



Ecopetrol S.A - I.D. Revamp Azufre II  
Consolidación Identificación Piping class de tubería - 04/05/2023

## Ecopetrol S.A I.D. Revamp Azufre II

### Piping

## Especificación Técnica Consolidación Identificación Piping class de tubería

**HATCH**

NÚMERO DE CONTRATO: 2022-3037681-014

☒ 1. APROBADO PARA DISEÑO / CONSTRUCCIÓN  
☐ 2. APROBADO PARA COMENTARIOS DEL CLIENTE, PUEDE PROCEDER  
SUJETO A LA INCORPORACIÓN DE LOS CAMBIOS INDICADOS.  
☐ 3. DEVUELTO Y REVISADO, NO PUEDE PROCEDER  
☐ 4. SOLO PARA INFORMACIÓN

FIRMA:  FECHA: 05/05/2023

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|              |             |                                            |                                                                                     |                                                                                       |                                                                                       |
|--------------|-------------|--------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|              |             |                                            |  |  |  |
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| 20/12/2022   | A           | Emitido para<br>comentarios del<br>Cliente | R. Posada                                                                           | R. Alzate                                                                             | H. Suarez                                                                             |
| 23/11/2022   | P           | Preliminar                                 | R. Posada                                                                           | R. Alzate                                                                             | H. Suarez                                                                             |
| <b>Fecha</b> | <b>Rev.</b> | <b>Estatus</b>                             | <b>Preparado por</b>                                                                | <b>Revisado por</b>                                                                   | <b>Aprobado por</b>                                                                   |
| <b>HATCH</b> |             |                                            |                                                                                     |                                                                                       |                                                                                       |

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## 1. Objetivo y alcance

El propósito de este documento es establecer los parámetros de la selección de clases de materiales de tubería (Piping Class) a ser aplicados para los sistemas alcance del proyecto I.D. Revamp Azufre II a realizarse en la refinería de Barrancabermeja ubicada en el departamento de Santander.

La selección está enmarcada en los alcances de los códigos de diseño de tubería ASME B31.3 y considera la información suministrada por el Cliente generada en la ingeniería realizada por HATCH, como información de referencia para esta ODS. De esta información suministrada, en relación con la Piping Class, sólo se valida la selección, de acuerdo las condiciones de Proceso descritas en las bases de Diseño de la Ingeniería de Detalle.

## 2. Definiciones y abreviaturas

- CA: Corrosion Allowance, Espesor adicional por corrosión
- CS: Carbon Steel, Acero al carbono
- ECP: Ecopetrol
- FACING: Cara de bridas
- FGA: Servicio Gas Acido
- FUG: Servicio Gas Combustible
- FW: Servicio Sistema Contra incendios
- IB: Ingeniería Básica
- ID: Ingeniería de Detalle
- INA: Servicio Aire de Instrumentos
- KCS: Killed Carbon Steel, Acero al carbono desgasificado o calmado
- LPS: Servicio Vapor de Baja Presión
- NIT: Servicio Nitrógeno
- OEW: Servicio Aguas Aceitosas
- OFFSPEC: Elemento de tubería no disponible en las especificaciones de tubería
- POT: Servicio Agua Potable
- PWHT: Post Weld Heat Treatment, Tratamiento térmico post soldadura
- QUI: Servicio Inyección de Químicos
- RATING: Clasificación presión-temperatura para conexiones bridadas (ASME B16.5)
- RF: Raised Face, Elementos bridados con cara resaltada
- SLP: Servicio Hidrocarburos a SLOP
- SWI: Servicio Aguas Acidas
- UTA: Servicio Aire Industrial
- WU: Servicio Agua Industrial

### 3. Documentación de referencia

#### 3.1 Documentos del Proyecto

**Tabla 1. Documentos de Referencia**

| Código                 | Nombre                                                          |
|------------------------|-----------------------------------------------------------------|
| GRB-2880-MET-CD-000001 | Criterios de Diseño - Disciplina Tubería                        |
| GRB-2880-MET-LI-000002 | Listado de Líneas a ser intervenidas o desmanteladas            |
| GRB-2880-MET-IS-000001 | Notas Generales y Planos de Referencia de Isométricos de Piping |

#### 3.2 Documentos / Estándares suministrados por el cliente

**Tabla 2. Documentos Suministrados por el Cliente**

| Código                                      | Nombre                                                                      |
|---------------------------------------------|-----------------------------------------------------------------------------|
| 2282-0000-JSD-1300-01_1                     | Documentación del proyecto HDT-GCB- Piping classes summary and piping class |
| 2282-0000-JSD-1300-01-ATT-1_1               | Documentación del proyecto HDT-GCB- Piping classes summary                  |
| 2282-0000-JSD-1300-01-ATT-2_1               | Documentación del proyecto HDT-GCB- Piping classes Detail                   |
| BRANCH TABLES 2282-0000-JSD-1300-01-ATT-3_1 | Documentación del proyecto HDT-GCB- Branch tables.                          |
| Clase AA1A23A-01                            | PIPING CLASS-Comunidad Smartplant                                           |
| Clase AA2A23A-01                            | PIPING CLASS-Comunidad Smartplant                                           |
| Clase AA2A33A-01                            | PIPING CLASS-Comunidad Smartplant                                           |
| Clase AA3A33A-01                            | PIPING CLASS-Comunidad Smartplant                                           |
| ECP-VST-P-MET-ET-006                        | Piping Material Specification                                               |
| ECP-VST-P-MET-ET-014                        | Especificación Técnica para tubería según ASME B31.3 Tubería de proceso.    |

#### 3.3 Normas y códigos de referencia

**Tabla 3. Normas y Códigos de Referencia**

| Código                         | Nombre                                                                                                                                                     |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ANSI / NACE MR0103 / ISO 17945 | Petroleum, Petrochemical and Natural Gas Industries - Metallic Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments |
| ASME B1.1                      | Unified Inch Screw Threads (UN, UNR, and UNJ Thread Forms)                                                                                                 |
| ASME B1.20.1 NPT               | Pipe Threads, General Purpose, Inch                                                                                                                        |

| Código       | Nombre                                                                                                          |
|--------------|-----------------------------------------------------------------------------------------------------------------|
| ASME B16.5   | Pipe Flanges and Flanged Fittings                                                                               |
| ASME B16.9   | Factory-Made Wrought Buttwelding Fittings                                                                       |
| ASME B16.11  | Forged Fittings, Socket-Welding and Threaded                                                                    |
| ASME B18.2.1 | Bolts and Screws                                                                                                |
| ASME B18.2.2 | Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)     |
| ASME B16.20  | Metallic Gaskets for Pipe Flanges                                                                               |
| ASME B16.21  | Nonmetallic Flat Gaskets for Pipe Flanges                                                                       |
| ASME B16.25  | Buttwelding Ends                                                                                                |
| ASME B16.34  | Valves — Flanged, Threaded, and Welding End                                                                     |
| ASME B16.47  | Large Diameter Steel Flanges: NPS 26 through NPS 60, Metric/Inch Standard                                       |
| ASME B16.48  | Line Blanks                                                                                                     |
| ASME B36.10  | Welded and Seamless Wrought Steel Pipe                                                                          |
| ASME B36.19  | Stainless Steel Pipe                                                                                            |
| ASME B31.3   | Process Piping                                                                                                  |
| NFPA 24      | Standard for the Installation of Private Fire Service Mains and Their Appurtenances                             |
| API 594      | Check Valves: Flanged, Lug, Wafer, and Butt-welding                                                             |
| API 598      | Valve Inspection and Testing                                                                                    |
| API 599      | Metal Plug Valves—Flanged, Threaded, and Welding Ends                                                           |
| API 600      | Steel Gate Valves—Flanged and Butt-welding Ends, Bolted Bonnets                                                 |
| API 602      | Gate, Globe, and Check Valves for Sizes DN 100 (NPS 4) and Smaller for the Petroleum and Natural Gas Industries |
| API 607      | Fire Test for Quarter-turn Valves and Valves Equipped with Nonmetallic Seats                                    |
| API 608      | Metal Ball Valves—Flanged, Threaded, and Welding Ends                                                           |
| API 609      | Butterfly Valves: Double-flanged, Lug- and Wafer-type, and Butt-welding Ends                                    |
| API 623      | Steel Globe Valves—Flanged and Butt-welding Ends, Bolted Bonnets                                                |
| MSS SP-80    | Bronze Gate, Globe, Angle, and Check Valves                                                                     |
| MSS SP-95    | Swage(d) Nipples and Bull Plugs                                                                                 |
| MSS SP-97    | Integrally Reinforced Forged Branch Outlet Fittings: Socket Welding, Threaded, and Buttwelding Ends             |

## 4. Premisas y Consideraciones

La selección de materiales de tubería para el desarrollo de la presente ingeniería tiene en cuenta las siguientes premisas y consideraciones:

- Las clases se seleccionarán de acuerdo con las especificaciones y documentación de referencia suministradas por el cliente, ver Tabla 2, buscando estandarización y minimizando la variabilidad de clases en los diseños con respecto a lo usado actualmente en la refinería. Para el presente proyecto se tendrán dos fuentes principales para determinar las clases con los servicios de proceso:
  - La primera son las clases definidas dentro de la comunidad de Smartplant, plataforma que actualmente estará a cargo de la documentación de las clases y su ingreso a las plataformas de Ecopetrol, en dicha plataforma se tienen especificadas las clases aplicables e ingresadas a la fecha para trabajar según ASME B31.3 Tubería de Proceso.
  - La segunda, en caso de que no se encuentre disponible las clases requeridas en la comunidad de smartplant, se utilizan las sugeridas en el documento "Piping Class Detail – Proyecto HDT – GCB", el cual contiene clases que ya se han utilizado anteriormente en la facilidad de refinería, de no encontrarse una clase aplicable en dicho documento se usarán las disponibles en el documento "ET para Tubería según ASME B31.3 Tubería de Proceso ECP-VST-P-MET-ET-014/06" documentos que sirven como base pero que en la actualidad se consideran desactualizados.
- Para las conexiones a sistemas existentes se usará en lo posible materiales con la misma especificación de los sistemas instalados, sin embargo, en caso de no estar disponibles o no poder determinarse se seleccionará previa evaluación de idoneidad y compatibilidad.
- De acuerdo con los requisitos indicados, todos los materiales 304SS y 316SS que requieran instalación por soldadura deberán ser suministrados con estampado doble 304/304L y 316/316L.

## 5. Parámetros de selección

### 5.1 Código de diseño

Las nuevas tuberías se diseñarán de acuerdo con el código ASME B31.3. Por lo tanto, las inspecciones, pruebas y ensayos de aceptación para sistemas de tubería deberán realizarse según se indique en la respectiva clase de materiales de tubería y los requisitos del código. Los sistemas de tuberías parte del sistema contraincendio, deberán ser diseñados de acuerdo con el estándar NFPA 24 y demás estándares NFPA aplicables.

### 5.2 Rating de presión

De acuerdo con las presiones y temperaturas de operación y de diseño disponibles en el listado de líneas de Procesos, y considerando los límites de presión indicados en ASME B16.5 para las clases: 150, 300 y 600, se selecciona el rating de presión considerando el material base en función del fluido transportado.

En la Tabla 4 se encuentra un resumen de las condiciones de operación para cada servicio de acuerdo con los incluidos en el listado de líneas y el rating de presión seleccionado.

**Tabla 4. Parámetros Básicos de los Servicios Requeridos**

| Servicio(s)                        | Presión de diseño,<br>psig @ Temp. de<br>diseño, °F | Rating |
|------------------------------------|-----------------------------------------------------|--------|
| ACID FLARE (AFL)                   | 50 @ 400                                            | 150#   |
| AGUA CONTRA INCENDIO (FWA)         | 211 @ 113                                           | 150#   |
| BOILER FEED WATER (BFW)            | 300 @ 845                                           | 600#   |
| COMBUSTION AIR (COA)               | 60 @ 450                                            | 150#   |
| CONDESATE (CND)                    | 50 @ 400                                            | 150#   |
| COOLING WATER – SUPPLY (CWS)       | 60 @ 140                                            | 150#   |
| FLUE GAS (FLU)                     | 50 @ 400                                            | 150#   |
| FUEL GAS (FUG)                     | 50 @ 400                                            | 150#   |
| HYDROCARBONS VAPORS (VAP)          | 75 @ 650                                            | 150#   |
| HYDROGEN (HYD)                     | 215 @ 132                                           | 150#   |
| HIGH PRESSURE CONDENSATE (HPC)     | 700 @ 752                                           | 600#   |
| HIGH PRESSURE STEAM (HPS)          | 621 @ 800                                           | 600#   |
| INSTRUMENT AIR (INA)               | 99 @ 160                                            | 150#   |
| INDUSTRIAL AIR (UTA)               | 120 @ 150                                           | 150#   |
| INDUSTRIAL AIR (UTA) ALTA PRESIÓN  | 250 @ 300                                           | 300#   |
| LÍQUIDO SULPHUR (AZU)              | 75 @ 650                                            | 150#   |
| LOW PRESSURE CONDENSATE (LPC)      | 90 @ 353                                            | 150#   |
| LOW PRESSURE STEAM (LPS)           | 75 @ 400                                            | 150#   |
| MEDIUM PRESSURE CONDENSATE (MPC)   | 175 @ 530                                           | 300#   |
| MEDIUM PRESSURE STEAM (MPS)        | 175 @ 530                                           | 300#   |
| NATURAL GAS (NTG)                  | 145 @ 132                                           | 150#   |
| NITROGEN (NIT)                     | 95 @ 140                                            | 150#   |
| OILY WATER (OSW)                   | 14 @ 353                                            | 150#   |
| OXYGEN (GOX)                       | 40 @ 150                                            | 150#   |
| PROCESS GAS (P)                    | 75 @ 650                                            | 150#   |
| SOFTENED WATER (SWA)               | 50 @ 400                                            | 150#   |
| SOUR GAS (FGA)-Antes de tambores   | 50 @ 300                                            | 150#   |
| SOUR WATER (SWI)                   | 75 @ 400                                            | 150#   |
| SWEET GAS (SWG)– Antes de tambores | 50 @ 400                                            | 150#   |
| TAIL GAS (TG)                      | 14 @ 650                                            | 150#   |

## 5.3 FLUIDOS Y METALURGIA

De acuerdo con los fluidos indicados en la Tabla 4, se identifican como de alta tendencia al “Cracking” las corrientes con alto contenido de H<sub>2</sub>S combinado con agua libre y Cianuros, considerándolos como “Sour Service”, lo cual hace necesario el uso de materiales de tubería para fluidos de acuerdo con los requerimientos de la norma NACE MR0103 (control de la dureza mediante PWHT).

Lo anterior es aplicable para los servicios de: Aguas Ácidas, Drenajes de Aguas Agrias, Gas y Acido. La especificación de materiales de tubería con los requerimientos indicados se encuentra incluida en las clases de materiales de tubería A6L-1F, A3L-3F, M1L-1F y A3L-1F del Piping Class suministrado por el Cliente referenciado en 0 (2282-0000-JSD-1300-01-ATT-2\_1), el espesor definido para estas clases, en ratings 150# y 300# y elementos KCS.

Se considera que los demás fluidos del proyecto no son “Sour Service” por lo cual no es necesario el requerimiento NACE, por lo cual para las demás clases trabajadas no se usará: A3-1F, A3J-1F, A3V-1F, A3V-1F, A3E-1F, M2-1F.

Para las tuberías de OXIGENO(O), la tubería especificarse es en material de acero inoxidable grado 304L. La clase M2-1F cumple con dichos requerimientos.

## 6. SELECCIÓN DE CLASES DE MATERIALES

De acuerdo con los criterios y consideraciones indicadas previamente, la selección de las Clases de Tubería (Piping Class) para el desarrollo de la ingeniería se incluye en la Tabla 5.

**Tabla 5. Clases Seleccionadas**

| Items | Clase de Tubería | Servicio                                                                                                                                      | Material Base | Rating / Facing | CA (mm) |
|-------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------|---------|
| 1     | A3-1F            | COMBUSTION AIR (COA)<br>COOLING WATER – SUPPLY (CWS)<br>LÍQUIDO SULPHUR (AZU)<br>BOILER FEED WATER (BFW)<br>TAIL GAS (TG)<br>OILY WATER (OSW) | K.C.S.        | 150             | 3       |
| 2     | A3J-1F           | LÍQUIDO SULPHUR (AZU) Con Chaqueta<br>BOILER FEED WATER (BFW) Con Chaqueta                                                                    | K.C.S.        | 150             | 3       |
| 3     | A3V-1F           | LOW PRESSURE STEAM (LPS)<br>Exterior Chaqueta                                                                                                 | K.C.S.        | 150             | 3       |

| Items | Clase de Tubería | Servicio                                                                                                                                                                                                                                                                                                                                                               | Material Base              | Rating / Facing | CA (mm) |
|-------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-----------------|---------|
| 4     | A6L-1F           | SOUR GAS (FGA)-Antes de tambores<br>SWEET GAS (SWG)- Antes de tambores<br>SOUR WATER (SWI)                                                                                                                                                                                                                                                                             | K.C.S.<br>NACE<br>MR-0103  | 150             | 6       |
| 5     | A3E-1F           | TAIL GAS (TG)<br>PROCESS GAS (P)                                                                                                                                                                                                                                                                                                                                       | K.C.S.                     | 150             | 3       |
| 6     | A3L-3F           | PROCESS GAS (P)                                                                                                                                                                                                                                                                                                                                                        | K.C.S.<br>NACE<br>MR-0103  | 300             | 3       |
| 7     | M1L-1F           | ACID FLARE (AFL)                                                                                                                                                                                                                                                                                                                                                       | SS 304L<br>NACE<br>MR-0103 | 150             | 1       |
| 8     | M2-1F            | OXYGEN                                                                                                                                                                                                                                                                                                                                                                 | SS<br>304/304 L            | 150             | 1.5     |
| 9     | A3L-1F           | SOUR GAS (FGA)-Después de tambores<br>SWEET GAS (SWG)-Después de tambores<br>TAIL GAS (TG)                                                                                                                                                                                                                                                                             | K.C.S.<br>NACE<br>MR-0103  | 150             | 3       |
| 10    | AA1A23A-01       | FLUE GAS (FLU)<br>FUEL GAS (FUG)<br>INSTRUMENT AIR (INA)<br>INDUSTRIAL AIR (UTA)<br>LOW PRESSURE<br>CONDENSATE (LPC)<br>CONDENSATE (CND)<br>LOW PRESSURE STEAM (LPS)<br>NITROGEN (NIT)<br>NATURAL GAS (NTG)<br>INDUSTRIAL AIR (UTA)<br>HYDROCARBONS VAPORS (VAP)<br>HYDROGEN (HYD)<br>MEDIUM PRESSURE STEAM (MPS)<br>SOFTENED WATER (SWA)<br>AGUA CONTRAINCENDIO (FWA) | C.S.                       | 150             | 1.5     |
| 11    | AA2A23A-01       | INDUSTRIAL AIR (UTA)<br>MEDIUM PRESSURE STEAM (MPS),<br>Clase 300 o 150 spec AA1A23A-01                                                                                                                                                                                                                                                                                | C.S.                       | 300             | 1.5     |
| 12    | AA2A33A-01       | CONDENSADO DE ALTA PRESIÓN<br>(HPC)                                                                                                                                                                                                                                                                                                                                    | C.S.                       | 300             | 3       |

| Items | Clase de Tubería | Servicio                                                                                   | Material Base | Rating / Facing | CA (mm) |
|-------|------------------|--------------------------------------------------------------------------------------------|---------------|-----------------|---------|
| 13    | AA3A33A-01       | VAPOR DE ALTA PRESIÓN (HPS)<br>CONDENSADO DE ALTA PRESIÓN (HPC)<br>BOILER FEED WATER (BFW) | C.S.          | 600             | 3       |

## 7. ELEMENTOS FUERA DE ESPECIFICACIÓN

En caso de que los diseños correspondientes al alcance de la presente orden de servicio requieran del uso de elementos de tubería no incluidos en las especificaciones definidas, estos serán incluidos como elementos “Fuera de Especificación” / “Offspec” previa confirmación técnica de idoneidad y compatibilidad con los demás elementos de la clase de tubería donde sean incluidos.

## 8. ANEXOS

### ANEXO 1: Especificaciones de Tubería Seleccionadas (Piping Class)

- A3-1F
- A3J-1F
- A3V-1F
- A6L-1F
- A3E-1F
- A3L-3F
- M1L-1F
- M2-1F
- A3L-1F
- AA1A23A-01
- AA2A23A-01
- AA2A33A-01
- AA3A33A-01

### ANEXO 2: Tabla de Ensayos No Destructivos y Tratamiento térmico despues de Soldadura

### ANEXO 3: Especificaciones Técnicas para Materiales de Tubería para Servicios Ácidos

## **Anexo 1 – Especificaciones de Tubería Seleccionadas (Piping Class)**



## PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/ 12/ 2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE       |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------------|
| A3-1F     | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process       |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS |               | STRESS RELIEF |
|           | 285 PSIG @ -20 A 800 °F  |                             |                        |               | No            |

### PIPING SCHEDULES

| SIZE | 1/2" | 3/4" | 1" | 1.1/2" | 2" | 10"  | 14" | 16" | 12"  | 3"    | 4" | 6" | 8" | 18" | 20" | 24" | 26"   | 28" | 30"  |
|------|------|------|----|--------|----|------|-----|-----|------|-------|----|----|----|-----|-----|-----|-------|-----|------|
| SCH. | S-XS |      |    |        |    | S-20 |     |     | S-30 | S-STD |    |    |    |     |     |     | S-STD |     | S-XS |

### SPEC ITEMS

| ELEMENT               | COMMODITY CODE    | SIZE |    | DESCRIPTION                                                                                                        | NOTES |
|-----------------------|-------------------|------|----|--------------------------------------------------------------------------------------------------------------------|-------|
|                       |                   | FROM | TO |                                                                                                                    |       |
| PIPING                | PPPABQPEACRAP1G   | 1/2  | 2  | Pipe, ASME B36.10M, Plain Ends, ASTM A106 Grade B, Seamless, Length: 6m Aprox Length                               |       |
|                       | PPPABQBEACRAP1G   | 3    | 24 | Pipe, ASME B36.10M, Beveled Ends, ASTM A106 Grade B, Seamless, Length: 6m Aprox Length                             |       |
|                       | PPPABQBEAE5AP2D   | 26   | 30 | Pipe, ASME B36.10M, Beveled Ends, ASTM A672 Grade C60, Electric Fusion Welded, 100% XRAY, Length: 12m Aprox Length |       |
| SOCKOLET (BR. TABLE)  | OSOCAM9SSWACGZZZZ | 3    | 30 | Socketolet, MSS SP-97, Class 3000, Socket Welded Ends, ASTM A105                                                   |       |
| TEE (BRANCH TABLE)    | OETEAB2SSWACGZZZZ | 1/2  | 2  | Straight Tee, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                                               |       |
|                       | BTEEABMBEACKA3AZ  | 3    | 24 | Straight Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                              |       |
|                       | BTEEABMBEACKAB1B  | 26   | 30 | Straight Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Welded, 100% XRAY                                     |       |
| THREDOLET (BR. TABLE) | OTHLAM9STFACGZZZZ | 3    | 30 | Threadolet, MSS SP-97, Class 3000, Female Threaded Ends, ASTM A105                                                 |       |
| RED. TEE (BR. TABLE)  | ORTEAB2SSWACGZZZZ | 3/4  | 2  | Reducing Tee, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                                               |       |
|                       | BTERABMBEACKA3AZ  | 4    | 24 | Reducing Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                              |       |
|                       | BTERABMBEACKAB1B  | 26   | 30 | Reducing Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Welded, 100% XRAY                                     |       |
| WELDOLET (BR. TABLE)  | BWELAM9BEACGZZZZ  | 8    | 30 | Weldolet, MSS SP-97, Beveled Ends, ASTM A105                                                                       |       |
| CAP                   | OCAPAB2SSWACGZZZZ | 1/2  | 2  | Cap, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                                                        |       |
|                       | OCAPAB2STFACGZZZZ | 1/2  | 2  | Cap, ASME B16.11, Class 3000, Female Threaded Ends, ASTM A105                                                      |       |
|                       | BCAPABMBEACKA3AZ  | 3    | 30 | Cap, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                                       |       |
| CPLG.                 | OCPLAB2SSWACGZZZZ | 1/2  | 2  | Coupling/connector, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                                         |       |
|                       | OCPLAB2STFACGZZZZ | 1/2  | 2  | Coupling/connector, ASME B16.11, Class 3000, Female Threaded Ends, ASTM A105                                       |       |
| 45 DEG. ELBOW         | OE45AB2SSWACGZZZZ | 1/2  | 2  | 45° elbow, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                                                  |       |
|                       | BE4LABMBEACKA3AZ  | 3    | 24 | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                    |       |
|                       | BE4LABMBEACKAB1B  | 26   | 30 | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Welded, 100% XRAY                           |       |
| 45-90 DEG DIRECTION   | BE9LABMBEACKA3AZ  | 3    | 24 | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                    |       |
|                       | BE9LABMBEACKAB1B  | 26   | 30 | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Welded, 100% XRAY                           |       |
| 90 DEGREE ELBOW       | BE9LABMBEACKA3AZ  | 3    | 24 | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                    |       |
|                       | OE90AB2SSWACGZZZZ | 1/2  | 2  | 90° elbow, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                                                  |       |
|                       | BE9LABMBEACKAB1B  | 26   | 30 | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Welded, 100% XRAY                           |       |
| <45 DEG DIRECTION CH  | BE4LABMBEACKA3AZ  | 3    | 24 | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                    |       |
|                       | BE4LABMBEACKAB1B  | 26   | 30 | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Welded, 100% XRAY                           |       |
| EQ. CROSS             | BXEEABMBEACKA3AZ  | 1    | 12 | Cross, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                                     |       |



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/ 12/ 2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3-1F     | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 285 PSIG @ -20 A 800 °F  |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT            | COMMODITY CODE   | SIZE  |       | DESCRIPTION                                                                                                                                                                    | NOTES |
|--------------------|------------------|-------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                    |                  | FROM  | TO    |                                                                                                                                                                                |       |
| NIPPLE             | ONIPABQTMACRA1AZ | 1/2   | 2     | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, 4in Long, Seamless                                                                                           |       |
|                    | ONIPABQPEACRA1AZ | 1/2   | 2     | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, 4in Long, Seamless                                                                                                   |       |
|                    | ONIPABQPMACRA1AZ | 1/2   | 2     | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, 4in Long, Seamless                                                                                |       |
|                    | ONIPABQTMACRA1GZ | 1/2   | 2     | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, 8in Long, Seamless                                                                                           |       |
|                    | ONIPABQPEACRA1GZ | 1/2   | 2     | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, 8in Long, Seamless                                                                                                   |       |
|                    | ONIPABQPMACRA1GZ | 1/2   | 2     | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, 8in Long, Seamless                                                                                |       |
| PLUG               | OPLRAB2TMACGZZZZ | 1/2   | 2     | Plug, round, ASME B16.11, Male Threaded Ends, ASTM A105                                                                                                                        |       |
| CON. REDUCER       | BRECABMBEACKA3AZ | 4     | 24    | Concentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                                                                                    |       |
|                    | BRECABMBEACKAB1B | 26    | 30    | Concentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Welded, 100% XRAY                                                                                           |       |
| ECC. REDUCER       | BREEABMBEACKA3AZ | 4     | 24    | Eccentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                                                                                     |       |
|                    | BREEABMBEACKAB1B | 26    | 30    | Eccentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Welded, 100% XRAY                                                                                            |       |
| CONC. SWAGE NIPPLE | OSGCAM8PEACKZZZZ | 3/4   | 2     | Concentric swage, MSS SP-95, Plain Ends, ASTM A234 Grade WPB                                                                                                                   |       |
|                    | OSGCAM8PMAKZZZZ  | 3/4   | 2     | Concentric swage, MSS SP-95, Plain End x Male Threaded End, ASTM A234 Grade WPB                                                                                                |       |
|                    | OSGCAM8BPAKZZZZ  | 3     | 4     | Concentric swage, MSS SP-95, Beveled End x Plain End, ASTM A234 Grade WPB                                                                                                      |       |
|                    | OSGCAM8MBAKZZZZ  | 3     | 4     | Concentric swage, MSS SP-95, Beveled End x Male Threaded End, ASTM A234 Grade WPB                                                                                              |       |
| ECC. SWAGE NIPPLE  | OSGEAM8PEACKZZZZ | 3/4   | 2     | Eccentric swage, MSS SP-95, Plain Ends, ASTM A234 Grade WPB                                                                                                                    |       |
|                    | OSGEAM8PMAKZZZZ  | 3/4   | 2     | Eccentric swage, MSS SP-95, Plain End x Male Threaded End, ASTM A234 Grade WPB                                                                                                 |       |
|                    | OSGEAM8BPAKZZZZ  | 3     | 4     | Eccentric swage, MSS SP-95, Beveled End x Plain End, ASTM A234 Grade WPB                                                                                                       |       |
| BLIND FLG.         | FBLABLRFAOGZZZZ  | 1/2   | 2     | Blind flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105                                                                                                                 |       |
|                    | FBLABLDRFAOGZZZZ | 1/2   | 24    | Blind flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105                                                                                                                 |       |
|                    | FBLABJDRFAOGZZZZ | 26    | 30    | Blind flange, ASME B16.47 Series B, Class 150, RF Flanged end, ASTM A105                                                                                                       |       |
| FLANGE             | FSWABLDRFAOGZZZZ | 1/2   | 2     | Socket welded flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105                                                                                                         |       |
|                    | FSWABLRFAOGZZZZ  | 1/2   | 2     | Socket welded flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105                                                                                                         |       |
|                    | FSWABLLRFAOGZZZZ | 1/2   | 2     | Socket welded flange, ASME B16.5, Class 600, RF Flanged end, ASTM A105                                                                                                         |       |
|                    | FLWABLRFAOGZZZZ  | 1-1/2 | 1-1/2 | Long weld neck flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105                                                                                                        |       |
|                    | FWNABLDRFAOGZZZZ | 3     | 24    | Weld neck flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105                                                                                                             |       |
|                    | FWNABLRFAOGZZZZ  | 3     | 24    | Weld neck flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105                                                                                                             |       |
|                    | FWNABLLRFAOGZZZZ | 3     | 24    | Weld neck flange, ASME B16.5, Class 600, RF Flanged end, ASTM A105                                                                                                             |       |
|                    | FWNABJIRFAOGZZZZ | 26    | 30    | Weld neck flange, ASME B16.47 Series B, Class 300, RF Flanged end, ASTM A105                                                                                                   |       |
| ORIFICE FLG        | FO2ABDIRFAOGAF2H | 2     | 24    | Weldneck Orifice Flange with 0.5" Threaded Tap, ASME B16.36, Class 300, RF Flanged end, ASTM A105, 2 Nos. Taps, w/ Jack Screws, A193 Grade B7M / A194 Grade 2HM Cadmium + PTFE |       |
| BALL VALVE         |                  |       |       |                                                                                                                                                                                |       |



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3-1F     | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 285 PSIG @ -20 A 800 °F  |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT            | COMMODITY CODE         | SIZE |    | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                            | NOTES |
|--------------------|------------------------|------|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                    |                        | FROM | TO |                                                                                                                                                                                                                                                                                                                                                                        |       |
| BALL VALVE         | VBRAA7IESBECA0GB1WBB5H | 1    | 2  | Ball valve, floating, API 608, Class 300, Socket Welded Ends w/2 nipples, Full Port, Split-Body 2-3 Pieces, Bolted Cover, ASTM A105, Lever Operator, SS316 Ball, SS316 Stem, RPTFE Seats, Viton Seals, Supply w/2 welded nipples A106 Gr B Length=6"                                                                                                                   |       |
|                    | VBSAA7DRFE4CACDB1WZZZZ | 3    | 6  | Ball valve, trunnion, API 608, Class 150, RF Flanged end, Full Port, Split-Body 2-3 Pieces, Bolted Cover, Short Pattern, ASTM A216 Grade WCB, Lever Operator, SS316 Ball, SS316 Stem, RPTFE Seats, Viton Seals                                                                                                                                                         |       |
|                    | VBSAA7DRFE4MACDB1WZZZZ | 8    | 8  | Ball valve, trunnion, API 608, Class 150, RF Flanged end, Full Port, Split-Body 2-3 Pieces, Bolted Cover, Short Pattern, ASTM A216 Grade WCB, Gear Operator, SS316 Ball, SS316 Stem, RPTFE Seats, Viton Seals                                                                                                                                                          |       |
| BUTTERFLY VALVE    | VYWAA4DRTCAQDY4CY1C    | 4    | 6  | Butterfly Valve Wafer Type, API 609 Cat A, Class 150, RF thru-bolted end without bolt holes, Lever Operator, ASTM A216 Grade WCB, Aluminum Bronze Disc, AISI 316 Stem, EPDM Sleeve Seat, Graphite Packing, Inspection and Testing Per API 598                                                                                                                          |       |
|                    | VYWAA4DRTMACDY4CY1C    | 8    | 24 | Butterfly Valve Wafer Type, API 609 Cat A, Class 150, RF thru-bolted end without bolt holes, Gear Operator, ASTM A216 Grade WCB, Aluminum Bronze Disc, AISI 316 Stem, EPDM Sleeve Seat, Graphite Packing, Inspection and Testing Per API 598                                                                                                                           |       |
| SWING CHECK VALVES | VQLCAA5MSWE5A0G08RC02B | 1/2  | 2  | Check valve, lift, API 602, Class 800, Socket Welded Ends, Piston, Bolted Cover, ASTM A105, API Trim 8, Inconel X750 Spring, Renewable Seats, Spiral Wound AISI 304+Graphite Cover Gasket, Bonnet Gasket Thickness: 6mm, Inspection and Testing Per API 598                                                                                                            |       |
|                    | VCSAA2DRFPA0C08SZZZZ   | 3    | 24 | Check valve, swing, API 594, Class 150, RF Flanged end, Bolted Cover, ASTM A216 Grade WCB, API Trim 8, Renewable Seats, Spiral Wound AISI 304+Graphite Cover Gasket, Bonnet Gasket Thickness: 6mm                                                                                                                                                                      |       |
| GATE VALVE         | VGRAA5MSWG2FACG9QZZZZ  | 1/2  | 2  | Gate valve, solid wedge, API 602, Class 800, Socket Welded Ends, Standard Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 8, Renewable Seats, Flexible Graphite Packing, Bonnet Gasket Thickness: 6mm                                                                                                                                   |       |
|                    | VGWAA4DRFG4FACD9RZZZZ  | 3    | 10 | Gate valve, flexible wedge, API 600, Class 150, RF Flanged end, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 8, Renewable Seats & Backseat, Tanged Graphite Gasket AISI 304, Thickness of S/Sinsertion 0.1 mm, Number of S/S insertions: 2, Flexible Graphite Packing, Bonnet Gasket Thickness: 6mm                   |       |
|                    | VGWAA4DRFG4MACD9RZZZZ  | 12   | 24 | Gate valve, flexible wedge, API 600, Class 150, RF Flanged end, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Gear Operator, API Trim 8, Renewable Seats & Backseat, Tanged Graphite Gasket AISI 304, Thickness of S/Sinsertion 0.1 mm, Number of S/S insertions: 2, Flexible Graphite Packing, Bonnet Gasket Thickness: 6mm                        |       |
|                    | VGWAA4DRHG4MACD9RZZZZ  | 26   | 30 | Gate valve, flexible wedge, API 600, Class 150, RF Flanged end as per ASME B16.47 Sr B, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Gear Operator, API Trim 8, Renewable Seats & Backseat, Tanged Graphite Gasket AISI 304, Thickness of S/Sinsertion 0.1 mm, Number of S/Sinsertions: 2, Flexible Graphite Packing, Bonnet Gasket Thickness: 6mm |       |
| GLOBE VALVE        |                        |      |    |                                                                                                                                                                                                                                                                                                                                                                        |       |



