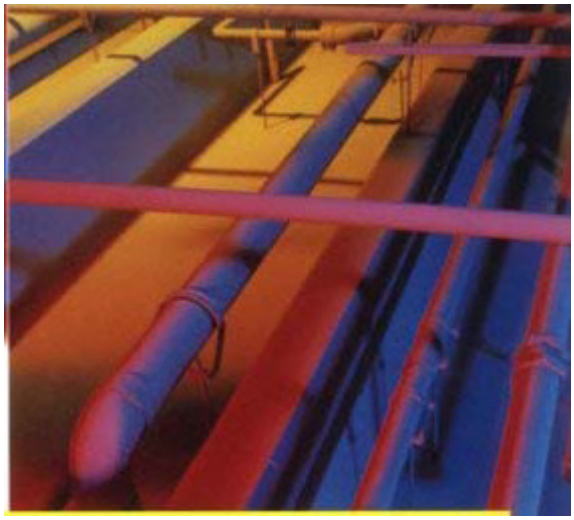
Institute of Piping Engineering & Building Services

PROCESS PIPING DESIGN & ENGINEERING PER ASME B 31.3



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206, B-BLOCK, II FLOOR, MAYUR KUSHAL COMPLEX, ABIDS
HYDERABAD – 1. Tel: 040-30623249, 0091 – 9885946711,
E-MAIL: info@ipebs.in WEBSITE: www.ipebs.in

PROCESS PIPING/PLANT/PIPELINES DESIGN & LAYOUT/DETAILED ENGINEERING & STRESS ANALYSIS –ASME B 31 Codes

Overview

This is a fast-paced program designed to present all major topics relative to the Detailed Engineering / Layout Engineering of Piping Systems, Mechanical design, Hydraulic design and Stress Analysis of Process Piping Systems.

The program also covers Process Equipments, Plant Layout, Mechanical & Hydraulic Design of Pipelines. It is one of the Unique Training Program which covers comprehensive Stress Anlaysis of Piping Systems along with CAESAR – II software.

The program duration is 45 days Full time Instruction including concept theory, problem solving, system design, drafting and exposure to Industry Leading Pipe Stress Analysis Software.

WHAT YOU SHOULD BRING

Course participants should bring an open mind, a thirst for knowledge, a scientific calculator, sketch pad, pen and long book.

Program Description

This certificate program introduces the participants to

I) Piping Systems Detailed Engineering /Plant & Piping Layout Engineering / Piping Drafting

- Piping Fundamentals
- ASME Codes & Standards
- Pipe Fittings
- Flanges
- Valves
- Special Elements
- Mechanical/Process Equipments
- Flow Diagrams
- Piping Specifications
- Piping & Equipment Layout
- Piping Isometrics
- Piping Spools
- Pipe Supports

II) Piping & Pipeline Systems Design

- Pressure Design of Process Piping Systems/ Pipelines/ Building Services Piping.
- Hydraulic Design of Liquid Piping Systems & Pipelines.

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III) Pipe Stress Analysis

- Introduction
- Pipe Span Calculations
- Expansion Loops & Expansion Joints
- Layout Solutions for Weight, Thermal, & Wind Loads.
- Sustained Loads
- Flexibility Analysis using Code Equations
- Occasional Loads

IV) CAESAR II – Static Analysis

NOTES:

1) Please find below the detailed syllabus under each topic of the course.
2) Oil Refinery Project on Detailed Engineering of Piping Systems.
3) * 100 Practical Examples shall be covered during the course for Detailed Engineering, Design & Stress Analysis.

Each topic is presented so as to demonstrate the "real world" impact of design decisions on resulting system performance. Numerous examples of actual designs are presented. (See the "Course Outline" section for details of topics.)

