



Process Piping - Supports and Components

An Online Continuing Education Course for Engineers

Course Number: M-5022

Credit: 5 Hours / 5 PDH / 5 CPD

Process Piping – Supports and Components

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All pipes irrespective of materials of construction have a self-weight based on diameter of pipe and wall thickness. Pipe supports, pipe hangers etc. are normally used to support pipe lines by suspending them from structural members or supporting pipe lines from the bottom where ever feasible.

Pipe lines not supported at regular intervals will lead to sagging, causing stress at welded joints, flanges etc., which may end in leaks and ultimately lead to failure or rupture in the line. Therefore, it is essential to have a well-designed pipe layout and pipe supports / hangers for long trouble free service in the plant.

This 5-hour course provides technical knowledge in the design, layout, selection and installation of pipe support systems.

This course will benefit engineers and designers, stress engineers, construction contractors and fabricators, operation and maintenance personnel, vendors and estimators, who need to know about piping components and systems. The quick easy format of the course will enable a time-saving means to broaden and update their knowledge of piping.

This course is the 7th of the 9 modules in series that cover the entire gamut of piping engineering in in quick reference. All topics are introduced to readers with no or limited background on the subject.

The course is divided into Three (3) chapters:

CHAPTER -1: OVERVIEW OF PIPE SUPPORTS

The chapter provides overview of pipe supports. It introduces readers to the function of supports; primary supports and secondary supports including hangers, restraints and braces. It discusses the necessary inputs and design steps for selection of supports.

CHAPTER – 2: PRIMARY SUPPORTS

This chapter discusses about the yard piping and differentiates between pipe racks and sleepers. It discusses the various configurations of pipe racks and the layout requirements.

CHAPTER– 3: SECONDARY SUPPORTS

The chapter discusses the common type of supports including rigid hangers, variable spring hangers, constant hangers, pipe shoes, various types of clamps, saddles, trunnion supports, roller supports, different types of brackets, restraints, snubbers, struts, braces, PTFE slide bearings etc.

CHAPTER 1: OVERVIEW OF PIPE SUPPORTS

1. Pipe Supports

All pipes irrespective of materials of construction have a self-weight based on diameter of pipe and wall thickness. This is typically expressed in Pipe handbooks as weight per running meter for specific material. In addition to the empty weight of piping, the load includes pipe fittings, the weight of the fluids inside the pipe and the pipe covering such as insulation. Pipelines have to be therefore supported by external means at regular intervals to:

- Avoid excessive sag
- Maintain the intended layout and slope
- Minimize reactions on equipment nozzles
- Minimize stresses in the piping
- Prevent piping shock by the vibration, hammering occasional loads.

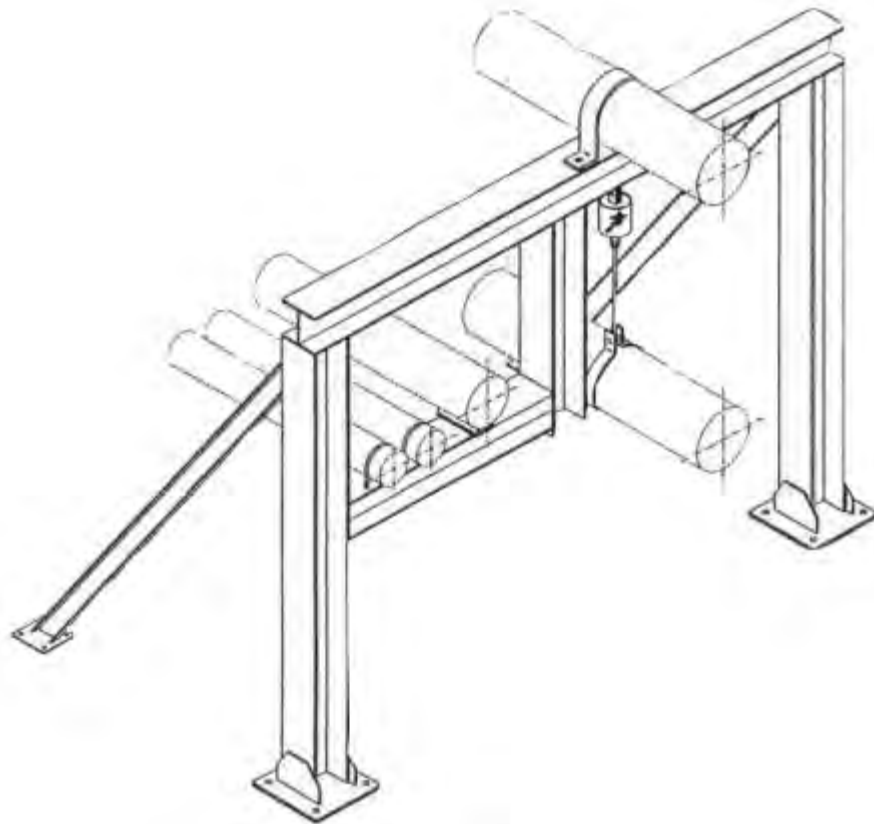
A pipe support or pipe hanger is a designed element that transfers the load from the pipe to the supporting structures. The four main functions of a pipe support are to anchor, guide, absorb shock and support a specified load. Pipe supports used in high or low temperature applications may contain insulation materials. The overall design configuration of a pipe support assembly is dependent on the loading and operating conditions.

