INTRODUCTION TO SAUDI ARAMCO QUALITY STANDARD AND QUALITY REQUIREMENTS

PIPING

PRESENTATION OUTLINE

I. OBJECTIVES
II. RESPONSIBILITIES
III. APPLICABLE CODES & STANDARDS FOR MANIFA PROJECT
IV. MATERIALS (RECEIVING, STORAGE & HANDLING)
V. PIPE FIT-UP TOLERANCES
VI. FABRICATION AND INSTALLATION REQUIREMENTS
VII. PIPE SUPPORTS AND HANGERS
VIII. PRESSURE TESTING (OTHER SET OF PRESENTATION)
    a. Pneumatic Testing (EMS)
    b. Hydrostatic Testing (RFP / RAD)
IX. REINSTATEMENT
    a. Bolt Torquing & Tensioning (RGP)
    b. Lay-up (RAD)

I. OBJECTIVES

- TO PROVIDE A MINIMUM GUIDELINES TO CARRY PIPING FABRICATION AND ERECTION TO ENSURE THAT THE WORK IS CARRIED OUT WITH PROJECT DRAWINGS AND SAUDI ARAMCO PROJECT SPECIFICATIONS.
- TO AVOID COMMON DEFICIENCIES DURING INSTALLATION
- TO MINIMIZE / REDUCE WORK DURING LINE CHECKING
- TO ATTAIN PRESSURE TESTING SCHEDULE

II. RESPONSIBILITIES

- IT IS RESPONSIBILITY OF THE CONSTRUCTION TO ENSURE THAT THE CONSTRUCTION OF THE PIPING IS COMMENCED IN ACCORDANCE WITH APPROVED DRAWINGS

- IT IS THE RESPONSIBILITY OF THE CONSTRUCTION TO ENSURE THAT THE CONSTRUCTION OF THE PIPING SYSTEM IS IN COMPLIANCE WITH THE APPLICABLE CODES AND SAUDI ARAMCO STANDARDS AND STANDARD DRAWINGS

III. APPLICABLE CODES & STANDARDS FOR ARACMO PROJECTS

A. INTERNATIONAL STANDARDS

B. SAUDI ARAMCO STANDARDS

C. JAL PROJECT SPECIFICATIONS

D. ARCC PROJECT PROCEDURES

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

A. INTERNATIONAL STANDARDS

a. **ASME B31.1** for power plant piping

b. **ASME B31.3** for chemical process plant piping

c. **ASME IIC** for welding rods, electrodes, and filler metals

d. **ASME V** for nondestructive examination

e. **ASME IX** for welding qualifications

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

B. SAUDI ARAMCO STANDARDS

a. **SAES** SAUDI ARAMCO ENGINEERING STANDARD

b. **SAIC** SAUDI ARAMCO INSPECTION CHECKLIST

c. **SATIP** SAUDI ARAMCO TYPICAL INSPECTION PLAN

d. **SATR** SAUDI ARAMCO TEST REPORT

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

a. APPLICABLE SAES

THERE ARE 20 APPLICABLE SAES LISTED BELOW

SAES-A-004	GENERAL REQUIREMENTS FOR PRESSURE TESTING
SAES-A-007	HYDROSTATIC TESTING FLUID AND LAY-UP PROCEDURE
SAES-A-206	POSITIVE MATERIAL IDENTIFICATION
SAES-B-067	SAFETY IDENTIFICATION AND SAFETY COLORS
SAES-G-116	CLEANLINESS STANDARD FOR LUBE/SEAL OIL FLUID POWER SYSTEMS
SAES-H-002	INTERNAL AND EXTERNAL COATINGS FOR STEEL PIPELINES AND PIPING
SAES-H-100	PAINTING REQUIREMENTS FOR INDUSTRIAL FACILITIES
SAES-H-200	STORAGE, HANDLING AND INSTALLATION OF EXTERNALLY COATED PIPE

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

a. APPLICABLE SAES

SAES-L-101	REGULATED VENDOR LIST FOR PIPES, FITTINGS AND GASKETS
SAES-L-102	REGULATED VENDOR LIST FOR VALVES
SAES-L-105	PIPING MATERIAL SPECIFICATIONS
SAES-L-109	SELECTION OF FLANGES, STUD BOLTS AND GASKETS
SAES-L-110	LIMITATIONS ON PIPE JOINTS AND COMPONENTS
SAES-L-120	PIPING FLEXIBILITY ANALYSIS
SAES-L-125	SAFETY INSTRUCTION SHEET FOR PIPING AND PIPELINES
SAES-L- 150	PRESSURE TESTING OF PLANT PIPING AND PIPELINES

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

a. APPLICABLE SAES

- ❑ SAES-L-310 DESIGN OF PLANT PIPING
- ❑ SAES-L-350 CONSTRUCTION OF PLANT PIPING
- ❑ SAES-L-450 CONSTRUCTION OF CROSS-COUNTRY PIPELINES
- ❑ SAES-L-460 PIPELINES CROSSINGS UNDER ROADS AND RAILROAD
- ❑ SAES-W-011 WELDING REQUIREMENTS OF ON-PLOT PIPING
- ❑ SAES-X-600 CATHODIC PROTECTION OF PLANT FACILITIES

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

b. APPLICABLE SAIC

THERE ARE 39 APPLICABLE SAIC LISTED BELOW

❑ SAIC-L-2001	REVIEW PROCEDURE – INTERNAL CLEANING FOR PLANT SYSTEM, PLANT EQUIPMENT & PIPELINES
❑ SAIC-L-2002	REVIEW PROCEDURE – FLANGE JOINT ASSEMBLY & GASKET INSTALLATION
❑ SAIC-L-2003	REVIEW PROCEDURE – PIPING MATERIAL TRACEABILITY
❑ SAIC-L-2004	REVIEW OF POSITIVE MATERIAL IDENTIFICATION PROGRAM & TESTING PROCEDURE
❑ SAIC-L-2005	RECEIVING INSPECTION OF PIPE & PIPE NIPPLES (PLANT PIPING)
❑ SAIC-L-2006	RECEIVING INSPECTION OF PIPE FITTINGS & FLANGES

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

b. APPLICABLE SAIC

❑ SAIC-L-2007	REVIEW INSPECTION OF GASKET
❑ SAIC-L-2008	REVIEW INSPECTION OF FLANGE BOLTS (STUDS, MACHINE BOLTS, & WASHERS)
❑ SAIC-L-2009	RECEIVING INSPECTION OF VENTURI, RESTRICTION & FLOW ORIFICE
❑ SAIC-L-2010	POSITIVE MATERIAL IDENTIFICATION (PMI) OF ALLOY PIPING & ALLOY COMPONENTS (ALL APPLICATION)
❑ SAIC-L-2011	PIPING PRE-INSTALLATION INSPECTION (PRIOR TO ON-PLOT WORK) INCLUDING SPEC CHECK
❑ SAIC-L-2012	PIPE LAYING, SPOOL ERECTION & ASSEMBLY ON PIPERACKS AND SLEEPERWAYS

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

b. APPLICABLE SAIC

❑ SAIC-L-2013	INSPECTION OF PIPING BRANCH CONNECTIONS
❑ SAIC-L-2014	INSPECTION OF BOLTED FLANGE JOINT ASSEMBLY
❑ SAIC-L-2015	INSPECT THREADED JOINT ENGAGEMENT (GAP CONTROL)
❑ SAIC-L-2016	INSPECTION OF VENTURI, RESTRICTION ORIFICE AND FLOW ORIFICE
❑ SAIC-L-2017	PIPING/EQUIPMENT INTERNAL CLEANING INSPECTION
❑ SAIC-L-2018	INSPECTION OF PIPE SUPPORT & PIPE ANCHOR INSTALLATION

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

b. APPLICABLE SAIC

- ❑ SAIC-L-2019 INSPECTION OF BURIED PIPING (UG ON-PLOT METALLIC PIPING
- ❑ SAIC-L-2022 FINAL PIPING PUNCHLISTING (PIPING REINSTATEMENT)
- ❑ SAIC-L-2025 REVIEW OF TIE-IN PKG & TIE-IN PROCEDURE (PLANT PIPING)
- ❑ SAIC-L-2026 PREPARATORY TIE-IN REQUIREMENTS (PLANT PIPING)
- ❑ SAIC-L-2028 FINAL PUNCHLISTING FOR TIE-IN WORKS (RE-INSTATEMENT)
- ❑ SAIC-L-2029 INSPECTION OF TIE-IN MATERIALS

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

b. APPLICABLE SAIC

❑	SAIC-L-2031	REVIEW & APPROVE PIPING FABRICATION SHOP (GUIDE-ASSURE SUCCESSFUL PROJECT START-UP)
❑	SAIC-L-2034	INSPECTION OF MATERIAL STORAGE & HANDLING AT FAB. SHOP
❑	SAIC-L-2035	CUTTING & ASSEMBLY FIT-UP
❑	SAIC-L-2038	FINAL INSPECTION FOR RELEASE OF FABRICATED PIPING
❑	SAIC-L-2039	FINAL INSPECTION FOR RELEASE OF FABRICATED PIPING COMPONENTS

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

b. APPLICABLE SAIC

SAIC-L-2081	INSTALLATION OF UTILITY AIR OR NITROGEN GAS CONNECTIONS TO PROCESS EQUIPMENT
SAIC-L-2087	INSTALLATION OF PIPE ANCHORS & SUPPORTS
SAIC-L-2106	REVIEW OF PIPE TO PIPE TIE-IN PROCEDURES FOR PIPELINES
SAIC-L-2113	INSTALLATION OF PIPE/PIPE STRING (PIPE LAYING) FOR ABOVE GROUND PIPELINE
SAIC-L-2116	INSPECTION OF ABOVE GROUND ANCHORS & PIPE SUPPORTS
SAIC-L-2129	RE-INSTATEMENT / PUNCH LISTING OF ABOVEGROUND PIPELINE
SAIC-L-2130	INSTALLATION OF BURIED ANCHOR FOR UNDERGROUND PIPELINES
SAIC-L-2132	UNDERGROUND PIPELINE STRINGING & PIPE LAYING

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

b. APPLICABLE SAIC

- ❑ SAIC-L-2133 RE-INSTATEMENT / PUNCHLISTING OF UNDERGROUND PIPELINE
- ❑ SAIC-L-2138 GRAVITY SEWER PIPING INSTALLATION INSPECTION

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

c. APPLICABLE SATIP

THERE ARE 8 APPLICABLE SATIP LISTED BELOW

❑ SATIP-A-004-02	HYDROSTATIC TESTING OF ON-PLOT PIPING
❑ SATIP-A-004-03	HYDROSTATIC TESTING OF PIPELINES
❑ SATIP-A-004-05	LEAK TESTING
❑ SATIP-L-108-01	VALVE INSPECTION, TESTING AND INSTALLATION
❑ SATIP-L-350-01	ON-PLOT PIPING METALLIC PIPING INSTALLATION
❑ SATIP-L-350-02	PIPING TIE-IN INSTALLATION FOR PLANT PIPING
❑ SATIP-L-350-08	FABRICATION – PIPING & MISCELLANEOUS STEEL STRUCTURES
❑ SATIP-L-350-09	UTILITY PIPING INSTALLATION – PLANT AIR & NITROGEN GAS

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

d. APPLICABLE SATR

THERE ARE 19 APPLICABLE SATR LISTED BELOW

- ❑ SATR-A-2001 PRESSURE TEST REPORT
- ❑ SATR-A-2001V PRESSURE TEST REPORT (VALVE INSPECTION & FIELD TESTING)
- ❑ SATR-A-2002 CALIBRATION TEST REPORT – PRESSURE GAUGE
- ❑ SATR-A-2003 CALIBRATION TEST REPORT – TEMPERATURE GAUGE
- ❑ SATR-A-2004 CALIBRATION TEST REPORT – PRESSURE RECORDER
- ❑ SATR-A-2005 CALIBRATION TEST REPORT – TEMPERATURE RECORDER
- ❑ SATR-A-2006 CALIBRATION TEST REPORT – PRESSURE TEST RELIEF VALVE
- ❑ SATR-A-2007 PRE-PRESSURE TEST CHECKLIST (FORM)

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

d. APPLICABLE SATR

- ❑ SATR-A-2008 INTERNAL CLEANLINESS REPORT (PIPING SYSTEMS & EQUIP)
- ❑ SATR-A-2009 SYSTEM LAY-UP REPORT (CERTIFICATE)
- ❑ SATR-A-2010 LEAK TEST REPORT
- ❑ SATR-A-2011 RE-INSTATEMENT CHECKLIST (FORM)
- ❑ SATR-A-2012 POSITIVE MATERIAL IDENTIFICATION (PMI) REPORT
- ❑ SATR-A-2013 POSITIVE MATERIAL REPORT (PMI) LOG SHEET
- ❑ SATR-A-2014 WATER CHEMISTRY REPORT
- ❑ SATR-A-6133 FINAL INSPECTION/RE-INSTATEMENT PUNCH LIST

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

d. APPLICABLE SATR

- ❑ SATR-L-2001 FLANGE JOINT TIGHTENING INSPECTION REPORT
- ❑ SATR-L-2009 PIPELINE INTERNAL CLEANING REPORT
- ❑ SATR-L-2010 VISUAL INSPECTION & ULTASONIC (UT) THICKNESS REPORT

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

a. FWBS Code **FUNCTIONAL WORK BREAKDOWN STRUCTURE**

b. Specifications under FWBS Code

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

a. FWBS Code FUNCTIONAL WORK BREAKDOWN STRUCTURE

FWBS Code	Work Description
6000	PIPING WORKS
6200	ABOVEGROUND INSTALLATION
6300	UNDERGROUND INSTALLATION
6400	SUPPORT FOR PIPING
6600	POST WELD HEAT TREATMENT
6700	RADIOGRAPHIC INSPECTION
6800	PRESSURE TEST, FLUSHING & LAY-UP
6Z00	BOLT TENSIONING

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

a. FWBS Code FUNCTIONAL WORK BREAKDOWN STRUCTURE

FWBS Code	Work Description
6000	PIPING WORKS

SCOPE OF WORK

1. This category covers piping works such as fabrication, installation, inspection, pressure test and cleaning/flushing which comprise facilities for handling liquid, gas or powder.

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

a. FWBS Code FUNCTIONAL WORK BREAKDOWN STRUCTURE

FWBS Code	Work Description
6200	ABOVEGROUND INSTALLATION

SCOPE OF WORK

1. The aboveground piping installation works shall mean the erection of the piping including reviewing of the prefabricated spools prepared by the other party, components and raw materials to be installed in exposed conditions, not buried under the ground. This scope includes transportation of raw/prefabricated piping materials, hoisting, assembling, cutting, beveling, fitting, pre-heating, welding, bolting, installation of piping components such as all valves, strainers, blind/orifice plates, flow/level/pressure/temperature instruments, spring hangers, counter-weights, sliding plates, expansion joints, emergency showers, locking devices, all non-destructive examination except for RT which is to be measured under FWBS 6700.

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

a. FWBS Code FUNCTIONAL WORK BREAKDOWN STRUCTURE

FWBS Code	Work Description
6200	ABOVEGROUND INSTALLATION

SCOPE OF WORK

2. Installation of the following local instruments shall be handled in this category:
   - pressure gauge (directly mounted on piping)
   - thermocouple, resistance bulb, thermometer and well
   - displacement type level instrument, level switch, and level gauge
   - in-line flow instrument, e.g. PD meter, turbine meter, magnetic meter, area meter, vortex meter, etc.

3. Spool drawings preparation and prefabrication of the small bore piping shall be included under this work category, in addition to the installation of the piping at the Site.

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

a. FWBS Code FUNCTIONAL WORK BREAKDOWN STRUCTURE

FWBS Code	Work Description
6200	ABOVEGROUND INSTALLATION

APPLICABLE STANDARDS

SAUDI ARAMCO TYPICAL INSPECTION PLAN

SATIP-L-350-01

SAUDI ARAMCO INSPECTION CHECKLISTS

SAIC-A-2001	SAIC-A-2007	SAIC-A-2013	SAIC-A-2019
SAIC-A-2002	SAIC-A-2008	SAIC-A-2014	SAIC-A-2020
SAIC-A-2003	SAIC-A-2009	SAIC-A-2015	SAIC-A-2021
SAIC-A-2004	SAIC-A-2010	SAIC-A-2016	SAIC-A-2022
SAIC-A-2005	SAIC-A-2011	SAIC-A-2017	
SAIC-A-2006	SAIC-A-2012	SAIC-A-2018	

SAUDI ARAMCO TEST REPORTS

SATR-A-2007	SATR-A-2011
SATR-A-2008	SATR-L-2001
SATR-A-2009	

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

a. FWBS Code FUNCTIONAL WORK BREAKDOWN STRUCTURE

FWBS Code	Work Description
6300	UNDERGROUND INSTALLATION

SCOPE OF WORK

1. The underground piping installation works shall mean the erection of the piping to be buried under the ground up to and including the first bend when such underground piping stubs up above the ground level or connected to the aboveground piping. This scope includes transportation of raw/prefabricated piping materials, hoisting, assembling, cutting, beveling, fitting, pre-heating, welding, bolting, installation of piping components such as valves, strainers, blind and orifice plates, flow/level/pressure/temperature instruments, fire hydrants, fire monitors, hose reels, laying sand bags underneath the piping, additional excavation of trench for working spaces, non-destructive examination except for RT which is to be measured under FWBS 6700, etc.

