

**Project Execution Services (PES)**



# *Specifications*

*To be our customer's benchmark for dependability, expertise & safety*



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project execution services

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Project Execution Services (PES)

Lesson Objectives

Lesson Objectives

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Become familiar with piping material specifications.

Be able to select piping material in accordance with the material specifications.

<b>FLUOR DANIEL</b>	
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*All phases  
Of piping  
Are covered by  
Specifications*

All aspects of piping design are covered by specifications. The main specifications are:

Process and Utility Design, Layout, and Drawing (000 250 50001)

Shop Fabrication and Handling – Process and Utility Piping (000 250 50025)

Field Fabrication and Installation – Process and Utility Piping (000 250 50026)

Piping Material Specification Line Class – Process and Utility Piping (000 250 50003)



Piping Material Specification is developed by the Material Engineer

The Material Specification conforms to:

Process Flow Summary

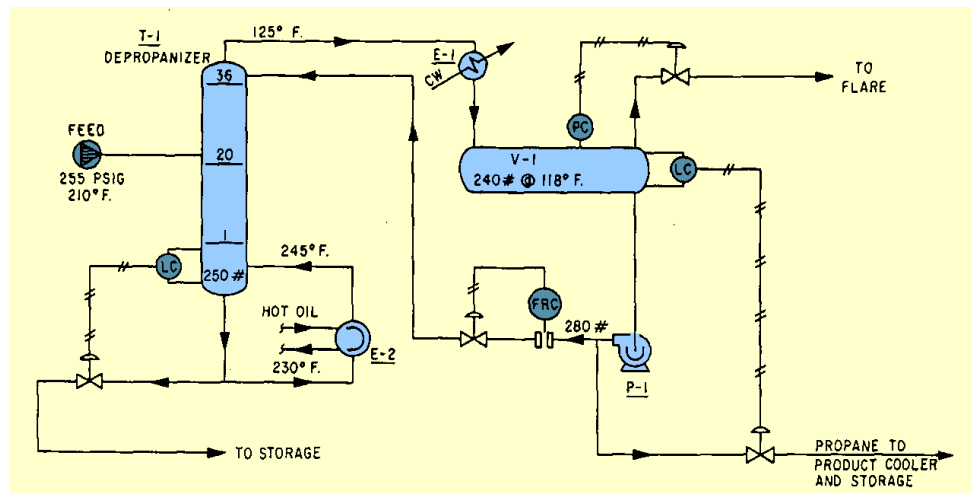
Customer Specifications

Fluor Standard Specifications

Piping Codes (Federal and/or local or applicable foreign codes)

The Process Engineer, Material Engineer, and the Metallurgist all work together to develop each individual line class or specification.

# Process Flow Diagram

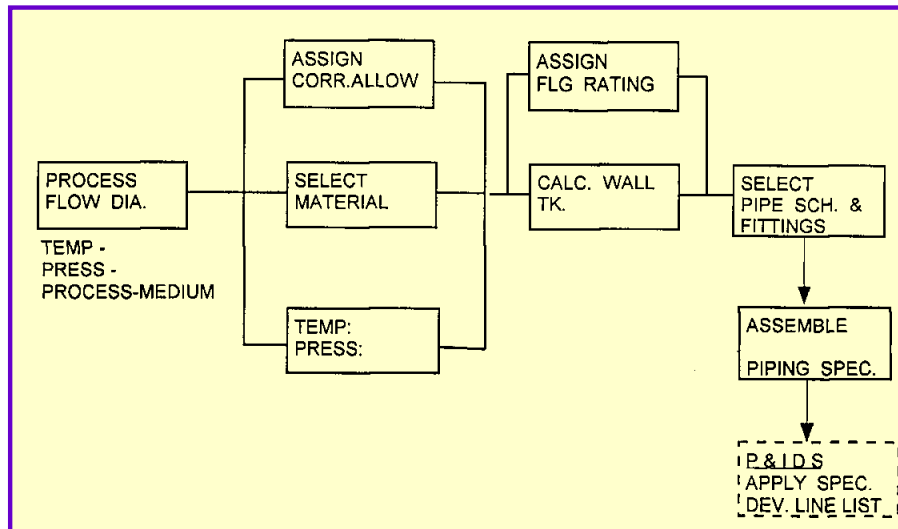


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The Process Engineer, Material Engineer, and the Metallurgist use the Process Flow Diagram (PFD) to create a Material Selection Diagram (MSD).

## Piping Material Selection

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The Material Engineer uses the MSD to assign each individual line a line class on the Piping and Instrumentation Diagram (P&ID).

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## Piping Material Specifications:

Three Sections:  
Material Line Class Index  
General Notes  
Specific Line Classes

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The Material Specification is very important because all piping material used for a project is covered within the specification. The Material Specification will guide a piping designer as to what fitting to use when. For example, when you need to use a slip-on flange rather than a weldneck flange.

Material Specifications will change from project to project depending on Client preference.

