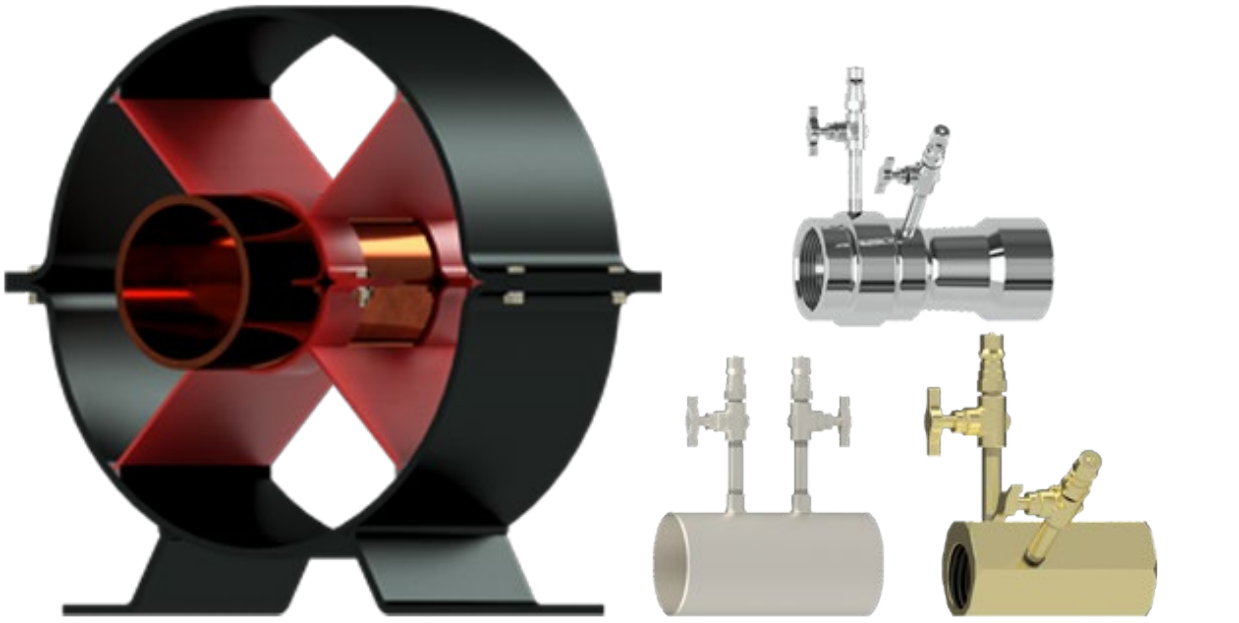
Hyspan

Engineered Motion. Proven Reliability.

Specialty Products

Hyspan Precision Products™
Product Catalog

Series 6700 • 6800 • 9500



Hyspan Precision Products, Inc.
1685 Brandywine Avenue · Chula Vista, CA 91911
hyspan.com · +1 619.421.1355 · websales@hyspan.com

CONTENTS

Note: This catalog covers Hyspan Precision Products specialty product lines. Series 6700 content is from Catalog 5000A. Series 6800 content is from Catalog 3000B Rev A, Hyspan Barco product line. For metal bellows expansion joints and hose assemblies, refer to the applicable Hyspan product catalogs.

Company Overview

Engineered Motion. Proven Reliability.

Hyspan Precision Products designs and manufactures metal expansion joints, flexible metal hose assemblies, and motion-control components for mission-critical piping and pressure systems worldwide. Founded in 1968 and headquartered in Chula Vista, California, Hyspan has built a 50+ year record of engineering quality and manufacturing capability across industrial, energy, defense, aerospace, and commercial markets.

As a member of the Expansion Joint Manufacturers Association (EJMA), Hyspan designs and manufactures in accordance with applicable ASME, military, and international codes and standards. Products are built to order in Hyspan's vertically integrated manufacturing facilities, with complete material traceability and documented inspection at every stage.

Core Capabilities

- All four expansion joint technologies
- Metal bellows expansion joints
- Flexible metal hose assemblies and braided connectors
- Ball joints and slip joints
- Venturis, VibraSnubbers, struts and pipe alignment guides
- Custom engineered assemblies — ¼" to 32 ft diameter, full vacuum to 5,000+ PSIG
- Exotic materials: Inconel 625, Hastelloy, Monel, Titanium, and others
- FEA/CFD analysis, fatigue life evaluation, seismic and vibration modeling

Certifications

Markets Served

- Energy & Petrochemical — refineries, FCCU, piping systems
- Power & Utility — steam, hot water, district energy
- Defense & Maritime — NAVSEA-qualified, naval shipboard systems
- Aerospace — AS9100D certified, fatigue-rated precision bellows
- Advanced Technology & Development — UHV, R&D
- Commercial & Industrial — HVAC, mechanical rooms, building systems
- Automotive — OEM exhaust and flexible assembly manufacturing

For custom requirements, specification review, or application engineering support, contact Hyspan at websales@hyspan.com or +1 619.421.1355

Series 6700 – Venturis & Flow Meters

Series	V1 (Brass/Bronze, ½"–3" NPT), V5 (Steel, 2½"–10" flanged/weld), V3 (Fabricated Steel, 12"–30" flanged/weld)
Accuracy	±2% of true value standard; individual calibration available to ±¼ of 1%
Pressure Rating	225–500 PSIG depending on series and size (see ordering tables)
Temperature	+250°F standard (brass/bronze); +600°F (steel series)
Beta Ratio	20%–30% permanent pressure loss; recovers remaining pressure downstream
End Connections	NPT threaded (V1), 150 lb. flange or weld end (V3/V5), grooved end available
Meter Options	Direct reading gpm, linear ΔP (inches H_2O), percentage scale, gas flow meter, electronic transmitter
Fitting Kits	Standard (500 PSIG/250°F), High Temperature (500 PSIG/400°F), High Pressure (1500 PSIG)

Key Advantages

- Accuracy — ±2% of true value in all sizes; no moving parts to wear or clog
- Low Pressure Loss — only 15% of actual differential compared to 50% for a flow nozzle and 63% for an orifice plate at a 0.6 beta ratio
- Reliability and Long Life — smooth flow, internal configuration resists erosion and clogging
- Maintenance Free — no springs, glass readouts, or other failure-prone devices
- Versatile — fixed or portable meters; suitable for liquid, gas, and steam service
- Saves Space — requires fewer pipe diameters upstream and downstream than other measurement devices

Product Description

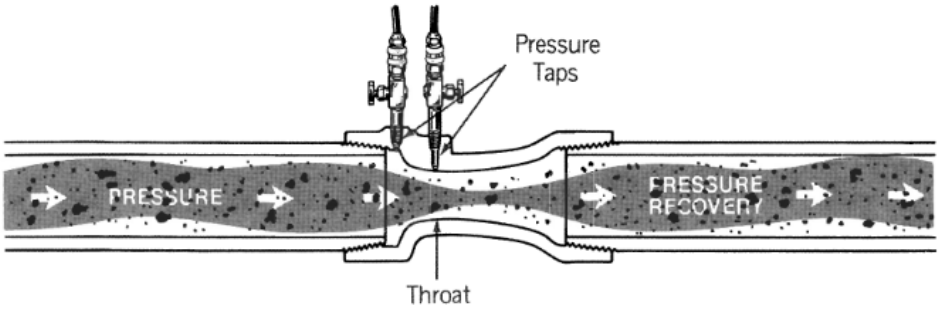
Hyspan Venturi Flow Measurement Systems (Catalog 5000A) provide accurate, reliable, and long-life flow measurement for liquid and gas piping systems. The venturi uses Bernoulli's principle — fluid passing through the reduced throat area increases in velocity, creating a differential pressure that is directly related to flow rate.

How a Venturi Works

Venturi Principal

If a fluid system is to achieve the designed objectives, an accurate and reliable method of measurablity and balancing flow must be specified. A Venturi Flow Measurement System utilizes the basic engineering principle of the venturi installed in a fluid line. Fluid passing through the reduced area of the venturi throat increases in velocity creating a pressure differential between the inlet and throat areas. After passing through the throat, the flow area is gradually increased which decreases the velocity and allows pressure recovery. The differential pressure across the throat of the venturi (see Figure 1) can be read directly or easily translated into actual flow in gals./min. by use of various types of differential pressure meters and capacity curves.

In order to evaluate the merits of a Venturi Flow Measurement System, all of the advantages must be examined. These advantages are presented here for consideration by the system design engineer.



Accuracy

Venturi accuracy and reliability are based on a well-known engineering principle (Bernoulli's Theorem). This principle covers the relationship between pressure differentials and velocity changes in various fluid flow conditions.

No flow measurement device can achieve greater long term accuracy than a properly calibrated venturi. A properly calibrated venturi can provide accurate measurements within ±½% in all sizes.

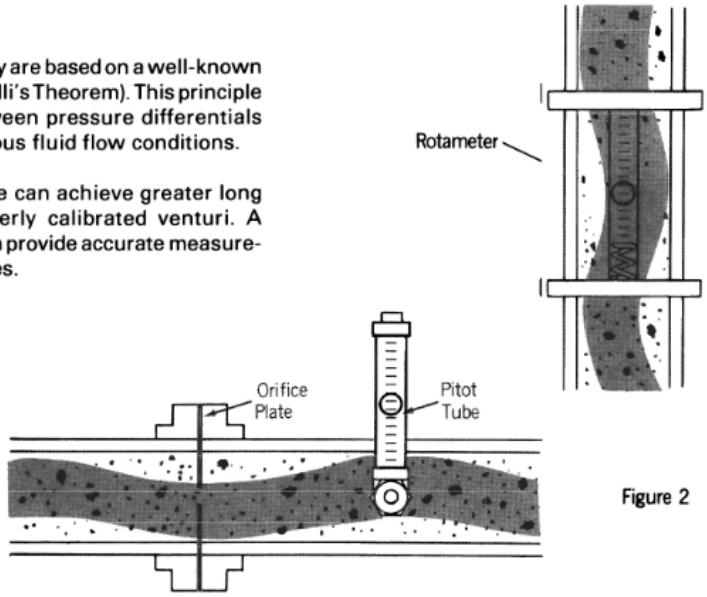


Figure 2

Reliability and Long Life

A venturi will maintain its accuracy over an extremely long period of time. The venturi is really a "self-cleaning" device. Its internal configuration, which permits smooth flow and efficient pressure recovery, eliminates erosion and resists clogging by foreign matter. Hydronic system water is usually "dirty", with particles of foreign matter. Other devices using small orifices, spring loading, or glass readouts in bypass arrangements are not self-cleaning and can be adversely affected by clogging or corrosive action (see Figure 2). Such loss of accuracy over years of continuous operation can seriously affect system redesign, system additions, or maintenance efforts when required later.

Maintenance Free

Maintenance of venturis is virtually unnecessary. Venturis have no moving parts, no springs to fatigue, or glass to break or stain. They will remain in the system throughout its life, always available for quick meter attachment and ready measurement.

Versatile

The venturi system is also versatile, because it can provide permanent stations with fixed meters, or portable meters which can be carried to a number of stations. A variety of meter types can be supplied, depending upon the application. Also, the wide range of sizes and beta ratios permits the designer to select the venturi that will exactly suit his needs.

Economy

HYSPAN Venturi Flow Measurement Systems have proven to be economical in the long run. They simplify maintenance, provide more system versatility and maintain their accuracy for many years, providing long range economy for the user.

Low Pressure Loss—Energy Savings

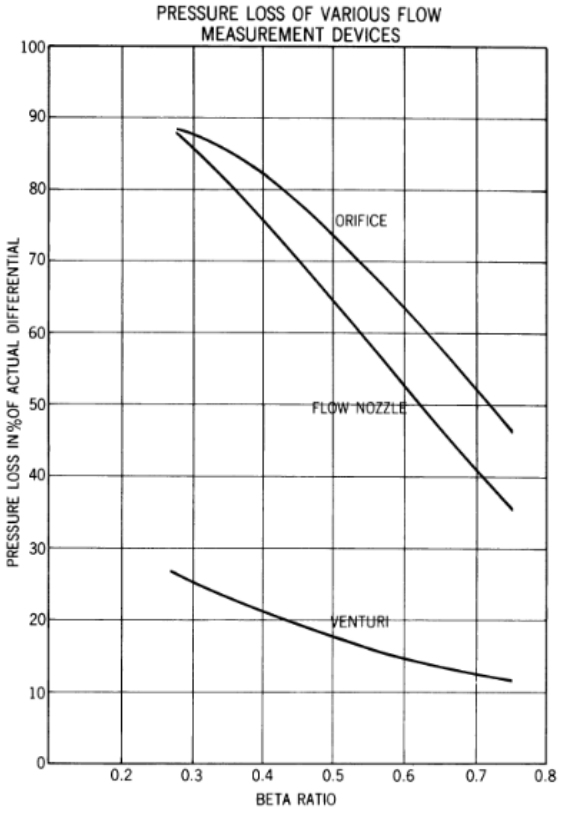
A significant advantage of the venturi is its low pressure loss, particularly when compared to other devices (see Figure 3—graph). For example, a venturi with a 0.6 beta ratio has a pressure loss of only 15% of actual pressure differential compared to 50% with a flow nozzle and 63% with an orifice plate. In addition, pressure recovery is smooth and gradual within a minimum length of pipe after the fluid had passed through the throat area.

Experience

Thousands of venturis have been installed in a variety of fluid systems. This experience contributes to the reliability of this product, and assures users that technical assistance or problem solving know-how is available at any time.

Saves Space

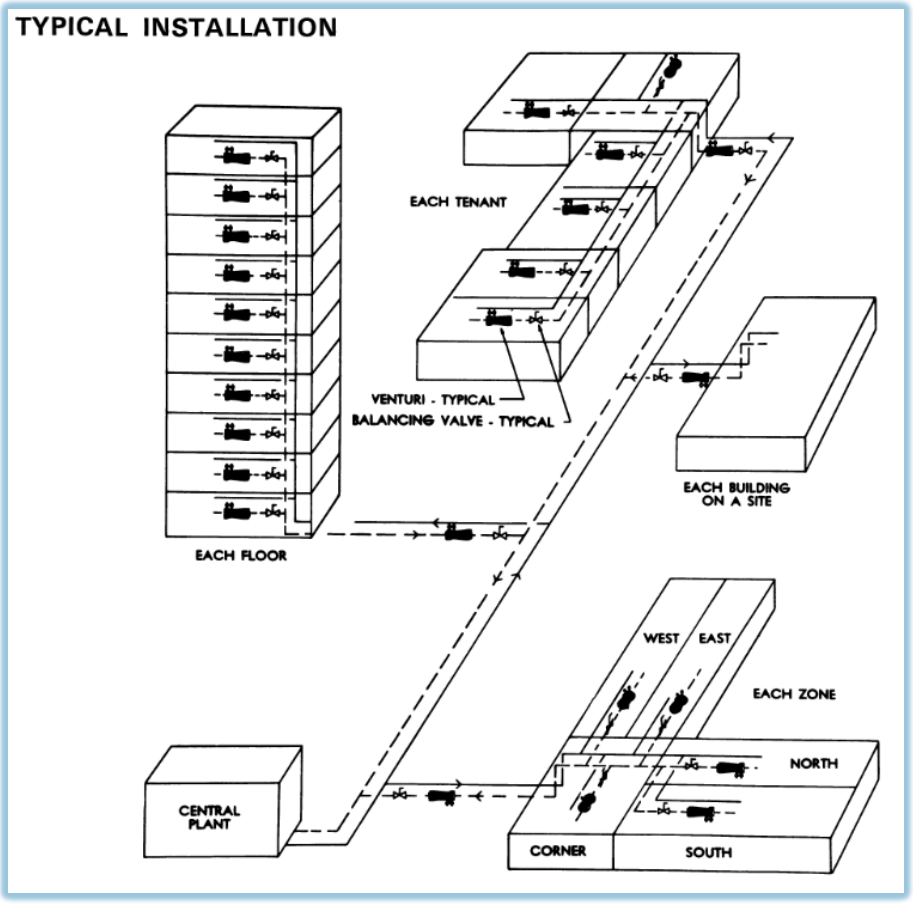
Requires fewer pipe diameters upstream and downstream for pressure recovery.

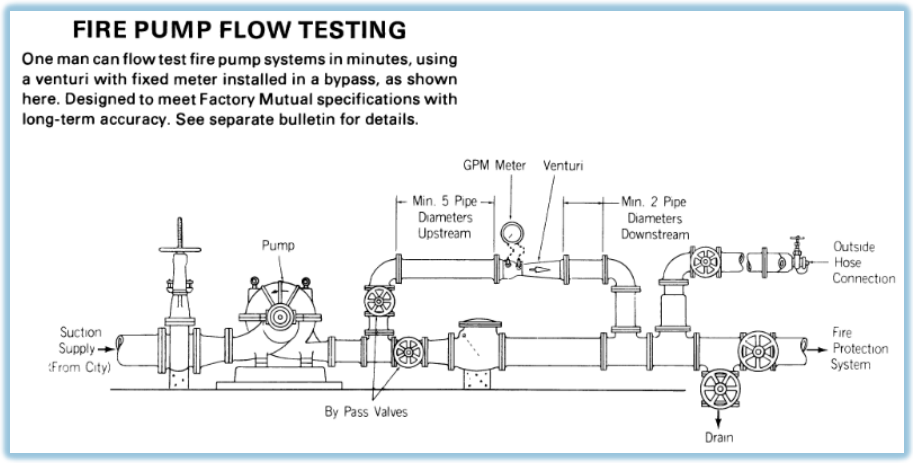


Applications

Hyspan Venturi Flow Measurement Systems are used in any fluid system where flow measurement and balancing must be specified. Primary applications include:

- HVAC hydronic systems — hot water and chilled water, heating and cooling coil return lines
- Large commercial buildings — offices, hotels, hospitals where comfort control is critical
- Industrial plants — process flow measurement and balancing
- Steam systems — with steam adapter for proper differential pressure measurement
- Fire pump flow testing — Factory Mutual-compliant bypass installation
- Multi-building campus systems — individual tenant and zone metering





Venturi Selection — How to Specify

Select a Hyspan Venturi in four steps:

1. Determine the flow requirements and establish the line size. Venturis are available in several different beta ratios in each size.
2. Study the proper capacity curve. Each beta ratio has its own capacity curve showing differential pressure in inches of water vs. flow in GPM. Select readings between 20% and 100% range.
3. Select suitable beta ratios. It is important to select a beta ratio in each case that will provide differential pressure readings in the middle range (20%–80%) of the capacity curve and full scale range of the meter.
4. Specify proper part numbers for each venturi station. Detailed part numbers and dimensional data are found on pages 18 through 23 of the original catalog.

1. Determine the flow requirements and establish each line size. In order to provide for various flow rates in each pipe size, venturis are available in several different "beta ratios" in each size. The beta ratio is a mathematical relationship between the throat I.D. and the pipe I.D. (e.g. see Figure 1 which shows a 1" venturi with a .705" throat, i.e., a 1" 705 venturi).

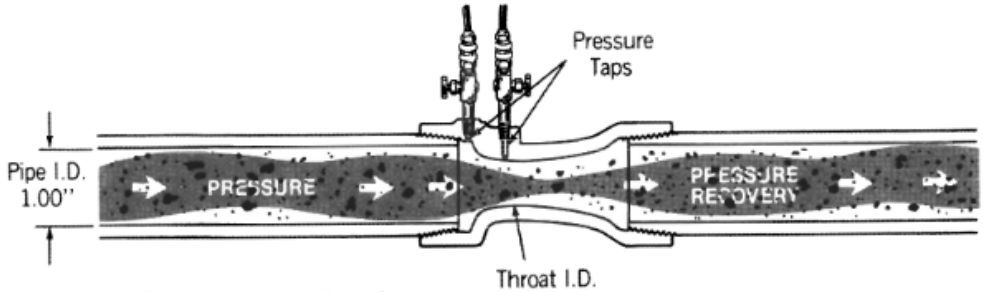


Figure 1 –1" 705 Venturi

2. Study the proper capacity curve.

Each separate beta ratio has its own capacity or flow curve. These capacity curves, shown on the following pages, indicate the differential pressure reading at various flow rates. Flow in gallons per minute is shown along the bottom of the chart. The corresponding differential pressure from 3 to 300 inches of water, is found along the left side of the chart. Since the graph is logarithmic, the curve appears as a straight line.

Because of space limitations in this catalog, these capacity curves are limited in size, and therefore, accuracy. They are suggested for use as venturi selection guidelines only and for applications where extreme accuracy is not needed. **HYSPAN** can provide larger charts where more accuracy is essential. Please also note the capacity curves are for water at +70°F. For conversion to other media, or other temperatures, see pages 26 & 27.

3. Select suitable beta ratios for each specific venturi required. It is important to select a beta ratio in each case that will produce a differential pressure reading in the middle range (between 20% and the full scale range) of the meter being used.

For example, if we wish to flow 20 gpm of water through a 1¼" pipe (see page 8) we select the 588 beta ratio venturi, which gives us a differential pressure of 30 inches of water on a 0–50" linear meter.

4. Specify proper part number for each venturi station. Detailed part numbers and dimensional information on all **HYSPAN** Venturis, along with temperature and pressure ratings and How to Order information are found on pages 18 thru 23.

