

CH402 Chemical Engineering Process Design

Class Notes L2

Piping Design, Part 2

BONUS OP

Chemical Engineering Plebe Open House

22 JAN 2025 1245 to ~1400

Bartlett Hall Room 150¹

30 minutes = 5 points²

Max 1.0 hours (10 points)

Notes:

1. If we are moved to a different location, we will still be somewhere near 150.
2. Sign in and out on the provided roster with time in and time out. Interact with prospective cadets. Stay active. Try not to congregate in friend clusters.

Piping Design

Important Design Equations are in Lesson 1 – they are not shown here



Piping can range from 15 to 70% of the total delivered equipment cost.

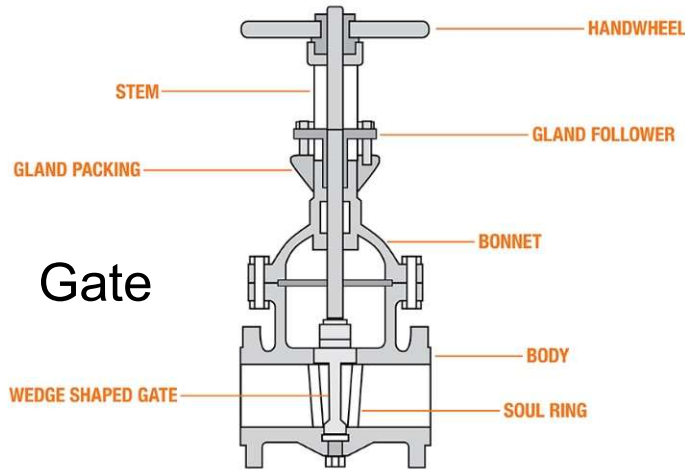
This does not include instrumentation (control valves, sensors, actuators, IT.)

A mid-sized chemical manufacturing plant can contain more than 61 miles of insulated piping, and a mid-sized refinery contains 356 miles of piping.



<https://insulation.org/io/articles/insulation-management-and-its-value-to-industry/>

Valve Basics – Watch This [Video](#)



Gate

<https://www.homedepot.com>

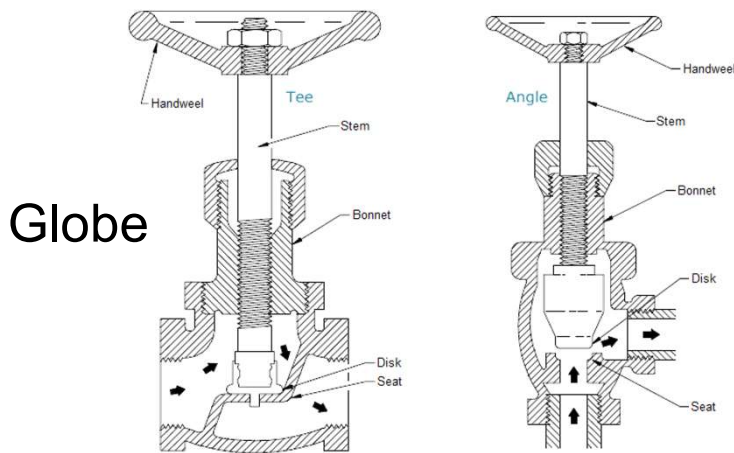


<https://www.homedepot.com>



<https://www.irrigationking.com>

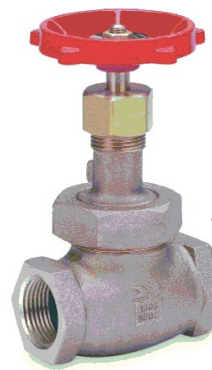
Gate valves can be used for starting and stopping flow, but they cannot regulate flow because a partial flow can damage the gate and introduce vibrations.