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

a. FWBS Code FUNCTIONAL WORK BREAKDOWN STRUCTURE

FWBS Code	Work Description
6300	UNDERGROUND INSTALLATION

APPLICABLE STANDARDS

SAUDI ARAMCO TYPICAL INSPECTION PLAN

SATIP-S-070-03

SAUDI ARAMCO INSPECTION CHECKLISTS

SAIC-S-4054
SAIC-S-4055
SAIC-S-4056
SAIC-S-4057
SAIC-S-4058

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

a. FWBS Code FUNCTIONAL WORK BREAKDOWN STRUCTURE

FWBS Code	Work Description
6400	SUPPORT FOR PIPING

SCOPE OF WORK

1. This category shall cover the fabrication and installation of piping supports including support pads. This scope includes purchasing of the materials as per the Exhibit B of this Annex, transportation of raw/prefabricated support materials, hoisting, assembling, fitting, cutting, pre-heating, welding, bolting, necessary inspection, etc. **Supports for the heat tracing piping/tubing are excluded herefrom.**

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

a. FWBS Code FUNCTIONAL WORK BREAKDOWN STRUCTURE

FWBS Code	Work Description
6400	SUPPORT FOR PIPING

SCOPE OF WORK

The work under this category is broken down into FWBS Code 6410 and 6420:

FWBS Code 6410 **FABRICATION**

- The work under this FWBS Code covers the fabrication of piping supports at shop in field or other place.

FWBS Code 6420 **INSTALLATION**

- The work under this FWBS Code covers the installation of fabricated supports on the piping.
- Pre-cast concrete foundation installation shall be included in this category.
- Special supports such as spring supports, sliding plates, counter weights, etc., which are fabricated by manufactures and supplied in prefabricated or pre-assembled condition are not included in this category. They shall be deemed to be a part of the installation of piping components under FWBS 6200 and 6300.

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

THIS WILL BE SEPARATELY DISCUSSED BY WELDING PRESENTOR

a. FWBS Code FUNCTIONAL WORK BREAKDOWN STRUCTURE

FWBS Code	Work Description
6600	POST WELD HEAT TREATMENT

SCOPE OF WORK

1. It is heat treatment work at shop or work site after welding of piping and pipe supports which are welded directly to pipe. This scope includes hardness tests after heat treating.

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

THIS WILL BE SEPARATELY DISCUSSED BY WELDING PRESENTOR

a. FWBS Code FUNCTIONAL WORK BREAKDOWN STRUCTURE

FWBS Code	Work Description
6700	RADIOGRAPHIC INSPECTION

SCOPE OF WORK

1. It is radiographic inspection work at work site or shop. This scope includes all preparation works, safety control around the radioactive sources and working areas, development of films, interpretation of radiographic films, etc.

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

a. FWBS Code FUNCTIONAL WORK BREAKDOWN STRUCTURE

FWBS Code	Work Description
6800	PRESSURE TEST, FLUSHING & LAY-UP

SCOPE OF WORK

1. It is the pressure testing and dewatering work for piping. This scope includes all preparation works such as line check, temporary dismantling of piping components; prefabrication, installation and dismantling of temporary spools, blinds, and other temporary pieces; reinstallation of piping components and instruments after test and flushing or blowing by available media; pressure test, tightness test, drying, disposal of water, preparation of test package, etc.

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

a. FWBS Code FUNCTIONAL WORK BREAKDOWN STRUCTURE

FWBS Code	Work Description
6800	PRESSURE TEST, FLUSHING & LAY-UP

SCOPE OF WORK

2. The work under this category is broken down into FWBS Code 6810 thru 6830:

FWBS Code 6810 **PRESSURE TEST**

- This covers the pressure tests and tightness tests with air, water or any specified materials, drain out of water.

FWBS Code 6820 **FLUSHING**

- This covers the flushing or blowing by means of available media at the Site and ambient lay-up.

FWBS Code 6830 **LAY-UP**

- This covers to lay-up and maintain dry condition internal piping system. Further breakdown of this work category is as follows;
  - Dry Lay-up
    Dew point is – 1 deg C
  - N2 Lay-up

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

a. FWBS Code **FUNCTIONAL WORK BREAKDOWN STRUCTURE**

FWBS Code	Work Description
6800	PRESSURE TEST, FLUSHING & LAY-UP

APPLICABLE STANDARDS

SAUDI ARAMCO TYPICAL INSPECTION PLAN

SATIP-A-004-01 → PNEUMATIC PRESSURE TESTING

SA INSPECTION CHECKLISTS

SAIC-A-2001	SAIC-A-2011
SAIC-A-2003	SAIC-A-2020
SAIC-A-2004	SAIC-A-2021
SAIC-A-2005	SAIC-A-2022
SAIC-A-2006	SAIC-A-2023
SAIC-A-2009	SAIC-L-2001
SAIC-A-2010	SAIC-L-2017

SA TEST REPORTS

SATR-A-2001	SATR-A-2007
SATR-A-2002	SATR-A-2008
SATR-A-2003	SATR-A-2010
SATR-A-2006	SATR-A-2011

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

a. FWBS Code FUNCTIONAL WORK BREAKDOWN STRUCTURE

FWBS Code	Work Description
6800	PRESSURE TEST, FLUSHING & LAY-UP

APPLICABLE STANDARDS

SAUDI ARAMCO TYPICAL INSPECTION PLAN

SATIP-A-004-02 → PRESSURE TESTING-HYDROSTATIC TEST OF PLANT PIPING

SA INSPECTION CHECKLISTS

SAIC-A-2001	SAIC-A-2015
SAIC-A-2003	SAIC-A-2016
SAIC-A-2006	SAIC-A-2017
SAIC-A-2007	SAIC-A-2018
SAIC-A-2008	SAIC-A-2021
SAIC-A-2009	SAIC-A-2023
SAIC-A-2010	SAIC-L-2001
SAIC-A-2011	SAIC-L-2041
SAIC-A-2013	SAIC-L-2042

SA TEST REPORTS

SATR-A-2001	SATR-A-2009
SATR-A-2001V	SATR-A-2010
SATR-A-2002	SATR-A-2011
SATR-A-2003	SATR-A-6133
SATR-A-2004	
SATR-A-2005	
SATR-A-2006	
SATR-A-2007	
SATR-A-2008	

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

a. FWBS Code FUNCTIONAL WORK BREAKDOWN STRUCTURE

FWBS Code	Work Description
6800	PRESSURE TEST, FLUSHING & LAY-UP

APPLICABLE STANDARDS

SAUDI ARAMCO TYPICAL INSPECTION PLAN

SATIP-A-004-03 → PRESSURE TESTING-HYDROSTATIC TEST OF PIPELINES

SA INSPECTION CHECKLISTS

SAIC-A-2001	SAIC-A-2016
SAIC-A-2003	SAIC-A-2017
SAIC-A-2006	SAIC-A-2018
SAIC-A-2007	SAIC-L-2001
SAIC-A-2008	SAIC-L-2017
SAIC-A-2009	SAIC-L-2041
SAIC-A-2011	SAIC-L-2042
SAIC-A-2013	SAIC-L-2139
SAIC-A-2015	SAIC-L-2042

SA TEST REPORTS

SATR-A-2001	SATR-A-2009
SATR-A-2001V	SATR-A-2010
SATR-A-2002	SATR-A-2014
SATR-A-2003	SATR-A-2021
SATR-A-2004	SATR-A-2023
SATR-A-2005	
SATR-A-2006	
SATR-A-2007	
SATR-A-2008	

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

a. FWBS Code FUNCTIONAL WORK BREAKDOWN STRUCTURE

FWBS Code	Work Description
6Z00	BOLT TENSIONING

SCOPE OF WORK

1. It is the bolt tensioning using hydro tensioning machine for piping system. This scope includes all preparation works such as marking, setting of machine, recording, marking, dismantling of machine, scaffolding, etc.

2. Bolt tightening work which can be performed without utilization of hydro tensioning machine shall be considered as a part of work elements covered under FWBS 6200.

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

a. FWBS Code FUNCTIONAL WORK BREAKDOWN STRUCTURE

FWBS Code	Work Description
6Z00	BOLT TENSIONING

APPLICABLE STANDARDS

JAL PROJECT SPECIFICATIONS

S-000-3160-015 → FLANGE BOLT TENSIONING PROCEDURE FOR PIPING

ARCC PROJECT PROCEDURES

1170-MS-6Z00 → BOLT TORQUING AND TENSIONING FOR PIPING

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

b. Specifications under FWBS Code

FWBS Code	Work Description
1360	PIPING
S-000-1360-001	PIPING MATERIAL SPECIFICATION
S-000-1360-002	IDENTIFICATION OF PIPING MATERIALS
S-000-1360-003	FLANGE FACING FINISH
S-000-1360-005	PROCEDURE OF PIPING STRESS ANALYSIS
3160	PIPING ERECTION
S-000-3160-001	PIPING WORK AT PRE-FABRICATION SHOP
S-000-3160-002	PIPING CONSTRUCTION WORK IN FIELD
S-000-3160-004	PIPING PRESSURE TEST PROCEDURE
S-000-3160-100	PIPING SPOOL DRAWING PREPARATION AND WELD JOINT REGISTRATION PROCEDURE
S-000-3160-102	ISO / SPOOL DRAWING & DATA HANDLING PROCEDURE FOR PIPING WORK

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

C. JAL PROJECT SPECIFICATIONS

b. Specifications under FWBS Code

TIPS : ***HOW TO IDENTIFY THAT THE DOCUMENT IS A SCOPE OF PIPING***

FOR SPECIFICATION S-000-1366-003

FOR VENDOR DOCUMENT V-216B-144C-A-201

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

D. ARCC PROJECT PROCEDURES

a. **QCP** **QUALITY CONTROL PROCEDURES**

b. **MS** **METHOD STATEMENTS**

c. **SPP** **SPECIAL PROCESS PROCEDURES**

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

D. ARCC PROJECT PROCEDURES

a. QCP QUALITY CONTROL PROCEDURES

(THERE ARE 2 APPLICABLE QCP FOR PIPING LISTED BELOW)

Document No.	Work Description
1170-QCP-001	CONTROL OF NON-CONFORMITIES
1170-QCP-002	POSITIVE MATERIAL IDENTIFICATION AND TESTING PROCEDURE

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

D. ARCC PROJECT PROCEDURES

b. MS METHOD STATEMENTS (THERE ARE 5 APPLICABLE MS FOR PIPING LISTED BELOW)

Document No.	Work Description
1170-MS-6200 →	MS FOR PIPING ABOVEGROUND INSTALLATION
1170-MS-6300 →	MS FOR PIPING RTR INSTALLATION
1170-MS-6400 →	MS FOR PIPING SUPPORT
1170-MS-6800 →	MS FOR FLUSHING AND LAY-UP PROCEDURE
1170-MS-6Z00 →	MS FOR BOLT TORQUING & TENSIONING

III. APPLICABLE CODES & STANDARDS FOR ARAMCO PROJECTS

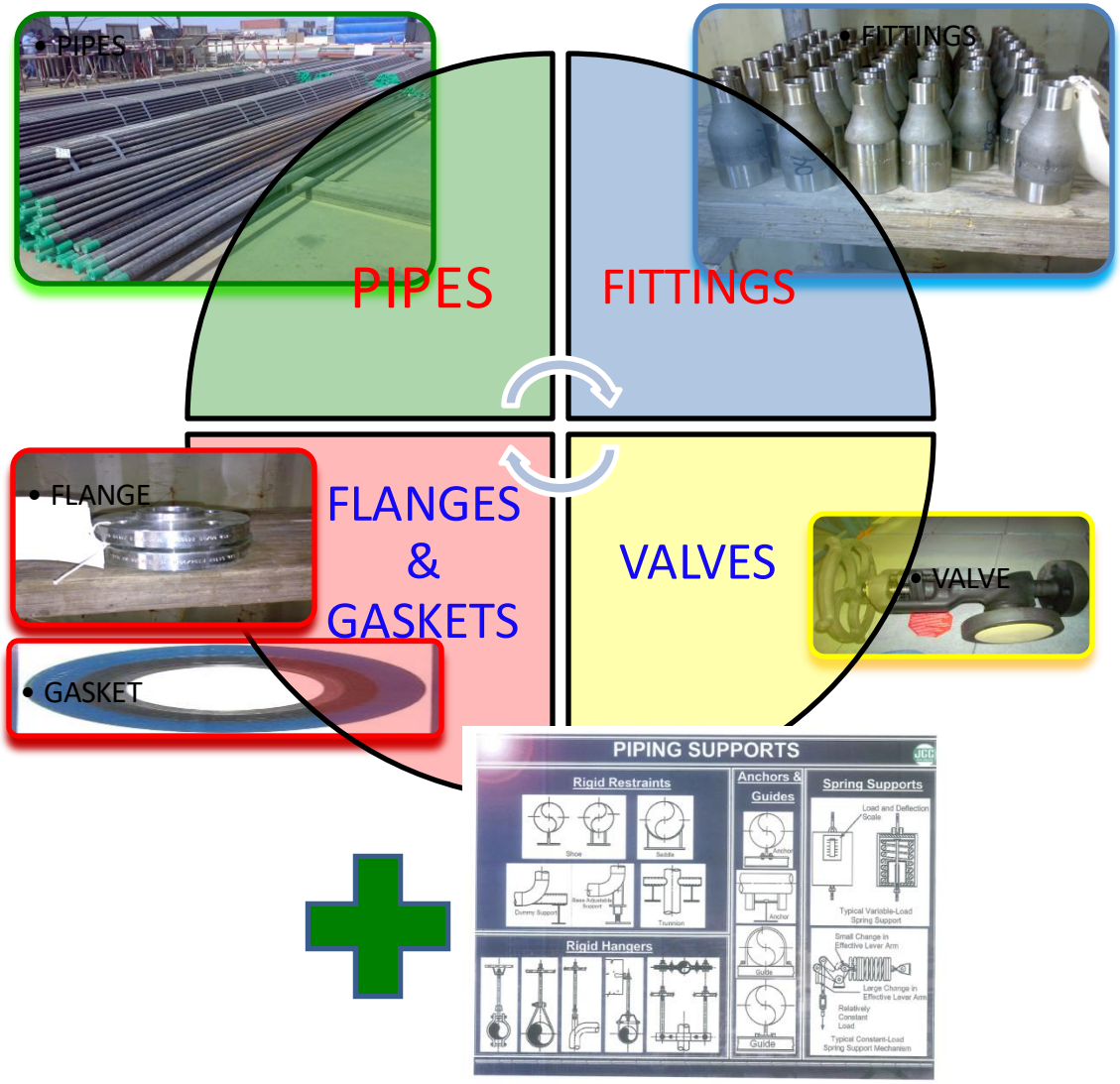
D. ARCC PROJECT PROCEDURES

c. SPP SPECIAL PROCESS PROCEDURES (THERE ARE 6 APPLICABLE SPP FOR PIPING LISTED BELOW)

Document No.	Work Description
1170-SPP-002	SPP FOR HARDNESS TESTING PROCEDURE
1170-SPP-005	SPP FOR HYDRO TESTING PROCEDURE
1170-SPP-006	SPP FOR PNEUMATIC TESTING PROCEDURE
1170-SPP-008	SPP FOR GASKET INSTALLATION PROCEDURE
1170-SPP-009	SPP FOR GAP CONTROL FOR SOCKET WELD AND BACK WELDED THREADED FITTINGS
1170-SPP-012	SPP FOR RTR PIPE WORK

IV. MATERIALS

PIPING REFERS TO THE OVERALL NETWORK OF PIPES, FITTINGS, VALVES, FLANGES, PIPING SUPPORTS, AND OTHER COMPONENTS THAT COMPRISE A COMPLETE SYSTEM USED TO CONVEY FLUIDS (LIQUIDS, VAPORS, OR GAS)