The Material Specification is divided into three sections:

Index

General Notes

Specific Line Classes

# Piping Material Specification Index:

## Master Line Class Index

LINE CLASS	REV	CORR ALLOW	MATERIAL	FLANGE RATING	TEMP RANGE / COMMENT	SERVICE	REF LINE CLASS
BTG6	0	0 IN	316 SS TUBE		33 / 300 F	AC CLEAN AIR AR ARGON ARV ARGON VENT CO2 CARBON DIOXIDE N2 NITROGEN WC CITY WATER WHPO HOT POTABLE WATER WPOT POTABLE WATER DESIGN: 150 PSIG @ 100 F CODE: ASME B31.3	
CAA1	0	0.062 IN	CARBON STEEL	150 RF	-20 / 500 F	NONCORROSIVE PROCESS DESIGN: ANSI B16.5 MG 1.1 CODE: ASME B31.3	
CAA1B	0	0.062 IN	CARBON STEEL	150 RF	-20 / 500 F	NONCORROSIVE PROCESS DESIGN: ANSI B16.5 MG 1.1 CODE: ASME B31.3	
CAF1	0	0.03 IN	304L STAINLESS STEEL	150 RF	-20 / 350 F	CORROSIVE PROCESS DESIGN: ANSI B16.5 MG 2.1 CODE: ASME B31.3	
CAG1	0	0.03 IN	316L STAINLESS STEEL	150 RF	-20 / 350 F	CORROSIVE PROCESS DESIGN: ANSI B16.5 MG 2.2 CODE: ASME B31.3	
CAK1	0	0 IN	MONEL	150 RF	-20 / 350 F	CORROSIVE PROCESS DESIGN: ANSI B16.5 MG 3.4 CODE: ASME B31.3	
CAL1	0	0.03 IN	ALLOY 20	150 RF	-20 / 350 F	CORROSIVE PROCESS DESIGN: ANSI B16.5 MG 3.1 CODE: ASME B31.3	
CANC1	0	0.03 IN	HASTELLOY C276	150 RF	-20 / 350 F	CORROSIVE PROCESS DESIGN: ANSI B16.5 MG 3.8 CODE: ASME B31.3	
CAP1	0	0 IN	TITANIUM	150 RF	-20 / 350 F	CORROSIVE PROCESS DESIGN: 275 PSIG @ 100 F	

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The Material Line Class Index lists all the line classes currently being used on the project along with a brief summary.



# Piping Material Specification General Notes:

Client Name  
Project Name  
Contract Number

Master Specification 000 250 50003  
Date 18Jan00  
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## 1.0 GENERAL

### 1.1 Summary

#### A. *Scope of Specification*

#### B. *Related Specifications*

The following specifications prescribe items of related Work:

- 000.250.50025: Shop Fabrication And Handling - Process And Utility Piping
- 000.250.50026: Field Fabrication And Installation - Process And Utility Piping
- 000.250.50201: Piping Support Elements
- 000.285.50028: Internal Cleaning of Piping Systems
- 000.285.50030: Geographic Color Coding
- 000.285.86070: Galvanizing
- 000.285.86081: Spray Applied Linings for Carbon Steel
- 000.285.86110: Hot Insulation
- 000.285.86210: Painting
- 000.285.86310: Coatings for Underground Steel Surfaces

Coordinate Work prescribed by this specification with Work prescribed by the above listed specifications.

00025050003.doc

Piping Engineering

The General Notes section of the Material Specification contains general information related to the piping materials used such as references to other specifications such as pipe supports, insulation, and painting.

## Piping Material Specification General Notes:

### A. ASME (American Society of Mechanical Engineers)

1. ASME B31.3 Power Piping
2. ASME B31.3 Process Piping
3. ASME B31.4 Liquid Transportation Systems for Hydrogen, LPG, Anhydrous Ammonia and Alcohols
4. ASME B16.5 Pipe Flanges and Flanged Fittings

5. ASME B16.34 Valves-Flanged, Threaded, and Welding End
6. ASME Boiler and Pressure Vessel Code, Section VIII, Division 1

### B. API (American Petroleum Institute)

1. Publication 941 Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants

### C. NACE (National Association of Corrosion Engineers)

1. Corrosion Data Survey
2. NACE MR-01-75 Sulfide Stress Corrosion Cracking Resistant Metallic Materials for Oilfield Service

- D.** Where fabrication and design criteria in this specification are affected by city, county, province, state, or federal requirements, this specification shall be modified as necessary to ensure compliance.

Water Specification 000 250 S0003  
Date 18Jan00  
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Revision

#### TILITY PIPING

3 characteristics may be submitted

Classes are abbreviated and shall

Piping Material Commodities

criptions shall not be used for

r A) or greater partial pressure of  
vice is normally based on American

n that contains liquid water and at least  
c.

least 0.05 psia partial pressure of

. Each publication shall be the latest  
on is issued. Approved for Construction  
ments specified herein or the details of  
form to the applicable provisions of

ersj

ons for Hydrogen, LPG, Anhydrous

Fittings

The General Notes section of the Material Specification also contains general information related to the piping materials used such as references to applicable codes.

## Piping Material Specification General Notes:

Client Name	Master Specification 000 250 50003
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<b>FLUOR</b>	
PIPING - MATERIAL SPECIFICATION LINE CLASS - PROCESS AND UTILITY PIPING	

### **C. Terminology**

#### **1. Base Code**

Piping system in this specification is categorized as Normal Fluid Service in accordance with the applicable Code for Pressure Piping, ASME B31.1, ASME B31.3, ASME B31.4, etc., unless indicated in the individual Line Class.

#### **2. Design Conditions**

Unless otherwise specified, pressures and temperatures refer to design conditions

#### **3. Pressure-Temperature Ratings**

Pressure-temperature ratings for NPS 24 and smaller carbon steel, ferritic alloy steel, and austenitic stainless steel piping systems are based on ASME B16.5. Pressure-temperature ratings for NPS 26 through 60 carbon steel piping systems are based on ASME B16.47.

## Piping Engineering

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## Piping Material Specification General Notes:

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PIPING - MATERIAL SPECIFICATION LINE CLASS - PROCESS AND UTILITY PIPING

### 9. Item Descriptions

#### 11. Hydrogen Service

Hydrogen Service is defined as 100 psia (7 bar A) or greater partial pressure of hydrogen. Selection of steels for hydrogen service is normally based on American Petroleum Institute Publication 941.

#### 12. Sour Water Service

Sour Water Service is defined as a fluid stream that contains liquid water and at least 50 ppm (mg/Kg) of dissolved hydrogen sulfide.