Globe

<https://www.wermac.org>

Fig. 12-7 (1-inch, 2070 kPa, stainless):



<https://www.grainger.com>

$$\$300 \cdot \frac{1315.9}{555.8} = \$710$$

Grainger: \$587.81
(8 Jan 2025)
1-in 5000 psi, FNPT-FNPT



<https://www.plumbersstock.com>

Globe valves can be used to start, stop, and regulate flow. Their name comes from the shape of the valve body. A cone-shaped plug moves in and out of the flow of fluid. The flow is controlled by how far away the plug is from its seat. They offer more resistance to fluid flow, and the pressure drop is greater.

Design: C_v (valve coefficient, relates flow rate to ΔP) and K_d (discharge coefficient, describes flow loss).

Valve Costs

This information is needed for Problem Set 2 and Design Problem 1
PTW, pp. 504-506

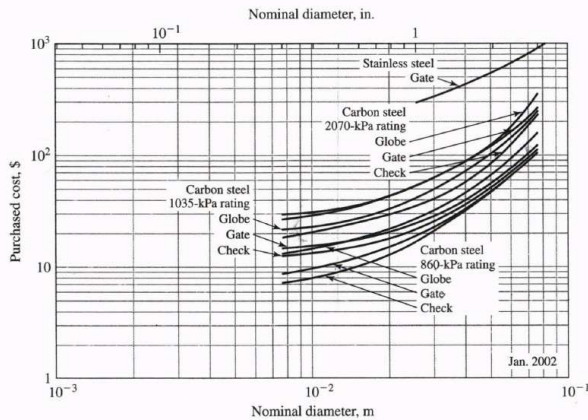


Figure 12-7