What You Will Learn

Layout / Detailed Engineering, Drafting, Design, Stress Analysis, & Installation of Process Piping inclusive of Chemical plant, Petroleum refinery, Gas Processing plant, Petrochemical, Pharmaceutical, Textile, Paper, Semiconductor & Cryogenic Plants per ASME B 31.3*

WHO SHOULD ATTEND

- Mechanical/ Chemical/Petroleum Engineers.
- Technicians
- Draftsmen

Training Features

- Excellent Material Provided (Design Manual, Design Charts)
- Industry Leading Software's used in Training.
- Individual Attention & Placement Guidance.
- Hundreds of Students placed in India, Middle East, Far East & African Countries.

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PROCESS PIPING/PLANT/PIPELINES DESIGN & LAYOUT/DETAILED ENGINEERING & STRESS ANALYSIS –ASME B 31 Codes – "Course Outline"

I) Piping Systems Detailed Engineering /Plant & Piping Layout Engineering / Drafting

1) Piping Fundamentals

- Introduction to Process Plants
- Scope of Piping in Projects.
- Plant Piping Systems and Transportation Pipelines.
- Definition & Application of Pipe
- Pipe Designators – NPS , IPS , NB, Pipe Wall Thickness & Schedule, Pipe Weights, Lengths, Grades, Ends, Joining Methods, Methods of Manufacture, Pipe Ratings, Pipe Symbols.

2) ASME Codes & Standards

- Introduction to ASME Pressure Piping Design Codes.
- ASME Standards for Common Piping Elements.
- API Codes
- Other Codes & Standards

3) Pipe Fittings – ASME Standards, Selection, Application, Drawing Symbols & Dimensioning.

- Types of Fittings – Butt Weld, Screwed & Socket Weld.
- Elbow – 90 degree (LR & SR), 45 degree, Reducing Ell. ,
- Pipe Bends – Miter Bends, 180 degree Return.
- Branch Connections – Weld Straight & Reducing Tee, Cross & Lateral.
- Fabricated Branch Connections – Stub In & Stub On, Welding Minimums for Stub In,
- Branch Reinforcements – Reinforcing Pad, Welding Saddle & Olets.
- Olet Fittings – Weldolets, Sockolets, Threadolets, Latrolets, Elbolets & Sweepolets.
- Reducers – Concentric & Eccentric, Reducer Offsets.
- Types of Couplings, Weld Cap.
- Fitting Makeup – Dimensioning, Minimum Pipe Length Requirements, Placement of Dimensions.
- Screwed & Socket Weld Fittings – Union, Plug, Coupling, Types of Swages.
- Dimensioning Exercises

4) Pipe Flanges – ASME Standards, Symbols, Selection & Application.

- Definition of Flange.
- Types of Flanges based on Face and Application, P-T. Ratings. – Forged Steel and Cast Iron Flanges.
- Flange Facings – Flat Face, Raised Face, RTJ, & Male - Female, Tongue & Groove. Flange Face Finish.
- Weld Neck, Slip On, Threaded, Socket Weld, Lap-Joint, Reducing, Blind & Orifice Flanges.

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- Gaskets – Types, Thickness, Bolts & Nuts.
- Dimensioning Exercises.

5) Valves – ASME/API Standards, Symbols, Selection & Application

- Definition.
- Valve Funtions, Locations & End Connections.
- Valve Types – Gate, Globe, Ball, Check, Butterfly, Angle, PRV/PSV, & Plug etc.
- Control Valve Manifold. – Layout Representation & Requirements.
- Valve Operators.
- Valve Layout Considerations.
- Valve Data Sheets
- Valve Selection
- Dimensioning Exercises.

6) Piping Special Elements

- Strainers
- Bellows/Expansion Joints
- Rupture Disc
- Spectacle Blind
- Blanks
- Spacers
- Spray Nozzles
- Steam Traps
- Flame Arrestor
- Vortex Breaker
- Hose

7) Process Mechanical Equipments - API Standards, Symbols, & Application.