#### 13. Sour Service

Sour Service is defined as a system having at least 0.05 psia partial pressure of hydrogen sulfide, above 65 psia total pressure.

4. ASME B16.5 Pipe Flanges and Flanged Fittings

This section of the General Notes defines any project-related or Process requirements which has an affect on the selection of piping materials.

# Piping Material Specification General Notes:

Client Name  
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Contract Number

Master Specification 000 250 50003  
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FLUOR

- B.

E.

**Thread Compound**

Thread compound requirements, unless otherwise specified in the individual line class, shall conform to the following (or Fluor Daniel Piping Material Engineering approved substitute):

- 46° C thru 260° C (-50° F thru 500° F): Lubon #404
  - 261° C thru 621° C (501° F thru 1150° F): Liquid-O-Ring #HT-1880
  - Stainless steels and nickel alloys: Nickel-Eze for all temperatures
  - Use Teflon tape only when specified in the individual Line Classes.

C.

F.

**Valve Operators**

1. Gate valves shall normally be handwheel operated. Manual gear operators, when specified, shall be fully enclosed type designed to bolt on to valve yoke and shall be field mountable. If gear operated valves are not specified in the individual Line Classes and an operator is required, the valves shall be identified with an item code number on the P&IDs and drawings.

2. Globe valves larger than those specified in the individual Line Classes are permitted. However, such valves shall be individually reviewed for possible gear operator requirements, and if an operator is required, the valves shall be identified with an item code number on P&IDs and drawings.

D.

G. Full Port Valves

This section defines the criteria to be used in the selection or installation of components included in individual line classes.

# Piping Material Specification General Notes:

<b>H. Flanges</b>  1. Weld-neck 2. Orifice	<b>L. Short Radius Elbows</b>  Consideration shall be given to the use of short radius in lieu of long radius elbows for NPS 30 and larger for economic reasons with Process Engineering concurrence.
<b>I. Lap Joint St</b>  Lap joint studs shall have the	<b>M. Lok-Ring Fittings</b>  Lok-Ring fittings are mechanically attached connectors that may be used in lieu of socketweld fittings where all-in labor rate is high or where the piping system is required to be assembled without any hot work permit.
<b>J. Bolting</b>  1. Bolt length  2. Machine extreme  3. Stud bolts  4. Bolt length	<div>1. Class 150 Carbon Steel, Stainless Steel and Nickel Alloys. 2. Corrosion allowance of 0.063" or less. 3. Utility hydrocarbons except hydrogen and lethal services.</div> <b>Construction Details</b> <b>A. Pipe Bends</b> <div>1. Bends may be used in place of fittings subject to authorization by Piping Engineering.  2. One and a half diameter hot induction bends may be used in lieu of butt welding elbows, 12 NPS and smaller. Three diameter or 5 diameter bends may be considered for 14 NPS and larger piping systems. Bends are normally economical on heavy wall (Schedule 80 or heavier) carbon steel and low chrome alloys.</div>
<b>K. Flange Fitt</b>  Unless other in accordance	

## Piping Material Specification General Notes:

Client Name  
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FLUOR

Master Specification 000 250 50003  
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### **B. Seal Welding**

1. Seal welding is required for all services (except water and air) and any line subject to vibration. Seal welding for these conditions shall entail the following connections:
  - a. On
  - b. On  
atm
  - c. Wi  
flar
  - d. On
  - e. On
2. The we  
that req
  3. Thread compound or Teflon tape shall not be used on threads to be seal welded.
  4. Ball and plug valves shall be disassembled prior to seal welding to prevent heat damage to stem packing and seals.
  5. When seal welding one side of a valve, the threads on the other side shall be protected or chased after welding.
  6. Screwed connections at instruments shall not be seal welded.
  7. Seal welding of connections to equipment shall conform to the applicable, latest revision API Standard:
    - API 610 Centrifugal pumps
    - API 611 Steam turbines
    - API 612 Special-purpose steam turbines
    - API 617 Centrifugal compressors
    - API 618 Reciprocating compressors
    - API 672 Packaged plant and instrument air compressors



# Piping Material Specification General Notes:

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Project Name  
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**FLUOR**

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PIPING - MATERIAL SPECIFICATION LINE CLASS - PROCESS AND UTILITY PIPING

## C. Valve Installation

1. The preferred orientation for swing and split-disc type check valves is horizontal; however, vertical orientation is an acceptable alternative in upward flow installations. Where allowed, split-disc wafer type check valves, when installed in horizontal lines, shall be installed with the shaft in the vertical position. Other types of check valves shall be installed in the horizontal position. Other orientations require Piping Engineering authorization.
2. The type of check valves shall be individually investigated for reciprocating pump or compressor discharge lines.
3. Valves installed against water storage tank nozzles shall be steel and shall be so identified on P&IDs and drawings with an item code number.
4. Flanged valves shall be used in place of socketweld in locations where isolation by blinding is required.
5. Flanged valves shall be used in place of socketweld or screwed valves whenever mounted directly to vessels or other equipment that has been furnished with flanged connections. The rating of the valves shall match the nozzle connection.

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Piping Engineering

# Piping Material Specification General Notes:

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Master Specification 000.250.50003  
Date 18Jan09  
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PIPING - MATERIAL SPECIFICATION LINE CLASS - PROCESS AND UTILITY PIPING

1. The preferred orientation for swing and split-disc type check valves is horizontal, however, vertical orientation is an acceptable alternative in upward flow installations. When allowed, vertical orientation for check valves is subject to design approval.

## **E. Postweld Heat Treatment (PWHT) and Non-Destructive Examination (NDE)**

Postweld heat treatment and non-destructive examination of pipe welds shall be in accordance with Specification 000.285.85002, Welding.