Meter Selection

gpm Meters (Direct Reading)

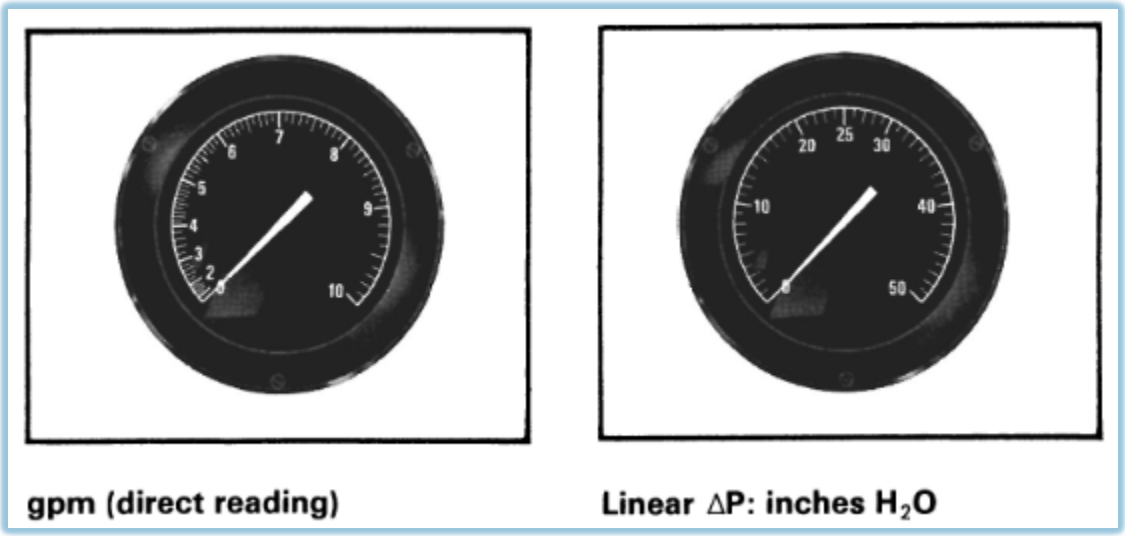
The gpm meter reads directly in gallons per minute through the venturi. The gpm meter is selected for one specific venturi size and beta ratio — it can only be used with the venturi for which it was selected. Selection method: divide the design flow by 7, round to nearest available scale, then determine the differential pressure at maximum reading using the capacity curve.

Linear ΔP Meters (inches H_2O)

Linear differential pressure meters measure differential pressure in inches of water between the upstream and throat pressure taps. They can be used on a venturi of any size or beta ratio within the meter range. Readings should be taken between 20% and 100% range.

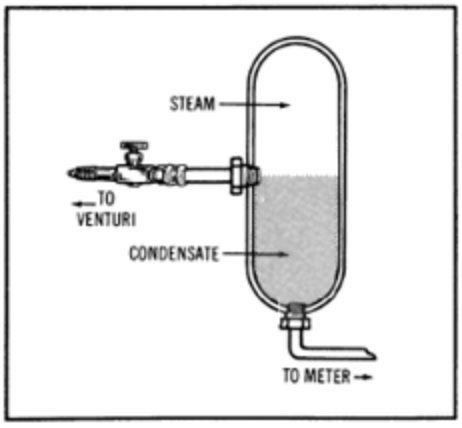
Other Meter Types

- Percentage Scale Meter — measures percentage of the stipulated flow for a specific venturi size and beta ratio
- Gas Flow Meter — ΔP linear meters for gas service; reads SCFM or CFM scales
- Electronic Transmitter — 4–20 mA output for integrated energy management systems (Foxboro #843 compatible)

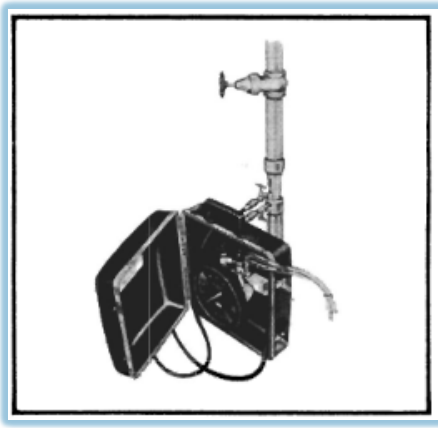


ADAPTER (steam flow)

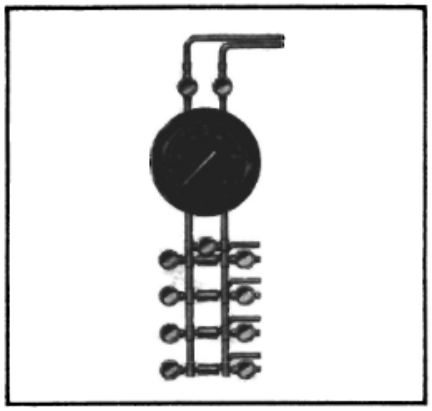
When measuring steam flow, a special adapter is required to properly determine the differential pressure across the venturi pressure taps. This adapter, called a seal pot, is mounted on each pressure tap, as illustrated. Steam condensate in the meter provides a reliable measurement of pressure differential. Maximum ratings are 500 psi and +470°F. Two units per venturi are required; one for each pressure tap.



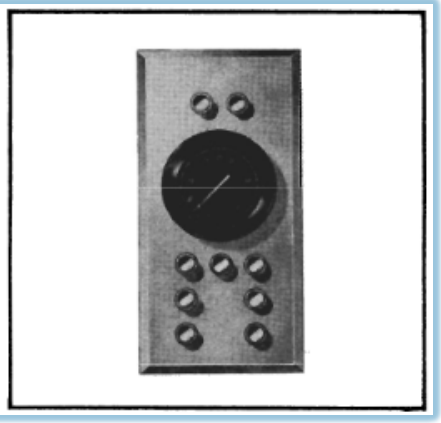
Mounting Styles



Portable Master Meter



Wall-Mounted



Panel-Mounted

RATINGS

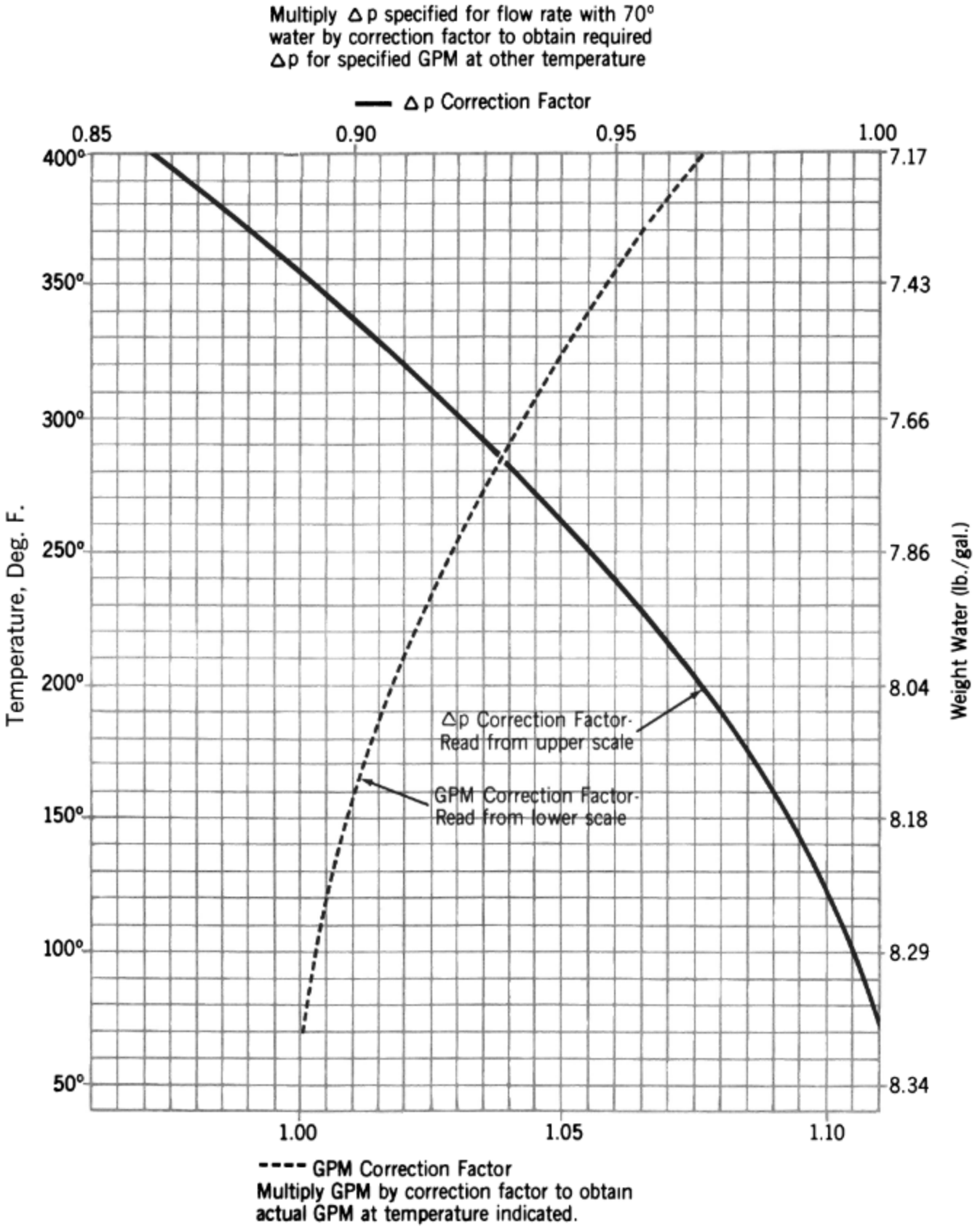
Fitting Kits

1) **Standard Fitting Kit**
   - 500 PSIG, +250°F
   - P/N 30-10103-32-32
   - Nipples, brass: 2600 PSIG at +250°F
   - Valve, brass: 500 PSIG at +250°F
   - Quick connect coupling (male): 1000 PSIG at +250°F
2) **High Temperature Fitting Kit**
   - 500 PSIG, +400°F
   - P/N 30-10468-32-32
   - Nipples, stainless steel: 4500 PSIG at +400°F
   - Valve, stainless steel (seals): 500 PSIG at +400°F
   - Quick connect coupling (male): up to 1600 PSIG at +400°F
3) **High Pressure Fitting Kit:** available to 1500 PSIG. Consult factory.

Meter Fittings

1) **High Pressure:**
   - 500 PSIG, +250°F
   - Meter body: 500 PSIG at +250°F
   - Meter valves: 2500 PSIG at +250°F
   - Meter Hose (portable meter only—Teflon hose with brass fittings): 500 PSIG at +250°F
   - Quick connect coupling (female): 1000 PSIG at +250°F
2) **Standard Pressure:**
   - 250 PSIG, +250°F
   - Meter body: 500 PSIG at +250°F
   - Meter valves: 250 PSIG at +250°F
   - Meter hose (portable meter only—rubber braided hose with brass fittings): 250 PSIG at +250°F
   - Quick connect coupling (female): 1000 PSIG at +250°F
3) **Higher Pressure** (1500 PSIG): Consult factory for proper parts.

Engineering and Media Conversion Factors



Capacity curves are for water at +70°F. For water at higher temperature, see page 26. Most other media can be converted to equivalent gpm water at +70°F. by the use of an appropriate formula with the following constants.

Constants:

1.0 gpm water at +70°F. is approximately equal to:

Air (C_a) = 3.8 SCFM AT 0 PSIG & +70°F.

Steam (C_s) = 12.25 PPH at 0 PSIG saturated (+212°F.)

$$Gas\ (C_g) = \frac{3.8}{\sqrt{S_g}}\ SCFM\ at\ 0\ PSIG\ \&\ +70°F.$$

Legend:

Q_1 = given quantity of fluid.
Q_2 = sizing quantity equivalent gpm +70°F. water.
F_{pa} = pressure correction factor for air.
F_{ta} = temperature correction factor for air.
F_{ps} = pressure correction factor for steam.
SCFM = a cubic foot of air at 14.7 PSIA and +70°F.
PPH = pounds per hour.
S_g = specific gravity of gas relative to air.

1. Water

Read directly from capacity curves which are designed to read gpm water at +70°F. For other temperatures, see correction factors on page 26.

2. Air (use for sizing venturi)*

To find the equivalent gpm water at +70°F. use the following formula:

$$Q_2 = \frac{Q_1}{C_a} \times F_{pa} \times F_{ta}$$

Example: 500 SCFM Air at 100 psig and +150°F.

$$Q_2 = \frac{500}{3.8} \times .36 \times 1.07 = 51\ gpm$$

Solution: Use 2"-636 to read 25.5" ΔP

3. Saturated Steam (use for sizing venturi)*

Use the following formula:

$$Q_2 = \frac{Q_1}{C_s} \times F_{ps}$$

Example: 5000 PPH at 100 psig

$$Q_2 = \frac{5000}{12.25} \times .38 = 155\ gpm$$

Solution: Use 3"-750 to read 21" ΔP

4. Other Liquids

Use the following formula:

$$Q_2 = Q_1 \sqrt{S_g}$$

Example: 100 gpm, specific gravity 1.21, viscosity 1.0 centistokes

$$Q_2 = Q_1 \sqrt{S_g}$$
$$Q_2 = 100 \times 1.1 = 110\ gpm$$

Solution: 2½"-750 to read 25" ΔP

5. Gas (use for sizing venturi)*

Use the following formula:

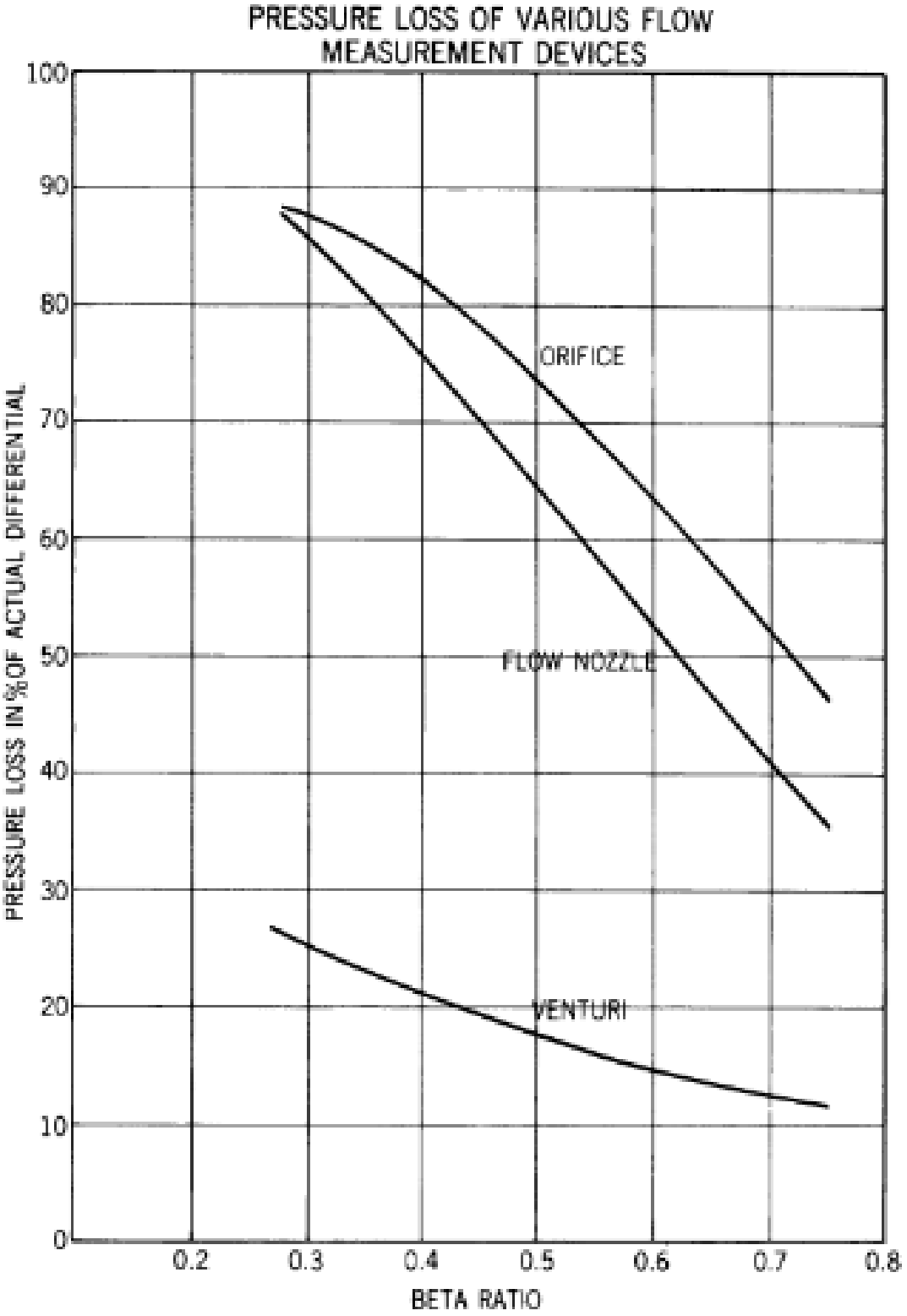
$$Q_2 = \frac{Q_1}{C_g} \times F_{pa} \times F_{ta}$$

Example: 24,000 SCFM natural gas with specific gravity of 0.6 and measured at 15 psig and +70°F.

$$Q_2 = 24{,}000 \div \frac{3.8}{\sqrt{0.6}} \times .70 \times 1.0 = 3425\ gpm$$

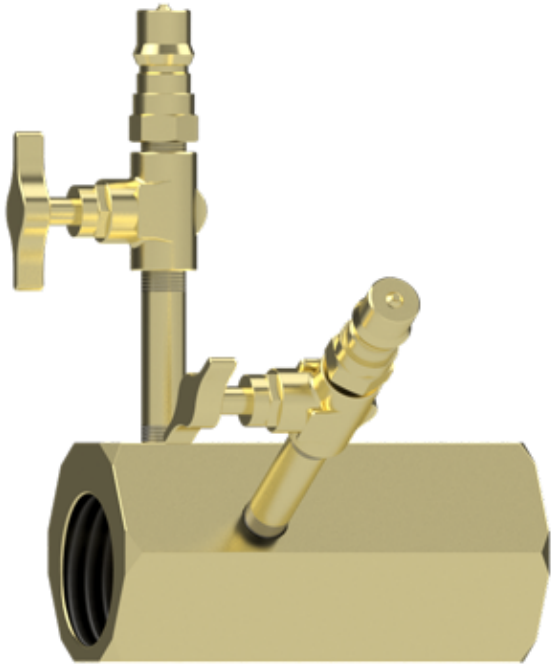
Solution: Use 14"-756 to read 30.0" ΔP

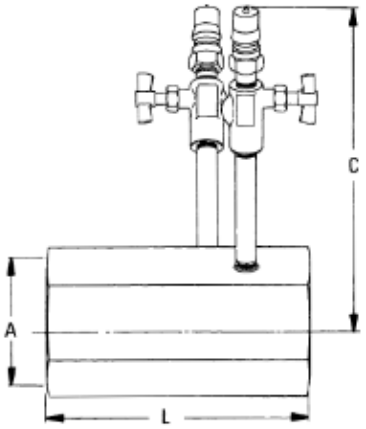
Temperature		Pressure		
Deg. F	Air/Gas Temp. F_{ta}	PSIG	Air/Gas Press. F_{pa}	Sat. Steam Press. F_{ps}
0	0.932	0	1.000	1.000
2	0.933	2	.938	.934
4	0.936	4	.886	.887
6	0.938	6	.843	.846
8	0.940	8	.805	.811
10	0.942	10	.771	.780
12	0.944	12	.742	.752
14	0.946	14	.716	.727
16	0.948	16	.692	.705
18	0.950	18	.670	.685
20	0.952	20	.651	.666
25	0.956	25	.608	.626
30	0.961	30	.573	.592
35	0.966	35	.544	.564
40	0.971	40	.518	.539
50	0.981	50	.477	.498
60	0.990	60	.443	.466
70	1.000	70	.416	.439
80	1.009	80	.394	.416
90	1.019	90	.375	.397
100	1.028	100	.358	.380
120	1.046	120	.330	.352
140	1.064	140	.308	.331
160	1.081	160	.290	.312
180	1.099	180	.275	.296
200	1.116	200	.261	.282
225	1.137	225	.247	.267
250	1.157	250	.235	.255
275	1.177	275	.225	.244
300	1.197	300	.216	.234
325	1.217	325	.208	.226
350	1.236	350	.201	.218
375	1.255	375	.194	.211
400	1.274	400	.188	.204
425	1.292	425	.183	.198
450	1.310	450	.178	.193
475	1.328	475	.173	.188
500	1.346	500	.169	.183


PRESSURE LOSS OF VARIOUS FLOW MEASUREMENT DEVICES
PRESSURE LOSS IN % OF ACTUAL DIFFERENTIAL
100
90
80
70
60
50
40
30
20
10
0
ORIFICE
FLOW NOZZLE
VENTURI
0.2
0.3
0.4
0.5
0.6
0.7
0.8
BETA RATIO

Series V1 — Brass & Bronze Venturis

Series V1 Brass Venturis (½"–1") and Bronze Venturis (1¼"–3") are precision-made for pressures to 250 PSIG and temperatures to +250°F. Shipped with identification tags and fitting kit (brass nipples, brass valves, and color-coded quick connect couplings).



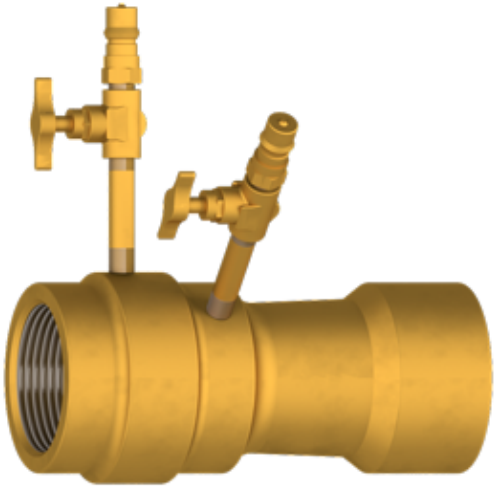


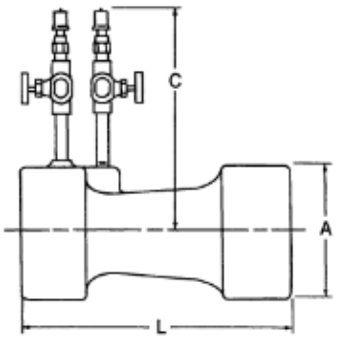
The Series V1 Brass Venturi in sizes ½" to 1" is shown above. It is rated to handle pressures to 250 psig and temperatures to +250°F. Each brass venturi is precision made to assure accuracy. Shipped with identification tags and fitting kit (brass nipples, brass valves and color-coded quick connect couplings) attached.

