| | |
|---|---|
| Project No. | 7G02 |
| Contractor Doc No. | MEG-7G02-00-04-001 |
| Change No. | 0 |
| Revision No. | 0 |
| Page | 1 / 19 |

# Piping Material Specification

## Discipline: Piping Material

| Rev | Date | Purpose | ORIG. By | CHK'D By | APP'D By | F. APP'D By | Customer |
|---|---|---|---|---|---|---|---|
| 0 | 2023.08.11 | Issued for Final | Yang Jie. | Liu Man | Wang Meng | | |
| B | 2023.07.24 | Issued for Review | Yang Jie. | Liu Man | Wang Meng | | |
| A | 2022.12.30 | Issued for Review | Yang Jie. | Liu Man | Wang Meng | | |
| Unit | | Offsite & Utilities | | | Unit/Sub-unit Code | | 00 |
| Sub-unit | | General | | | Project Stage | | FEED |

EuroChem MINERAL AND CHEMICAL COMPANY

Chemical Complex for Phosphates Processing Project

# CONTENT

# 1 General & Project Description

As part of the implementation of a strategic investment project, “EuroChem” decided to build a Chemical Complex for the processing of phosphates in the Republic of Kazakhstan. The Project Site is located approx. 25 km west of Zhanatas.

# 2 Introduction

The specification will be applied to design of all units in Chemical Complex for Phosphates Processing Project. Additions or revisions to the specification may be proposed by licensor or sub-contractors by raising a technical query.

# 3 Scope

This Specification is applicable for the design and selection of piping materials during all the phases of Phosphates Processing Project (unit).

# 4 Normative References

| Document No. | Title |
|---|---|
| GB/T 20801 | Pressure piping code-Industrial piping |
| GB 50316 | Design Code for Industrial metallic piping |
| GB 50235 | Code for construction of industrial metallic piping engineering |
| GB 50236 | Code for construction of field equipment, industrial pipe welding engineering |
| GB 50184 | Code for acceptance of construction quality of industrial metallic piping engineering |

# 5 General Requirements

5.1 All the piping shall be designed, manufactured, welded, heat treated (if required), inspected and tested as per the standards and specifications such as GB/T 20801 and GB 50316 etc. Subsequent classifications and optional choices shall be done in agreement of the Company as

per the good engineering practices and keeping above the minimum acceptance criterias of local codes and directives, as well as other projects specifications

5.2 All the pipes, piping components, on-line items and special items in piping system shall be in conformity with the dimensions, materials and other requirements in the standards such as GB, HG etc.

5.3 If the materials are not included in the above recognized standards but are in accordance with the standard of manufacturer, they require approval by the Company.

5.4 Alloys with low melting points such as aluminum, brass and bronze shall not be used with inflammable media or flammable liquid media. Aluminum can be used for the media with low temperatures.

5.5 The limits for use of copper and copper based alloys are as following:

5.5.1 Ammonia: the alloys with the copper content exceeding 50% cannot be used for ammonia media or ammonia liquor with PH value over 8.5.

5.5.2 Alkali: cannot use the alloys with copper content less than 85%.

5.5.3 Acetylene: the alloys with copper content over 50% cannot be used for the acetylene media existing in wet environment.

5.5.4 Copper cannot be used in the environment with sulfur or hydrogen sulfide.

5.6 The minimum weld coefficient of welded pipe shall be 0.85. For welded pipe, the following requirements apply:

5.6.1 Manufacturers shall perform hydro-test for all longitudinal or spiral welded pipes.

5.6.2 Manufacturers shall test 100 percent of weld for the electrical resistance welded pipes with ultrasonic method. Manufacturers shall perform 10 percent test for EFW pipes with radiograph. At least 250mm on each pipe end shall be radiographed. In case pipe thickness exceeds 12.7mm, base metal (plate) shall be examined by magnetic or ultrasonic methods.

5.6.3 Furnace welded pipes are not permitted.

5.6.4 Spiral welded pipes within process units are only used for water. Spiral welded pipes shall be double submerged welded. ERW pipes are only permitted for water services.