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/ 12/ 2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3-1F     | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 285 PSIG @ -20 A 800 °F  |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT     | COMMODITY CODE        | SIZE |    | DESCRIPTION                                                                                                                                                                                                                                                                              | NOTES |
|-------------|-----------------------|------|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|             |                       | FROM | TO |                                                                                                                                                                                                                                                                                          |       |
| GLOBE VALVE | VLRAA5MSWL6FAOGL6TZZZ | 1/2  | 2  | Globe Valve, API 602, Class 800, Socket Welded Ends, Standard Port , Plug Disc, OS&Y-Rising Stem , Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 8 , Renewable Seats , Spiral Wound AISI 304 + Graphite Bonnet Gasket , Bonnet Gasket Thickness: 6mm , Graphite Packing         |       |
|             | VLRAA3DRFLDFACDL6TZZZ | 3    | 10 | Globe Valve, API 623, Class 150, RF Flanged end, Plug Disc , OS&Y-Rising Stem, Rising Operator , Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 8 , Renewable Seats , Spiral Wound AISI 304 + Graphite Bonnet Gasket , Bonnet Gasket Thickness: 6mm , Graphite Packing |       |
|             | VLRAA3DRFL7MACDL6TZZZ | 12   | 12 | Globe Valve, API 623, Class 150, RF Flanged end, Plug Disc , OS&Y-Rising Stem , Bolted Bonnet, ASTM A216 Grade WCB, Gear Operator, API Trim 8 , Renewable Seats , Spiral Wound AISI 304 + Graphite Bonnet Gasket , Bonnet Gasket Thickness: 6mm , Graphite Packing                       |       |
| PLUG VALVE  | VPSAA8DRFP7CAQGP4DZZZ | 1    | 2  | Plug valve, short pattern, API 599, Class 150, RF Flanged end, Bolted Bonnet , Non-Lubricated, ASTM A105, Lever Operator, SS316 Tapered Plug , SS316 Stem , RPTFE Sleeve                                                                                                                 |       |
|             | VPSAA8DRFP7CAQDP4DZZZ | 3    | 6  | Plug valve, short pattern, API 599, Class 150, RF Flanged end, Bolted Bonnet , Non-Lubricated, ASTM A216 Grade WCB, Lever Operator, SS316 Tapered Plug , SS316 Stem , RPTFE Sleeve                                                                                                       |       |
|             | VPSBA8DRFP7MACDP4DZZZ | 8    | 12 | Plug valve, short pattern, API 599, Class 150, RF Flanged end, Bolted Bonnet , Non-Lubricated, ASTM A216 Grade WCB, Gear Operator, SS316 Tapered Plug , SS316 Stem , RPTFE Sleeve                                                                                                        |       |
|             | VPPAA8DRFP7MACDP4DZZZ | 14   | 14 | Plug valve, regular pattern, API 599, Class 150, RF Flanged end, Bolted Bonnet , Non-Lubricated, ASTM A216 Grade WCB, Gear Operator, SS316 Tapered Plug , SS316 Stem , RPTFE Sleeve                                                                                                      |       |
| GASKETS     | GSWAB9DRFAZHAG1K      | 1/2  | 10 | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 150, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler , w/ CS outer ring , Wall Thickness 6 mm                                                                                              |       |
|             | GSWAB9IRFAZHAG1K      | 1/2  | 10 | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 300, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler , w/ CS outer ring , Wall Thickness 6 mm                                                                                              |       |
|             | GSWAB9LRFZHBKZ        | 1/2  | 24 | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 600, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler , w/ 304 SS inner ring and CS outer ring , Wall Thickness 6 mm                                                                        |       |
|             | GSWAB9DRFAZHBKZ       | 12   | 24 | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 150, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler , w/ 304 SS inner ring and CS outer ring , Wall Thickness 6 mm                                                                        |       |
|             | GSWAB9IRFAZHBKZ       | 12   | 24 | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 300, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler , w/ 304 SS inner ring and CS outer ring , Wall Thickness 6 mm                                                                        |       |
|             | GSWAB8DRFAZHBKZ       | 26   | 30 | Spiral Wound Gasket, ASME B16.20, for ASME B16.47 Series B Flanges, Class 150, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler , w/ 304 SS inner ring and CS outer ring , Wall Thickness 6 mm                                                              |       |
|             | GSWAB8IRFAZHBKZ       | 26   | 30 | Spiral Wound Gasket, ASME B16.20, for ASME B16.47 Series B Flanges, Class 300, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler , w/ 304 SS inner ring and CS outer ring , Wall Thickness 6 mm                                                              |       |
| BOLTS       |                       |      |    |                                                                                                                                                                                                                                                                                          |       |



## PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3-1F     | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 285 PSIG @ -20 A 800 °F  |                             |                        | No            |         |

### SPEC ITEMS

| ELEMENT         | COMMODITY CODE   | SIZE |       | DESCRIPTION                                                                                                                              | NOTES |
|-----------------|------------------|------|-------|------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                 |                  | FROM | TO    |                                                                                                                                          |       |
| BOLTS           | LSEABSAX1AL1J    | 1/2  | 1-1/4 | Continuous Thread Stud Bolt, ASME B18.31.2/B18.2.2, ASTM A193 Grade B7M, with 2 Heavy Hexagonal Nuts, ASTM A194 Gr. 2HM                  |       |
| PADDLE BLIND    | DBPABMDRTACGZZZZ | 14   | 24    | Paddle blind (Paddle blank or Blind spacer), ASME B16.48, Class 150, RF thru-bolted end, ASTM A105                                       |       |
|                 | DBPABPDRTACGAD1B | 26   | 30    | Paddle blind (Paddle blank or Blind spacer), ASME B31.3, Class 150, RF thru-bolted end, ASTM A105, designed according to ASME B16.47 S B |       |
| SPECTACLE BLIND | DF8ABMDRTACGZZZZ | 1/2  | 12    | Spectacle blind (Figure 8 blind), ASME B16.48, Class 150, RF thru-bolted end, ASTM A105                                                  |       |
|                 | DF8ABMIRTAOGZZZZ | 1/2  | 12    | Spectacle blind (Figure 8 blind), ASME B16.48, Class 300, RF thru-bolted end, ASTM A105                                                  |       |
| PADDLE SPACER   | DBSABMDRTACGZZZZ | 14   | 24    | Paddle spacer (Open spacer or Ring spacer), ASME B16.48, Class 150, RF thru-bolted end, ASTM A105                                        |       |
|                 | DBSABPDRTACGAD1B | 26   | 30    | Paddle spacer (Open spacer or Ring spacer), ASME B31.3, Class 150, RF thru-bolted end, ASTM A105, designed according to ASME B16.47 S B  |       |

### SPECIFICATION NOTES

### COMPONENT NOTES



## PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3-1F     | 150                      | ASM E B31.3                 | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 285 PSIG @ -20 A 800 °F  |                             |                        | No            |         |

| HEADER | BRANCH |      |     |        |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
|--------|--------|------|-----|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
|        | 1/2"   | 3/4" | 1"  | 1.1/2" | 2"  | 3"  | 4"  | 6"  | 8"  | 10" | 12" | 14" | 16" | 18" | 20" | 24" | 26" | 28" | 30" |  |
| 1/2"   | ETE    |      |     |        |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 3/4"   | RTE    | ETE  |     |        |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 1"     | RTE    | RTE  | ETE |        |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 1.1/2" | RTE    | RTE  | RTE | ETE    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 2"     | RTE    | RTE  | RTE | RTE    | ETE |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 3"     | SOC    | SOC  | SOC | SOC    | SOC | TEE |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 4"     | SOC    | SOC  | SOC | SOC    | SOC | TER | TEE |     |     |     |     |     |     |     |     |     |     |     |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 6"     | SOC    | SOC  | SOC | SOC    | SOC | TER | TER | TEE |     |     |     |     |     |     |     |     |     |     |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 8"     | SOC    | SOC  | SOC | SOC    | SOC | WEL | TER | TER | TEE |     |     |     |     |     |     |     |     |     |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 10"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | TER | TER | TER | TEE |     |     |     |     |     |     |     |     |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 12"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TEE |     |     |     |     |     |     |     |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 14"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TER | TEE |     |     |     |     |     |     |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 16"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TER | TER | TEE |     |     |     |     |     |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 18"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | TER | TER | TER | TER | TER | TEE |     |     |     |     |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 20"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TEE |     |     |     |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 24"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TEE |     |     |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 26"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TEE |     |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 28"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TER | TEE |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
| 30"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TER | TER | TEE |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |

### NOMENCLATURE

ETE = Straight Tee  
TER = Reducing Tee

RTE = Reducing Tee  
THL = Thredolet

SOC = Sockolet  
WEL = Weldolet

TEE = Straight Tee



## PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/ 12/ 2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3J1F     | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 285 PSIG @ -20 A 425 °F  |                             |                        | No            |         |

### PIPING SCHEDULES

| SIZE | 1"   | 10"  | 12"  | 3"    | 4" | 6" | 8" | 2"   |
|------|------|------|------|-------|----|----|----|------|
| SCH. | S-XS | S-20 | S-30 | S-STD |    |    |    | S-XS |

### SPEC ITEMS

| ELEMENT        | COMMODITY CODE         | SIZE |    | DESCRIPTION                                                                                                                                                                                                                                                                                                                                     | NOTES |
|----------------|------------------------|------|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                |                        | FROM | TO |                                                                                                                                                                                                                                                                                                                                                 |       |
| PIPING         | PPPABQPEACRAP1G        | 1    | 1  | Pipe, ASME B36.10M, Plain Ends, ASTM A106 Grade B, Seamless, Length: 6m Aprox Length                                                                                                                                                                                                                                                            |       |
|                | PPPABQBEACRAP1A        | 2    | 12 | Pipe, ASME B36.10M, Beveled Ends, ASTM A106 Grade B, Seamless, Length: 12m Aprox Length                                                                                                                                                                                                                                                         |       |
| CROSS          | BXEEABMBEACKA3AZ       | 1    | 12 | Cross, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                                                                                                                                                                                                                                                                  |       |
| CON. REDUCER   | BRECABMBEACKA3AZ       | 2    | 12 | Concentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                                                                                                                                                                                                                                                     |       |
| ECC. REDUCER   | BREEABMBEACKA3AZ       | 2    | 12 | Eccentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                                                                                                                                                                                                                                                      |       |
| BLIND FLG.     | FBLABLDRFACGZZZZ       | 2    | 12 | Blind flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105                                                                                                                                                                                                                                                                                  |       |
| JKT PLUG VALVE | VJPAA8DRFQ2CACGP4DPP1R | 2    | 2  | Plug valve, full jacket, API 599, Class 150, RF Flanged end, Bolted Cover, Non-Lubricated, Short Pattern, ASTM A105, Lever Operator, SS316 Tapered Plug, SS316 Stem, RPTFE Sleeve, Fire safe Per API 607, W/Jacketed connection 1/2" flanged RF, CL150, with pipe extension ASTM A106 Gr, B, Length=6in, Liquid Sulphur                         |       |
|                | VJPAA8DRFQ2CACGP4DPP1S | 3    | 3  | Plug valve, full jacket, API 599, Class 150, RF Flanged end, Bolted Cover, Non-Lubricated, Short Pattern, ASTM A216 Grade WCB, Lever Operator, SS316 Tapered Plug, SS316 Stem, RPTFE Sleeve, Fire safe Per API 607, W/Jacketed connection 3/4" flanged RF, CL150, with pipe extension ASTM A106 Gr, B + NACE MR0103, Length=6in, Liquid Sulphur |       |
|                | VJPAA8DRFQ2CACGP4DPP1S | 6    | 6  | Plug valve, full jacket, API 599, Class 150, RF Flanged end, Bolted Cover, Non-Lubricated, Short Pattern, ASTM A216 Grade WCB, Lever Operator, SS316 Tapered Plug, SS316 Stem, RPTFE Sleeve, Fire safe Per API 607, W/Jacketed connection 3/4" flanged RF, CL150, with pipe extension ASTM A106 Gr, B + NACE MR0103, Length=6in, Liquid Sulphur |       |
|                | VJPAA8DRFQ2CACGP4DPP1T | 6    | 6  | Plug valve, full jacket, API 599, Class 150, RF Flanged end, Bolted Cover, Non-Lubricated, Short Pattern, ASTM A216 Grade WCB, Lever Operator, SS316 Tapered Plug, SS316 Stem, RPTFE Sleeve, Fire safe Per API 607, W/Jacketed connection 1" flanged RF, CL150, with pipe extension ASTM A106 Gr, B + NACE MR0103, Length=6in, Liquid Sulphur   |       |
|                | VJPAA8DRFQ2CACGP4DPP1T | 8    | 8  | Plug valve, full jacket, API 599, Class 150, RF Flanged end, Bolted Cover, Non-Lubricated, Short Pattern, ASTM A216 Grade WCB, Lever Operator, SS316 Tapered Plug, SS316 Stem, RPTFE Sleeve, Fire safe Per API 607, W/Jacketed connection 1" flanged RF, CL150, with pipe extension ASTM A106 Gr, B + NACE MR0103, Length=6in, Liquid Sulphur   |       |
|                | VJPAA8DRFQ2MACDP4DPP1T | 10   | 10 | Plug valve, full jacket, API 599, Class 150, RF Flanged end, Bolted Cover, Non-Lubricated, Short Pattern, ASTM A216 Grade WCB, Gear Operator, SS316 Tapered Plug, SS316 Stem, RPTFE Sleeve, Fire safe Per API 607, W/Jacketed connection 1" flanged RF, CL150, with pipe extension ASTM A106 Gr, B + NACE MR0103, Length=6in, Liquid Sulphur    |       |
|                | VJPAA8DRFQ2MACDP4DPP1U | 12   | 12 | Plug valve, full jacket, API 599, Class 150, RF Flanged end, Bolted Cover, Non-Lubricated, Short Pattern, ASTM A216 Grade WCB, Gear Operator, SS316 Tapered Plug, SS316 Stem, RPTFE Sleeve, Fire safe Per API 607, W/Jacketed connection 1-1/2" flanged RF, CL150, with pipe extension ASTM A106 Gr, B, Length=6in, Liquid Sulphur              |       |



## PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3J-1F    | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 285 PSIG @ -20 A 425 °F  |                             |                        | No            |         |

### SPECIFICATIONS

| ELEMENT        | COMMODITY CODE        | SIZE |      | DESCRIPTION                                                                                                                                                                                                                                                                                                                       | NOTES |
|----------------|-----------------------|------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                |                       | FROM | TO   |                                                                                                                                                                                                                                                                                                                                   |       |
| JKT PLUG VALVE | VJPA8DRFQ2MACDP4DPP1U | 14   | 14   | Plug valve, full jacket, API 599, Class 150, RF Flanged end, Bolted Cover, Non-Lubricated, Short Pattern, ASTM A216 Grade WCB, Gear Operator, SS316 Tapered Plug, SS316 Stem, RPTFE Sleeve, Fire safe Per API 607, W/Jacketed connection 1-1/2" flanged RF, Q150, with pipe extension ASTM A106 Gr. B, Length=6in, Liquid Sulphur |       |
| GASKETS        | GSWAB9DRFAZHBAKZ      | 2    | 12   | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 150, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler, w/ 304 SS inner ring and CS outer ring, Wall Thickness 6 mm                                                                                                                   |       |
| BOLTS          | LSEABSAX1AL1J         | 1/2  | .875 | Continuous Thread Stud Bolt, ASME B18.31.2/B18.2.2, ASTM A193 Grade B7M, with 2 Heavy Hexagonal Nuts, ASTM A194 Gr. 2HM                                                                                                                                                                                                           |       |

### SPECIFICATION NOTES

### COMPONENT NOTES



## PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3V-1F    | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 80 PSIG @ -20 A 425 °F   |                             |                        | No            |         |

### PIPING SCHEDULES

| SIZE | 1/2" | 3/4" | 1" | 1.1/2" | 10"  | 14" | 12"  | 3"    | 4" | 6" | 8" | 2"   |
|------|------|------|----|--------|------|-----|------|-------|----|----|----|------|
| SCH. | S-XS |      |    |        | S-20 |     | S-30 | S-STD |    |    |    | S-XS |

### SPEC ITEMS

| ELEMENT            | COMMODITY CODE    | SIZE |       | DESCRIPTION                                                                                                                                                          | NOTES |
|--------------------|-------------------|------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                    |                   | FROM | TO    |                                                                                                                                                                      |       |
| PIPING             | PPPABQPEACRAP1G   | 1/2  | 1-1/2 | Pipe, ASME B36.10M, Plain Ends, ASTM A106 Grade B, Seamless, Length: 6m Aprox Length                                                                                 |       |
|                    | PPPABQBEACRAP1A   | 2    | 14    | Pipe, ASME B36.10M, Beveled Ends, ASTM A106 Grade B, Seamless, Length: 12m Aprox Length                                                                              |       |
| CAP                | OAPAB2SSWACGZZZZ  | 1/2  | 1-1/2 | Cap, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                                                                                                          |       |
|                    | OAPAB2STFACGZZZZ  | 1/2  | 1-1/2 | Cap, ASME B16.11, Class 3000, Female Threaded Ends, ASTM A105                                                                                                        |       |
|                    | BCAPABMBEACKA3AZ  | 2    | 14    | Cap, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                                                                                         |       |
| CPLG.              | OCPLAB2SSWACGZZZZ | 1/2  | 1-1/2 | Coupling/connector, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                                                                                           |       |
|                    | OCPLAB2STFACGZZZZ | 1/2  | 2     | Coupling/connector, ASME B16.11, Class 3000, Female Threaded Ends, ASTM A105                                                                                         |       |
| HALF CPLG.         | OCPHAB2SPSACGZZZZ | 1/2  | 1-1/2 | Half coupling, ASME B16.11, Class 3000, Plain End x Socket Welded End, ASTM A105                                                                                     |       |
| CROSS              | BXEEABMBEACKAB2X  | 2    | 14    | Cross, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless, Two Halves                                                                                           |       |
| 45 DEG. ELBOW      | OE45AB2SSWACGZZZZ | 1/2  | 1-1/2 | 45° elbow, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                                                                                                    |       |
| 90 DEGREE ELBOW    | OE90AB2SSWACGZZZZ | 1/2  | 1-1/2 | 90° elbow, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                                                                                                    |       |
| NIPPLE             | ONIPABQTMACRA1AZ  | 1/2  | 2     | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, 4in Long, Seamless                                                                                 |       |
|                    | ONIPABQPEACRA1AZ  | 1/2  | 2     | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, 4in Long, Seamless                                                                                         |       |
|                    | ONIPABQPMACRA1AZ  | 1/2  | 2     | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, 4in Long, Seamless                                                                      |       |
|                    | ONIPABQTMACRA1GZ  | 1/2  | 2     | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, 8in Long, Seamless                                                                                 |       |
|                    | ONIPABQPEACRA1GZ  | 1/2  | 2     | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, 8in Long, Seamless                                                                                         |       |
|                    | ONIPABQPMACRA1GZ  | 1/2  | 2     | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, 8in Long, Seamless                                                                      |       |
| PLUG               | OPLRAB2TMACGZZZZ  | 1/2  | 2     | Plug, round, ASME B16.11, Male Threaded Ends, ASTM A105                                                                                                              |       |
| CON. REDUCER       | BRECABMBEACKAB2X  | 3    | 14    | Concentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless, Two Halves                                                                              |       |
| ECC. REDUCER       | BREEABMBEACKAB2X  | 3    | 14    | Eccentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless, Two Halves                                                                               |       |
| CONC. SWAGE NIPPLE | OSGCAM8PEACKZZZZ  | 3/4  | 1-1/2 | Concentric swage, MSS SP-95, Plain Ends, ASTM A234 Grade WPB                                                                                                         |       |
|                    | OSGCAM8PMACKZZZZ  | 3/4  | 1-1/2 | Concentric swage, MSS SP-95, Plain End x Male Threaded End, ASTM A234 Grade WPB                                                                                      |       |
| ECC. SWAGE NIPPLE  | OSGEAM8PEACKZZZZ  | 3/4  | 1-1/2 | Eccentric swage, MSS SP-95, Plain Ends, ASTM A234 Grade WPB                                                                                                          |       |
|                    | OSGEAM8PMACKZZZZ  | 3/4  | 1-1/2 | Eccentric swage, MSS SP-95, Plain End x Male Threaded End, ASTM A234 Grade WPB                                                                                       |       |
| BLIND FLG.         | FBLABLDRFAOGZZZZ  | 1/2  | 1-1/2 | Blind flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105                                                                                                       |       |
| FLANGE             | FSWABLDRFAOGZZZZ  | 1/2  | 1-1/2 | Socket welded flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105                                                                                               |       |
| GASKETS            | GSWAB9DRFAZHAG1J  | 1/2  | 1-1/2 | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 150, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler, w/ CS outer ring |       |
| BOLTS              |                   |      |       |                                                                                                                                                                      |       |



PIPING CLASS  
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Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3V-1F    | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 80 PSIG @ -20 A 425 °F   |                             |                        | No            |         |

SPEC ITEMS

| ELEMENT | COMMODITY CODE | SIZE |    | DESCRIPTION                                                                                                            | NOTES |
|---------|----------------|------|----|------------------------------------------------------------------------------------------------------------------------|-------|
|         |                | FROM | TO |                                                                                                                        |       |
| BOLTS   | LSEABSAX5AL1B  | 1/2  | 1  | Continuous Thread Stud Bolt, ASME B18.31.2/ B18.2.2, ASTM A193 Grade B7, with 2 Heavy Hexagonal Nuts, ASTM A194 Gr. 2H |       |

SPECIFICATION NOTES

COMPONENT NOTES



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/ 12/ 2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE       |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------------|
| A6L-1F    | 150                      | ASME B31.3                  | 6mm                    | Carbon Steel  | Process       |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS |               | STRESS RELIEF |
|           | 285 PSIG @ -7 A 800 °F   |                             |                        |               | No            |

## PIPING SCHEDULES

| SIZE | 2"    | 3/4"  | 1" | 1.1/2" | 3"    | 24"  | 12"  | 14" | 18" | 8"   | 4"   | 6" | 10" | 16" | 20" |
|------|-------|-------|----|--------|-------|------|------|-----|-----|------|------|----|-----|-----|-----|
| SCH. | S-160 | S-XXS |    |        | S-160 | S-30 | S-40 |     |     | S-60 | S-XS |    |     |     |     |

## SPEC ITEMS

| ELEMENT              | COMMODITY CODE         | SIZE  |       | DESCRIPTION                                                                                                                                                                                                                                                                                               | NOTES |
|----------------------|------------------------|-------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                      |                        | FROM  | TO    |                                                                                                                                                                                                                                                                                                           |       |
| PIPING               | PPPABQBEACRAP2H        | 3/4   | 2     | Pipe, ASME B36.10M, Beveled Ends, ASTM A106 Grade B, NACE MR0103, Seamless, Length: 6m Aprox Length                                                                                                                                                                                                       |       |
|                      | PPPABQBEACRAP2G        | 3     | 24    | Pipe, ASME B36.10M, Beveled Ends, ASTM A106 Grade B, NACE MR0103, Seamless, Length: 12m Aprox Length                                                                                                                                                                                                      |       |
| TEE (BRANCH TABLE)   | BTEEABMBEACKABCZ       | 3/4   | 24    | Straight Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                                                                                                                                                                        |       |
| RED. TEE (BR. TABLE) | BTERABMBEACKABCZ       | 1     | 24    | Reducing Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                                                                                                                                                                        |       |
| WELDOLET (BR. TABLE) | BWELAM9BEACGABSZ       | 3     | 24    | Weldolet, MSS SP-97, Beveled Ends, ASTM A105, NACE MR0103                                                                                                                                                                                                                                                 |       |
| CAP                  | BCAPABMBEACKABCZ       | 1     | 24    | Cap, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                                                                                                                                                                                 |       |
| 45 DEG. ELBOW        | BE4LABMBEACKABCZ       | 1     | 24    | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                                                                                                                                                              |       |
| 45-90 DEG DIRECTION  | BE9LABMBEACKABCZ       | 3/4   | 24    | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                                                                                                                                                              |       |
| 90 DEGREE ELBOW      | BE9LABMBEACKABCZ       | 1/2   | 24    | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                                                                                                                                                              |       |
| <45 DEG DIRECTION CH | BE4LABMBEACKABCZ       | 1     | 24    | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                                                                                                                                                              |       |
| NIPPLE               | ONIPABQPMACRABYZ       | 3/4   | 3/4   | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, NACE MR0103, 4in Long                                                                                                                                                                                                        |       |
|                      | ONIPABQMBACRABZZ       | 3/4   | 3/4   | Pipe Nipple, ASME B36.10M, Beveled End x Male Threaded End, ASTM A106 Grade B, NACE MR0103, 8in Long                                                                                                                                                                                                      |       |
| CON. REDUCER         | BRECABMBEACKABCZ       | 1-1/2 | 24    | Concentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                                                                                                                                                                  |       |
| ECC. REDUCER         | BREEABMBEACKABCZ       | 1-1/2 | 24    | Eccentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                                                                                                                                                                   |       |
| BLIND FLG.           | FBLABLDRFAOGAASZ       | 3/4   | 24    | Blind flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105, NACE MR0103                                                                                                                                                                                                                               |       |
| FLANGE               | FWNABLDRFAOGAASZ       | 3/4   | 24    | Weld neck flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105, NACE MR0103                                                                                                                                                                                                                           |       |
|                      | FWNABLRFAOGAASZ        | 1     | 24    | Weld neck flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105, NACE MR0103                                                                                                                                                                                                                           |       |
|                      | FWNABLLRFAOGAASZ       | 1     | 24    | Weld neck flange, ASME B16.5, Class 600, RF Flanged end, ASTM A105, NACE MR0103                                                                                                                                                                                                                           |       |
|                      | FLWABLRFAOGAASZ        | 1-1/2 | 1-1/2 | Long weld neck flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105, NACE MR0103                                                                                                                                                                                                                      |       |
| ORIFICE FLG          | FO3ABDIRFAOGAF2G       | 2     | 24    | Weldneck Orifice Flange with 0.75" Threaded Tap, ASME B16.36, Class 300, RF Flanged end, ASTM A105, NACE MR0103, 2 Nos. Taps, w/ Jack Screws, A193 Grade B7M / A194 Grade 2HM Cadmium + PTFE                                                                                                              |       |
| BALL VALVE           | VBRAA7DRFE4CAOGB7DOC1A | 2     | 2     | Ball valve, floating, API 608, Class 150, RF Flanged end, Full Port, Split-Body 2-3 Pieces, Bolted Cover, Short Pattern, ASTM A105, Lever Operator, SS316 Ball, SS316 Stem, RPTFE Seats, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, Internal Lining: PTFE, Fire safe Per API 607, NACE MR0103           |       |
|                      | VBSAA7DRFE4CACDB7DOC1A | 3     | 4     | Ball valve, trunnion, API 608, Class 150, RF Flanged end, Full Port, Split-Body 2-3 Pieces, Bolted Cover, Short Pattern, ASTM A216 Grade WCB, Lever Operator, SS316 Ball, SS316 Stem, RPTFE Seats, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, Internal Lining: PTFE, Fire safe Per API 607, NACE MR0103 |       |
| SWING CHECK VALVES   |                        |       |       |                                                                                                                                                                                                                                                                                                           |       |



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/ 12/ 2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A6L-1F    | 150                      | ASME B31.3                  | 6mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 285 PSIG @ -7 A 800 °F   |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT            | COMMODITY CODE         | SIZE |       | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                      | NOTES |
|--------------------|------------------------|------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                    |                        | FROM | TO    |                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |
| SWING CHECK VALVES | VQLCAA5DRFE5ACG06Z0C4K | 3/4  | 2     | Check valve, lift, API 602, Class 150, RF Flanged end, Piston , Bolted Cover, ASTM A105, API Trim 12 , Inconel X750 Spring , Renewable Seats , Spiral Wound AISI 316+Graphite Cover Gasket , Bonnet Gasket Thickness: 6mm , A193 Gr. B7M/ A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103 , Fire Safe Per API 6FD                                                                                                                                    |       |
|                    | VCSAA2DRFPAR3C8Q0C4K   | 3    | 24    | Check valve, swing, API 594, Class 150, RF Flanged end, Bolted Cover, ASTM A351 Grade CF3, API Trim 12 , Renewable Seats , Spiral Wound AISI 304+Graphite Cover Gasket , Bonnet Gasket Thickness: 6mm , A193 Gr. B7M/ A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103 , Fire Safe Per API 6FD                                                                                                                                                        |       |
| GATE VALVE         | VGRAA5DRFG2FA0G9KH1E   | 3/4  | 1-1/2 | Gate valve, solid wedge, API 602, Class 150, RF Flanged end, Standard Port , OS&Y-Rising Stem , Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 12 , Renewable Seats , Flexible Graphite Packing , Bonnet Gasket Thickness: 6mm , A193 Gr. B7M/ A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103 , Fire safe Per API 6FA                                                                                                                       |       |
|                    | VGRAA4DRFG4FA0G2EH1E   | 2    | 2     | Gate valve, solid wedge, API 600, Class 150, RF Flanged end, Full Port , OS&Y-Rising Stem , Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 12 , Renewable Seats & Backseat , Flexible Graphite Packing , Bonnet Gasket Thickness: 6mm , A193 Gr. B7M/ A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103 , Fire safe Per API 6FA                                                                                                                |       |
|                    | VGWAA4DRFG4FA0G9FHH1E  | 3    | 10    | Gate valve, flexible wedge, API 600, Class 150, RF Flanged end, Full Port , OS&Y-Rising Stem , Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 12 , Renewable Seats & Backseat , Tanged Graphite Gasket AISI 316 , Thickness of S/Sinertion 0.1 mm , Number of S/S insertions: 2 , Bonnet Gasket Thickness: 6mm , Flexible Graphite Packing , A193 Gr. B7M/ A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103 , Fire safe Per API 6FA |       |
|                    | VGWAA4DRFG4MA0D9FHH1E  | 12   | 24    | Gate valve, flexible wedge, API 600, Class 150, RF Flanged end, Full Port , OS&Y-Rising Stem , Bolted Bonnet, ASTM A216 Grade WCB, Gear Operator, API Trim 12 , Renewable Seats & Backseat , Tanged Graphite Gasket AISI 316 , Thickness of S/Sinertion 0.1 mm , Number of S/S insertions: 2 , Bonnet Gasket Thickness: 6mm , Flexible Graphite Packing , A193 Gr. B7M/ A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103 , Fire safe Per API 6FA      |       |
| GLOBE VALVE        | VLRAA5DRFLFFACGL1XLL1L | 1    | 2     | Globe Valve, API 602, Class 150, RF Flanged end, Standard Port , Plug Disc , OS&Y-Rising Stem , Rising Operator , Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 12 , Renewable Seats , Spiral Wound AISI 316 + Graphite Gasket , Bonnet Gasket Thickness: 6mm , Graphite Packing , A193 Gr. B7M/ A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103                                                                                            |       |
|                    | VLRAA3DRFLDFACDL1XLL1L | 3    | 10    | Globe Valve, API 623, Class 150, RF Flanged end, Plug Disc , OS&Y-Rising Stem , Rising Operator , Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 12 , Renewable Seats , Spiral Wound AISI 316 + Graphite Gasket , Bonnet Gasket Thickness: 6mm , Graphite Packing , A193 Gr. B7M/ A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103                                                                                                  |       |
|                    | VLRAA3DRFL7MA0DL1XLL1L | 12   | 12    | Globe Valve, API 623, Class 150, RF Flanged end, Plug Disc , OS&Y-Rising Stem , Bolted Bonnet, ASTM A216 Grade WCB, Gear Operator, API Trim 12 , Renewable Seats , Spiral Wound AISI 316 + Graphite Gasket , Bonnet Gasket Thickness: 6mm , Graphite Packing , A193 Gr. B7M/ A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103                                                                                                                         |       |
| PLUG VALVE         |                        |      |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A6L-1F    | 150                      | ASME B31.3                  | 6mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 285 PSIG @ -7 A 800 °F   |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT         | COMMODITY CODE         | SIZE  |       | DESCRIPTION                                                                                                                                                                                                                                                                   | NOTES |
|-----------------|------------------------|-------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                 |                        | FROM  | TO    |                                                                                                                                                                                                                                                                               |       |
| PLUG VALVE      | VPSAA8DRFP7CA0GP4EPP1X | 1-1/2 | 1-1/2 | Plug valve, short pattern, API 599, Class 150, RF Flanged end, Bolted Bonnet, Non-Lubricated, ASTM A105, Lever Operator, SS316 Tapered Plug, SS316 Stem, RPTFE Sleeve, Internal lining: PTFE, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire safe Per API 607 |       |
| GASKETS         | GSWAB9DRFAZGBAMZ       | 3/4   | 24    | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 150, RF flanged end, 316 stainless steel (16 Cr-12 Ni-2 Mo), w/ flexible graphite filler, w/ 316 SS inner ring and CS outer ring, Wall Thickness 6 mm                                                         |       |
|                 | GSWAB9IRFAZGBAMZ       | 1     | 24    | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 300, RF flanged end, 316 stainless steel (16 Cr-12 Ni-2 Mo), w/ flexible graphite filler, w/ 316 SS inner ring and CS outer ring, Wall Thickness 6 mm                                                         |       |
|                 | GSWAB9LRFAZGBAMZ       | 1     | 24    | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 600, RF flanged end, 316 stainless steel (16 Cr-12 Ni-2 Mo), w/ flexible graphite filler, w/ 316 SS inner ring and CS outer ring, Wall Thickness 6 mm                                                         |       |
| BOLTS           | LSEABSAX1AL1J          | 1/2   | 1-1/4 | Continuous Thread Stud Bolt, ASME B18.31.2/B18.2.2, ASTM A193 Grade B7M, with 2 Heavy Hexagonal Nuts, ASTM A194 Gr. 2HM                                                                                                                                                       |       |
| PADDLE BLIND    | DBPABMDRTACGAP2M       | 14    | 24    | Paddle blind (Paddle blank or Blind spacer), ASME B16.48, Class 150, RF thru-bolted end, ASTM A105, NACE MR0103, Wall Thickness 6 mm                                                                                                                                          |       |
| SPECTACLE BLIND | DF8ABMDRTACGAP2M       | 1     | 12    | Spectacle blind (Figure 8 blind), ASME B16.48, Class 150, RF thru-bolted end, ASTM A105, NACE MR0103, Wall Thickness 6 mm                                                                                                                                                     |       |
| PADDLE SPACER   | DBSABMDRTACGAP2M       | 14    | 24    | Paddle spacer (Open spacer or Ring spacer), ASME B16.48, Class 150, RF thru-bolted end, ASTM A105, NACE MR0103, Wall Thickness 6 mm                                                                                                                                           |       |