All **HYSPAN** Venturis are shipped with a permanently attached tag which shows the correct capacity curve for converting meter readings to gpm.

All dimensions in inches. **BRASS 1/2" TO 1"**

Pipe Size	Beta Ratio	Size Code	End Code	COMPLETE PART NUMBER	A Diam.	C	L	End Connection	Weight each (lbs.)	Rating PSI at +250°F.*
1/2	251	08	31	BR12251-08-31	1.50	5.13	3.40	½" NPT	2.0	250
	323	08	31	BR12323-08-31	1.50	5.13	3.40	½" NPT	2.0	250
	402	08	31	BR12402-08-31	1.50	5.13	3.40	½" NPT	2.0	250
3/4	220	12	31	BR12220-12-31	1.75	5.26	3.40	¾" NPT	2.5	250
	290	12	31	BR12290-12-31	1.75	5.26	3.40	¾" NPT	2.5	250
	390	12	31	BR12390-12-31	1.75	5.26	3.40	¾" NPT	2.5	250
	425	12	31	BR12425-12-31	1.75	5.26	3.40	¾" NPT	2.5	250
	550	12	31	BR12550-12-31	1.75	5.26	3.40	¾" NPT	2.5	250
1	298	16	31	BR12298-16-31	2.00	5.38	4.12	1" NPT	3.0	250
	358	16	31	BR12358-16-31	2.00	5.38	4.12	1" NPT	3.0	250
	448	16	31	BR12448-16-31	2.00	5.38	4.12	1" NPT	3.0	250
	567	16	31	BR12567-16-31	2.00	5.38	4.12	1" NPT	3.0	250
	705	16	31	BR12705-16-31	2.00	5.38	4.12	1" NPT	3.0	250





HOW TO ORDER

To order a **HYSPAN** Venturi, state the complete part number, as shown in color below. The part number consists of the following elements: first, a basic assembly number which designates the type of venturi; second, the beta ratio; third, the size; and fourth, the end code. Below is a typical example.

End Code

31 = NPT

Complete Part Number **BR12374-20-31**

- Basic Assembly Number
- Beta Ratio
- Size Code
- End Code

The Series V1 Bronze Venturi in sizes 1¼" to 3" is shown above. It is rated to handle pressures to 250 psig and temperatures to +250°F. Each bronze venturi is precision made to assure accuracy. Shipped with identification tags and fitting kit (brass nipples, brass valves and color-coded quick connect couplings) attached.

All dimensions in inches.

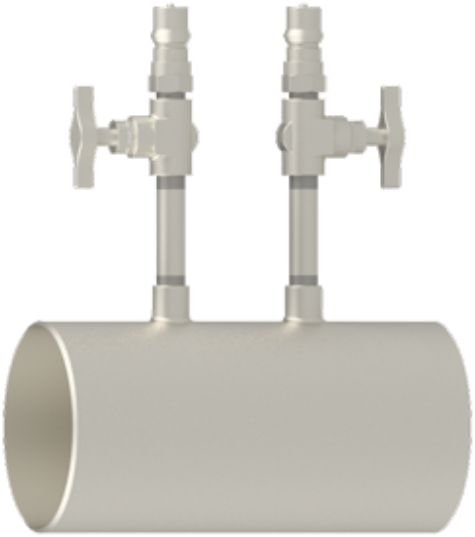
BRONZE 1 1/4" TO 3"

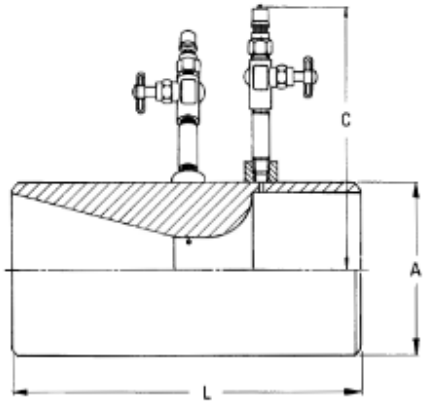
*** For pressure rating of fittings, see page 25.**

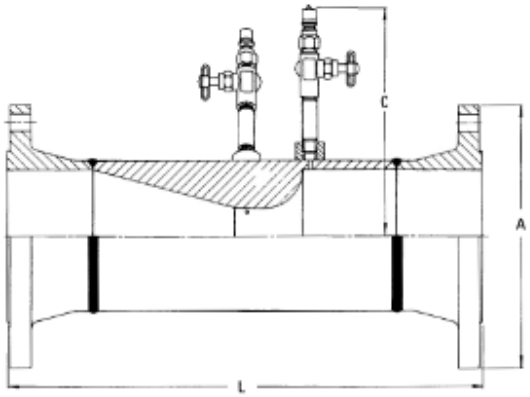
Pipe Size	Beta Ratio	Size Code	End Code	COMPLETE PART NUMBER	A Diam.	C	L	End Connection	Weight each (lbs.)	Rating PSI at +250°F.*
1 1/4	374	20	31	BR12374-20-31	2.09	5.50	6.10	1¼" NPT	4.0	250
	498	20	31	BR12498-20-31	2.09	5.50	6.10	1¼" NPT	4.0	250
	588	20	31	BR12588-20-31	2.09	5.50	6.10	1¼" NPT	4.0	250
	725	20	31	BR12725-20-31	2.09	5.50	6.10	1¼" NPT	4.0	250
1 1/2	427	24	31	BR12427-24-31	2.34	5.63	6.60	1½" NPT	5.0	250
	563	24	31	BR12563-24-31	2.34	5.63	6.60	1½" NPT	5.0	250
	698	24	31	BR12698-24-31	2.34	5.63	6.60	1½" NPT	5.0	250
2	393	32	31	BR12393-32-31	2.94	5.88	7.83	2" NPT	6.0	250
	483	32	31	BR12483-32-31	2.94	5.88	7.83	2" NPT	6.0	250
	636	32	31	BR12636-32-31	2.94	5.88	7.83	2" NPT	6.0	250
2 1/2	480	40	31	BR12480-40-31	3.55	6.17	8.22	2½" NPT	9.0	250
	607	40	31	BR12607-40-31	3.55	6.17	8.22	2½" NPT	9.0	250
	750	40	31	BR12750-40-31	3.55	6.17	8.22	2½" NPT	9.0	250
3	478	48	31	BR12478-48-31	4.27	6.49	8.31	3" NPT	12.0	250
	610	48	31	BR12610-48-31	4.27	6.49	8.31	3" NPT	12.0	250
	750	48	31	BR12750-48-31	4.27	6.49	8.31	3" NPT	12.0	250

Series V5 — Steel Venturis (2½"–10")

Series V5 Steel Venturis are available in sizes 2½" through 10" with flanged or weld ends. Shipped with identification tags and fitting kit. Rated to 225 PSIG (2½"–3") and 500 PSIG (4"–10") at +250°F.







Series V5 Steel Venturis are available in sizes from 2½" thru10", with flanged or weld ends. Shipped with identification tags and fitting kit (brass nipples, brass valves and color-coded quick connect couplings) attached.

All **HYSPAN** Venturis are shipped with a permanently attached tag which shows the correct capacity curve for converting meter readings to gpm.

Other materials, schedule weld ends, flanges, etc., are available on request.

All dimensions in inches.

Pipe Size	Beta Ratio	Size Code	End Code	COMPLETE PART NUMBER	A Diam.	C	L	End Connection	Weight each (lbs.)	Rating PSI at +250°F.*
2½	480	40	41	BR29480-40-41	7.00	6.26	11.25	150# Flange	25.0	225**
	480	40	61	BR29480-40-61	3.10	6.26	5.50	Sch. 40 .203 Wall	5.5	500†
	607	40	41	BR29607-40-41	7.00	6.26	10.50	150# Flange	23.5	225**
	607	40	61	BR29607-40-61	3.10	6.26	4.75	Sch. 40 .203 Wall	5.0	500†
	750	40	41	BR29750-40-41	7.00	6.26	9.75	150# Flange	22.0	225**
	750	40	61	BR29750-40-61	3.10	6.26	4.00	Sch. 40 .203 Wall	4.0	500†
3	478	48	41	BR29478-48-41	7.50	6.56	11.75	150# Flange	34.0	225**
	478	48	61	BR29478-48-61	3.79	6.56	6.00	Sch. 40 .216 Wall	8.0	500†
	610	48	41	BR29610-48-41	7.50	6.56	11.00	150# Flange	32.0	225**
	610	48	61	BR29610-48-61	3.79	6.56	5.25	Sch. 40 .216 Wall	7.0	500†
	750	48	41	BR29750-48-41	7.50	6.56	10.25	150# Flange	30.0	225**
	750	48	61	BR29750-48-61	3.79	6.56	4.50	Sch. 40 .216 Wall	6.0	500†

HOW TO ORDER

To order a **HYSPAN** Venturi, state the complete part number, as shown in color below. The part number consists of the following elements: first, a basic assembly number which designates the type of venturi; second, the beta ratio; third, the size; and fourth, the end code. Below is a typical example.

End Codes

41 = 150 lb. Flange **61** = Weld End **81** = Grooved End

Complete Part Number **BR29465-64-41**

- Basic Assembly Number
- Beta Ratio
- Size Code
- End Code

* For pressure rating of fittings, see page 25.

** When flanges are used, venturi body without fitting kit is rated at the flange pressure rating, i.e., ANSI 150 lb., ANSI 300 lb., or ANSI 600 lb. (2", 2½" and 3" only).

† Pressure rating of venturi body without fitting kit for 2", 2½", 3" and 4" is designed to meet ANSI 600 lb. ratings, i.e., 1440 psig up to +100°F., 1100 psig up to +600°F.

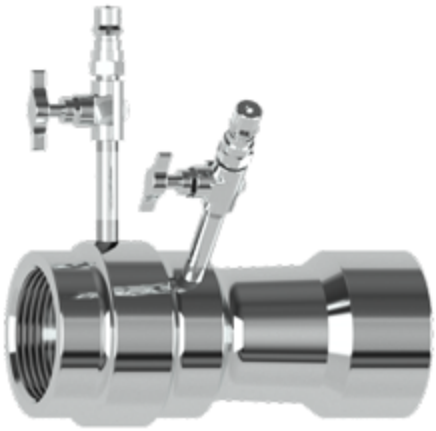
‡ Pressure rating of venturi body without fitting kit for 5", 6", 8", and 10" is designed to meet ANSI 300 lb. ratings, i.e., 720 psig up to +100°F., 550 psig up to +600°F.

All dimensions in inches.

Pipe Size	Beta Ratio	Size Code	End Code	COMPLETE PART NUMBER	A Diam.	C	L	End Connection	Weight each (lbs.)	Rating PSI at +250°F.*
4	465	64	41	BR29465-64-41	9.00	7.04	13.75	150# Flange	47.0	225**
	465	64	61	BR29465-64-61	4.89	7.04	7.50	Sch. 40 .237 Wall	17.0	500†
	620	64	41	BR29620-64-41	9.00	7.04	12.50	150# Flange	42.0	225**
	620	64	61	BR29620-64-61	4.89	7.04	6.25	Sch. 40 .237 Wall	14.0	500†
	745	64	41	BR29745-64-41	9.00	7.04	11.50	150# Flange	40.0	225**
	745	64	61	BR29745-64-61	4.89	7.04	5.25	Sch. 40 .237 Wall	12.0	500†
5	572	65	41	BR29572-65-41	10.00	7.61	14.75	150# Flange	58.0	225**
	572	65	61	BR29572-65-61	5.91	7.61	7.50	Sch. 40 .258 Wall	21.0	500†
	718	65	41	BR29718-65-41	10.00	7.61	12.75	150# Flange	51.0	225**
	718	65	61	BR29718-65-61	5.91	7.61	5.50	Sch. 40 .258 Wall	15.0	500†
6	628	66	41	BR29628-66-41	11.00	8.12	15.25	150# Flange	74.0	225**
	628	66	61	BR29628-66-61	6.92	8.12	8.00	Sch. 40 .280 Wall	29.0	500‡
	750	66	41	BR29750-66-41	11.00	8.12	13.25	150# Flange	64.0	225**
	750	66	61	BR29750-66-61	6.92	8.12	6.00	Sch. 40 .280 Wall	21.0	500‡
8	615	68	41	BR29615-68-41	13.50	9.12	18.25	150# Flange	123.0	225**
	615	68	61	BR29615-68-61	8.96	9.12	10.00	Sch. 40 .322 Wall	49.0	500‡
	743	68	41	BR29743-68-41	13.50	9.12	16.25	150# Flange	110.0	225**
	743	68	61	BR29743-68-61	8.96	9.12	8.00	Sch. 40 .322 Wall	39.0	500‡
10	605	70	41	BR29605-70-41	16.00	10.12	21.00	150# Flange	154	225**
	605	70	61	BR29605-70-61	10.75	10.12	13.00	Sch. 40 .365 Wall	62	500
	796	70	41	BR29796-70-41	16.00	10.12	17.00	150# Flange	138	225**
	796	70	61	BR29796-70-61	10.75	10.12	9.00	Sch. 40 .365 Wall	50	500

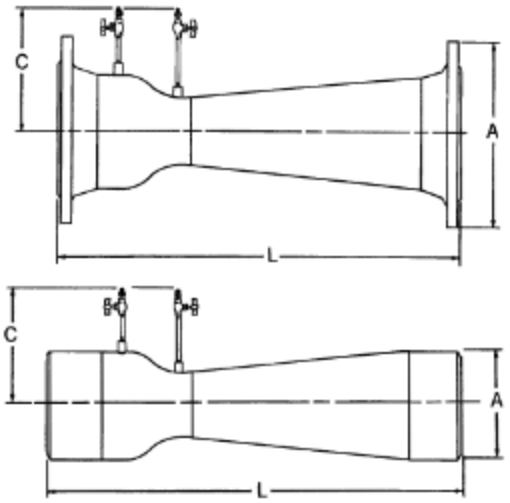
Series V3 — Fabricated Steel Venturis (12”–30”)

Series V3 Fabricated Steel Venturis are available with flanged or weld ends in sizes 12” to 30”. Design pressure ratings are indicated on the ordering page and are limited to the pressure ratings of the Series V3 venturi body (without fitting kit). Shipped with identification tags and fitting kit.



Series V3 Fabricated Steel Venturi is available with flanged or weld ends in sizes from 12" to 30". Design pressure ratings of Series V3 venturi body (without fitting kit) is limited to pressure ratings as indicated on this page and the next. Shipped with identification tags and fitting kit (brass nipples, brass valves and color-coded quick connect couplings) attached.

Sizes: 12" thru 16"



Other materials, schedule weld ends, flanges, etc., are available on request.

All dimensions in inches.

Pipe Size	Beta Ratio	Size Code	End Code	COMPLETE PART NUMBER	A Diam.	C	L	End Connection	Weight each (lbs.)	Rating PSI at +250°F.*
12	506	72	41	BR24506-72-41	19.00	13.89	42.00	150# Flange	300	225**
	506	72	61	BR24506-72-61	12.75	13.82	45.00	Std. Sch. .375 Wall	175	500
	665	72	41	BR24665-72-41	19.00	13.89	34.00	150# Flange	225	225**
	665	72	61	BR24665-72-61	12.75	13.82	37.00	Std. Sch. .375 Wall	150	500
	750	72	41	BR24750-72-41	19.00	14.31	36.50	150# Flange	240	225**
	750	72	61	BR24750-72-61	12.75	14.31	39.50	Std. Sch. .375 Wall	130	500
14	602	74	41	BR24602-74-41	21.00	14.75	45.00	150# Flange	375	225**
	602	74	61	BR24602-74-61	14.00	14.75	47.00	Sch. 30 .375 Wall	225	450
	756	74	41	BR24756-74-41	21.00	14.82	37.00	150# Flange	350	225**
	756	74	61	BR24756-74-61	14.00	14.82	39.00	Sch. 30 .375 Wall	200	450
16	523	76	41	BR24523-76-41	23.50	15.75	54.00	150# Flange	500	225**
	523	76	61	BR24523-76-61	16.00	15.75	56.00	Sch. 30 .375 Wall	275	400
	658	76	41	BR24658-76-41	23.50	15.82	46.00	150# Flange	475	225**
	658	76	61	BR24658-76-61	16.00	15.44	48.00	Sch. 30 .375 Wall	250	400
	786	76	41	BR24786-76-41	23.50	15.82	39.00	150# Flange	450	225**
	786	76	61	BR24786-76-61	16.00	15.82	41.00	Sch. 30 .375 Wall	225	400

HOW TO ORDER

To order a **HYSPAN** Venturi, state the complete part number, as shown in color below. The part number consists of the following elements: first, a basic assembly number which designates the type of venturi; second, the beta ratio; third, the size; and fourth, the end code. Below is a typical example.

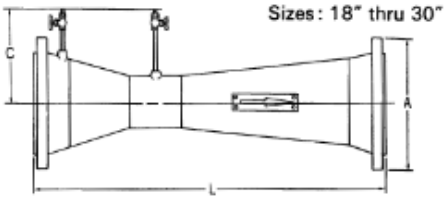
End Codes

41 = 150 lb. Flange **61** = Weld End **81** = Grooved End

Complete Part Number **BR24605-70-41**

- Basic Assembly Number
- Beta Ratio
- Size Code
- End Code

All **HYSPAN** Venturis are shipped with a permanently attached tag which shows the correct capacity curve for converting meter readings to gpm.



*** For pressure rating of fittings, see page 25.**

**** When flanges are used, venturi body without fitting kit is rated at the flange pressure rating for the 12" through 20" venturi, i.e., ANSI 150 lb.**

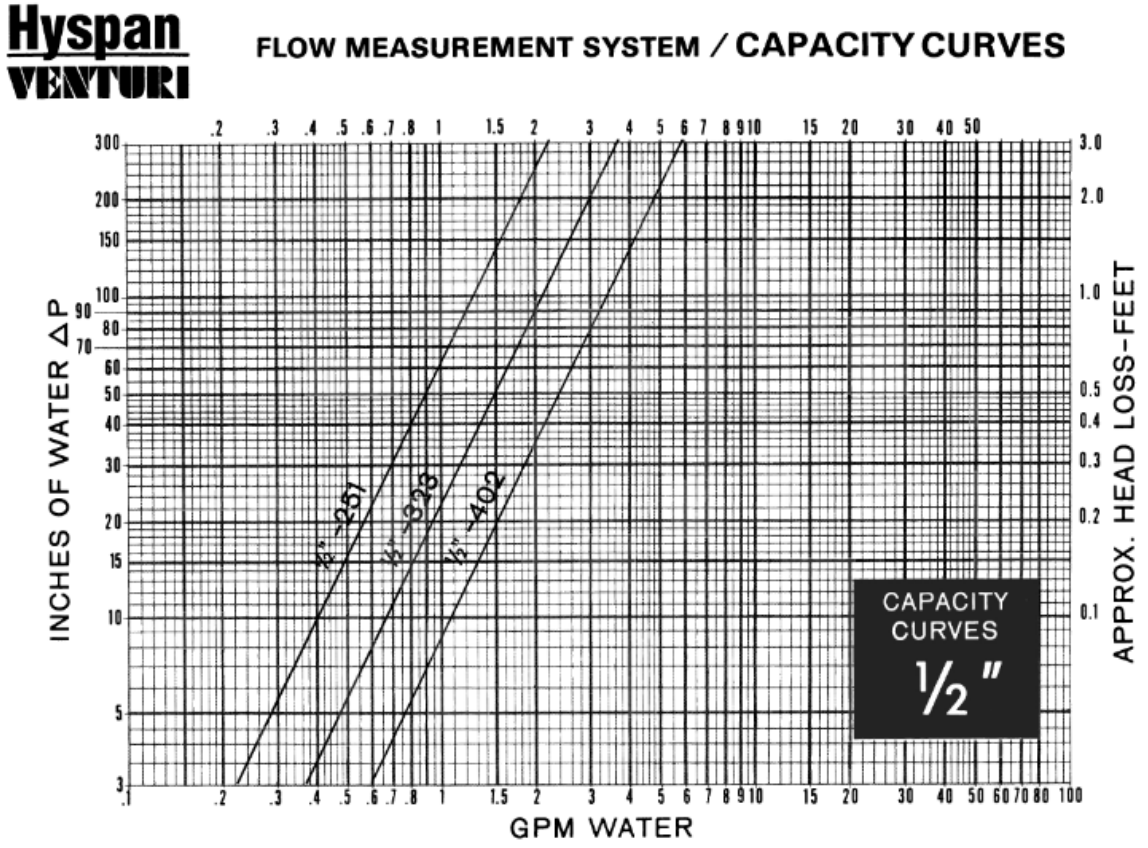
† Maximum pressure rating for 24" and 30" venturi is 250 psig, with or without 150 lb. flanges.