5.6.5 The peaking is limited to 3 mm (1/8 in) that is measured with Company approved template method, when longitudinal welded pipes of CS and low alloy steel are used in the creep range (great than 400°C for CS, great than 455°C for alloy steel of C-l/2Mo and Cr-Mo), or used under severe cycling conditions. Peaking is the deviation of the pipe outside contour from a true circle at longitudinally welded joints.

5.6.6 Pipes of alloy 1 l/4Cr-l/2Mo with longitudinal weld shall not be used in the conditions of design temperature greater than 480°C. Unless exception to be submitted to Company approval.

5.7 Welding between any metallurgical different materials shall be avoided to the maximum extent possible. If two kinds of metals are welded together (Only with the approval of both CONTRACTOR specialist and COMPANY), 100% radiographic examination shall be made. The heat treatment of welds interesting two different metals shall be approved by the Company.

5.8 Cast iron and spheroidal graphite cast iron pipes are limited to water media without freezing (except for boiler feed water, in conformity with Class D). They shall be limited to non pressure, non hazardous sewer service and to fire and other water services up to 95°C and a maximum pressure of 17barg. Large steam traps having bodies cast from these materials are acceptable for use up to 8 barg saturated steam service when steel or ductile iron materials are not readily available.

# 6 Piping

## 6.1 Piping

Dimensions shall comply with HG/T 20553 Sr.II.

6.1.1 DN32（NPS1-1/4）, DN65（NPS2-1/2）, DN90（NPS3-1/2）, DN125（NPS5）, DN550（NPS22）and DN650（NPS26）shall not be used. However, in cases where the use of these sizes cannot be

avoided, the required piping material, fittings, flanges, valves and gaskets shall be the same material as next larger sizes in the applicable piping class.

6.1.2 The following is an equivalent nominal pipe size table:

| DN (Metric mm) | Imperial (inch) | O.D. (Metric mm) |
|---|---|---|
| 15 | 1/2″ | 18 |
| 20 | 3/4″ | 25 |
| 25 | 1″ | 32 |
| 40 | 1-1/2″ | 45 |
| 50 | 2″ | 57 |
| 80 | 3″ | 89 |
| 100 | 4″ | 108 |
| 150 | 6″ | 159 |
| 200 | 8″ | 219 |
| 250 | 10″ | 273 |
| 300 | 12″ | 325 |
| 350 | 14″ | 377 |
| 400 | 16″ | 426 |
| 450 | 18″ | 480 |
| 500 | 20″ | 530 |
| 600 | 24″ | 630 |
| 700 | 28″ | 720 |
| 800 | 32″ | 820 |
| 900 | 36″ | 920 |
| 1000 | 40″ | 1020 |
| 1200 | 48″ | 1220 |
| 1400 | 56″ | 1420 |
| 1600 | 64″ | 1620 |

## 6.2 Flanges

6.2.1 Flange szie shall comply with HG/T 20592 Sr B.

6.2.2 Flange facing finish shall comply with HG/T 20592.

6.2.3 Sizes for reducing or blind flanges are indicated by nominal pipe sizes.

6.2.4 Minimum size for orifice flanges is DN40. Orifice unions are not permitted.

6.2.5 Piping flanges not shown in the piping classes but that are required to mate to control valves, spec breaks at valves, equipment, or vessel nozzles, are permitted. (For example: Higher rating flanges are permitted in lesser rating piping system, All mating flanges with applicable line class bolting and gasket materials shall be provided as indicated on piping BOM.

Each orifice flange shall be furnished with a jack screw of the same metallurgy that shall be at least asÜorrosion resistant as the flange.

## 6.3 Fittings

6.3.1 Reducing Fittings

- Reducing fittings shall only be utilized as indicated in the individual Piping Class Branch Connection Chart, unless otherwise indicated on the P&ID or piping drawings.
- Reducing tees, DN15 and smaller, may be fabricated, from full size tees and reducing inserts. The maximum reduction for the utilization of reducing inserts is two sizes.
- Reducers (concentric or eccentric) are the fittings for all buttweld end reductions.
- Swage Nipples shall be used for reductions between buttweld end and socketweld or threaded end pipe and piping components. The maximum size of any swage shall be DN80.
- Reducing couplings shall be used for line reductions DN15 and smaller where the centerline of pipe elevations are to be maintained. Reducing couplings are preferred in lieu of swages for sizes DN15 and less.