## SPECIFICATION NOTES

## COMPONENT NOTES

| HEADER | BRANCH |     |        |     |     |     |     |     |     |     |     |     |     |     |     |
|--------|--------|-----|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|        | 3/4"   | 1"  | 1.1/2" | 2"  | 3"  | 4"  | 6"  | 8"  | 10" | 12" | 14" | 16" | 18" | 20" | 24" |
| 3/4"   | TEE    |     |        |     |     |     |     |     |     |     |     |     |     |     |     |
| 1"     | TER    | TEE |        |     |     |     |     |     |     |     |     |     |     |     |     |
| 1.1/2" | TER    | TER | TEE    |     |     |     |     |     |     |     |     |     |     |     |     |
| 2"     | TER    | TER | TER    | TEE |     |     |     |     |     |     |     |     |     |     |     |
| 3"     | WEL    | WEL | TER    | TER | TEE |     |     |     |     |     |     |     |     |     |     |
| 4"     | WEL    | WEL | WEL    | TER | TER | TEE |     |     |     |     |     |     |     |     |     |
| 6"     | WEL    | WEL | WEL    | WEL | TER | TER | TEE |     |     |     |     |     |     |     |     |
| 8"     | WEL    | WEL | WEL    | WEL | WEL | TER | TER | TEE |     |     |     |     |     |     |     |
| 10"    | WEL    | WEL | WEL    | WEL | WEL | TER | TER | TER | TEE |     |     |     |     |     |     |
| 12"    | WEL    | WEL | WEL    | WEL | WEL | WEL | TER | TER | TER | TEE |     |     |     |     |     |
| 14"    | WEL    | WEL | WEL    | WEL | WEL | WEL | TER | TER | TER | TER | TEE |     |     |     |     |
| 16"    | WEL    | WEL | WEL    | WEL | WEL | WEL | TER | TER | TER | TER | TER | TEE |     |     |     |
| 18"    | WEL    | WEL | WEL    | WEL | WEL | WEL | WEL | TER | TER | TER | TER | TER | TEE |     |     |
| 20"    | WEL    | WEL | WEL    | WEL | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TEE |     |
| 24"    | WEL    | WEL | WEL    | WEL | WEL | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TEE |

### NOM ENCLATURE

TEE = Straight Tee

TER = Reducing Tee

WEL = Weldolet



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/ 12/ 2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE       |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------------|
| A3E-1F    | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process       |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS |               | STRESS RELIEF |
|           | 285 PSIG @ -20 A 800 °F  |                             |                        |               | No            |

## PIPING SCHEDULES

| SIZE | 1/2" | 3/4" | 1" | 1.1/2" | 2" | 10"  | 14" | 16" | 12"  | 3"    | 4" | 6" | 8" | 18" | 20" | 24" |
|------|------|------|----|--------|----|------|-----|-----|------|-------|----|----|----|-----|-----|-----|
| SCH. | S-XS |      |    |        |    | S-20 |     |     | S-30 | S-STD |    |    |    |     |     |     |

## SPEC ITEMS

| ELEMENT               | COMMODITY CODE    | SIZE |    | DESCRIPTION                                                                                     | NOTES |
|-----------------------|-------------------|------|----|-------------------------------------------------------------------------------------------------|-------|
|                       |                   | FROM | TO |                                                                                                 |       |
| PIPING                | PPPABQPEACRA1G    | 1/2  | 2  | Pipe, ASME B36.10M, Plain Ends, ASTM A106 Grade B, Seamless, Length: 6m Aprox Length            |       |
|                       | PPPABQBEACRA1A    | 3    | 24 | Pipe, ASME B36.10M, Beveled Ends, ASTM A106 Grade B, Seamless, Length: 12m Aprox Length         |       |
| SOCKET (BR. TABLE)    | OSOCAM9SSWACGZZZZ | 3    | 24 | Socket, MSS SP-97, Class 3000, Socket Welded Ends, ASTM A105                                    |       |
| TEE (BRANCH TABLE)    | OETEAB2SSWACGZZZZ | 1/2  | 2  | Straight Tee, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                            |       |
|                       | BTEEABMBEACKA3AZ  | 3    | 24 | Straight Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                           |       |
| THREDOLET (BR. TABLE) | OTHLAM9STFACGZZZZ | 3    | 24 | Thredolet, MSS SP-97, Class 3000, Female Threaded Ends, ASTM A105                               |       |
| RED. TEE (BR. TABLE)  | ORTEAB2SSWACGZZZZ | 3/4  | 2  | Reducing Tee, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                            |       |
|                       | BTERABMBEACKA3AZ  | 4    | 24 | Reducing Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                           |       |
| WELDOLET (BR. TABLE)  | BWELAM9BEACGZZZZ  | 8    | 30 | Weldolet, MSS SP-97, Beveled Ends, ASTM A105                                                    |       |
| CAP                   | OCAPAB2SSWACGZZZZ | 1/2  | 2  | Cap, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                                     |       |
|                       | OCAPAB2STFACGZZZZ | 1/2  | 2  | Cap, ASME B16.11, Class 3000, Female Threaded Ends, ASTM A105                                   |       |
|                       | BCAPABMBEACKA3AZ  | 3    | 24 | Cap, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                    |       |
| CPLG.                 | OCPLAB2SSWACGZZZZ | 1/2  | 2  | Coupling/connector, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                      |       |
|                       | OCPLAB2STFACGZZZZ | 3/4  | 1  | Coupling/connector, ASME B16.11, Class 3000, Female Threaded Ends, ASTM A105                    |       |
| CROSS                 | BXEEABMBEACKA3AZ  | 2    | 6  | Cross, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                  |       |
| 45 DEG. ELBOW         | OE45AB2SSWACGZZZZ | 1/2  | 2  | 45° elbow, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                               |       |
|                       | BE4LABMBEACKA3AZ  | 3    | 24 | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                 |       |
| 45-90 DEG DIRECTION   | BE9LABMBEACKA3AZ  | 3    | 24 | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                 |       |
| 90 DEGREE ELBOW       | OE90AB2SSWACGZZZZ | 1/2  | 2  | 90° elbow, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                               |       |
|                       | BE9LABMBEACKA3AZ  | 3    | 24 | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                 |       |
|                       | BE9SABMBEACKA3AZ  | 10   | 18 | 90° elbow, short radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                |       |
| <45 DEG DIRECTION CH  | BE4LABMBEACKA3AZ  | 3    | 24 | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                 |       |
| NIPPLE                | ONIPABQTMACRA1AZ  | 1/2  | 1  | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, 4in Long, Seamless            |       |
|                       | ONIPABQPMACRA1AZ  | 1/2  | 1  | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, 4in Long, Seamless |       |
|                       | ONIPABQTMACRA1GZ  | 1/2  | 1  | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, 8in Long, Seamless            |       |
|                       | ONIPABQPMACRA1GZ  | 1/2  | 1  | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, 8in Long, Seamless |       |
|                       | ONIPABQPEACRA1AZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, 4in Long, Seamless                    |       |
|                       | ONIPABQPEACRA1GZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, 8in Long, Seamless                    |       |
| PLUG                  | OPLRAB2TMACGZZZZ  | 3/4  | 1  | Plug, round, ASME B16.11, Male Threaded Ends, ASTM A105                                         |       |



# PIPING CLASS

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CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3E-1F    | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 285 PSIG @ -20 A 800 °F  |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT            | COMMODITY CODE          | SIZE  |       | DESCRIPTION                                                                                                                                                                                                                                                                 | NOTES |
|--------------------|-------------------------|-------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                    |                         | FROM  | TO    |                                                                                                                                                                                                                                                                             |       |
| CON. REDUCER       | BRECABMBEACKA3AZ        | 4     | 24    | Concentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                                                                                                                                                                                 |       |
| ECC. REDUCER       | BREEABMBEACKA3AZ        | 4     | 24    | Eccentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                                                                                                                                                                                  |       |
| CONC. SWAGE NIPPLE | OSGCAM8PEACKZZZZ        | 3/4   | 2     | Concentric swage, MSS SP-95, Plain Ends, ASTM A234 Grade WPB                                                                                                                                                                                                                |       |
|                    | OSGCAM8PMACKZZZZ        | 1     | 2     | Concentric swage, MSS SP-95, Plain End x Male Threaded End, ASTM A234 Grade WPB                                                                                                                                                                                             |       |
|                    | OSGCAM8BPACKZZZZ        | 3     | 4     | Concentric swage, MSS SP-95, Beveled End x Plain End, ASTM A234 Grade WPB                                                                                                                                                                                                   |       |
|                    | OSGCAM8MBAKZZZZ         | 3     | 4     | Concentric swage, MSS SP-95, Beveled End x Male Threaded End, ASTM A234 Grade WPB                                                                                                                                                                                           |       |
| ECC. SWAGE NIPPLE  | OSGEAM8PEACKZZZZ        | 3/4   | 2     | Eccentric swage, MSS SP-95, Plain Ends, ASTM A234 Grade WPB                                                                                                                                                                                                                 |       |
|                    | OSGEAM8PMACKZZZZ        | 1     | 2     | Eccentric swage, MSS SP-95, Plain End x Male Threaded End, ASTM A234 Grade WPB                                                                                                                                                                                              |       |
|                    | OSGEAM8BPACKZZZZ        | 3     | 4     | Eccentric swage, MSS SP-95, Beveled End x Plain End, ASTM A234 Grade WPB                                                                                                                                                                                                    |       |
| BLIND FLG.         | FBLABLDRFAOGZZZZ        | 1/2   | 24    | Blind flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105                                                                                                                                                                                                              |       |
| FLANGE             | FSWABLDRFAOGZZZZ        | 1/2   | 2     | Socket welded flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105                                                                                                                                                                                                      |       |
|                    | FSWABLIRFAOGZZZZ        | 1/2   | 2     | Socket welded flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105                                                                                                                                                                                                      |       |
|                    | FLWABLIRFAOGZZZZ        | 1-1/2 | 1-1/2 | Long weld neck flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105                                                                                                                                                                                                     |       |
|                    | FWNABLDRFAOGZZZZ        | 3     | 24    | Weld neck flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105                                                                                                                                                                                                          |       |
|                    | FWNABLIRFAOGZZZZ        | 3     | 24    | Weld neck flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105                                                                                                                                                                                                          |       |
| RED. FLG.          | FRWABLDRFAOGZZZZ        | 18    | 18    | Weld neck reducing flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105                                                                                                                                                                                                 |       |
| ORIFICE FLG        | FO2ABDIRFAOGAF2G        | 2     | 24    | Weldneck Orifice Flange with 0.5" Threaded Tap, ASME B16.36, Class 300, RF Flanged end, ASTM A105, NACE MR0103, 2 Nos. Taps, w/Jack Screws, A193 Grade B7M / A194 Grade 2HM Cadmium + PTFE                                                                                  |       |
| BALL VALVE         | VBRAA7IESBEACGB2EBB1H   | 1     | 2     | Ball valve, floating, API 608, Class 300, Socket Welded Ends w/2 nipples, Full Port, Split-Body 2-3 Pieces, Bolted Cover, ASTM A105, Lever Operator, SS316 Ball, SS316 Stem, RPTFE Seats, RPTFE Seals, Fire safe Per API 607, Supply w/2 welded nipples A106 Gr B Length=6" |       |
|                    | VBSAA7DRFE4CACDB2EBB1A  | 3     | 4     | Ball valve, trunnion, API 608, Class 150, RF Flanged end, Full Port, Split-Body 2-3 Pieces, Bolted Cover, Short Pattern, ASTM A216 Grade WCB, Lever Operator, SS316 Ball, SS316 Stem, RPTFE Seats, RPTFE Seals, Fire safe Per API 607                                       |       |
| SWING CHECK VALVES | VQLCAA5MSWE5AOCGB8RC04L | 1/2   | 2     | Check valve, lift, API 602, Class 800, Socket Welded Ends, Piston, Bolted Cover, ASTM A105, API Trim 8, Inconel X750 Spring, Renewable Seats, Spiral Wound AISI 304+Graphite Cover Gasket, Bonnet Gasket Thickness: 6mm, Fire Safe Per API 6FD                              |       |
|                    | VCSCAA2DRFPACDC8SC04L   | 3     | 24    | Check valve, swing, API 594, Class 150, RF Flanged end, Bolted Cover, ASTM A216 Grade WCB, API Trim 8, Renewable Seats, Spiral Wound AISI 304+Graphite Cover Gasket, Bonnet Gasket Thickness: 6mm, Fire Safe Per API 6FD                                                    |       |
| GATE VALVE         | VGRAA5MSWG2FAOCG9QGG4B  | 1/2   | 2     | Gate valve, solid wedge, API 602, Class 800, Socket Welded Ends, Standard Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 8, Renewable Seats, Flexible Graphite Packing, Bonnet Gasket Thickness: 6mm, Fire safe Per API 6FA                 |       |



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/ 12/ 2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3E-1F    | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 285 PSIG @ -20 A 800 °F  |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT        | COMMODITY CODE         | SIZE |       | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                  | NOTES |
|----------------|------------------------|------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                |                        | FROM | TO    |                                                                                                                                                                                                                                                                                                                                                                              |       |
| GATE VALVE     | VGWAA4DRFG4FACD G9RG4B | 3    | 10    | Gate valve, flexible wedge, API 600, Class 150, RF Flanged end, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 8, Renewable Seats & Backseat, Tanged Graphite Gasket AISI 304, Thickness of S/S insertion 0.1 mm, Number of S/S insertions: 2, Flexible Graphite Packing, Bonnet Gasket Thickness: 6mm, Fire safe Per API 6FA |       |
|                | VGWAA4DRFG4MACD G9RG4B | 12   | 24    | Gate valve, flexible wedge, API 600, Class 150, RF Flanged end, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Gear Operator, API Trim 8, Renewable Seats & Backseat, Tanged Graphite Gasket AISI 304, Thickness of S/S insertion 0.1 mm, Number of S/S insertions: 2, Flexible Graphite Packing, Bonnet Gasket Thickness: 6mm, Fire safe Per API 6FA      |       |
| GLOBE VALVE    | VLRAA5MSWLFFACGL6TZZZ  | 1/2  | 2     | Globe Valve, API 602, Class 800, Socket Welded Ends, Standard Port, Plug Disc, OS&Y-Rising Stem, Rising Operator, Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 8, Renewable Seats, Spiral Wound AISI 304 + Graphite Bonnet Gasket, Bonnet Gasket Thickness: 6mm, Graphite Packing                                                                                  |       |
|                | VLRAA3DRFLDFACDL6TZZZ  | 3    | 10    | Globe Valve, API 623, Class 150, RF Flanged end, Plug Disc, OS&Y-Rising Stem, Rising Operator, Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 8, Renewable Seats, Spiral Wound AISI 304 + Graphite Bonnet Gasket, Bonnet Gasket Thickness: 6mm, Graphite Packing                                                                                           |       |
|                | VLRAA3DRFL7MACDL6TZZZ  | 12   | 12    | Globe Valve, API 623, Class 150, RF Flanged end, Plug Disc, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Gear Operator, API Trim 8, Renewable Seats, Spiral Wound AISI 304 + Graphite Bonnet Gasket, Bonnet Gasket Thickness: 6mm, Graphite Packing                                                                                                                 |       |
| JKT PLUG VALVE | VJPAABDRFQ2CACDP4DPP2A | 6    | 6     | Plug valve, full jacket, API 599, Class 150, RF Flanged end, Bolted Cover, Non-Lubricated, Short Pattern, ASTM A216 Grade WCB, Lever Operator, SS316 Tapered Plug, SS316 Stem, RPTFE Sleeve, Fire safe Per API 607, W/Jacketed connection 3/4" flanged RF, CL150, with pipe extension ASTM A106 Gr. B, Length=6in                                                            |       |
|                | VJPAABDRFQ2CACDP4DPP2B | 6    | 6     | Plug valve, full jacket, API 599, Class 150, RF Flanged end, Bolted Cover, Non-Lubricated, Short Pattern, ASTM A216 Grade WCB, Lever Operator, SS316 Tapered Plug, SS316 Stem, RPTFE Sleeve, Fire safe Per API 607, W/Jacketed connection 1" flanged RF, CL150, with pipe extension ASTM A106 Gr. B, Length=6in                                                              |       |
|                | VJPAABDRFQ2CACDP4DPP2B | 8    | 8     | Plug valve, full jacket, API 599, Class 150, RF Flanged end, Bolted Cover, Non-Lubricated, Short Pattern, ASTM A216 Grade WCB, Lever Operator, SS316 Tapered Plug, SS316 Stem, RPTFE Sleeve, Fire safe Per API 607, W/Jacketed connection 1" flanged RF, CL150, with pipe extension ASTM A106 Gr. B, Length=6in                                                              |       |
| GASKETS        | GSWAB9DRFAZHBAKZ       | 1/2  | 24    | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 150, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler, w/ 304 SS inner ring and CS outer ring, Wall Thickness 6 mm                                                                                                                                                              |       |
|                | GSWAB9IRFAZHBAKZ       | 1/2  | 24    | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 300, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler, w/ 304 SS inner ring and CS outer ring, Wall Thickness 6 mm                                                                                                                                                              |       |
| BOLTS          | LSEABSAX1AL1J          | 1/2  | 1-1/4 | Continuous Thread Stud Bolt, ASME B18.31.2/B18.2.2, ASTM A193 Grade B7M, with 2 Heavy Hexagonal Nuts, ASTM A194 Gr. 2HM                                                                                                                                                                                                                                                      |       |
| PADDLE BLIND   | DBPABMDRTACGZZZZ       | 14   | 24    | Paddle blind (Paddle blank or Blind spacer), ASME B16.48, Class 150, RF thru-bolted end, ASTM A105                                                                                                                                                                                                                                                                           |       |



## PIPING CLASS

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Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3E-1F    | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 285 PSIG @ -20 A 800 °F  |                             |                        | No            |         |

### SPEC ITEMS

| ELEMENT         | COMMODITY CODE   | SIZE |    | DESCRIPTION                                                                                       | NOTES |
|-----------------|------------------|------|----|---------------------------------------------------------------------------------------------------|-------|
|                 |                  | FROM | TO |                                                                                                   |       |
| SPECTACLE BLIND | DF8ABMDRTACGZZZZ | 1/2  | 12 | Spectacle blind (Figure 8 blind), ASME B16.48, Class 150, RF thru-bolted end, ASTM A105           |       |
|                 | DF8ABMDRTACGZZZZ | 14   | 14 | Spectacle blind (Figure 8 blind), ASME B16.48, Class 150, RF thru-bolted end, ASTM A105           |       |
| PADDLE SPACER   | DBSABMDRTACGZZZZ | 14   | 24 | Paddle spacer (Open spacer or Ring spacer), ASME B16.48, Class 150, RF thru-bolted end, ASTM A105 |       |

### SPECIFICATION NOTES

### COMPONENT NOTES

| HEADER | BRANCH |      |     |        |     |     |     |     |     |     |     |     |     |     |     |     |
|--------|--------|------|-----|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|        | 1/2"   | 3/4" | 1"  | 1.1/2" | 2"  | 3"  | 4"  | 6"  | 8"  | 10" | 12" | 14" | 16" | 18" | 20" | 24" |
| 1/2"   | ETE    |      |     |        |     |     |     |     |     |     |     |     |     |     |     |     |
| 3/4"   | RTE    | ETE  |     |        |     |     |     |     |     |     |     |     |     |     |     |     |
| 1"     | RTE    | RTE  | ETE |        |     |     |     |     |     |     |     |     |     |     |     |     |
| 1.1/2" | RTE    | RTE  | RTE | ETE    |     |     |     |     |     |     |     |     |     |     |     |     |
| 2"     | RTE    | RTE  | RTE | RTE    | ETE |     |     |     |     |     |     |     |     |     |     |     |
| 3"     | SOC    | SOC  | SOC | SOC    | SOC | TEE |     |     |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 4"     | SOC    | SOC  | SOC | SOC    | SOC | TER | TEE |     |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 6"     | SOC    | SOC  | SOC | SOC    | SOC | TER | TER | TEE |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 8"     | SOC    | SOC  | SOC | SOC    | SOC | WEL | TER | TER | TEE |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 10"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | TER | TER | TER | TEE |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 12"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TEE |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 14"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TER | TEE |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 16"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TER | TER | TEE |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 18"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | TER | TER | TER | TER | TER | TEE |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 20"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TEE |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 24"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TEE |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |

#### NOMENCLATURE

ETE = Straight Tee

RTE = Reducing Tee

SOC = Sockolet

TEE = Straight Tee

TER = Reducing Tee

THL = Thredolet

WEL = Weldolet



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Elaborado: 30/ 12/ 2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE       |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------------|
| A3L-3F    | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process       |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS |               | STRESS RELIEF |
|           | 740 PSIG @ -20 A 800 °F  |                             |                        |               | No            |

## PIPING SCHEDULES

| SIZE | 1/2"  | 3/4" | 1"   | 1.1/2" | 2" | 12"  | 3"    | 4" | 6" | 8" | 10" |
|------|-------|------|------|--------|----|------|-------|----|----|----|-----|
| SCH. | S-160 |      | S-XS |        |    | S-40 | S-STD |    |    |    |     |

## SPEC ITEMS

| ELEMENT               | COMMODITY CODE    | SIZE |     | DESCRIPTION                                                                                          | NOTES |
|-----------------------|-------------------|------|-----|------------------------------------------------------------------------------------------------------|-------|
|                       |                   | FROM | TO  |                                                                                                      |       |
| PIPING                | PPPABQPEACRAP2H   | 1/2  | 2   | Pipe, ASME B36.10M, Plain Ends, ASTM A106 Grade B, NACE MR0103, Seamless, Length: 6m Aprox Length    |       |
|                       | PPPABQBEACRAP2G   | 3    | 12  | Pipe, ASME B36.10M, Beveled Ends, ASTM A106 Grade B, NACE MR0103, Seamless, Length: 12m Aprox Length |       |
| SOCKET (BR. TABLE)    | OSOCAM9XSWACGAAGZ | 3    | 12  | Socket, MSS SP-97, Class 6000, Socket Welded Ends, ASTM A105, NACE MR0103                            |       |
|                       | OSOCAM9SSWACGAAGZ | 3    | 12  | Socket, MSS SP-97, Class 3000, Socket Welded Ends, ASTM A105, NACE MR0103                            |       |
| TEE (BRANCH TABLE)    | OETEAB2XSWACGAAGZ | 1/2  | 3/4 | Straight Tee, ASME B16.11, Class 6000, Socket Welded Ends, ASTM A105, NACE MR0103                    |       |
|                       | OETEAB2SSWACGAAGZ | 1    | 2   | Straight Tee, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105, NACE MR0103                    |       |
|                       | BTEEABMBEACKABCZ  | 3    | 12  | Straight Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                   |       |
| THREDOLET (BR. TABLE) | OTHLAM9STFACGAAGZ | 3    | 12  | Thredolet, MSS SP-97, Class 3000, Female Threaded Ends, ASTM A105, NACE MR0103                       |       |
| RED. TEE (BR. TABLE)  | ORTEAB2XSWACGAAGZ | 3/4  | 3/4 | Reducing Tee, ASME B16.11, Class 6000, Socket Welded Ends, ASTM A105, NACE MR0103                    |       |
|                       | ORTEAB2SSWACGAAGZ | 1    | 2   | Reducing Tee, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105, NACE MR0103                    |       |
|                       | BTERABMBEACKABCZ  | 4    | 12  | Reducing Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                   |       |
| WELDOLET (BR. TABLE)  | BWELAM9BEACGABSZ  | 8    | 12  | Weldolet, MSS SP-97, Beveled Ends, ASTM A105, NACE MR0103                                            |       |
| CAP                   | OCAPAB2XSWACGAAGZ | 1/2  | 3/4 | Cap, ASME B16.11, Class 6000, Socket Welded Ends, ASTM A105, NACE MR0103                             |       |
|                       | OCAPAB2STFACGAAGZ | 3/4  | 1   | Cap, ASME B16.11, Class 3000, Female Threaded Ends, ASTM A105, NACE MR0103                           |       |
|                       | OCAPAB2SSWACGAAGZ | 1    | 2   | Cap, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105, NACE MR0103                             |       |
|                       | BCAPABMBEACKABCZ  | 3    | 12  | Cap, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                            |       |
| CPLG.                 | OCPLAB2XSWACGAAGZ | 1/2  | 3/4 | Coupling/connector, ASME B16.11, Class 6000, Socket Welded Ends, ASTM A105, NACE MR0103              |       |
|                       | OCPLAB2STFACGAAGZ | 3/4  | 1   | Coupling/connector, ASME B16.11, Class 3000, Female Threaded Ends, ASTM A105, NACE MR0103            |       |
|                       | OCPLAB2SSWACGAAGZ | 1    | 2   | Coupling/connector, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105, NACE MR0103              |       |
| CROSS                 | BXEEABMBEACKA3AZ  | 2    | 6   | Cross, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                       |       |
| 45 DEG. ELBOW         | OE45AB2XSWACGAAGZ | 1/2  | 3/4 | 45° elbow, ASME B16.11, Class 6000, Socket Welded Ends, ASTM A105, NACE MR0103                       |       |
|                       | OE45AB2SSWACGAAGZ | 1    | 2   | 45° elbow, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105, NACE MR0103                       |       |
|                       | BE4LABMBEACKABCZ  | 3    | 12  | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless         |       |
| 45-90 DEG DIRECTION   | BE9LABMBEACKABCZ  | 3    | 12  | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless         |       |
| 90 DEGREE ELBOW       | OE90AB2XSWACGAAGZ | 1/2  | 3/4 | 90° elbow, ASME B16.11, Class 6000, Socket Welded Ends, ASTM A105, NACE MR0103                       |       |
|                       | OE90AB2SSWACGAAGZ | 1    | 2   | 90° elbow, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105, NACE MR0103                       |       |
|                       | BE9LABMBEACKABCZ  | 3    | 12  | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless         |       |
| <45 DEG DIRECTION CH  | BE4LABMBEACKABCZ  | 3    | 12  | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless         |       |



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Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3L-3F    | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 740 PSIG @ -20 A 800 °F  |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT            | COMMODITY CODE         | SIZE  |       | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                            | NOTES |
|--------------------|------------------------|-------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                    |                        | FROM  | TO    |                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |
| NIPPLE             | ONIPABQTMACRABYZ       | 1/2   | 1     | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, NACE MR0103, 4in Long                                                                                                                                                                                                                                                                                                                                                |       |
|                    | ONIPABQPMACRABYZ       | 1/2   | 1     | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, NACE MR0103, 4in Long                                                                                                                                                                                                                                                                                                                                     |       |
|                    | ONIPABQTMACRABZZ       | 1/2   | 1     | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, NACE MR0103, 8in Long                                                                                                                                                                                                                                                                                                                                                |       |
|                    | ONIPABQPMACRABZZ       | 1/2   | 1     | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, NACE MR0103, 8in Long                                                                                                                                                                                                                                                                                                                                     |       |
|                    | ONIPABQPEACRABYZ       | 1/2   | 2     | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, NACE MR0103, 4in Long                                                                                                                                                                                                                                                                                                                                                        |       |
|                    | ONIPABQPEACRABZZ       | 1/2   | 2     | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, NACE MR0103, 8in Long                                                                                                                                                                                                                                                                                                                                                        |       |
| PLUG               | OPLRAB2TMACGAAGZ       | 3/4   | 1     | Plug, round, ASME B16.11, Male Threaded Ends, ASTM A105, NACE MR0103                                                                                                                                                                                                                                                                                                                                                                   |       |
| CON. REDUCER       | BRECABMBEACKABCZ       | 4     | 12    | Concentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                                                                                                                                                                                                                                                                                               |       |
| ECC. REDUCER       | BREEABMBEACKABCZ       | 4     | 12    | Eccentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                                                                                                                                                                                                                                                                                                |       |
| CONC. SWAGE NIPPLE | OSGCAM8PEACKAAGZ       | 3/4   | 2     | Concentric swage, MSS SP-95, Plain Ends, ASTM A234 Grade WPB, NACE MR0103                                                                                                                                                                                                                                                                                                                                                              |       |
|                    | OSGCAM8PMACKAAGZ       | 1     | 1     | Concentric swage, MSS SP-95, Plain End x Male Threaded End, ASTM A234 Grade WPB, NACE MR0103                                                                                                                                                                                                                                                                                                                                           |       |
|                    | OSGCAM8BPACKAAGZ       | 3     | 4     | Concentric swage, MSS SP-95, Beveled End x Plain End, ASTM A234 Grade WPB, NACE MR0103                                                                                                                                                                                                                                                                                                                                                 |       |
|                    | OSGCAM8MBACKAAGZ       | 3     | 4     | Concentric swage, MSS SP-95, Beveled End x Male Threaded End, ASTM A234 Grade WPB, NACE MR0103                                                                                                                                                                                                                                                                                                                                         |       |
| ECC. SWAGE NIPPLE  | OSGEAM8PEACKAAGZ       | 3/4   | 2     | Eccentric swage, MSS SP-95, Plain Ends, ASTM A234 Grade WPB, NACE MR0103                                                                                                                                                                                                                                                                                                                                                               |       |
|                    | OSGEAM8PMACKAAGZ       | 1     | 1     | Eccentric swage, MSS SP-95, Plain End x Male Threaded End, ASTM A234 Grade WPB, NACE MR0103                                                                                                                                                                                                                                                                                                                                            |       |
|                    | OSGEAM8BPACKAAGZ       | 3     | 4     | Eccentric swage, MSS SP-95, Beveled End x Plain End, ASTM A234 Grade WPB, NACE MR0103                                                                                                                                                                                                                                                                                                                                                  |       |
| BLIND FLG.         | FBLABLRFAOGAASZ        | 1/2   | 12    | Blind flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105, NACE MR0103                                                                                                                                                                                                                                                                                                                                                            |       |
| FLANGE             | FSWABLRFAOGAASZ        | 1/2   | 2     | Socket welded flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105, NACE MR0103                                                                                                                                                                                                                                                                                                                                                    |       |
|                    | FSWABLLRFAOGAASZ       | 1/2   | 2     | Socket welded flange, ASME B16.5, Class 600, RF Flanged end, ASTM A105, NACE MR0103                                                                                                                                                                                                                                                                                                                                                    |       |
|                    | FLWABLRFAOGAASZ        | 1-1/2 | 1-1/2 | Long weld neck flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105, NACE MR0103                                                                                                                                                                                                                                                                                                                                                   |       |
|                    | FWNABLRFAOGAASZ        | 3     | 12    | Weld neck flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105, NACE MR0103                                                                                                                                                                                                                                                                                                                                                        |       |
|                    | FWNABLLRFAOGAASZ       | 3     | 12    | Weld neck flange, ASME B16.5, Class 600, RF Flanged end, ASTM A105, NACE MR0103                                                                                                                                                                                                                                                                                                                                                        |       |
| ORIFICE FLG        | FO2ABDIRFAOGAAXZ       | 2     | 12    | Weldneck Orifice Flange with 0.5" Threaded Tap, ASME B16.36, Class 300, RF Flanged end, ASTM A105, NACE MR0103, 2 Nos. Taps, w/ Jack Screws                                                                                                                                                                                                                                                                                            |       |
| BALL VALVE         | VBSAA71RFB3FACDB1WCC1H | 6     | 6     | Ball valve, trunnion, API 608, Class 300, RF Flanged end, Full Port, Split-Body 2-3 Pieces, Bolted Cover, Long Pattern, ASTM A216 Grade WCB, Handwheel Operator, SS316 Ball, SS316 Stem, RPTFE Seats, Viton Seals, NACE MR0103                                                                                                                                                                                                         |       |
| SWING CHECK VALVES | VQLCAA5MESE3AOG06Z004G | 1/2   | 2     | Check valve, lift, API 602, Class 800, Socket Welded Ends w/2 nipples, Piston, Bolted Bonnet, ASTM A105, API Trim 12, Inconel X750 Spring, Renewable Seats, Spiral Wound AISI 316+Graphite Cover Gasket, Bonnet Gasket Thickness: 6mm, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire Safe Per API 6FD, Inspection and Testing Per API 598, Supply w/2 welded nipples A106 Gr B-NACE MR0103 Sch. 160 L=6" at both ends |       |