Purchased cost of screwed valves for water, oil, and gas

Screwed

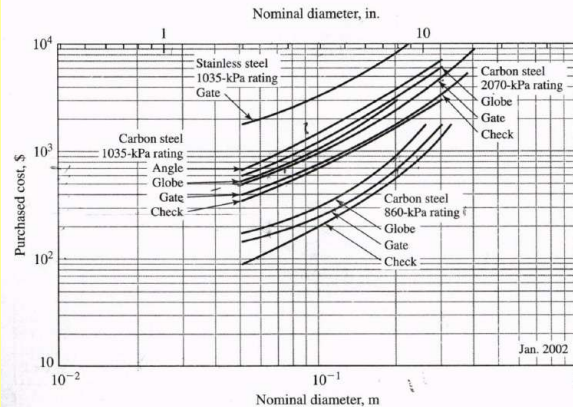


Figure 12-8
Purchased cost of flanged valves for water, oil, and gas

Flanged

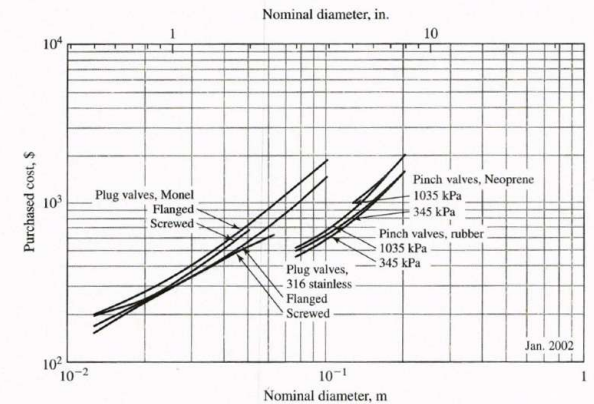


Figure 12-9
Purchased cost of plug and pinch valves

Plug & Pinch

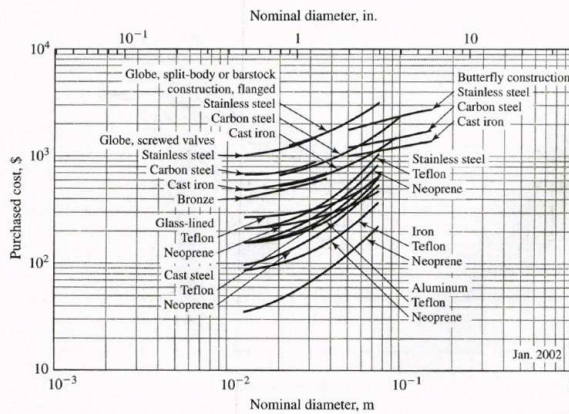


Figure 12-10
Purchased cost of diaphragm valves

Diaphragm

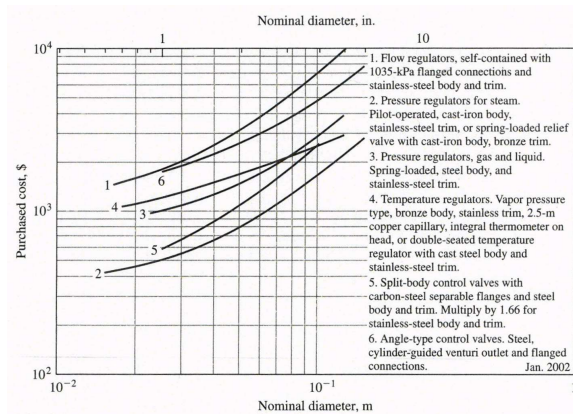


Figure 12-11
Purchased cost for control and relief valves

Control & Relief

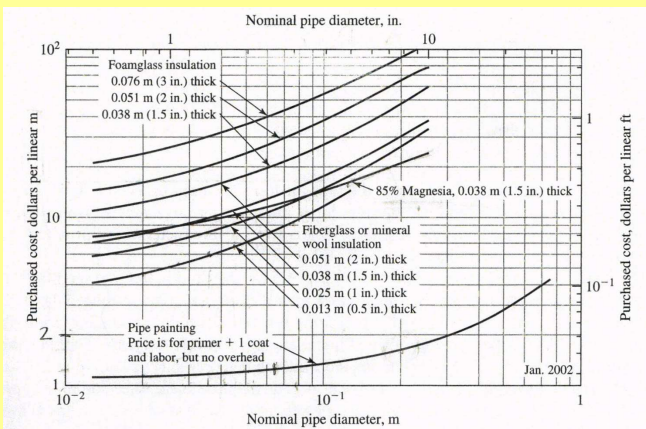


Figure 12-12
Purchased cost of pipe insulation and pipe painting per unit length. Insulation price includes cost of standard covering

Insulation & paint

Fitting Costs

This information is needed for Problem Set 2 and Design Problem 1
PTW, 3rd Edition, pp. 529-544