Static – Horizontal Vessels, Vertical Vessels, Storage Tanks, Heat Exchanger & Reboiler.
Rotary – Pumps, Compressor, Fans, & Steam Turbines.

8) Flow Diagrams

- Process Flow Diagram – PFD
- Piping & Instrumentation Diagram – P & ID.
  - Line Numbering
  - P& ID Requirements
  - Print Reading Exercise
  - Line Number
  - Flow Diagram Vs Piping Drawings.
  - Flow Diagram Exercises.
  - Symbols & Abbreviations.
- Instrument Types & Symbols – Flow, Temp, and Pressure & Level.
- Utility Flow Diagram – UFD

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9) Piping Specifications

Piping Specifications / Material Selection / P-T ratings / Valve Data Sheets.

10) Plot Plan, Equipment Layout, & Piping GA Drawings.

- Plot Plan Development & Requirements.
- Equipment Layout Terminology, Control Point & Battery Limits.
- Preparation of Equipment Layout.
- Piping GA Drawing Requirements and Layout Procedure.
- Pump GA Drawing and Layout Consideration.
- Tank & Vessel Layout Consideration.
- GA - Print Reading Exercise.

11) Piping Isometrics

- Definition
- Drawing Piping Isometrics
- Isometric Dimensions, Notes & Callouts.
- Isometric Offsets.
- Print Reading Exercises.
- Exercises on Creation of Isometrics form Piping Plans and Sections.

12) Piping Spools

- Definition
- Types of Spool Drawings.
- Guidelines to Prepare Spool Drawings.
- Print Reading Exercises.
- Exercises on Creation of Piping Spool from Piping Isometrics.
- Preparation of BOQ.

13) Pipe Supports

- Classification of Supports
- Primary & Secondary
- Anchors
- Pipe Guides
- Limit Stops
- Pipe Shoe
- Dummy Leg / Trunion
- Field Support / Base Support
- Rigid Hangers – Rod & Clevis, Trapeze.
- Flexible Hangers – Variable & Constant.
- Pipe Rack Design – Types, Height & Width Calculations, Pipe Arrangements
- Control Station & Utility Station on Pipe Racks

Numerous Examples are covered to illustrate application Piping Systems Detailed Engineering / Layout Engineering & Pipe Drafting.

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II) Piping Systems Design

1) Pressure Design of Process Piping Systems – ASME B 31.3

- Scope of ASME B 31.3, B31.4 & B 31.8
- ASME B 31.3 Fluid Service Categories
- Design Pressure & Design Temperature for Piping Systems.
- P-T Ratings of Flanges, Butt-weld Fittings & Socket Weld Fittings
- Pressure Design of Straight Pipe under Internal Pressure. – Wall thickness Calculations
- MDP – Maximum Design Pressure for Piping Systems
- Branch Reinforcements – Reinforcement Pad Calculations
- Pipeline Wall thickness Calculations – B 31.4 / B 31.8
- MAOP – Maximum Allowable Operating Pressure for Pipelines.
- Pressure Design of Miter Bends – Single & Multiple Miters.
- Pressure Design of Blanks.
- Piping Material Selection per ASME Code.
- Severe Cyclic Conditions.

Numerous Examples are covered to illustrate application of ASME B31.3 code for Piping Design.

2) Hydraulic Design of Liquid Piping Systems & Pipelines

- Pressure Drop due to Friction
  - Velocity Variation in Pipes
  - Typical Velocities for Water Piping & Other Liquids
  - Pipe Sizing
  - Reynolds Number
  - Darcy Weisbach Equation
  - Friction Factor
  - Colebrook White Equation
  - Moody Diagram
  - Hazen Williams Equation
  - Minor Losses in Pipe Fittings – Equivalent Length Method & K-Factor method.

- Pressure & Horse Power Required

  - Total Pressure Required – Friction Head, Elevation Head, Minimum Delivery Pressure
  - Elements of Total Dynamic Head – Static Head, Pressure Head, Velocity Head, Friction Head
  - Pump Horse Power Required.
  - Cavitation in Pumps
  - NPSH Required & NPSH Available for Pumps.
  - Pump Performance Curves.