## **F. Line Reductions**

1. When reducing in, to or from a screwed or socketweld fitting, use a swage nipple.
2. When reducing in butt welding construction, use a butt weld reducer.
3. For large diameter piping, stub-on connections into butt weld cap may be used in lieu of reducers, subject to Stress Engineering authorization.

## **G. Branch Connections**

Unless otherwise noted in the individual line class, branch connections shall be made in accordance with the Branch Charts BC-1 thru BC-4.

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Piping Engineering

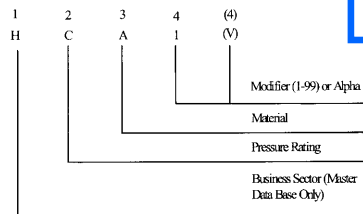
# Piping Material Specification LINE CLASS DESIGNATORS:

## FLUOR STANDARD

FLUOR DANIEL

PIPING MATERIAL ENGINEERING – PIPING LINE CLASS DESIGNATIONS

### Line Class Designations



#### IDENTIFIER 1

##### Business Sectors

- B - Biotech
- C - Process
- D - Pharmaceuticals
- F - Food
- G - Government
- H - Hydrocarbons
- I - Industrial
- P - Power
- S - Steel Mills
- U - Utilities
- W - Pulp and Paper

#### IDENTIFIER 2

##### Pressure Rating

- A - Class 150
- B - Class 125
- C - Class 500
- F - Class 600
- G - Class 900
- H - Class 1500
- J - Class 2500
- K - Underground
- L - Class 125 or other low ratings
- M - > Class 2500
- N - Class 150 (Utility)
- R - Class 300 (Utility)
- S - Class 600 (Utility)
- T - Class 900 (Utility)
- U - Class 1500 (Utility)
- V - Class 2500 (Utility)

#### IDENTIFIER 3

##### Material

- A - C Steel / Lo Temp Steel
- B - 1-1/4 CR / 2-1/4 CR
- C - 5 CR
- D - 9 CR
- E - Other CR
- F - 304 SS
- G - 316 SS
- H - 321 / 347 SS
- I - Other Stainless
- J - Monel
- K - Alloy 20
- L - Inconel / Incoloy
- M - Hastelloy
- N - Titanium
- P - Aluminum
- R - Cast/Ductile Iron
- S - Others
- T - Lined Pipe
- U - Non-Metallics
- V - Others
- Z - Zirconium

#### IDENTIFIER 4

##### Modifiers

- 1 - Base Case 0.065 inches Corrosion Allowance
- 2 - 0.125 inches Corrosion Allowance
- 3 - 0.187 inches Corrosion Allowance
- L - Low Temp Steel
- S - Sour Service
- V - Vacuum Service
- A - ASME Code Piping

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Piping Engineering

This section of the Material Specification defines how the line class or specifications are structured.

## Piping Material Specification Line Class Designators:

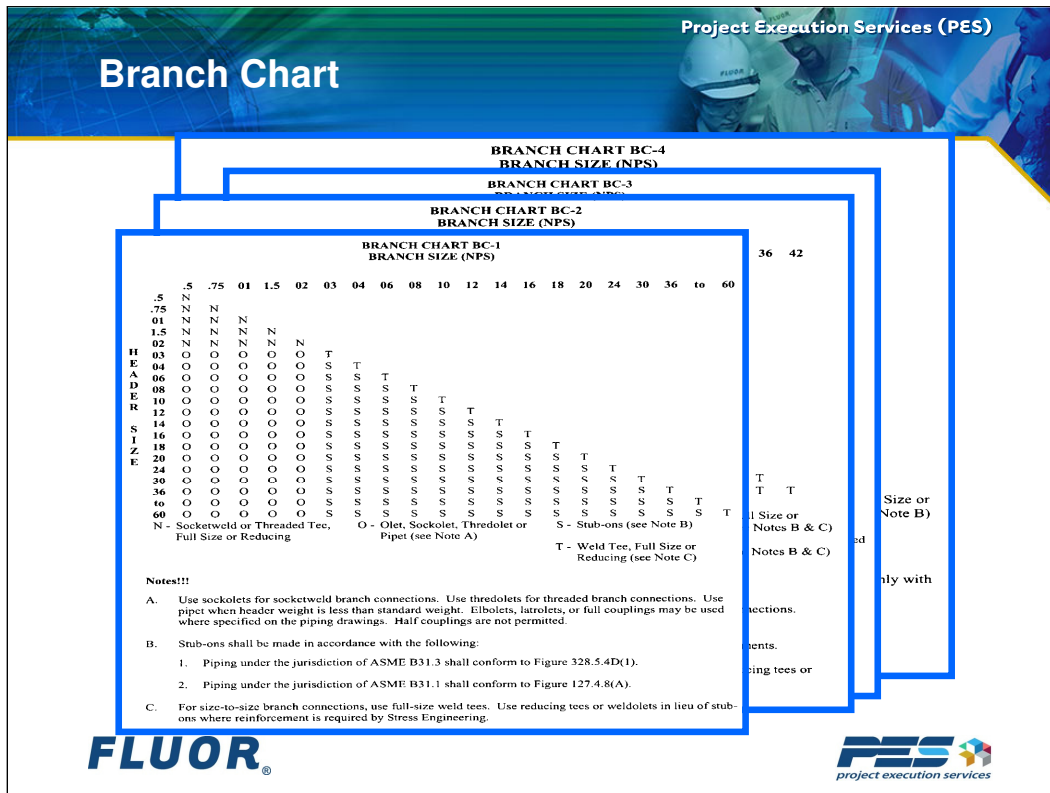
**PIP****Process Industry Practices  
Piping**

### 3.6 Example

An example of a complete piping Line Class designator is 3CS1S01. This designator means:

First Field:	3	= ASME Pressure Class 300
Second Field:	CS	= Carbon Steel Base Material Piping System
Third Field:	1	= Nominal Corrosion Allowance in multiples of 1/16"
Fourth Field:	S	= Socketweld Small Bore Construction and Butt weld and Flanged Large Bore Construction
Fifth Field:	01	= Sequence Number (first in this piping material/ pressure class series)

Another system of describing piping material specifications is outlined in “PIP”, an industry wide standard.