Pipe supports are fabricated from a variety of materials including structural steel, carbon steel, stainless steel, galvanized steel, aluminum, and ductile iron. Most pipe supports are coated to protect against moisture and corrosion. Some methods for corrosion protection include: painting, zinc coatings, hot dip galvanizing or a combination of these.

Normally pipes are placed on pipe racks, sleepers or supported from the building structural members. Accordingly, the pipe supports are split into two families; 1) The primary pipe support systems, and 2) the secondary pipe support systems.

1.1. Primary Pipe Supports

The primary pipe supports systems are those supports that are a part of the infrastructure and fall under the prime responsibility of the structural department.



These primary pipe supports systems may also be referred to as pipe racks, pipe ways, and sleepers. These support systems may be major or minor and they may be overhead or sleeper pipe racks. It is important to understand that even though they are called pipe racks they support and carry more than just piping. These other items may include the cables for electrical and instrumentation services.

For clarification, overhead pipe racks are elevated to the point where you can walk and/or drive under the supported piping. Sleepers or sleeper ways are low to the ground so there is no passage under the supported piping.

Pipe racks (overhead or sleeper) are normally established and sized early in the preliminary engineering phase of a project. This time of the project is normally called the plant development phase or the plot plan development phase. Once they are established and sized they are one of the first things the structural department can work on.

1.2. Secondary Pipe Support Systems

The secondary pipe support systems are more a part of the piping systems and as such fall under the prime responsibility of the piping department.

The secondary pipe support systems are a broad family of devices with two branches defined as Engineered devices and Miscellaneous pipe support devices.

1.2.1. Engineered pipe supports

The term "engineered" pipe supports relates to devices that are non-static, one-of-a-kind, location and condition specific. They are identified at the time the need is recognized and then designed and engineered for that specific need. Constant support spring hangers and snubbers are just two of the devices in this category. The piping stress engineer is normally responsible for specifying/designing these.

1.2.2. Miscellaneous pipe supports

The term "miscellaneous" pipe support refers to a broad array of devices that includes items such as Anchors, Base Supports, Cradles, Dummy Support Legs, Guides, Hanger Rods, Pick-ups, Shoes, Trunnions, etc. These devices typically have multiple or repetitive point of use in a plant subject to similar conditions. The piping designers simply pick and choose these from manufacturer's catalogs. The extensive use of computers and plant design software makes the selection easier. The standardized approach saves money, provides consistency of design, and results in a safer design.

1.3. Necessary Inputs

There are two main factors that need to be considered when selecting a pipe support:

- a. What kind of load will need to be supported?
- b. What are the conditions under which the support will be expected to function?

Following inputs are necessary for design of supports.

- Pipe Size
- Pipe Insulation material and thickness
- Pipe Load (bare pipe + fluid + insulation)
- Load of valves and online equipment and instrument
- Piping General Arrangement drawings
- Thermal forces, moments and displacement of piping
- Occasional loads: Hydro test loads, Seismic loads, wind loads etc.
- Horizontal or lateral movement if any.

- Assembly length i.e. from bottom of structure from where the pipe is to be suspended to the center line of pipe.
- In the case of pipe bases, whether any antifriction pad like PTFE or Graphite is required or not, with or without mirror finished counter faces sheets.
- In case of pipe bases, the horizontal loads if any in axial and lateral direction with movement.

1.4. Data Collection

Basic information to be collected for pipe supports is as follows:

- A complete set of data for the location and detailing of pipe supports.
- A complete set of data for the movement foundation.
- A complete set of data for the location of electrical cable trays, etc.
- A complete set of data for the material of construction, pipe sizes, etc.
- Insulation specifications.
- Valve and specialty equipment connections.
- The movement of all equipment connections such as boiler headers, steam drums, turbine connections, etc.
- The results of stress, flexibility, and movement calculations performed for critical systems.

On collection of the above data, the steps in which the engineer will apply this basic information are as follows:

- The determination of support location.
- The determination of thermal movement of the piping at each support location.
- The calculation of load at each support location.
- The selection of the type of support i.e. Anchor Guide, Rest, Constant or Variable spring etc.
- Checking the physical interference of the support with structures, tray, ducts equipment's etc.

