

AN INTRODUCTION
TO
PIPING MATERIAL SPECIFICATIONS
(PMS)

PMS

- **What is PMS and what does it consist of?**
- **PMS stands for Piping Material Specifications. It gives details about all piping components. It consists of material details, dimension details, type of ends , schedules / thicknesses, branch offs, NDT requirements, applicable codes / standards etc. for all Piping components.**
- **It is a document Generated by Piping.**

USE OF PMS

- PMS is used for defining/specifying the various components of piping and fittings on P&IDs.
- Each pipe shown on P&ID is designated by a class appearing in the PMS for that job.
- Piping class for the pipe is a part of Line designation no. appearing on each Line in P&ID.
12"-P-212-1201-B1A-lh.
- For each job/project , a job specific PMS is prepared by piping which includes piping classes from standard PMS along with several new classes specific to the project.

PMS

- **How do we designate a PMS**
- **PMS is divided into various classes and the class designation comprises of three to four alpha-numeric characters e.g. A10A, A1A**

The PMS consists of various classes, each with the following specified :

- **Services & Corrosion Allowance**
- **Pressure / Temperature ratings**
- **NDT and other special requirements**
- **Connection details for vents, drains and instrument connections**
- **Branch connection table**
- **Details of material, dimension standard, ends, thickness, ratings etc for piping items like pipes, flanges, fittings, valves, gaskets, bolting, traps and strainers.**

Piping Class Designation :

- The **first** letter indicates pressure rating

A : 150 Class

B : 300 Class

C : 400 Class

D : 600 Class

E : 900 Class

F : 1500 Class

G : 2500 Class

J : 125 / 150 Class

K : UNCLASSIFIED

Piping Class Designation :

- **The last letter indicates type of material :**

A : Carbon steel,

B : Carbon Moly,

C : 1.0 % Cr., 0.5 % Moly,

D : 1.25 % Cr., 0.5 % Moly.

E : 2.25 % Cr., 1.0 % Moly,

F : 5.0 % Cr., 0.5 % Moly.

G : 9.0 % Cr., 1.0 % Moly,

H : 3.5 % Ni

J : Nickel/Titanium

K : S.S. type 304,304H,304L

L : Aluminum

M : S.S. type 316, 316H,321,347

N : S.S. type 316L

P : Monel/Alloy 20

Q : Inconel/incoloy

T : Cast Iron / Silicon Iron

V : Duplex Stainless Steel

Y: Lined steel (Rubber lined, Teflon lined etc.)

Z : HDPE / PDVF / Teflon / PVC

Piping Class Designation :

- The **middle** number (second and third letter) indicates difference in the process services within the same rating and material based on following criteria :
- Corrosion allowance
- Cryogenic
- Stress Relieved
- Low Temperature application (LTCS range)
- Hydrogen/NACE/IBR
- Category 'D' Fluids
- Vacuum
- Any other specific service requirements

Pipe specification :

- **Type of pipe (Seamless / E.FS.W / ERW / Welded)**
- **Ends(PE / BE / SCRD)**
- **Schedule / Thickness in MM**
- **Dimension Standard (B36.10 / B36.19)**
- **Material specification**
- **Size range**

Pipe thickness / Branch Reinforcement Calculations :

- **Codes : B 31.3**
- **Class Pr-Temp rating (B-16.5)/ Line conditions**
- **Corrosion Allowance**
- **Mill tolerance**
- **Joint efficiency factor depending on material specification & type of pipe.**

Flange group specification :

- **Type of Flange (WN / SW / SO / LJ / Blind / Fig.8 / SPCR&BLN)**
- **Dimension Standard (B16.5 / B16.47A / AWWA-C207)**
- **Rating (150 / 300 / 600 / 900 / 1500 / 2500)**
- **Facing & face finish (FF / RF / RTJ & 125AARH / 63AARH / Stock Finish)**
- **Material specification**
- **Size range**

Flanged Joints :

- **Flanges provide a bolted, separable joint in piping**
- **Where there is a clear need for removal of valves or equipment, for access of maintenance, or for blinding**
- **Flanged connections are potential leak source, their use should be kept to the minimum. Beyond Class 600, the use of flanges in all services is further limited.**

Fittings specification :

- **Type of Fitting (90 Elbow/ 45 Elbow/ Eq.Tee/ Red Tee/ Ecc.Red. / Conc. Red. / Conc.Swage, Caps, Couplings etc)**
- **Dimension Standard (B16.9 / B16.11 / MSS SP43 etc)**
- **Ends (SW / SCRF / SCRM / BW / FLGD)**
- **Ratings (For SW / SCRF / SCRM / FLGD) / Thickness(BW)**
- **Facing & face finish (FLGD)**
- **Material specification**
- **Size range**

Bolting specification :

- **Governed by service fluid & temperature**
- **The most commonly used bolts for flanges in refinery piping are the ASTM A193 Gr.B7 Stud bolts and ASTM A 194 Gr 2H nuts (Cr-Mo Steel) which fall into the high strength group as defined in ASME B 16.5. These stud bolts are generally used in CS and SS piping classes up to 427 deg C**
- **The medium strength ASTM A193 Gr.B7M studs are required in sour services to avoid sulfide stress corrosion cracking.**
- **For stainless steel piping classes in high temp application ASTM A 453 Gr 660 A/B(14%Cr-24%Ni) bolting is used**

Bolting specification : cont.