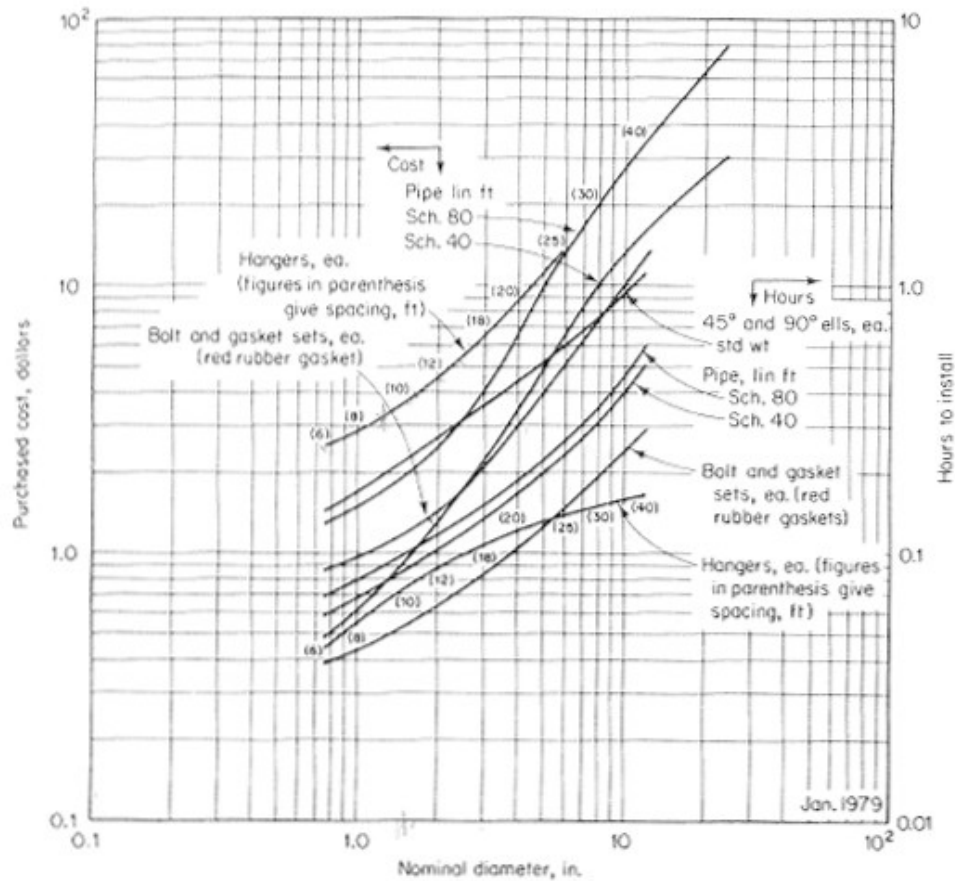


Figure 13-3 Cost and installation time for carbon-steel welded pipe and fittings.

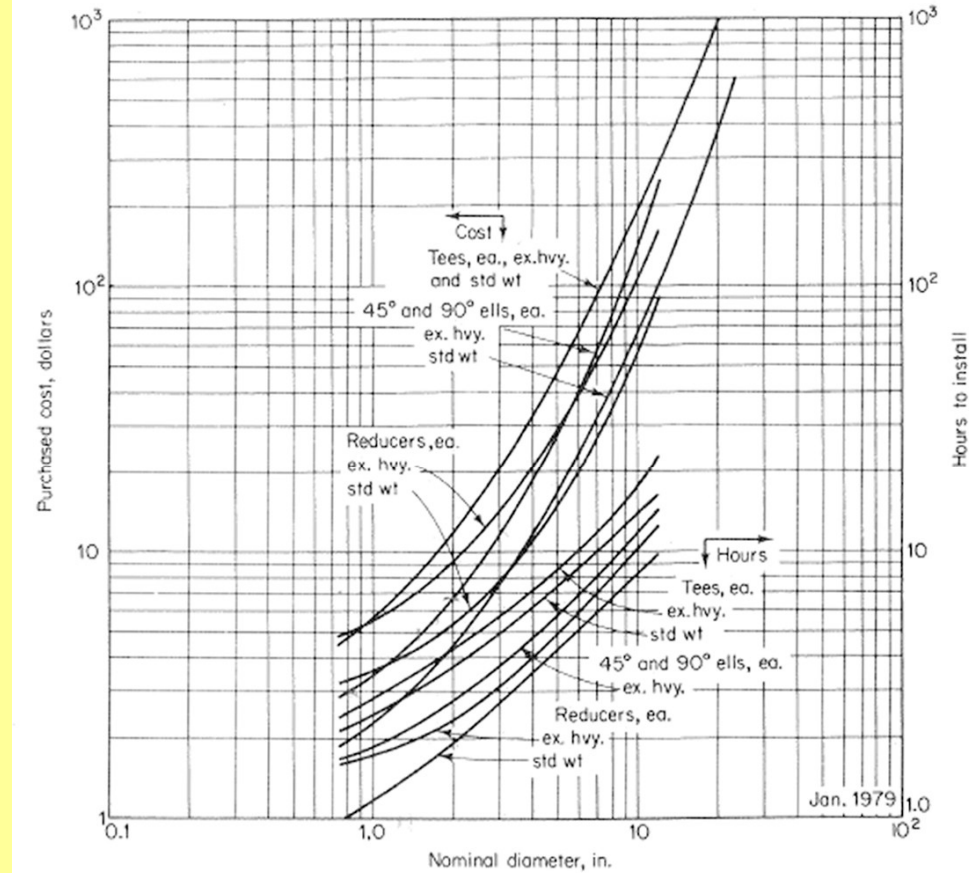


Figure 13-4 Cost and installation time for carbon-steel welded pipe fittings.

Questions?