The Material Specification will also include a Branch Chart which will define what type of branch connection to use for each header-branch size combination.

# Line Class Specs

SEQ NO.	REV NO.	NOTE NO.	ITEM NAME	ITEM CODE	SIZE RANGE / SMALL END SIZES	DESCRIPTION	REFERENCE / LARGE END SIZES	NOTES
10						***** VALVES *****	SES P02-S01 Para. 5.5, 6.4	
11								
12								
21			GAT	GA08CB302	1/2 - 2	GATE 800# SW CS BODY W13 CR TR HF ST WB		02 All butt-welded component thicknesses shall match pipe thickness.
22	06		GATSW	GA08CB202	1/2 - 2	GATE 800# SW 1/4 SCRD CS BODY W13 CR TR HF ST WB		03 Threaded joints are permitted only at outlet of vent and drain valves, at hydrostatic connections, at outlet of instrument take-off valves, and to match equipment.
23	15		GATFLG	GA01CB503	1/2 - 2	GATE 150# RF CS BODY W13 CR TR HF ST WB		05 Integrally reinforced branch connections are permitted outside the sizes shown in the branch connection table. Designer shall check weld thickness of integrally reinforced branch connections to determine if PWHT is required.
24			GAT	GA01CB501	3 - 14	GATE 150# RF CS BODY W13 CR TR HF ST FP		06 These valves shall be used only for vent, drain, and instrument connections.
25			GAT	GA01CB501GO	16 - 24	GATE 150# RF CS BODY W13 CR TR HF ST FP GO		11 Provide flat face flanges adjacent to flat face equipment nozzles.
26			GAT	GA01CB931	30 - 48	GATE 150# RF CS BODY W13 CR TR HF ST FP GO B16.47-A		12 To be used only to match Class 300 rated flange connections at control valves and special equipment.
27			GLO	GLO8CB302	1/2 - 2	GLOBE 800# SW CS BODY W13 CR TR, HF ST WB		13 Weldneck flanges shall be used against butt welded fittings. Otherwise, use slip-on flanges.
28			GLO	GLO1CB500	3 - 12	GLOBE 150# RF CS BODY W13 CR TR HF ST		136 Sch XS pipe shall be used for threaded connections for size NPS 2.
31	81		CHE	CLO8CB300	1/2 - 2	CHECK PISTON 800# SW CS BODY W13 CR TR HF ST LIFT		14 Use full face gaskets at flat face flanges.
32	82		CHE	C501CB500	3 - 24	CHECK 150# RF SWING CS BODY W13 CR TR HF ST		15 To be used when mating to flanged nozzles.
33	62		CHE	C501CB930	30 - 48	CHECK 150# RF CS BODY W13 CR TR HF ST SWING B16.47-A		61 Install in horizontal position with cover up.
34								62 Install in horizontal position with cover up or in vertical position with upward flow.
37	83		CHEWAF	CD01CB700	3 - 24	CHECK 150# WAFER CS BODY W13 SS DISC/ST DUAL PLT		63 Install in horizontal position with hinge pin vertical or in vertical position with upward flow.
38	63		CHEWAF	CD01CB930	30 - 48	CHECK 150# CS BODY W13 SS DISC/ST DUAL PLT B16.47-A		
40						***** PIPE *****	SES P02-S01 Para. 5.3, 6.2	
112								
116			PIP	5356899	1/2 - 1 1/2	PIPE XS SMLS STL A53-B		
121	136		PIPKS	5356899	2 - 2	PIPE XS SMLS STL A53-B		
122			PIP	5356649	2 - 24	PIPE STD WT ERW STL API-5L B / A53-B		
123			PIP	5356704	30 - 30	PIPE STD WT DSAW STL API-5L B		
124			PIP	5356707	36 - 48	PIPE XS DSAW STL API-5L B		
125						***** FITTINGS *****	SES P02-S01 Para. 5.4, 6.3	
210								
212								
214								
220	3		SOL	5532871	1/2 - 2	SOCKET 3000# STL A105		
222	3		TOL	5514671	1/2 - 2	THREDOLET 3000# STL A105		
223	3		LOT	5524751	1/2 - 2	LATROLET 3000# SW STL A105		
224	3		LOTSCR	5524751	1/2 - 2	LATROLET 3000# SCRD STL A105		
225	3		EOT	5516748U	1/2 - 2	ELBOLET 3000# SW STL A105		
226	3		EOTSCR	5516731	1/2 - 2	ELBOLET 3000# SCRD STL A105		
227								
228	3		ELL	5478105	1/2 - 2	ELL 90 DEG 3000# SW STL A105		
231	3		45L	5478106	1/2 - 2	ELL 45 DEG 3000# SW STL A105		
232	3		TEE	5478107	1/2 - 2	TEE 3000# SW STL A105		
233	3		PLGSW	5478115	1/2 - 2	PLUG ROUND HEAD SW STL A105		
234	3		PLG	5480665	1/2 - 2	PLUG ROUND HEAD SCRD STL A105		
235	3		COU	5478108	1/2 - 2	COUPLING 3000# SW STL A105		
244	3		CAP	5478108	1/2 - 2	CAP 3000# SW STL A105		
245			CAPSCR	5490267	1/2 - 2	CAP 3000# SCRD STL A105		
252								
253								
CONSTRUCTION						UNITED OLEFINS COMPLEX PROJECT		
2" & SMALLER - SOCKETWELD 3" & LARGER - BUTTWELD						CORR. ALLOW.	DATE	BY
						1.5 MM	09AUG01	EEC
							REV	SHEET
							3	1 OF 4
							PA	CLASS
							5	1CS1502

