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		Rev: 01
		April 2011
KLM Technology Group #03-12 Block Aronia, Jalan Sri Perkasa 2 Taman Tampoi Utama 81200 Johor Bahru Malaysia	CONSTRUCTION STANDARD FOR PLANT PIPING SYSTEM (PROJECT STANDARDS AND SPECIFICATIONS)	

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SCOPE

All shop or field fabrication, assembly and installation of process and utility piping system in oil, gas and petrochemical plants shall be performed according to relevant sections of ASME B 31.1 and B 31.3 as applicable, and additional requirements are specified in this Standard. In case of conflict between this Standard and above-mentioned ASME standards, the requirements of this Standard shall govern.

REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

1. ASME (American Society of Mechanical Engineers)

- B.1.20.1: 1983 "Pipe Threads, General Purpose"
- B.31.1 :2004 "Power Piping"
- B.31.3 :2004 "Process Piping"

DEFINITIONS AND TERMINOLOGY

Engineer - The Engineer referred to in this Project Standard and Specification is a person or a body appointed in writing by the Company.

SYMBOLS AND ABBREVIATIONS

<u>SYMBOL/ABBREVIATION</u>	<u>DESCRIPTION</u>
BOM	Bill of Material
FW	Field Weld
NDT	Non-Destructive Testing
PTFE	Polytetrafluoroethylene
QA	Quality Assurance
QC	Quality Control
WPQTR	Welder and Welding Operator Performance Qualification Test Record
WPQR	Welding Procedure Qualification Record
WPS	Welding Procedure Specification

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UNITS

This Standard is based on International System of Units (SI) except where otherwise specified.

GENERAL REQUIREMENTS

Documentations

All documents cited hereunder shall be submitted to the Engineer for his review and/or approval.

1. Documents to be prepared before commencement of pipe work

The documents shall include but not limited to the following:

a. Quality plan

The quality plan shall include details and the sequence of all examinations that will be performed for control of the Executor's work. The names of the individuals responsible for the implementation of all quality assurance (QA) and quality control (QC) functions shall also be included.

b. Recording system

The Executor shall establish and maintain documented procedures for identification, collection, indexing, access filing, storage, maintenance and disposition of the quality record.

c. Procedures

The procedures shall include but not limited to the following:

- material take over, handling and storage
- material and consumable material cont
- welding;
- N.D.T.
- mechanical working;
- heat treatment;
- mechanical cleaning;
- chemical cleaning;
- pressure testing;
- painting;
- Pre-commissioning and commissioning.

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- d. Other documents
 - i) welding procedure specification (WPS), welding procedure qualification record (WPQR) and welder and welding operator performance qualification test record (WPQTR) as per IPS-C-PI-290;
 - ii) work program.
2. Documentations to be prepared during execution of pipe work

The Executor shall maintain the following records:

 - a. Material and consumable material control;
 - b. Marked up isometric drawings;
 - c. Visual and dimensional inspection report;
 - d. N.D.T. reports;
 - e. Post weld heat treatment reports;
 - f. Remedial action reports;
 - g. Pressure test reports;
 - h. Any agreed deviation from job specification.
3. Documents to be prepared after completion of pipe work:
 - a. as built drawings,
 - b. certificate of compliance with job specification.
4. On completion of pipe work all documents mentioned in this Standard shall be submitted to the Engineer in numbers specified in contract

Storing

1. To allow easy and quick reference during handling and storage, the Executor shall maintain the color coding on piping.
2. Piping shall be stored in a relatively clean, dry or well drained area on elevated tonnage and protected against contact with salts or salty water.
3. Stainless steel piping material shall be stored in separate place from carbon steel piping material store and no direct contact of stainless steel with carbon steel shall be allowed.

FABRICATION

General

1. All materials included in the finished piping systems shall be new, undamaged and fully in accordance with the piping material indicated on Isometric/Piping

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Plan Drawing. Substitutions including heavier or thicker materials are not permitted without written approval of the Engineer.

2. All weld numbers and welders identification number shall be marked close to the weld, to enable traceability of each weld and each welder.
3. All pipe work shall be identified by indelible marking, free from sulphur, chloride and other halogens. When spools will be subject to post-weld heat treatment a suitable titanium oxide pigmented heat resisting paint shall be used. All applied marking shall have a life of at least one year under site condition.

The marking applied shall identify the material and the fabricator and include an item number enabling the spool to be traced to the relevant isometric drawing.