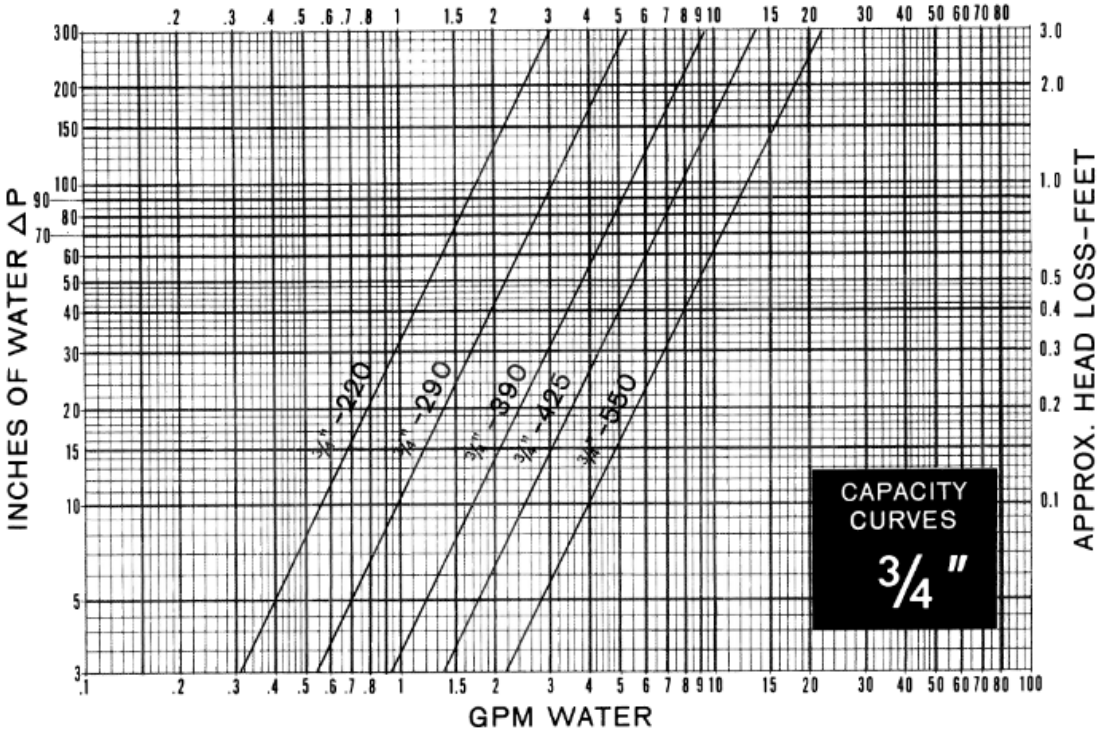
All dimensions in inches.

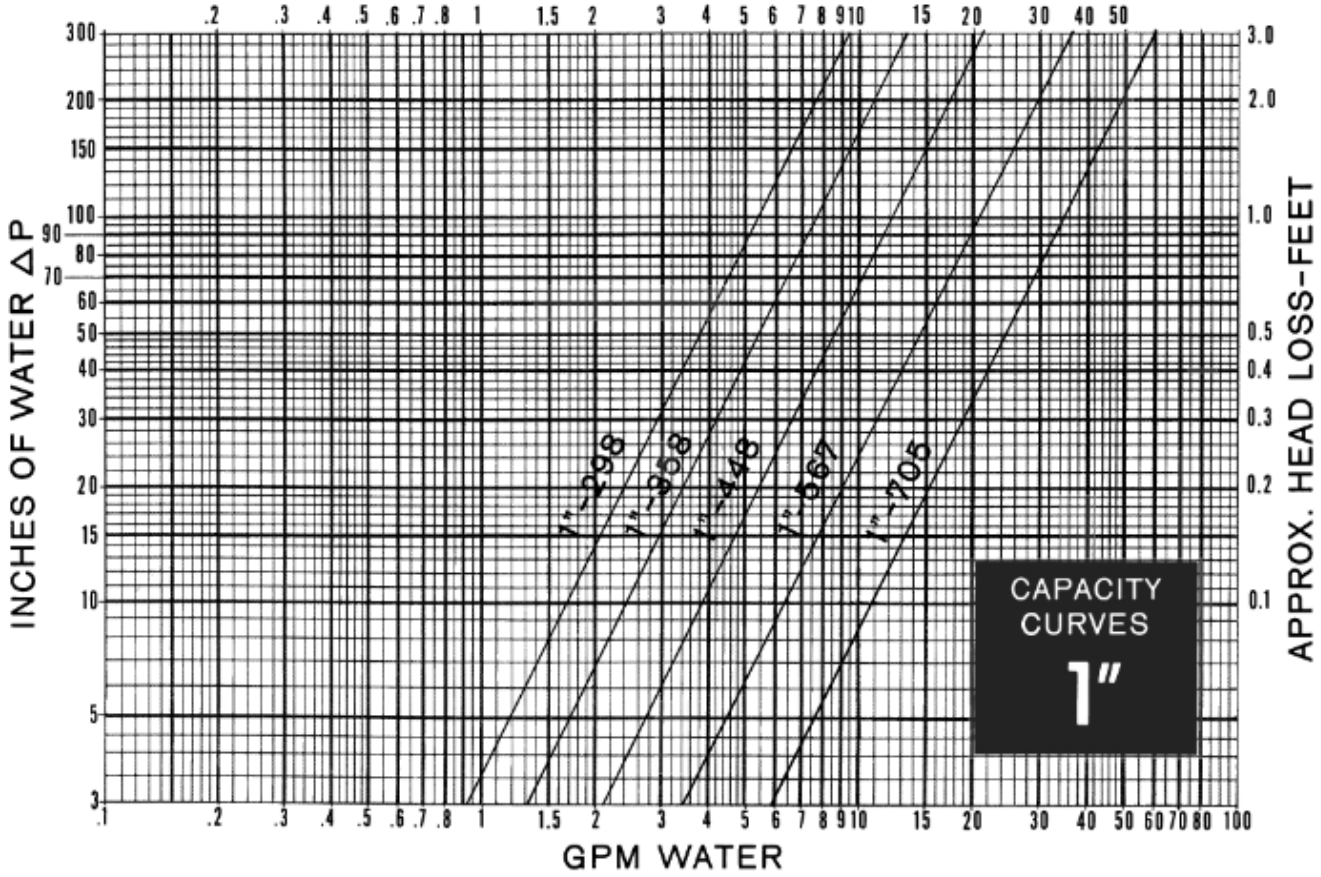
Pipe Size	Beta Ratio	Size Code	End Code	COMPLETE PART NUMBER	A Diam.	C	L	End Connection	Weight each (lbs.)	Rating PSI at +250°F.*
18	581	78	41	BR24581-78-41	25.00	16.82	67.00	150# Flange	600	225**
	581	78	61	BR24581-78-61	18.00	16.82	80.00	Std. Sch. .375 Wall	425	350
	696	78	41	BR24696-78-41	25.00	16.82	54.00	150# Flange	550	225**
	696	78	61	BR24696-78-61	18.00	16.82	67.00	Std. Sch. .375 Wall	375	350
	768	78	41	BR24768-78-41	25.00	16.51	46.00	150# Flange	500	225**
	768	78	61	BR24768-78-61	18.00	16.44	59.00	Std. Sch. .375 Wall	350	350
20	624	80	41	BR24624-80-41	27.50	17.51	67.38	150# Flange	700	225**
	624	80	61	BR24624-80-61	20.00	17.44	80.00	Sch. 20 .375 Wall	500	300
	689	80	41	BR24689-80-41	27.50	17.51	59.38	150# Flange	650	225**
	689	80	61	BR24689-80-61	20.00	17.44	72.00	Sch. 20 .375 Wall	450	300
	793	80	41	BR24793-80-41	27.50	17.51	46.38	150# Flange	600	225**
	793	80	61	BR24793-80-61	20.00	17.44	59.00	Sch. 20 .375 Wall	400	300
24	570	84	41	BR24570-84-41	32.00	19.51	87.00	150# Flange	900	225**
	570	84	61	BR24570-84-61	24.00	19.44	99.00	Sch. 20 .375 Wall	700	250†
	656	84	41	BR24656-84-41	32.00	19.51	73.00	150# Flange	850	225**
	656	84	61	BR24656-84-61	24.00	19.44	85.00	Sch. 20 .375 Wall	600	250†
	743	84	41	BR24743-84-41	32.00	19.51	61.00	150# Flange	800	225**
	743	84	61	BR24743-84-61	24.00	19.44	73.00	Sch. 20 .375 Wall	550	250†
30	521	90	41	BR24521-90-41	38.75	22.51	113.25	150# Flange	1600	225**
	521	90	61	BR24521-90-61	30.00	22.44	127.00	Std. Sch. .375 Wall	1050	250†
	590	90	41	BR24590-90-41	38.75	22.51	99.25	150# Flange	1500	225**
	590	90	61	BR24590-90-61	30.00	22.44	113.00	Std. Sch. .375 Wall	1000	250†
	658	90	41	BR24658-90-41	38.75	22.51	85.24	150# Flange	1400	225**
	658	90	61	BR24658-90-61	30.00	22.44	99.00	Std. Sch. .375 Wall	900	250†
	727	90	41	BR24727-90-41	38.75	22.51	71.25	150# Flange	1300	225**
	727	90	61	BR24727-90-61	30.00	22.44	85.00	Std. Sch. .375 Wall	800	250†

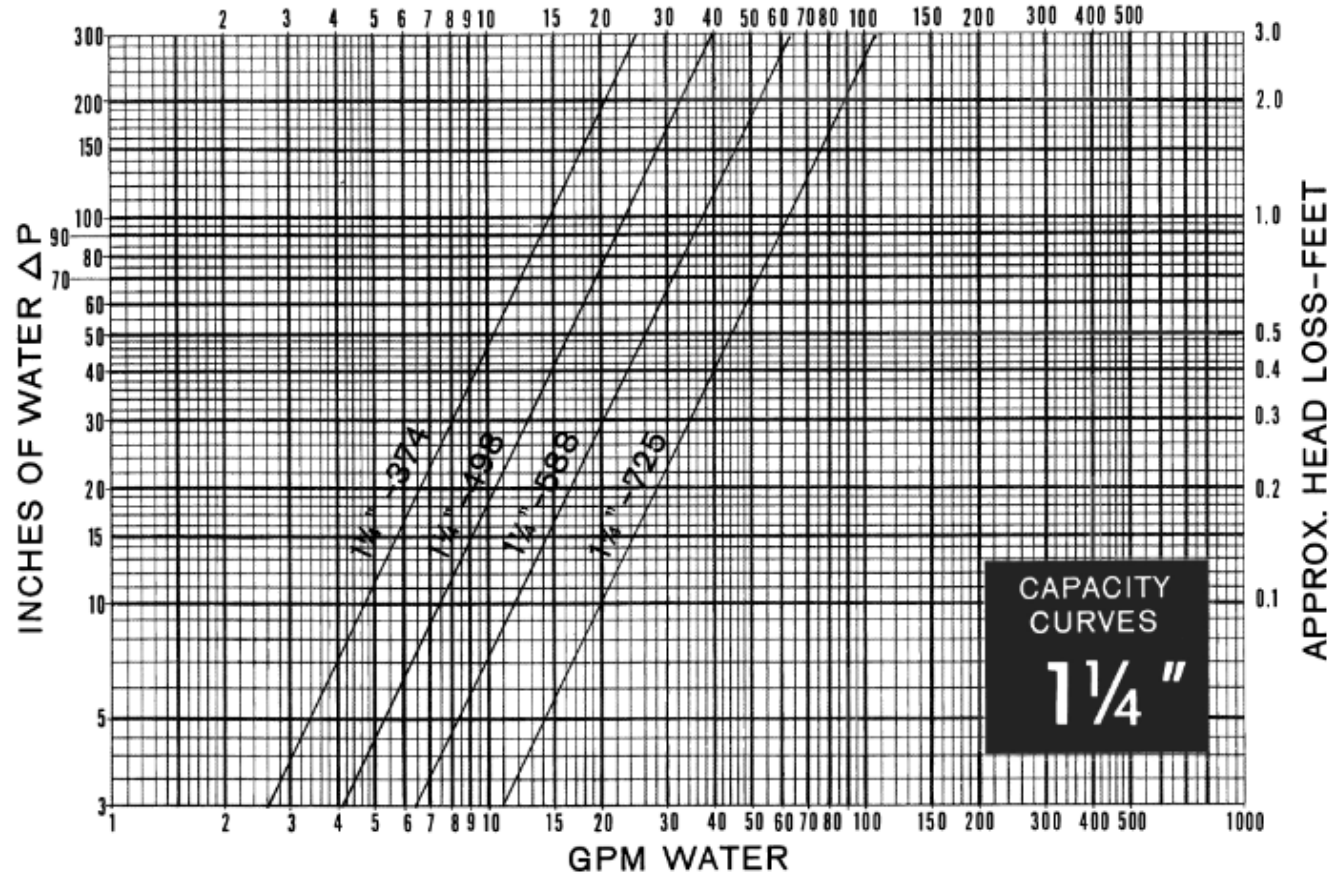
Capacity Curves

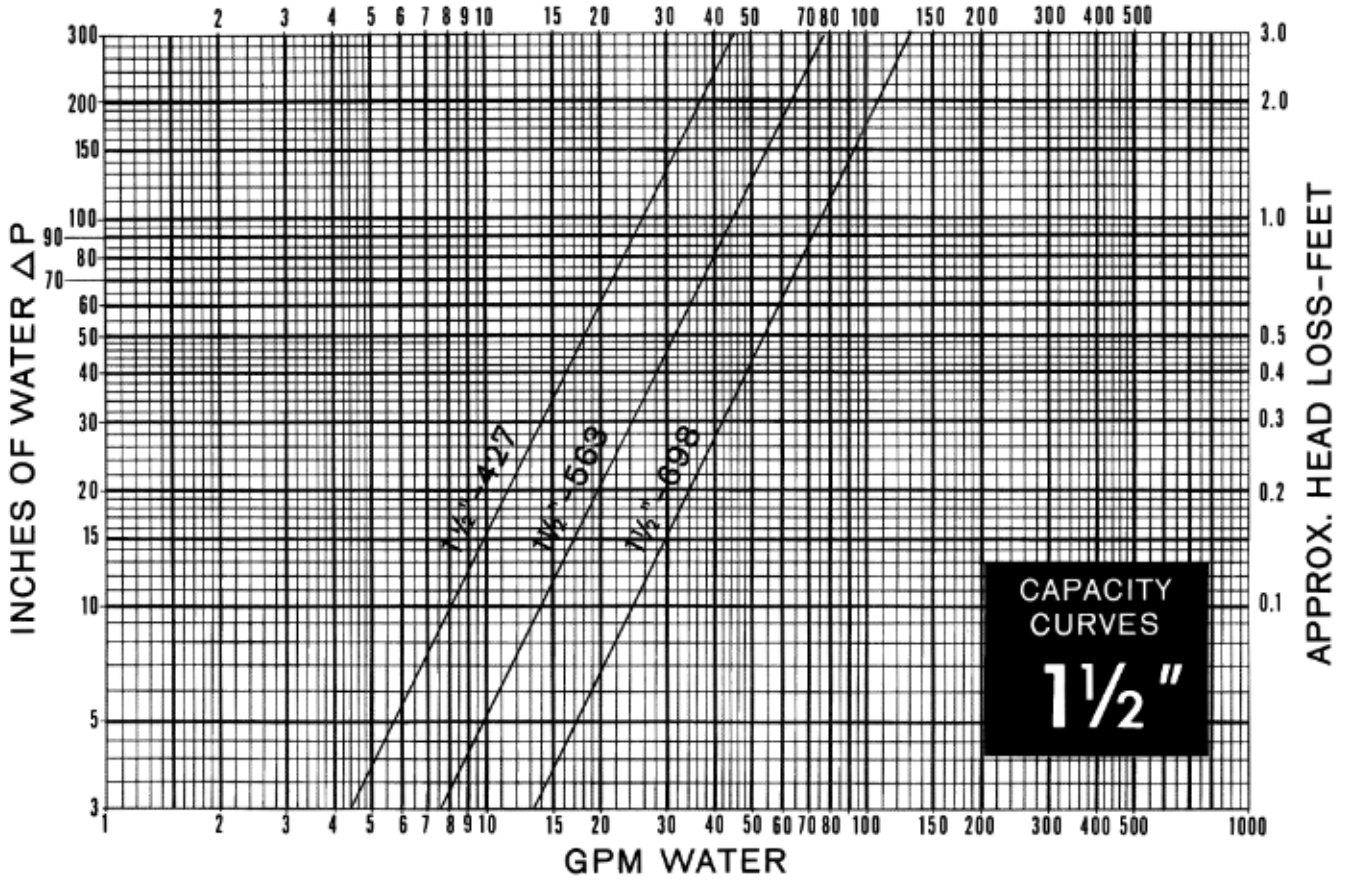
Capacity curves for each venturi size show flow in GPM water on the X-axis vs. differential pressure in inches of water on the Y-axis. Curves are for water at +70°F — for other temperatures or media, apply engineering and media conversion factors. Beta ratio curves are labeled numerically within each chart. Select venturis so that meter readings fall between 20% and 100% of the chart scale for best accuracy.

