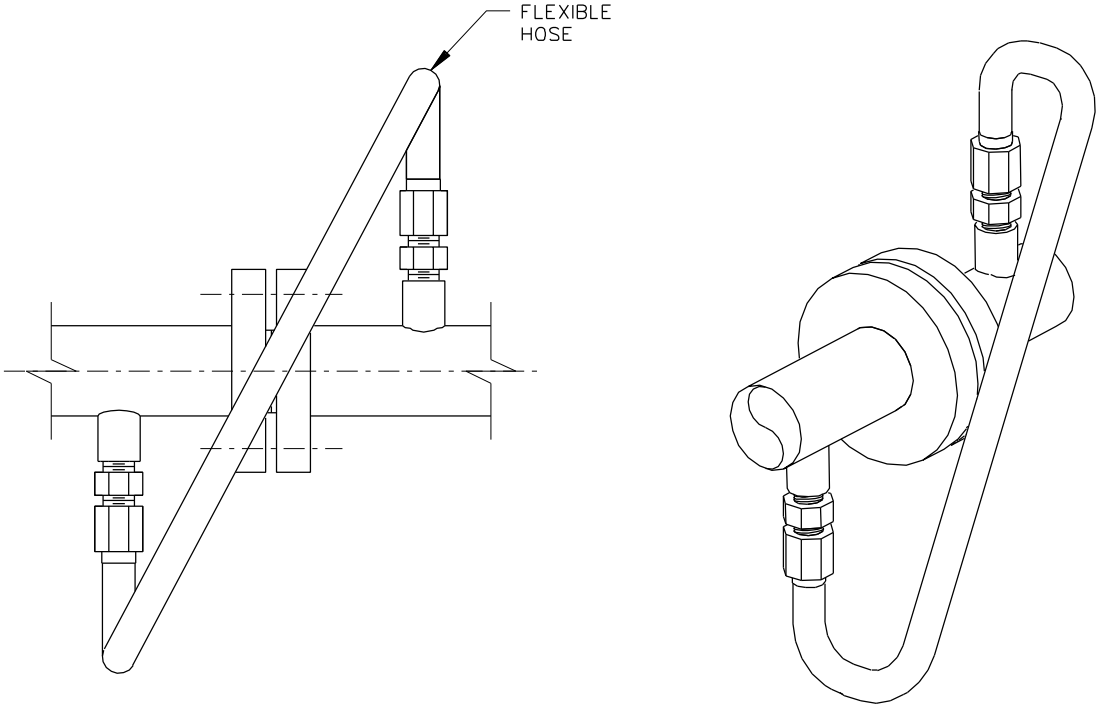
SIPHON TUBE ASSEMBLY



NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

FLEXIBLE METAL HOSE JUMPOVER



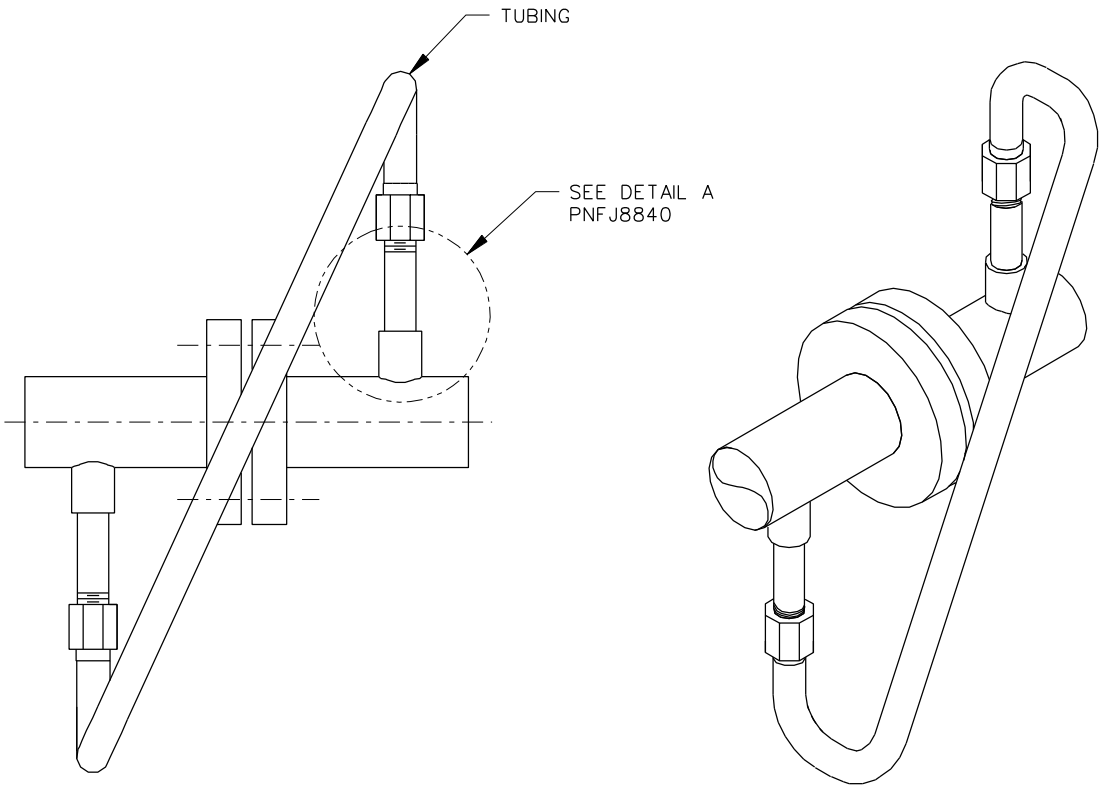
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. ALTERNATE DESIGN SHOWN. USE ONLY WHEN SPECIFIED IN THE ENGINEERING DESIGN OR PIPING MATERIAL SPECIFICATION LINE CLASS.
3. FLEXIBLE JUMPER HOSE SHALL BE OF THE PROPER LENGTH AND BEND RADIUS TO SUIT THE PARTICULAR INSTALLATION PER THE MANUFACTURER'S GUIDELINES.