IV. MATERIALS

PIPES

PIPE SCHEDULES

Pipe Size	O.D. (in)	5s	5	10s	10	20	30	40s Std.	40	60	80s & E.H.	80	100	120	140	160	Dble. E.H.
1/8	0.405		0.035 0.1383	0.049 0.1863	0.049 0.1863			0.068 0.2447	0.068 0.2447		0.095 0.3145	[illegible] 0.3145					
1/4	0.540		0.049 0.2570	0.065 0.3297	0.065 0.3297			0.088 0.4248	0.088 0.4248		0.119 0.5351	0.119 0.5351					
3/8	0.675		0.049 0.3276	0.065 0.4235	0.065 0.4235			0.091 0.5676	0.091 0.5676		0.126 0.7388	0.126 0.7388					
1/2	0.840	0.065 0.5383	0.065 0.5383	0.083 0.6710	0.083 0.6710			0.109 0.8510	0.109 0.8510		0.147 1.088	0.147 1.088				0.188 1.304	0.294 1.714
3/4	1.050	0.065 0.6838	0.065 0.6838	0.083 0.8572	0.083 0.8572			0.113 1.131	0.113 1.131		0.154 1.474	0.154 1.474				0.219 1.937	0.308 2.441
1	1.315	0.065 0.8678	0.065 0.8678	0.109 1.404	0.109 1.404			0.133 1.679	0.133 1.679		0.179 2.172	0.179 2.172				0.250 2.844	0.358 3.659
1-1/4	1.660	0.065 1.107	0.065 1.107	0.109 1.806	0.109 1.806			0.140 2.273	0.140 2.273		0.191 2.997	0.191 2.997				0.250 3.765	0.382 5.214
1-1/2	1.900	0.065 1.274	0.065 1.274	0.109 2.085	0.109 2.085			0.145 2.718	0.145 2.718		0.200 3.631	0.200 3.631				0.281 4.859	0.400 6.408
2	2.375	0.065 1.604	0.065 1.604	0.109 2.638	0.109 2.638			0.154 3.653	0.154 3.653		0.218 5.022	0.218 5.022				0.344 7.444	0.436 9.029
2-1/2	2.875	0.083 2.475	0.083 2.475	0.120 3.531	0.120 3.531			0.203 5.793	0.203 5.793		0.276 7.661	0.276 7.661				0.375 10.01	0.552 13.70
3	[illegible]	[illegible] 3.029	[illegible] 3.029	[illegible] 4.332	[illegible] 4.332			[illegible] 7.576	[illegible] 7.576		[illegible] 10.25	0.300 10.25				0.438 14.32	0.600 18.58
3-1/2	4.000	0.083 3.472	0.083 3.472	0.120 4.973	0.120 4.973			0.226 9.109	0.226 9.109		0.318 12.51	[illegible] 12.51					0.636 22.85
4	4.500	0.083 3.915	0.083 3.915	0.120 5.613	0.120 5.613			0.237 10.79	0.237 10.79	0.281 12.66	0.337 14.98	0.337 14.98		0.438 19.01		0.531 22.51	0.674 27.54
4-1/2	5.000							0.247 12.53			0.355 17.61						0.710 32.53
5	5.563	0.109 6.349	0.109 6.349	0.134 7.770	0.134 7.770			0.238 14.62	0.258 14.62		0.375 20.78	0.375 20.78		0.500 27.04		0.625 32.96	0.750 38.55
6	6.625	0.109 7.585	0.109 7.585	0.134 9.290	0.134 9.289			0.280 18.97	0.280 18.97		0.432 28.57	0.432 28.57		0.562 36.39		0.719 45.30	0.864 43.16
7	7.625							0.301 23.57			0.500 38.05						0.875 63.08
8	8.625	0.109 9.914	0.109 9.914	0.148 13.40	0.148 13.40	0.250 22.36	0.277 24.70	0.322 28.55	0.322 28.55	0.406 35.64	0.500 43.39	0.500 43.39	0.594 50.87	0.719 60.93	0.812 67.76	0.906 74.69	0.875 72.42
9	9.625							0.342 33.90			0.500 48.72						
10	10.750	0.134 15.19	0.134 15.19	0.165 18.65	0.165 18.70	0.250 28.04	0.307 34.24	0.365 40.48	0.365 40.48	0.500 54.74	0.500 54.74	0.594 64.33	0.719 76.93	0.844 89.20	1.000 104.1	1.125 115.7	
11	11.750							0.375 45.55			0.500 60.07						
12	12.750	0.156 21.07	0.165 22.18	0.180 24.16	0.180 24.20	0.250 33.38	0.330 43.77	0.375 49.56	0.406 53.33	0.562 73.16	0.500 65.42	0.688 88.51	0.844 107.2	1.000 125.5	1.125 139.7	1.312 160.3	
14	14.000	0.156 23.07		0.188 27.73	0.250 36.71	0.312 45.68	0.375 54.57	0.375 54.57	0.438 63.37	0.594 84.91	0.500 72.09	0.750 106.1	0.938 130.7	1.094 150.7	1.250 170.2	1.406 189.1	
16	16.000	0.165 27.90		0.188 31.75	0.250 42.05	0.312 52.36	0.375 62.58	0.375 62.58	0.500 82.77	0.656 107.5	0.500 82.77	0.844 136.5	1.031 164.8	0.129 192.3	1.438 223.5	1.594 245.1	
18	18.000	0.165 31.43		0.188 35.76	0.250 47.39	0.312 59.03	0.438 82.06	0.375 70.59	0.562 104.8	0.750 138.2	0.500 93.45	0.938 170.8	1.156 208.0	1.375 244.1	1.562 274.2	1.781 308.5	
20	20.000	0.188 39.78		0.218 46.05	0.250 52.73	0.375 78.60	0.500 104.1	0.375 78.60	0.594 122.9	0.812 166.4	0.500 104.1	1.031 208.9	1.281 256.1	1.500 296.4	1.750 341.1	1.969 379.0	
24	24.000	0.218 55.37		0.250 63.41	0.250 63.41	0.375 94.62	0.562 140.8	0.375 94.62	0.688 171.2	0.969 238.1	0.500 125.5	1.219 296.4	1.531 367.4	1.812 429.4	2.062 483.1	2.343 541.9	

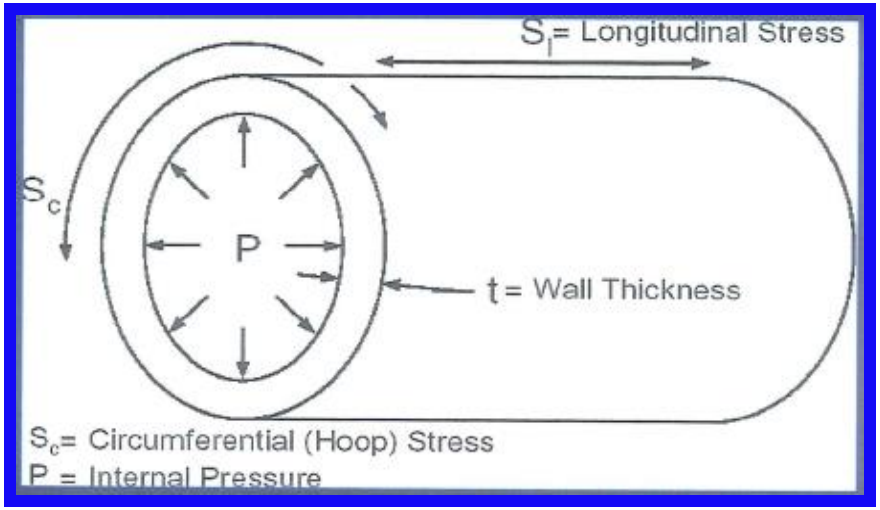
UPPER FIGURES
Wall Thickness
in inches

DIMENSIONS AND WEIGHTS OF SEAMLESS AND WELDED STEEL PIPE

LOWER FIGURES
Weight per foot
in pounds

IV. MATERIALS

A PIPE IS A TUBE WITH A ROUND CROSS SECTION HAVING AN OUTSIDE DIAMETER (O.D.) AND AN INSIDE DIAMETER (I.D.)



IV. MATERIALS

PIPES

MATERIAL STORAGE & HANDLING

Piping and materials are free from physical damages and missing or non-conforming items are identified, segregated or controlled and tracked.

Pipe and pipe nipples have the material specification and grade stamped, stenciled, or clearly marked with a permanent marking method.

Nipples are Schedule 80 minimum.

Threaded nipples are Schedule 80 minimum with threads to ASME B1.20.1 taper pipe thread.

All welding ends shall be beveled with an angle of 35 degrees, ± 5 degrees, & root face of 1.6 mm.

Bevels shall be either machine cut bevels or smooth, clean, slag-free flame cut. End plane shall be normal to the pipe axis as defined on the piping drawing, within 0.25 degrees. (SQUARENESS)

OTHER ACCEPTANCE CRITERIA SHALL BE SHOWN ON SAIC-L-2005

IV. MATERIALS

PIPES

MATERIAL HANDLING, & STORAGE

Pipe is not stored directly on the ground and is placed properly on mounds or sleepers.

End protectors on pipes, flanges, weld bevels, threads, and socket ends are firmly attached and free from damage.

Stainless steel materials are well protected against exposure to rain, elements and seawater splash during shipment and storage.

Coated pipe is handled at all times in a manner that prevents damage to the pipe walls, beveled ends, and to the coating (including internal coatings, if applied).

Coated pipes are stored at least 150 mm off the ground on either rock-free sand berms covered with polyethylene sheeting or on padded skids spaced and leveled so that the pipes are supported without damaging the coating.

OTHER ACCEPTANCE CRITERIA SHALL BE SHOWN ON SAIC-L-2005

IV. MATERIALS

FITTINGS

- A FITTINGS INCLUDE ELBOWS, TEES, REDUCERS, BRANCH CONNECTIONS AND INTEGRALLY REINFORCED CONNECTIONS.

IV. MATERIALS

FITTINGS

MATERIAL HANDLING, & STORAGE

Material is not rolled or dropped off trucks during unloading operations.

Fittings are stored in shipping crates or on racks off the ground.

Stainless steel materials are well protected against exposure to rain, elements and seawater splash during shipment and storage.

End bevel protectors remain on fittings while in storage and protectors do not cause damage to internal or external coating.

Slings used for lifting materials are nylon or similar material to prevent damage to the surfaces. Wire rope slings are not used. Metal hooks are padded to prevent contact damage to coating

Internally coated fittings are handled on outside diameter (OD) only

Coated materials are handled at all times in a manner that prevents damage to the fitting walls, beveled ends, and internal coatings.

OTHER ACCEPTANCE CRITERIA SHALL BE SHOWN ON SAIC-L-2006

IV. MATERIALS

VALVES

GATE VALVE : ON-OFF SERVICE, GOOD PRESSURE RETAINING CHARACTERISTICS.

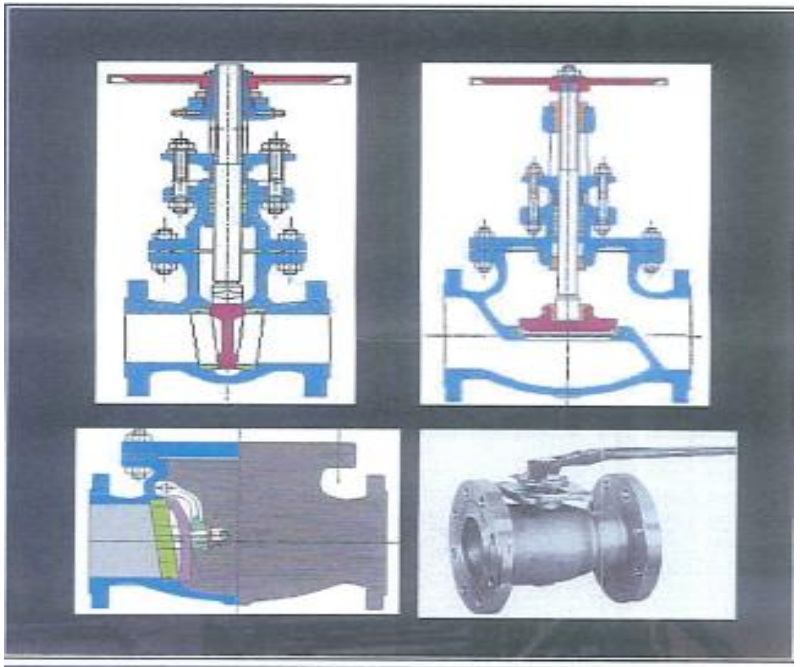
GLOBE VALVE : USE FOR THROTTLING

CHECK VALVE : USE TO PREVENT BACKFLOW – NORMALLY FLANGED

BALL VALVE : USE FOR ON-OFF AND THROTTLING – ¼ (90 DEG.) TURN FOR ON-OFF POSITION

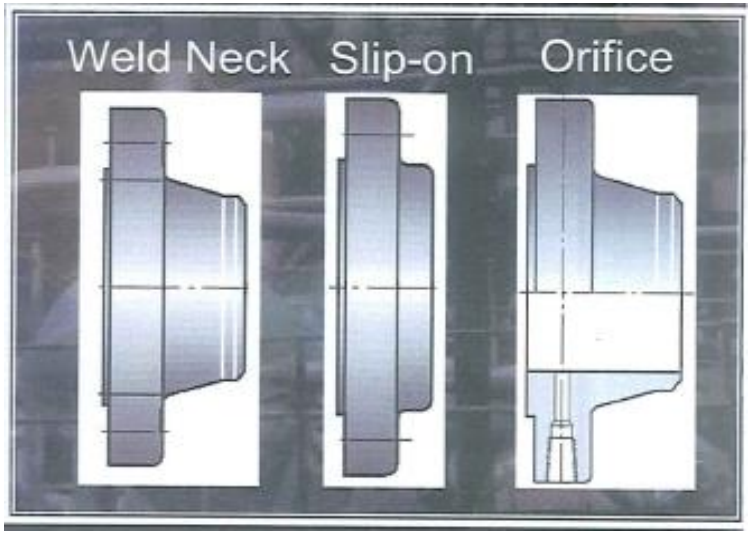
CONTROL VALVE : HAVE FOUR FUNCTIONS – CONTROL PRESSURE, FLOW, LEVEL , TEMPERATURE

BUTTERFLY VALVE : ECONOMICAL – FITS BETWEEN TWO FLANGES-USED IN WATER SYSTEMS



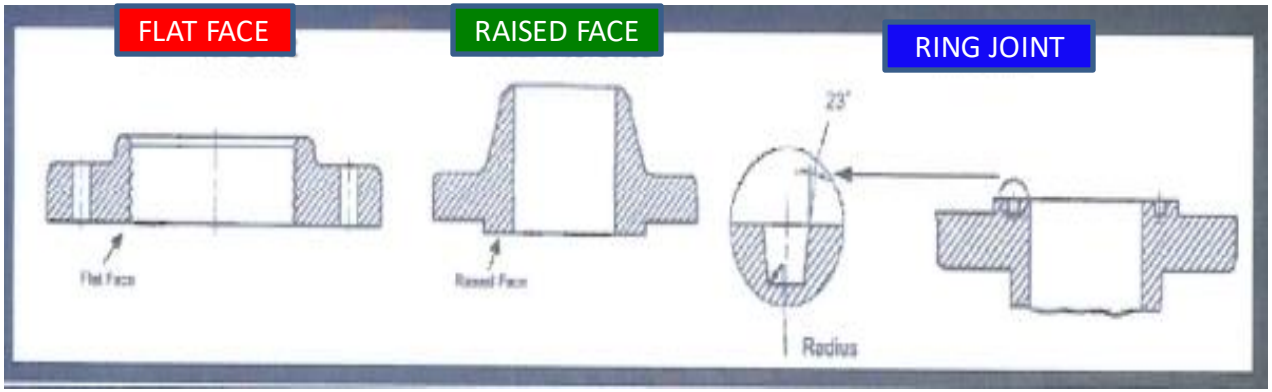
IV. MATERIALS

FLANGES DIFFER IN THE METHOD OF ATTACHMENT TO THE PIPE. THEY ARE WELDED (WELDING NECK OR SOCKET WELDED), SLIP-ON, SCREWED, LAPPED, BLIND, THREADED OR ORIFICE



IV. MATERIALS

FLANGE FACINGS – RAISED FACE, FLAT FACE, OR RING JOINT. RING JOINT FACINGS ARE UTILIZED ONLY IN HIGH PRESSURES OVER 900#.



IV. MATERIALS

FLANGES

MATERIAL HANDLING, & STORAGE

Material is not rolled or dropped off trucks during unloading operations.

Stainless steel materials are well protected against exposure to rain, elements and seawater splash during shipment and storage.

End bevel protectors remain on fittings while in storage and protectors do not cause damage to internal or external coating.

Slings used for lifting materials are nylon or similar material to prevent damage to the surfaces. Wire rope slings are not used. Metal hooks are padded to prevent contact damage to coating

Coated materials are handled at all times in a manner that prevents damage to the fitting walls, beveled ends, and internal coatings.

OTHER ACCEPTANCE CRITERIA SHALL BE SHOWN ON SAIC-L-2006

IV. MATERIALS

- A RESILIENT MATERIAL
- INSERTED BETWEEN FLANGES
- COMPRESSED BY BOLTS TO CREATE SEAL

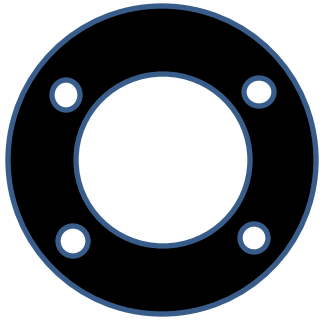
IV. MATERIALS

❖ COMMONLY USED TYPES:

- ➢ SHEET

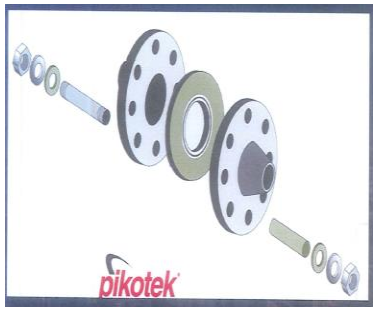
- ➢ SPIRAL WOUND

- ➢ RUBBER



- ➢ RING JOINT

- ➢ INSULATION



IV. MATERIALS

GASKETS

MATERIAL HANDLING, & STORAGE

Gaskets are visually checked during receiving in a clean area or warehouse appropriate to ensure gaskets, especially fillers and lubricated items are not fouled by sand and dust. Packaging is only opened as needed (due to oxidation and rusting concerns) to allow basic checks to assure gasket quality.