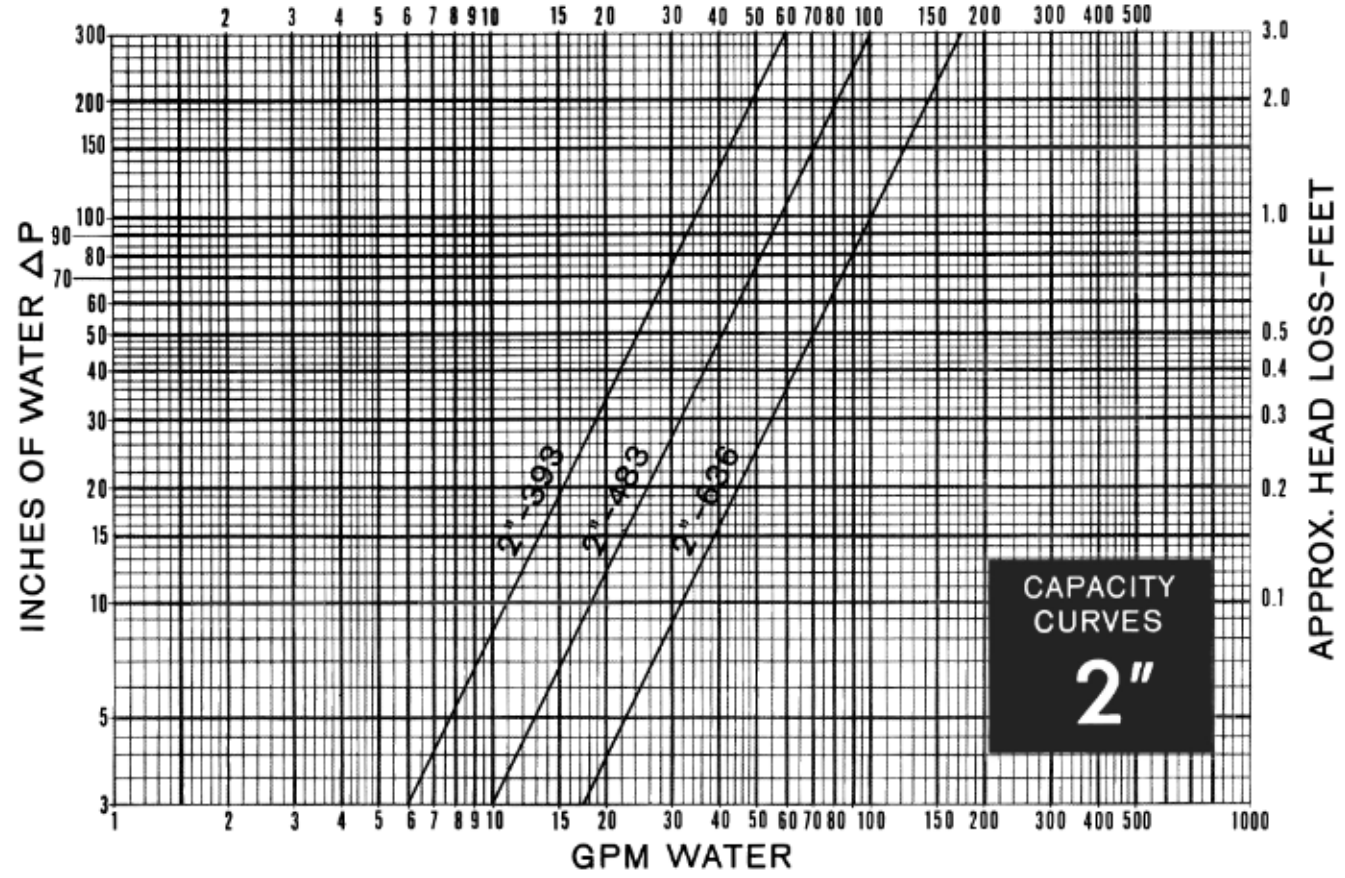


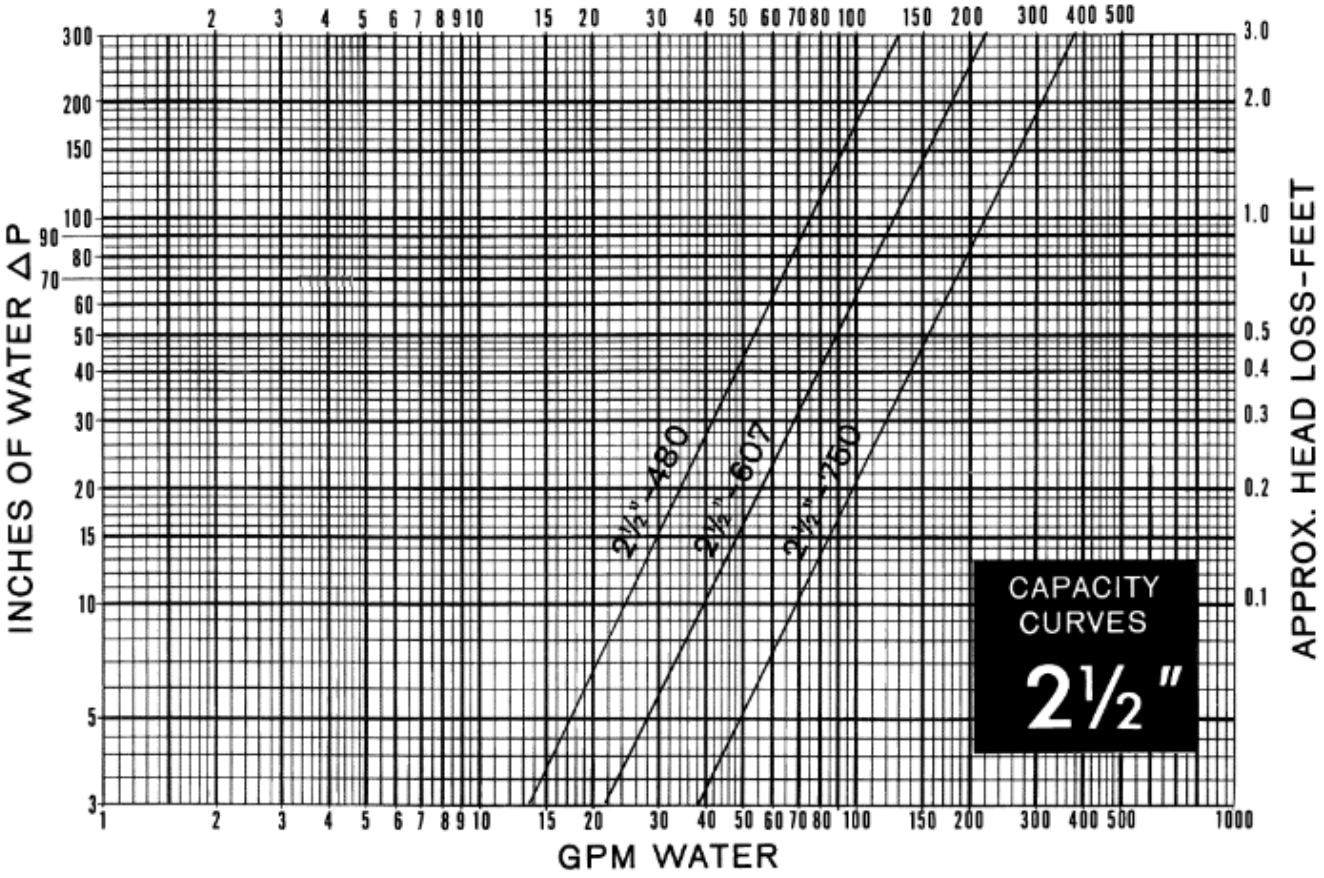


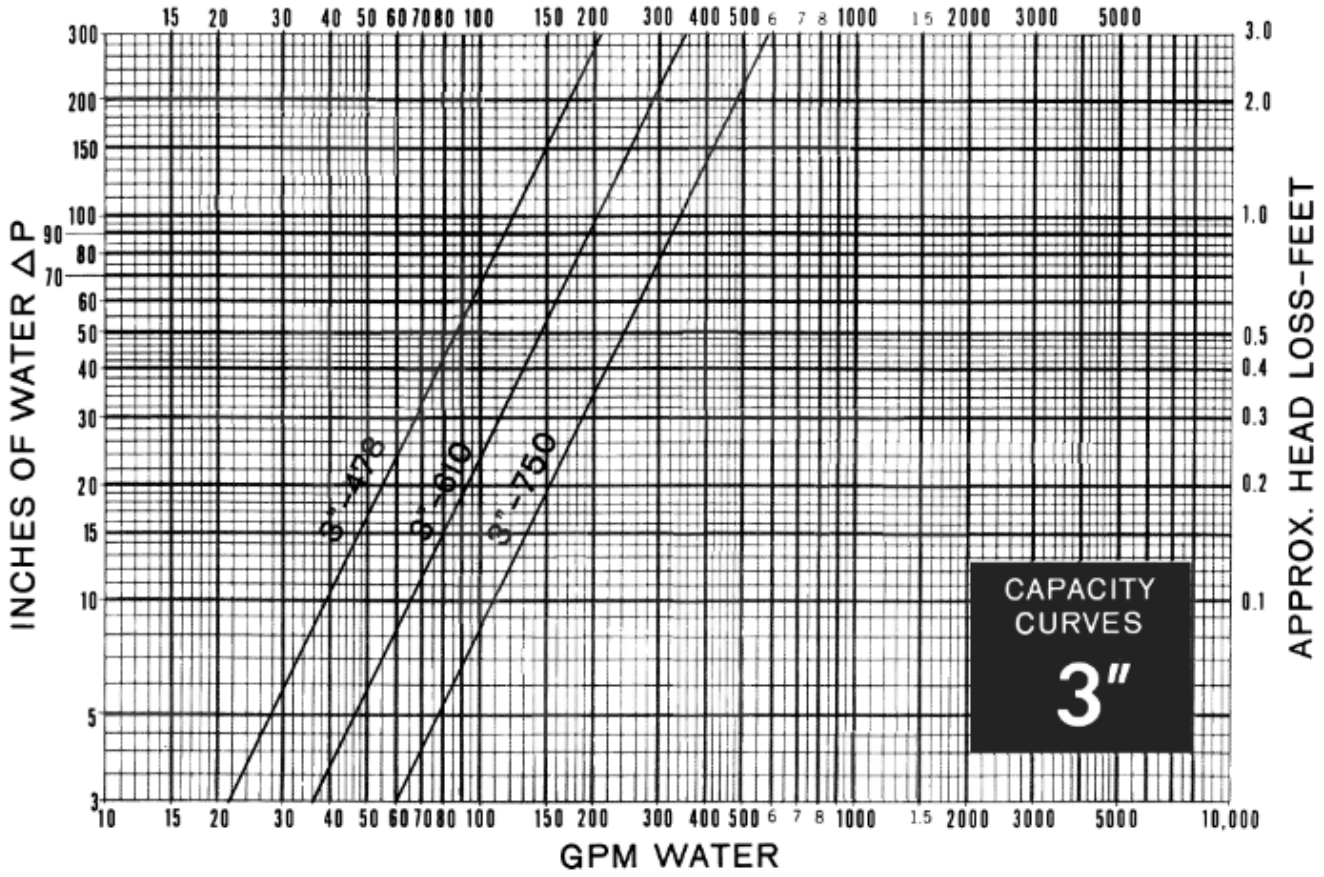

INCHES OF WATER ΔP
APPROX. HEAD LOSS-FEET
GPM WATER
1"-298
1"-358
1"-448
1"-567
1"-705
CAPACITY CURVES
1"

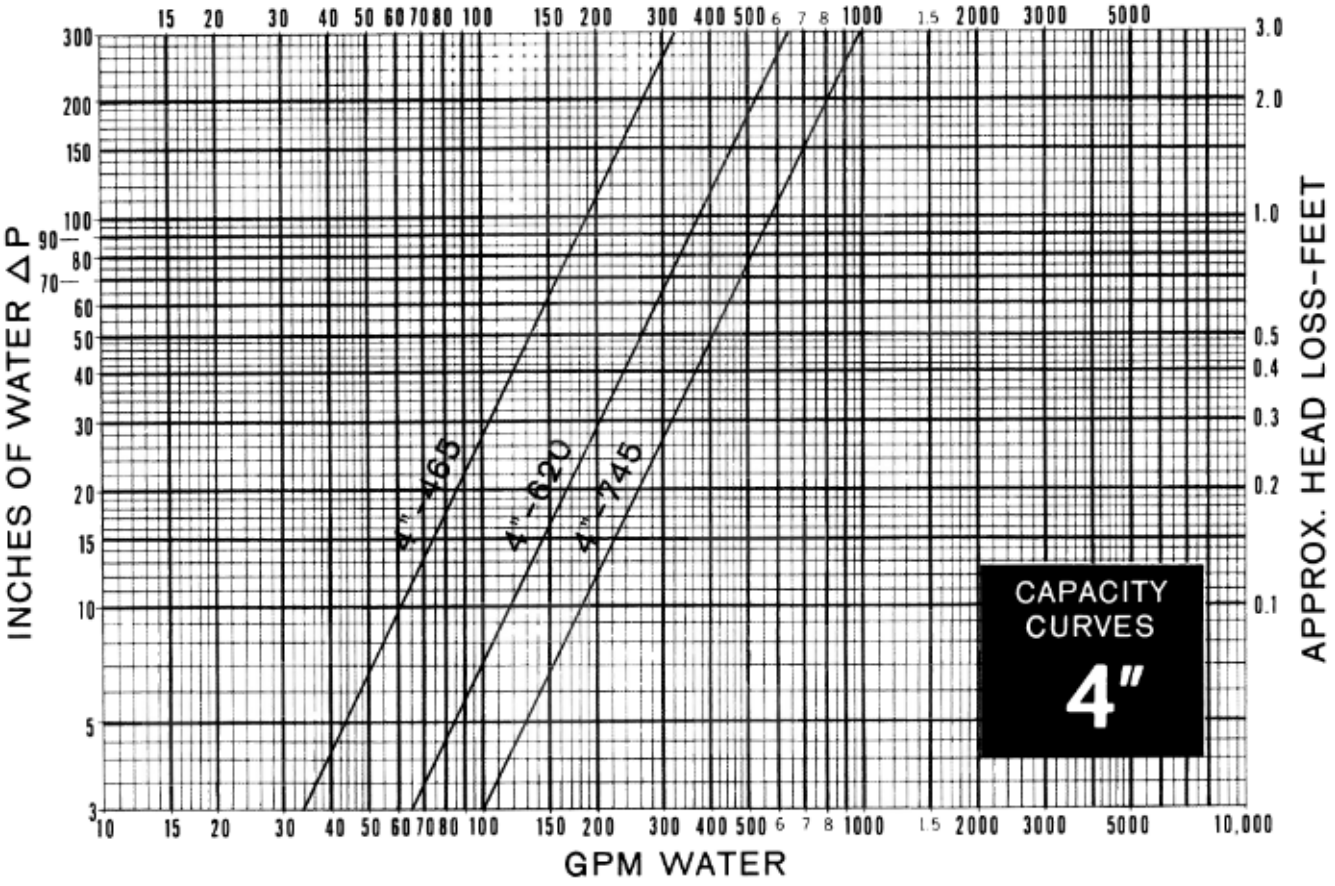

INCHES OF WATER ΔP
APPROX. HEAD LOSS-FEET
GPM WATER
1¼"-373
1¼"-498
1¼"-588
1¼"-725
CAPACITY CURVES
1¼"

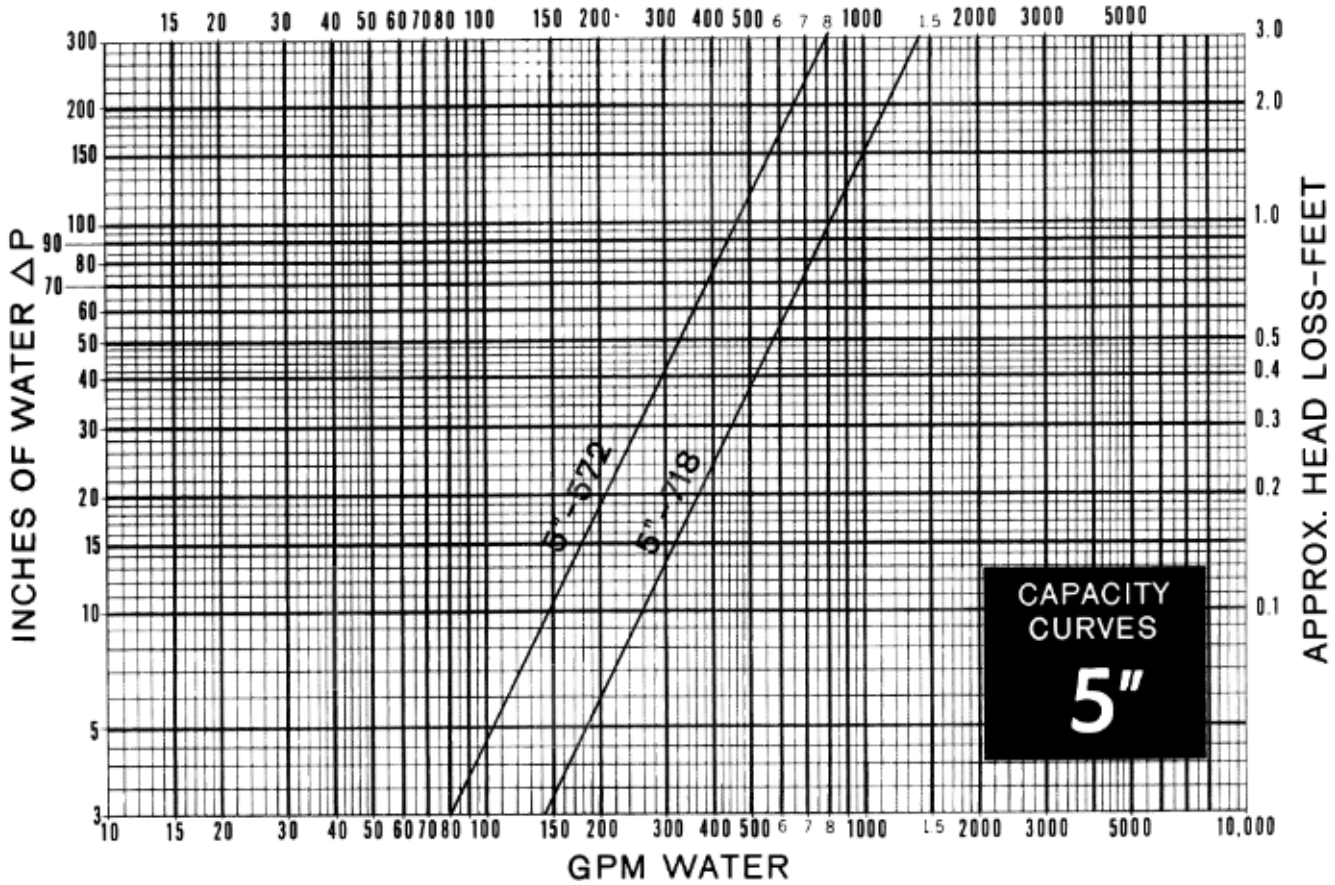

INCHES OF WATER ΔP
APPROX. HEAD LOSS-FEET
GPM WATER
1¼"-427
1½"-563
1½"-698
CAPACITY CURVES
1½"

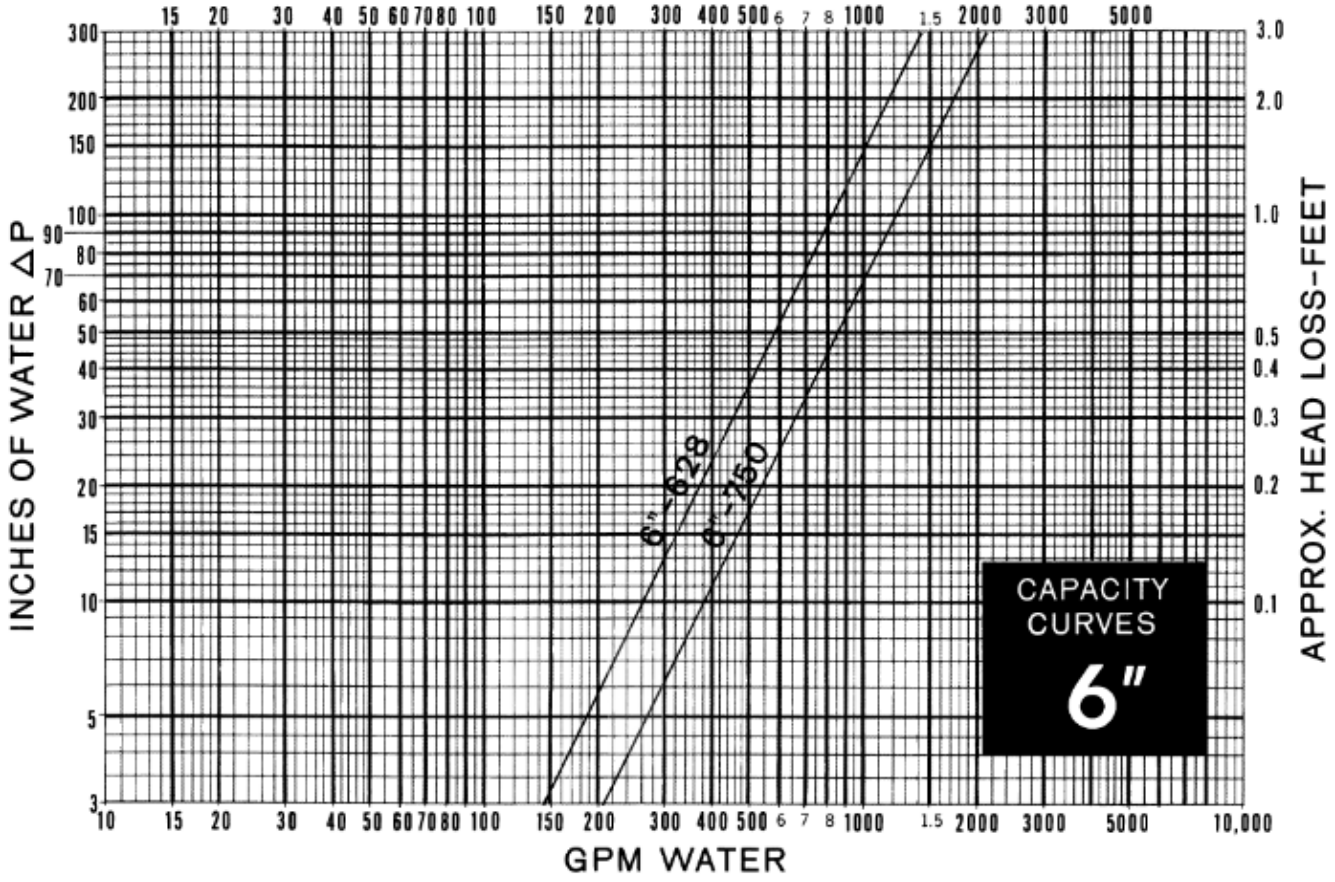

INCHES OF WATER ΔP
APPROX. HEAD LOSS-FEET
GPM WATER
2"-393
2"-483
2"-636
CAPACITY CURVES
2"

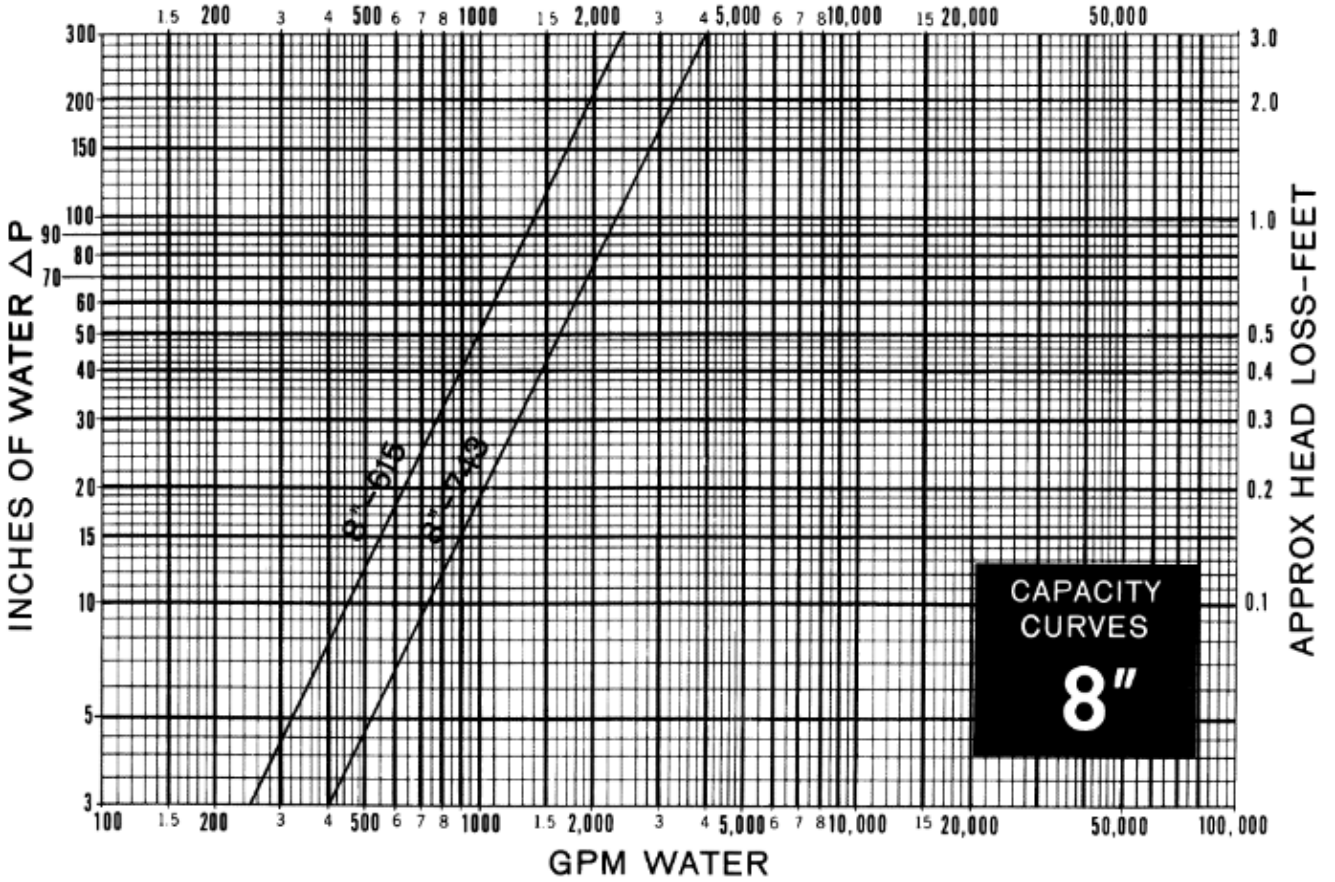

INCHES OF WATER ΔP
APPROX. HEAD LOSS-FEET
GPM WATER
2½"-480
2½"-607
2½"-750
CAPACITY CURVES
2½"