SAMPLE

# Line Class Specs

SEQ NO	REV	NOTE NO	ITEM NAME	ITEM CODE	SIZE RANGE / SMALL END SIZES	DESCRIPTION	REFERENCE / LARGE END SIZES	NOTES					
254						***** FITTINGS CONTINUED *****							
255													
256													
260	3		ELL	5380828	3 - 30	ELL 90 DEG LR STD WT STL A234 GR WPB-W							
262	3		45L	5380834	3 - 30	ELL 45 DEG STD WT STL A234 GR WPB-W							
264	3		TEE	5380837	3 - 30	TEE STD WT STL A234 GR WPB-W	3 - 30						
266	3		CAP	5374124	3 - 30	CAP STD WT STL A234 WPB-S							
268	3		REDCEBW	5380839	3 - 24	REDUCER CONC STD WT STL A234 GR WPB-W	4 - 30						
270	3		REDEBW	5380840	3 - 24	REDUCER ECC STD WT STL A234 GR WPB-W	4 - 30						
275													
276			ELL	5380990	36 - 48	ELL 90 DEG LR XS STL A234 WPB-W							
278			45L	5380996	36 - 48	ELL 45 DEG XS STL A234 WPB-W							
280			TEE	5380999	30 - 48	TEE XS STL A234 WPB-W	36 - 48						
282			CAP	5374286	36 - 48	CAP XS STL A234 WPB-S							
286			REDCEBW	5381001	24 - 42	REDUCER CONC XS STL A234 WPB-W	36 - 48						
288			REDEBW	5381002	24 - 42	REDUCER ECC XS STL A234 WPB-W	36 - 48						
289		05											
290	3		WOL	5504203	3 - 10	WELDOLET STD WT STL A105	18 - 30						
291	3		WOL	5504355	3 - 6	WELDOLET XS X STD WT STL A105	36 - 48						
292			WOL	5504355	18 - 30	WELDOLET XS X STD WT STL A105	36 - 48						
293			WOL	5504359	36 - 36	WELDOLET XS STL A105	48 - 48						
294													
296													
300		02				***** PIPE FLANGES *****	SES P02-S01 Para. 5.6, 6.5						
301													
302	3		SWF	5601738	1/2 - 1 1/2	FLG SW 150# RF STL XS BORE A105							
303	3		SWF	5601735	2 - 2	FLG SW 150# RF STL STD BORE A105							
304	3	11	SWFFF	5601728	1/2 - 1 1/2	FLG SW 150# FF STL XS BORE A105							
305	3	11	SWFFF	5601729	2 - 2	FLG SW 150# FF STL STD BORE A105							
306	3	12	SWF300	5601798	1/2 - 1 1/2	FLG SW 300# RF STL XS BORE A105							
307	3	12	SWFRF	5601796	2 - 2	FLG SW 300# RF STL STD BORE A105							
308			BLF	5615476	1/2 - 24	FLG BLIND 150# RF STL A105							
309			BLF	5620993	30 - 48	FLG BLIND B16.47-A 150# RF STL A105							
310			BLF300	5615497	1/2 - 24	FLG BLIND 300# RF STL A105							
312	3		SOF	5597469	3 - 24	FLG SO 150# RF STL A105							
314	3	12	SOF300	5597491	3 - 24	FLG SO 300# RF STL A105							
316													
320	3	13	WNK	5554402	3 - 24	FLG WN 150# RF STL STD BORE A105							
322	3	13	WNKFF	5554383	3 - 24	FLG WN 150# FF STL STD BORE A105							
324	3	13	WNK300	5554635	3 - 24	FLG WN 300# RF STL STD BORE A105							
326													
328	3		WNK	5617765	30 - 30	FLG WN B16.47-A 150# RF STL A105 STD BORE							
330			WNK	5617766UA	36 - 48	FLG WN B16.47-A 150# RF STL A105 XS BORE							
332													
334						***** ORIFICE FLANGES *****							
336													
340			ORI	5622520	2 - 24	WN ORIF SET 300# RF STL STD BORE A105	1/2" SW TAPS						
342													
343													
342													
SAMPLE						CONSTRUCTION	UNITED OLEFINS COMPLEX PROJECT						
						2" & SMALLER - SOCKETWELD 3" & LARGER - BUTTWELD	CORR. ALLOW. 1.5 MM	DATE 09AUG01	BY EEC	REV 3	SHEET 2 OF 4	PA 5	CLASS 1CS1502