Contractor has a Color Code System (Gasket Service Chart) for all gaskets to be used on the project and the gaskets received are checked against the color code chart. Color code chart (gaskets) is clearly posted in storage area.

Contractor has a system of incoming gasket segregation in a warehouse or other approved facility that prevents mixing of incoming gaskets with those already received and accepted. Gaskets received, inspected and accepted are identifiable, yet any marking or color coding system for this inspection acceptance does not affect gasket sealing or serviceability.

IV. MATERIALS

GASKETS

MATERIAL STORAGE, & HANDLING

Segregation is achieved by clear separation, color coding and the marking of bins or areas where gaskets are located/stored

Gasket storage does not contribute to gasket damage:
A) Gaskets are not hung or stored vertically, but are stored flat to prevent distortion, especially gaskets 24 inches and larger.
B) Rusting of carbon steel items due to open plastic wrappings.
C) Excessive weight on gaskets and fillers due to stacking too high
D) Storage in not outdoors, nor on oily, dirty, sandy areas or on painted shelves that foul gaskets or accelerate corrosion..

OTHER ACCEPTANCE CRITERIA SHALL BE SHOWN ON SAIC-L-2007

V. PIPE FIT-UP AND TOLERANCES

DIMENSIONAL TOLERANCES FOR PIPING

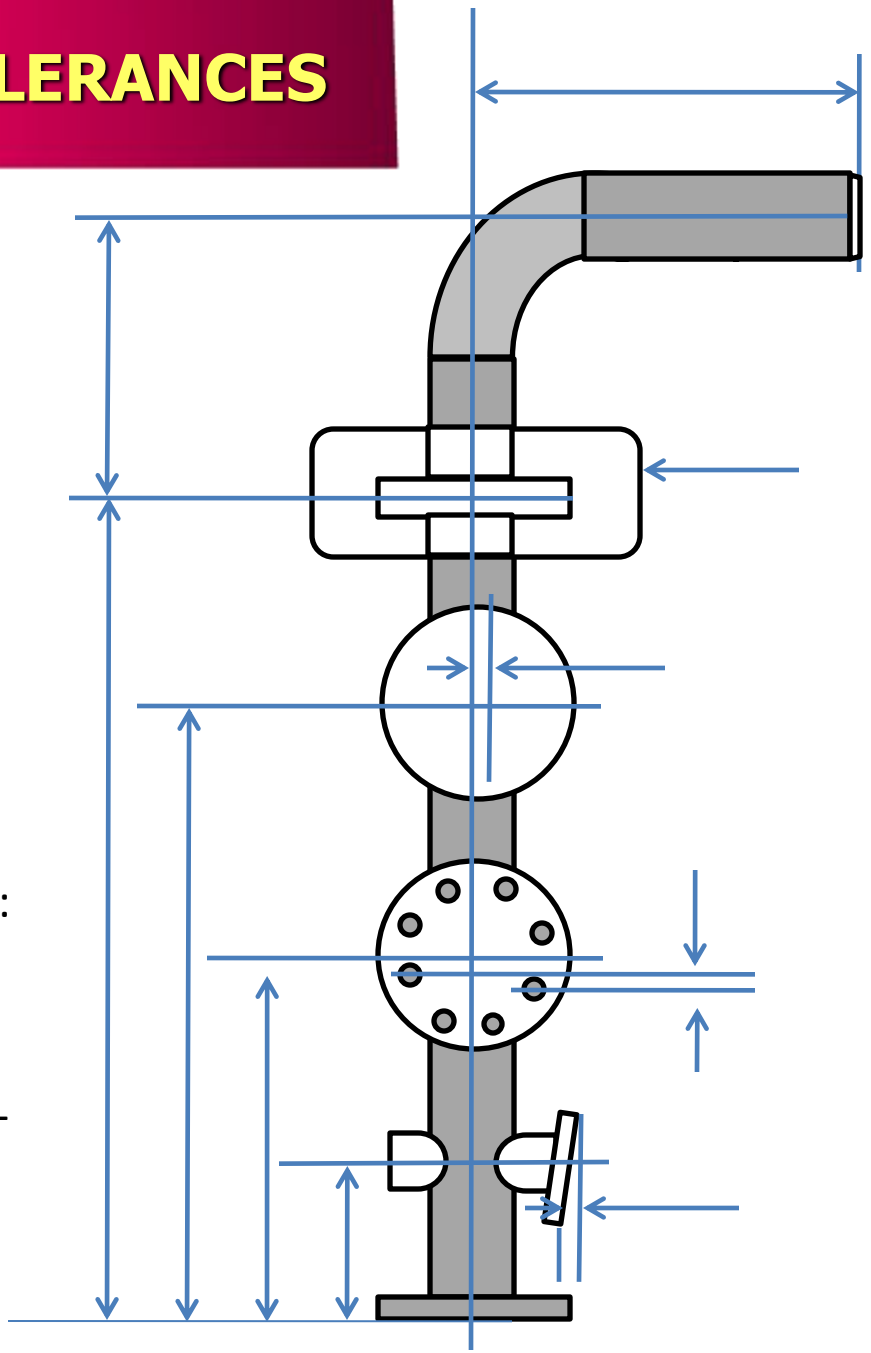
(1) MAXIMUM ALLOWABLE LOCATIONAL TOLERANCE : ±3 mm

(2) MAXIMUM HORIZONTAL OFF-SET OF BRANCHES, ETC. : ±1.5 mm

(3) MAXIMUM ALLOWABLE ROTATION OF FLANGE BOLT HOLE : ±2.4 mm

(4) INCLINATION OF FLANGE, MAXIMUM : ±1.6 mm

(5) FLANGE FACE SHALL BE PARALLEL WITHIN 0.5%, AND BOLT HOLES SHALL BE ALIGNED WITHIN 3 mm OFFSET



VI. FABRICATION & INSTALLATION REQUIREMENTS

FOR SHOP & FIELD GENERAL REQUIREMENTS

1. **PRIOR TO FABRICATION, MATERIALS SUCH AS PIPES, FLANGES, VALVES, TEES, ELBOWS, ETC. SHALL BE CHECKED AGAINST THE RELEVANT DRAWINGS AND SPECIFICATIONS**

VI. FABRICATION & INSTALLATION REQUIREMENTS

FOR SHOP & FIELD GENERAL REQUIREMENTS

2. PIPING LINE IDENTIFICATION SYMBOL

6” – FG – 123 – 1CS2P03

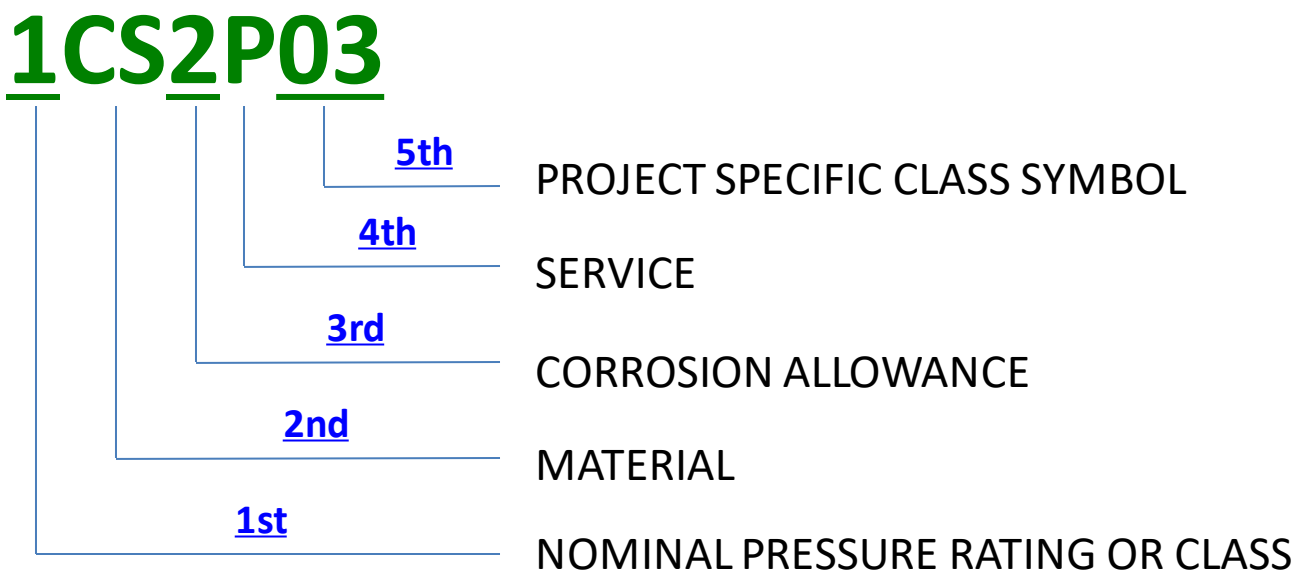
- LINE SIZE
- SERVICE CODE
- LINE NUMBER
- PIPING CLASS DESIGNATION CODE

VI. FABRICATION & INSTALLATION REQUIREMENTS

FOR SHOP & FIELD GENERAL REQUIREMENTS

2. PIPING LINE IDENTIFICATION SYMBOL

PIPING CLASS DESIGNATION CODE FAMILIARIZATION



VI. FABRICATION & INSTALLATION REQUIREMENTS

FOR SHOP & FIELD GENERAL REQUIREMENTS

2. PIPING LINE IDENTIFICATION SYMBOL

PIPING CLASS DESIGNATION CODE FAMILIARIZATION

1st NOMINAL PRESSURE RATING OR CLASS

Digit	Description	Digit	Description
(ASME B16.5 / B16.47 Flange Class)		**(ASME B16.1 Cast Iron Flange Class)**	
1	150	12	125
3	300	13	250
4	400	**(Specific Rating Designations)**	
6	600	50	Tubing (Component Rated)
9	900	80	Non-pressure
15	1500	85	Pressure Class 75/150 RF
25	2500	90	Class 3000, API 6A
		95	Class 10000, API 6A

VI. FABRICATION & INSTALLATION REQUIREMENTS

FOR SHOP & FIELD GENERAL REQUIREMENTS

2. PIPING LINE IDENTIFICATION SYMBOL

PIPING CLASS DESIGNATION CODE FAMILIARIZATION

2nd MATERIAL

Digit	Description	Digit	Description	Digit	Description
CA	Impact Tested Carbon Steel (for low temp. service)	DC	Cast Iron, Grey	NX	Titanium Grade 2
CB	Not used	FE	Glass Fiber Reinforced Epoxy	PU	CPVC (Chlorinated PVC)
CC	Carbon Steel (low carbon)	FF	Glass Fiber Vinyl Ester	PV	PVC (Polyvinyl Chloride)
CS	Carbon steel	GC	Refractory Lined Carbon Steel	SA	304 Stainless Steel
CG	Galvanized Carbon Steel	LC	Cement-lined Carbon Steel	SC	304L, 304H Stainless Steel
CJ	1-1/4 Cr-1/2 Mo Alloy Steel	LE	Epoxy-lined Carbon Steel	SD	316L Stainless Steel
CK	2-1/4 Cr-1 Mo Alloy Steel	LP	Polypropylene-lined Carbon Steel	SJ	321 Stainless Steel
CL	5 Cr-1/2 Mo Alloy Steel	NH	Hastelloy C276	SV	254 SMO (UNS S31254 or equivalent)
CM	9 Cr-1 Mo Alloy Steel	NM	Monel 400	SX	Duplex Stainless Steel
BC	Copper Tubing	NR	Incoloy 800	TX	Aluminum Alloys
BD	90-10 Cu-Ni	NT	Carpenter 20 (Alloy 20)		

VI. FABRICATION & INSTALLATION REQUIREMENTS

FOR SHOP & FIELD GENERAL REQUIREMENTS

2. PIPING LINE IDENTIFICATION SYMBOL

PIPING CLASS DESIGNATION CODE FAMILIARIZATION

3rd CORROSION ALLOWANCE

Digit	Description
0	Zero Corrosion allowance
1	1.6 mm
2	3.2 mm
3	4.8 mm
4	6.4 mm
9	Corrosion Allowance as noted. Refer to SAES-L-133 for specific corrosion protection requirements.

VI. FABRICATION & INSTALLATION REQUIREMENTS

FOR SHOP & FIELD GENERAL REQUIREMENTS

2. PIPING LINE IDENTIFICATION SYMBOL

PIPING CLASS DESIGNATION CODE FAMILIARIZATION

4th SERVICE

Digit	Description
A	Acid
C	Caustic
H	Hydrogen
P	Process (General Hydrocarbon) Utilities (plant air, nitrogen, steam, condensate, BFW etc. may be included for consolidation and reduction in required piping classes only, additions subject to client approval.
Q	Chlorination Gas (Owner Designator)
T	Wellhead Piping (Owner Designator)
U	Utilities (may include water)
W	Water

VI. FABRICATION & INSTALLATION REQUIREMENTS

FOR SHOP & FIELD GENERAL REQUIREMENTS

2. PIPING LINE IDENTIFICATION SYMBOL

PIPING CLASS DESIGNATION CODE FAMILIARIZATION

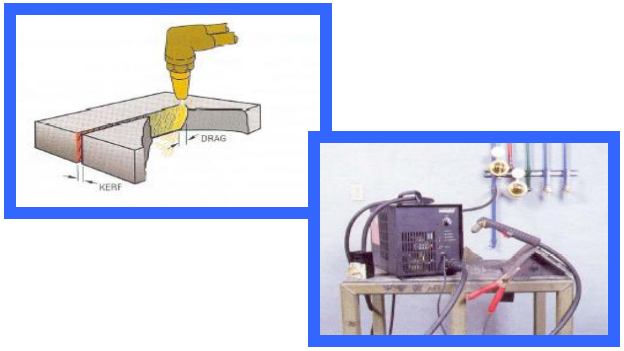
5th PROJECT SPECIFIC CLASS SYMBOL

Digit	Description	Digit	Description
01	Hydrocarbon Process Non Sour – ASME B31.3	09	Sulphuric Acid / Sulphur Jacketed / Extended Bonnet
02	Wet Sour H2S (NACE) ASME B31.3	10	Caustic
03	Severe Wet Sour H2S (NACE_HIC Test if CS or LTCS) ASME B31.3	11	Severe Wet Sour H2S (NACE_HIC Test if CS or LTCS) ASME B31.4
04	Caustic	12	Spare
05	Steam (ASME B31.3)	13	Oily Water Sewer (DP>175 psig)
06	Caustic / Acid	14	Spare
07	Amines	15	Steam Boiler Code (ASME B31.1)
08	Sulphuric Acid / Sulphur / Chemical Dosing	16	Water and other utilities

VI. FABRICATION & INSTALLATION REQUIREMENTS

2. CUTTING OF PIPES SHALL BE DONE EITHER BY :

MECHANICAL MEANS **OR** ARC CUTTING



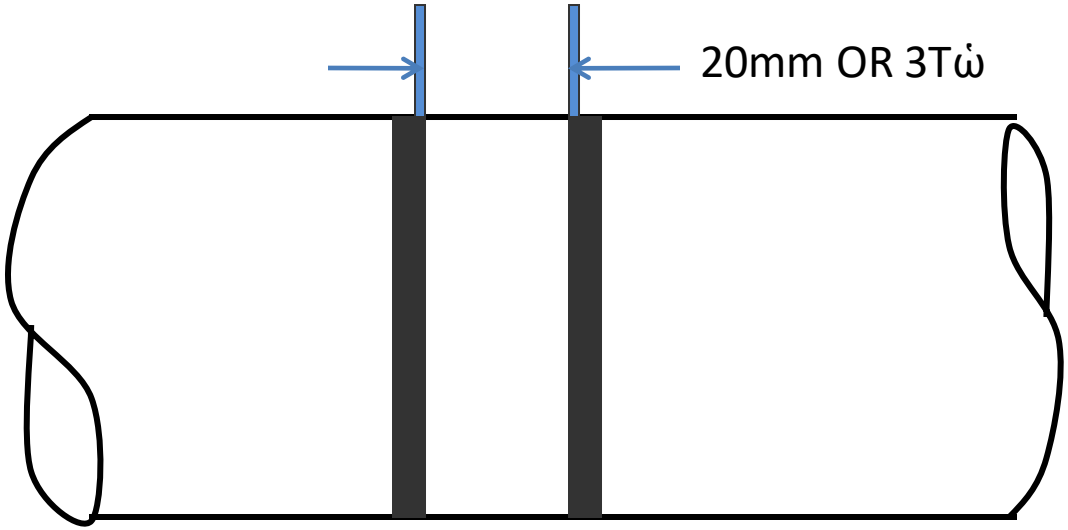
FOR CS: CUTTING DISC **OR** FLAME CUTTING

FOR SS: CUTTING DISC **OR** PLASMA CUTTING

VI. FABRICATION & INSTALLATION REQUIREMENTS

3. WELD ENCROACHMENT AND MINIMUM DISTANCE BETWEEN WELDS SHALL BE :

THE MINIMUM DISTANCE BETWEEN PARALLEL BUTT WELDS SHALL BE 20 mm OR THREE TIMES THE WALL THICKNESS OF THE JOINT, WHICHEVER IS GREATER.



