CHART CRYOGENIC TIP #4

Calculate Amount of Gas Required to Pressurize Tank or Pipe

The practice of pressure testing tanks and pipes is something that is done every day to insure the integrity of pressure vessels and pipe lines. Since the installation sites are usually located a distance away from our shops, we need to know how much nitrogen gas to bring to the site to accomplish the pressure test.

To demonstrate how easy it is, we will walk you through the calculations for two examples below, one for pipe and one for tank. For these examples we will be using the Ideal Gas Law.

Example Calculation for Pipe

Calculate Amount of Nitrogen required to pressurize a 300' long 12" Sch. 80 pipe from 0psi to 500psi using the following:

Outside Diameter ("OD") of 12" pipe = 12.75"
Wall Thickness ("WT") of Schedule 80 = 0.688"
π ("π") = 3.1416
1 Cubic Foot = 1,728 Cubic Inches
15 Pressure Units = 1 Atmosphere

1. Calculate Volume of Pipe in Cubic Feet ("cu. ft."):
   - Internal Dimension ("ID") of 12" pipe: OD minus (WT x 2)
     12.75 – (2 x 0.688) = 11.37" ID
   - Radius ("R") of the Pipe: ID divided by 2
     11.374 / 2 = 5.69" R
   - Cross Sectional Area ("CSA") of Pipe: Pi times R squared
     3.1416 x (5.69 x 5.69) = 101.71 CSA
   - Volume in Cubic Inches ("VCI") Per Foot of Pipe: CSA x 12
     101.71 x 12 = 1,220.52 VCI
   - Volume in Cubic Feet ("VCF") Per Foot of Pipe: VCI divided by number of cubic inches per cubic foot
     1,220.52 / 1,728 = 0.7063 VCF
   - Total Volume of 300' of 12' Sch 80 Pipe: VCF x number of feet of pipe
     0.7063 x 300 = 211.89 cu. ft.

2. Convert Pressure Units to Atmospheres
   - # of Atmospheres for 500psi: Psi plus pressure units in 1 atmosphere divided by pressure units in 1 atmosphere
     (500psi + 15) / 15 = 34.33 # of Atmospheres

3. Calculate Amount of Gas Required to Pressurize This Amount of Pipe from 0psi to 500psi
   - Amount of Gas Required in Standard Cu. Ft. ("SCF"): Volume in cu. ft. times # of atmospheres
     211.89 x 34.33 = 7,274.38 SCF
Example Calculation for Tank

Calculate amount of Nitrogen required to pressurize a 1,000 Gallon Tank from 0psi to 100psi using the following:

1 Gallon = 0.1337 cu. ft.
15 Pressure Units = 1 Atmosphere

1. Convert the Volume of the Tank from Gallons to Cubic Feet:
   - Volume in Cu. Ft.: Number of gallons divided by number of cubic feet in a gallon
     \[ \frac{1000 \times 0.1337 \text{ cu. ft.}}{1} = 133.70 \text{ cu. ft.} \]

2. Convert Pressure Units to Atmospheres
   - # of Atmospheres for 100psi: Psi plus pressure units in 1 atmosphere divided by pressure units in 1 atmosphere.
     \[ \frac{100psi + 15}{15} = 7.67 \text{ Atmospheres} \]

3. Calculate Amount of Gas Required to Pressurize This Size of Tank from 0psi to 100psi
   - Amount of Gas Required in Standard Cubic Feet ("SCF"): Volume in cubic feet x atmospheres
     \[ 133.70 \times 7.67 = 1,025.5 \text{ SCF} \]

If you have any questions, you can always call Chart’s Customer Service Department for more information at 800.400.4683.

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