Fittings

Flanges

Orifice Flg

# Line Class Specs

SEQ NO	REV NO	NOTE	ITEM NAME	ITEM CODE	SIZE RANGE / SMALL END SIZES	DESCRIPTION	REFERENCE / DE END SIZES	NOTES
400						***** PIPE NIPPLES *****		
401								
402	3		NIP TBE	5540953	1/2 - 2	NIPPLE XS STL A106-B TBE	75 MM - 300 MM	
404	3		NIP TDE	5540963	1/2 - 2	NIPPLE XS STL A106-B TDE	75 MM - 300 MM	
406	3		NIP PBE	5540927	1/2 - 2	NIPPLE XS STL A106-B PBE	75 MM - 300 MM	
408						***** SWAGE NIPPLES *****		
410								
412								
422	3		SWACTS	5543591	1/2 - 2	SWAGE CONC XS STL A234 GR WPB TSE	3/4 - 4	
424	3		SWACTL	5543601	1/2 - 1 1/2	SWAGE CONC XS STL A234 GR WPB TLE	3/4 - 2	
426	3		SWACBE	5543611	1/2 - 2	SWAGE CONC XS STL A234 GR WPB BBE	3/4 - 4	
428								
432	3		SWAETS	5548681	1/2 - 2	SWAGE ECC XS STL A234 GR WPB TSE	3/4 - 4	
434	3		SWAETL	5548691	1/2 - 1 1/2	SWAGE ECC XS STL A234 GR WPB TLE	3/4 - 2	
436	3		SWAEBE	5548701	1/2 - 2	SWAGE ECC XS STL A234 GR WPB BBE	3/4 - 4	
510						***** GASKETS *****		
512							SES P02-S01	
514							Para. 5.7, 6.6	
515	2		GAS	5672128	1/2 - 24	GASKET 150# 304SS SP WND GRAPHITE LS, 1/8" THK		
516	2		GAS300	5672149	1/2 - 24	GASKET 300# 304SS SP WND GRAPHITE, 1/8" THK		
517			GASFF	5668815U	1/2 - 24	GASKET 150# FF GRAFOIL, 316SS TANGED INSERT, 1/16" THICK		
518	3		GAS	5672124	30 - 48	GASKET 150# B16.47-A 304SS SP WND GRAPHITE LS, 1/8" THK	FLEX LS 1/8"	
610						***** BOLTING *****		
612								
614								
620			BOLS	5675648	1/4 - 99	STUD-BOLT A193 GR B7 WA194 GR 2H NUTS		
710						***** STRAINERS *****		
712								
713			STR	5762126	1/2 - 2	Y-STRAINER 600# SW STL 304 SCR .033 PERF		
714			STR	5762577	3 - 24	STRAINER 150# RF/FF CONICAL 200% OPENING		
716						***** LINE BLANKS *****		
717								
718			SPE	5749496	1/2 - 14	FIGURE 8 BLANK 150# RF STL		
720			SPEDIS	5749852	16 - 24	BLANK PADDLE 150# RF STL		
722			SPEDON	5749853	16 - 24	SPACER PADDLE 150# RF STL		
820						***** BRANCHES *****		
822								
824						USE BRANCH CHART 1CS1502		
826						***** CONSTRUCTION DETAILS *****		
828								
830						SEAL WELDING ---- REQUIRED		
832						PIPE BENDS ---- NONE		
834						THREAD SEALANT ---- LOCTITE 767		
836						PWHT ---- NONE		
838						NDE ---- MINIMUM REQUIRED PER ASME B31.3		
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SAMPLE					CONSTRUCTION			
					UNITED OLEFINS COMPLEX PROJECT			
					2" & SMALLER - SOCKETWELD 3" & LARGER - BUTTWELD			
					CORR. ALLOW. 1.5 MM			
					DATE 09AUG01			
					BY EEC			
					REV 3			
					SHEET 3 OF 4			
					PA 5			
					CLASS 1CS1502			



## Branch Reinforcement

FLUOR DANIEL, INC.  
06700300  
HOUSTON, TX.

LINE CLASS: 1CS1S02  
ANGLE: 90°  
REV: 3

LEGEND :

B = BRANCH WELD

E = REDUCING TEE

P = BRANCH WELD w / REINFORCING PAD

(Pad thickness equals run pipe thickness. Pad width equals 1/2 branch OD.)

S = SOCKOLET

T = TEE

W = WELDOLET (Note 05)

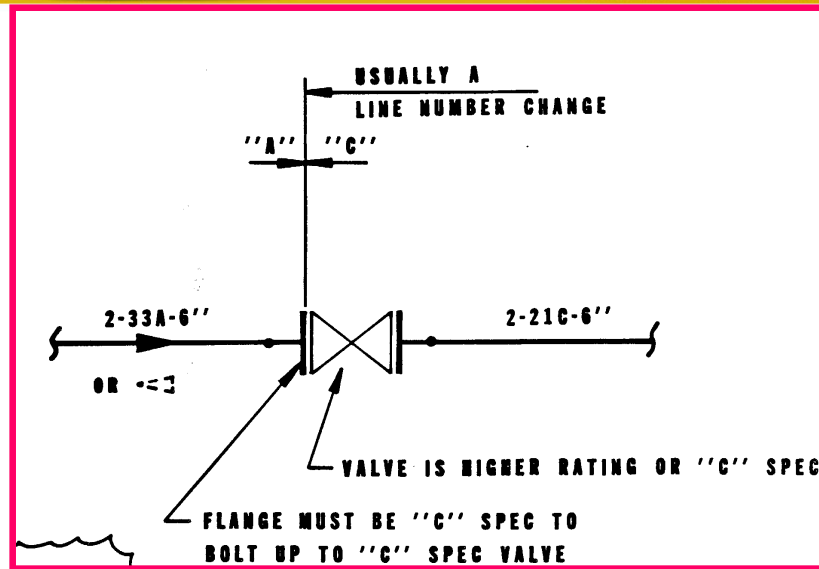
	48	T																			E = REDUCING TEE
	42	E	T																		P = BRANCH WELD w / REIN
	36	W	E	T																	(Pad thickness equals run pipe thickness)
	30	W	P	E	T																S = SOCKOLET
	24	W	P	W	E	T															T = TEE
	20	P	P	W	P	E	T														W = WELDOLET (Note 05)
	18	P	P	W	P	P	E	T													
	16	P	P	P	P	P	E	T													
	14	P	P	P	P	P	P	E	T												
	12	P	P	P	P	P	P	B	E	T											
	10	P	P	P	W	W	W	B	B	B	E	T									
	8	P	P	P	W	W	W	B	B	B	B	E	T								
	6	W	W	W	W	W	W	W	B	B	B	B	E	T							
	4	W	W	W	W	W	W	W	B	B	B	B	E	T							
	3	W	W	W	W	W	W	W	B	B	B	B	B	E	T						
	2	S	S	S	S	S	S	S	S	S	S	S	S	S	T						
	1-1/2	S	S	S	S	S	S	S	S	S	S	S	S	S	S	E	T				
	1	S	S	S	S	S	S	S	S	S	S	S	S	S	S	E	E	T			
	3/4	S	S	S	S	S	S	S	S	S	S	S	S	S	S	E	E	E	T		
	1/2	S	S	S	S	S	S	S	S	S	S	S	S	S	S	E	E	E	E	T	
		48	42	36	30	24	20	18	16	14	12	10	8	6	4	3	2	1-1/2	1	3/4	1/2
BRANCH SIZE																					