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/ 12/ 2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3L-3F    | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 740 PSIG @ -20 A 800 °F  |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT            | COMMODITY CODE         | SIZE |       | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                              | NOTES |
|--------------------|------------------------|------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                    |                        | FROM | TO    |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |
| SWING CHECK VALVES | VCSCAA21RFPACD06X004K  | 3    | 12    | Check valve, swing, API 594, Class 300, RF Flanged end, Bolted Cover, ASTM A216 Grade WCB, API Trim 12, Renewable Seats, Spiral Wound AISI 316+Graphite Cover Gasket, Bonnet Gasket Thickness: 6mm, A193 Gr. B7M/ A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire Safe Per API 6FD                                                                                                                                                                     |       |
| GATE VALVE         | VGRAA5MESG2FACGG9KH1C  | 1/2  | 2     | Gate valve, solid wedge, API 602, Class 800, Socket Welded Ends w/2 nipples, Standard Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 12, Renewable Seats, Flexible Graphite Packing, Bonnet Gasket Thickness: 6mm, A193 Gr. B7M/ A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire safe Per API 6FA, Supply w/2 welded nipples A106 Gr B NACE MR0103 Length=6"                                                           |       |
|                    | VGWAA41RFG4FACDG2EHH1E | 3    | 10    | Gate valve, flexible wedge, API 600, Class 300, RF Flanged end, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 12, Renewable Seats & Backseat, Flexible Graphite Packing, Bonnet Gasket Thickness: 6mm, A193 Gr. B7M/ A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire safe Per API 6FA                                                                                                                  |       |
|                    | VGWAA41RFG4MACDG2EHH1E | 12   | 12    | Gate valve, flexible wedge, API 600, Class 300, RF Flanged end, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Gear Operator, API Trim 12, Renewable Seats & Backseat, Flexible Graphite Packing, Bonnet Gasket Thickness: 6mm, A193 Gr. B7M/ A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire safe Per API 6FA                                                                                                                       |       |
| GLOBE VALVE        | VLRAA5MESLFFACGL1XL2K  | 1/2  | 2     | Globe Valve, API 602, Class 800, Socket Welded Ends w/2 nipples, Standard Port, Plug Disc, OS&Y-Rising Stem, Rising Operator, Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 12, Renewable Seats, Spiral Wound AISI 316 + Graphite Gasket, Bonnet Gasket Thickness: 6mm, Graphite Packing, A193 Gr. B7M/ A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Supply with two (2) welded nipples A106 Gr B + NACE MR0103 Sch. 160 Length=6" at both ends |       |
|                    | VLRAA31RFLDFACDL1XL1L  | 3    | 6     | Globe Valve, API 623, Class 300, RF Flanged end, Plug Disc, OS&Y-Rising Stem, Rising Operator, Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 12, Renewable Seats, Spiral Wound AISI 316 + Graphite Gasket, Bonnet Gasket Thickness: 6mm, Graphite Packing, A193 Gr. B7M/ A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103                                                                                                                  |       |
|                    | VLRAA31RFL7MACDL1XL1L  | 8    | 8     | Globe Valve, API 623, Class 300, RF Flanged end, Plug Disc, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Gear Operator, API Trim 12, Renewable Seats, Spiral Wound AISI 316 + Graphite Gasket, Bonnet Gasket Thickness: 6mm, Graphite Packing, A193 Gr. B7M/ A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103                                                                                                                                        |       |
| GASKETS            | GSWAB91RFAZGBA.JZ      | 1/2  | 12    | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 300, RF flanged end, 316 stainless steel (16 Cr-12 Ni-2 Mo), w/ flexible graphite filler, w/ 316 SS inner ring and CS outer ring                                                                                                                                                                                                                                                         |       |
|                    | GSWAB91RFAZGBA.JZ      | 1/2  | 12    | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 600, RF flanged end, 316 stainless steel (16 Cr-12 Ni-2 Mo), w/ flexible graphite filler, w/ 316 SS inner ring and CS outer ring                                                                                                                                                                                                                                                         |       |
| BOLTS              | LSEABSAX1AL1J          | 1/2  | 1.125 | Continuous Thread Stud Bolt, ASME B18.31.2/ B18.2.2, ASTM A193 Grade B7M, with 2 Heavy Hexagonal Nuts, ASTM A194 Gr. 2HM                                                                                                                                                                                                                                                                                                                                 |       |
| SPECTACLE BLIND    | DF8ABM1RTAOGAANZ       | 1/2  | 12    | Spectacle blind (Figure 8 blind), ASME B16.48, Class 300, RF thru-bolted end, ASTM A105, NACE MR0103                                                                                                                                                                                                                                                                                                                                                     |       |



## PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS                | RATING CLASS | DESIGN CODE                 | CORROSION ALLOWANCE | BASE MATERIAL          | SERVICE       |
|--------------------------|--------------|-----------------------------|---------------------|------------------------|---------------|
| A3L-3F                   | 150          | ASME B31.3                  | 3mm                 | Carbon Steel           | Process       |
| DESIGN CONDITIONS (MAWP) |              | OPERATION CONDITIONS (MAOP) |                     | HYDRO. TEST CONDITIONS | STRESS RELIEF |
| 740 PSIG @ -20 A 800 °F  |              |                             |                     |                        | No            |

### SPECIFICATION NOTES

### COMPONENT NOTES

| HEADER | BRANCH |      |     |        |     |     |     |     |     |     |     |  |
|--------|--------|------|-----|--------|-----|-----|-----|-----|-----|-----|-----|--|
|        | 1/2"   | 3/4" | 1"  | 1.1/2" | 2"  | 3"  | 4"  | 6"  | 8"  | 10" | 12" |  |
| 1/2"   | ETE    |      |     |        |     |     |     |     |     |     |     |  |
| 3/4"   | RTE    | ETE  |     |        |     |     |     |     |     |     |     |  |
| 1"     | RTE    | RTE  | ETE |        |     |     |     |     |     |     |     |  |
| 1.1/2" | RTE    | RTE  | RTE | ETE    |     |     |     |     |     |     |     |  |
| 2"     | RTE    | RTE  | RTE | RTE    | ETE |     |     |     |     |     |     |  |
| 3"     | SOC    | SOC  | SOC | SOC    | SOC | TEE |     |     |     |     |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |  |
| 4"     | SOC    | SOC  | SOC | SOC    | SOC | TER | TEE |     |     |     |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |  |
| 6"     | SOC    | SOC  | SOC | SOC    | SOC | TER | TER | TEE |     |     |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |  |
| 8"     | SOC    | SOC  | SOC | SOC    | SOC | WEL | TER | TER | TEE |     |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |  |
| 10"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | TER | TER | TER | TEE |     |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |  |
| 12"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TEE |  |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |  |

#### NOMENCLATURE

ETE = Straight Tee  
TER = Reducing Tee

RTE = Reducing Tee  
THL = Thredolet

SOC = Sockolet  
WEL = Weldolet

TEE = Straight Tee



## PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| M1L-1F    | 150                      | ASME B31.3                  | 1.0mm                  | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 230 PSIG @ -150 A 797 °F |                             |                        | No            |         |

### PIPING SCHEDULES

| SIZE | 1/2"  | 3/4" | 1" | 1.1/2" | 2" | 3"    | 4" | 6" | 10"   | 12" | 8"    |
|------|-------|------|----|--------|----|-------|----|----|-------|-----|-------|
| SCH. | S-80S |      |    |        |    | S-40S |    |    | S-10S |     | S-40S |

### SPEC ITEMS

| ELEMENT               | COMMODITY CODE    | SIZE |    | DESCRIPTION                                                                                                                              | NOTES |
|-----------------------|-------------------|------|----|------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                       |                   | FROM | TO |                                                                                                                                          |       |
| PIPING                | PPPABRPEAT3AP2H   | 1/2  | 2  | Pipe, ASME-B36.19M, Plain Ends, ASTM A312 Grade TP304L (UNS S30403), NACE MR0103, Seamless, Length: 6m Aprox Length                      |       |
|                       | PPPABRBEAT3AP2G   | 3    | 6  | Pipe, ASME-B36.19M, Beveled Ends, ASTM A312 Grade TP304L (UNS S30403), NACE MR0103, Seamless, Length: 12m Aprox Length                   |       |
|                       | PPPABRBEATSAP2L   | 8    | 12 | Pipe, ASME-B36.19M, Beveled Ends, ASTM A358 Grade 304L Class 1, NACE MR0103, Electric Fusion Welded, 100% XRAY, Length: 12m Aprox Length |       |
| SOCKOLET (BR. TABLE)  | OSOCAM9SSWARNAAGZ | 3    | 12 | Socketolet, MSS SP-97, Class 3000, Socket Welded Ends, ASTM A182 Grade F304L (UNS S30403), NACE MR0103                                   |       |
| TEE (BRANCH TABLE)    | OETEAB2SSWARNAAGZ | 1/2  | 2  | Straight Tee, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A182 Grade F304L (UNS S30403), NACE MR0103                               |       |
|                       | BTEEABMBEAS9ABCZ  | 3    | 6  | Straight Tee, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103, Seamless                                       |       |
|                       | BTEEABMBEAS9AB2Y  | 8    | 12 | Straight Tee, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103, Welded, 100% XRAY                              |       |
| THREDOLET (BR. TABLE) | OTHLAM9STFARNAAGZ | 3    | 12 | Thredolet, MSS SP-97, Class 3000, Female Threaded Ends, ASTM A182 Grade F304L (UNS S30403), NACE MR0103                                  |       |
| RED. TEE (BR. TABLE)  | ORTEAB2SSWARNAAGZ | 3/4  | 2  | Reducing Tee, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A182 Grade F304L (UNS S30403), NACE MR0103                               |       |
|                       | BTERABMBEAS9ABCZ  | 4    | 6  | Reducing Tee, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103, Seamless                                       |       |
|                       | BTERABMBEAS9AB2Y  | 8    | 12 | Reducing Tee, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103, Welded, 100% XRAY                              |       |
| CAP                   | OCAPAB2SSWARNAAGZ | 1/2  | 2  | Cap, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A182 Grade F304L (UNS S30403), NACE MR0103                                        |       |
|                       | OCAPAB2STFARNAAGZ | 1/2  | 2  | Cap, ASME B16.11, Class 3000, Female Threaded Ends, ASTM A182 Grade F304L (UNS S30403), NACE MR0103                                      |       |
|                       | BCAPABMBEAS9ABCZ  | 3    | 12 | Cap, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103, Seamless                                                |       |
| CPLG.                 | OCLAB2SSWARNAAGZ  | 1/2  | 2  | Coupling/connector, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A182 Grade F304L (UNS S30403), NACE MR0103                         |       |
|                       | OCLAB2STFARNAAGZ  | 1/2  | 2  | Coupling/connector, ASME B16.11, Class 3000, Female Threaded Ends, ASTM A182 Grade F304L (UNS S30403), NACE MR0103                       |       |
| 45 DEG. ELBOW         | OE45AB2SSWARNAAGZ | 1/2  | 2  | 45° elbow, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A182 Grade F304L (UNS S30403), NACE MR0103                                  |       |
|                       | BE4LABMBEAS9ABCZ  | 3    | 6  | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103, Seamless                             |       |
|                       | BE4LABMBEAS9AB2Y  | 8    | 12 | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103, Welded, 100% XRAY                    |       |
| 45-90 DEG DIRECTION   | BE9LABMBEAS9ABCZ  | 3    | 6  | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103, Seamless                             |       |
|                       | BE9LABMBEAS9AB2Y  | 8    | 12 | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103, Welded, 100% XRAY                    |       |
| 90 DEGREE ELBOW       | OE90AB2SSWARNAAGZ | 1/2  | 2  | 90° elbow, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A182 Grade F304L (UNS S30403), NACE MR0103                                  |       |
|                       | BE9LABMBEAS9ABCZ  | 3    | 6  | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103, Seamless                             |       |
|                       | BE9LABMBEAS9AB2Y  | 8    | 12 | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103, Welded, 100% XRAY                    |       |



# PIPING CLASS

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VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| M1L-1F    | 150                      | ASME B31.3                  | 1.0mm                  | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 230 PSIG @ -150 A 797 °F |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT              | COMMODITY CODE   | SIZE |    | DESCRIPTION                                                                                                              | NOTES |
|----------------------|------------------|------|----|--------------------------------------------------------------------------------------------------------------------------|-------|
|                      |                  | FROM | TO |                                                                                                                          |       |
| <45 DEG DIRECTION CH | BE4LABMBEAS9ABCZ | 3    | 6  | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103, Seamless             |       |
|                      | BE4LABMBEAS9AB2Y | 8    | 12 | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103, Welded, 100% XRAY    |       |
| NIPPLE               | ONIPABRTMAT3ABYZ | 1/2  | 2  | Pipe Nipple, ASME-B36.19M, Male Threaded Ends, ASTM A312 Grade TP304L (UNS S30403), NACE MR0103, 4in Long                |       |
|                      | ONIPABRPEAT3ABYZ | 1/2  | 2  | Pipe Nipple, ASME-B36.19M, Plain Ends, ASTM A312 Grade TP304L (UNS S30403), NACE MR0103, 4in Long                        |       |
|                      | ONIPABRPMAT3ABYZ | 1/2  | 2  | Pipe Nipple, ASME-B36.19M, Plain End x Male Threaded End, ASTM A312 Grade TP304L (UNS S30403), NACE MR0103, 4in Long     |       |
|                      | ONIPABRTMAT3ABZZ | 1/2  | 2  | Pipe Nipple, ASME-B36.19M, Male Threaded Ends, ASTM A312 Grade TP304L (UNS S30403), NACE MR0103, 8in Long                |       |
|                      | ONIPABRPEAT3ABZZ | 1/2  | 2  | Pipe Nipple, ASME-B36.19M, Plain Ends, ASTM A312 Grade TP304L (UNS S30403), NACE MR0103, 8in Long                        |       |
|                      | ONIPABRPMAT3ABZZ | 1/2  | 2  | Pipe Nipple, ASME-B36.19M, Plain End x Male Threaded End, ASTM A312 Grade TP304L (UNS S30403), NACE MR0103, 8in Long     |       |
| PLUG                 | OPLRAB2TMARNAAGZ | 1/2  | 2  | Plug, round, ASME B16.11, Male Threaded Ends, ASTM A182 Grade F304L (UNS S30403), NACE MR0103                            |       |
| CON. REDUCER         | BRECABMBEAS9ABCZ | 4    | 6  | Concentric reducer, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103, Seamless                 |       |
|                      | BRECABMBEAS9AB2Y | 8    | 12 | Concentric reducer, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103, Welded, 100% XRAY        |       |
| ECC. REDUCER         | BREEABMBEAS9ABCZ | 4    | 6  | Eccentric reducer, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103, Seamless                  |       |
|                      | BREEABMBEAS9AB2Y | 8    | 12 | Eccentric reducer, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103, Welded, 100% XRAY         |       |
| CONC. SWAGE NIPPLE   | OSGCAM8PEAS9AAGZ | 3/4  | 2  | Concentric swage, MSS SP-95, Plain Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103                                |       |
|                      | OSGCAM8PMAS9AAGZ | 3/4  | 2  | Concentric swage, MSS SP-95, Plain End x Male Threaded End, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103             |       |
|                      | OSGCAM8BPAS9AAGZ | 3    | 4  | Concentric swage, MSS SP-95, Beveled End x Plain End, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103                   |       |
|                      | OSGCAM8MBAS9AAGZ | 3    | 4  | Concentric swage, MSS SP-95, Beveled End x Male Threaded End, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103           |       |
| ECC. SWAGE NIPPLE    | OSGEAM8PEAS9AAGZ | 3/4  | 2  | Eccentric swage, MSS SP-95, Plain Ends, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103                                 |       |
|                      | OSGEAM8PMAS9AAGZ | 3/4  | 2  | Eccentric swage, MSS SP-95, Plain End x Male Threaded End, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103              |       |
|                      | OSGEAM8BPAS9AAGZ | 3    | 4  | Eccentric swage, MSS SP-95, Beveled End x Plain End, ASTM A403 Grade WP304L (UNS S30403), NACE MR0103                    |       |
| BLIND FLG.           | FBLABLDRFARNAASZ | 1/2  | 12 | Blind flange, ASME B16.5, Class 150, RF Flanged end, ASTM A182 Grade F304L (UNS S30403), NACE MR0103                     |       |
| FLANGE               | FSWABLDRFARNAASZ | 1/2  | 2  | Socket welded flange, ASME B16.5, Class 150, RF Flanged end, ASTM A182 Grade F304L (UNS S30403), NACE MR0103             |       |
|                      | FSWABLRFARNAASZ  | 1/2  | 2  | Socket welded flange, ASME B16.5, Class 300, RF Flanged end, ASTM A182 Grade F304L (UNS S30403), NACE MR0103             |       |
|                      | FWNABLLRFARNAASZ | 3    | 4  | Weld neck flange, ASME B16.5, Class 600, RF Flanged end, ASTM A182 Grade F304L (UNS S30403), NACE MR0103                 |       |
|                      | FWNABLDRFARNAASZ | 3    | 12 | Weld neck flange, ASME B16.5, Class 150, RF Flanged end, ASTM A182 Grade F304L (UNS S30403), NACE MR0103                 |       |
|                      | FWNABLRFARNAASZ  | 3    | 12 | Weld neck flange, ASME B16.5, Class 300, RF Flanged end, ASTM A182 Grade F304L (UNS S30403), NACE MR0103                 |       |
|                      | FWNABLDRFARNAATZ | 3    | 12 | Weld neck flange, ASME B16.5, Class 150, RF Flanged end, ASTM A182 Grade F304L (UNS S30403), NACE MR0103, w/ Jack Screws |       |
| ORIFICE FLG          |                  |      |    |                                                                                                                          |       |



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| M1L-1F    | 150                      | ASME B31.3                  | 1.0mm                  | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 230 PSIG @ -150 A 797 °F |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT            | COMMODITY CODE         | SIZE |    | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                            | NOTES |
|--------------------|------------------------|------|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                    |                        | FROM | TO |                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |
| ORIFICE FLG        | FO2ABDIRFARNAAXZ       | 2    | 12 | Weldneck Orifice Flange with 0.5" Threaded Tap, ASME B16.36, Class 300, RF Flanged end, ASTM A182 Grade F304L (UNS S30403), NACE MR0103, 2 Nos. Taps, w/ Jack Screws                                                                                                                                                                                                                                                                   |       |
| SWING CHECK VALVES | VLCQA5MSWE5ARN03PO04F  | 1/2  | 2  | Check valve, lift, API 602, Class 800, Socket Welded Ends, Piston, Bolted Cover, ASTM A182 Grade F304L (UNS S30403), API Trim 12, Inconel X750 Spring, Renewable Seats, Spiral Wound AISI 304+Graphite Cover Gasket, Bonnet Gasket Thickness: 6mm, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire Safe Per API 6FD, Inspection and Testing Per API 598                                                                 |       |
|                    | VCSQA2DRFPAR308Q004K   | 3    | 12 | Check valve, swing, API 594, Class 150, RF Flanged end, Bolted Cover, ASTM A351 Grade CF3, API Trim 12, Renewable Seats, Spiral Wound AISI 304+Graphite Cover Gasket, Bonnet Gasket Thickness: 6mm, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire Safe Per API 6FD                                                                                                                                                    |       |
| GATE VALVE         | VGRAA5MSWG2FARNG9KHH1E | 1/2  | 2  | Gate valve, solid wedge, API 602, Class 800, Socket Welded Ends, Standard Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A182 Grade F304L (UNS S30403), Handwheel Operator, API Trim 12, Renewable Seats, Flexible Graphite Packing, Bonnet Gasket Thickness: 6mm, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire safe Per API 6FA                                                                                        |       |
|                    | VGWAA4DRFG4FAR3G9FHH1E | 3    | 10 | Gate valve, flexible wedge, API 600, Class 150, RF Flanged end, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A351 Grade CF3, Handwheel Operator, API Trim 12, Renewable Seats & Backseat, Tanged Graphite Gasket AISI 316, Thickness of S/Sinsertion 0.1 mm, Number of S/S insertions: 2, Bonnet Gasket Thickness: 6mm, Flexible Graphite Packing, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire safe Per API 6FA |       |
|                    | VGWAA4DRFG4MAR3G9FHH1E | 12   | 12 | Gate valve, flexible wedge, API 600, Class 150, RF Flanged end, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A351 Grade CF3, Gear Operator, API Trim 12, Renewable Seats & Backseat, Tanged Graphite Gasket AISI 316, Thickness of S/Sinsertion 0.1 mm, Number of S/S insertions: 2, Bonnet Gasket Thickness: 6mm, Flexible Graphite Packing, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire safe Per API 6FA      |       |
| GLOBE VALVE        | VLRAA3DRFLDFAR3L6SL1L  | 3    | 8  | Globe Valve, API 623, Class 150, RF Flanged end, Plug Disc, OS&Y-Rising Stem, Rising Operator, Bolted Bonnet, ASTM A351 Grade CF3, Handwheel Operator, API Trim 12, Renewable Seats, Spiral Wound AISI 304 + Graphite Bonnet Gasket, Graphite Packing, Bonnet Gasket Thickness: 6mm, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103                                                                                          |       |
|                    | VLRAA5MSWLFFARNL6SL1L  | 1/2  | 2  | Globe Valve, API 602, Class 800, Socket Welded Ends, Standard Port, Plug Disc, OS&Y-Rising Stem, Rising Operator, Bolted Bonnet, ASTM A182 Grade F304L (UNS S30403), Handwheel Operator, API Trim 12, Renewable Seats, Spiral Wound AISI 304 + Graphite Bonnet Gasket, Graphite Packing, Bonnet Gasket Thickness: 6mm, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103                                                        |       |
| GASKETS            | GSWAB9DRFAZHAG1A       | 1/2  | 12 | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 150, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler, w/ 304 SSinner and outer ring                                                                                                                                                                                                                                                      |       |
|                    | GSWAB9IRFAZHAG1A       | 1/2  | 12 | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 300, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler, w/ 304 SSinner and outer ring                                                                                                                                                                                                                                                      |       |
|                    | GSWAB9LRFZHAG1A        | 3    | 4  | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 600, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler, w/ 304 SSinner and outer ring                                                                                                                                                                                                                                                      |       |
| BOLTS              |                        |      |    |                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |



PIPING CLASS  
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CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| M1L-1F    | 150                      | ASME B31.3                  | 1.0mm                  | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 230 PSIG @ -150 A 797 °F |                             |                        | No            |         |

SPECIFICATIONS

| ELEMENT         | COMMODITY CODE   | SIZE |       | DESCRIPTION                                                                                                                       | NOTES |
|-----------------|------------------|------|-------|-----------------------------------------------------------------------------------------------------------------------------------|-------|
|                 |                  | FROM | TO    |                                                                                                                                   |       |
| BOLTS           | LSEABSAX1AL1J    | 1/2  | 1.125 | Continuous Thread Stud Bolt, ASME B18.31.2/B18.2.2, ASTM A193 Grade B7M, with 2 Heavy Hexagonal Nuts, ASTM A194 Gr. 2HM           |       |
| SPECTACLE BLIND | DF8ABMDRTAV7AANZ | 1/2  | 12    | Spectacle blind (Figure 8 blind), ASME B16.48, Class 150, RF thru-bolted end, ASTM A240 (UNS S30403 AISI Grade 304L), NACE MR0103 |       |

SPECIFICATION NOTES

COMPONENT NOTES

| HEADER | BRANCH |      |     |        |     |     |     |     |     |     |     |     |
|--------|--------|------|-----|--------|-----|-----|-----|-----|-----|-----|-----|-----|
|        | 1/2"   | 3/4" | 1"  | 1.1/2" | 2"  | 3"  | 4"  | 6"  | 8"  | 10" | 12" |     |
|        | 1/2"   | ETE  |     |        |     |     |     |     |     |     |     |     |
|        | 3/4"   | RTE  | ETE |        |     |     |     |     |     |     |     |     |
|        | 1"     | RTE  | RTE | ETE    |     |     |     |     |     |     |     |     |
|        | 1.1/2" | RTE  | RTE | RTE    | ETE |     |     |     |     |     |     |     |
|        | 2"     | RTE  | RTE | RTE    | RTE | ETE |     |     |     |     |     |     |
|        | 3"     | SOC  | SOC | SOC    | SOC | SOC | TEE |     |     |     |     |     |
|        |        | THL  | THL | THL    | THL | THL |     |     |     |     |     |     |
|        | 4"     | SOC  | SOC | SOC    | SOC | SOC | TER | TEE |     |     |     |     |
|        |        | THL  | THL | THL    | THL | THL |     |     |     |     |     |     |
|        | 6"     | SOC  | SOC | SOC    | SOC | SOC | TER | TER | TEE |     |     |     |
|        |        | THL  | THL | THL    | THL | THL |     |     |     |     |     |     |
|        | 8"     | SOC  | SOC | SOC    | SOC | SOC | WEL | TER | TER | TEE |     |     |
|        |        | THL  | THL | THL    | THL | THL |     |     |     |     |     |     |
| 10"    | SOC    | SOC  | SOC | SOC    | SOC | SOC | WEL | TER | TER | TER | TEE |     |
|        | THL    | THL  | THL | THL    | THL | THL |     |     |     |     |     |     |
| 12"    | SOC    | SOC  | SOC | SOC    | SOC | SOC | WEL | WEL | TER | TER | TER | TEE |
|        | THL    | THL  | THL | THL    | THL | THL |     |     |     |     |     |     |

NOMENCLATURE

ETE = Straight Tee

RTE = Reducing Tee

SOC = Sockolet

TEE = Straight Tee

TER = Reducing Tee

THL = Thredolet

WEL = Weldolet



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Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| M 2-1F    | 150                      | ASME B31.3                  | 1.5mm                  | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 230 PSIG @ -150 A 797 °F |                             |                        | No            |         |

### PIPING SCHEDULES

| SIZE | 1/2"  | 3/4" | 1" | 1.1/2" | 2" | 3"    | 4" | 6" | 10"   | 12" | 8"    |
|------|-------|------|----|--------|----|-------|----|----|-------|-----|-------|
| SCH. | S-80S |      |    |        |    | S-40S |    |    | S-10S |     | S-40S |

### SPEC ITEMS

| ELEMENT               | COMMODITY CODE    | SIZE |    | DESCRIPTION                                                                                                                              | NOTES |
|-----------------------|-------------------|------|----|------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                       |                   | FROM | TO |                                                                                                                                          |       |
| PIPING                | PPPABRPEAT3AP1G   | 1/2  | 2  | Pipe, ASME-B36.19M, Plain Ends, ASTM A312 Grade TP304L (UNS S30403), Seamless, Length: 6m Aprox Length                                   |       |
|                       | PPPABRBEAT3AP1A   | 3    | 6  | Pipe, ASME-B36.19M, Beveled Ends, ASTM A312 Grade TP304L (UNS S30403), Seamless, Length: 12m Aprox Length                                |       |
|                       | PPPABRBEATSAP2L   | 8    | 12 | Pipe, ASME-B36.19M, Beveled Ends, ASTM A358 Grade 304L Class 1, NACE MR0103, Electric Fusion Welded, 100% XRAY, Length: 12m Aprox Length |       |
| SOCKET (BR. TABLE)    | OSOCAM9SSWARNZZZZ | 3    | 12 | Socket, MSS SP-97, Class 3000, Socket Welded Ends, ASTM A182 Grade F304L (UNS S30403)                                                    |       |
| TEE (BRANCH TABLE)    | OETEAB2SSWARNZZZZ | 1/2  | 2  | Straight Tee, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A182 Grade F304L (UNS S30403)                                            |       |
|                       | BTEEABMBEAS9A3AZ  | 3    | 6  | Straight Tee, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), Seamless                                                    |       |
| THREDOLET (BR. TABLE) | OTHLAM9STFARNZZZZ | 3    | 12 | Thredolet, MSS SP-97, Class 3000, Female Threaded Ends, ASTM A182 Grade F304L (UNS S30403)                                               |       |
| RED. TEE (BR. TABLE)  | ORTEAB2SSWARNZZZZ | 3/4  | 2  | Reducing Tee, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A182 Grade F304L (UNS S30403)                                            |       |
|                       | BTERABMBEAS9A3AZ  | 4    | 6  | Reducing Tee, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), Seamless                                                    |       |
| CAP                   | OCAPAB2SSWARNZZZZ | 1/2  | 2  | Cap, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A182 Grade F304L (UNS S30403)                                                     |       |
|                       | OCAPAB2STFARNZZZZ | 1/2  | 2  | Cap, ASME B16.11, Class 3000, Female Threaded Ends, ASTM A182 Grade F304L (UNS S30403)                                                   |       |
|                       | BCAPABMBEAS9A3AZ  | 3    | 12 | Cap, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), Seamless                                                             |       |
| CPLG.                 | OCPLAB2SSWARNZZZZ | 1/2  | 2  | Coupling/connector, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A182 Grade F304L (UNS S30403)                                      |       |
|                       | OCPLAB2STFARNZZZZ | 1/2  | 2  | Coupling/connector, ASME B16.11, Class 3000, Female Threaded Ends, ASTM A182 Grade F304L (UNS S30403)                                    |       |
| 45 DEG. ELBOW         | OE45AB2SSWARNZZZZ | 1/2  | 2  | 45° elbow, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A182 Grade F304L (UNS S30403)                                               |       |
|                       | BE4LABMBEAS9A3AZ  | 3    | 6  | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), Seamless                                          |       |
|                       | BE4LABMBEAS9AB1B  | 8    | 12 | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), Welded, 100% XRAY                                 |       |
| 45-90 DEG DIRECTION   | BE9LABMBEAS9A3AZ  | 3    | 6  | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), Seamless                                          |       |
|                       | BE9LABMBEAS9AB1B  | 8    | 12 | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), Welded, 100% XRAY                                 |       |
| 90 DEGREE ELBOW       | OE90AB2SSWAWZZZZ  | 1/2  | 2  | 90° elbow, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A182 Grade F304L (UNS S30403)                                               |       |
|                       | BE9LABMBEAS9A3AZ  | 3    | 6  | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), Seamless                                          |       |
|                       | BE9LABMBEAS9AB1B  | 8    | 12 | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), Welded, 100% XRAY                                 |       |
| <45 DEG DIRECTION CH  | BE4LABMBEAS9A3AZ  | 3    | 6  | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), Seamless                                          |       |
|                       | BE4LABMBEAS9AB1B  | 8    | 12 | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), Welded, 100% XRAY                                 |       |
| NIPPLE                | ONIPABRTMAT3A1AZ  | 1/2  | 2  | Pipe Nipple, ASME-B36.19M, Male Threaded Ends, ASTM A312 Grade TP304L (UNS S30403), 4in Long, Seamless                                   |       |
|                       | ONIPABRPEAT3A1AZ  | 1/2  | 2  | Pipe Nipple, ASME-B36.19M, Plain Ends, ASTM A312 Grade TP304L (UNS S30403), 4in Long, Seamless                                           |       |
|                       | ONIPABRPMAT3A1AZ  | 1/2  | 2  | Pipe Nipple, ASME-B36.19M, Plain End x Male Threaded End, ASTM A312 Grade TP304L (UNS S30403), 4in Long, Seamless                        |       |