JUMPOVER DETAILS
JMP-2

PNF J9130
ISSUED: MAY 2001
REAFFIRMED: MAY 2007
PAGE 1 OF 1
PIP PNFJ8000

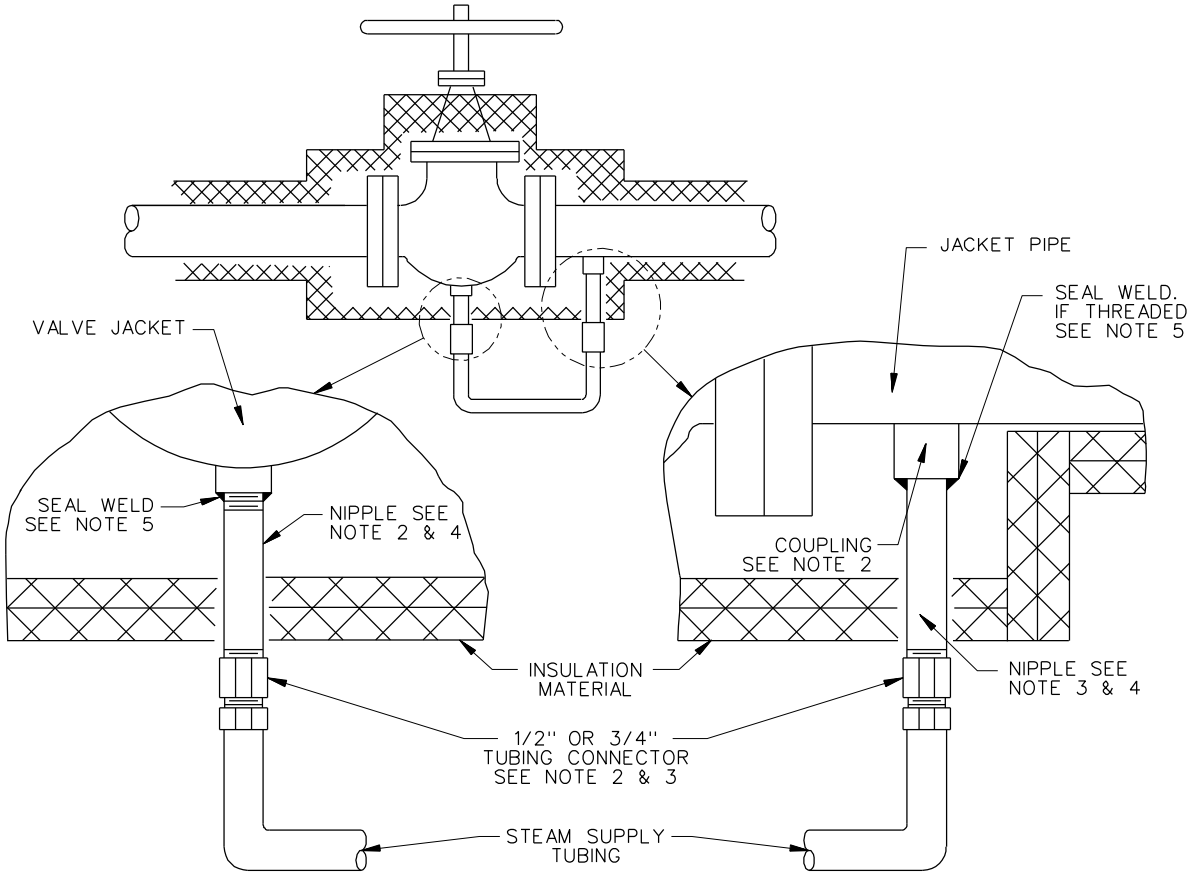
TUBING JUMPOVER



NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.