Numerous Examples are covered to illustrate application of Pipe Hydraulics

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III) Pipe Stress Analysis

1) Introduction

- Objectives & Definition of Stress Analysis
- Critical Line List
- Information Required for Stress Analysis
- Piping Loads – Static & Dynamic
- Static & Dynamic Analysis
- Forces, Moment & Stress Calculations.
- Requirements of ASME B 31.3 Code – Sustained Loads, Thermal Expansion & Occasional Loads.
- Classification of Loads
- Solutions for Piping Loads.

2) Pipe Span Calculations

- Span limitations based on Stress, Deflection & Natural Frequency.
- Allowable Pipe Span Calculations
- Suggested Pipe Support Spacing
- Pipe Span Reduction Factor for Elbows, Concentrated Loads etc.
- Selection of Supports.
- Location of Supports and Restraints.

3) Flexibility Analysis – Expansion Loops & Expansion Joints

- Concept of Thermal Expansion.
- Providing Flexibility in Piping
- Minimum Leg Required to Absorb Thermal Expansion
- Types of Expansion Loops
- Expansion Loop Sizing for Hot Piping
- Expansion Joints – Types, Application & Selection.
- Bellow Materials, Hydrostatic Test Pressure for Bellows
- Guide Spacing for Expansion Joints.

3) Layout Solutions for Weight, Thermal, Vibration & Wind Loads.

- Causes of Pipe Stress
- Layout Solution for Weight Stress – Continuously Supported & Branch Pipe Allowable Spans
- Solving Concentrated Loads and Reducing Loads on Equipment Nozzles.
- Equipment Nozzle Load Qualifications.
- Layout Solutions for Thermal Load using force & Stress Nomographs for Pump and Vessel Piping.
- Checking Piping Layout in Pipe Racks.
- Checking Piping Layout for Reciprocating Equipment
- Checking Piping Layout for Wind Load.

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5) Flexibility Analysis using ASME B 31.3 Code Equations

- Thermal Expansion Stress - Se and Code Allowable Thermal Displacement Stress Range Sa.
- Stress Range Reduction Factors - f
- Bending & Torsional Stress
- Formal Analysis Requirements
- Inplane & Outplane Bending Moments
- Stress Intensification Factors – SIF
- Calculation of Thermal Expansion Stress.
- Cold Spring.

6) Sustained Loads - Internal Pressure & Longitudinal stresses

- Theories of Failure
- Stresses acting in Pipe due to internal Pressure
- Sustained Loads Qualification

7) Occasional Load Stresses

- Wind Load
- Seismic Load
- Water Hammer Load
- Analyzing Vibrating Pipe

IV) CAESAR – II – Pipe Stress Analysis Software

- Introduction
- Nozzle Thermal Growth Calculations – pumps, vessels, heat exhangers.
- Piping Input Spreadsheet.
- Modelling of Piping Isometrics – Bends, Reducers, Valves, Loops etc.
- Performing Static Analysis.
- Modifying Load Cases.
- Hanger Selection.
- Set up of Wind Load Cases.
- Set up of SUS, OPE, EXP, HYD, HGR, & OCC loads.
- Load Case Editor
- Viewing Reports
- Evaluating API 610 Pump Nozzle Loads
- 10 Practical Examples – Input, Analysis & Redesign.

For Course fee, Availability of Seats & Course Registrations please call us @ 0091-9885946711 / 040-30623249 or write to E-mail: info@ipebs.in

The training programs can also be arranged on-site, customized for your organization. For more details, please call us at 040-30623249, 0091-9885946711.

