

Introduction To Flexible Metal Hose

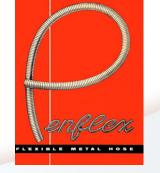
- Penflex.....Who we are.
- Penflex Catalog.
- Functions of a Metal Hose.
- Industry Standards Pertaining to Metal Hose.
- Manufacturing Methods.
- Stainless Steel and Corrosion.
- Influence of Corrugation Geometry on Performance.
- Influence of Braid on Metal Hose.
- Typical Fittings used on Metal Hose.
- Welding Hose Assemblies.
- Hose Failure Analysis.
- Penflex Website.



The Pennsylvania Flexible Metal Hose Company (Penflex) has been a pioneer in the industry. We continue today to be a leader in the design and manufacturing of flexible metal hose products.

- Widest Range of Products
 - Made in the USA
- Experienced Technical Support
- Responsive Customer Service Staff
 - Penflex owned Vietnam Plant





Penflex Products

- Corrugated Metal Hose (¼" 14" NB)
 - P3, ¼-2" 321/316L Braided Hose 321 & 316L Hose/304L Braid
 - P4, 1/4-4" 321/316L Braided Hose 321 & 316L Hose/304L Braid
 - 700, ¼-14" 321/316L/M400/I625/C276/C510 Braided Hose
 - 800, ¹/₄-6" 321/316L Braided Hose High Pressure
 - 900, ¹/₄-2" 316L Braided Hose Ultra High Pressure
 - 1400, High Pressure 3-4" 316L Braided Ultra High Pressure
- Contract Braiding: Wire & Synthetic Braids
- SS Expansion Joints

- Interlocked Metal Hose
 - M100
 - Exhaust
 - IE 30 light
 - IE 50 Standard
 - IE 65 Heavy
 - Conveyor
 - Standard
 - Smooth Bore
- Fittings & Hose Assemblies
- Welding Services



Hose Selection Criteria

[S]ize Diameter of the fittings to be used on the assembly. Minimum and maximum temperatures to which the assembly will be [T]emperature exposed. Material of each assembly component. If the materials are not known, then [A]lloy both the media (along with their concentrations) that will be conveyed through the assembly as well as to which the assembly may be exposed. Type of motion (bending, flexing, vibration, etc) with magnitude and [M]otion frequency Maximum pressure to which the assembly will be exposed, noting spikes, [P]ressure pulsation, and vacuum [E]nd Fittings Fitting types compatible with the hose and existing piping system. Overall length of the assembly. If the overall length is not known then the [D]eveloped Length dimensions of the installation including all movements must be defined



Minimum Live Length Calculator



About Penflex

Min Live Length Calculator

| • | Products | | | | |
|---|-----------------|--|--|--|--|
| • | Technical Tools | | | | |
| | Glossary | | | | |

Build Your Assembly Min Live Length Calculator

Velocity Calculator

Pressure Calculator

Adjustment Factors

Temperature

Chart

| | To find the Live Hose Length for the assembly, follow these steps: | | | | |
|--|---|--|--|--|--|
| | from the drop-down box, select appropriate type of the motion that your assembly is subjected to (angular by default) | | | | |
| | then choose the Hose Series used in the assembly (e.g. 700) | | | | |
| | select specific product (or hose size e.g. 7xx-016 for 1" hose) | | | | |
| | finally, just enter appropriate number for the deflection of the assembly – number of degrees in case of Angular Motion or number of inches for the Offset Motion or Total Travel for the Traveling Loops | | | | |

press "Calculate" button

For a video tutorial on using the calculator, please click here.

Corrosion Resistance Common Alloys Cross-Reference

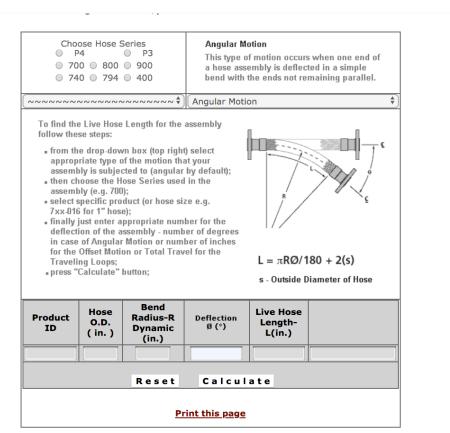
Resources

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Choose Hose Series P4 P3 ◎ 700 ◎ 800 ◎ 900 ◎ 740 ◎ 794 ◎ 400

This type of motion occurs when one end of a hose assembly is deflected in a simple bend with the ends not remaining parallel.