6.3.2 Threaded joints shall conform to American Standard taper (NPT) per GB/T12716.

6.3.3 Forged steel threaded and socket weld fittings shall be per GB/T14383 Sr.II.

6.3.4 Butt-weld fittings shall be in accordance with GB/T 12459 Sr.II. The bore of butt-weld fittings shall correspond to the inside diameter of the connecting pipe or piping components, permitting a

thickness difference up to 2mm. When the difference in wall thickness between the two components being joined exceeds 2mm, taper boring shall be performed on the component having the heavier wall per GB/T 20801

6.3.5 DN20 half-coupling is allowed only to be used to meet piping design requirement for drip legs or instrument details as shown on applicable drawings. The half-couplings shall have the same material and pressure rating as full-couplings specified in the applicable pipe classes.

6.3.6 Special Fittings: Fittings that are not directly referenced in an associated standard (i.e. laterals in GB/T 12459) shall meet the basic design criteria stated in those associated standards. In addition, the Supplier shall provide certified dimensional drawings and data for any Special Fittings that dimensional information is not provided in the associated standard.

6.3.7 Galvanized Materials: Components specified as galvanized shall be galvanized inside and outside by the hot dip process.The zinc used for coating shall be any grade of zinc conforming to GB/T 8163, GB/T 9948 and GB/T 9711 pipe specified as galvanized shall be hot dip galvanized according to GB/T 8163. Flange faces shall be protected during galvanizing operation. Galvanized pipe shall be supplied in maximum lengths of 6M

6.3.8 Special purpose grooved coupling Fittings can be used at above ground-galvanized piping systems like fire fighting water, with the permission of local authorities and the approval of the Company. (For such case, grooved wall thickness shall be based on strength calculations)

6.3.9 Long radius bends shall be supplied with 250mm straight length on both sides

## 6.4 Gaskets

6.4.1 Unless otherwise noted non-metallic gaskets shall be 1.5 mm thick after compression.

6.4.2 Unless otherwise noted spiral wound gaskets shall be 3.0 mm (C) thick after compression.

## 6.5 Bolting

6.5.1 Upon installation, the stud bolt shall have full thread engagement equal to one times the outside diameter of the stud bolt within either a tapped hole or a 2H nut. Only heavy duty nuts could be used.

6.5.2 Cap screws shall only be used when mating valves with threaded taps. These cap screws shall have the same material designation and grade as the stud bolts in the corresponding pipe classes. The valve manufacturer's stated tap depth and thread data shall be used as the basis for the final selection of cap screws.

6.5.3 Bolting M39 diameter and larger in all services shall be suitable for tensioning. For critical, severe and / or high pressure services all diameter bolting below M39 diameter shall in addition be reviewed for tensioning. Extra length bolts shall be used for tensioning and this extra length shall be protected after installation with metal/plastic caps

## 6.6 Threaded connections

6.6.1 Except for galvanized pipework and down stream of block valves threaded connections are not permitted.

6.6.2 Threaded plugs on hydrostatic vents, not provided with a valve, shall be seal welded after testing has been carried out.

6.6.3 All threaded connections that require seal welding, shall meet the requirements of the relevant fabrication standard.

6.6.4 Threaded connections, not requiring seal welding, shall be sealed as follows:

- 204℃ & below- use PTFE Jointing Tape, or approved jointing compound.
- Above 204℃ - Seal weld wherever possible, otherwise use pipe jointing compound to manufacturer's standards.

## 6.7 Colour Coding

Refer to "Color Coding Specification".

## 6.8 Protection

6.8.1 After inspection and test, pipe, fittings and flanges shall be completely free of water, dried and prepared for shipment. Adequate protection shall be provided against mechanical damage and atmospheric corrosion in transit, and for at least six months outdoor storage at job site prior to installation.