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IPEBS Corporate Training Clients Include:

- ✓ **Intergraph Consulting Pvt. Ltd. – Hyderabad.**
- ✓ **Vasavi Power Services – Hyderabad**
- ✓ **Infotech Enterprises – Hyderabad**
- ✓ **Siddi Consulting Engineers – Pune**
- ✓ **Hira Gulf Electro-Mechanical – Dubai**
- ✓ **Pamub Technical Services – Nigeria**
- ✓ **Locus Technologies – Hyderabad**
- ✓ **RASGAS – Qatar**
- ✓ **Qatar Petroleum – Doha, Qatar**
- ✓ **Petrodar Oil & Gas – Sudan**
- ✓ **Dr. Reddy's Labs – Hyderabad**

Frequently Asked Questions:

1) **What is the Course Schedule of Piping Engineering Training Program for the year 2010?**

   1st Jan, 15th Feb, 1st April, 15th May 2011 (other dates will be announced later)

2) **What are the timings of the Course?**

   10:00 AM to 4:00 PM with appropriate breaks for tea and lunch.

3) **Classes are offered for how many days in a week?**

   Monday to Saturday

4) **Will there be a class on Sundays too?**

   No, Sundays and Public Holidays there will no be classes.

5) **What is the duration of the Course?**

   45 days inclusive of Public holidays and Sundays.

6) **Will a certificate be awarded after the successful completion of the course?**

   Yes, a Diploma in Process Piping Design/Drafting & Stress Analysis per ASME B 31.3 certificate will be awarded after successful completion of the course.

7) **Is the Training program recognized by any university or AICTE?**

The course offered at IPEBS is Autonomous and is well respected in the Engineering and Construction Industry around the globe, for its alignment with the Job requirements.

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8) Will Training Material be provided during the Course?

Yes Extensive training material including Training Manual, Codes & Standards, Demo Software's, Sample Project Drawings, Interview Question & Answers, Technical Catalogs etc shall be provided to the participants.

9) How many no. of Seats are available for the Training Program?

50

10) How can I register for the course?

To register for the course, click on Register Now on the Home Page to download the course booking form available at our website. www.ipebs.in

Fill it with the following information – Course Interested, Course Starting Date, Name, Profession, Qualification and Contact details. And email it to info@ipebs.in

11) What is the course Fee?

Please write a mail to info@ipebs.in or call us on 040-30623249 , 09885946711

12) Do I have to pay the course fee in advance before joining the course.

No. You can pay the fee once the course starts.

13) Can I pay the fee In instalments?

Yes , two instalment facility is available.

14) Where exactly is IPEBS located in Hyderabad.

IPEBS is located in the heart of the City at the following address:

204/206, B & C Block, Mayur Kushal Complex, Beside Chermas Showroom, Abids-1, Hyderabad, A.P. India.

15) How far IPEBS is located from the Airport, Railway Station &Bus Station.

Airport – 24 kms,
Hyderabad Railway Station – 1km,
Secunderabad Railway Station – 5 kms
Hyderabad Bus Station – 3 Kms

16) Will IPEBS arrange for pick up from airport or railway station?

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No.

17) What is the nearest landmark to IPEBS?

Chermas Showroom - Abids.

18) Is Hostel Accomodation available for the trainees?

Yes, third party hostel accommodation is available for the trainees. Approximately INR 3,500/ - per month for food and shared accommodation. All the hostels are within 1 km radius to IPEBS.

<u>Hostel Contacts:</u>

Juloori Boys Hostel
Beside St. Phillips High School
Opp. Zam Zam Hotel, Sher Gate, Gunfoundry, Abids.
09391365305

Gurukrupa Athithi Gruha,
Beside Plaza Bakery, Tilak Raod, Bogulkunta,
Abids, 040-24761639.

M.S. Boys Hostel
East Side Lane, St. Joseph School
King Kothi, Hyderabad.
09848436549.