VI. FABRICATION & INSTALLATION REQUIREMENTS

4. REINFORCING PAD

IT IS A WELDED ATTACHMENT FOR WELDED TYPE BRANCH

NOTE:

a. PRESSURE TESTING FOR REINFORCING PAD SHALL BE PERFORMED WITH THE CONDITION BELOW:

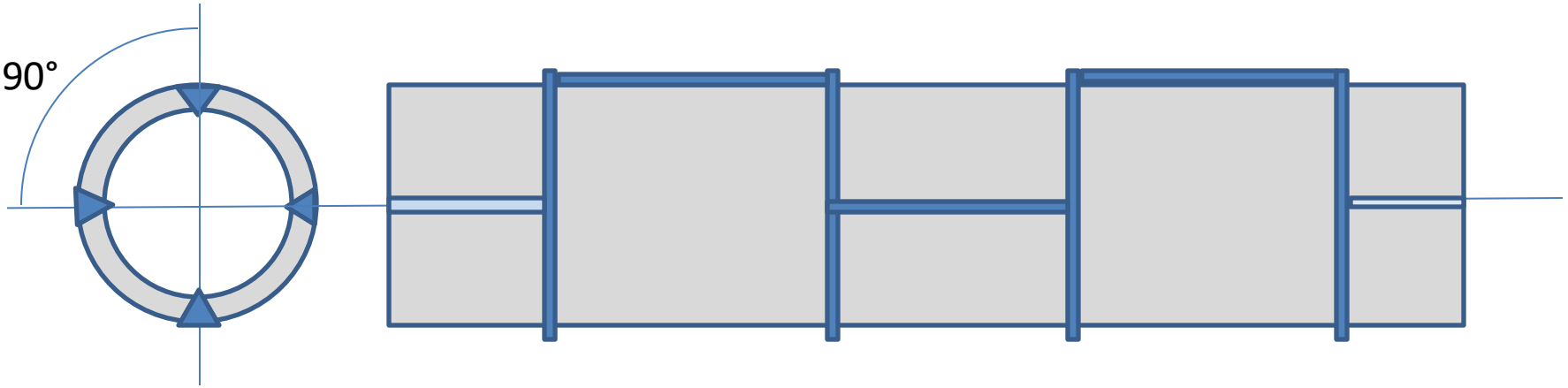
PRESSURE	:	25 PSI
HOLDING TIME	:	UNTIL COMPLETION OF SOAP TEST
TAP SIZE	:	6 mmØ

- THE TAPPED VENT HOLES SHALL BE PACKED WITH HEAVY GREASE AFTER THE COMPLETION OF SOAP TEST.

VI. FABRICATION & INSTALLATION REQUIREMENTS

5. CIRCUMFERENTIAL OFFSET

PREFERABLY, THE DISTANCE (CIRCUMFERENTIAL OFFSET) BETWEEN LONGITUDINAL WELDS OF ADJACENT PIPE JOINTS SHALL BE 90 DEGREES APART.

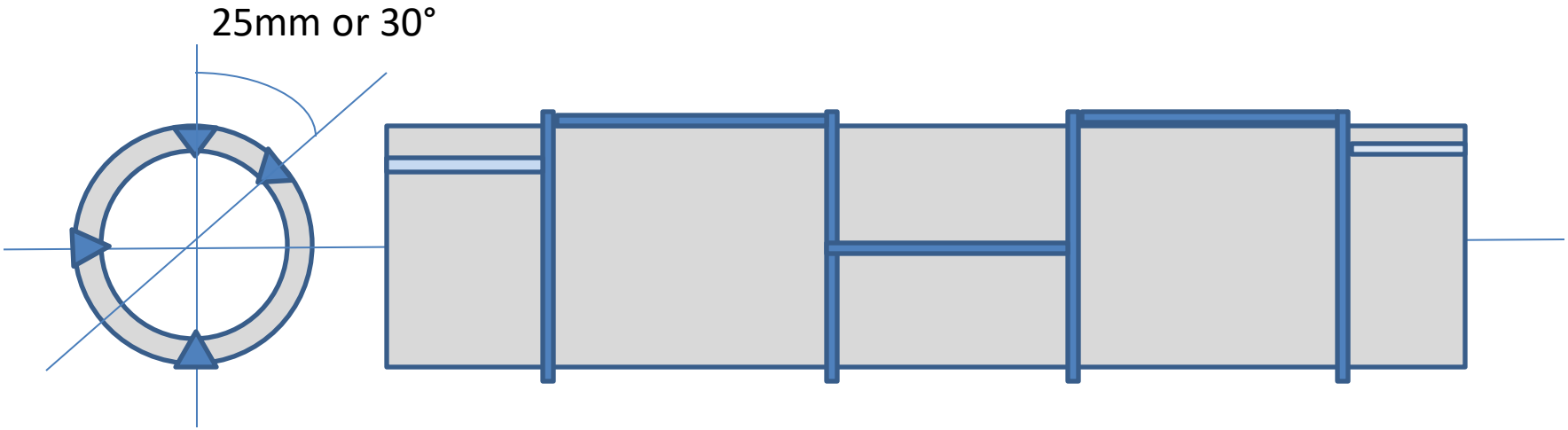


VI. FABRICATION & INSTALLATION REQUIREMENTS

5. CIRCUMFERENTIAL OFFSET

MINIMUM REQUIREMENT

- **PIPING DESIGNED BY 31.3 : AT LEAST 25mm OR 30°**

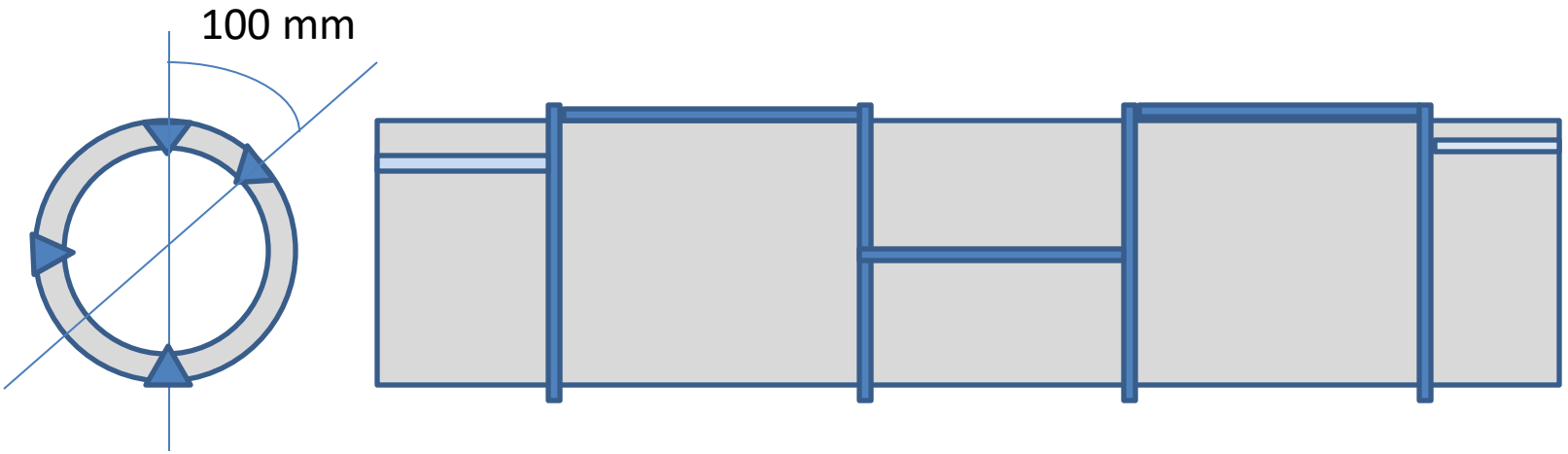


VI. FABRICATION & INSTALLATION REQUIREMENTS

5. CIRCUMFERENTIAL OFFSET

MINIMUM REQUIREMENT

- **PIPING DESIGNED BY 31.4 : AT LEAST 100mm APART**



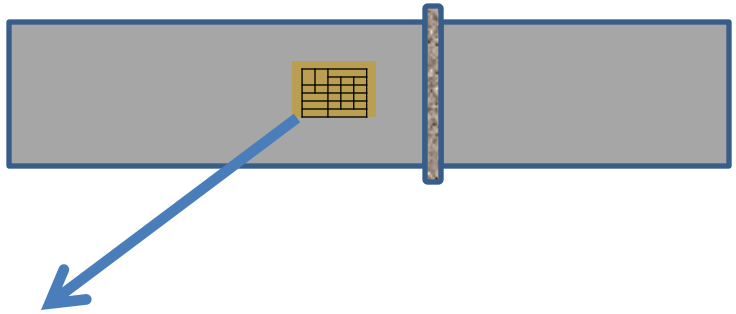
THE POSITION OF THE LONGITUDINAL WELD SHALL BE INDICATED ON SPOOL ERECTION DRAWING AND SPOOL PIECE DRAWING.

VI. FABRICATION & INSTALLATION REQUIREMENTS

6. JOINT BOX

ALL WELD JOINTS SHALL BE MARKED FOR IDENTIFICATION AS PER SKETCH BELOW

(1) JOINT NO. (SHOWN ON SPOOL ERECTION DRAWING)
(2) WPS NO.
(3) WELDER NO. (SHOWN ON SPOOL ERECTION DWG)
(4) WELDING ROD/ELECTRODE
(5) COLOR CODE OF WELDING ROD/ELECTRODE
(6) DRAWING NO.



Joint No. (1)	WPS No. (2)	Welder No. (3)		
		Root	Hot	Fill & Cap
001	ARCC-EEI-004	W-AR-547	W-AR-547	W-AR-547
Welding Rod/Electrode (4)		ER70S-6	ER70S-6	E7018
Color Code of Welding Rod / Electrode (5)		BLUE	BLUE	
Drawing No. (6)		A000-Q34-P-1010 REV. A0		

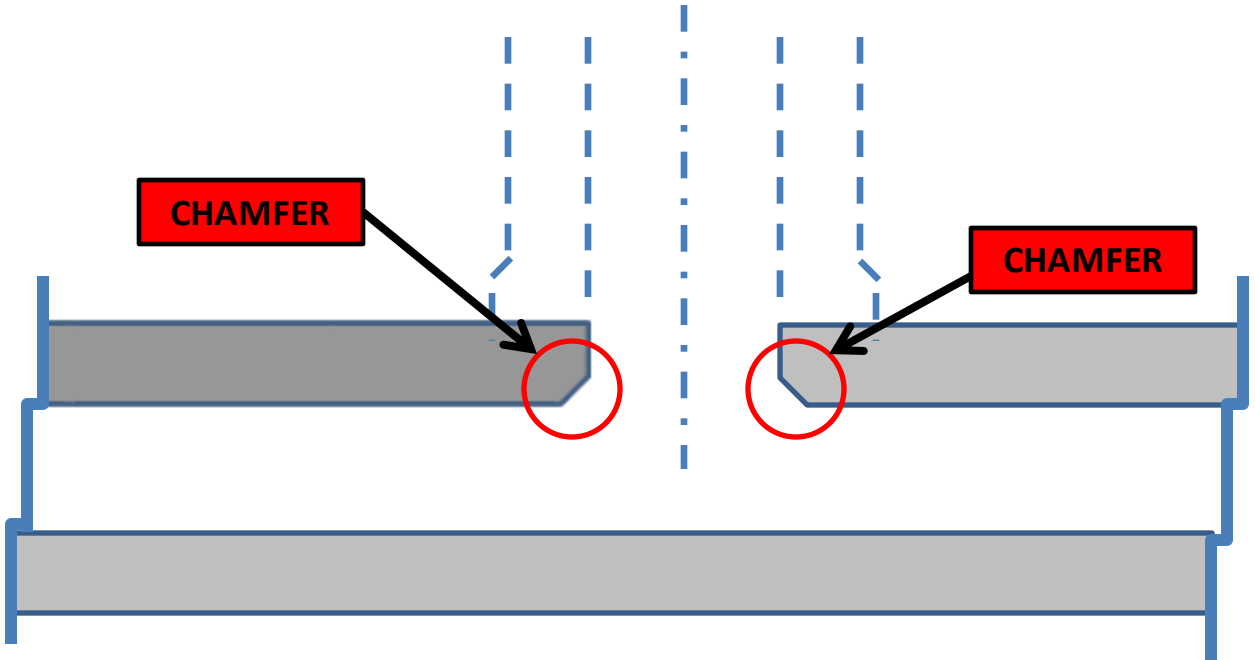
NOTE:

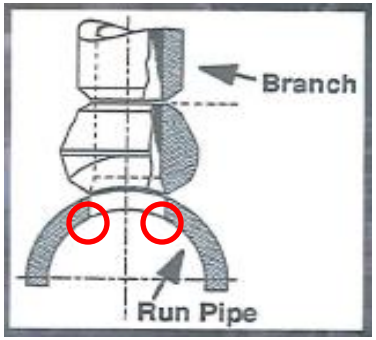
WHEN PIPING SIZE IS TOO SMALL TO USE THE INDICATED TABLE SHOWN, THE INFORMATION SHALL BE WRITTEN IN A ROW CLEARLY WITHOUT USING THE TABLE

VI. FABRICATION & INSTALLATION REQUIREMENTS

7. INTERNAL LINED PIPING

SPECIAL CAUTION SHALL BE TAKEN TO INTERNAL LINED PIPING. INSIDE BEAD SHALL BE AS SMOOTH AS POSSIBLE AND THE HEIGHT SHALL BE AS SMALL AS POSSIBLE FOR SECURE CONTACT WITH LINING. HOLE OF NOZZLE-WELD (INTERNAL-SIDE) SHALL BE APPLIED CHAMFER PRIOR TO SUBSEQUENT WELDING DUE TO THE SAME REASON.





SECTION

VI. FABRICATION & INSTALLATION REQUIREMENTS

8. WELDING ATTACHMENTS

ANY WELDING ATTACHMENTS SUCH AS SUPPORT, PAD, ANTI-VIBRATION BRACE, ETC. SHALL BE COMPLETELY WELDED TO SPOOL OR PIPE WHERE THEY ATTACH PRIOR TO INTERNAL LINING WORK, BECAUSE THE HEAT BY WELDING ON OUTSIDE THE SPOOL/PIPE TRAVELS TO INSIDE THE SPOOL/PIPE AND THEN DAMAGES THE INTERNAL LINING MATERIAL.

ALL WELDS TO THE PIPE SHALL BE CONTINUOUS WITH SMOOTH FINISH. SPOT WELDING IS NOT ACCEPTABLE AS PER SAES-L-350 SECT. 11.