Angular Motion





Making Simple Drawings from the Website

Build Your Own Assembly

| | Penflex Configuration Tool. In instructions below and fill out your information. | | Configuration Tool | | |
|---|---|--|---|-------------------------------|--|
| | ex Configuration Tool? | | | | |
| This tool was developed to allow the distributors and end users of Penfike hose to build drivings and spects for each specific application. It's a service that we've provided by request for years, and now we've automated it for your convenience. To begin specifying a corrupted metal hose assembly, there is some information | | | Please fill out your hose specifications below. As you make your selections, it will narrow the possible answers in the other filters to only what is | | |
| that must be gatl parameters, they | nered regarding the application. To help remember these have been arranged in the acronym STAMPED . | | will narrow the possible answers in the ot | ner filters to only what is | |
| [S]ize | Diameter of the fittings to be used on the assembly. | | compatible. | | |
| [T]emperature | Minimum and maximum temperatures to which the assembly will be exposed. | | companye. | | |
| [A]lloy | Material of each assembly component. If the materials are not known, then both the media (along with their concentrations) that will be conveyed through the assembly as well as to which the assembly may be exposed. | | STEP 1 HOSE SPECS 2 FITTING SPECS 3 | GEN DRAWING 4 SAVE & ORDER | |
| [M]otion | Type of motion (bending, flexing, vibration, etc) with magnitude and frequency | | | | |
| [P]ressure | Maximum pressure to which the assembly will be exposed, noting spikes, pulsation, and vacuum | | Indianta Llago Crecificationa | Movement Englishing | |
| [E]nd Fittings | Fitting types compatible with the hose and existing piping system. | | Indicate Hose Specifications | Movement Specifications | |
| [D] eveloped Length | Overall length of the assembly. If the overall length is not known then the dimensions of the installation including all movements must be defined. | | Choose the Nominal Size (in/mm) | Select Movement | |
| In addition to the considered: | STAMPED parameters, there are other factors that should be | | | Flow Condition | |
| Flow. Very high velocities may require the use of a liner Additional protections (i.e. guards and covers) Conformance to other standards Physical space limitations Enhanced life cycle requirements Heat treatment Secelal requests including hose constructions, attachment methods, fitting | | | Max Operating Ten 🔶 🕈 | | |
| | | | ······ • • • • • • • • • • • • • • • • | Static or Dynamic Application | |
| | | | | | |
| | | | Max Operating Dra | | |
| orientations, t | olerances, testing, cleaning, packaging or documentation. | | Max Operating Pre | | |
| | e information below so that we can better track and label your | | | | |
| drawings. Note: Please use Explorer 10 or hi | the latest version of Chrome, Firefox, Safari, or Internet gher. | | | | |
| Company / Clier | t Name* Email* | | | | |
| | Client Project ID* | | BACK TO INSTRUCTIONS | GO TO STEP 2 > | |



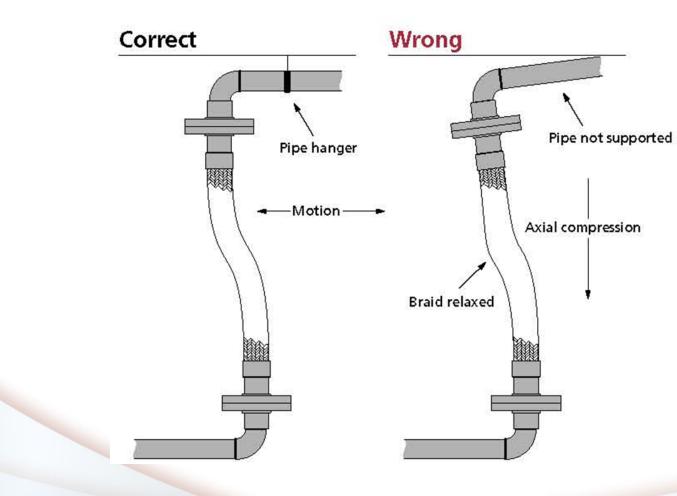
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About Pee
 Products
 Technical
 Glossary
 Build You
 Assembly
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 Calculato
 Velocity
 Calculato