# PIPING CLASS

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CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/ 12/ 2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| M 2-1F    | 150                      | ASME B31.3                  | 1.5mm                  | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 230 PSIG @ -150 A 797 °F |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT            | COMMODITY CODE          | SIZE |    | DESCRIPTION                                                                                                                                                                                                                                                                                                  | NOTES |
|--------------------|-------------------------|------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                    |                         | FROM | TO |                                                                                                                                                                                                                                                                                                              |       |
| NIPPLE             | ONIPABRTMAT3A1GZ        | 1/2  | 2  | Pipe Nipple, ASME-B36.19M, Male Threaded Ends, ASTM A312 Grade TP304L (UNS S30403), 8in Long, Seamless                                                                                                                                                                                                       |       |
|                    | ONIPABRPEAT3A1GZ        | 1/2  | 2  | Pipe Nipple, ASME-B36.19M, Plain Ends, ASTM A312 Grade TP304L (UNS S30403), 8in Long, Seamless                                                                                                                                                                                                               |       |
|                    | ONIPABRPMAT3A1GZ        | 1/2  | 2  | Pipe Nipple, ASME-B36.19M, Plain End x Male Threaded End, ASTM A312 Grade TP304L (UNS S30403), 8in Long, Seamless                                                                                                                                                                                            |       |
| PLUG               | OPLRAB2TMARNZZZZ        | 1/2  | 2  | Plug, round, ASME B16.11, Male Threaded Ends, ASTM A182 Grade F304L (UNS S30403)                                                                                                                                                                                                                             |       |
| CON. REDUCER       | BRECABM BEAS9A3AZ       | 4    | 6  | Concentric reducer, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), Seamless                                                                                                                                                                                                                  |       |
|                    | BRECABM BEAS9AB1B       | 8    | 12 | Concentric reducer, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), Welded, 100% XRAY                                                                                                                                                                                                         |       |
| ECC. REDUCER       | BREEABM BEAS9A3AZ       | 4    | 6  | Eccentric reducer, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), Seamless                                                                                                                                                                                                                   |       |
|                    | BREEABM BEAS9AB1B       | 8    | 12 | Eccentric reducer, ASME B16.9, Beveled Ends, ASTM A403 Grade WP304L (UNS S30403), Welded, 100% XRAY                                                                                                                                                                                                          |       |
| CONC. SWAGE NIPPLE | OSGCAM8PEAS9ZZZZ        | 3/4  | 2  | Concentric swage, MSS SP-95, Plain Ends, ASTM A403 Grade WP304L (UNS S30403)                                                                                                                                                                                                                                 |       |
|                    | OSGCAM8PMAS9ZZZZ        | 3/4  | 2  | Concentric swage, MSS SP-95, Plain End x Male Threaded End, ASTM A403 Grade WP304L (UNS S30403)                                                                                                                                                                                                              |       |
|                    | OSGCAM8BPAS9ZZZZ        | 3    | 4  | Concentric swage, MSS SP-95, Beveled End x Plain End, ASTM A403 Grade WP304L (UNS S30403)                                                                                                                                                                                                                    |       |
|                    | OSGCAM8MBAS9ZZZZ        | 3    | 4  | Concentric swage, MSS SP-95, Beveled End x Male Threaded End, ASTM A403 Grade WP304L (UNS S30403)                                                                                                                                                                                                            |       |
| ECC. SWAGE NIPPLE  | OSGEAM8PEAS9ZZZZ        | 3/4  | 2  | Eccentric swage, MSS SP-95, Plain Ends, ASTM A403 Grade WP304L (UNS S30403)                                                                                                                                                                                                                                  |       |
|                    | OSGEAM8PMAS9ZZZZ        | 3/4  | 2  | Eccentric swage, MSS SP-95, Plain End x Male Threaded End, ASTM A403 Grade WP304L (UNS S30403)                                                                                                                                                                                                               |       |
|                    | OSGEAM8BPAS9ZZZZ        | 3    | 4  | Eccentric swage, MSS SP-95, Beveled End x Plain End, ASTM A403 Grade WP304L (UNS S30403)                                                                                                                                                                                                                     |       |
| BLIND FLG.         | FBLABLDRFARNZZZZ        | 1/2  | 12 | Blind flange, ASME B16.5, Class 150, RF Flanged end, ASTM A182 Grade F304L (UNS S30403)                                                                                                                                                                                                                      |       |
| FLANGE             | FSWABLDRFARNZZZZ        | 1/2  | 2  | Socket welded flange, ASME B16.5, Class 150, RF Flanged end, ASTM A182 Grade F304L (UNS S30403)                                                                                                                                                                                                              |       |
|                    | FSWABLIRFARNZZZZ        | 1/2  | 2  | Socket welded flange, ASME B16.5, Class 300, RF Flanged end, ASTM A182 Grade F304L (UNS S30403)                                                                                                                                                                                                              |       |
|                    | FWNABLDRFARNZZZZ        | 3    | 12 | Weld neck flange, ASME B16.5, Class 150, RF Flanged end, ASTM A182 Grade F304L (UNS S30403)                                                                                                                                                                                                                  |       |
|                    | FWNABLIRFARNZZZZ        | 3    | 12 | Weld neck flange, ASME B16.5, Class 300, RF Flanged end, ASTM A182 Grade F304L (UNS S30403)                                                                                                                                                                                                                  |       |
|                    | FWNABLLRFARNZZZZ        | 3    | 12 | Weld neck flange, ASME B16.5, Class 600, RF Flanged end, ASTM A182 Grade F304L (UNS S30403)                                                                                                                                                                                                                  |       |
|                    | FWNABLDRFARNA1PZ        | 3    | 12 | Weld neck flange, ASME B16.5, Class 150, RF Flanged end, ASTM A182 Grade F304L (UNS S30403), w/ Jack Screws                                                                                                                                                                                                  |       |
| ORIFICE FLG        | FO2ABDIRFARNA1LZ        | 2    | 12 | Weldneck Orifice Flange with 0.5" Threaded Tap, ASME B16.36, Class 300, RF Flanged end, ASTM A182 Grade F304L (UNS S30403), 2 Nos. Taps, w/ Jack Screws                                                                                                                                                      |       |
| SWING CHECK VALVES | VCSCAA5MSWESAPIN08H004H | 1/2  | 2  | Check valve, lift, API 602, Class 800, Socket Welded Ends, Piston, Bolted Cover, ASTM A182 Grade F304L (UNS S30403), API Trim 12, Inconel X750 Spring, Renewable Seats, Spiral Wound AISI 304+Graphite Cover Gasket, Fire Safe Per API 6FD, Inspection and Testing Per API 598, Cleaning Method per ASTM G93 |       |
|                    | VCSCAA2DRFPAR308N004J   | 3    | 12 | Check valve, swing, API 594, Class 150, RF Flanged end, Bolted Cover, ASTM A351 Grade CF3, API Trim 12, Renewable Seats, Spiral Wound AISI 304+Graphite Cover Gasket, Bonnet Gasket Thickness: 6mm, Fire Safe Per API 6FD, Cleaning Method per ASTM G93                                                      |       |
| GATE VALVE         |                         |      |    |                                                                                                                                                                                                                                                                                                              |       |



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CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| M 2-1F    | 150                      | ASME B31.3                  | 1.5mm                  | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 230 PSIG @ -150 A 797 °F |                             |                        | No            |         |

### SPEC ITEMS

| ELEMENT         | COMMODITY CODE         | SIZE |      | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                  | NOTES |
|-----------------|------------------------|------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                 |                        | FROM | TO   |                                                                                                                                                                                                                                                                                                                                                                              |       |
| GATE VALVE      | VGRAA5MSWG2FARNG9LHH1F | 1/2  | 2    | Gate valve, solid wedge, API 602, Class 800, Socket Welded Ends, Standard Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A182 Grade F304L (UNS S30403), Handwheel Operator, API Trim 12, Renewable Seats, Flexible Graphite Packing, Bonnet Gasket Thickness: 6mm, Fire safe Per API 6FA, Cleaning Method per ASTM G93                                                          |       |
|                 | VGWAA4DRFG4FAR3G9MHH1F | 3    | 10   | Gate valve, flexible wedge, API 600, Class 150, RF Flanged end, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A351 Grade CF3, Handwheel Operator, API Trim 12, Renewable Seats & Backseat, Tanged Graphite Gasket AISI 316, Thickness of S/Sinsertion 0.1 mm, Number of S/S insertions: 2, Flexible Graphite Packing, Fire safe Per API 6FA, Cleaning Method per ASTM G93 |       |
| GLOBE VALVE     | VLRAA5MSWLFFARNL6RLLE  | 1/2  | 2    | Globe Valve, API 602, Class 800, Socket Welded Ends, Standard Port, Plug Disc, OS&Y-Rising Stem, Rising Operator, Bolted Bonnet, ASTM A182 Grade F304L (UNS S30403), Handwheel Operator, API Trim 12, Renewable Seats, Spiral Wound AISI 304 + Graphite Bonnet Gasket, Bonnet Gasket Thickness: 6mm, Cleaning Method per ASTM G93                                            |       |
|                 | VLRAA3DRFLDFAR3L6RLLE  | 3    | 8    | Globe Valve, API 623, Class 150, RF Flanged end, Plug Disc, OS&Y-Rising Stem, Rising Operator, Bolted Bonnet, ASTM A351 Grade CF3, Handwheel Operator, API Trim 12, Renewable Seats, Spiral Wound AISI 304 + Graphite Bonnet Gasket, Bonnet Gasket Thickness: 6mm, Cleaning Method per ASTM G93                                                                              |       |
| GASKETS         | GSWAB9DRFAZHAG1E       | 1/2  | 10   | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 150, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler, w/ outer ring                                                                                                                                                                                                            |       |
|                 | GSWAB9IRFAZHAG1E       | 1/2  | 10   | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 300, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler, w/ outer ring                                                                                                                                                                                                            |       |
|                 | GSWAB9LRFZAHAG1A       | 3    | 12   | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 600, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler, w/ 304 SSinner and outer ring                                                                                                                                                                                            |       |
|                 | GSWAB9DRFAZHAG1A       | 12   | 12   | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 150, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler, w/ 304 SSinner and outer ring                                                                                                                                                                                            |       |
|                 | GSWAB9IRFAZHAG1A       | 12   | 12   | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 300, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler, w/ 304 SSinner and outer ring                                                                                                                                                                                            |       |
| BOLTS           | LSEABSAX1AAPZ          | 1/2  | .875 | Continuous Thread Stud Bolt, ASME B18.31.2/B18.2.2, ASTM A193 Grade B7M, with 2 Heavy Hexagonal Nuts, ASTM A194 Gr. 2HM, Both bolt and nuts with Cadmium + PTFE                                                                                                                                                                                                              |       |
| SPECTACLE BLIND | DF8ABMDRTAV7ZZZZ       | 1/2  | 12   | Spectacle blind (Figure 8 blind), ASME B16.48, Class 150, RF thru-bolted end, ASTM A240 (UNS S30403 AISI Grade 304L)                                                                                                                                                                                                                                                         |       |

### SPECIFICATION NOTES

### COMPONENT NOTES



PIPING CLASS  
ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| M 2-1F    | 150                      | ASM E B31.3                 | 1.5mm                  | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 230 PSIG @ -150 A 797 °F |                             |                        | No            |         |

| HEADER | BRANCH |      |     |        |     |     |     |     |     |     |     |     |
|--------|--------|------|-----|--------|-----|-----|-----|-----|-----|-----|-----|-----|
|        | 1/2"   | 3/4" | 1"  | 1.1/2" | 2"  | 3"  | 4"  | 6"  | 8"  | 10" | 12" |     |
|        | 1/2"   | ETE  |     |        |     |     |     |     |     |     |     |     |
|        | 3/4"   | RTE  | ETE |        |     |     |     |     |     |     |     |     |
|        | 1"     | RTE  | RTE | ETE    |     |     |     |     |     |     |     |     |
|        | 1.1/2" | RTE  | RTE | RTE    | ETE |     |     |     |     |     |     |     |
|        | 2"     | RTE  | RTE | RTE    | RTE | ETE |     |     |     |     |     |     |
|        | 3"     | SOC  | SOC | SOC    | SOC | SOC | TEE |     |     |     |     |     |
|        |        | THL  | THL | THL    | THL | THL |     |     |     |     |     |     |
|        | 4"     | SOC  | SOC | SOC    | SOC | SOC | TER | TEE |     |     |     |     |
|        |        | THL  | THL | THL    | THL | THL |     |     |     |     |     |     |
|        | 6"     | SOC  | SOC | SOC    | SOC | SOC | TER | TER | TEE |     |     |     |
|        |        | THL  | THL | THL    | THL | THL |     |     |     |     |     |     |
|        | 8"     | SOC  | SOC | SOC    | SOC | SOC | WEL | TER | TER | TEE |     |     |
|        |        | THL  | THL | THL    | THL | THL |     |     |     |     |     |     |
|        | 10"    | SOC  | SOC | SOC    | SOC | SOC | WEL | TER | TER | TER | TEE |     |
|        |        | THL  | THL | THL    | THL | THL |     |     |     |     |     |     |
|        | 12"    | SOC  | SOC | SOC    | SOC | SOC | WEL | WEL | TER | TER | TER | TEE |
|        |        | THL  | THL | THL    | THL | THL |     |     |     |     |     |     |

NOM ENCLATURE

ETE = Straight Tee      RTE = Reducing Tee      SOC = Sockolet      TEE = Straight Tee  
TER = Reducing Tee      THL = Threadolet      WEL = Weldolet



## PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/ 12/ 2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE       |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------------|
| A3L-1F    | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process       |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS |               | STRESS RELIEF |
|           | 285 PSIG @ -20 A 800 °F  |                             |                        |               | No            |

### PIPING SCHEDULES

| SIZE | 1/2" | 3/4" | 1" | 1.1/2" | 2" | 10"  | 14" | 16" | 12"  | 3"    | 4" | 6" | 8" | 18" | 20" | 24" | 26"   | 28" | 30" |
|------|------|------|----|--------|----|------|-----|-----|------|-------|----|----|----|-----|-----|-----|-------|-----|-----|
| SCH. | S-XS |      |    |        |    | S-20 |     |     | S-30 | S-STD |    |    |    |     |     |     | S-STD |     |     |

### SPEC ITEMS

| ELEMENT               | COMMODITY CODE    | SIZE |    | DESCRIPTION                                                                                                                                                                                      | NOTES |
|-----------------------|-------------------|------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                       |                   | FROM | TO |                                                                                                                                                                                                  |       |
| PIPING                | PPPABQPEACRAP2H   | 1/2  | 2  | Pipe, ASME B36.10M, Plain Ends, ASTM A106 Grade B, NACE MR0103, Seamless, Length: 6m Aprox Length                                                                                                |       |
|                       | PPPABQBEACRAP2G   | 3    | 24 | Pipe, ASME B36.10M, Beveled Ends, ASTM A106 Grade B, NACE MR0103, Seamless, Length: 12m Aprox Length                                                                                             |       |
|                       | PPPABQBEAE5BAP2J  | 26   | 30 | Pipe, ASME B36.10M, Beveled Ends, A672 Grade C60 Class 42, NACE MR0103, Electric Fusion Welded, 100% XRAY, HIC Test as per NACE TM 0284, NACE TM 0177, Test solution A, Length: 12m Aprox Length |       |
| SOCKOLET (BR. TABLE)  | OSOCAM9SSWACGAAGZ | 3    | 30 | Socketolet, MSS SP-97, Class 3000, Socket Welded Ends, ASTM A105, NACE MR0103                                                                                                                    |       |
| TEE (BRANCH TABLE)    | OETEAB2SSWACGAAGZ | 1/2  | 2  | Straight Tee, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105, NACE MR0103                                                                                                                |       |
|                       | BTEEABMBEACKABCZ  | 3    | 24 | Straight Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                                                               |       |
|                       | BTEEABMBEACKAP2K  | 26   | 30 | Straight Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Welded, 100% XRAY, HIC Test as per NACE TM 0284, NACE TM 0177, Test solution A                                         |       |
| THREDOLET (BR. TABLE) | OTHLAM9STFAOGAAGZ | 3    | 30 | Thredolet, MSS SP-97, Class 3000, Female Threaded Ends, ASTM A105, NACE MR0103                                                                                                                   |       |
| RED. TEE (BR. TABLE)  | ORTEAB2SSWACGAAGZ | 3/4  | 2  | Reducing Tee, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105, NACE MR0103                                                                                                                |       |
|                       | BTERABMBEACKABCZ  | 4    | 24 | Reducing Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                                                               |       |
|                       | BTERABMBEACKAP2K  | 26   | 30 | Reducing Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Welded, 100% XRAY, HIC Test as per NACE TM 0284, NACE TM 0177, Test solution A                                         |       |
| WELDOLET (BR. TABLE)  | BWELAM9BEACGABSZ  | 8    | 30 | Weldolet, MSS SP-97, Beveled Ends, ASTM A105, NACE MR0103                                                                                                                                        |       |
| CAP                   | OCAPAB2SSWACGAAGZ | 1/2  | 2  | Cap, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105, NACE MR0103                                                                                                                         |       |
|                       | OCAPAB2STFAOGAAGZ | 3/4  | 1  | Cap, ASME B16.11, Class 3000, Female Threaded Ends, ASTM A105, NACE MR0103                                                                                                                       |       |
|                       | BCAPABMBEACKABCZ  | 3    | 30 | Cap, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                                                                        |       |
| CPLG.                 | OCPLAB2SSWACGAAGZ | 1/2  | 2  | Coupling/connector, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105, NACE MR0103                                                                                                          |       |
|                       | OCPLAB2STFAOGAAGZ | 3/4  | 1  | Coupling/connector, ASME B16.11, Class 3000, Female Threaded Ends, ASTM A105, NACE MR0103                                                                                                        |       |
| CROSS                 | BXEEABMBEACKA3AZ  | 2    | 6  | Cross, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                                                                                                                   |       |
| 45 DEG. ELBOW         | OE45AB2SSWACGAAGZ | 1/2  | 2  | 45° elbow, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105, NACE MR0103                                                                                                                   |       |
|                       | BE4LABMBEACKABCZ  | 3    | 24 | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                                                     |       |
|                       | BE4LABMBEACKAP2K  | 26   | 30 | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Welded, 100% XRAY, HIC Test as per NACE TM 0284, NACE TM 0177, Test solution A                               |       |
| 45-90 DEG DIRECTION   | BE9LABMBEACKABCZ  | 3    | 24 | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                                                     |       |
|                       | BE9LABMBEACKAP2K  | 26   | 30 | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Welded, 100% XRAY, HIC Test as per NACE TM 0284, NACE TM 0177, Test solution A                               |       |
| 90 DEGREE ELBOW       | OE90AB2SSWACGAAGZ | 1/2  | 2  | 90° elbow, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105, NACE MR0103                                                                                                                   |       |
|                       | BE9LABMBEACKABCZ  | 3    | 24 | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                                                     |       |



## PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3L-1F    | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 285 PSIG @ -20 A 800 °F  |                             |                        | No            |         |

### SPEC ITEMS

| ELEMENT              | COMMODITY CODE   | SIZE  |       | DESCRIPTION                                                                                                                                                        | NOTES |
|----------------------|------------------|-------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                      |                  | FROM  | TO    |                                                                                                                                                                    |       |
| 90 DEGREE ELBOW      | BE9LABMBEACKAP2K | 26    | 30    | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Welded, 100% XRAY, HIC Test as per NACE TM 0284, NACE TM 0177, Test solution A |       |
| <45 DEG DIRECTION CH | BE4LABMBEACKABCZ | 3     | 24    | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                       |       |
|                      | BE4LABMBEACKAP2K | 26    | 30    | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Welded, 100% XRAY, HIC Test as per NACE TM 0284, NACE TM 0177, Test solution A |       |
| NIPPLE               | ONIPABQTMACRABYZ | 1/2   | 1     | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, NACE MR0103, 4in Long                                                                            |       |
|                      | ONIPABQPMACRABYZ | 1/2   | 1     | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, NACE MR0103, 4in Long                                                                 |       |
|                      | ONIPABQTMACRABZZ | 1/2   | 1     | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, NACE MR0103, 8in Long                                                                            |       |
|                      | ONIPABQPMACRABZZ | 1/2   | 1     | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, NACE MR0103, 8in Long                                                                 |       |
|                      | ONIPABQPEACRABYZ | 1/2   | 2     | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, NACE MR0103, 4in Long                                                                                    |       |
|                      | ONIPABQPEACRABZZ | 1/2   | 2     | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, NACE MR0103, 8in Long                                                                                    |       |
| PLUG                 | OPLRAB2TMACGAAGZ | 3/4   | 1     | Plug, round, ASME B16.11, Male Threaded Ends, ASTM A105, NACE MR0103                                                                                               |       |
| CON. REDUCER         | BRECABMBEACKABCZ | 4     | 24    | Concentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                           |       |
|                      | BRECABMBEACKAP2K | 26    | 30    | Concentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Welded, 100% XRAY, HIC Test as per NACE TM 0284, NACE TM 0177, Test solution A     |       |
| ECC. REDUCER         | BREEABMBEACKABCZ | 4     | 24    | Eccentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Seamless                                                                            |       |
|                      | BREEABMBEACKAP2K | 26    | 30    | Eccentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, NACE MR0103, Welded, 100% XRAY, HIC Test as per NACE TM 0284, NACE TM 0177, Test solution A      |       |
| CONC. SWAGE NIPPLE   | OSGCAM8PEACKAAGZ | 3/4   | 2     | Concentric swage, MSS SP-95, Plain Ends, ASTM A234 Grade WPB, NACE MR0103                                                                                          |       |
|                      | OSGCAM8PMACKAAGZ | 1     | 1     | Concentric swage, MSS SP-95, Plain End x Male Threaded End, ASTM A234 Grade WPB, NACE MR0103                                                                       |       |
|                      | OSGCAM8BPACKAAGZ | 3     | 4     | Concentric swage, MSS SP-95, Beveled End x Plain End, ASTM A234 Grade WPB, NACE MR0103                                                                             |       |
|                      | OSGCAM8MBACKAAGZ | 3     | 4     | Concentric swage, MSS SP-95, Beveled End x Male Threaded End, ASTM A234 Grade WPB, NACE MR0103                                                                     |       |
| ECC. SWAGE NIPPLE    | OSGEAM8PEACKAAGZ | 3/4   | 2     | Eccentric swage, MSS SP-95, Plain Ends, ASTM A234 Grade WPB, NACE MR0103                                                                                           |       |
|                      | OSGEAM8PMACKAAGZ | 1     | 1     | Eccentric swage, MSS SP-95, Plain End x Male Threaded End, ASTM A234 Grade WPB, NACE MR0103                                                                        |       |
|                      | OSGEAM8BPACKAAGZ | 3     | 4     | Eccentric swage, MSS SP-95, Beveled End x Plain End, ASTM A234 Grade WPB, NACE MR0103                                                                              |       |
| BLIND FLG.           | FBLABLRFAOGAASZ  | 1/2   | 2     | Blind flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105, NACE MR0103                                                                                        |       |
|                      | FBLABLDRFAOGAASZ | 1/2   | 24    | Blind flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105, NACE MR0103                                                                                        |       |
|                      | FBLABJDRFAOGAASZ | 26    | 30    | Blind flange, ASME B16.47 Series B, Class 150, RF Flanged end, ASTM A105, NACE MR0103                                                                              |       |
| FLANGE               | FSWABLDRFAOGAASZ | 1/2   | 2     | Socket welded flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105, NACE MR0103                                                                                |       |
|                      | FSWABLRFAOGAASZ  | 1/2   | 2     | Socket welded flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105, NACE MR0103                                                                                |       |
|                      | FSWABLLRFAOGAASZ | 1/2   | 2     | Socket welded flange, ASME B16.5, Class 600, RF Flanged end, ASTM A105, NACE MR0103                                                                                |       |
|                      | FLWABLRFAOGAASZ  | 1-1/2 | 1-1/2 | Long weld neck flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105, NACE MR0103                                                                               |       |
|                      | FWNABLDRFAOGAASZ | 3     | 24    | Weld neck flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105, NACE MR0103                                                                                    |       |



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/ 12/ 2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3L-1F    | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 285 PSIG @ -20 A 800 °F  |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT            | COMMODITY CODE         | SIZE |    | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                             | NOTES |
|--------------------|------------------------|------|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                    |                        | FROM | TO |                                                                                                                                                                                                                                                                                                                                                                                                                                         |       |
| FLANGE             | FWNABLRFAQGAASZ        | 3    | 24 | Weld neck flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105, NACE MR0103                                                                                                                                                                                                                                                                                                                                                         |       |
|                    | FWNABLLRFAQGAASZ       | 3    | 24 | Weld neck flange, ASME B16.5, Class 600, RF Flanged end, ASTM A105, NACE MR0103                                                                                                                                                                                                                                                                                                                                                         |       |
|                    | FWNABJDRFAQGAASZ       | 26   | 30 | Weld neck flange, ASME B16.47 Series B, Class 150, RF Flanged end, ASTM A105, NACE MR0103                                                                                                                                                                                                                                                                                                                                               |       |
|                    | FWNABJIRFAQGAASZ       | 26   | 30 | Weld neck flange, ASME B16.47 Series B, Class 300, RF Flanged end, ASTM A105, NACE MR0103                                                                                                                                                                                                                                                                                                                                               |       |
| ORIFICE FLG        | FO2ABDIRFAQAF2G        | 2    | 24 | Weldneck Orifice Flange with 0.5" Threaded Tap, ASME B16.36, Class 300, RF Flanged end, ASTM A105, NACE MR0103, 2 Nos. Taps, w/ Jack Screws, A193 Grade B7M / A194 Grade 2HM Cadmium + PTFE                                                                                                                                                                                                                                             |       |
| BALL VALVE         | VBRAA7MESBECAQGB700C1B | 3/4  | 2  | Ball valve, floating, API 608, Class 800, Socket Welded Ends w/2 nipples, Full Port, Split-Body 2-3 Pieces, Bolted Cover, ASTM A105, Lever Operator, SS316 Ball, SS316 Stem, RPTFE Seats, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, Fire safe Per API 607, NACE MR0103, Supply w/2 welded nipples A106 Gr B Length=6"                                                                                                                |       |
|                    | VBSAA7DRFE4CAQDB700C1A | 3    | 6  | Ball valve, trunnion, API 608, Class 150, RF Flanged end, Full Port, Split-Body 2-3 Pieces, Bolted Cover, Short Pattern, ASTM A216 Grade WCB, Lever Operator, SS316 Ball, SS316 Stem, RPTFE Seats, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, Fire safe Per API 607, NACE MR0103                                                                                                                                                      |       |
|                    | VBSAA7DRFE4MAQDB700C1A | 8    | 8  | Ball valve, trunnion, API 608, Class 150, RF Flanged end, Full Port, Split-Body 2-3 Pieces, Bolted Cover, Short Pattern, ASTM A216 Grade WCB, Gear Operator, SS316 Ball, SS316 Stem, RPTFE Seats, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, Fire safe Per API 607, NACE MR0103                                                                                                                                                       |       |
| BUTTERFLY VALVE    | VYTAA2DRFMAQDY4BYY1F   | 24   | 24 | Butterfly Valve Wafer Type Tripple Offset Design, API 609 Cat B, Class 150, RF Flanged end, Gear Operator, ASTM A216 Grade WCB, A182 F316 Disc, AISI 316 Shaft, Stellite 21 Overlay Seats, Molded Graphite Packing, Short Pattern, NACE MR0103, Fire safe Per API 607                                                                                                                                                                   |       |
| SWING CHECK VALVES | VQLCAA5MESE5ACG06Z004G | 1/2  | 2  | Check valve, lift, API 602, Class 800, Socket Welded Ends w/2 nipples, Piston, Bolted Cover, ASTM A105, API Trim 12, Inconel X750 Spring, Renewable Seats, Spiral Wound AISI 316+Graphite Cover Gasket, Bonnet Gasket Thickness: 6mm, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire Safe Per API 6FD, Inspection and Testing Per API 598, Supply w/2 welded nipples A106 Gr B-NACE MR0103 Sch. 160 L=6" at both ends   |       |
|                    | VCSQAA2DRFPAR3C8Q004K  | 3    | 24 | Check valve, swing, API 594, Class 150, RF Flanged end, Bolted Cover, ASTM A351 Grade CF3, API Trim 12, Renewable Seats, Spiral Wound AISI 304+Graphite Cover Gasket, Bonnet Gasket Thickness: 6mm, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire Safe Per API 6FD                                                                                                                                                     |       |
| GATE VALVE         | VGRAA5MESG2FAQGG9KH1C  | 1/2  | 2  | Gate valve, solid wedge, API 602, Class 800, Socket Welded Ends w/2 nipples, Standard Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 12, Renewable Seats, Flexible Graphite Packing, Bonnet Gasket Thickness: 6mm, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire safe Per API 6FA, Supply w/2 welded nipples A106 Gr B NACE MR0103 Length=6"                                           |       |
|                    | VGWAA4DRFG4FAQDG9FHH1E | 3    | 10 | Gate valve, flexible wedge, API 600, Class 150, RF Flanged end, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 12, Renewable Seats & Backseat, Tanged Graphite Gasket AISI 316, Thickness of S/S insertion 0.1 mm, Number of S/S insertions: 2, Bonnet Gasket Thickness: 6mm, Flexible Graphite Packing, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire safe Per API 6FA |       |



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3L-1F    | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 285 PSIG @ -20 A 800 °F  |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT        | COMMODITY CODE         | SIZE |    | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                              | NOTES |
|----------------|------------------------|------|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                |                        | FROM | TO |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |
| GATE VALVE     | VGWAA4DRFG4MACDG9FHH1E | 12   | 24 | Gate valve, flexible wedge, API 600, Class 150, RF Flanged end, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Gear Operator, API Trim 12, Renewable Seats & Backseat, Tanged Graphite Gasket AISI 316, Thickness of S/Sinsertion 0.1 mm, Number of S/S insertions: 2, Bonnet Gasket Thickness: 6mm, Flexible Graphite Packing, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire safe Per API 6FA                        |       |
|                | VGWAA4DRHG4MACDG9FHH1E | 26   | 30 | Gate valve, flexible wedge, API 600, Class 150, RF Flanged end as per ASME B16.47 Sr B, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Gear Operator, API Trim 12, Renewable Seats & Backseat, Tanged Graphite Gasket AISI 316, Thickness of S/Sinsertion 0.1 mm, Number of S/Sinsertions: 2, Bonnet Gasket Thickness: 6mm, Flexible Graphite Packing, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire safe Per API 6FA |       |
| GLOBE VALVE    | VLRAA5MESLFFACGL1XLL2K | 1/2  | 2  | Globe Valve, API 602, Class 800, Socket Welded Ends w/ 2 nipples, Standard Port, Plug Disc, OS&Y-Rising Stem, Rising Operator, Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 12, Renewable Seats, Spiral Wound AISI 316 + Graphite Gasket, Bonnet Gasket Thickness: 6mm, Graphite Packing, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Supply with two (2) welded nipples A106 Gr B + NACE MR0103 Sch. 160 Length=6" at both ends |       |
|                | VLRAA3DRFLDFACDL1XLL1L | 3    | 10 | Globe Valve, API 623, Class 150, RF Flanged end, Plug Disc, OS&Y-Rising Stem, Rising Operator, Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 12, Renewable Seats, Spiral Wound AISI 316 + Graphite Gasket, Bonnet Gasket Thickness: 6mm, Graphite Packing, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103                                                                                                                   |       |
|                | VLRAA3DRFL7MACDL1XLL1L | 12   | 12 | Globe Valve, API 623, Class 150, RF Flanged end, Plug Disc, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Gear Operator, API Trim 12, Renewable Seats, Spiral Wound AISI 316 + Graphite Gasket, Bonnet Gasket Thickness: 6mm, Graphite Packing, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103                                                                                                                                         |       |
| JKT PLUG VALVE | VJPAA8DRFQ2CACDP4FPP1Q | 6    | 6  | Plug valve, full jacket, API 599, Class 150, RF Flanged end, Bolted Cover, Non-Lubricated, Short Pattern, ASTM A216 Grade WCB, Lever Operator, SS316 Tapered Plug, SS316 Stem, RPTFE Sleeve, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire safe Per API 607, W/Jacketed connection 3/4" flanged RF, QL150, with pipe extension ASTM A106 Gr. B + NACE MR0103, Length=6in                                                                |       |
|                | VJPAA8DRFQ2CACDP4FPP1H | 6    | 6  | Plug valve, full jacket, API 599, Class 150, RF Flanged end, Bolted Cover, Non-Lubricated, Short Pattern, ASTM A216 Grade WCB, Lever Operator, SS316 Tapered Plug, SS316 Stem, RPTFE Sleeve, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire safe Per API 607, W/Jacketed connection 1" flanged RF, QL150, with pipe extension ASTM A106 Gr. B + NACE MR0103, Length=6in                                                                  |       |
|                | VJPAA8DRFQ2CACDP4FPP1H | 8    | 8  | Plug valve, full jacket, API 599, Class 150, RF Flanged end, Bolted Cover, Non-Lubricated, Short Pattern, ASTM A216 Grade WCB, Lever Operator, SS316 Tapered Plug, SS316 Stem, RPTFE Sleeve, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire safe Per API 607, W/Jacketed connection 1" flanged RF, QL150, with pipe extension ASTM A106 Gr. B + NACE MR0103, Length=6in                                                                  |       |



## PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3L-1F    | 150                      | ASME B31.3                  | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 285 PSIG @ -20 A 800 °F  |                             |                        | No            |         |