VI. FABRICATION & INSTALLATION REQUIREMENTS

9. JOINTS

A. BUTT JOINT

B. SOCKET JOINT

REFER TO SAIC-W-2037

C. THREADED JOINT

REFER TO SAIC-L-2015

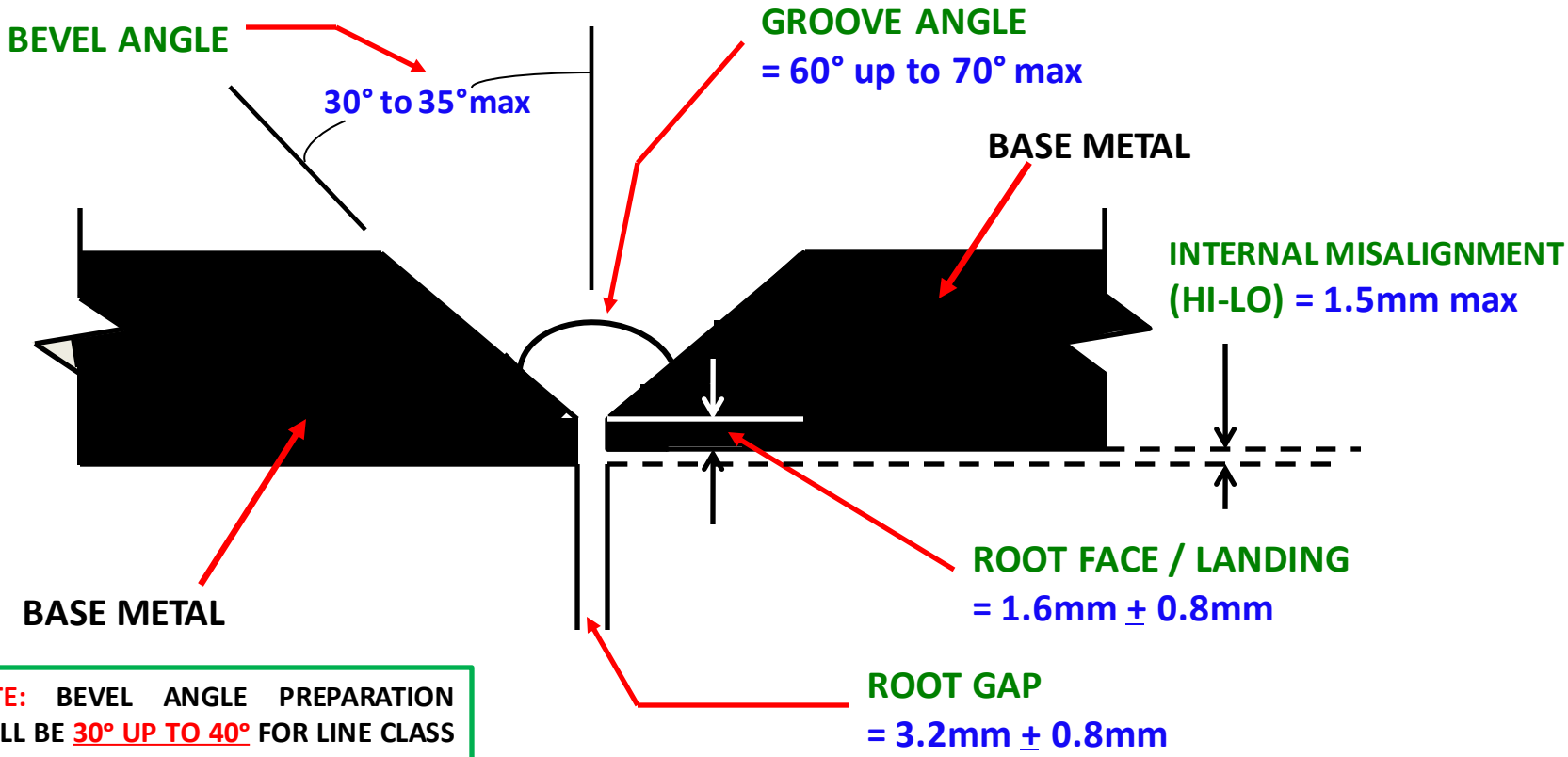
D. FLANGED JOINT

REFER TO SAIC-L-2014

VI. FABRICATION & INSTALLATION REQUIREMENTS

9. JOINTS

A. **BUTT JOINT** – A JOINT BETWEEN TWO MEMBERS ALIGNED APPROXIMATELY IN THE SAME PLANE.



NOTE: BEVEL ANGLE PREPARATION SHALL BE 30° UP TO 40° FOR LINE CLASS OF 1CA2P03, 1CS2P03, & 1LE0P03

VI. FABRICATION & INSTALLATION REQUIREMENTS

9. JOINTS

A. BUTT JOINT

AS PER JGC SPECIFICATION :

UNLESS SPECIFIED OTHERWISE IN THE QUALIFIED WELDING PROCEDURE, A ROOT GAP OF ABOUT 3mm SHALL BE REQUIRED FOR JOINTS (INCLUDING BRANCH CONNECTIONS).

EXCEPTION:

if Tw < 4.5mm, Root Gap shall be 1.5mm to 3mm max.

if reinforcing pad is attached on the pipe, 1.5mm max. gap shall exist between their periphery measured before welding.

VI. FABRICATION & INSTALLATION REQUIREMENTS

9. JOINTS

A. BUTT JOINT

PRIOR TO START WELDING, THE FOLLOWING SHALL BE CHECKED,

1. CLEANLINESS OF INSIDE PIPING
2. BEVEL ANGLE AND ROOT FACE
3. CLEANLINESS OF GROOVE
4. ALIGNMENT OF PIPING

VI. FABRICATION & INSTALLATION REQUIREMENTS

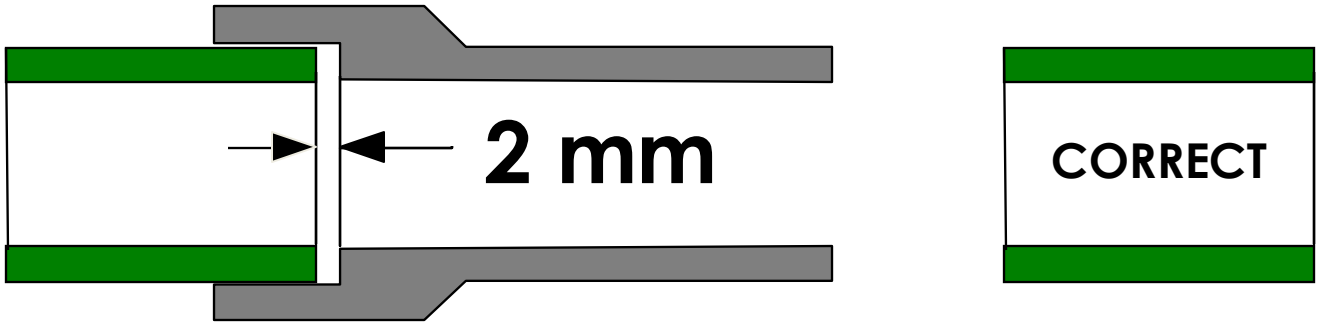
9. JOINTS

B. SOCKET WELDING JOINT

REFER TO SAIC-W-2037

THE AXIAL GAP BETWEEN MALE AND FEMALE COMPONENT SHALL BE MAXIMUM OF 3mm AND A MINIMUM OF 1.5mm. ✓

ACCEPTABLE

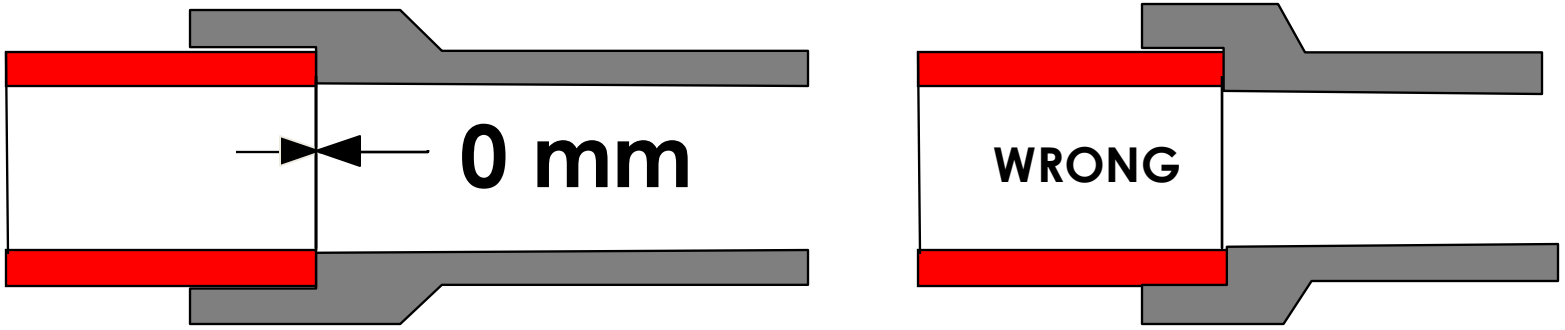


VI. FABRICATION & INSTALLATION REQUIREMENTS

9. JOINTS

B. SOCKET WELDING JOINT

NO GAP SHALL NOT BE ACCEPTABLE

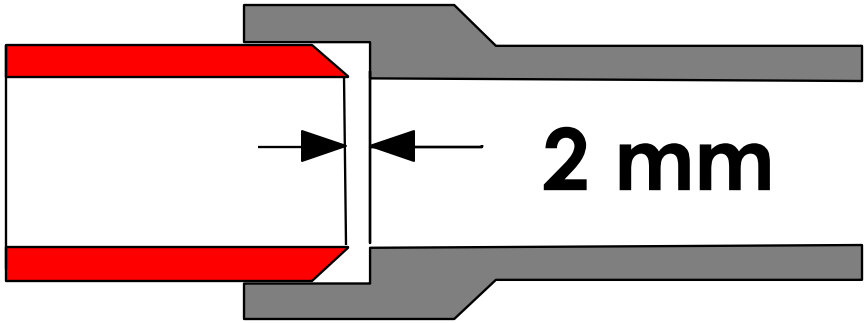


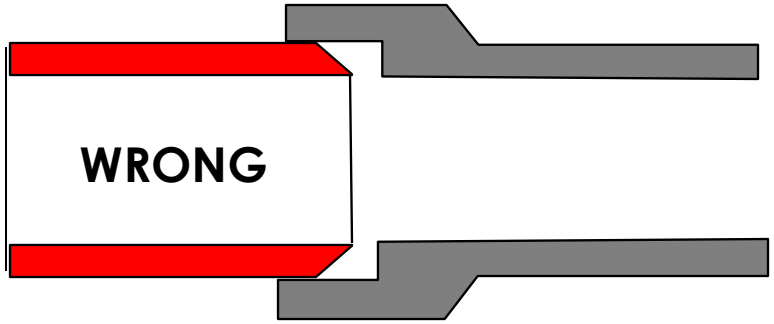
VI. FABRICATION & INSTALLATION REQUIREMENTS

9. JOINTS

B. SOCKET WELDING JOINT

BEVEL END SHALL NOT BE ACCEPTABLE



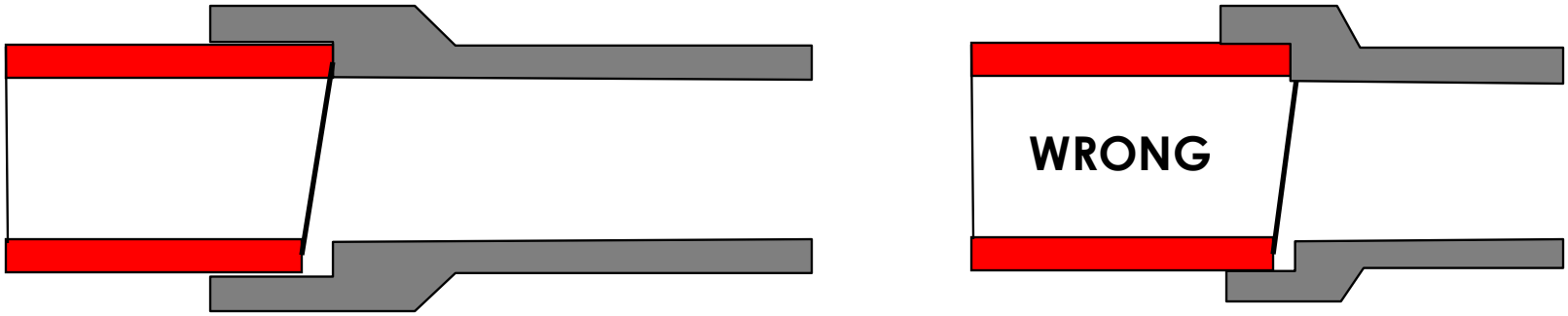


VI. FABRICATION & INSTALLATION REQUIREMENTS

9. JOINTS

B. SOCKET WELDING JOINT

CUTTING NOT SQUARE SHALL NOT BE ACCEPTABLE

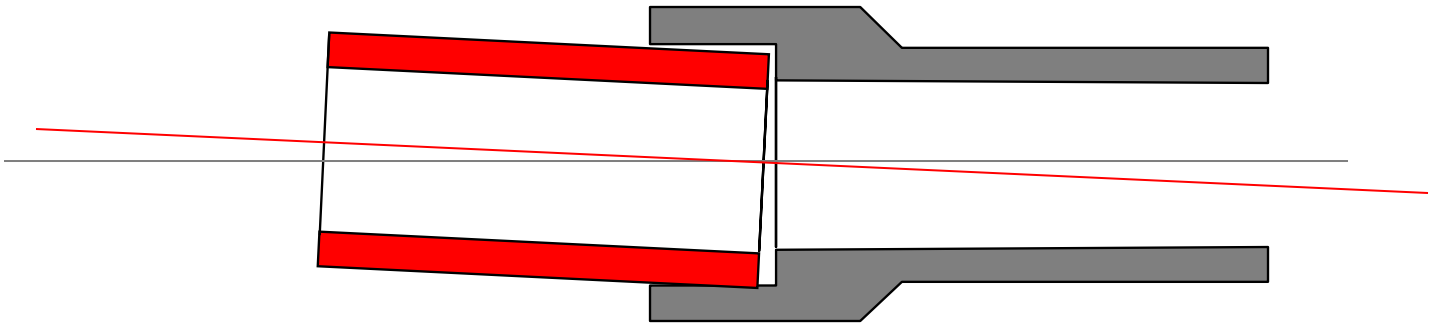


VI. FABRICATION & INSTALLATION REQUIREMENTS

9. JOINTS

B. SOCKET WELDING JOINT

MISALIGN SHALL NOT BE ACCEPTABLE



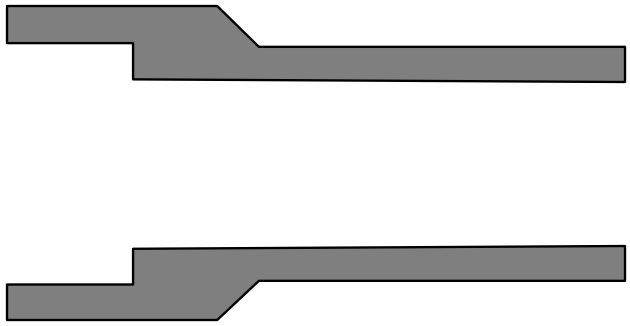
VI. FABRICATION & INSTALLATION REQUIREMENTS