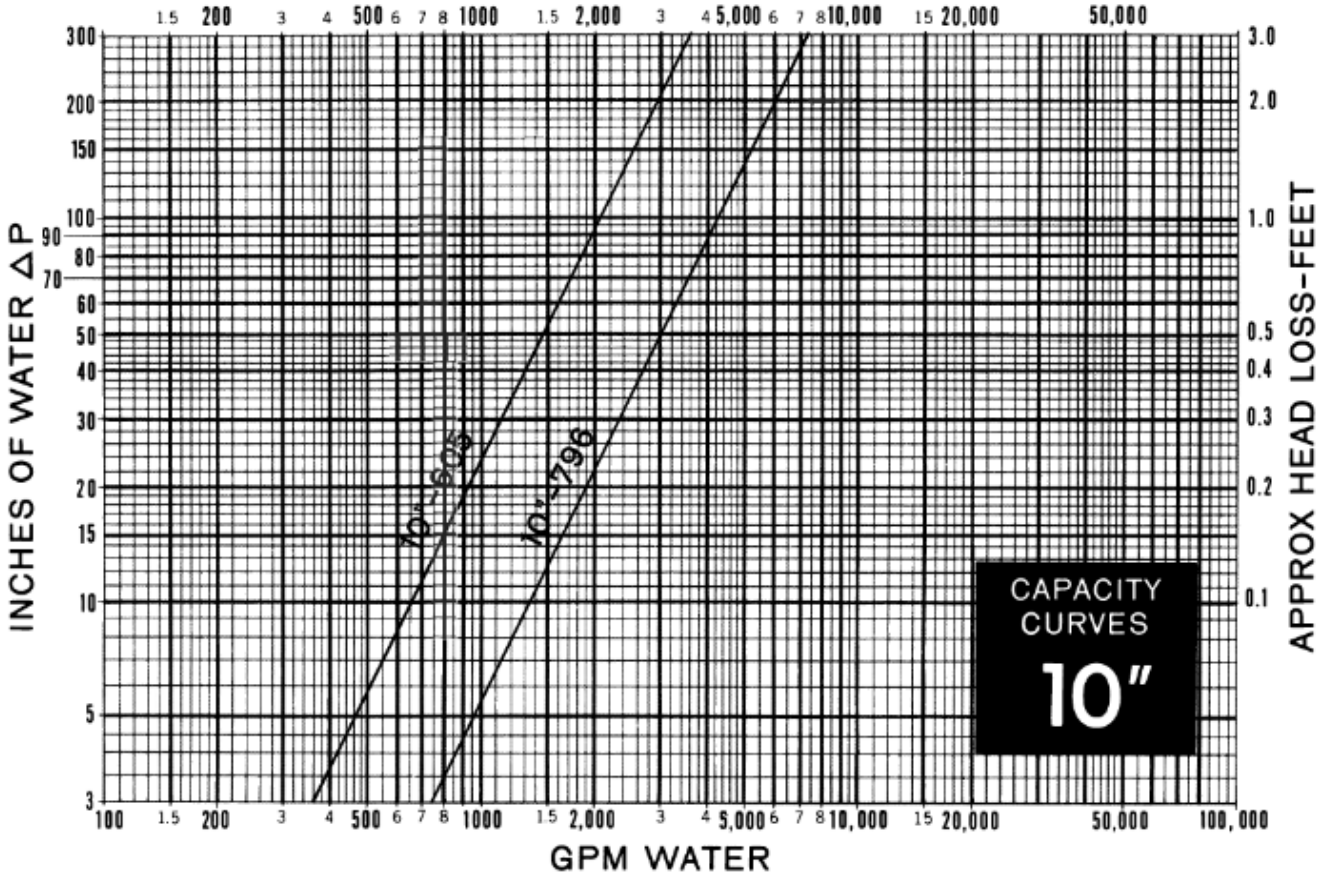

INCHES OF WATER ΔP
APPROX. HEAD LOSS-FEET
GPM WATER
3"-478
3"-610
3"-750
CAPACITY CURVES
3"

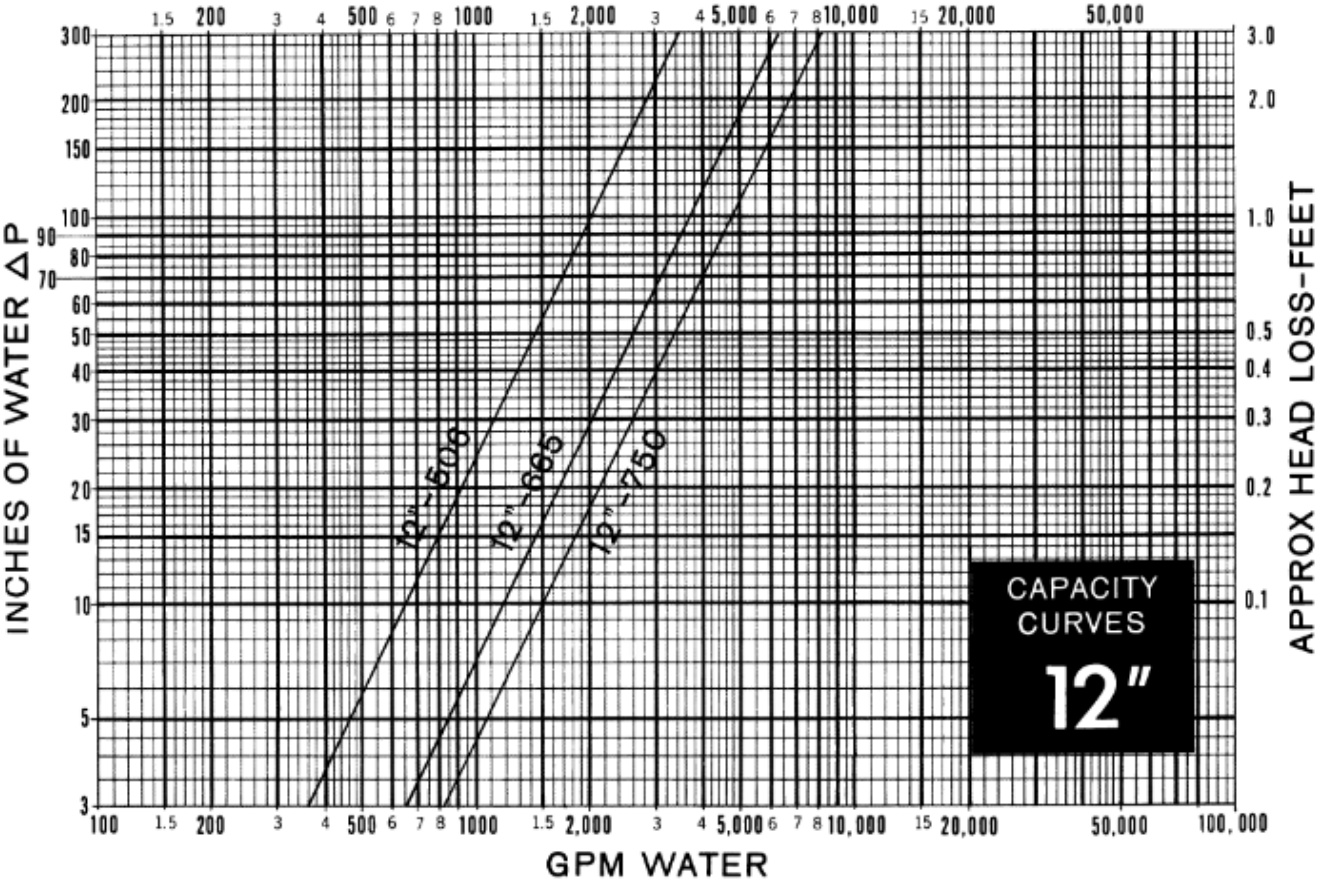

INCHES OF WATER ΔP
APPROX. HEAD LOSS-FEET
GPM WATER
4"-465
4"-620
4"-745
CAPACITY CURVES
4"

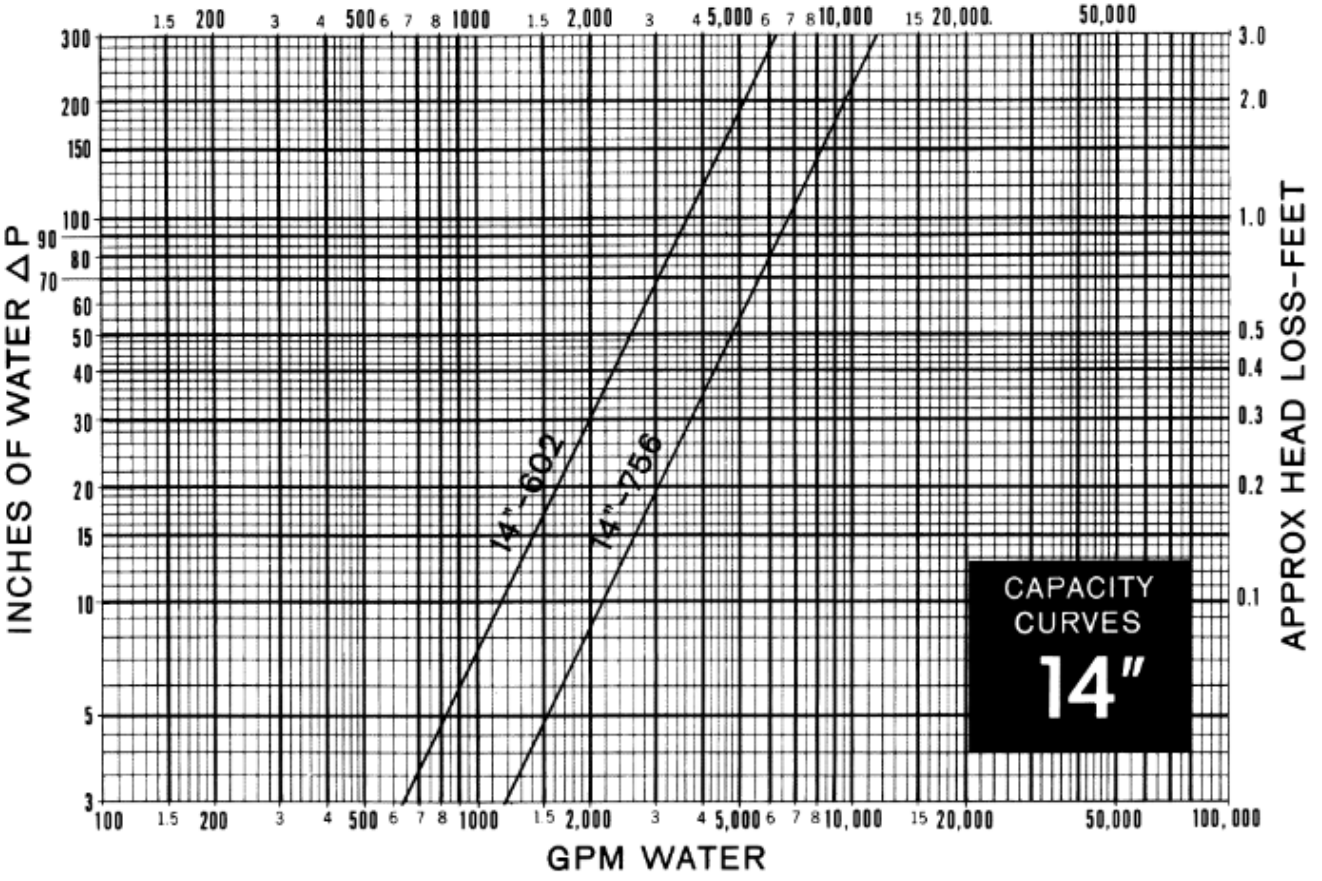

INCHES OF WATER ΔP
APPROX. HEAD LOSS-FEET
GPM WATER
5"-572
5"-718
CAPACITY CURVES
5"

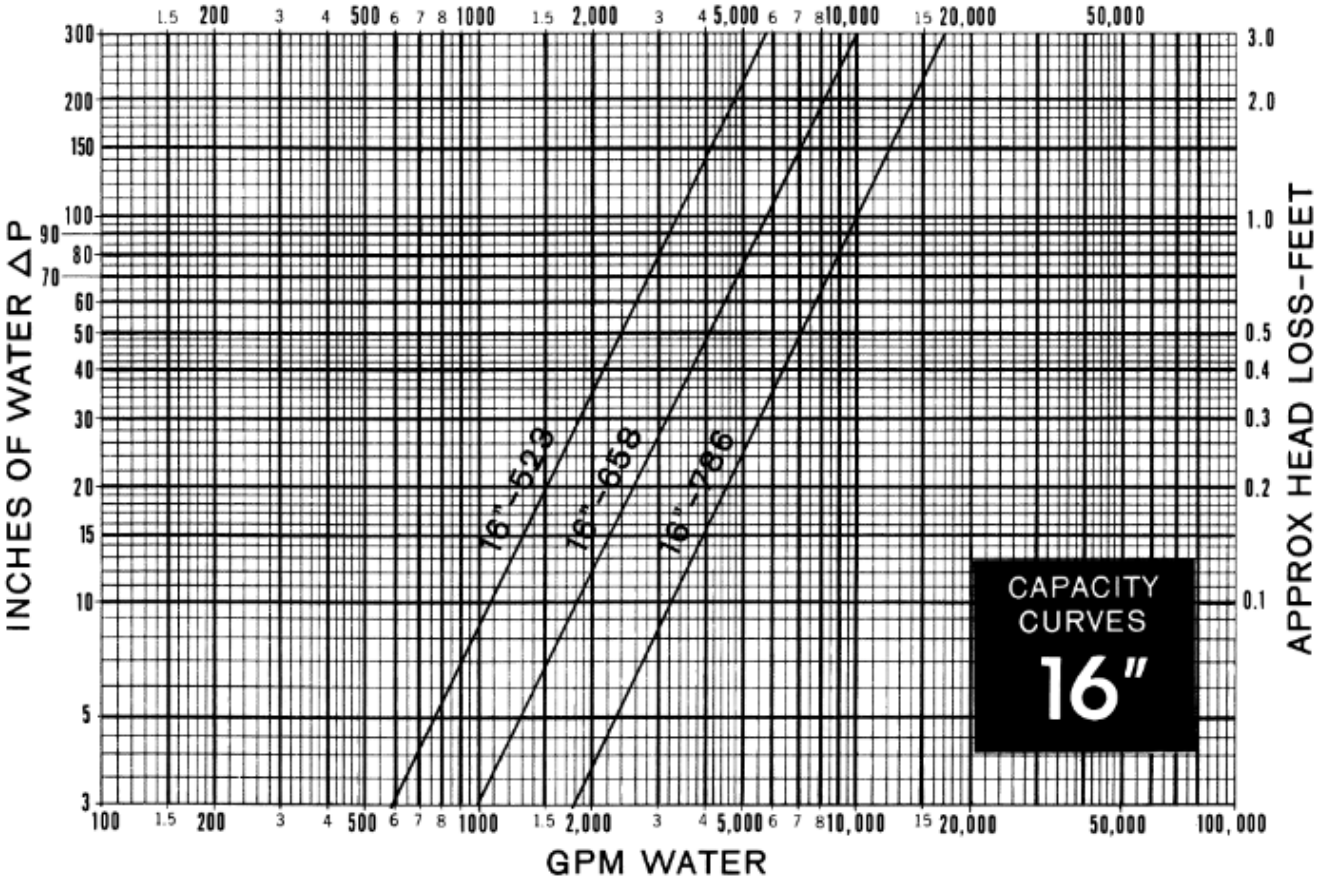

INCHES OF WATER ΔP
APPROX. HEAD LOSS-FEET
GPM WATER
6"-628
6"-250
CAPACITY CURVES
6"

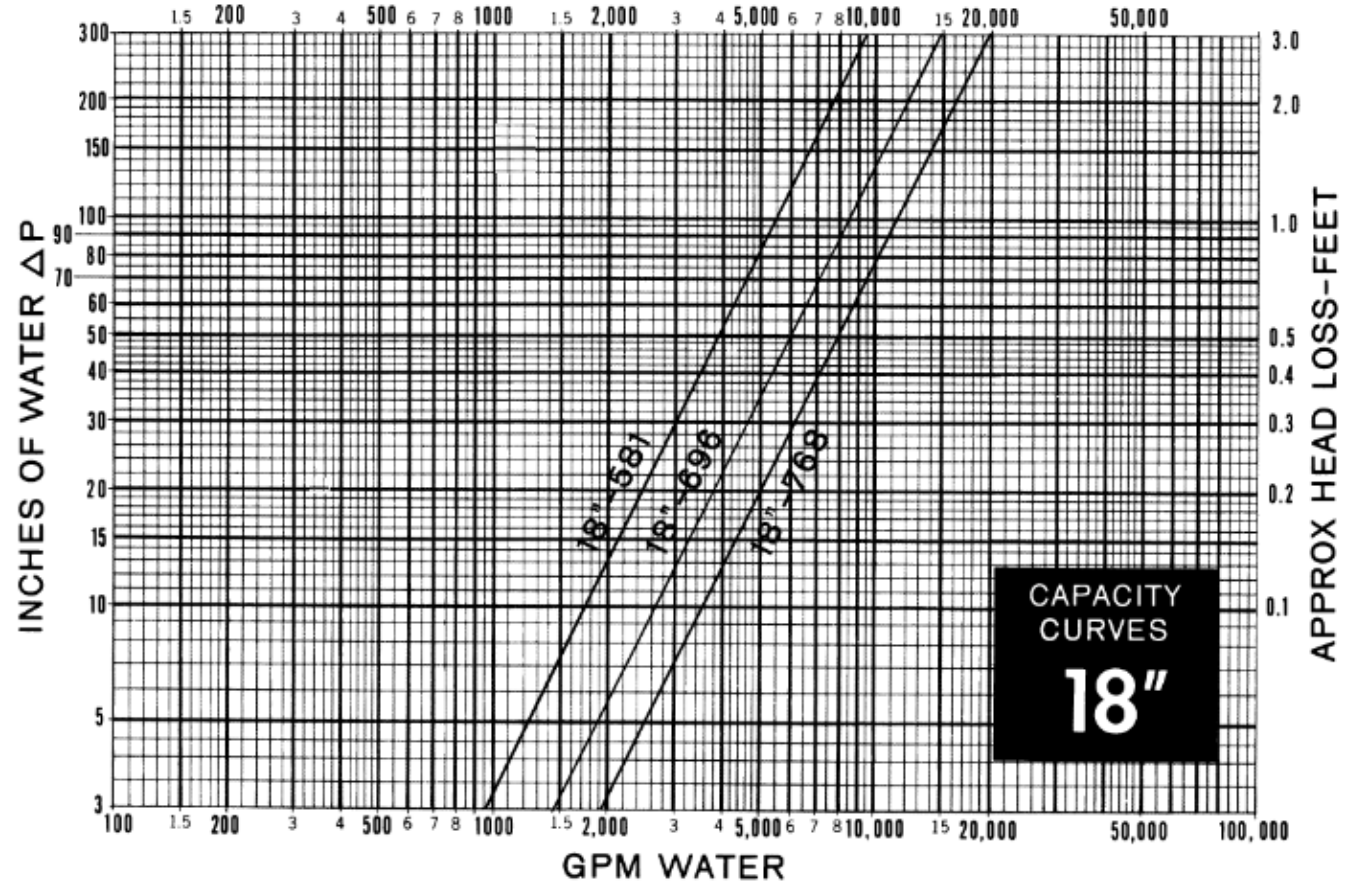

INCHES OF WATER ΔP
APPROX HEAD LOSS-FEET
GPM WATER
8"-515
8"-343
CAPACITY CURVES
8"

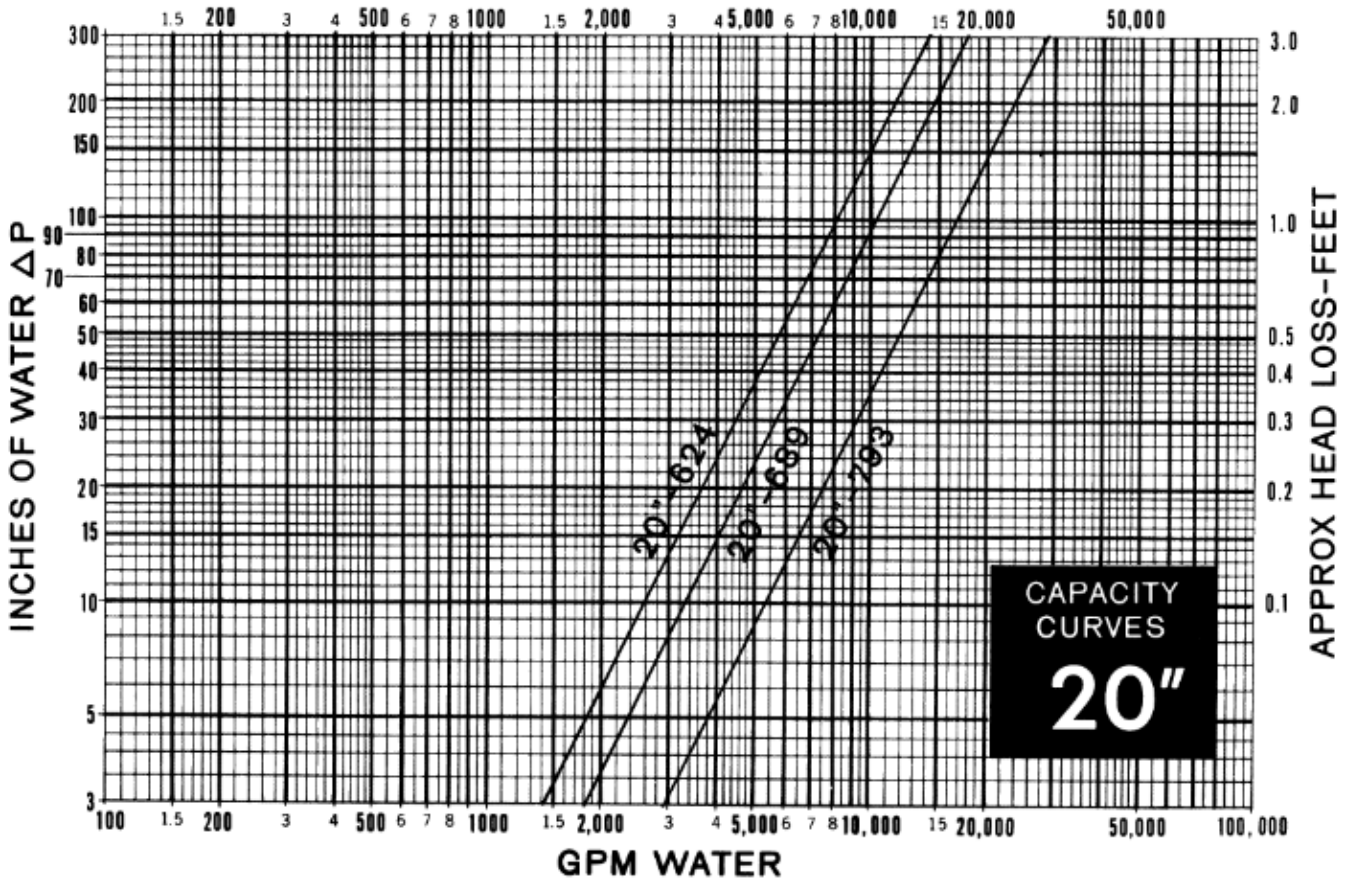

INCHES OF WATER ΔP
APPROX HEAD LOSS-FEET
GPM WATER
10"-605
10"-796
CAPACITY CURVES
10"