4. The Executor shall provide identification marks on leftover pipe length whenever marked up pipe lengths have been fabricated /erected.
5. On all lines DN 80 (NPS 3) and over, pipe clamps shall be used to maintain alignment when welding pipes together, both in Executor's pipe fabrication shop and, on site of over ground piping.
6. All piping shall be fabricated in strict accordance with isometric spool drawings. If spool drawings are not furnished, piping shall be fabricated to the dimensions shown on the piping arrangement drawings.
7. All "FW" located by dimension shall be held to dimensions noted. Additional field welds, other than those indicated on the spool drawings, which may be required to suit handling may be added by the Executor.
8. The Executor shall be responsible for working to the dimensions shown on the drawings. However, Executor shall bear in mind that there may be variations between the dimensions shown in the drawings & those actually occurring at site due to minor variations in the location of equipment, inserts etc. The Executor shall take care of these variations.

Isometric, if supplied, may have the field welds marked on them. However, it is the responsibility of the Executor to provide adequate number of "FW".

Wherever errors/omissions occur in the drawings and bills of material (BOM), it shall be the Executor's responsibility to notify the Engineer prior to fabrication or erection.

9. Austenitic stainless steel materials shall be cut by mechanical means, sawing, abrasive discs or plasma arc cutting. No flame cutting is allowed.

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Dimensional Tolerances

The tolerances listed in the following paragraphs are permissible maximums. These tolerances pertain to all piping including alloy pipes.

1. General dimensions such as face to face, face or end to end, face or end to center and center to center shall be ± 3 mm (see Fig. 1 Item A). Tolerances shall not be cumulative.
2. Flange bolt holes shall straddle to vertical, horizontal or North-South centerline unless otherwise noted. Rotation of flange bolt holes shall not exceed 1.5 mm measured across the flange face parallel to a centerline and between the holes nearest to it. (See Fig. 1 Item D).
3. Inclination of flange face from true position, in any direction shall be 4 mm per meter. (See Fig. 1 Item E).
4. Displacement of branch connection from indicated location shall be ± 1.5 mm. (see Fig. 1 Item C).

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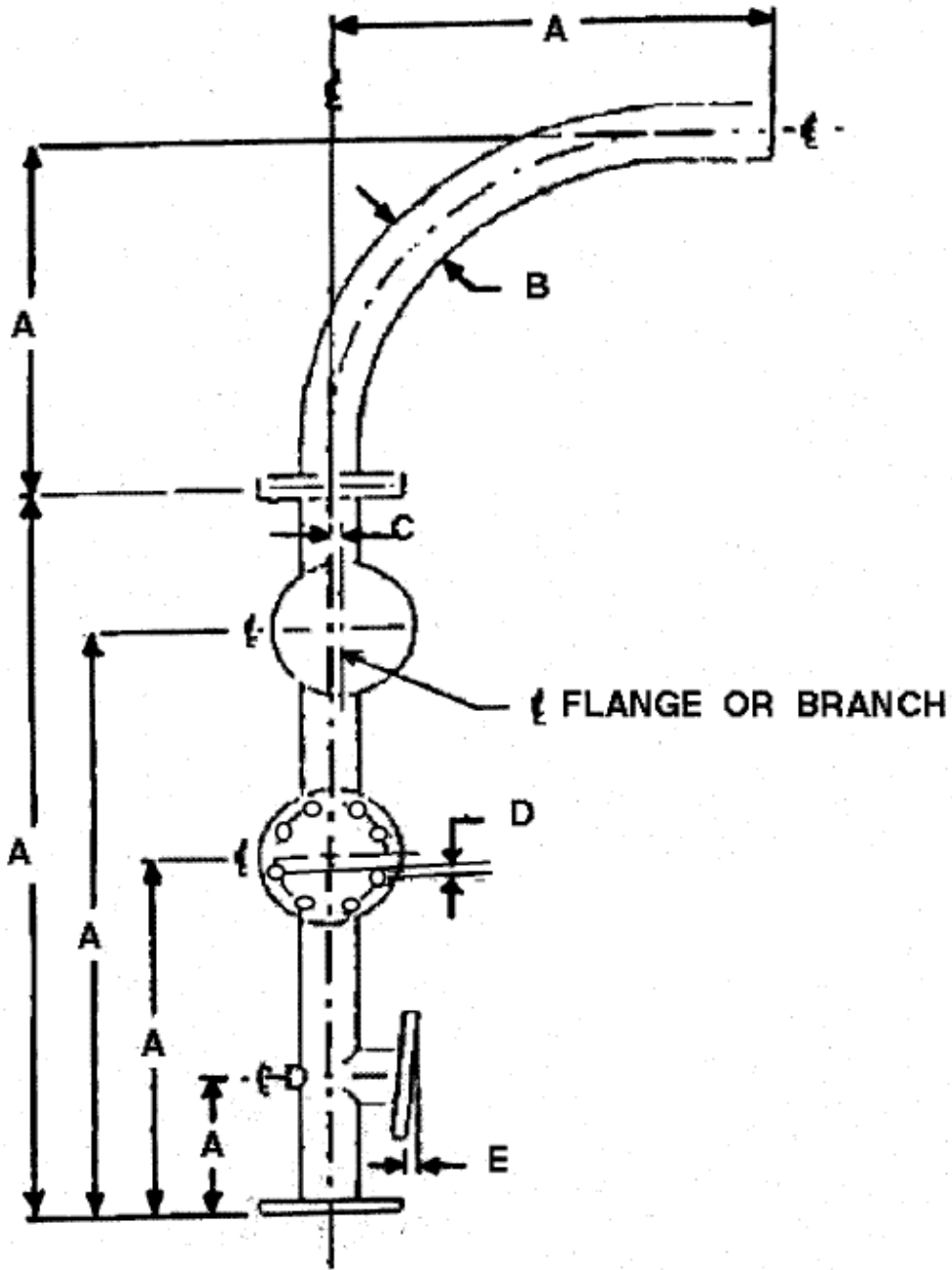