6.8.2 Exposed finished and machined surfaces shall be given a heavy coating of Project approved rust inhibitor compound. Internal metal surfaces shall be sprayed or coated with a similar rust preventative. The rust inhibitor shall be easily removable in the field.

6.8.3 Weld bevels on pipe and piping components shall be clean and free of all foreign material before being coated inside and out for a distance of approximately 75 mm with a rust preventative compound that is not detrimental to welding.

6.8.4 Pipe, fittings and flanges shall be protected against damage and the ingress of water and foreign matter. Weld ends shall be protected by suitable caps, securely fastened, which will be suitable for site exposure as para 5.8.1 above. Flanged ends shall be protected by plastic (preferred) or wooden flange protectors which shall be held in place by a minimum of four bolts / inserts. End protection being offered should be clearly identified at the bid stage.

## 6.9 Y-Strainers

6.9.1 Unless otherwise noted, Y-Strainers shown shall be furnished with heavy gage perforated 304SS screen and shall comply with line PN material/pressure-rating per HG/T 20592 as per respective piping classes.

6.9.2 Y-Strainers for acid and caustic services or galvanized spec shall be furnished with flanged blowdown connections.

## 6.10 T-Strainers

6.10.1 T-Strainers in sizes DN80 through DN600 shall have minimum 11 gage perforated stainless steel basket (with reinforcement rings where required) and shall comply with fitting material and wall schedule rating per HG/T 20592 as per respective piping classes. The in-line end connections of T-Strainers shall be butt-weld ends unless flanged ends are required by piping design as indicated on piping drawings.

6.10.2 T-Strainers for acid and caustic services or galvanized spec shall be furnished with flanged blowdown connections.

## 6.11 Chemical Composition

All carbon and low temperature carbon steel grades of material for pipe, fittings and flanges shall have a maximum carbon content of 0.25% and a maximum carbon equivalent of 0.45% based on the following formula:

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

% S ≤ 0.025

% P ≤ 0.025

### 6.12 Certification

All material shall be supplied with a minimum of the respective standard certification, unless specifically noted differently on requisition and / or data sheets.

### 6.13 Impact Testing

Impact testing shall to be in line with GB/T 20801 requirements as minimum and applicable local codes and regulations.

## 7 Valve

### 7.1 General

7.1.1 Unless otherwise specified, steel valves shall conform to GB/T 12224. However, the requirements of the plant design code shall be taken into account as stated on the valve data sheet.

7.1.2 Face-to-face dimensions of steel flanged valves shall conform to GB/T 12221 to the extent covered. For valves not covered in GB, certified dimensions drawings shall be provided by the Selected Supplier.

7.1.3 Unless otherwise noted, control valves should be flanged ends according to HG/T 20592. The designer shall check instrument supplier data / drawings to verify flange connections and dimensions.

7.1.4 When permitted in piping class, wafer butterfly valves shall be used wherever possible. Butterfly valves that are threaded lug or dual flange design shall only be used as required for 'dead end' service and these valves shall be clearly noted on the applicable piping drawing.

7.1.5 Full bore, single piece balls shall be preferred where possibble. Nickel coated CS balls are prohibited.

7.1.6 Ball, Butterfly and Plug valves shall be reviewed for cap screw requirements. Full bore, single piece balls shall be preferred where possibble. Nickel coated CS balls are prohibited.

7.1.7 All valves DN50 and above shall be provided with a locking facility for the 'open and closed' positions. The facility shall enable a padlock (supplied by others) with a minimum diameter of 5 mm to be fitted.

7.1.8 All valves shall be protective coated in accordance with project specifications. Alternative (higher grade supplier's standard) coatings may be accepted if highlighted at bidding stage.

7.1.9 Any exposed (unpainted) carbon steel parts / surfaces shall be given a heavy coating of project approved rust inhibitor. Internal metal surfaces shall be sprayed or coated with similar suitable rust preventative.