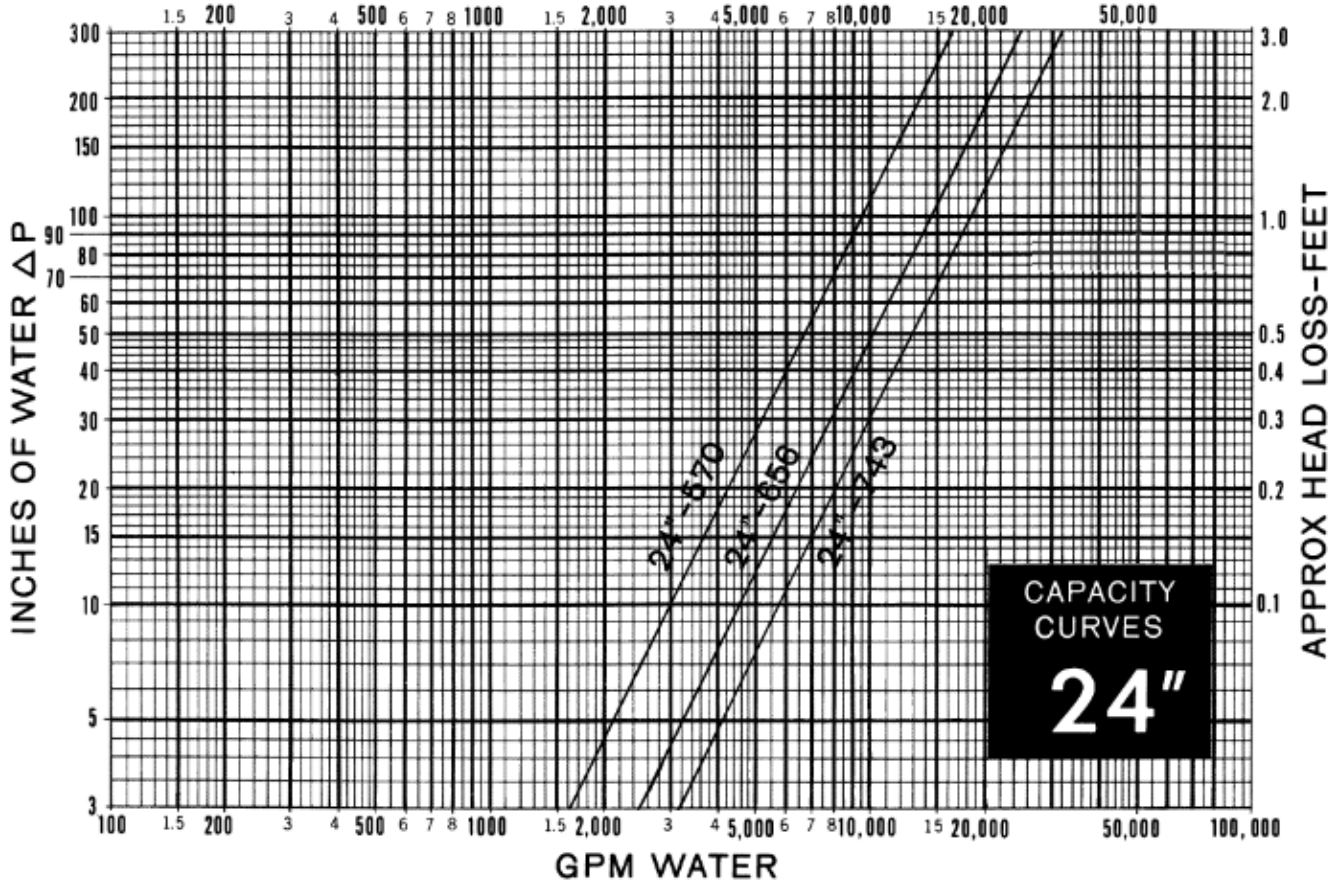

INCHES OF WATER ΔP
APPROX HEAD LOSS-FEET
GPM WATER
12"-506
12"-665
12"-750
CAPACITY CURVES
12"

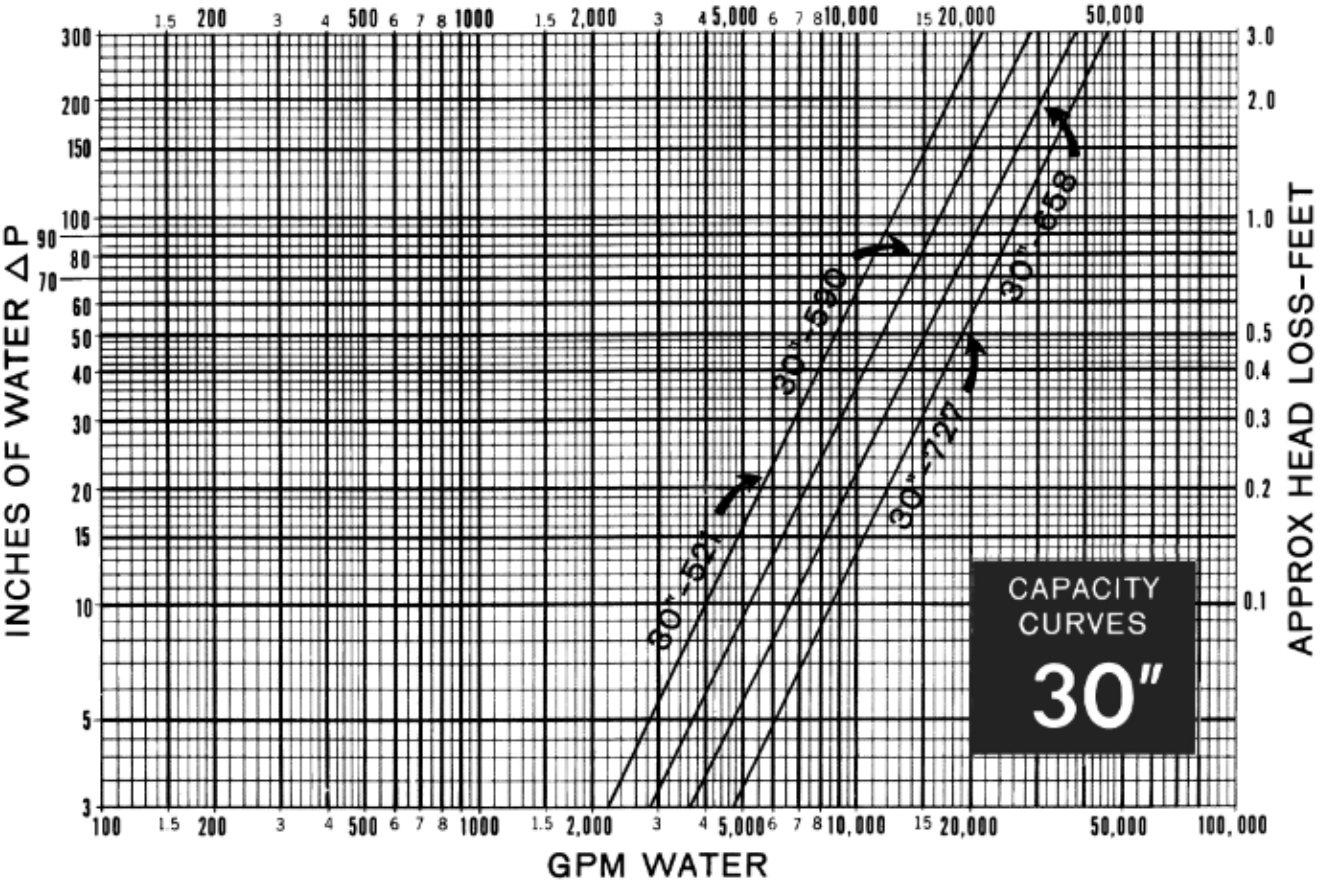

INCHES OF WATER ΔP
APPROX HEAD LOSS-FEET
GPM WATER
14"-602
14"-756
CAPACITY CURVES
14"


INCHES OF WATER ΔP
APPROX HEAD LOSS-FEET
GPM WATER
16"-523
16"-658
16"-786
CAPACITY CURVES
16"


INCHES OF WATER ΔP
APPROX HEAD LOSS-FEET
GPM WATER
18"-681
18"-696
18"-769
CAPACITY CURVES
18"


INCHES OF WATER ΔP
APPROX HEAD LOSS-FEET
GPM WATER
20"-624
20"-699
20"-293
CAPACITY CURVES
20"


INCHES OF WATER ΔP
APPROX HEAD LOSS-FEET
GPM WATER
24"-570
24"-656
24"-743
CAPACITY CURVES
24"


INCHES OF WATER ΔP
APPROX HEAD LOSS-FEET
GPM WATER
30"-521
30"-590
30"-658
30"-727
CAPACITY CURVES
30"

Calibration

The accuracy of venturis is well-known throughout the industry. Independent of size or beta ratio, stock Hyspan Venturi Systems through 8" are guaranteed to be accurate within ±2% of the true value, regardless of flow. For flow monitoring situations requiring greater accuracy than ±2%, individual calibration is available to ±¼ of 1%. Venturis above 4" in size are calibrated at Alden Research Laboratories and Foxboro Company.

Typical Venturi Specification

The following is suggested wording for a typical specification. Service conditions and other factors will vary on different projects; exact wording may need revision for specific situations.

TYPICAL SPECIFICATIONS

1.0 Furnish and install where shown on drawings, complete **Hyspan** Venturi Flow Measurement System as manufactured by **Hyspan**. This shall be a coordinated system, including individual Venturi Flow Stations and Portable (or permanently mounted) Master Meter, supplied by one manufacturer.

2.0 Each primary flow element shall be a **Hyspan** Venturi selected from manufacturers' engineering data to permit prescribed flow at a minimum of head loss. For maximum accuracy and minimal turbulence in recovery area and thus low pressure loss, the beta ratio shall be selected to allow for a differential pressure compatible with the meter as specified herein and insure a proper system accuracy throughout the entire range. This accuracy must be obtained with as little as five (5) pipe diameters of straight pipe upstream and two (2) diameters downstream from the venturi. Each venturi shall be furnished with two (2) accurately located built-in sensing taps, nipples, shutoff valves and quick connect couplings. Venturis shall be complete with an identification tag on chain giving pipe size, venturi series, station identification and meter reading at specified flow rate, flow vs differential curves and installation instructions.

3.0 Venturi stations shall be one-piece brass or bronze threaded ½" through 3". Sizes 2½" through 10" shall consist of one-piece steel, with weld or flanged ends. Sizes 12" and larger shall be fabricated steel, with weld or flanged ends.

4.0 Venturi sizes and beta ratios shall be selected so that design flow rates shall read between 20% and the full scale range on a linear meter (e.g. between 10" and 50" on a 0–50" meter), with permanent pressure loss of not more than 25% of indicated flow rate differential pressure.

5.0 The indicating meter shall be portable (or permanently mounted) type with 6" round dial, 270° indication. It shall be the dual rupture-proof liquid filled bellows type with integral temperature compensation. The meter shall have over-range protection in either direction equal to the working pressure equivalent of the instrument housing (250 psig @ +250°F.). The accuracy of the meter shall be no less than 0.75% full scale. The meter case shall be waterproof. It shall have external zero and range adjusting screws and lifelong lubrication. Scale shall be calibrated uniformly either in differential pressure (0–5", 0–100"); percent of flow; or directly in gpm.

5.1 Portable Master Meters shall be mounted in a durable metal reinforced plastic carrying case with the following accessories:

a) Two (2) 10" lengths of connecting hose, each with color-coded quick connect couplings compatible with the venturi couplings.

b) Two (2) brass blow-down valves with Buna-N seals.

c) Blow-down hoses.

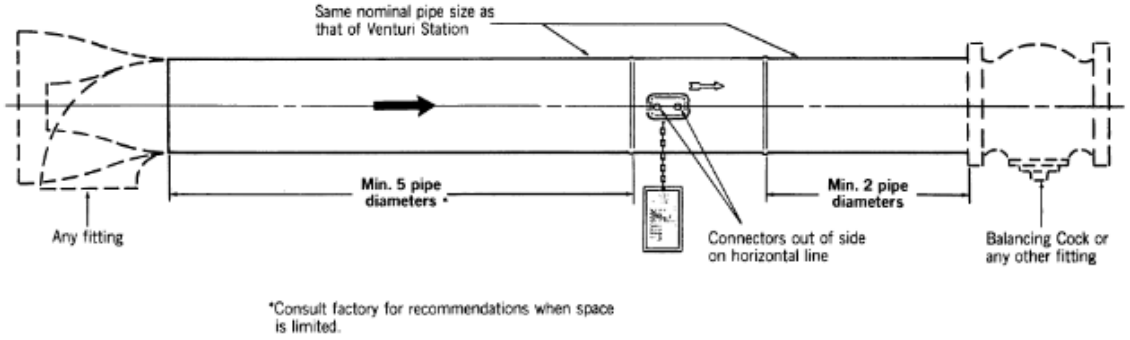
d) Instruction book with flow vs differential curves.

Portable Master Meter shall (shall not) become the property of owner.

5.2 Stationary, or permanently mounted meters shall be furnished with wall or panel mounting brackets, bleedoff and shutoff valves, connectors, fittings and assembly piping for single, or multiple stations. Piping connections from venturi to meter shall be furnished by the contractor.

Installation Instructions

1. Note the directional arrow on the venturi and make sure the flow is in the direction of the arrow.
2. Position the venturi so that the taps are not pointing straight up, or straight down, but preferably in a horizontal direction.
3. Red quick connect assembly should be installed on the red (upstream) tap.
4. Green quick connect assembly should be installed on the green (downstream) tap.
5. Tag should hang through the insulation, if present, to have station information readily available.
6. Venturis can be installed in horizontal, vertical, or inclined pipe lines.

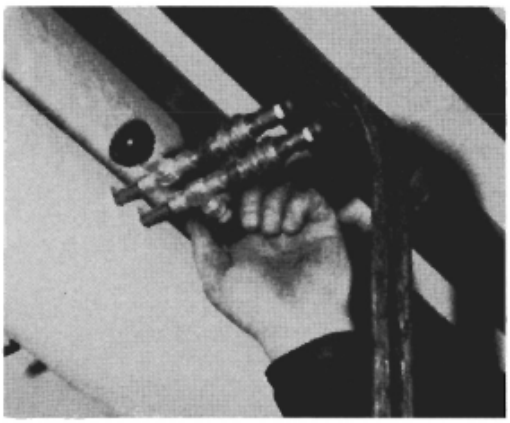


*Consult factory for recommendations when space is limited.

1. **Note the directional arrow on the venturi and make sure the flow is in the direction of the arrow.**
2. **Position the venturi so that the taps are not pointing straight up, or straight down, but preferably in a horizontal direction.**
3. **Red quick connect assembly should be installed on red, or upstream, tap.**
4. **Green quick connect assembly should be installed on green, or downstream, tap.**
5. **Tag should hang through the insulation, if present, to have station information readily available.**
6. **Venturis can be installed in horizontal, vertical, or inclined pipe lines.**

Photo at right shows a reading with flow meter on an insulated water line.

Far right photo shows a reading with the flow meter on an uninsulated portion of another water line.



Series 6800 – Flexible Strut Joints

Ball End Sizes	¾” (20mm) × 1” (25mm) through 10” (250mm) × 12” (300mm)
Maximum Load (Tension or Compression)	7,000 lb (31.2 kN) to 250,000 lb (1,112 kN)
Angular Movement	±10°
Operating Temperature	Maximum 650°F (343°C)
Pipe Schedule — Ball End	Sch. 80 (¾”–3”) or Sch. 120 (10”)
Pipe Schedule — Casing End	Sch. 80 (all sizes)
Assembly P/N (small)	BB-35500-XX (¾”×1” through 3”×4”)
Assembly P/N (large)	BB-35000-XX (5”×6” through 10”×12”)

Product Description

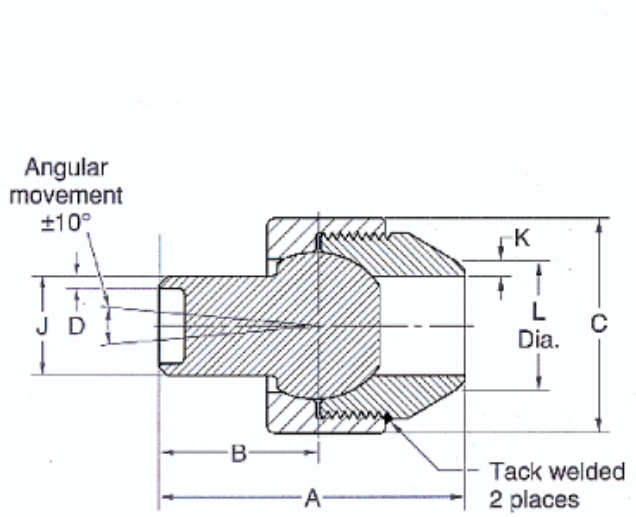
Hyspan Barco “Ball Type” Flexible Strut Joints function as positive restraints in process systems where the restraint is required in one direction, yet some movement must be allowed in other directions. This is accomplished by using a flexible ball type joint located at each end of a solid strut.

Flexible Strut Joints may be applied for static or dynamic loads. They are equally rated for tensile or compressive loads. The most common uses are: structural sway bracing for hot stacks and pipes; supports or hangers for horizontal piping; stability supports for tall or slender towers, structures or vessels; and restraints to direct and control thermal expansion away from components that should not be stressed, such as turbine nozzles and pump flanges.

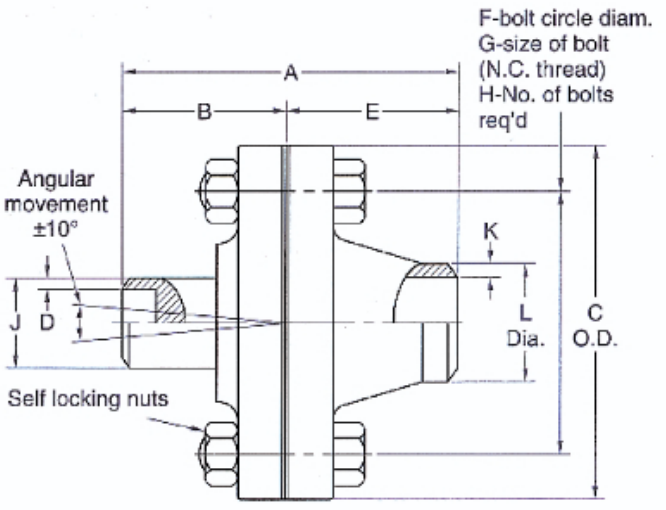
Advantages

- Double Acting — handles both tensile and compressive loads; accommodates push, pull, and slide movement with positive control
- Precision Built — factory machined to close tolerances and rigidly inspected
- Lower Cost — lower initial cost compared to other motion control and restraint methods, and economical operation
- Maintenance Free — lubricated for life; no adjusting or service required
- Simple — simplifies structural designing and eliminates the need for special struts, tie-rods, or clevis-and-pin arrangements
- Safety — high load carrying capacity for reliable service in severe conditions, combined with easy calculation of proper sizes

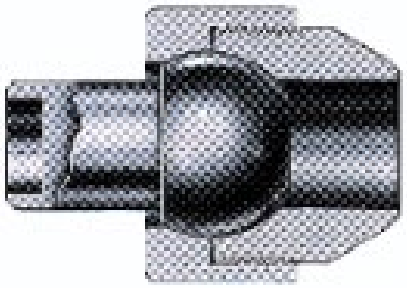
Design Features



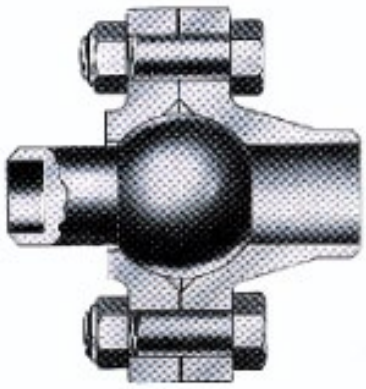
BB-35500-XX



BB-35000-XX



BB-35500-XX
FOR SIZES: 3/4" x 1"; 1" x 1 1/4"; 1 1/2" x 2"; 2" x 2 1/2"; 3" x 4"



BB-35000-XX
FOR SIZES: 5" x 6"; 8" x 8"; 10" x 12"

Table 1 — Standard Sizes

Ball End in mm	¾ (20)	1 (25)	1½ (40)	2 (50)	3 (80)	5* (125)	6* (150)	10* (250)
Pipe Schedule Ball End	160	160	80	80	80	80	80	120
Casing End in mm	1 (25)	1¼ (32)	2 (50)	2½ (65)	4 (100)	6 (150)	8 (200)	12 (300)
Pipe Schedule Casing End	80	80	80	80	80	80	80	80

*Sizes: 5" (125mm) x 6" (150mm); 6" (150mm) x 8" (200mm); 10" (250mm) x 12" (300mm) available on special order only, other sizes carried in stock.