### SPEC ITEMS

| ELEMENT         | COMMODITY CODE         | SIZE |       | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                            | NOTES |
|-----------------|------------------------|------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                 |                        | FROM | TO    |                                                                                                                                                                                                                                                                                                                                                                                        |       |
| JKT PLUG VALVE  | VJPA8DRFQ2MACDP4FPP1H  | 10   | 10    | Plug valve, full jacket, API 599, Class 150, RF Flanged end, Bolted Cover, Non-Lubricated, Short Pattern, ASTM A216 Grade WCB, Gear Operator, SS316 Tapered Plug, SS316 Stem, RPTFE Sleeve, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, NACE MR0103, Fire safe Per API 607, W/Jacketed connection 1" flanged RF, CL150, with pipe extension ASTM A106 Gr. B + NACE MR0103, Length=6in |       |
| PLUG VALVE      | VPSAA8DRFP7CAQGP4GPP1X | 1    | 1     | Plug valve, short pattern, API 599, Class 150, RF Flanged end, Bolted Bonnet, Non-Lubricated, ASTM A105, Lever Operator, SS316 Tapered Plug, SS316 Stem, RPTFE Sleeve, A193 Gr. B7M/A194 Gr. 2HM with Cadmium+PTFE, Bonnet Gasket Thickness: 6mm, NACE MR0103, Fire safe Per API 607                                                                                                   |       |
| GASKETS         | GSWAB9DRFAZGBAMZ       | 1/2  | 24    | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 150, RF flanged end, 316 stainless steel (16 Cr-12 Ni-2 Mo), w/ flexible graphite filler, w/ 316 SS inner ring and CS outer ring, Wall Thickness 6 mm                                                                                                                                                                  |       |
|                 | GSWAB9IRFAZGBAMZ       | 1/2  | 24    | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 300, RF flanged end, 316 stainless steel (16 Cr-12 Ni-2 Mo), w/ flexible graphite filler, w/ 316 SS inner ring and CS outer ring, Wall Thickness 6 mm                                                                                                                                                                  |       |
|                 | GSWAB9LRFAZGBAMZ       | 1/2  | 24    | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 600, RF flanged end, 316 stainless steel (16 Cr-12 Ni-2 Mo), w/ flexible graphite filler, w/ 316 SS inner ring and CS outer ring, Wall Thickness 6 mm                                                                                                                                                                  |       |
|                 | GSWAB8DRFAZGBAMZ       | 26   | 30    | Spiral Wound Gasket, ASME B16.20, for ASME B16.47 Series B Flanges, Class 150, RF flanged end, 316 stainless steel (16 Cr-12 Ni-2 Mo), w/ flexible graphite filler, w/ 316 SS inner ring and CS outer ring, Wall Thickness 6 mm                                                                                                                                                        |       |
|                 | GSWAB8IRFAZGBAMZ       | 26   | 30    | Spiral Wound Gasket, ASME B16.20, for ASME B16.47 Series B Flanges, Class 300, RF flanged end, 316 stainless steel (16 Cr-12 Ni-2 Mo), w/ flexible graphite filler, w/ 316 SS inner ring and CS outer ring, Wall Thickness 6 mm                                                                                                                                                        |       |
| BOLTS           | LSEABSAX1AL1J          | 1/2  | 1.375 | Continuous Thread Stud Bolt, ASME B18.31.2/B18.2.2, ASTM A193 Grade B7M, with 2 Heavy Hexagonal Nuts, ASTM A194 Gr. 2HM                                                                                                                                                                                                                                                                |       |
| PADDLE BLIND    | DBPABMDRTACGAANZ       | 14   | 24    | Paddle blind (Paddle blank or Blind spacer), ASME B16.48, Class 150, RF thru-bolted end, ASTM A105, NACE MR0103                                                                                                                                                                                                                                                                        |       |
|                 | DBPABPDRTACGAD1G       | 26   | 30    | Paddle blind (Paddle blank or Blind spacer), ASME B31.3, Class 150, RF thru-bolted end, ASTM A105, NACE MR0103, designed according to ASME B16.47 Sr B                                                                                                                                                                                                                                 |       |
| SPECTACLE BLIND | DF8ABMDRTACGAANZ       | 1/2  | 12    | Spectacle blind (Figure 8 blind), ASME B16.48, Class 150, RF thru-bolted end, ASTM A105, NACE MR0103                                                                                                                                                                                                                                                                                   |       |
| PADDLE SPACER   | DBSABMDRTACGAANZ       | 14   | 24    | Paddle spacer (Open spacer or Ring spacer), ASME B16.48, Class 150, RF thru-bolted end, ASTM A105, NACE MR0103                                                                                                                                                                                                                                                                         |       |
|                 | DBSABPDRTACGAD1G       | 26   | 30    | Paddle spacer (Open spacer or Ring spacer), ASME B31.3, Class 150, RF thru-bolted end, ASTM A105, NACE MR0103, designed according to ASME B16.47 Sr B                                                                                                                                                                                                                                  |       |
| BUTTERFLY VALVE |                        | 24   | 24    |                                                                                                                                                                                                                                                                                                                                                                                        |       |

### SPECIFICATION NOTES

### COMPONENT NOTES



## PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|-----------|--------------------------|-----------------------------|------------------------|---------------|---------|
| A3L-1F    | 150                      | ASM E B31.3                 | 3mm                    | Carbon Steel  | Process |
|           | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|           | 285 PSIG @ -20 A 800 °F  |                             |                        | No            |         |

| HEADER | BRANCH |      |     |        |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|--------|--------|------|-----|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|        | 1/2"   | 3/4" | 1"  | 1.1/2" | 2"  | 3"  | 4"  | 6"  | 8"  | 10" | 12" | 14" | 16" | 18" | 20" | 24" | 26" | 28" | 30" |
| 1/2"   | ETE    |      |     |        |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 3/4"   | RTE    | ETE  |     |        |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 1"     | RTE    | RTE  | ETE |        |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 1.1/2" | RTE    | RTE  | RTE | ETE    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 2"     | RTE    | RTE  | RTE | RTE    | ETE |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 3"     | SOC    | SOC  | SOC | SOC    | SOC | TEE |     |     |     |     |     |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 4"     | SOC    | SOC  | SOC | SOC    | SOC | TER | TEE |     |     |     |     |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 6"     | SOC    | SOC  | SOC | SOC    | SOC | TER | TER | TEE |     |     |     |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 8"     | SOC    | SOC  | SOC | SOC    | SOC | WEL | TER | TER | TEE |     |     |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 10"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | TER | TER | TER | TEE |     |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 12"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TEE |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 14"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TER | TEE |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 16"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TER | TER | TEE |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 18"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | TER | TER | TER | TER | TER | TEE |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 20"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TEE |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 24"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TEE |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 26"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | WEL | WEL | TER | TER | TER | TER | TER | TEE |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 28"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TEE |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 30"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TER | TER | TEE |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |     |     |     |

### NOMENCLATURE

ETE = Straight Tee

RTE = Reducing Tee

SOC = Sockolet

TEE = Straight Tee

TER = Reducing Tee

THL = Thredolet

WEL = Weldolet



## PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS  | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE       |
|------------|--------------------------|-----------------------------|------------------------|---------------|---------------|
| AA1A23A-01 | 150                      | ASME B31.3                  | 0.063in                | Carbon Steel  | Process       |
|            | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS |               | STRESS RELIEF |
|            | 285 PSIG @ -20 A 100 °F  |                             |                        |               | No            |

### PIPING SCHEDULES

| SIZE | 1/2" | 3/4" | 1" | 1.1/2" | 2" | 10"  | 12" | 14" | 16" | 18" | 3"    | 4" | 6" | 8" | 20" | 24" |
|------|------|------|----|--------|----|------|-----|-----|-----|-----|-------|----|----|----|-----|-----|
| SCH. | S-XS |      |    |        |    | S-20 |     |     |     |     | S-STD |    |    |    |     |     |

### SPECIFICATIONS

| ELEMENT               | COMMODITY CODE    | SIZE |     | DESCRIPTION                                                                                     | NOTES |
|-----------------------|-------------------|------|-----|-------------------------------------------------------------------------------------------------|-------|
|                       |                   | FROM | TO  |                                                                                                 |       |
| PIPING                | PPPABQPEACRAP1G   | 1/2  | 2   | Pipe, ASME B36.10M, Plain Ends, ASTM A106 Grade B, Seamless, Length: 6m Aprox Length            |       |
|                       | PPPABQBEACRAP1A   | 3    | 24  | Pipe, ASME B36.10M, Beveled Ends, ASTM A106 Grade B, Seamless, Length: 12m Aprox Length         |       |
| SOCKET (BR. TABLE)    | OSOCAM9SSWACGZZZZ | 3    | 24  | Socket, MSS SP-97, Class 3000, Socket Welded Ends, ASTM A105                                    |       |
| TEE (BRANCH TABLE)    | OETEAB2SSWACGZZZZ | 1/2  | 2   | Straight Tee, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                            |       |
|                       | BTEEABMBEACKA3AZ  | 3    | 24  | Straight Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                           |       |
| THREDOLET (BR. TABLE) | OTHLAM9STFACGZZZZ | 3    | 24  | Thredolet, MSS SP-97, Class 3000, Female Threaded Ends, ASTM A105                               |       |
| RED. TEE (BR. TABLE)  | ORTEAB2SSWACGZZZZ | 3/4  | 2   | Reducing Tee, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                            |       |
|                       | BTERABMBEACKA3AZ  | 4    | 24  | Reducing Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                           |       |
| WELDOLET (BR. TABLE)  | BWELAM9BEACKZZZZ  | 8    | 24  | Weldolet, MSS SP-97, Beveled Ends, ASTM A234 Grade WPB                                          |       |
| CAP                   | OCAPAB2SSWACGZZZZ | 1/2  | 2   | Cap, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                                     |       |
|                       | OCAPAB2STFACGZZZZ | 1/2  | 2   | Cap, ASME B16.11, Class 3000, Female Threaded Ends, ASTM A105                                   |       |
|                       | BCAPABMBEACKA3AZ  | 3    | 24  | Cap, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                    |       |
| CPLG.                 | OCPLAB2SSWACGZZZZ | 1/2  | 2   | Coupling/connector, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                      |       |
|                       | OCPLAB2STFACGZZZZ | 1/2  | 2   | Coupling/connector, ASME B16.11, Class 3000, Female Threaded Ends, ASTM A105                    |       |
| RED. CPLG.            | MFBEABQTFAH1ZZZZ  | 3/4  | 3/4 | Reducing coupling, ASME B16.3, Class 300, Female Threaded Ends, ASTM A197                       |       |
| 45 DEG. ELBOW         | OE45AB2SSWACGZZZZ | 1/2  | 2   | 45° elbow, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                               |       |
|                       | BE4LABMBEACKA3AZ  | 3    | 24  | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                 |       |
| 45-90 DEG DIRECTION   | BE9LABMBEACKA3AZ  | 3    | 24  | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                 |       |
| 90 DEGREE ELBOW       | OE90AB2SSWACGZZZZ | 1/2  | 2   | 90° elbow, ASME B16.11, Class 3000, Socket Welded Ends, ASTM A105                               |       |
|                       | BE9LABMBEACKA3AZ  | 3    | 24  | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                 |       |
| <45 DEG DIRECTION CH  | BE4LABMBEACKA3AZ  | 3    | 24  | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                 |       |
| NIPPLE                | ONIPABQTMACRA1CZ  | 1/2  | 2   | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, 3in Long, Seamless            |       |
|                       | ONIPABQPEACRA1CZ  | 1/2  | 2   | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, 3in Long, Seamless                    |       |
|                       | ONIPABQPMACRA1CZ  | 1/2  | 2   | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, 3in Long, Seamless |       |
|                       | ONIPABQTMACRA1AZ  | 1/2  | 2   | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, 4in Long, Seamless            |       |
|                       | ONIPABQPEACRA1AZ  | 1/2  | 2   | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, 4in Long, Seamless                    |       |
|                       | ONIPABQPMACRA1AZ  | 1/2  | 2   | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, 4in Long, Seamless |       |
|                       | ONIPABQTMACRA1BZ  | 1/2  | 2   | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, 6in Long, Seamless            |       |



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS  | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|------------|--------------------------|-----------------------------|------------------------|---------------|---------|
| AA1A23A-01 | 150                      | ASME B31.3                  | 0.063in                | Carbon Steel  | Process |
|            | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|            | 285 PSIG @ -20 A 100 °F  |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT            | COMMODITY CODE         | SIZE |    | DESCRIPTION                                                                                                                                                                                                            | NOTES |
|--------------------|------------------------|------|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                    |                        | FROM | TO |                                                                                                                                                                                                                        |       |
| NIPPLE             | ONIPABQPEACRA1BZ       | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, 6in Long, Seamless                                                                                                                                           |       |
|                    | ONIPABQPMACRA1BZ       | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, 6in Long, Seamless                                                                                                                        |       |
| PLUG               | OPLRAB2TMAOGZZZZ       | 1/2  | 2  | Plug, round, ASME B16.11, Male Threaded Ends, ASTM A105                                                                                                                                                                |       |
| CON. REDUCER       | BRECABMBEACKA3AZ       | 4    | 24 | Concentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                                                                                                                            |       |
| ECC. REDUCER       | BREEABMBEACKA3AZ       | 4    | 24 | Eccentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                                                                                                                             |       |
| CONC. SWAGE NIPPLE | OSGCAM8PEACKZZZZ       | 3/4  | 2  | Concentric swage, MSS SP-95, Plain Ends, ASTM A234 Grade WPB                                                                                                                                                           |       |
|                    | OSGCAM8TMAACKZZZZ      | 3/4  | 2  | Concentric swage, MSS SP-95, Male Threaded Ends, ASTM A234 Grade WPB                                                                                                                                                   |       |
|                    | OSGCAM8BEACKZZZZ       | 3    | 4  | Concentric swage, MSS SP-95, Beveled Ends, ASTM A234 Grade WPB                                                                                                                                                         |       |
|                    | OSGCAM8BPAACKZZZZ      | 3    | 4  | Concentric swage, MSS SP-95, Beveled End x Plain End, ASTM A234 Grade WPB                                                                                                                                              |       |
|                    | OSGCAM8MBAACKZZZZ      | 3    | 4  | Concentric swage, MSS SP-95, Beveled End x Male Threaded End, ASTM A234 Grade WPB                                                                                                                                      |       |
| ECC. SWAGE NIPPLE  | OSGEAM8PEACKZZZZ       | 3/4  | 2  | Eccentric swage, MSS SP-95, Plain Ends, ASTM A234 Grade WPB                                                                                                                                                            |       |
|                    | OSGEAM8TMAACKZZZZ      | 3/4  | 2  | Eccentric swage, MSS SP-95, Male Threaded Ends, ASTM A234 Grade WPB                                                                                                                                                    |       |
|                    | OSGEAM8BEACKZZZZ       | 3    | 4  | Eccentric swage, MSS SP-95, Beveled Ends, ASTM A234 Grade WPB                                                                                                                                                          |       |
|                    | OSGEAM8BPAACKZZZZ      | 3    | 4  | Eccentric swage, MSS SP-95, Beveled End x Plain End, ASTM A234 Grade WPB                                                                                                                                               |       |
|                    | OSGEAM8MBAACKZZZZ      | 3    | 4  | Eccentric swage, MSS SP-95, Beveled End x Male Threaded End, ASTM A234 Grade WPB                                                                                                                                       |       |
| UNION              | OUNOAM7SSWACGZZZZ      | 1/2  | 2  | Union, MSS SP-83, Class 3000, Socket Welded Ends, ASTM A105                                                                                                                                                            |       |
|                    | OUNOAM7STFACGZZZZ      | 1/2  | 2  | Union, MSS SP-83, Class 3000, Female Threaded Ends, ASTM A105                                                                                                                                                          |       |
| BLIND FLG.         | FBLABLDRFACGZZZZ       | 1/2  | 24 | Blind flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105                                                                                                                                                         |       |
| FLANGE             | FSWABLDRFACGZZZZ       | 1/2  | 2  | Socket welded flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105                                                                                                                                                 |       |
|                    | FWNABLDRFACGZZZZ       | 3    | 24 | Weld neck flange, ASME B16.5, Class 150, RF Flanged end, ASTM A105                                                                                                                                                     |       |
| ORIFICE FLG        | FO2ABDIRFACGA1LZ       | 1    | 24 | Weldneck Orifice Flange with 0.5" Threaded Tap, ASME B16.36, Class 300, RF Flanged end, ASTM A105, 2 Nos. Taps, w/ Jack Screws                                                                                         |       |
| BALL VALVE         | VBRAA7MSWBECACGB1WZZZZ | 1/2  | 2  | Ball valve, floating, API 608, Class 800, Socket Welded Ends, Full Port, Split-Body 2-3 Pieces, Bolted Cover, ASTM A105, Lever Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals                            |       |
|                    | VBRAA7MTFBECACGB1WZZZZ | 1/2  | 2  | Ball valve, floating, API 608, Class 800, Female Threaded Ends, Full Port, Split-Body 2-3 Pieces, Bolted Cover, ASTM A105, Lever Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals                          |       |
|                    | VBRAA7MSWBDCACGB1WZZZZ | 1/2  | 2  | Ball valve, floating, API 608, Class 800, Socket Welded Ends, Reduced Port, Split-Body 2-3 Pieces, Bolted Cover, ASTM A105, Lever Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals                         |       |
|                    | VBRAA7MTFBDACGB1WZZZZ  | 1/2  | 2  | Ball valve, floating, API 608, Class 800, Female Threaded Ends, Reduced Port, Split-Body 2-3 Pieces, Bolted Cover, ASTM A105, Lever Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals                       |       |
|                    | VBSAA7DRFBLFACDB1WZZZZ | 3    | 12 | Ball valve, trunnion, API 608, Class 150, RF Flanged end, Reduced Port, Split-Body 2-3 Pieces, Bolted Cover, Long Pattern, ASTM A216 Grade WCB, Handwheel Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals |       |



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/ 12/ 2013

Version: 1

| TAG CLASS  | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|------------|--------------------------|-----------------------------|------------------------|---------------|---------|
| AA1A23A-01 | 150                      | ASME B31.3                  | 0.063in                | Carbon Steel  | Process |
|            | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|            | 285 PSIG @ -20 A 100 °F  |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT            | COMMODITY CODE        | SIZE |    | DESCRIPTION                                                                                                                                                                                                                          | NOTES |
|--------------------|-----------------------|------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                    |                       | FROM | TO |                                                                                                                                                                                                                                      |       |
| BALL VALVE         | VBSAA7DRFB3FACDB1WZZZ | 3    | 12 | Ball valve, trunnion, API 608, Class 150, RF Flanged end, Full Port, Split-Body 2-3 Pieces, Bolted Cover, Long Pattern, ASTM A216 Grade WCB, Handwheel Operator, SS316 Ball, SS316 Stem, RPTFE Seats, Viton Seals                    |       |
|                    | VBSAA7DRFBLMACDB1WZZZ | 14   | 24 | Ball valve, trunnion, API 608, Class 150, RF Flanged end, Reduced Port, Split-Body 2-3 Pieces, Bolted Cover, Long Pattern, ASTM A216 Grade WCB, Gear Operator, SS316 Ball, SS316 Stem, RPTFE Seats, Viton Seals                      |       |
|                    | VBSAA7DRFB3MACDB1WZZZ | 14   | 24 | Ball valve, trunnion, API 608, Class 150, RF Flanged end, Full Port, Split-Body 2-3 Pieces, Bolted Cover, Long Pattern, ASTM A216 Grade WCB, Gear Operator, SS316 Ball, SS316 Stem, RPTFE Seats, Viton Seals                         |       |
| BUTTERFLY VALVE    | VYLA2DREACDY1CZZZ     | 3    | 12 | Butterfly valve, lugged, API 609 Cat B, Class 150, RF thru-bolted end with threaded bolt holes, Lever Operator, ASTM A216 Grade WCB, SS316 Disc, Inconel Seat                                                                        |       |
|                    | VYWA2DRTACDY1CZZZ     | 3    | 12 | Butterfly Valve Wafer Type, API 609 Cat B, Class 150, RF thru-bolted end without bolt holes, Lever Operator, ASTM A216 Grade WCB, SS316 Disc, Inconel Seat                                                                           |       |
|                    | VYLA2DREMACDY1CZZZ    | 14   | 24 | Butterfly valve, lugged, API 609 Cat B, Class 150, RF thru-bolted end with threaded bolt holes, Gear Operator, ASTM A216 Grade WCB, SS316 Disc, Inconel Seat                                                                         |       |
|                    | VYWA2DRTMACDY1CZZZ    | 14   | 24 | Butterfly Valve Wafer Type, API 609 Cat B, Class 150, RF thru-bolted end without bolt holes, Gear Operator, ASTM A216 Grade WCB, SS316 Disc, Inconel Seat                                                                            |       |
| BALL CHECK VALVE   | VCBDA5MSWCACG6AZZZ    | 1/2  | 2  | Check valve, ball, API 602, Class 800, Socket Welded Ends, Standard Port, Bolted Cover, ASTM A105, API Trim 8, SS316 Ball, SS316 Spring, Integral Seats                                                                              |       |
|                    | VCBDA5MSWC5ACG6AZZZ   | 1/2  | 2  | Check valve, ball, API 602, Class 800, Socket Welded Ends, Full Port, Bolted Cover, ASTM A105, API Trim 8, SS316 Ball, SS316 Spring, Integral Seats                                                                                  |       |
| SWING CHECK VALVES | VCSCA2DRFPACDC1AZZZ   | 3    | 24 | Check valve, swing, API 594, Class 150, RF Flanged end, Bolted Cover, ASTM A216 Grade WCB, API Trim 8, Stellite Renewable Seats                                                                                                      |       |
| GATE VALVE         | VGRAA5MSWG4FACGG7FZZZ | 1/2  | 2  | Gate valve, solid wedge, API 602, Class 800, Socket Welded Ends, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 8, Integral Seats, Flexible Graphite Packing                                    |       |
|                    | VGRAA5MSWG2FACGG7FZZZ | 1/2  | 2  | Gate valve, solid wedge, API 602, Class 800, Socket Welded Ends, Standard Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 8, Integral Seats, Flexible Graphite Packing                                |       |
|                    | VGWAA4DRFG4FACDG5BZZZ | 3    | 12 | Gate valve, flexible wedge, API 600, Class 150, RF Flanged end, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 8, Renewable Seats & Backseat, Flexible Graphite Packing               |       |
|                    | VGWAA4DRFG4FACDG5BZZZ | 3    | 12 | Gate valve, flexible wedge, API 600, Class 150, RF Flanged end, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 8, Renewable Seats & Backseat, Flexible Graphite Packing               |       |
|                    | VGWAA4DRFG4MACDG5BZZZ | 14   | 24 | Gate valve, flexible wedge, API 600, Class 150, RF Flanged end, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Gear Operator, API Trim 8, Renewable Seats & Backseat, Flexible Graphite Packing                    |       |
|                    | VGWAA4DRFG4MACDG5BZZZ | 14   | 24 | Gate valve, flexible wedge, API 600, Class 150, RF Flanged end, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Gear Operator, API Trim 8, Renewable Seats & Backseat, Flexible Graphite Packing                    |       |
| GLOBE VALVE        | VLRAA5MSWL6FACGL1VZZZ | 1/2  | 2  | Globe Valve, API 602, Class 800, Socket Welded Ends, Standard Port, Plug Disc, OS&Y-Rising Stem, Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 8, Stellite Integral Seats, Graphite Stem Packing Replaceable Under Pressure |       |

**PIPING CLASS**ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS  | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|------------|--------------------------|-----------------------------|------------------------|---------------|---------|
| AA1A23A-01 | 150                      | ASME B31.3                  | 0.063in                | Carbon Steel  | Process |
|            | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|            | 285 PSIG @ -20 A 100 °F  |                             |                        | No            |         |

**SPEC ITEMS**

| ELEMENT         | COMMODITY CODE         | SIZE |       | DESCRIPTION                                                                                                                                                                                                                                       | NOTES |
|-----------------|------------------------|------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                 |                        | FROM | TO    |                                                                                                                                                                                                                                                   |       |
| GLOBE VALVE     | VLRAA5MSWLKFAOGL1VZZZZ | 1/2  | 2     | Globe Valve, API 602, Class 800, Socket Welded Ends, Full Port, Plug Disc, OS&Y-Rising Stem, Rising Operator, Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 8, Stellite Integral Seats, Graphite Stem Packing Replaceable Under Pressure |       |
|                 | VLRAA3DRFL7FACDL1KZZZZ | 3    | 12    | Globe Valve, API 623, Class 150, RF Flanged end, Plug Disc, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 8, Stellite Renewable Seats, Graphite Stem Packing Replaceable Under Pressure                      |       |
|                 | VLRAA3DRFLDFACDL1KZZZZ | 3    | 12    | Globe Valve, API 623, Class 150, RF Flanged end, Plug Disc, OS&Y-Rising Stem, Rising Operator, Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 8, Stellite Renewable Seats, Graphite Stem Packing Replaceable Under Pressure     |       |
| PLUG VALVE      | VPPAA8DRFP7FACDADAZZZZ | 3    | 12    | Plug valve, regular pattern, API 599, Class 150, RF Flanged end, Bolted Bonnet, Non-Lubricated, ASTM A216 Grade WCB, Handwheel Operator, SS316 Plug                                                                                               |       |
|                 | VPPAA8DRFP7MACDADAZZZZ | 14   | 24    | Plug valve, regular pattern, API 599, Class 150, RF Flanged end, Bolted Bonnet, Non-Lubricated, ASTM A216 Grade WCB, Gear Operator, SS316 Plug                                                                                                    |       |
| GASKETS         | GSWAB9DRFAZHAG1J       | 1/2  | 24    | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 150, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler, w/ CS outer ring                                                                              |       |
|                 | GSWAB9IRFAZHAG1J       | 1/2  | 24    | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 300, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler, w/ CS outer ring                                                                              |       |
| BOLTS           | LSEABSAX5AL1B          | 1/2  | 1-1/2 | Continuous Thread Stud Bolt, ASME B18.31.2/B18.2.2, ASTM A193 Grade B7, with 2 Heavy Hexagonal Nuts, ASTM A194 Gr. 2H                                                                                                                             |       |
| PADDLE BLIND    | DBPABMDRTAF1ZZZZ       | 14   | 24    | Paddle blind (Paddle blank or Blind spacer), ASME B16.48, Class 150, RF thru-bolted end, ASTM A516 Grade 70                                                                                                                                       |       |
| SPECTACLE BLIND | DF8ABMDRTAF1ZZZZ       | 1/2  | 12    | Spectacle blind (Figure 8 blind), ASME B16.48, Class 150, RF thru-bolted end, ASTM A516 Grade 70                                                                                                                                                  |       |
| PADDLE SPACER   | DBSABMDRTAF1ZZZZ       | 14   | 24    | Paddle spacer (Open spacer or Ring spacer), ASME B16.48, Class 150, RF thru-bolted end, ASTM A516 Grade 70                                                                                                                                        |       |

**OFF SPEC ITEMS**

| ELEMENT | COMMODITY CODE   | SIZE |    | DESCRIPTION                                                                                                                                                  | NOTES |
|---------|------------------|------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|         |                  | FROM | TO |                                                                                                                                                              |       |
| FLANGE  | FWNABLDFFACGZZZZ | 4    | 4  | Weld neck flange, ASME B16.5, Class 150, FF flanged end, ASTM A105                                                                                           |       |
| GASKETS | GNMAB7DFFAAEA1FZ | 4    | 4  | Flat gasket, non-metallic, solid, ASME B16.21, Class 150, FF flanged end, Compressed aramid fiber with nitrile rubber binder, Wall Thickness 1/8 in (3.2 mm) |       |

**SPECIFICATION NOTES****COMPONENT NOTES**



## PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS  | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|------------|--------------------------|-----------------------------|------------------------|---------------|---------|
| AA1A23A-01 | 150                      | ASME B31.3                  | 0.063in                | Carbon Steel  | Process |
|            | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|            | 285 PSIG @ -20 A 100 °F  |                             |                        | No            |         |

| HEADER | BRANCH |      |     |        |     |     |     |     |     |     |     |     |     |     |     |     |
|--------|--------|------|-----|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|        | 1/2"   | 3/4" | 1"  | 1.1/2" | 2"  | 3"  | 4"  | 6"  | 8"  | 10" | 12" | 14" | 16" | 18" | 20" | 24" |
| 1/2"   | ETE    |      |     |        |     |     |     |     |     |     |     |     |     |     |     |     |
| 3/4"   | RTE    | ETE  |     |        |     |     |     |     |     |     |     |     |     |     |     |     |
| 1"     | RTE    | RTE  | ETE |        |     |     |     |     |     |     |     |     |     |     |     |     |
| 1.1/2" | RTE    | RTE  | RTE | ETE    |     |     |     |     |     |     |     |     |     |     |     |     |
| 2"     | RTE    | RTE  | RTE | RTE    | ETE |     |     |     |     |     |     |     |     |     |     |     |
| 3"     | SOC    | SOC  | SOC | SOC    | SOC | TEE |     |     |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 4"     | SOC    | SOC  | SOC | SOC    | SOC | TER | TEE |     |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 6"     | SOC    | SOC  | SOC | SOC    | SOC | TER | TER | TEE |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 8"     | SOC    | SOC  | SOC | SOC    | SOC | WEL | TER | TER | TEE |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 10"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | TER | TER | TER | TEE |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 12"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TEE |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 14"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TER | TEE |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 16"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TER | TER | TEE |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 18"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | TER | TER | TER | TER | TER | TEE |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 20"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TEE |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 24"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TEE |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |

### NOMENCLATURE

ETE = Straight Tee  
TER = Reducing Tee

RTE = Reducing Tee  
THL = Thredolet

SOC = Sockolet  
WEL = Weldolet

TEE = Straight Tee



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS  | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|------------|--------------------------|-----------------------------|------------------------|---------------|---------|
| AA2A23A-01 | 300                      | ASME B31.3                  | 0.063in                | Carbon Steel  | Process |
|            | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|            | 740 PSIG @ -20 A 100 °F  |                             |                        | No            |         |

## PIPING SCHEDULES

| SIZE | 1/2" | 3/4" | 1" | 1.1/2" | 2" | 12"  | 14" | 18" | 20" | 24" | 3"    | 4" | 6" | 8" | 10" | 16"  |
|------|------|------|----|--------|----|------|-----|-----|-----|-----|-------|----|----|----|-----|------|
| SCH. | S-XS |      |    |        |    | S-40 |     |     |     |     | S-STD |    |    |    |     | S-XS |

## SPEC ITEMS

| ELEMENT               | COMMODITY CODE    | SIZE |    | DESCRIPTION                                                                                     | NOTES |
|-----------------------|-------------------|------|----|-------------------------------------------------------------------------------------------------|-------|
|                       |                   | FROM | TO |                                                                                                 |       |
| PIPING                | PPPABQPEACRAP1G   | 1/2  | 2  | Pipe, ASME B36.10M, Plain Ends, ASTM A106 Grade B, Seamless, Length: 6m Aprox Length            |       |
|                       | PPPABQBEACRAP1A   | 3    | 24 | Pipe, ASME B36.10M, Beveled Ends, ASTM A106 Grade B, Seamless, Length: 12m Aprox Length         |       |
| SOCKET (BR. TABLE)    | OSOCAM9XSWACGZZZZ | 3    | 24 | Socket, MSS SP-97, Class 6000, Socket Welded Ends, ASTM A105                                    |       |
| TEE (BRANCH TABLE)    | OETEAB2XSWACGZZZZ | 1/2  | 2  | Straight Tee, ASME B16.11, Class 6000, Socket Welded Ends, ASTM A105                            |       |
|                       | BTEEABMBEACKA3AZ  | 3    | 24 | Straight Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                           |       |
| THREDOLET (BR. TABLE) | OTHLAM9XTFACGZZZZ | 3    | 24 | Thredolet, MSS SP-97, Class 6000, Female Threaded Ends, ASTM A105                               |       |
| RED. TEE (BR. TABLE)  | ORTEAB2XSWACGZZZZ | 3/4  | 2  | Reducing Tee, ASME B16.11, Class 6000, Socket Welded Ends, ASTM A105                            |       |
|                       | BTERABMBEACKA3AZ  | 3    | 24 | Reducing Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                           |       |
| WELDOLET (BR. TABLE)  | BWELAM9BEACKZZZZ  | 8    | 24 | Weldolet, MSS SP-97, Beveled Ends, ASTM A234 Grade WPB                                          |       |
| CAP                   | OCAPAB2XSWACGZZZZ | 1/2  | 2  | Cap, ASME B16.11, Class 6000, Socket Welded Ends, ASTM A105                                     |       |
|                       | OCAPAB2XTFACGZZZZ | 1/2  | 2  | Cap, ASME B16.11, Class 6000, Female Threaded Ends, ASTM A105                                   |       |
|                       | BCAPABMBEACKA3AZ  | 3    | 24 | Cap, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                    |       |
| CPLG.                 | OCPLAB2XTFACGZZZZ | 1/2  | 2  | Coupling/connector, ASME B16.11, Class 6000, Female Threaded Ends, ASTM A105                    |       |
|                       | OCPLAB2XSACGZZZZ  | 1/2  | 2  | Coupling/connector, ASME B16.11, Class 6000, Socket Welded End x Female Threaded End, ASTM A105 |       |
| 45 DEG. ELBOW         | OE45AB2XSWACGZZZZ | 1/2  | 2  | 45° elbow, ASME B16.11, Class 6000, Socket Welded Ends, ASTM A105                               |       |
|                       | BE4LABMBEACKA3AZ  | 3    | 24 | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                 |       |
| 45-90 DEG DIRECTION   | BE9LABMBEACKA3AZ  | 3    | 24 | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                 |       |
| 90 DEGREE ELBOW       | OE90AB2XSWACGZZZZ | 1/2  | 2  | 90° elbow, ASME B16.11, Class 6000, Socket Welded Ends, ASTM A105                               |       |
|                       | BE9LABMBEACKA3AZ  | 3    | 24 | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                 |       |
| <45 DEG DIRECTION CH  | BE4LABMBEACKA3AZ  | 3    | 24 | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                 |       |
| NIPPLE                | ONIPABQTMACRA1CZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, 3in Long, Seamless            |       |
|                       | ONIPABQPEACRA1CZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, 3in Long, Seamless                    |       |
|                       | ONIPABQPMACRA1CZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, 3in Long, Seamless |       |
|                       | ONIPABQTMACRA1AZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, 4in Long, Seamless            |       |
|                       | ONIPABQPEACRA1AZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, 4in Long, Seamless                    |       |
|                       | ONIPABQPMACRA1AZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, 4in Long, Seamless |       |
|                       | ONIPABQTMACRA1BZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, 6in Long, Seamless            |       |
|                       | ONIPABQPEACRA1BZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, 6in Long, Seamless                    |       |