7.1.10 Valve ends shall be suitably protected against damage and the ingress of foreign matter. Ends shall be protected as below:

- Socketweld and plain ends shall be closed with metal or plastic protectors that fit either inside or outside the valve ends.
- Threaded ends shall be fitted with plastic plugs / caps.
- Flanged ends shall be protected by plastic (preferred), or wood covers, securely held in place by a minimum of four bolts / inserts. Gasket contact surfaces shall be protected to ensure serrations are not damaged in transit or storage.

7.1.11 All valves shall be marked / tagged with (as a minimum) the project tag and commodity code number in additional to information required by the applicable design standard. Full marking requirements will be stated within the enquiry.

7.1.12 All valves having a preferred direction of flow shall be marked with an arrow cast on the valve body.

7.1.13 Stamping or engraving shall not infringe on the minimum required wall thickness of the valve.

7.1.14 All flanged valves shall have end flanges conforming dimensionally to HG/T 20592. Flange surface finishes will be stated on valve data sheets and will refer to the respective standard.

1.1.1 End and bonnet flanges shall be cast or forged integrally with the valve body. Conversion of weld end valves to flanged by welding on flanges is not permitted.

7.1.15 All valves shall be supplied with a minimum of the respective standard certification. The level of certification will be stated on the valve data sheet.

7.1.16 Fugitive Emissions

- The valve manufacturer shall provide a written guarantee (warranty) stating that all steel valves are provided with 'low emission' bonnet gaskets, stem seals and packing. The detectable leakage fugitive emission rate shall be less than 500 ppm, but may be required to be less than this for critical applications. The valve data sheet will indicate the level of emission allowable.
- Production tests are not required, unless otherwise stated. However, all valves shall be capable of meeting the stated emission limits when and if tested in accordance with ISO 15848-1.

7.1.17 Records of successful lab test results confirming the above shall be available for review by the Contractor during quotation stages.

7.1.18 Valves specified as needing to be 'fire safe' shall have been tested and certified as having met the requirements of API 607.

7.1.19 When specified on valve data sheets any valve with weld deposits shall be impact tested as per project requirements. The testing will be for weld deposit, heat affected zone (HAZ) and Charpy impact test results will meet the minimum requirement for the project. The testing may be carried out on representative materials subject to Contractors approval.

7.1.20 When stated on data sheets valves shall be suitable for full vacuum service. Long stuffing box shall be used. Supplier shall provide a written guarantee (warranty) to this effect.

7.1.21 Written records confirming the above shall be available for review by the Contractor during the bidding stage.

7.1.22 Any valve stated as being in 'sour service' shall meet the requirements for sour environments as stated in NACE MR-01-75.

7.1.23 Supplier shall not modify an existing valve to bring into conformance with data sheet requirements without written approval of the Contractor. Examples of modifications are as follows:

- Addition of extended bonnet (gas column) to a standard valve.
- Inserting resilient seats.
- Revising trim.
- Modifying flanged end valves to buttweld end (machining off flanges).
- Changing bolting and / or packing.
- Weld repair to castings and any subsequent heat treatment.
- All weld repairs on heat treated casting shall be followed by a new heat treatment. Modifying a buttweld end valve to threaded or socketweld ends.
- Modifying a threaded end valve to socketweld ends.

7.1.24 Buttweld, socketweld and threaded end carbon steel valves shall have a 0.3% maximum carbon content. Free machining steel shall not be used.

7.1.25 Unless otherwise specified, all austenitic stainless steel materials (300 series) shall be furnished in a solution annealed condition. Approved repairs, if any, shall be made prior to solution annealing.

7.1.26 Where a valve data sheet calls for body plugs, these shall be as a minimum equal in composition to the valve body. Valves shall not have drilled and plugged holes unless specifically requested on data sheets.

7.1.27 Bonnet gaskets shall be Manufacturer's standard (non-asbestos), unless stated otherwise on the valve data sheet. Gasket shall be fully detailed in quotation.

7.1.28 Metallic and non-metallic bonnet and cover gaskets shall have corrosion resistance equal (or better) than that of the body and bonnet materials.