HEADER SIZE

Pressure - Temperature Ratings	
T (°C)	P (barg)
-29	19.65
38	19.65
93	17.95
149	15.85
204	13.8
260	11.7
316	9.65
371	7.6
427	5.5

**FLUOR®**

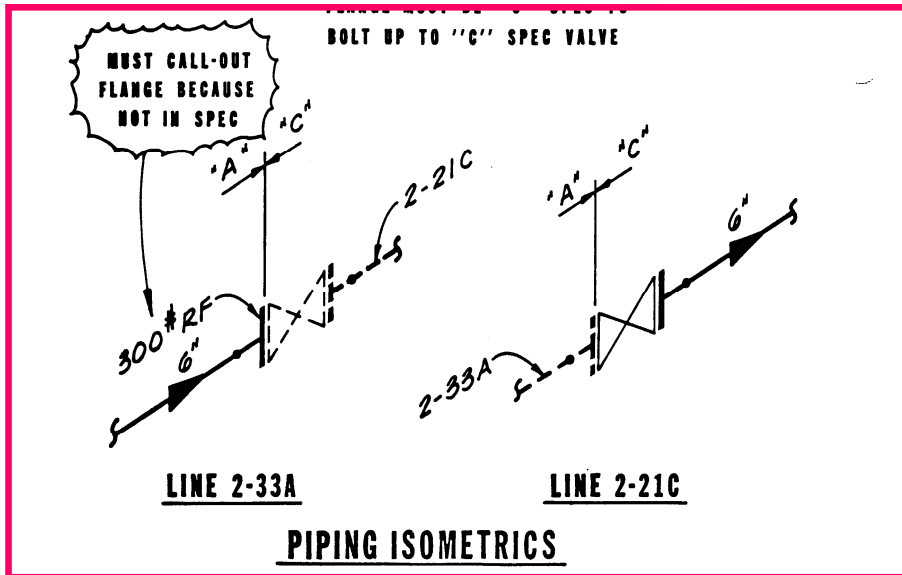
# Material Spec Break P&ID Representation:



**FLUOR**

**PES**  
project execution services

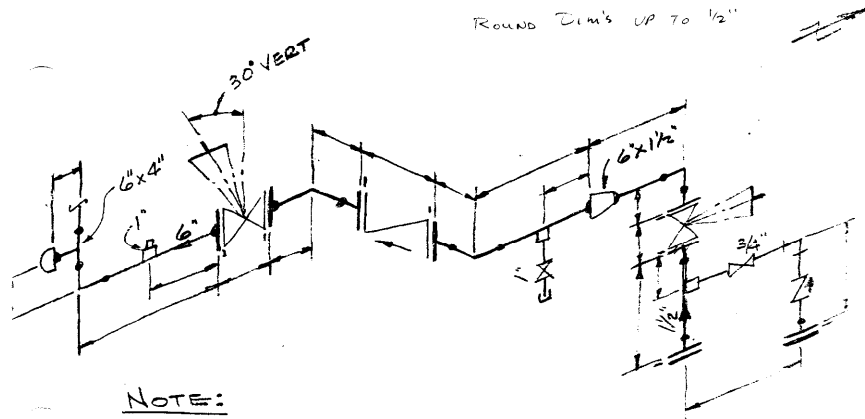
# Material Spec Break Isometric Representation:



**FLUOR®**

**PES**  
project execution services

## Exercise

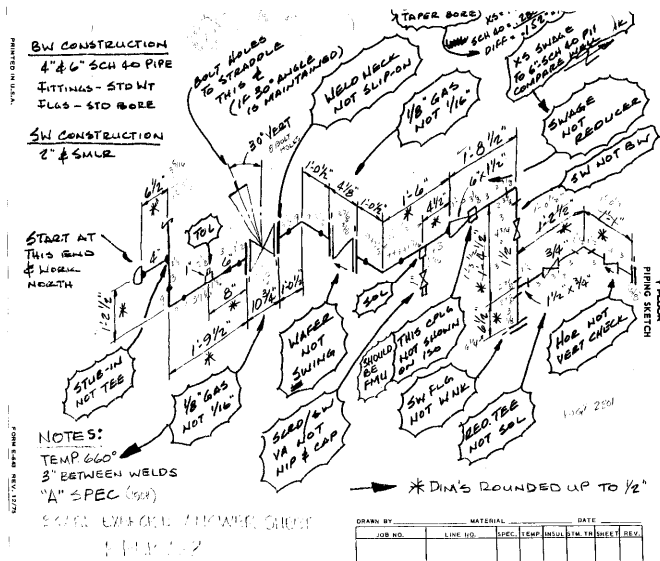


NOTE:  
TEMP. 660°  
3" BETWEEN WELDS  
ISO # RATING

**FLUOR**

**PES**  
project execution services

## Exercise Key Sheet

**FLUOR®**

Questions??



## Exercise PI-E10



# Test PI-T10