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/ 12/ 2013

Version: 1

| TAG CLASS  | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|------------|--------------------------|-----------------------------|------------------------|---------------|---------|
| AA2A23A-01 | 300                      | ASME B31.3                  | 0.063in                | Carbon Steel  | Process |
|            | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|            | 740 PSIG @ -20 A 100 °F  |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT            | COMMODITY CODE         | SIZE |    | DESCRIPTION                                                                                                                                                                                                            | NOTES |
|--------------------|------------------------|------|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                    |                        | FROM | TO |                                                                                                                                                                                                                        |       |
| NIPPLE             | ONIPABQPMACRA1BZ       | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, 6in Long, Seamless                                                                                                                        |       |
| PLUG               | OPLHAB2TMACGZZZZ       | 1/2  | 2  | Plug, hexagonal, ASME B16.11, Male Threaded Ends, ASTM A105                                                                                                                                                            |       |
| CON. REDUCER       | BRECABMBEACKA3AZ       | 4    | 24 | Concentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                                                                                                                            |       |
| ECC. REDUCER       | BREEABMBEACKA3AZ       | 4    | 24 | Eccentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                                                                                                                             |       |
| CONC. SWAGE NIPPLE | OSGCAM8PEACKZZZZ       | 3/4  | 2  | Concentric swage, MSS SP-95, Plain Ends, ASTM A234 Grade WPB                                                                                                                                                           |       |
|                    | OSGCAM8TMACKZZZZ       | 3/4  | 2  | Concentric swage, MSS SP-95, Male Threaded Ends, ASTM A234 Grade WPB                                                                                                                                                   |       |
|                    | OSGCAM8BEACKZZZZ       | 4    | 4  | Concentric swage, MSS SP-95, Beveled Ends, ASTM A234 Grade WPB                                                                                                                                                         |       |
| ECC. SWAGE NIPPLE  | OSGEAM8PEACKZZZZ       | 3/4  | 2  | Eccentric swage, MSS SP-95, Plain Ends, ASTM A234 Grade WPB                                                                                                                                                            |       |
|                    | OSGEAM8TMACKZZZZ       | 3/4  | 2  | Eccentric swage, MSS SP-95, Male Threaded Ends, ASTM A234 Grade WPB                                                                                                                                                    |       |
|                    | OSGEAM8BEACKZZZZ       | 4    | 4  | Eccentric swage, MSS SP-95, Beveled Ends, ASTM A234 Grade WPB                                                                                                                                                          |       |
| UNION              | OUNOAM7XSWACGZZZZ      | 1/2  | 2  | Union, MSS SP-83, Class 6000, Socket Welded Ends, ASTM A105                                                                                                                                                            |       |
|                    | OUNOAM7XTFACGZZZZ      | 1/2  | 2  | Union, MSS SP-83, Class 6000, Female Threaded Ends, ASTM A105                                                                                                                                                          |       |
| BLIND FLG.         | FBLABLI RFAOGZZZZ      | 1/2  | 24 | Blind flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105                                                                                                                                                         |       |
| FLANGE             | FSWABLI RFAOGZZZZ      | 1/2  | 2  | Socket welded flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105                                                                                                                                                 |       |
|                    | FWNABLI RFAOGZZZZ      | 3    | 24 | Weld neck flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105                                                                                                                                                     |       |
| ORIFICE FLG        | FO2ABDI RFAOGA1LZ      | 1    | 24 | Weldneck Orifice Flange with 0.5" Threaded Tap, ASME B16.36, Class 300, RF Flanged end, ASTM A105, 2 Nos. Taps, w/ Jack Screws                                                                                         |       |
| BALL VALVE         | VBRAA7MTFBEACGB1WZZZZ  | 1/2  | 2  | Ball valve, floating, API 608, Class 800, Female Threaded Ends, Full Port, Split-Body 2-3 Pieces, Bolted Cover, ASTM A105, Lever Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals                          |       |
|                    | VBRAA7MSWBEACGB1WZZZZ  | 1/2  | 2  | Ball valve, floating, API 608, Class 800, Socket Welded Ends, Full Port, Split-Body 2-3 Pieces, Bolted Cover, ASTM A105, Lever Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals                            |       |
|                    | VBRAA7MTFBDCAQGB1WZZZZ | 1/2  | 2  | Ball valve, floating, API 608, Class 800, Female Threaded Ends, Reduced Port, Split-Body 2-3 Pieces, Bolted Cover, ASTM A105, Lever Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals                       |       |
|                    | VBRAA7MSWBDCQGB1WZZZZ  | 1/2  | 2  | Ball valve, floating, API 608, Class 800, Socket Welded Ends, Reduced Port, Split-Body 2-3 Pieces, Bolted Cover, ASTM A105, Lever Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals                         |       |
|                    | VBSAA71RFB3FACDB1WZZZZ | 3    | 12 | Ball valve, trunnion, API 608, Class 300, RF Flanged end, Full Port, Split-Body 2-3 Pieces, Bolted Cover, Long Pattern, ASTM A216 Grade WCB, Handwheel Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals    |       |
|                    | VBSAA71RFB3FACDB1WZZZZ | 3    | 12 | Ball valve, trunnion, API 608, Class 300, RF Flanged end, Reduced Port, Split-Body 2-3 Pieces, Bolted Cover, Long Pattern, ASTM A216 Grade WCB, Handwheel Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals |       |
|                    | VBSAA71RFB3MACDB1WZZZZ | 14   | 24 | Ball valve, trunnion, API 608, Class 300, RF Flanged end, Full Port, Split-Body 2-3 Pieces, Bolted Cover, Long Pattern, ASTM A216 Grade WCB, Gear Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals         |       |



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS  | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|------------|--------------------------|-----------------------------|------------------------|---------------|---------|
| AA2A23A-01 | 300                      | ASME B31.3                  | 0.063in                | Carbon Steel  | Process |
|            | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|            | 740 PSIG @ -20 A 100 °F  |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT            | COMMODITY CODE        | SIZE |    | DESCRIPTION                                                                                                                                                                                                                                       | NOTES |
|--------------------|-----------------------|------|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                    |                       | FROM | TO |                                                                                                                                                                                                                                                   |       |
| BALL VALVE         | VBSAA71RFBMACDB1WZZZ  | 14   | 24 | Ball valve, trunnion, API 608, Class 300, RF Flanged end, Reduced Port, Split-Body 2-3 Pieces, Bolted Cover, Long Pattern, ASTM A216 Grade WCB, Gear Operator, SS316 Ball, SS316 Stem, RPTFE Seats, Viton Seals                                   |       |
| BUTTERFLY VALVE    | VYWAA21RTACADY1CZZZ   | 3    | 12 | Butterfly Valve Wafer Type, API 609 Cat B, Class 300, RF thru-bolted end without bolt holes, Lever Operator, ASTM A216 Grade WCB, SS316 Disc, Inconel Seat                                                                                        |       |
|                    | VYLA21REACADY1CZZZ    | 3    | 12 | Butterfly valve, lugged, API 609 Cat B, Class 300, RF thru-bolted end with threaded bolt holes, Lever Operator, ASTM A216 Grade WCB, SS316 Disc, Inconel Seat                                                                                     |       |
|                    | VYWAA21RTMACDY1CZZZ   | 14   | 24 | Butterfly Valve Wafer Type, API 609 Cat B, Class 300, RF thru-bolted end without bolt holes, Gear Operator, ASTM A216 Grade WCB, SS316 Disc, Inconel Seat                                                                                         |       |
|                    | VYLA21REMACDY1CZZZ    | 14   | 24 | Butterfly valve, lugged, API 609 Cat B, Class 300, RF thru-bolted end with threaded bolt holes, Gear Operator, ASTM A216 Grade WCB, SS316 Disc, Inconel Seat                                                                                      |       |
| BALL CHECK VALVE   | VCBDAA5MSWCACG06AZZZ  | 1/2  | 2  | Check valve, ball, API 602, Class 800, Socket Welded Ends, Standard Port, Bolted Cover, ASTM A105, API Trim 8, SS316 Ball, SS316 Spring, Integral Seats                                                                                           |       |
|                    | VCBDAA5MSWC5ACG06AZZZ | 1/2  | 2  | Check valve, ball, API 602, Class 800, Socket Welded Ends, Full Port, Bolted Cover, ASTM A105, API Trim 8, SS316 Ball, SS316 Spring, Integral Seats                                                                                               |       |
| SWING CHECK VALVES | VCSCAA21RFPACDC1AZZZ  | 3    | 24 | Check valve, swing, API 594, Class 300, RF Flanged end, Bolted Cover, ASTM A216 Grade WCB, API Trim 8, Stellite Renewable Seats                                                                                                                   |       |
| GATE VALVE         | VGRAA5MSWG4FA0GG7FZZZ | 1/2  | 2  | Gate valve, solid wedge, API 602, Class 800, Socket Welded Ends, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 8, Integral Seats, Flexible Graphite Packing                                                 |       |
|                    | VGRAA5MSWG2FA0GG7FZZZ | 1/2  | 2  | Gate valve, solid wedge, API 602, Class 800, Socket Welded Ends, Standard Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 8, Integral Seats, Flexible Graphite Packing                                             |       |
|                    | VGWAA41RFG4FACDG5BZZZ | 3    | 10 | Gate valve, flexible wedge, API 600, Class 300, RF Flanged end, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 8, Renewable Seats & Backseat, Flexible Graphite Packing                            |       |
|                    | VGWAA41RFG4MACDG5BZZZ | 12   | 24 | Gate valve, flexible wedge, API 600, Class 300, RF Flanged end, Full Port, OS&Y-Rising Stem, Bolted Bonnet, ASTM A216 Grade WCB, Gear Operator, API Trim 8, Renewable Seats & Backseat, Flexible Graphite Packing                                 |       |
| GLOBE VALVE        | VLRAA5MSWLKFA0GL1VZZZ | 1/2  | 2  | Globe Valve, API 602, Class 800, Socket Welded Ends, Full Port, Plug Disc, OS&Y-Rising Stem, Rising Operator, Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 8, Stellite Integral Seats, Graphite Stem Packing Replaceable Under Pressure |       |
|                    | VLRAA5MSWL6FA0GL1VZZZ | 1/2  | 2  | Globe Valve, API 602, Class 800, Socket Welded Ends, Standard Port, Plug Disc, OS&Y-Rising Stem, Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 8, Stellite Integral Seats, Graphite Stem Packing Replaceable Under Pressure              |       |
|                    | VLRAA31RFLDFACDL1KZZZ | 3    | 12 | Globe Valve, API 623, Class 300, RF Flanged end, Plug Disc, OS&Y-Rising Stem, Rising Operator, Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 8, Stellite Renewable Seats, Graphite Stem Packing Replaceable Under Pressure     |       |
|                    | VLRAA31RFLDFACDL1KZZZ | 3    | 12 | Globe Valve, API 623, Class 300, RF Flanged end, Plug Disc, OS&Y-Rising Stem, Rising Operator, Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 8, Stellite Renewable Seats, Graphite Stem Packing Replaceable Under Pressure     |       |
| PLUG VALVE         |                       |      |    |                                                                                                                                                                                                                                                   |       |

**PIPING CLASS**ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS  | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|------------|--------------------------|-----------------------------|------------------------|---------------|---------|
| AA2A23A-01 | 300                      | ASME B31.3                  | 0.063in                | Carbon Steel  | Process |
|            | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|            | 740 PSIG @ -20 A 100 °F  |                             |                        | No            |         |

**SPEC ITEMS**

| ELEMENT         | COMMODITY CODE         | SIZE |       | DESCRIPTION                                                                                                                                                          | NOTES |
|-----------------|------------------------|------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                 |                        | FROM | TO    |                                                                                                                                                                      |       |
| PLUG VALVE      | VPPAA8IRFP7FACDADAZZZZ | 6    | 12    | Plug valve, regular pattern, API 599, Class 300, RF Flanged end, Bolted Bonnet, Non-Lubricated, ASTM A216 Grade WCB, Handwheel Operator, SS316 Plug                  |       |
|                 | VPPAA8IRFP7MACDADAZZZZ | 14   | 24    | Plug valve, regular pattern, API 599, Class 300, RF Flanged end, Bolted Bonnet, Non-Lubricated, ASTM A216 Grade WCB, Gear Operator, SS316 Plug                       |       |
|                 | VPPAA8IRFP8FACDADAZZZZ | 6    | 12    | Plug valve, regular pattern, API 599, Class 300, RF Flanged end, Bolted Bonnet, Lubricated, ASTM A216 Grade WCB, Handwheel Operator, SS316 Plug                      |       |
|                 | VPPAA8IRFP8MACDADAZZZZ | 14   | 24    | Plug valve, regular pattern, API 599, Class 300, RF Flanged end, Bolted Bonnet, Lubricated, ASTM A216 Grade WCB, Gear Operator, SS316 Plug                           |       |
| GASKETS         | GSWAB9IRFAZHAG1J       | 1/2  | 24    | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 300, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler, w/ CS outer ring |       |
| BOLTS           | LSEABSAX5AL1B          | 1/2  | 1-1/2 | Continuous Thread Stud Bolt, ASME B18.31.2/ B18.2.2, ASTM A193 Grade B7, with 2 Heavy Hexagonal Nuts, ASTM A194 Gr. 2H                                               |       |
| PADDLE BLIND    | DBPABMIRTAFF2ZZZZ      | 14   | 16    | Paddle blind (Paddle blank or Blind spacer), ASME B16.48, Class 300, RF thru-bolted end, ASTM A516 Grade 70N                                                         |       |
|                 | DBPABMIRTAFF1ZZZZ      | 18   | 24    | Paddle blind (Paddle blank or Blind spacer), ASME B16.48, Class 300, RF thru-bolted end, ASTM A516 Grade 70                                                          |       |
| SPECTACLE BLIND | DF8ABMIRTAFF1ZZZZ      | 1/2  | 12    | Spectacle blind (Figure 8 blind), ASME B16.48, Class 300, RF thru-bolted end, ASTM A516 Grade 70                                                                     |       |
| PADDLE SPACER   | DBSABMIRTAFF2ZZZZ      | 14   | 24    | Paddle spacer (Open spacer or Ring spacer), ASME B16.48, Class 300, RF thru-bolted end, ASTM A516 Grade 70N                                                          |       |

**SPECIFICATION NOTES****COMPONENT NOTES**



## PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS  | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|------------|--------------------------|-----------------------------|------------------------|---------------|---------|
| AA2A23A-01 | 300                      | ASME B31.3                  | 0.063in                | Carbon Steel  | Process |
|            | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|            | 740 PSIG @ -20 A 100 °F  |                             |                        | No            |         |

| HEADER | BRANCH |      |     |        |     |     |     |     |     |     |     |     |     |     |     |     |
|--------|--------|------|-----|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|        | 1/2"   | 3/4" | 1"  | 1.1/2" | 2"  | 3"  | 4"  | 6"  | 8"  | 10" | 12" | 14" | 16" | 18" | 20" | 24" |
| 1/2"   | ETE    |      |     |        |     |     |     |     |     |     |     |     |     |     |     |     |
| 3/4"   | RTE    | ETE  |     |        |     |     |     |     |     |     |     |     |     |     |     |     |
| 1"     | RTE    | RTE  | ETE |        |     |     |     |     |     |     |     |     |     |     |     |     |
| 1.1/2" | RTE    | RTE  | RTE | ETE    |     |     |     |     |     |     |     |     |     |     |     |     |
| 2"     | RTE    | RTE  | RTE | RTE    | ETE |     |     |     |     |     |     |     |     |     |     |     |
| 3"     | SOC    | SOC  | SOC | SOC    | SOC | TEE |     |     |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 4"     | SOC    | SOC  | SOC | SOC    | SOC | TER | TEE |     |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 6"     | SOC    | SOC  | SOC | SOC    | SOC | TER | TER | TEE |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 8"     | SOC    | SOC  | SOC | SOC    | SOC | WEL | TER | TER | TEE |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 10"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | TER | TER | TER | TEE |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 12"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TEE |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 14"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TER | TEE |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 16"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TER | TER | TEE |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 18"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | TER | TER | TER | TER | TER | TEE |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 20"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TEE |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 24"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TEE |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |

### NOMENCLATURE

ETE = Straight Tee  
TER = Reducing Tee

RTE = Reducing Tee  
THL = Thredolet

SOC = Sockolet  
WEL = Weldolet

TEE = Straight Tee



# PIPING CLASS

ECOPETROL DESARROLLO DE PROYECTOS  
VICEPRESIDENCIA DE PROYECTOS Y PERFORACIÓN

CÓDIGO FORMATO: ECP-VIN-P-MET-FT-001

Elaborado: 30/12/2013

Version: 1

| TAG CLASS  | RATING CLASS             | DESIGN CODE                 | CORROSION ALLOWANCE    | BASE MATERIAL | SERVICE |
|------------|--------------------------|-----------------------------|------------------------|---------------|---------|
| AA2A33A-01 | 300                      | ASME B31.3                  | 0.125in                | Carbon Steel  | Process |
|            | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|            | 740 PSIG @ -20 A 100 °F  |                             |                        | No            |         |

## PIPING SCHEDULES

| SIZE | 1/2"  | 3/4" | 1" | 1.1/2" | 2" | 12"  | 14" | 18" | 20" | 24" | 3"    | 4" | 6" | 8" | 10" | 16"  |
|------|-------|------|----|--------|----|------|-----|-----|-----|-----|-------|----|----|----|-----|------|
| SCH. | S-160 |      |    |        |    | S-40 |     |     |     |     | S-STD |    |    |    |     | S-XS |

## SPEC ITEMS

| ELEMENT               | COMMODITY CODE    | SIZE |    | DESCRIPTION                                                                                     | NOTES |
|-----------------------|-------------------|------|----|-------------------------------------------------------------------------------------------------|-------|
|                       |                   | FROM | TO |                                                                                                 |       |
| PIPING                | PPPABQPEACRAP1G   | 1/2  | 2  | Pipe, ASME B36.10M, Plain Ends, ASTM A106 Grade B, Seamless, Length: 6m Aprox Length            |       |
|                       | PPPABQBEACRAP1A   | 3    | 24 | Pipe, ASME B36.10M, Beveled Ends, ASTM A106 Grade B, Seamless, Length: 12m Aprox Length         |       |
| SOCKET (BR. TABLE)    | OSOCAM9XSWACGZZZZ | 3    | 24 | Socket, MSS SP-97, Class 6000, Socket Welded Ends, ASTM A105                                    |       |
| TEE (BRANCH TABLE)    | OETEAB2XSWACGZZZZ | 1/2  | 2  | Straight Tee, ASME B16.11, Class 6000, Socket Welded Ends, ASTM A105                            |       |
|                       | BTEEABMBEACKA3AZ  | 3    | 24 | Straight Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                           |       |
| THREDOLET (BR. TABLE) | OTHLAM9XTFACGZZZZ | 3    | 24 | Thredolet, MSS SP-97, Class 6000, Female Threaded Ends, ASTM A105                               |       |
| RED. TEE (BR. TABLE)  | ORTEAB2XSWACGZZZZ | 3/4  | 2  | Reducing Tee, ASME B16.11, Class 6000, Socket Welded Ends, ASTM A105                            |       |
|                       | BTERABMBEACKA3AZ  | 3    | 24 | Reducing Tee, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                           |       |
| WELDOLET (BR. TABLE)  | BWELAM9BEACKZZZZ  | 8    | 24 | Weldolet, MSS SP-97, Beveled Ends, ASTM A234 Grade WPB                                          |       |
| CAP                   | OCAPAB2XSWACGZZZZ | 1/2  | 2  | Cap, ASME B16.11, Class 6000, Socket Welded Ends, ASTM A105                                     |       |
|                       | OCAPAB2XTFACGZZZZ | 1/2  | 2  | Cap, ASME B16.11, Class 6000, Female Threaded Ends, ASTM A105                                   |       |
|                       | BCAPABMBEACKA3AZ  | 3    | 24 | Cap, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                    |       |
| CPLG.                 | OCPLAB2XTFACGZZZZ | 1/2  | 2  | Coupling/connector, ASME B16.11, Class 6000, Female Threaded Ends, ASTM A105                    |       |
|                       | OCPLAB2XSACGZZZZ  | 1/2  | 2  | Coupling/connector, ASME B16.11, Class 6000, Socket Welded End x Female Threaded End, ASTM A105 |       |
| 45 DEG. ELBOW         | OE45AB2XSWACGZZZZ | 1/2  | 2  | 45° elbow, ASME B16.11, Class 6000, Socket Welded Ends, ASTM A105                               |       |
|                       | BE4LABMBEACKA3AZ  | 3    | 24 | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                 |       |
| 45-90 DEG DIRECTION   | BE9LABMBEACKA3AZ  | 3    | 24 | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                 |       |
| 90 DEGREE ELBOW       | OE90AB2XSWACGZZZZ | 1/2  | 2  | 90° elbow, ASME B16.11, Class 6000, Socket Welded Ends, ASTM A105                               |       |
|                       | BE9LABMBEACKA3AZ  | 3    | 24 | 90° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                 |       |
| <45 DEG DIRECTION CH  | BE4LABMBEACKA3AZ  | 3    | 24 | 45° elbow, long radius, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                 |       |
| NIPPLE                | ONIPABQTMACRA1CZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, 3in Long, Seamless            |       |
|                       | ONIPABQPEACRA1CZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, 3in Long, Seamless                    |       |
|                       | ONIPABQPMACRA1CZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, 3in Long, Seamless |       |
|                       | ONIPABQTMACRA1AZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, 4in Long, Seamless            |       |
|                       | ONIPABQPEACRA1AZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, 4in Long, Seamless                    |       |
|                       | ONIPABQPMACRA1AZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, 4in Long, Seamless |       |
|                       | ONIPABQTMACRA1BZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Male Threaded Ends, ASTM A106 Grade B, 6in Long, Seamless            |       |
|                       | ONIPABQPEACRA1BZ  | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Plain Ends, ASTM A106 Grade B, 6in Long, Seamless                    |       |



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|------------|--------------------------|-----------------------------|------------------------|---------------|---------|
| AA2A33A-01 | 300                      | ASME B31.3                  | 0.125in                | Carbon Steel  | Process |
|            | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|            | 740 PSIG @ -20 A 100 °F  |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT            | COMMODITY CODE         | SIZE |    | DESCRIPTION                                                                                                                                                                                                            | NOTES |
|--------------------|------------------------|------|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                    |                        | FROM | TO |                                                                                                                                                                                                                        |       |
| NIPPLE             | ONIPABQPMACRA1BZ       | 1/2  | 2  | Pipe Nipple, ASME B36.10M, Plain End x Male Threaded End, ASTM A106 Grade B, 6in Long, Seamless                                                                                                                        |       |
| PLUG               | OPLHAB2TMACGZZZZ       | 1/2  | 2  | Plug, hexagonal, ASME B16.11, Male Threaded Ends, ASTM A105                                                                                                                                                            |       |
| CON. REDUCER       | BRECABMBEACKA3AZ       | 4    | 24 | Concentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                                                                                                                            |       |
| ECC. REDUCER       | BREEABMBEACKA3AZ       | 4    | 24 | Eccentric reducer, ASME B16.9, Beveled Ends, ASTM A234 Grade WPB, Seamless                                                                                                                                             |       |
| CONC. SWAGE NIPPLE | OSGCAM8PEACKZZZZ       | 3/4  | 2  | Concentric swage, MSS SP-95, Plain Ends, ASTM A234 Grade WPB                                                                                                                                                           |       |
|                    | OSGCAM8TMACKZZZZ       | 3/4  | 2  | Concentric swage, MSS SP-95, Male Threaded Ends, ASTM A234 Grade WPB                                                                                                                                                   |       |
|                    | OSGCAM8BEACKZZZZ       | 4    | 4  | Concentric swage, MSS SP-95, Beveled Ends, ASTM A234 Grade WPB                                                                                                                                                         |       |
| ECC. SWAGE NIPPLE  | OSGEAM8PEACKZZZZ       | 3/4  | 2  | Eccentric swage, MSS SP-95, Plain Ends, ASTM A234 Grade WPB                                                                                                                                                            |       |
|                    | OSGEAM8TMACKZZZZ       | 3/4  | 2  | Eccentric swage, MSS SP-95, Male Threaded Ends, ASTM A234 Grade WPB                                                                                                                                                    |       |
|                    | OSGEAM8BEACKZZZZ       | 4    | 4  | Eccentric swage, MSS SP-95, Beveled Ends, ASTM A234 Grade WPB                                                                                                                                                          |       |
| UNION              | OUNOAM7XSWACGZZZZ      | 1/2  | 2  | Union, MSS SP-83, Class 6000, Socket Welded Ends, ASTM A105                                                                                                                                                            |       |
|                    | OUNOAM7XTFACGZZZZ      | 1/2  | 2  | Union, MSS SP-83, Class 6000, Female Threaded Ends, ASTM A105                                                                                                                                                          |       |
| BLIND FLG.         | FBLABLI RFAOGZZZZ      | 1/2  | 24 | Blind flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105                                                                                                                                                         |       |
| FLANGE             | FSWABLI RFAOGZZZZ      | 1/2  | 2  | Socket welded flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105                                                                                                                                                 |       |
|                    | FWNABLI RFAOGZZZZ      | 3    | 24 | Weld neck flange, ASME B16.5, Class 300, RF Flanged end, ASTM A105                                                                                                                                                     |       |
| ORIFICE FLG        | FO2ABDI RFAOGA1LZ      | 1    | 24 | Weldneck Orifice Flange with 0.5" Threaded Tap, ASME B16.36, Class 300, RF Flanged end, ASTM A105, 2 Nos. Taps, w/ Jack Screws                                                                                         |       |
| BALL VALVE         | VBRAA7MTFBEOAGB1WZZZZ  | 1/2  | 2  | Ball valve, floating, API 608, Class 800, Female Threaded Ends, Full Port, Split-Body 2-3 Pieces, Bolted Cover, ASTM A105, Lever Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals                          |       |
|                    | VBRAA7MSWBEAGB1WZZZZ   | 1/2  | 2  | Ball valve, floating, API 608, Class 800, Socket Welded Ends, Full Port, Split-Body 2-3 Pieces, Bolted Cover, ASTM A105, Lever Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals                            |       |
|                    | VBRAA7MTFBDCAQGB1WZZZZ | 1/2  | 2  | Ball valve, floating, API 608, Class 800, Female Threaded Ends, Reduced Port, Split-Body 2-3 Pieces, Bolted Cover, ASTM A105, Lever Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals                       |       |
|                    | VBRAA7MSWBDCAGB1WZZZZ  | 1/2  | 2  | Ball valve, floating, API 608, Class 800, Socket Welded Ends, Reduced Port, Split-Body 2-3 Pieces, Bolted Cover, ASTM A105, Lever Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals                         |       |
|                    | VBSAA71RFB3FACDB1WZZZZ | 3    | 12 | Ball valve, trunnion, API 608, Class 300, RF Flanged end, Full Port, Split-Body 2-3 Pieces, Bolted Cover, Long Pattern, ASTM A216 Grade WCB, Handwheel Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals    |       |
|                    | VBSAA71RFB3FACDB1WZZZZ | 3    | 12 | Ball valve, trunnion, API 608, Class 300, RF Flanged end, Reduced Port, Split-Body 2-3 Pieces, Bolted Cover, Long Pattern, ASTM A216 Grade WCB, Handwheel Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals |       |
|                    | VBSAA71RFB3MACDB1WZZZZ | 14   | 24 | Ball valve, trunnion, API 608, Class 300, RF Flanged end, Full Port, Split-Body 2-3 Pieces, Bolted Cover, Long Pattern, ASTM A216 Grade WCB, Gear Operator, SS 316 Ball, SS 316 Stem, RPTFE Seats, Viton Seals         |       |



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|------------|--------------------------|-----------------------------|------------------------|---------------|---------|
| AA2A33A-01 | 300                      | ASME B31.3                  | 0.125in                | Carbon Steel  | Process |
|            | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|            | 740 PSIG @ -20 A 100 °F  |                             |                        | No            |         |

## SPEC ITEMS

| ELEMENT            | COMMODITY CODE         | SIZE |    | DESCRIPTION                                                                                                                                                                                                                                             | NOTES |
|--------------------|------------------------|------|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                    |                        | FROM | TO |                                                                                                                                                                                                                                                         |       |
| BALL VALVE         | VBSAA71RFBMACDB1WZZZZ  | 14   | 24 | Ball valve, trunnion, API 608, Class 300, RF Flanged end, Reduced Port , Split-Body 2-3 Pieces , Bolted Cover , Long Pattern, ASTM A216 Grade WCB, Gear Operator, SS316 Ball , SS316 Stem , RPTFE Seats , Viton Seals                                   |       |
| BUTTERFLY VALVE    | VYWAA21RTACADY1CZZZZ   | 3    | 12 | Butterfly Valve Wafer Type, API 609 Cat B, Class 300, RF thru-bolted end without bolt holes, Lever Operator, ASTM A216 Grade WCB, SS316 Disc, Inconel Seat                                                                                              |       |
|                    | VYLA21REACADY1CZZZZ    | 3    | 12 | Butterfly valve, lugged, API 609 Cat B, Class 300, RF thru-bolted end with threaded bolt holes, Lever Operator, ASTM A216 Grade WCB, SS316 Disc, Inconel Seat                                                                                           |       |
|                    | VYWAA21RTMACDY1CZZZZ   | 14   | 24 | Butterfly Valve Wafer Type, API 609 Cat B, Class 300, RF thru-bolted end without bolt holes, Gear Operator, ASTM A216 Grade WCB, SS316 Disc, Inconel Seat                                                                                               |       |
|                    | VYLA21REMACDY1CZZZZ    | 14   | 24 | Butterfly valve, lugged, API 609 Cat B, Class 300, RF thru-bolted end with threaded bolt holes, Gear Operator, ASTM A216 Grade WCB, SS316 Disc, Inconel Seat                                                                                            |       |
| BALL CHECK VALVE   | VCBDAA5MSWCACG06AZZZZ  | 1/2  | 2  | Check valve, ball, API 602, Class 800, Socket Welded Ends, Standard Port , Bolted Cover, ASTM A105, API Trim 8 , SS316 Ball , SS316 Spring , Integral Seats                                                                                             |       |
|                    | VCBDAA5MSWC5ACG06AZZZZ | 1/2  | 2  | Check valve, ball, API 602, Class 800, Socket Welded Ends, Full Port , Bolted Cover, ASTM A105, API Trim 8 , SS316 Ball , SS316 Spring , Integral Seats                                                                                                 |       |
| SWING CHECK VALVES | VCSCAA21RFPACDC1AZZZZ  | 3    | 24 | Check valve, swing, API 594, Class 300, RF Flanged end, Bolted Cover, ASTM A216 Grade WCB, API Trim 8 , Stellite Renewable Seats                                                                                                                        |       |
| GATE VALVE         | VGRAA5MSWG4FA0GG7FZZZZ | 1/2  | 2  | Gate valve, solid wedge, API 602, Class 800, Socket Welded Ends, Full Port , OS&Y-Rising Stem , Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 8 , Integral Seats , Flexible Graphite Packing                                                   |       |
|                    | VGRAA5MSWG2FA0GG7FZZZZ | 1/2  | 2  | Gate valve, solid wedge, API 602, Class 800, Socket Welded Ends, Standard Port , OS&Y-Rising Stem , Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 8 , Integral Seats , Flexible Graphite Packing                                               |       |
|                    | VGWAA41RFG4FACDG5BZZZZ | 3    | 10 | Gate valve, flexible wedge, API 600, Class 300, RF Flanged end, Full Port , OS&Y-Rising Stem , Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 8 , Renewable Seats & Backseat , Flexible Graphite Packing                              |       |
|                    | VGWAA41RFG4MACDG5BZZZZ | 12   | 24 | Gate valve, flexible wedge, API 600, Class 300, RF Flanged end, Full Port , OS&Y-Rising Stem , Bolted Bonnet, ASTM A216 Grade WCB, Gear Operator, API Trim 8 , Renewable Seats & Backseat , Flexible Graphite Packing                                   |       |
| GLOBE VALVE        | VLRAA5MSWLKFA0GL1VZZZZ | 1/2  | 2  | Globe Valve, API 602, Class 800, Socket Welded Ends, Full Port , Plug Disc , OS&Y-Rising Stem , Rising Operator , Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 8 , Stellite Integral Seats , Graphite Stem Packing Replaceable Under Pressure |       |
|                    | VLRAA5MSWL6FA0GL1VZZZZ | 1/2  | 2  | Globe Valve, API 602, Class 800, Socket Welded Ends, Standard Port , Plug Disc , OS&Y-Rising Stem , Bolted Bonnet, ASTM A105, Handwheel Operator, API Trim 8 , Stellite Integral Seats , Graphite Stem Packing Replaceable Under Pressure               |       |
|                    | VLRAA31RFLDFACDL1KZZZZ | 3    | 12 | Globe Valve, API 623, Class 300, RF Flanged end, Plug Disc , OS&Y-Rising Stem , Rising Operator , Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 8 , Stellite Renewable Seats , Graphite Stem Packing Replaceable Under Pressure      |       |
|                    | VLRAA31RFLDFACDL1KZZZZ | 3    | 12 | Globe Valve, API 623, Class 300, RF Flanged end, Plug Disc , OS&Y-Rising Stem , Rising Operator , Bolted Bonnet, ASTM A216 Grade WCB, Handwheel Operator, API Trim 8 , Stellite Renewable Seats , Graphite Stem Packing Replaceable Under Pressure      |       |
| PLUG VALVE         |                        |      |    |                                                                                                                                                                                                                                                         |       |