7.1.29 Rings for valves with ring-joint type bonnet or cover shall have a maximum hardness in accordance with the following:

- Soft Iron 90 BHN
- 5% Chrome 130 BHN
- Austenitic Stainless Steel 150~160 BHN
- Monel 125 BHN

7.1.30 The Contractor shall provide documentation of examination, inspection and testing as specified in the relevant Chinese standard specification. All test documentation shall be certified 'true' by the Supplier.

7.1.31 Each individual valve shall be subjected to a shell and seat pressure test, at the pressures stated on the valve drawing.

7.1.32 Any optional backseat, low pressure closure or high pressure closure test shall be clearly identified on the valve drawing. Supplier shall include all additional costs for these tests.

7.1.33 All pressure testing of austenitic stainless steel valves shall be carried out with water having a maximum of 50 ppm chloride content.

## 7.2 Gate and Globe Valves

7.2.1 Unless otherwise noted, rising stem valves shall be supplied with bevel gear operators for the following class and size of valve.

| Rating | Gate Valves | Globe Valves |
|---|---|---|
| PN10 | NPS 16 and larger | NPS 14 and larger |
| PN16 | NPS 16 and larger | NPS 12 and larger |
| PN25 | NPS 14 and larger | NPS 12 and larger |
| PN40 | NPS 14 and larger | NPS 10 and larger |
| PN63 | NPS 12 and larger | NPS 8 and larger |
| PN100 | NPS 10 and larger | NPS8 and larger |

7.2.2 Gate Valves, Double Seated Design for Steam Service

7.2.3 The location and orientation of double seated gate valves, where specified, in PN100 and greater and in sizes DN500 and larger shall be reviewed (process systems/piping Eng.) for various operation modes to minimize the potential for trapping of liquid in the center cavity.

7.2.4 Gate valves DN40 and smaller shall be conventional port, unless otherwise noted.

7.2.5 Gate valves used as isolation valves in pressure relief systems should be installed with stems oriented horizontally or if this is not feasible the stem could be oriented downward to a maximum of 45 degree from the horizontal.(For the special case of low temperature applications individual review shall be performed by process systems/piping Eng.)

7.3 Quarter turn Valves (Butterfly, Plug, Ball)

7.3.1 Unless otherwise noted, quarter turn valves shall be supplied with worm gear operators as follows:

| Rating | Plug Valves | Butterfly Valves | Ball Valves |
|---|---|---|---|
| PN10 | NPS 6 and larger | NPS 8 and larger | NPS 6 and larger |
| PN16 | NPS 6 and larger | NPS 6 and larger | NPS 6 and larger |
| PN25 | NPS 6 and larger | NPS 6 and larger | NPS 6 and larger |
| PN40 | NPS 6 and larger | NPS 6 and larger | NPS 6 and larger |
| PN63 | | NPS 4 and large | NPS 4 and larger |
| PN100 | | NPS 4 and large | NPS 4 and larger |

7.3.2 Stems of ball valves shall be 'blow out proof '(contained within the valve body casting / forging), and shall be furnished with an anti-static device.

7.3.3 The operating levers (or handles) on ball valves shall indicate, by their position, whether the valve is open or closed. The open position shall be when the lever (or handle) points in a direction parallel to the flow through the valve. It shall also be impossible to re-assemble any valve to affect this indication.

7.3.4 All ball valves shall have self relieving cavity mechanisms. Details of this shall be supplied with bid. For seat supported (floating ball) type valves this may be achieved by use of a hole drilled in the ball subject to approval from Contractor. The use of a hole in ball will make the valve uni-directional.

7.3.5 All wrench operated ball valves in insulated lines shall have an extended spindle (measured from the valve bonnet) to ensure that the wrench clears valve insulation. The spindle to have an outer stationary tube welded to the valve bonnet and having a weather seal at the wrench end. The stationary tube enables the insulation to be properly sealed around it.

- 100mm for valves 50mm NS and smaller.
- 150mm for valves 75mm NS and larger.

7.4 Check Valve

Lift check valves shall be installed horizontally only. Unless otherwise noted, all other types of check valves shall be installed horizontally or vertically with upward flow.