- For alloy steel piping classes in high temp application ASTM A 193 Gr B 16 /A 194 Gr 4 (Cr-Mo-V) bolting is used
- Low carbon steel machine bolts as per ASTM A307 Gr.B are in the low strength group, used for category D fluids
- Standards ASME / ANSI B18.2.1 & B18.2.2

Gaskets specification :

- **Type of gasket :**
 - **Soft gaskets – Butyl Rubber / Asbestos /Teflon(Fullface / Ring)**
 - **Semi-metallic – Spiral Wound metal strip with non metallic filler**
 - **Metallic (RTJ gaskets : Octagonal / Oval)**
- **Dimension Stds :**
 - **B16.20 : Metallic Gaskets for Pipe Flanges – Ring-Joint, Spiral-Wound and Jacketed**
 - **B16.21 :Non-metallic Flat Gaskets for Pipe Flanges**

Important points in case of Gaskets :

- **Hardness of gaskets for RTJ joints to be minimum 20 BHN less than that of flange groove**
- **Use on Inner / Outer Ring for Sp.Wnd. Gasket**
 - **As per code (B16.20) requirement**
 - **In case 26" & above**
 - **Vacuum / Hydrogen / Cryo service**
 - **SS321 / SS347 & H-Grade SS**
 - **900# class & above**
 - **Temp. > 427°C**
- **Use of asbestos restricted / prohibited**

Miscellaneous Items :

- **Steam Traps :**
 - **Thermodynamic**
 - **Thermostatic**
 - **Mechanical- inverted Bucket, Ball Float Type**
- **Strainers :**
 - **Temporary (Conical)**
 - **Permanent (T-type / Y-type)**

Valve specification in PMS :

- **Type of Valve (Gate / Globe / Check / Ball, etc)**
- **Valve Standard**
- **Body & Trim Material**
- **Rating & Ends details**
- **Tag Number**

Function-wise categories of Valves :

- **On-off Valves** : Gate, Ball, Plug, Butterfly, Diaphragm
- **Flow regulation** : Globe, Butterfly
- **Non-return valves** : Check
- **Sample Valves** : Globe, Needle ,Plug

Preparation of Job PMS :

- **Standard PMS used as a basis**
- **New Piping Classes developed based on job requirements as specified by**
 - **Client**
 - **Process**
 - **Licensors**

Data for new classes

- Material of construction(from SMMS)
- Corrosion allowance
- Service
- Size range
- Design pressure and temperature
- Type and sizes of valves required
- Any other requirements lethal service /toxic

OBJECTIVES OF MATERIAL SELECTION

- PRIMARY OBJECTIVE
 - ACHIEVEMENT OF METALLURGICAL STABILITY TO PREVENT FAILURE RESULTING FROM CORROSIVE ENVIRONMENT, NORMAL OPERATION AND UPSET CONDITIONS
- SECONDARY OBJECTIVE
 - ACHIEVEMENT OF EXPECTED LIFE BY ADEQUATE PROVISION AGAINST METAL WASTAGE
- MATERIAL SELECTION FOR ACHIEVEMENT OF METALLURGICAL STABILITY IS MADE ON THE BASIS OF DESIGN CONDITIONS
- THE PROVISION AGAINST WASTAGE, AS BY CORROSION OR EROSION IS MADE ON THE BASIS OF MAXIMUM OPERATING CONDITIONS

DESIGN LIFE OF EQUIPMENT

- DESIGN LIFE OF 20 YEARS FOR:
 - REACTORS AND HIGH PRESSURE VESSELS
 - HIGH PRESSURE EXCHANGER SHELL
 - COLUMNS
- DESIGN LIFE OF 10 YEARS FOR:
 - PIPING
 - HEAT EXCHANGER BUNDLES
 - REMOVABLE INTERNALS FOR REACTORS AD VESSELS
 - LOW PRESSURE EXCHANGER SHELLS
 - LOW PRESSURE VESSELS

AREAS OF CONCERN FOR MOC

- RESISTANCE TO STRESS AND WEAR
 - INVOLVES MECHANICAL PROPERTIES OF MATERIALS SUCH AS TENSILE STRENGTH, YIELD STRENGTH, DUCTILITY, FATIGUE STRENGTH, WEAR RESISTANCE ETC.
- RESISTANCE TO CORROSION FROM PROCESS AND ATMOSPHERIC CONDITIONS
 - DEPENDENT ON SEVERAL FACTORS SUCH AS OPERATING PRESSURE AND TEMPERATURE, PROCESS STREAM COMPOSITION, PHASES, PRESENCE OF LIQUID WATER, CORRODENTS, CRACK INDUCING AGENTS AND UPSET CONDITIONS.

Thank You