Fig. 1-Dimensional Tolerances for Fabricated Pipework

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Dimensional Tolerances for Fabricated Pipework

Item	Normal Service Conditions	Operation temp. > 460°c PN ≥ 150 (rating 900)
A	±3 mm max. from indicated dimension for face to face, center to face, location of attachments	
B	max. 8% of dia. (for Int. press) max. 3% of dia. (for Ext. press)	max. 2% of dia.
	Flattening measured as difference between the max. and min. dia. at any section of bends.	
C	±1.5 mm max. lateral translation of branches or Connections	±0.75 mm max. lateral translation of branches or connections
D	±1.5 mm max. rotation of flanges from the indicated position measured as shown	
E	4 mm/m	2 mm/m

- The difference between maximum and minimum diameter at any cross section of bends performed by the Executor shall not be more than 8% of diameter for internal pressure and more than 3% of diameter for external pressure; see Fig. 1, Item B in this respect.

Pipe Joints

Longitudinal seams in adjoining lengths of welded pipe shall be staggered over a distance of at least 5 times the wall thickness of pipe measured over the circumference of the pipe or by approximately 30 degree off-set, so that they do not form a continuous line at a butt welding joint.

Longitudinal welds shall be located at the top, 90 degree of the pipe spool and shall also clear branch connections and other welded attachments.

The toes of adjacent circumferential butt welds shall be no closer than four times the nominal thickness of the pipe, in the case of DN 300 (NPS 12) and below, with a minimum acceptable separation of 50 mm. For nominal diameter greater than DN 300 (NPS 12) the minimum acceptable separation shall be 100 mm.

Welding

- Prior to the start of welding, a distance of 50 mm from the weld edge shall be thoroughly cleaned of any contaminants (e.g. oil, grease, and NDT materials) which may adversely affect the weld quality. The weld area shall be scratch-brushed using a stainless steel wire brush followed by solvent cleaning. All cleaning fluids, solvents etc. shall be halide-free and non-injurious to the materials being cleaned and shall be applied with lint-free cloth.

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2. End preparation, alignment and fit-up of pipe pieces to be welded, preheating, welding, post heating, inspection and post weld heat treatment shall conform to this Standard.
3. Austenitic stainless steel weld deposits shall have a ferrite content of 3 to 10 percent. One deposited weld metal sample shall be taken for every 30 linear meter of welding and shall be checked for carbon, chromium, nickel, silicon, molybdenum, manganese and columbium content. These analyses shall be used to determine the ferrite content by the schaeffler Diagram.

When approved by the Engineer, the ferrite scope may be used as an alternative method to verify ferrite content. The ferrite scope shall be used prior to weld heat treatment.

4. Branch and non-pressure part attachment welds should not cross longitudinal seams or circumferential butt welds and shall be subject to the toe to toe separation distance specified for circumferential butt welds.

Where such intersections are unavoidable the main weld shall be subject to non-destructive examination prior to making the attachment weld. The extent of examination shall be at least twice the diameter of the branch pipe measured from the center line of the branch.

5. Joints involving the intersection of more than two welds shall be avoided.
6. Joints to be seal welded shall be made up clean and without the use of tape or any compound. Welding shall be performed in accordance with the qualified procedure by a qualified welder. All exposed threads shall be covered by the seal weld.

Screwed Piping (Threaded Joints)

1. If threading of piping is performed, the threads shall be standard taper pipe threads, concentric with the pipe in accordance with ASME B1.20.1.
2. Threads shall be clean cut, without any burrs or stripping and the ends shall be reamed. Threading of pipes shall be done preferably after bending, forging or heat treating operations. If this is not possible, threads shall be gage checked and chased after welding, heat treatment, etc.
3. During assembly of threaded joints, all threads of pipes and fittings shall be thoroughly cleaned of cuttings, dirt, oil or any other foreign matter.
4. A thread compound or lubricant shall be used for all assemblies except where seal welded, in particular to prevent galling with stainless steel bolting. It shall be suitable for the service conditions and not react unfavorably with the service fluid, the bolts, gaskets or piping material.