### 7.5 Plug Valve

Lubricated plug valves shall not be used where lubricant could contaminate process fluid and shall be used only when specified by the piping class or indicated on the P&ID.

### 7.6 Extended Bonnet Lengths / Low Temperature Service

7.6.1 Extended bonnet valves for low temperature service shall have the minimum extended bonnet lengths complied with GB/T 24925, measured from the centerline of the valve bore to the bottom of the packing (stuffing box).

7.6.2 If the design temperature below -50℃， the valve shall be furnished with extended bonnet.

7.6.3 In addition to point 6.6.2 above, consideration should be given to valves that are in services with an operating temperature of below -50℃ but are not required to be operated at these temperatures. In such cases valves should be able to ‘seal and survive1, which means having sealing components that can withstand the low temperatures and will recover to hold pressure as the temperature rises. Subject valves can also be supplied without extended bonnet.

## 8 Branch Connection

8.1 Branch connections for header sizes two inches and larger which require reinforcement other than sockolet or weldolet shall be in accordance with the applicable branch connection table and GB/T 20801.

8.2 Reinforcement pad shall primarily be the same material as pipe. Plate material with compatible strength, weldability, heat treatment requirements, galvanic corrosion, thermal expansion etc. may be used as an alternative reinforcing pad material subject to company to review and approval, but this doesn't release CONTRACTOR from his full responsibility

8.2.1 Thickness of reinforcement pad shall be the same as header wall thickness and pad width shall be two times the outside diameter of the branch pipe, unless otherwise specified by the stress analyst and shown on the piping isometric.

8.2.2 The need for a reinforcement pad or fitting could be eliminated on case by case basis.

8.2.3 Minimum spacing of branch connections shall be as follows: the clear distance between the edges of attachment welds for adjacent branch connections or reinforcement pads shall not be less than four times the thickness of the run wall, or 25 mm, whichever is greater.

8.2.4 Pad reinforcement branch connections are not permitted whenever the piping design temperature is 427℃ or greater.

8.3 Substitutions may be made for stub-in or other fittings as calculated and determined by the stress engineer when high stress concentrations or any other reasons preclude the use of branch connection shown in the branch table. The branch connection as marked on the piping isometric as determined by the stress engineer shall override the branch table.

8.4 Integrally reinforced fittings may also be substituted for stub-in, reinforcement pads, or other fittings as determined by stress analyst when high thermal cycling or constant vibration is present in the piping system or high stress concentrations or any other reasons preclude the use of stub-in, reinforcement pads, or other fittings shown in the branch table.

8.5 Unless otherwise noted, the 45 degree lateral branch connections shall be as follows:

8.5.1 For DN300 and smaller, use "Latrolet" type fitting.

8.5.2 For sizes larger than DN300, consult with piping engineering.

8.6 The branch connections at elbows shall be as follows:

8.6.1 For DN300 and smaller, use "Elbolet" type fitting.

8.6.2 For sizes larger than DN300, consult with piping engineering.

8.7 On any of following occasions, the integral reinforcement branch welding fitting (O-let) with size DN 100mm (NPS 4) are not allowed to be welded to the outside surface of main pipes without Company permission.

8.7.1 Ratio of d/D (diameter of branch pipe/diameter of main pipe) is more than 0.8;

8.7.2 Wall thickness of main pipes is less than standard wall thickness (STD);

8.7.3 Outside diameter is more than 900mm (36 inch) while wall thickness of main pipes is less than 19mm (0.75 inch).

8.8 Unless otherwise noted or as previously indicated, 90° branch connections shall be made in accordance with the branch tables as indicated in the individual piping classes.

8.9 Unless otherwise noted, stub-in branch connection with or without reinforcement pad shall be sit-in type as shown in detail GB/T 20801.

8.10 Branch connections for vent, drain and sample connections, and for piping/instrument connections shall be based on the modules referenced in each pipe class.

8.11 Branch reinforcement requirements shall be in accordance with GB/T 20801.

8.12 Branch tables are not applicable for branch connections at angles other than 90°. Branch connections at angles smaller than 90° shall be designed and calculated by the Contractor.