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|------------|--------------------------|-----------------------------|------------------------|---------------|---------|
| AA2A33A-01 | 300                      | ASME B31.3                  | 0.125in                | Carbon Steel  | Process |
|            | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|            | 740 PSIG @ -20 A 100 °F  |                             |                        | No            |         |

### SPEC ITEMS

| ELEMENT         | COMMODITY CODE        | SIZE |       | DESCRIPTION                                                                                                                                                          | NOTES |
|-----------------|-----------------------|------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                 |                       | FROM | TO    |                                                                                                                                                                      |       |
| PLUG VALVE      | VPPAA8IRFP7FACDADAZZZ | 6    | 12    | Plug valve, regular pattern, API 599, Class 300, RF Flanged end, Bolted Bonnet, Non-Lubricated, ASTM A216 Grade WCB, Handwheel Operator, SS316 Plug                  |       |
|                 | VPPAA8IRFP7MACDADAZZZ | 14   | 24    | Plug valve, regular pattern, API 599, Class 300, RF Flanged end, Bolted Bonnet, Non-Lubricated, ASTM A216 Grade WCB, Gear Operator, SS316 Plug                       |       |
| GASKETS         | GSWAB9IRFAZHAG1J      | 1/2  | 24    | Spiral Wound Gasket, ASME B16.20, for ASME B16.5 Flanges, Class 300, RF flanged end, 304 stainless steel (18 Cr-8 Ni), w/ flexible graphite filler, w/ CS outer ring |       |
| BOLTS           | LSEABSAX5AL1B         | 1/2  | 1-1/2 | Continuous Thread Stud Bolt, ASME B18.31.2/ B18.2.2, ASTM A193 Grade B7, with 2 Heavy Hexagonal Nuts, ASTM A194 Gr. 2H                                               |       |
| PADDLE BLIND    | DBPABMIRTAFF2ZZZZ     | 14   | 24    | Paddle blind (Paddle blank or Blind spacer), ASME B16.48, Class 300, RF thru-bolted end, ASTM A516 Grade 70N                                                         |       |
| SPECTACLE BLIND | DF8ABMIRTAFF1ZZZZ     | 1/2  | 12    | Spectacle blind (Figure 8 blind), ASME B16.48, Class 300, RF thru-bolted end, ASTM A516 Grade 70                                                                     |       |
| PADDLE SPACER   | DBSABMIRTAFF2ZZZZ     | 14   | 24    | Paddle spacer (Open spacer or Ring spacer), ASME B16.48, Class 300, RF thru-bolted end, ASTM A516 Grade 70N                                                          |       |

### SPECIFICATION NOTES

### COMPONENT NOTES



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|            | DESIGN CONDITIONS (MAWP) | OPERATION CONDITIONS (MAOP) | HYDRO. TEST CONDITIONS | STRESS RELIEF |         |
|            | 740 PSIG @ -20 A 100 °F  |                             |                        | No            |         |

| HEADER | BRANCH |      |     |        |     |     |     |     |     |     |     |     |     |     |     |     |
|--------|--------|------|-----|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|        | 1/2"   | 3/4" | 1"  | 1.1/2" | 2"  | 3"  | 4"  | 6"  | 8"  | 10" | 12" | 14" | 16" | 18" | 20" | 24" |
| 1/2"   | ETE    |      |     |        |     |     |     |     |     |     |     |     |     |     |     |     |
| 3/4"   | RTE    | ETE  |     |        |     |     |     |     |     |     |     |     |     |     |     |     |
| 1"     | RTE    | RTE  | ETE |        |     |     |     |     |     |     |     |     |     |     |     |     |
| 1.1/2" | RTE    | RTE  | RTE | ETE    |     |     |     |     |     |     |     |     |     |     |     |     |
| 2"     | RTE    | RTE  | RTE | RTE    | ETE |     |     |     |     |     |     |     |     |     |     |     |
| 3"     | SOC    | SOC  | SOC | SOC    | SOC | TEE |     |     |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 4"     | SOC    | SOC  | SOC | SOC    | SOC | TER | TEE |     |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 6"     | SOC    | SOC  | SOC | SOC    | SOC | TER | TER | TEE |     |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 8"     | SOC    | SOC  | SOC | SOC    | SOC | WEL | TER | TER | TEE |     |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 10"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | TER | TER | TER | TEE |     |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 12"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TEE |     |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 14"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TER | TEE |     |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 16"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | TER | TER | TER | TER | TER | TEE |     |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 18"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | TER | TER | TER | TER | TER | TEE |     |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 20"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TEE |     |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |
| 24"    | SOC    | SOC  | SOC | SOC    | SOC | WEL | WEL | WEL | WEL | TER | TER | TER | TER | TER | TER | TEE |
|        | THL    | THL  | THL | THL    | THL |     |     |     |     |     |     |     |     |     |     |     |

NOM ENCLATURE

ETE = Straight Tee

TER = Reducing Tee

RTE = Reducing Tee

THL = Thredolet

SOC = Sockolet

WEL = Weldolet

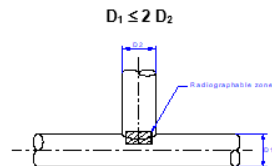
TEE = Straight Tee

## **ANEXO 2 - Tabla de Ensayos No Destructivos y Tratamiento térmico después de Soldadura**

| ITEM | MATERIAL     | NÚMERO<br>p | CLASE                                                                                        | FLUIDO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | TRATAMIENTO TERMICO °C |                         |                     |                  | DUREZA<br>BRINELL<br>(2) | END (%)            |                    |                     |                    |                               |                    |                          |                       |
|------|--------------|-------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------------------|---------------------|------------------|--------------------------|--------------------|--------------------|---------------------|--------------------|-------------------------------|--------------------|--------------------------|-----------------------|
|      |              |             |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Espesor<br>(mm)        | Rango de<br>temperatura | Tiempo de<br>espera | Tiempo<br>Mínimo |                          | Exam<br>Visual (1) | Tipo de<br>Control | Extremo<br>Biselado | Tipo de<br>Control | Derivación<br>Tubo a tubo (4) | Extremo<br>tipo SW | Extremo tipo<br>Biselado | Soldadura<br>de Sello |
| 1    | C.S. / K.C.S | 1           | AA1A23A-01<br>AA2A23A-01<br>AA2A33A-01<br>AA3A33A-01<br>A3J-1F<br>A3J-1F<br>A3V-1F<br>A3E-1F | FLUE GAS (FLU)<br>FUEL GAS (FUG)<br>INSTRUMENT AIR (INA)<br>INDUSTRIAL AIR (UTA)<br>LOW PRESSURE<br>CONDENSATE (LPC)<br>CONDENSATE (CND)<br>LOW PRESSURE STEAM (LPS)<br>NITROGEN (NIT)<br>NATURAL GAS (NTG)<br>INDUSTRIAL AIR (UTA)<br>HYDROCARBONS VAPORS (VAP)<br>HYDROGEN (HYD)<br>MEDIUM PRESSURE STEAM (MPS)<br>SOFTENED WATER (SWA)<br>AGUA CONTRA INCENDIO (FWA)<br>INDUSTRIAL AIR (UTA)<br>MEDIUM PRESSURE STEAM (MPS)<br>VAPOR DE ALTA PRESIÓN (HPS)<br>CONDENSADO DE ALTA PRESIÓN (HPC) | >19                    | 595 - 650               | 1hr/in              | 1 hr.            | ≤225                     | 100                | RT (3)             | 10                  | MT RT(4)           | 10                            | 10                 | 10                       | 10                    |
| 2    | K.C.S NACE   | 1           | A6L-1F<br>A3J-3F<br>M1L-1F<br>A3L-1F                                                         | SOUR GAS (FGA)-Antes de tambores<br>SWEET GAS (SWG)-Antes de tambores<br>SOUR WATER (SWI)<br>PROCESS GAS (P)                                                                                                                                                                                                                                                                                                                                                                                      | ALL                    | 600 - 650               | 1hr/in              | 1 hr.            | ≤200                     | 100                | RT (3)             | 20                  | MT RT(4)           | 20                            | 20                 | 20                       | 20                    |
| 3    | SS 304 L     | 8           | M2-1F                                                                                        | ACID FLARE (AFL)<br>OXYGEN (O)                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | /                      | /                       | /                   | /                | /                        | 100                | RT (3)             | 10                  | LP RT(4)           | 10                            | 10                 | 10                       | 10                    |

#### NOTAS APLICABLES

- (1) La examinación visual debe realizarse de acuerdo a ASME B31.3 parágrafos 344.2.1 and 344.2.2.
- (2) Cuando aplique, las pruebas de dureza sobre las soldaduras deberán realizarse después del tratamiento térmico después de soldadura
- (3) El procedimiento de examinación radiográfica y el criterio de aceptación deben estar de acuerdo a los requerimientos del ASME B31.3
- (4) Las derivaciones deben ser consideradas radiografiables cuando se presente la situación mostrada en la siguiente imagen:





## **Anexo 3 – Especificaciones Técnicas para Materiales de Tubería para Servicios Ácidos**

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## 1.0 OBJETIVO Y ALCANCE

Esta Especificación define los materiales, soldadura, tratamiento térmico, examen y requisitos de prueba principalmente en materiales de construcción de acero al carbono para equipos que están diseñados para funcionar en entornos de proceso de H<sub>2</sub>S húmedo "ácido o amargo", a ser aplicados para los sistemas alcance del proyecto "ID Revamp Azufre II" a realizarse en la refinería de Barrancabermeja ubicada en el departamento de Santander.

La selección está enmarcada en los alcances de los códigos de diseño de tubería ASME B31.3 y considera la información suministrada por el Cliente.

Se aplicarán requisitos adicionales para material diferente al acero al carbono, siempre que lo especifiquen los Códigos y Normas aplicables.

Los requisitos de esta especificación se aplican principalmente a recipientes a presión diseñados según ASME VIII Div. 1 o 2, según corresponda, y al sistema de tuberías dentro del alcance de ASME B 31.3.

Sin embargo, cuando se especifican otros códigos de pruebas de diseño y fabricación, como códigos nacionales, europeos, internacionales, directivas (PED) o regulaciones, la aplicación de códigos de materias y normas asociadas, las normas reemplazarán a las referidas en esta especificación.

Para las unidades con licencia, esta especificación deberá aplicarse junto con las especificaciones aplicables del licenciante. Los requisitos más estrictos prevalecerán.

Los sistemas de transporte y distribución de gas están excluidos de esta especificación.

En esta especificación se pretende prevenir el riesgo de varios tipos de agrietamiento y formación de ampollas que pueden ocurrir en materiales y equipos cuando se exponen a ambientes que contienen H<sub>2</sub>S. Estos incluyen (pero no se limitan a) el agrietamiento por tensión de sulfuro (SSC), formación de ampollas de hidrógeno, agrietamiento inducido por hidrógeno (HIC) y agrietamiento inducido por hidrógeno orientado por estrés (SOHIC).

Esta especificación complementa los Códigos y Normas enumerados en la Sección 3.0, y se aplica cuando se hace referencia directamente en la hoja de datos del proyecto u otras especificaciones.

## 2.0 DEFINICIONES Y ABREVIATURAS

- CA: Corrosion Allowance, Espesor adicional por corrosión
- CONTRATISTA: La parte que realiza todo o parte del diseño, ingeniería, procura, para el PROYECTO.
- CS: Carbon Steel, Acero al carbono
- ECP: Ecopetrol
- FABRICANTE / VENDEDOR / PROVEEDOR: La (s) parte (s) que fabrica y / o suministra equipos y servicios para realizar las tareas especificadas por el CONTRATISTA.
- FACING: Cara de bridas
- FGA: Servicio Gas Acido
- FUG: Servicio Gas Combustible
- FW: Servicio Sistema Contra incendios
- IB: Ingeniería Básica
- ID: Ingeniería de Detalle
- INA: Servicio Aire de Instrumentos
- KCS: Killed Carbon Steel, Acero al carbono desgasificado o calmado

- LPS: Servicio Vapor de Baja Presión
- NIT: Servicio Nitrógeno
- OEW: Servicio Aguas Aceitosas
- OFFSPEC: Elemento de tubería no disponible en las especificaciones de tubería
- PWHT: Post Weld Heat Treatment, Tratamiento térmico post soldadura
- QUI: Servicio Inyección de Químicos
- RATING: Clasificación presión-temperatura para conexiones bridadas (ASME B16.5)
- RF: Raised Face, Elementos bridados con cara resaltada
- SLP: Servicio Hidrocarburos a SLOP
- Sour Service: Servicio ácido o amargo
- SWI: Servicio Aguas Acidas
- UTA: Servicio Aire Industrial
- WU: Servicio Agua Industrial

**Sour Service** se define como una corriente de proceso que contiene agua como líquido y H<sub>2</sub>S dentro del ámbito de aplicación de la norma NACE MR 0103.

### 3.0 DOCUMENTACIÓN DE REFERENCIA

#### 3.1 DOCUMENTOS DEL PROYECTO

Tabla 1. Documentos de Referencia

| Código                                   | Nombre                                                          |
|------------------------------------------|-----------------------------------------------------------------|
| ECP-UCE-21003-VRP-GRB-IB-01-0-MET-CD-001 | Bases de diseño Tubería                                         |
| ECP-UCE-21003-VRP-GRB-IB-01-0-PRO-LI-004 | Líneas a ser intervenidas, desmanteladas y conectadas           |
| GRB-2880-MET-IS-000001                   | Notas Generales y Planos de Referencia de Isométricos de Piping |

#### 3.2 DOCUMENTOS / ESTÁNDARES SUMINISTRADOS POR EL CLIENTE

Tabla 2. Documentos Suministrados por el Cliente

| Código                                      | Nombre                                                                      |
|---------------------------------------------|-----------------------------------------------------------------------------|
| 2282-0000-JSD-1300-01_1                     | Documentación del proyecto HDT-GCB- Piping classes summary and piping class |
| 2282-0000-JSD-1300-01-ATT-1_1               | Documentación del proyecto HDT-GCB- Piping classes summary                  |
| 2282-0000-JSD-1300-01-ATT-2_1               | Documentación del proyecto HDT-GCB- Piping classes Detail                   |
| BRANCH TABLES 2282-0000-JSD-1300-01-ATT-3_1 | Documentación del proyecto HDT-GCB- Branch tables.                          |
| Clase AA1A23A-01                            | PIPING CLASS-Comunidad Smartplant                                           |
| Clase AA2A23A-01                            | PIPING CLASS-Comunidad Smartplant                                           |
| Clase AA2A33A-01                            | PIPING CLASS-Comunidad Smartplant                                           |
| ECP-VST-P-MET-ET-006                        | Piping Material Specification                                               |
| ECP-VST-P-MET-ET-014                        | Especificación Técnica para tubería según ASME B31.3 Tubería de proceso.    |

### 3.3 NORMAS Y CÓDIGOS DE REFERENCIA

**Tabla 3. Normas y Códigos de Referencia**

| Código                         | Nombre                                                                                                                                                     |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ANSI / NACE MR0103 / ISO 17945 | Petroleum, Petrochemical and Natural Gas Industries - Metallic Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments |
| ASME B31.3                     | Process Piping                                                                                                                                             |
| ASME VIII DIV.1 or 2           | Boiler & Pressure Vessel Code                                                                                                                              |
| ASTM A-20                      | Specification for General Requirements for Steel Plates for Pressure Vessels                                                                               |
| ASTM A-578                     | Specification for Straight-Beam Ultrasonic Examination of Plain and Clad Steel Plates for Special Applications                                             |
| ASTM E112                      | Methods for Determining Average Grain Size                                                                                                                 |
| ASTM E213                      | Standard Practice for Ultrasonic Examination of Metal Pipe and Tubing                                                                                      |
| NACE TM0284                    | Standard Test Method, Evaluation of Pipeline and Pressure Vessel Steels for Resistance to Stepwise Cracking                                                |
| NACE TM 0177                   | Standard Test Method, Laboratory Testing of Metals for resistance to sulfide stress Cracking and stress Corrosion Cracking in H <sub>2</sub> S environment |
| NACE RP0472                    | Methods and Control to Prevent In-Service Environment Cracking of Carbon Steel Weldment in Corrosive Petroleum Environment.                                |
| NACE 8X194                     | Materials and Fabrication Practice for new pressure vessel used in wet H <sub>2</sub> S Refinery Service.                                                  |
| EN 10204                       | Inspection Documents for the delivery of Metallic products.                                                                                                |
| MSS SP 53                      | Quality Standard for Steel Castings and Forgings for Valves, Flanges and Fittings and Other Piping Components Magnetic Particle Examination Method         |

## 4.0 MATERIALES

### 4.1 GENERAL

Todos los materiales deben seleccionarse entre los permitidos en la norma NACE MR0103 y cumplir con los siguientes requisitos:

- Los requisitos de esta especificación para el análisis químico se aplicarán al análisis térmico.
- Para los componentes soldados, el análisis químico también debe incluir los elementos utilizados para la determinación del Equivalente de Carbono.
- Todos los materiales de acero al carbono deben ser Killed
- La composición química debe estar de acuerdo con la listada en las Tablas aplicable a cada tipo de material.
- El material de la placa se suministrará en condiciones normalizadas independientemente del espesor.

- Otras condiciones de tratamiento térmico como templado y revenido o Proceso Controlado Mecánico Térmico (TMCP) estarán sujetas al acuerdo del CONTRATISTA.
- La aceptabilidad del material acabado en caliente estará sujeta a la aprobación del CONTRATISTA.
- Se requiere alivio de tensión térmica para todas las soldaduras de taller / campo y para la zona de curvatura fría

## 4.2 LAMINAS

Las nuevas tuberías se diseñarán de acuerdo con el código ASME B31.3. Por lo tanto, las inspecciones, pruebas y ensayos de aceptación para sistemas de tubería deberán realizarse según se indique en la respectiva clase de materiales de tubería y los requisitos del código.

### Requerimientos técnicos (Análisis de colada)

| Elementos (Notas 1-2-5)       | % Máximo                        |
|-------------------------------|---------------------------------|
| ♦ Carbono                     | 0.20                            |
| ♦ Manganeso                   | 1.20                            |
| ♦ Silicio                     | 0.45                            |
| ♦ Azufre                      | 0.020 / 0.002 ( <b>Nota 4</b> ) |
| ♦ Fósforo                     | 0.030 / 0.008 ( <b>Nota 4</b> ) |
| ♦ Cobre                       | 0.20                            |
| ♦ Niquel                      | 0.10                            |
| ♦ Cromo                       | 0.20                            |
| ♦ Molibdeno                   | 0.20                            |
| CE para lámina <2" de espesor | 0.42 ( <b>Nota 3</b> )          |
| CE para lámina >2" de espesor | 0.45 ( <b>Nota 3</b> )          |

### Notas:

1. Los elementos de microaleación añadidos deliberadamente deberán requerir la aprobación previa del contratista.
2. Se considera que los elementos de microaleación se añaden deliberadamente cuando los valores únicos de niobio (Nb), vanadio (V) y titanio (Ti) son superiores a 0,01 y boro (B) superiores a 0,0005.
3. Se utilizará la siguiente fórmula para calcular el Carbono Equivalente (CE):

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Cu + Ni}{15}$$

4. Cuando se especifica "Resistente a HIC", se aplicará el valor más bajo
5. Cuando se especifica "Resistente a HIC", el contenido de oxígeno debe ser <0,002%.

El acero para las láminas se producirá teniendo en cuenta los siguientes requisitos:

- El acero se fabricará mediante horno de arco eléctrico o en el proceso de horno de oxígeno básico.

- El acero se fabricará mediante un proceso de desgasificación al vacío y se producirá con una práctica de grano fino, con un proceso de bajo contenido de azufre y fósforo. El tamaño de grano debe ser 5 o más fino según lo definido por ASTM E 112.
- El acero debe ser tratado con calcio para control de forma, excepto por un contenido de azufre bajo igual o menor al 0.002%, que se dejará a opción del fabricante del acero. Los métodos alternativos de control de forma de inclusión estarán sujetos a la aceptación del Contratista.
- El tratamiento con calcio, si lo hubiere, será una relación  $Ca / S > 1.2$  y tampoco excederá de 3 veces el contenido de azufre.

Todas las láminas deben someterse a pruebas ultrasónicas de acuerdo con el requisito de ASTM A 578 con los requisitos suplementarios S1.

Se aplicarán los criterios de aceptación de nivel C.

La prueba de HIC se requiere sólo cuando la hoja de datos / clase de tubería u otra especificación relevante del Proyecto requiera láminas de acero al carbono "resistentes a HIC" en la siguiente extensión:

- Se probará la placa de mayor espesor y de menor espesor correspondiente a cada colada.

El procedimiento de prueba de HIC se define a continuación:

- **Procedimiento de Referencia**

El HIC debe estar de acuerdo con el procedimiento definido en la norma NACE TM 0284 utilizando la solución de prueba A de NACE TM 0177.

- **Criterios de aceptación**

Se deben cumplir los siguientes criterios de aceptación (ver NACE 8X194):

|          | CLR % | CTR % | CSR % |
|----------|-------|-------|-------|
| Promedio | 5     | 1.5   | 0,5   |

La longitud máxima de la fisura en cualquier sección no debe exceder los 5 mm.

Si alguna de las muestras no cumple con los criterios de aceptación anteriores, se requiere realizar una prueba de HIC adicional

Las muestras para volver a analizar se pueden tomar de la misma ubicación de la placa original.

Además, tres láminas adicionales de la misma colada estarán sujetas a pruebas de HIC.

Si alguna muestra no cumple con los criterios anteriores, se rechazará la colada completa y las láminas correspondientes.

- **Informe de resultados de Prueba HIC**

El informe de Prueba HIC debe incluir la siguiente información:

- Resultados de la evaluación de fisuras indicando CLR, CTR y CSR individuales y promedio para cada sección.

- Fotomicrografías de las probetas que muestran agrietamiento, junto con microfotografías de estructuras de materiales adyacentes:
  - ✓ Sin retocar, mostrando el tipo de inclusiones en el acero (aumento 200X),
  - ✓ Retocado, mostrando la microestructura del material original (aumento 200X),
- pH de la solución saturada de H<sub>2</sub>S al inicio y al final de la prueba y tipo de solución,
- Fotografías de muestras que muestren ampollas,
- Ubicación y dimensiones de las muestras,
- Análisis químico completo y resultados de propiedades mecánicas del material probado.

El certificado de ensayo de material deberá incluir las disposiciones para el tratamiento térmico posterior a la soldadura simulado para anticipar el ciclo máximo de tratamiento térmico previsto durante la fabricación del equipo de acuerdo con los requisitos suplementarios S3 de ASTM A 20.

El informe de prueba de material certificado (CMTR) debe incluir:

- Química
- Propiedades mecánicas (incluidas las pruebas después de PWHT simulado)
- Resultados de las pruebas de HIC (cuando sea necesario)
- Resultados del examen ultrasónico
- Resultados de las pruebas de impacto (cuando sea necesario para satisfacer los requisitos de temperatura mínima del metal de diseño)
- Informes de tratamiento térmico (normalización)
- Los resultados de la prueba de dureza y la ubicación se registrarán en CMTR

#### 4.3 TUBERIA Y ACCESORIOS SIN COSTURA

El análisis químico debe incluir todos los elementos requeridos por las normas de materiales aplicables, así como los elementos utilizados para la determinación del Carbono Equivalente.

##### Requerimientos técnicos (Análisis de colada)

| Elementos (Nota 1)       | % Máximo |
|--------------------------|----------|
| ♦ Carbono                | 0.20     |
| ♦ Manganeso              | 1.10     |
| ♦ Silicio                | 0.30     |
| ♦ Azufre                 | 0.020    |
| ♦ Fósforo                | 0.030    |
| Carbono Equivalente (CE) | 0.41     |

##### Notas:

1. Se utilizará la siguiente fórmula para calcular el Carbono Equivalente (CE):

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Cu + Ni}{15}$$

La tubería debe suministrarse normalizada.

La tubería sin costura, de espesor superior a 19 mm, se examinará en toda su longitud mediante ultrasonidos, mediante el método de haz de ángulo de pulso de acuerdo con ASTM E 213.

La prueba de HIC no es requerida para este tipo de tubería y accesorios.

#### 4.4 TUBERIA Y ACCESORIOS SOLDADOS

Cuando sea necesario el uso de tubería soldada, debido al gran diámetro involucrado, estas deben estar hechas de lámina de acuerdo con la cláusula 4.2 de esta especificación.

La prueba de HIC se requerirá sólo si la clase de tubería relevante requiere material "resistente a HIC".

La calificación del procedimiento de soldadura y las restricciones de dureza asociadas deben estar de acuerdo con la cláusula 5.1 de esta especificación.

Las soldaduras longitudinales se examinarán en toda su longitud mediante examen ultrasónico y / o examen de radiografía de acuerdo con la especificación estándar de material de tubería aplicable.

#### 4.5 FORJAS

Para bridas y accesorios, una designación aceptable es ASTM A 105 (aplicable también para bridas de recipientes como ASME SA 105)

La forja debe cumplir con el siguiente análisis químico

##### Requerimientos técnicos (Análisis de colada)

| Elementos (Nota 1)       | % Máximo |
|--------------------------|----------|
| ♦ Carbono                | 0.20     |
| ♦ Manganeso              | 1.35     |
| ♦ Azufre                 | 0.025    |
| ♦ Fósforo                | 0.030    |
| Carbono Equivalente (CE) | 0.41     |

##### Notas:

1. Se utilizará la siguiente fórmula para calcular el Carbono Equivalente (CE):

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Cu + Ni}{15}$$

La prueba de HIC no es requerida para los elementos de Tubería fabricados por método de Forja.

Todos los accesorios se suministrarán en condiciones normalizadas, normalizadas y templadas o templadas.

Los accesorios fabricados por debajo de 620°C se someterán a un tratamiento térmico de normalización o alivio de tensión.

Todos los accesorios se inspeccionarán con partículas magnéticas al 100% en superficies forjadas o extruidas de acuerdo con MSS SP 53.

#### 4.6 FUNDICIONES

Una designación aceptable es ASTM A216 WCB para piezas fundidas.

Las piezas fundidas deben cumplir con el siguiente análisis químico:

| Requerimientos técnicos (Análisis de colada) |          |
|----------------------------------------------|----------|
| Elementos (Nota 1)                           | % Máximo |
| ♦ Carbono                                    | 0.20     |
| ♦ Manganeso                                  | 1.35     |
| ♦ Azufre                                     | 0.025    |
| ♦ Fósforo                                    | 0.030    |
| Carbono Equivalente (CE)                     | 0.43     |

##### Notas:

1. Se utilizará la siguiente fórmula para calcular el Carbono Equivalente (CE):

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Cu + Ni}{15}$$

Para la fabricación de las fundiciones, se deben cumplir los siguientes requisitos:

- Todas las piezas fundidas deben ser tratadas térmicamente adecuadamente después de que se hayan realizado las operaciones de soldadura. Este requisito también se aplica a la reparación de defectos por soldadura, independientemente del tamaño. La práctica de dejar áreas "como soldadas" en las piezas fundidas para su uso es inaceptable.
- Todas las piezas fundidas se aliviarán de la tensión.
- La calificación del procedimiento de soldadura para cualquier reparación debe incluir pruebas de dureza como se define en la cláusula 5.1 de esta Especificación.
- No se requieren pruebas de HIC en materiales de tubería fabricados a partir de proceso de fundición.

#### 4.7 PERNOS Y TORNILLOS

El material de los pernos utilizado como los pernos externos en las tuberías o equipos, incluidas todas las juntas con bridas que se enterrarán, aislarán, se equiparán con protectores de bridas o se evitará la exposición atmosférica directa, además deben cumplir con los requisitos de NACE MR0103 incluyendo el criterio de dureza. No se requieren pruebas de HIC para los pernos y tornillos.

#### 4.8 REVESTIMIENTOS METÁLICOS DE PROTECCIÓN

Los revestimientos de resistencia a la corrosión adheridos por proyección, adheridos por rodillos y adheridos por fusión, como el acero inoxidable austenítico y la aleación a base de

níquel, se consideran barreras eficaces para el entorno de sulfuros. Cuando se emplea tal recubrimiento, el material de respaldo no necesita ajustarse a esta especificación.

## **5.0 FABRICACIÓN DE SOLDADURA DE COMPONENTES Y EQUIPOS SOMETIDOS A PRESIÓN**

### **5.1 CALIFICACIONES DE LOS PROCEDIMIENTOS DE SOLDADURA (PQR)**

Todas las calificaciones de los procedimientos de soldadura deben estar calificadas de acuerdo con los requisitos de ASME IX complementados por el estudio de macro dureza Vickers HV10.

La serie de lecturas incluirá material base no afectado, zona afectada por la soldadura, metal de soldadura. La primera hendidura en ZAT se ubicará lo más cerca posible de la línea de fusión.

A menos que se especifique lo contrario, la dureza máxima en PQR no debe exceder 248 HVN en metal base, metal de soldadura y zona afectada por la soldadura (ver NACE RP 0472).

Los registros de pruebas de materiales certificados (CMTR) se deben enviar junto con el PQR.

El aporte de calor en el proceso de soldadura se considerará como una variable esencial complementaria para PQR y pruebas de producción.

### **5.2 REQUISITOS SUPLEMENTARIOS DEL PROCESO DE SOLDADURA**

#### **5.2.1. Soldadura por arco de metal blindado (SMAW)**

Las soldaduras de retención de presión se harán con electrodos de bajo hidrógeno.

#### **5.2.2. Consumibles de soldadura**

El contenido de níquel de los materiales de aporte de soldadura no debe exceder el 1%.

#### **5.2.3. Precalentar**

La temperatura de precalentamiento no debe ser inferior a la especificada en la WPS aplicable.

#### **5.2.4. Cupones de soldadura de prueba de producción**

Para cada procedimiento de soldadura calificado utilizado para juntas soldadas de las categorías A y B de cada recipiente o grupo de recipientes <sup>(1)</sup> se requerirá un cupón de soldadura de producción para el estudio de prueba de macrodureza como se define en la cláusula 6.1 de esta especificación.

<sup>(1)</sup>: La definición de grupo de recipientes se da en ASME VIII Div. 1, cláusula UG 84.

#### **5.2.5. Soldadura de material diferente**

No se permitirá la soldadura de material diferente entre el acero ferrítico y el acero inoxidable austenítico cuando se exponga directamente a un ambiente de H<sub>2</sub>S húmedo y ácido.

## **6.0 TRATAMIENTO TÉRMICO POSTERIOR A LA SOLDADURA (PWHT)**

### **6.1 RECIPIENTES A PRESIÓN**

Se requiere PWHT para recipientes a presión independientemente del grosor.

## 6.2 SISTEMA DE TUBERÍAS (PREFABRICACIÓN Y MONTAJE)

PWHT es obligatorio para todas las soldaduras de retención de presión.

## 6.3 PROCEDIMIENTO PWHT

La temperatura y el tiempo de aplicación de PWHT deben estar en el rango de 600°C a 625°C, 1 hora por cada 25 mm de espesor, 1 hora como mínimo.

No se permite usar una temperatura más baja durante un período de tiempo más largo. Las tasas de calentamiento y enfriamiento deben estar de acuerdo con ASME Sección VIII Div. 1 o 2, ASME B.31.3 según corresponda.

No se permite la combustión interna de gas sin la aprobación del CONTRATISTA.

La siguiente documentación deberá presentarse al CONTRATISTA para su aprobación antes de PWHT.

- Procedimiento PWHT, que indica el tipo de horno, método de calentamiento, etc.
- PWHT local, si lo hubiera
- Número y ubicación de termopares
- Velocidad de calentamiento, enfriamiento.
- Temperatura y tiempo de remojo.

## 7.0 EXAMEN NO DESTRUCTIVO

### 7.1 RECIPIENTES A PRESIÓN

El examen no destructivo será según lo especificado por el Código y las especificaciones del Contratista complementadas de la siguiente manera:

|                     | Categoría de Junta (1) | Antes del PWHT     | Después del PWHT   |
|---------------------|------------------------|--------------------|--------------------|
| Espesor $\leq$ 50mm | A, B                   | -                  | 100% RT (2)        |
|                     | D                      | -                  | 100% UT            |
| Espesor > 50mm      | A, B                   | 100% RT<br>100% UT | 100% RT<br>100% UT |
|                     | D                      | 100% UT            | 100% UT            |

#### Notas:

(1) Las juntas soldadas de categoría se definen en ASME VIII Div 1 UW-3

(2) Para espesores entre 12,5 mm y 50 mm, se puede realizar un examen de radiografía al 100% antes de que se proporcione el PWHT para complementarlo con un examen ultrasónico al 100% después del PWHT

Además, el 100% de todos los accesorios internos accesibles, la soldadura de filete y la conexión de derivaciones se examinarán mediante la prueba de partículas magnéticas húmedas (WMT).

## **7.2 SISTEMA DE TUBERÍA**

Todas las soldaduras circunferenciales a tope, ranura a inglete y todas las conexiones de derivación soldadas a tope deben ser examinadas por RT.

## **7.3 PRUEBA DE DUREZA**

Todas las soldaduras de retención de presión en equipos y tuberías deben someterse a una prueba de dureza después de PWHT como se detalla en el párrafo relevante de la Especificación de trabajo de recipientes a presión y tuberías.

La dureza no debe exceder los 200HB después de PWHT (ver NACE RP0472).

Cuando el acceso esté disponible, las pruebas se realizarán en el lado de la soldadura con contacto con el proceso; de lo contrario, las pruebas se pueden realizar en el lado que no es del proceso (O.D.).

La dureza se llevará a cabo mediante un probador de dureza portátil en superficies debidamente rectificadas.

El procedimiento de dureza se someterá a la aprobación del CONTRATISTA.