9. JOINTS

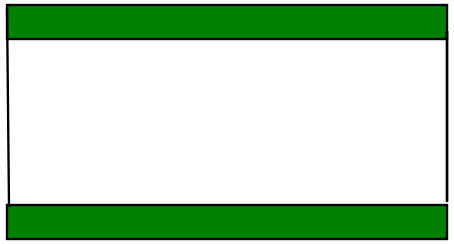
B. SOCKET WELDING JOINT

TYPICAL STEPS IN FIT-UP OF SOCKET JOINT

STEP 1 : CLEAN SOCKET END



STEP 2 : CUT PIPE NICE AND SQUARE



VI. FABRICATION & INSTALLATION REQUIREMENTS

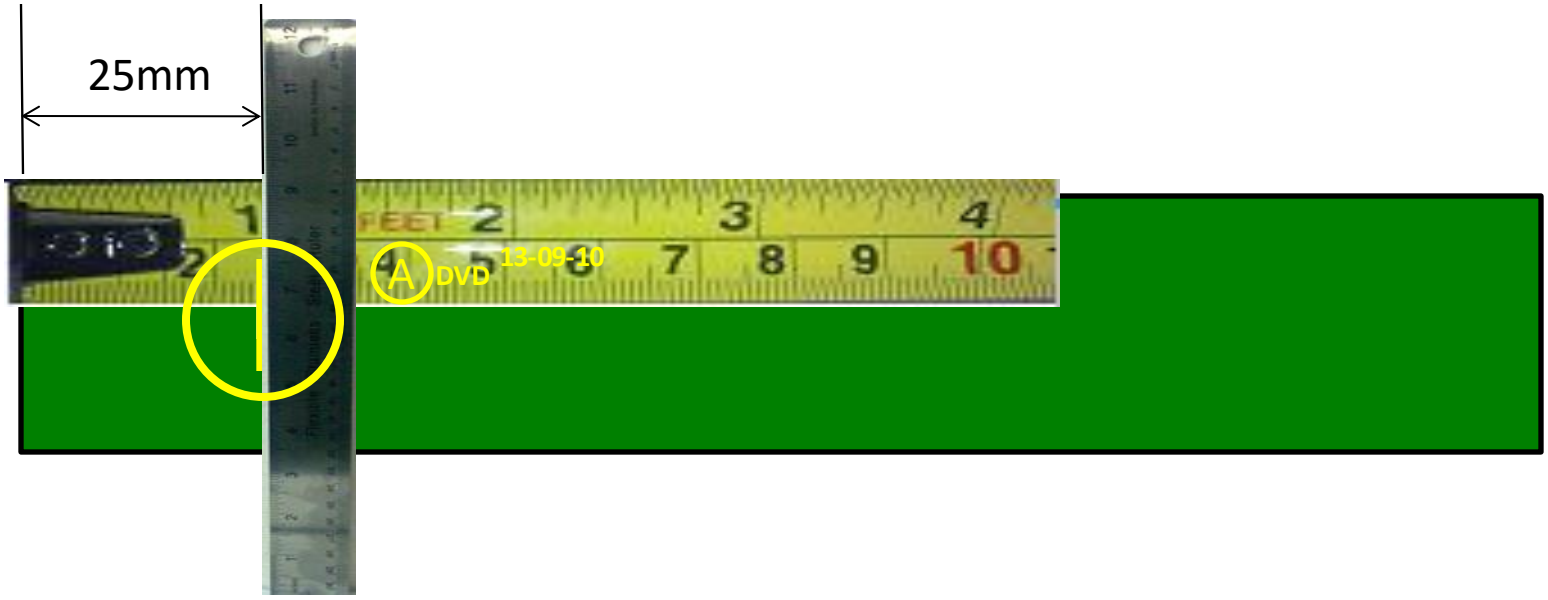
9. JOINTS

B. SOCKET WELDING JOINT

STEP 3 : MECHANICAL MARK – A 25mm RULE

A. MARK A POINT EXACTLY 25mm FROM PIPE END

B. QC WILL WITNESS DIMENSION. (QC SHALL USE PERMANENT SHARPY PEN OR MARKER AND CIRCLE THE 25mm VERIFICATION MARK).



VI. FABRICATION & INSTALLATION REQUIREMENTS

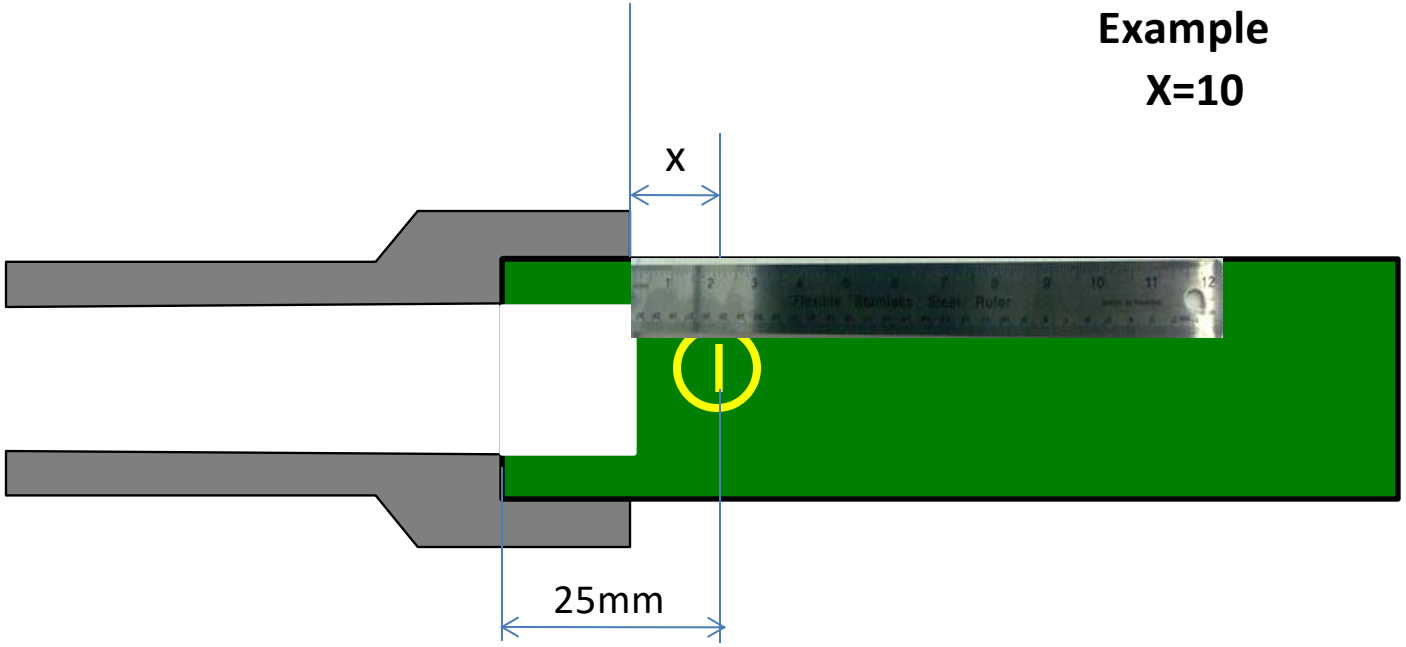
9. JOINTS

B. SOCKET WELDING JOINT

STEP 4 : INSERT THE PIPE FULLY INTO THE SOCKET UNTIL THE PIPE CONTACTS TO THE INNER SOCKET FACE. THEN MEASURE THE DISTANCE FROM EDGE OF FITTING TO THE MARK.

Example

X=10

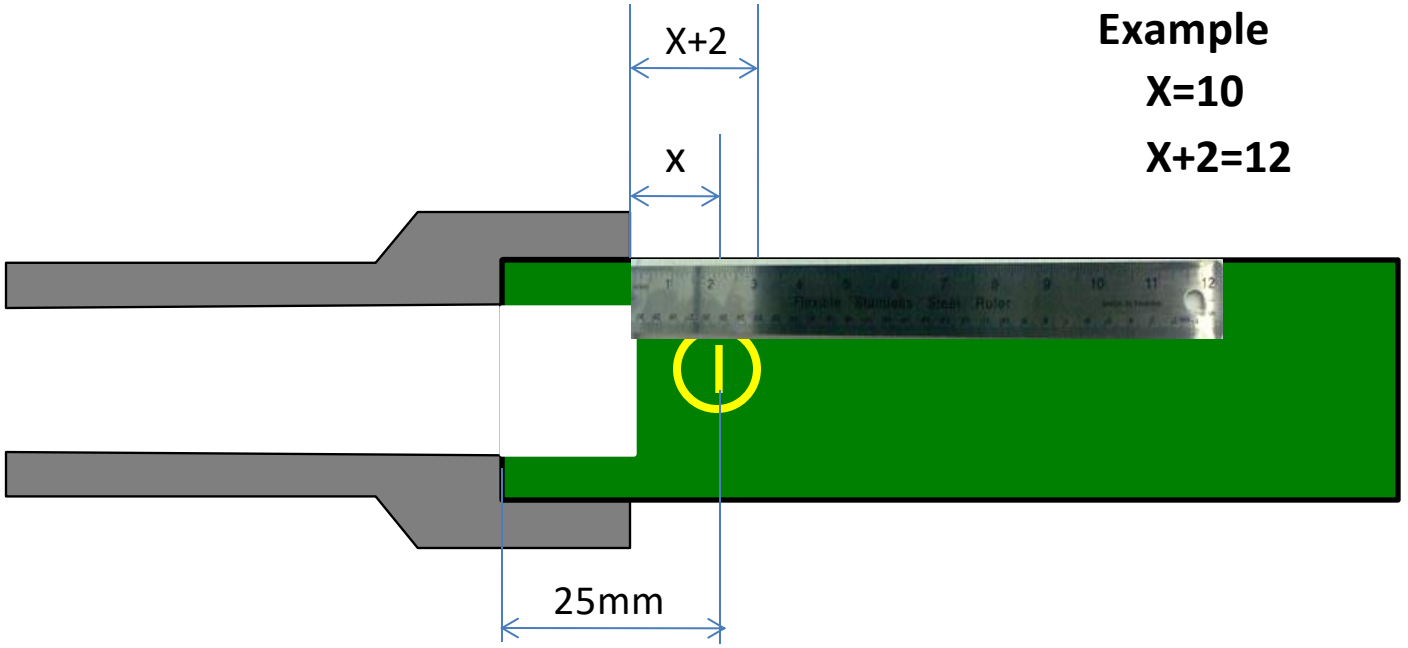


VI. FABRICATION & INSTALLATION REQUIREMENTS

9. JOINTS

B. SOCKET WELDING JOINT

STEP 5 : RETRACT PIPING 2mm ABOVE THE EDGE OF THE FITTING USING THE MARK AS REFERENCE.



Example

X=10

X+2=12

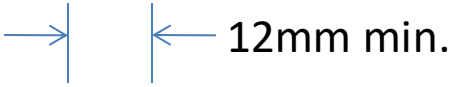
VI. FABRICATION & INSTALLATION REQUIREMENTS

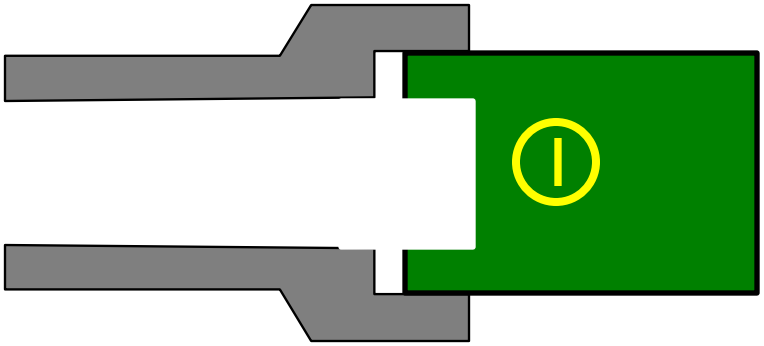
9. JOINTS

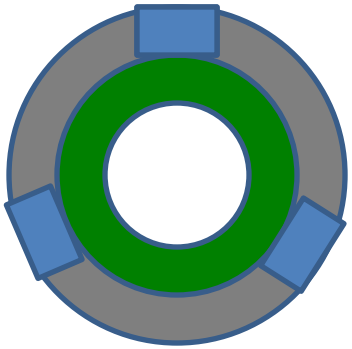
B. SOCKET WELDING JOINT

STEP 6 : TACK WELD THE JOINT.

THEN ENDORSE TO QC PRIOR SEAL WELDING.







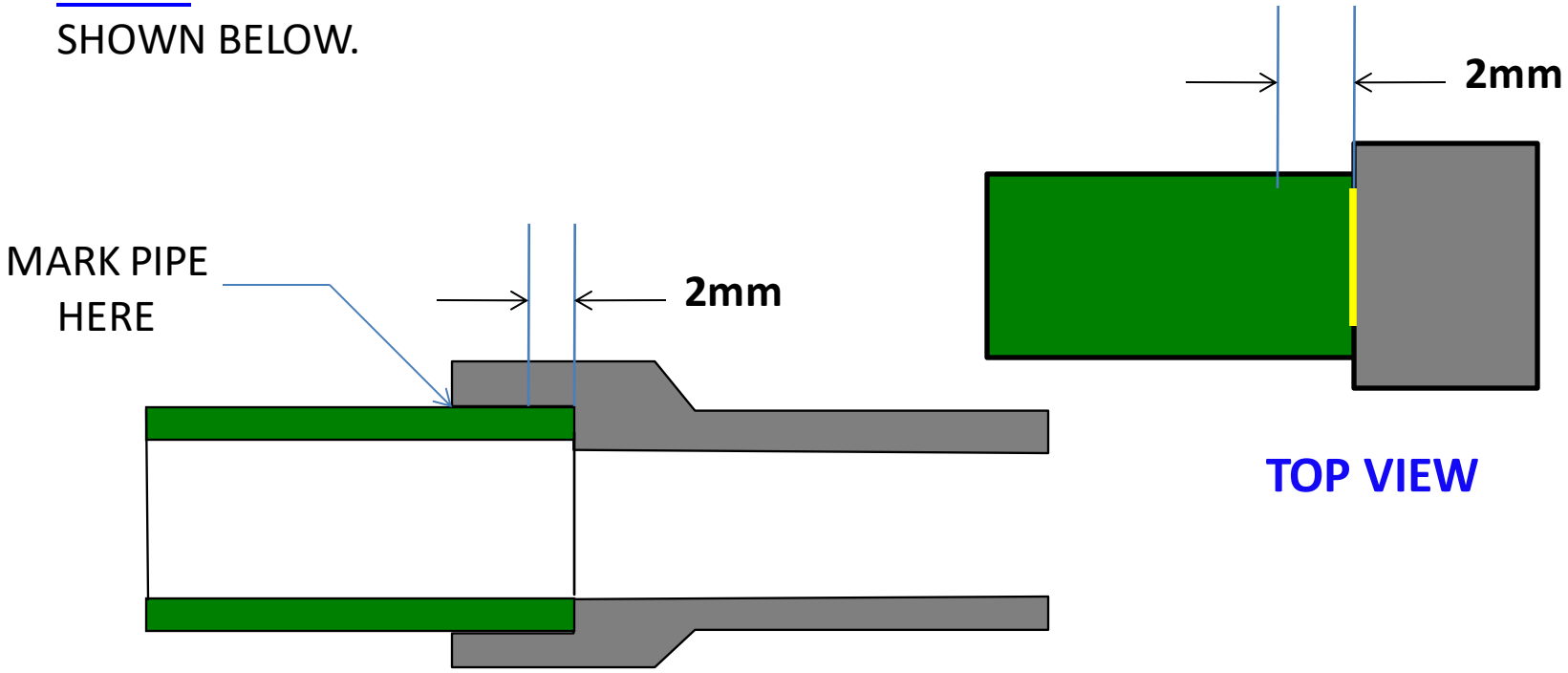
VI. FABRICATION & INSTALLATION REQUIREMENTS

9. JOINTS

PREVIOUS

B. SOCKET WELDING JOINT

STEP 4 : PULL OUT CUT PIPE UNTIL MARKING IS 2mm FROM SOCKET END AS SHOWN BELOW.



VI. FABRICATION & INSTALLATION REQUIREMENTS

9. JOINTS

C. THREADED JOINT

1. IN CASE OF SEAL WELDING REQUIRED FOR THREADED CONNECTIONS, IT SHALL MEET THE REQUIREMENTS SPECIFIED IN PARA. 8 OF SAES-L-110.

2. THREADED PLUGS ON HYDROSTATIC VENTS, NOT PROVIDED WITH A VALVE, SHALL BE SEAL WELDED AFTER TESTING HAS BEEN CARRIED OUT.

3. THREADED CONNECTIONS, EXCEPT FOR 1 & 2, SHALL BE SEALED AS FOLLOWS:
   - DESIGN TEMP. 400 °F (204 °C) & BELOW – USE **LOCTITE** (OR PTFE JOINTING TAPE, APPROVED JOINTING COMPOUND).
   - DESIGN TEMP. ABOVE 400 °F (204 °C) – SEAL WELD WHEREVER POSSIBLE, OTHERWISE JOINTING COMPOUND MUST BE APPLIED AFTER JGC's APPROVAL.

4. SEALING COMPOUNDS OR TAPES SHALL NOT BE USED ON JOINTS THAT ARE TO BE SEAL WELDED.

VI. FABRICATION & INSTALLATION REQUIREMENTS

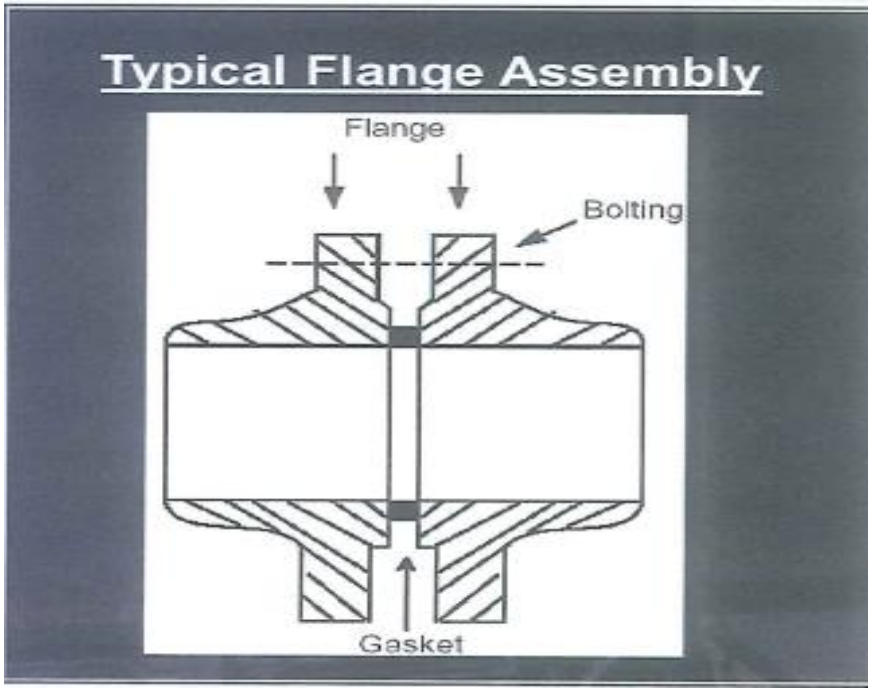
9. JOINTS

C. FLANGED JOINT

A JOINT IN A PIPING SYSTEM IS ACHIEVED BY 1.) WELDING 2.) THREADING 3.) FLANGES

A FLANGE JOINT IS COMPOSED OF THREE INDEPENDENT AND SEPARATE COMPONENTS :

1. **FLANGE**
2. **GASKET**
3. **BOLTING**



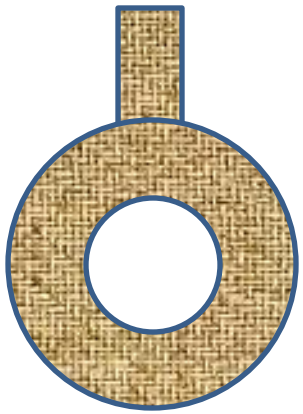
VI. FABRICATION & INSTALLATION REQUIREMENTS

9. JOINTS

C. FLANGED JOINT

- **FOR TEMPORARY GASKET**

WHEN TEMPORARY GASKET TO BE USED IN LINE, ITS GASKETS SHALL BE PAINTED OTHER THAN ORANGE / WHITE / RED / BLUE COLOUR ON ALL AROUND SURFACE. (RECOMMENDED COLOR IS **YELLOW** AS PER JAL SPECIFICATION)