Pressure Calculato Temperat Adjustme Factors Corrosior Resistant

Contact

Importance of Correct Installation





Comparison of Different 1" Hoses

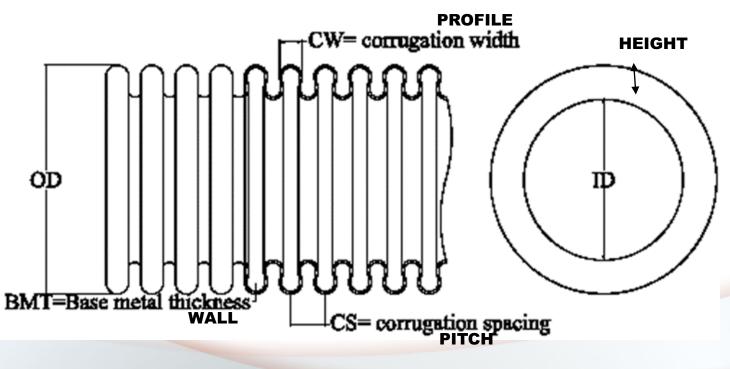
| | P4 | P3 | AF4700 |
|------------------------------|-------------|------------|-------------|
| Nom ID | 1" | 1" | 1" |
| Hose OD | 1.51 | 1.27 | 1.47 |
| Hose Wt/Ft | 0.53 | 0.24 | 0.26 |
| Original Hose Wall Thickness | 0.015 | 0.008 | 0.010 |
| Avg Sidewall Thickness | 0.016 | 0.00848 | 0.00941 |
| Avg Crest Thickness | 0.01669 | 0.00807 | 0.00825 |
| Avg Valley Thickness | 0.01212 | 0.00767 | 0.01003 |
| Braid Construction | 36x10x0.014 | 48x7x0.014 | 36x12x0.010 |
| Braid Wt/Ft | 0.26 | 0.24 | 0.24 |
| Total Wt/Ft | 0.79 | 0.48 | 0.5 |
| Max WP @70°F | 590 | 796 | 718 |
| Catalog Burst Pressure PSI | 2360 | 3184 | 2872 |
| Actual Burst Test #1 | 4006 | 3754 | 2535 |
| Actual Burst Test #2 | 3560 | 3771 | 2572 |
| Actual Burst Test #3 | 4170 | 3776 | N/A |



What Creates Flexibility?

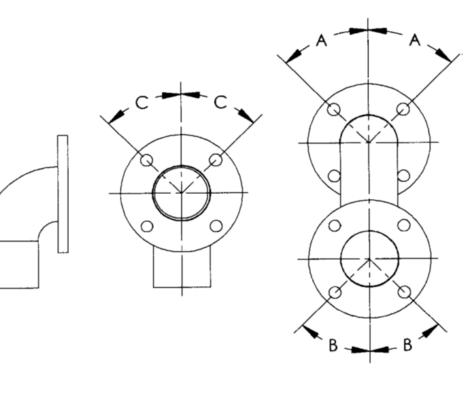
4 key design characteristics define flexibility in a metal hose

- 1. Wall Thickness
- 2. Pitch/Core Count
- 3. Height of corrugations
- 4. Profile





Bolt Hole Alignment (Clocking or 2 Holing)







- **ASME** : American Society of Mechanical Engineers
- <u>B31.3</u> Process Piping: piping typically found in petroleum refineries; chemical, pharmaceutical, textile, paper, semiconductor, and cryogenic plants; and related processing plants and terminals
- ASME Boiler and Pressure Vessel Code,
 - **Section IX:** Welding and Brazing Qualifications



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Testing Hose Assemblies





Markets Served

- Power Plants
- Gas & Steam Turbine
- HVAC
- Solar Technology
- Oil & Gas Drilling
- Hot Metal Processing
- Iron Ore Reduction
- Cryogenic Liquids
- Compressed Gases
- Vacuum & UHV Technology
- Fuel Cell Power
- Oil & Gas Distribution



- Pulp & Paper
- Shipbuilding & Repair
- Chemical Processing
- Pharmaceuticals
- Waste & Waste Water
- Petro Chemical & Refining
- Plastic & Pellet Manufacturing
- Laboratories & Instrumentation
- Liquid Terminals & Storage Facilities
- Tank Cleaning Services
- OEM Engine exhaust

What's Wrong With This Picture?