STEAM / CONDENSATE JUMPOVER ASSEMBLY



JACKETED VALVE ASSEMBLY

JACKETED PIPE ASSEMBLY

NOTES:

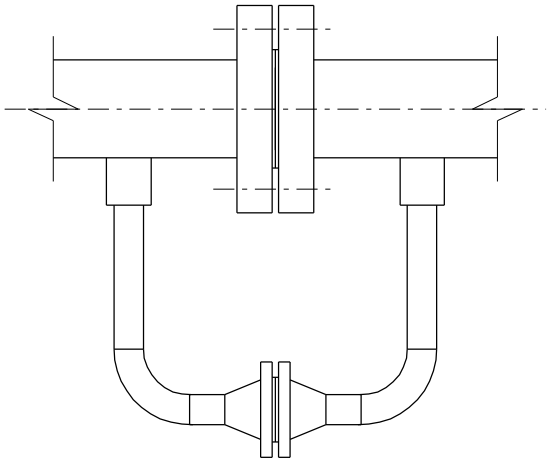
1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. FOR VALVE SIZES 1" AND SMALLER WITH 2" INSULATION, NIPPLE TO BE 1/2" x 4". FOR VALVE SIZES 1 1/2" AND LARGER WITH 2" INSULATION, NIPPLE TO BE 3/4" x 4". NIPPLE MATERIAL AND SCHEDULE TO BE PER THE LINE CLASS SPECIFICATION.
3. FOR JACKET SIZES SMALLER THAN 2" USE 1/2"-3000LB COUPLING, SIZES 2 1/2" AND LARGER USE 3/4"-3000LB COUPLING. FOR JACKET SIZES 1" THRU 2" WITH 2" INSULATION, USE 1/2" x 5" NIPPLE. FOR JACKET SIZES 2 1/2" THRU 14" WITH 2" INSULATION USE 3/4" x 5" NIPPLE.
4. IN PIPING SYSTEMS WITH 4" INSULATION, ADD 2" TO LENGTH OF NIPPLES.
5. THREADS HIDDEN UNDER INSULATION SHALL BE THOROUGHLY CLEANED BEFORE ASSEMBLY AND SHALL BE SEAL WELDED.

JUMPOVER DETAILS
JMP-4

PNFJ9150
ISSUED: MAY 2007
REAFFIRMED: NA

PIP PNFJ8000

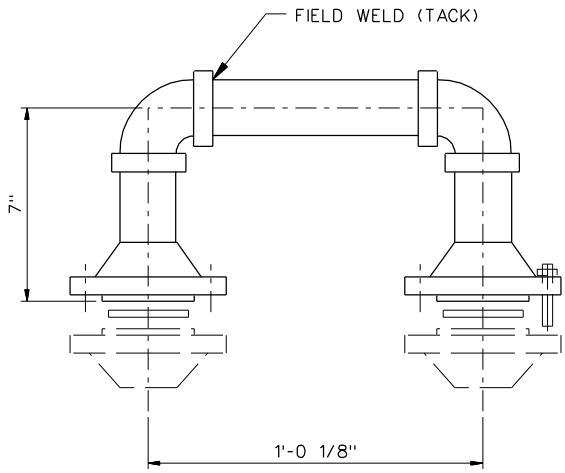
PIPING JUMPOVER



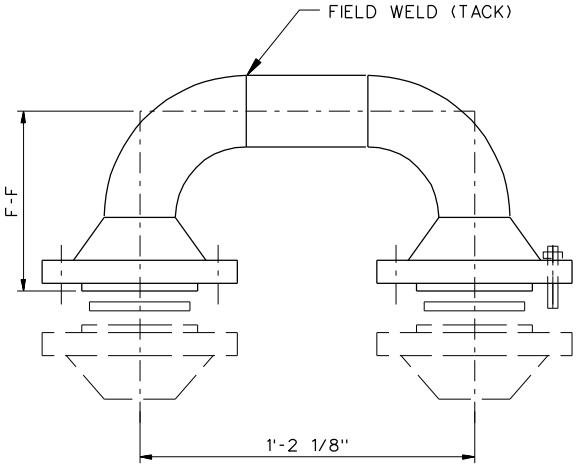
NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.
2. BUTT WELD FITTINGS SHOWN. USE SIMILAR CONSTRUCTION FOR SOCKET WELD.
3. NOT FOR RING JOINT FLANGED JUMPER CONNECTIONS. SEE PNFJ9160.
4. ORIENTATION OF JUMPER INLET AND OUTLET TO BE AS SPECIFIED IN DESIGN.

PIPING JUMPOVER



3/4" - 1 1/2"
SOCKET WELD



2" - 4"
BUTT WELD

NOTES:

1. MATERIALS OF CONSTRUCTION SHALL BE PER PIPING MATERIAL SPECIFICATION LINE CLASS.