Sri Sai Krishna Boys Hostel
Beside Fernandez Maternity Hospital
Bogulkunta, Abids.
Tel: 040-65595592, 09247259503

NOTE: a) More choice is available in Hostel Accomodation. Private/Individual Accomodation also available.

b) For International trainees the accommodation and food charges per month may be approximately INR 15,000/-

19) Is the course available in Correspondence Mode or Online Training?

Currently the course is only available in regular classroom environment. Shortly IPEBS shall also start the course offering in Distance learning and Online Training.

20) Does IPEBS have any branches in other cities of India , or around the world.

No, IPEBS is only based in Hyderabad, India.

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21) For International Trainees what is the procedure for admission?

Course Booking Form required.
Course Fee to be paid in Advance.
IPEBS shall send an Invitation letter after the receipt of the Course fee to obtain a visa from the Indian embassy.

22) Will Tea, Snacks or Lunch be served to the Trainees during the course.

No, the participants shall bear their own expenses for tea, snacks and lunch.

23) Since how long IPEBS have been into training & consulting?

Since 5 years, IPEBS is unquestionably the number one training company in India for Piping & Pipeline Engineering, Plant Design, HVAC & MEP Engineering and related Software's.

24) Who's training @ IPEBS?

People with a passion to train & mentor with real-time industrial and training experience. Having a collective experience of 90 years.

25) Does IPEBS offer a week or two weeks training program in Piping Engineering.

Currently No, Very shortly to be started.

26) Is placement assured after the Training program?

IPEBS provides 100% satisfaction guaranteed learning experience to its trainees, the courses designed are very comprehensive and aligned with the industry job requirements.

We provide the trainees with a comprehensive database of companies looking for piping engineers through out India, assist the trainees in preparing a professional resume, provide comprehensive interview question & answers, and guide them continuously for job placements.

Our trainees are currently working in various multinationals through out India and around the world like Foster Wheeler, Rolta, Reliance Industries, Saudi Aramco, Worley Parsons, L & T, GE, HDO, Honeywell, Schlumberger, to name a few.

"References of Previous Trainees are provided on request."

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27) What Courses does IPEBS currently offer?

- **PROCESS PIPING/PLANT/PIPELINES DESIGN & LAYOUT/DETAILED ENGINEERING & STRESS ANALYSIS – ASME B 31 Codes**
- **Pipe Stress Analysis**
- **Pipeline Design & Construction.**
- **HVAC – Heating Ventilation & Air-Conditioning Design & Drafting per ASHRAE.**
- **HVAC Softwares.**
- **Plumbing Engineering**
- **Corporate Training programs for 3d Modelling Software's for Piping & Plant Layout like PDMS / PDS / AutoPlant / etc.**

28) What is the Minimum qualification to undergo the Piping Engineering Training?

Diploma or Bachelors in Mechanical / Chemical / Petroleum / Electrical / Civil Engineering.

29) What are the Major Modules of the Training Program?

- **Fundamentals**
- **Detailed Engineering of Piping Systems / Piping & Plant Layout Engineering / Pipe Drafting**
- **Piping & Pipeline Design – Pressure and Hydraulic**
- **Pipe Stress Analysis**
- **CAESAR - II**

30) What is PDS / PDMS and their use in Piping Engineering?

PDS – Plant Design System, PDMS – Plant Design Management System are 3d CAD software's used for 3d modelling of mechanical equipments, piping, & structure & extraction of Orthographic and Isometric piping drawings.

The prerequisite to learn or work on 3d modelling software's is to have sound knowledge in Piping Fundamentals and Detailed Engineering /Layout Engineering of Piping and Plant/ Pipe Drafting.

31) What software's are used in industry for Piping Engineering?

- **AutoCAD, Micro station – Creating Piping Orthographic / Isometric Drawings.**
- **PDS, PDMS, SP3d, AutoPlant, CADworkxPlant – for Plant 3d Modelling**
- **PipeFlow and Pipenet – Hydraulic Analysis of Piping & Pipelines.**
- **CAESAR-II, CAEPipe etc – Pipe Stress Analysis.**

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