VI. FABRICATION & INSTALLATION REQUIREMENTS

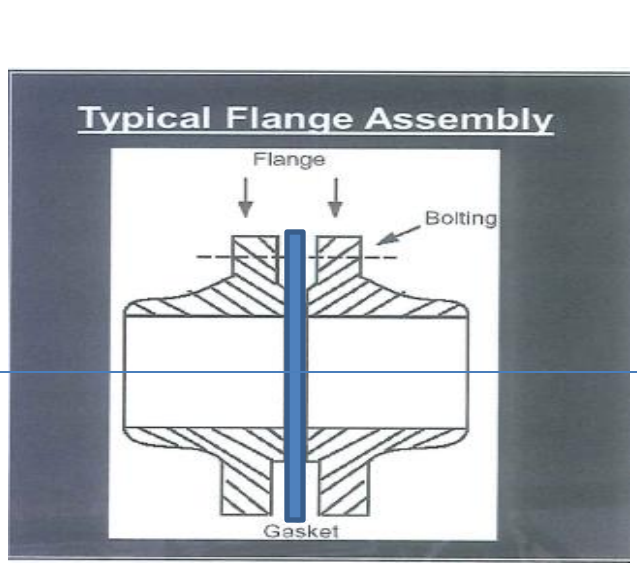
9. JOINTS

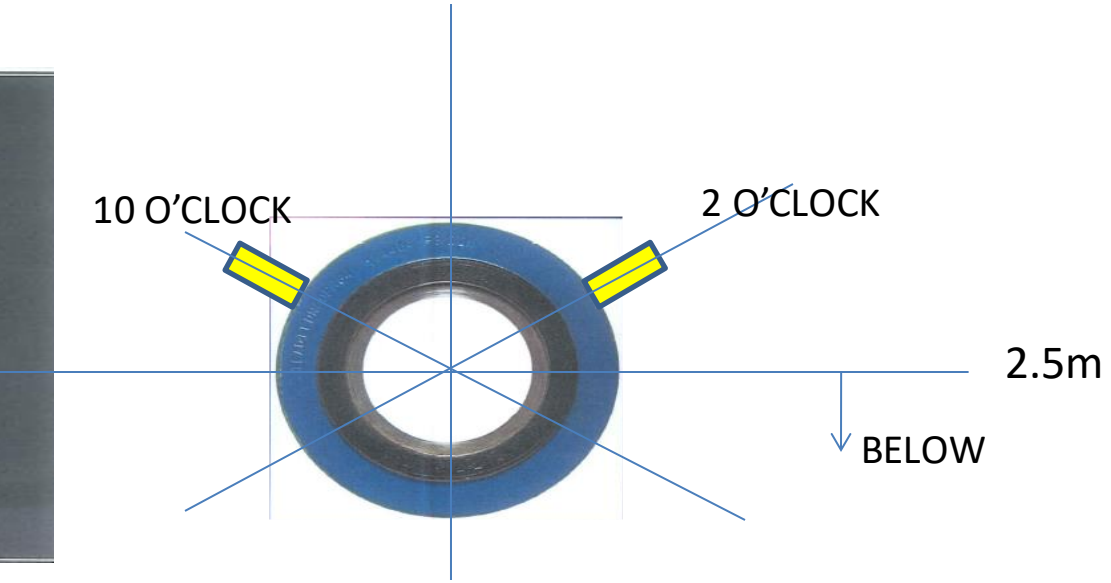
C. FLANGED JOINT

- **FOR PERMANENT GASKET**

THE GASKET IDENTIFICATION HANDLE POSITION WHEN INSTALLED IN THE FLANGE SET SHALL FOLLOW

a. WHEN THE FLANGE JOINT IS LESS THAN 2.5m HIGH, LOCATE HANDLE AT 10 O'CLOCK OR 2 O'CLOCK POSITION





VI. FABRICATION & INSTALLATION REQUIREMENTS

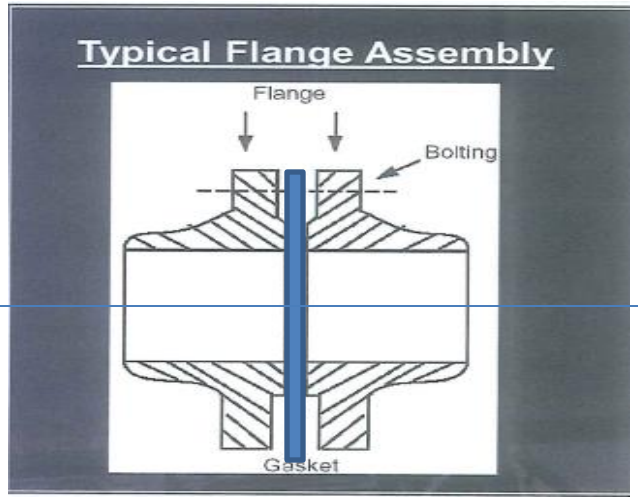
9. JOINTS

C. FLANGED JOINT

➢ **FOR PERMANENT GASKET**

THE GASKET IDENTIFICATION HANDLE POSITION WHEN INSTALLED IN THE FLANGE SET SHALL FOLLOW

b. WHEN THE FLANGE JOINT IS MORE THAN 2.5m HIGH, LOCATE HANDLE AT 4 O'CLOCK OR 8 O'CLOCK POSITION



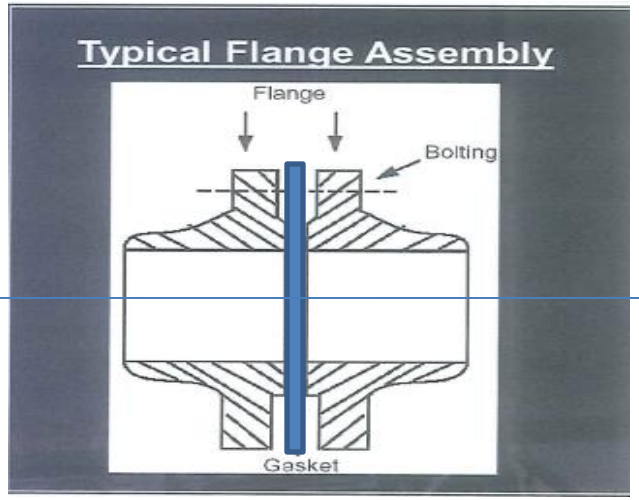
VI. FABRICATION & INSTALLATION REQUIREMENTS

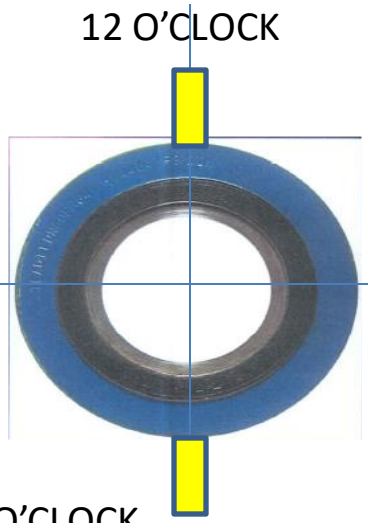
9. JOINTS

C. FLANGED JOINT

- **FOR PERMANENT GASKET**

c. THE 12 O'CLOCK & 6 O'CLOCK POSITION SHALL BE AVOIDED TO PREVENT ANY CONFLICT OR CONFUSION WITH THE IDENTIFICATION HANDLE PROVIDED FOR STRAINERS OR ORIFICE PLATES.





2.5m

VI. FABRICATION & INSTALLATION REQUIREMENTS

10. CLEANING

INTERNAL CLEANING FOR PLANT PIPING SYSTEM

PRIOR TO INSTALLATION & PRESSURE TESTING AS A MINIMUM & PRIOR TO INSTALLATION AND/OR ERECTION OF PIPE SPOOLS ON PIPE RACKS & PIPE SUPPORTS, THE FOLLOWING SHALL BE CONDUCTED:

A. ALL PIPES SHALL BE INTERNALLY CLEANED BY AIR BLOWING WITH A MINIMUM EXIT VELOCITY OF 15m/s. ALSO, LARGE DIAMETER PIPE IS RAG CLEANED (BRUSHED, SWEPT) AS PRACTICAL TO DO SO.

B. ALL PREFABRICATED PIPE SPOOLS SHALL BE VISUALLY INSPECTED FOR CLEANLINESS & SHALL HAVE FOREIGN MATERIALS REMOVED FROM THE INSIDE.

C. PIPING ENDS SHALL BE COVERED AFTER INSPECTION TO PREVENT UNAUTHORIZED REMOVAL OF END COVERS PRIOR TO MAKING THE JOINT TO THE SUCCEEDING SECTION OF PIPING.

APPLICABLE DOCUMENTS:

SAIC- L-2017	PIPING/EQUIPMENT INTERNAL CLEANING INSPECTION
SATR-A-2008	INTERNAL CLEANLINESS REPORT (PIPING SYSTEMS AND EQUIPMENT)

VII. PIPE SUPPORTS, ANCHORS, GUIDES

AS PER PROJECT REQUIREMENTS

PIPE SUPPORTS, ANCHORS, PIPE GUIDES, AND SHOES SHALL BE INSTALLED IN PROPER POSITION IN ACCORDANCE WITH RELATIVE DRAWINGS SUCH AS STANDARD SUPPORT DRAWING, ISO DRAWING, AND SPOOL DRAWING.

WHEN TEMPORARY SUPPORTS OR BRACKETS ARE NECESSARY DURING PIPING ERECTION, THOSE TEMPORARY MATERIALS SHALL NOT BE WELDED DIRECTLY ON THE PIPING SPOOLS.

ON LOCATION OF U-BOLT, U-BAND, U-STRAP, WRAPPING WITH 0.3mm THICKNESS OF STAINLESS STEEL PLATE AROUND PIPING IS REQUIRED WHEN THE PIPE MATERIAL IS STAINLESS STEEL.

DURING HYDRO TESTING, SPRING SUPPORT SHALL BE LOCKED. THE LOCK SHALL BE RELEASED AFTER HYDRO TESTING.

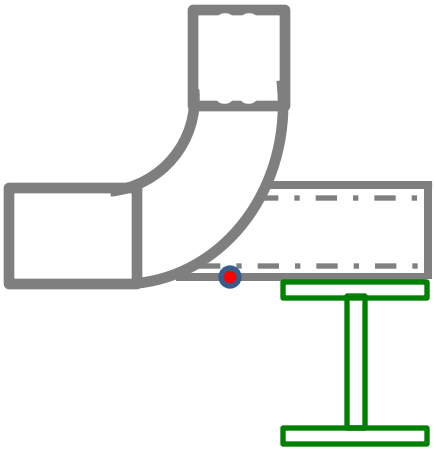
ACCEPTANCE CRITERIA FOR INSPECTION SHALL BE SHOWN ON SAIC-L-2018

VII. PIPE SUPPORTS, ANCHORS, GUIDES

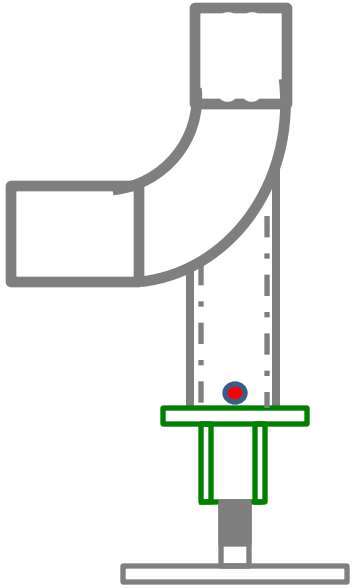
AS PER PROJECT REQUIREMENTS

WEEPHOLES OR TELLTALE HOLES

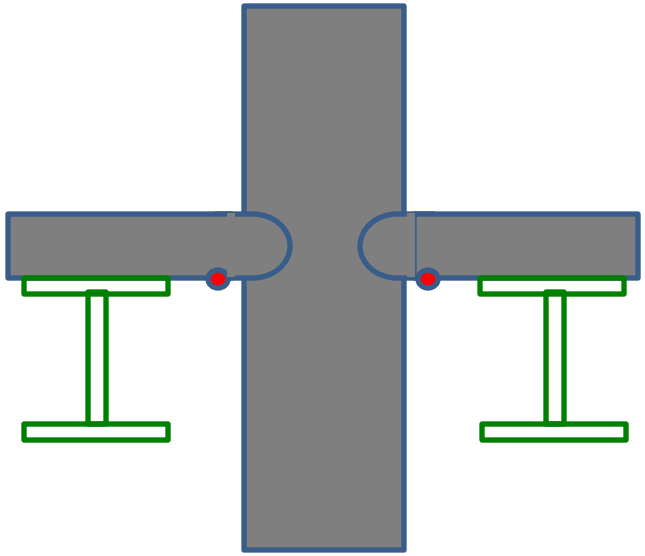
A 6mm WEEP HOLE IS DRILLED FOR ALL DUMMY SUPPORS LOCATED NEAR THE BASEPLATE FOR ALL VERTICAL DUMMY SUPPORTS, AND NEAR THE RUN PIPE AT 6 O'CLOCK FOR ALL DUMMY SUPPORTS.



DUMMY SUPPORT



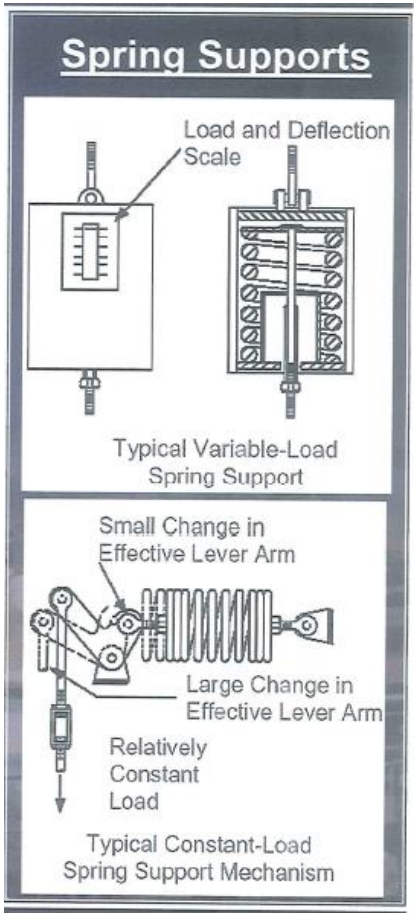
BASE SCREWED SUPPORT

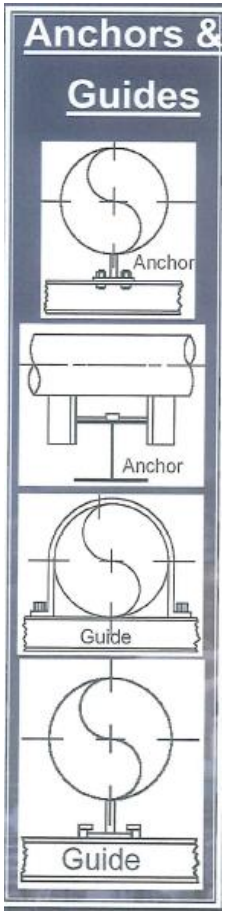


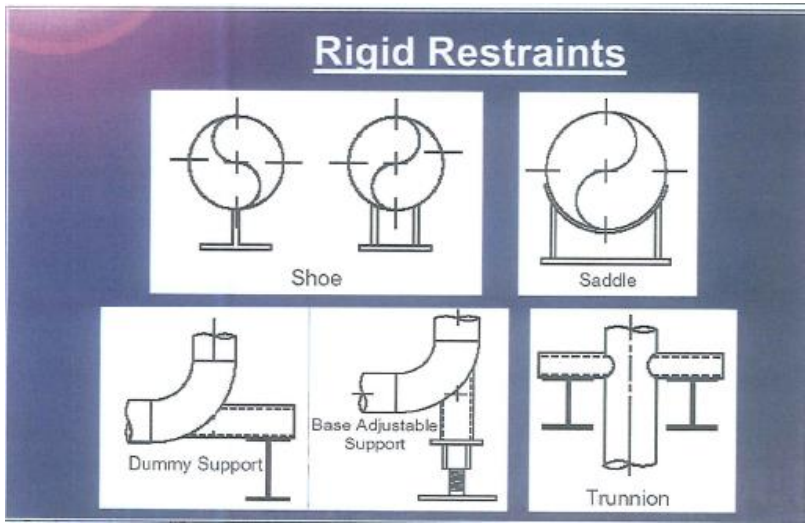
TRUNNION

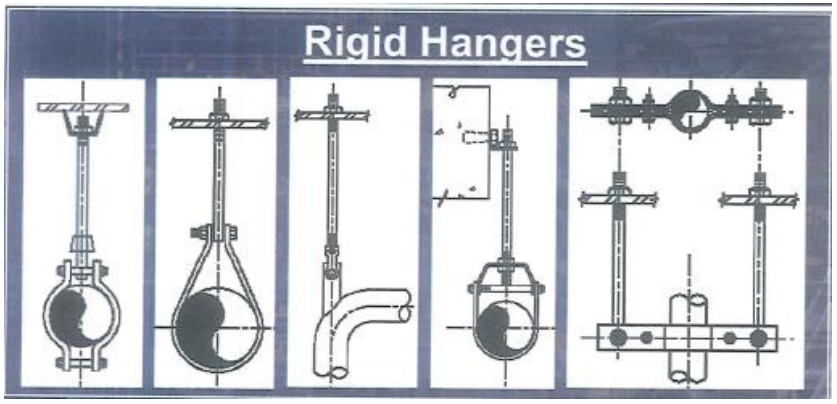
VII. PIPE SUPPORTS, ANCHORS, GUIDES

EXAMPLE PHOTOS









IX. PRESSURE TESTING

A. PNEUMATIC TESTING

B. HYDROSTATIC TESTING

1. TESTING OF PIPING SYSTEM
2. TESTING OF VALVES

X. REINSTATEMENT

A. BOLT TORQUING & TENSIONING

B. LAY-UP