Table 2 — Maximum Loading

Ball End in mm	¾ (20)	1 (25)	1½ (40)	2 (50)	3 (80)	5 (125)	6 (150)	10 (250)
Loading lb kN	7,000 (31.2)	10,000 (44.5)	14,500 (64.5)	20,000 (89.0)	40,000 (178.0)	80,000 (355.5)	120,000 (533.2)	250,000 (1,112.1)

Table 3 — Dimensional Data

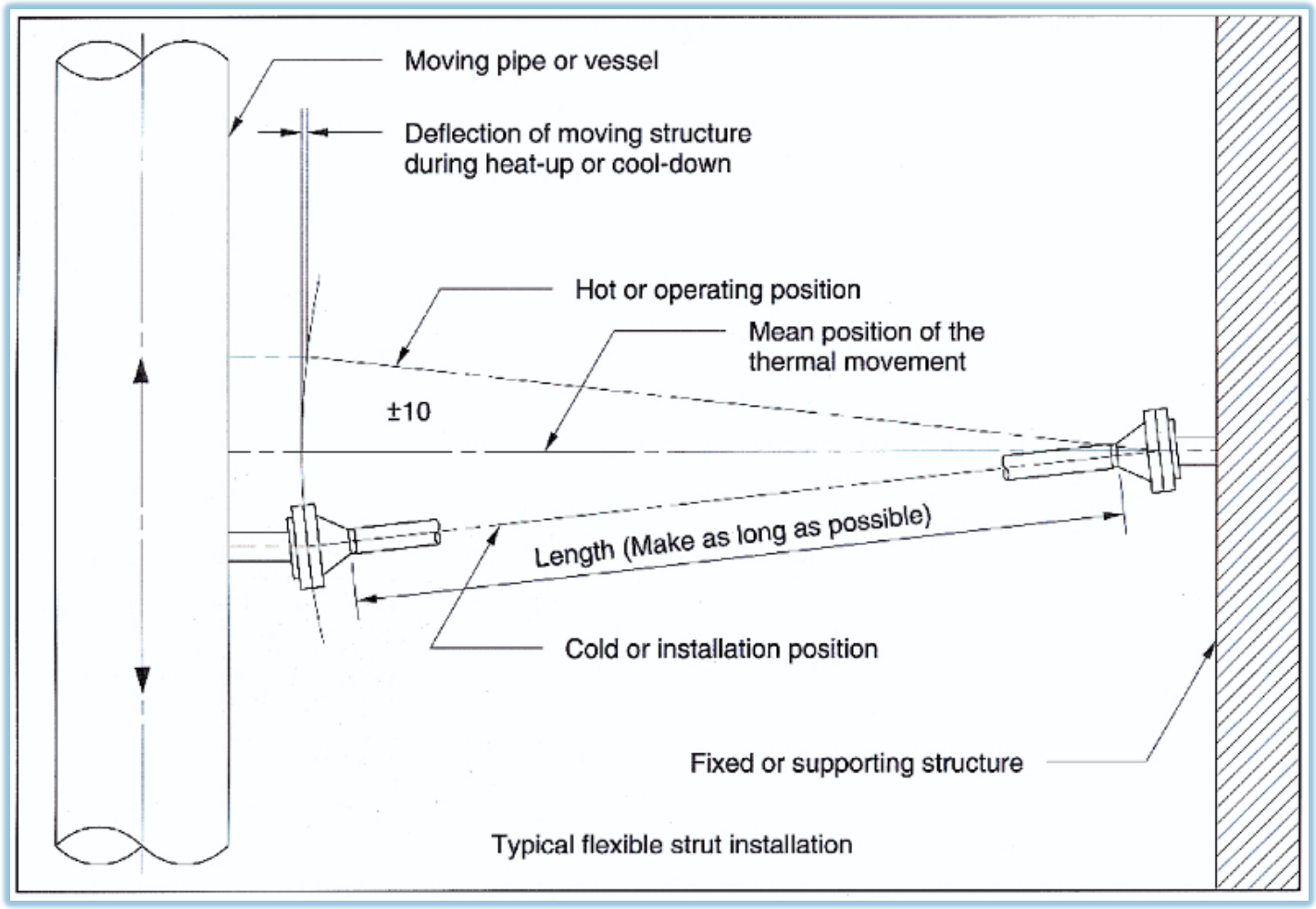
Assembly Part No.	Size: in (mm)	A	B	C	D	F	G	H	J	K	L	Shipping Wt.: lb (kg)
BB-35500-16	¾x1 (20x25)	3.50 (88.9)	1.75 (44.5)	2.63 (66.8)	.218 (5.5)	N/A	N/A	N/A	1.05 (26.7)	.179 (4.5)	1.32 (33.5)	3.0 (1.4)
BB-35500-20	1x1¼ (25x32)	4.25 (108.0)	2.12 (53.8)	3.25 (82.6)	.250 (6.4)	N/A	N/A	N/A	1.32 (33.5)	.191 (4.8)	1.66 (42.2)	6.0 (2.7)
BB-35500-32	1½x2 (40x50)	5.75 (146.1)	3.00 (76.2)	4.25 (108.0)	.200 (5.1)	N/A	N/A	N/A	1.90 (48.3)	.218 (5.5)	2.38 (60.5)	12.5 (5.7)
BB-35500-40	2x2½ (50x65)	6.00 (152.4)	3.00 (76.2)	5.00 (127.0)	.218 (5.5)	N/A	N/A	N/A	2.38 (60.5)	.276 (7.0)	2.88 (73.2)	19.0 (8.6)
BB-35500-64	3x4 (80x100)	6.62 (168.1)	3.25 (82.6)	6.50 (165.1)	.300 (7.6)	N/A	N/A	N/A	3.50 (88.9)	.337 (8.6)	4.50 (114.3)	35.0 (15.8)
BB-35000-66	5x6 (125x150)	7.50 (190.5)	3.63 (92.2)	12.50 (317.5)	.375 (9.5)	10.63 (270.0)	¾"-10	12 12	5.56 (141.2)	.432 (11.0)	8.63 (168.4)	120.0 (54.5)
BB-35000-68	6x8 (150x200)	8.88 (225.6)	4.50 (114.3)	15.00 (381.0)	.432 (11.0)	13.0 (330.2)	7/8"-9	12 12	6.63 (168.4)	.500 (12.7)	8.63 (219.2)	225.0 (102.2)
BB-35000-72	10x12 (250x300)	14.38 (365.2)	8.25 (209.6)	22.00 (558.8)	.843 (21.4)	19.25 (489.0)	1¼"-7	20 20	10.75 (273.1)	.687 (17.4)	12.75 (323.9)	650 (294.8)

*For fabricated assemblies complete with extension pipe, contact Hyspan.

Design and Engineering Notes

Hyspan Barco "Ball Type" Flexible Strut Joints can be installed in any position from vertical to horizontal. The joints at either end can be attached to a pipe, vessel, or flatplate steel structure by butt-welding. Flexible strut joints should be located at a distance from any hot mass or surface to maintain their operating temperature below a maximum of 650°F (343°C).

The total load to which the joints will be subjected determines the selection of the proper size. The total load includes: 1) normal operating load(s); 2) sudden or wind-shock loads; 3) the forces or loads involved in decreasing the distance between the supporting and supported structures when one or the other structure must move, like periodic thermal expansion and contraction.



How to Order — Flexible Strut Joints

1. Determine tensile or compression load for your application. Select the ball end size to handle this load from the Maximum Loading table (Table 2).
2. Find the correct size in the Dimensional Data table (Table 3). Determine the strut joint Assembly Part Number and specify accordingly.

Shipping Note: Each Ball Type Strut Joint is shipped separately — two are needed for each flexible strut. The center connecting pipe, weld reducers (if needed), and stubs for ends are to be furnished by the customer.

Engineering Applications — Flexible Strut Joints

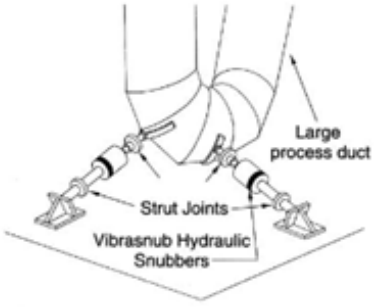


Fig.1 — This illustrates a typical use for "VIBRASNUB" Hydraulic Snubbers in a two-plane assembly on a large U-bend in a modern refinery. The snubbers allow slow expansion movements to occur but dampen out shock and vibratory movements.

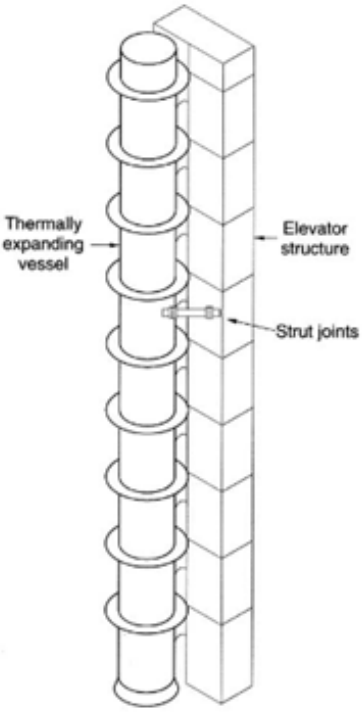


Fig.2 — This drawing illustrates the use of one pair of Flexible Strut Joints to provide lateral stability to an otherwise unstable, narrow elevator structure. Although the structure is over 200 feet (61.2m) high, overturning movement due to wind load was greatly reduced. This resulted in a savings in both the design of the foundation and in the structure. Flexible Strut Joints also provide a positive compression-or-tension member which flexes to accommodate the thermal expansion of the supporting vessel.

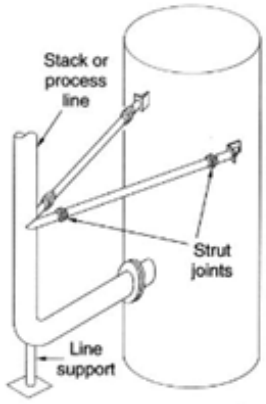


Fig.3 — Two "Ball Type" Flexible Struts in "A" frame arrangement allow vertical expansion of the stack or process line. They also prevent excessive horizontal movements due to wind forces and give stability to the line.

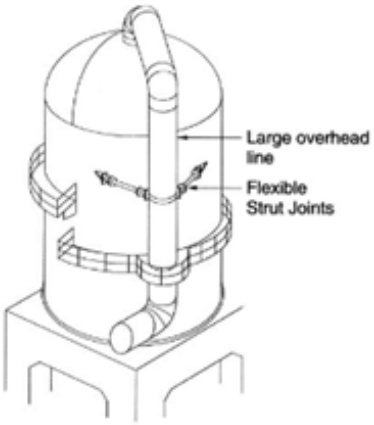


Fig.4 — Two Flexible Struts allow thermal expansion movements of the vessel and line without restraint and provide rigid support of the large overhead line. They are used in place of noisy and cumbersome sliding plate guides and structural brackets.

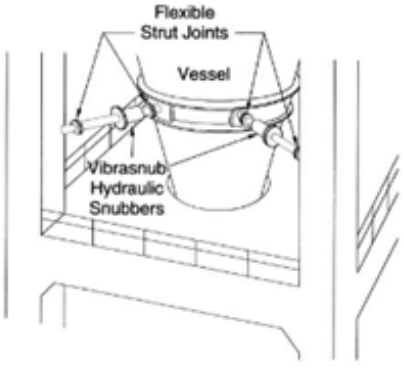


Fig.5 — "VIBRASNUB" Hydraulic Snubbers allow vertical expansion of the hot vessel and provide a tight mechanical connection to transmit high-frequency vibrations to the snubbers.

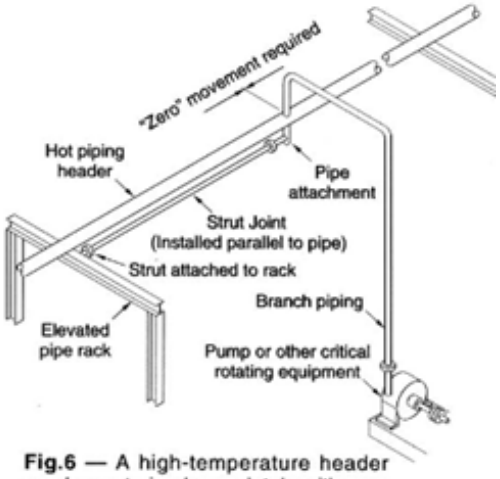


Fig.6 — A high-temperature header can be restrained completely with zero axial movement by using Strut Joints at a point relatively distant from the resisting structure. This is important where the branch piping is not flexible enough to absorb extraneous movement from the header without overstressing the equipment to which it is attached.

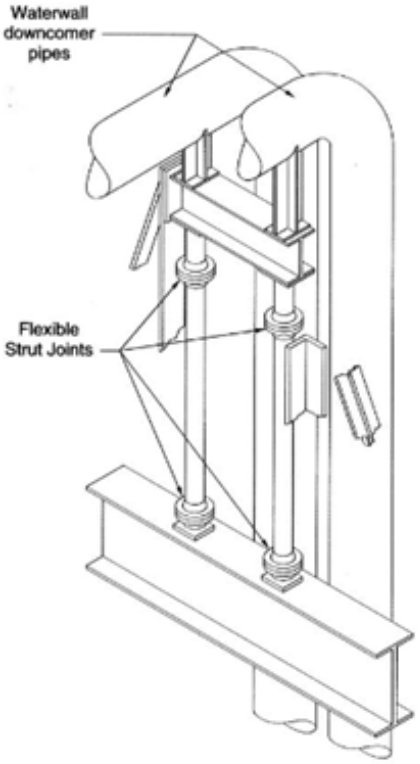


Fig.7 — This is a supporting arrangement for boiler water wall downcomer pipes in a large steam generating station. Two Flexible Strut Joints are used as compression members. They eliminate the need for overhead hanger steel which would cantilever beyond the column. Conical action of the strut joints accommodates lateral and axial movement of piping.

Fig.8 — Engineers needed to brace a 60ft (18.3m) high power plant boiler against wind sway and allow for downward thermal expansion of the boiler and its integral furnace. The boiler is supported by hanging from the top, within four I-beam corner columns. Eight Flexible Struts, in opposite pairs at 35ft (10.7m) and 50ft (15.3m) were used to meet these requirements efficiently and economically. The use of eight struts allowed the construction of a lighter steel structure at the anchor points.

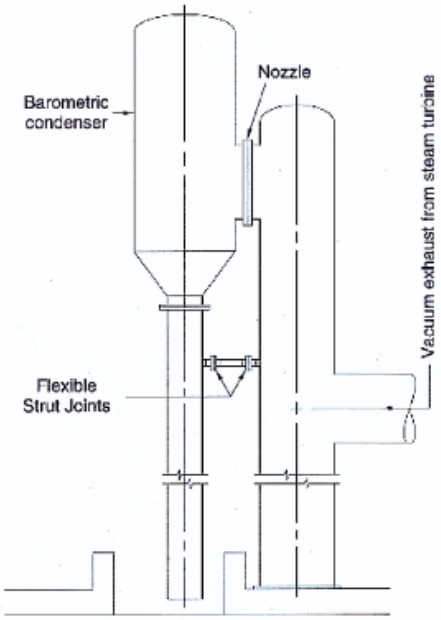


Fig.10 — A single Flexible Strut Joint is used as a compression member to eliminate weight-moment at the barometric condenser nozzle, thus permitting the nozzle to be the only support required for the condenser and barometric leg.

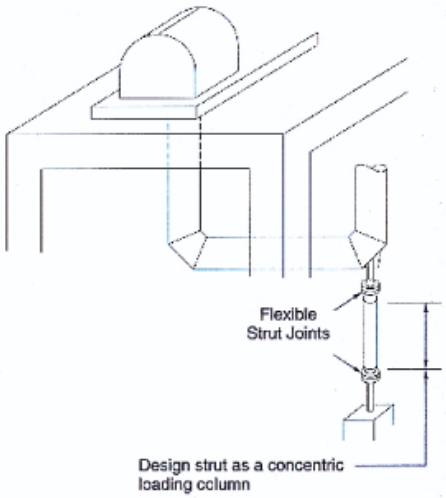


Fig.12 — A single Flexible Strut provides frictionless support for a large air blower intake pipe. Negligible forces are transmitted back to the blower due to free expansion movement. The use of flexible struts eliminates the need and cost of an expansion joint at the blower nozzle.

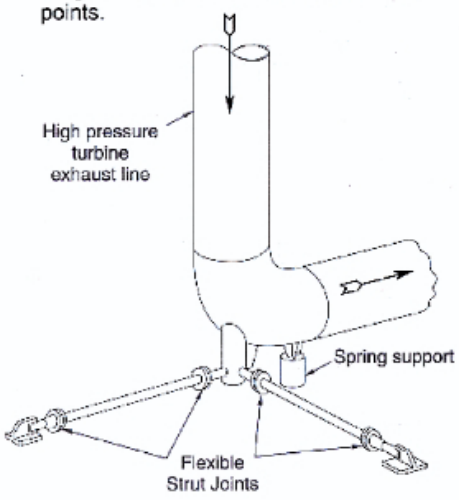
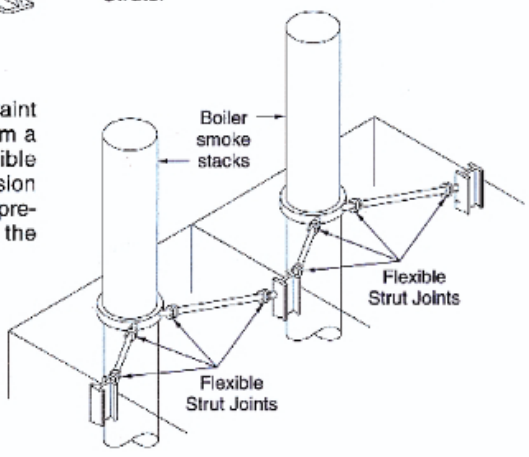


Fig.9 — Spring support and restraint for a 30" (750mm) exhaust pipe from a high-pressure turbine. Two Flexible Strut Joints permit vertical expansion movement of the exhaust pipe, but prevent any horizontal movement of the vertical sectionof pipe.

Fig. 11 — Builders of electric power plants use Flexible Strut Joints as guides to stabilize 200ft. (61.2m) high, steel boiler smoke stacks. This economical and efficient structural design maintains axial alignment and resists wind sway while accommodating thermal expansion and contraction. Additional beams and columns were eliminated by the use of Barco Flexible Struts.



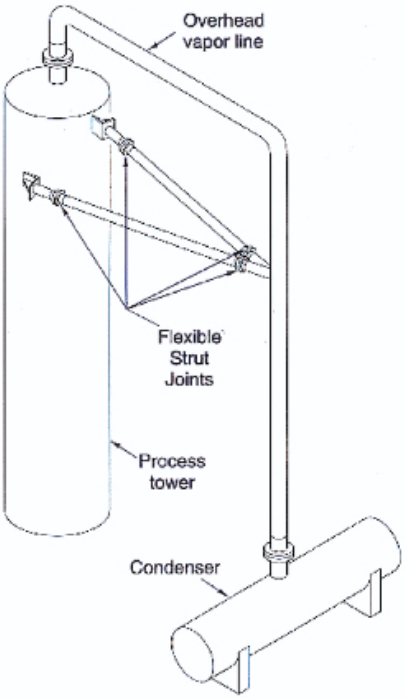


Fig.13 — Two Flexible Struts form a guide to stabilize a high, overhead vapor line. The struts allow vertical line expansion and reduce forces due to wind, shock loads and earthquakes.

Series 6800 – VibraSnub™ Hydraulic Snubbers

VibraSnub™ Sizes	1½" (40mm), 2½" (65mm), 4" (100mm)
Nominal Pipe Size of Extension	2" (50mm), 2½" (65mm), 4" (100mm)
Maximum Load	7,000 lbs (31.2 kN), 12,000 lbs (53.4 kN), 30,000 lbs (133.5 kN)
Frictional Resistance	75 lbs (.33 kN), 100 lbs (.45 kN), 200 lbs (.90 kN)
Piston Travel	1½": ±4"; 2½" and 4": ±6"
Hydraulic Fluid	High-grade petroleum-base fluid per U.S. Govt. Spec. MIL-H-6083, −20°F to +200°F (93°C)
Shipping Weight	70 lbs (32 kg), 90 lbs (41 kg), 175 lbs (79 kg)
Assembly P/Ns	BB-35001 (1½"), BB-35004 (2½"/4") — cylinder only; BB-35502/35503 (complete assemblies)

Product Description

Hyspan Barco "VibraSnub" Hydraulic Vibration Snubbers function as a stop or restraint for dynamic vibration and shock loads. These rapid movements may (or may not) be accompanied by slower natural movements, like thermal expansion or contraction. Rapid vibration movements are absorbed by the snubber assembly. More gradual thermal movement is accommodated by bypassing hydraulic fluid through a restricted orifice in the piston of the snubber cylinder.

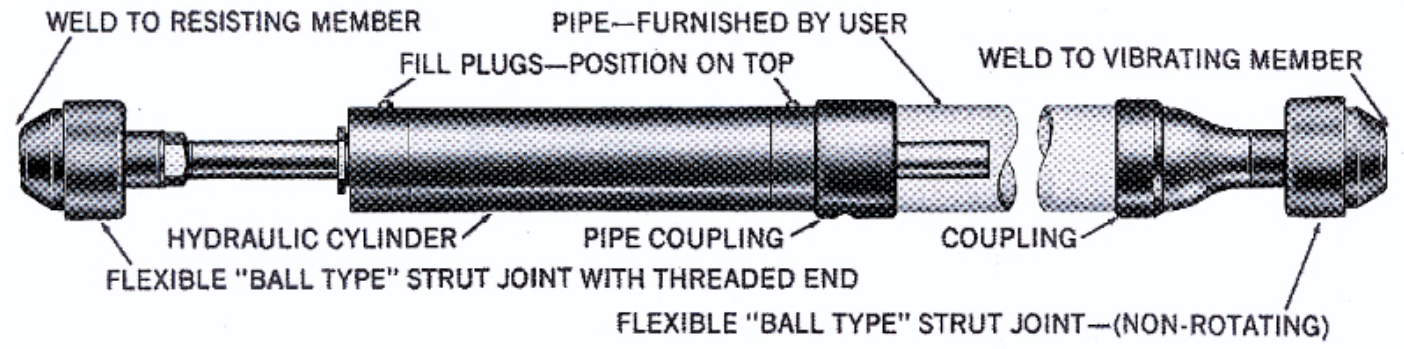
The "Ball Type" Flexible Strut Joints on each end of the assembly permit a ±10° alignment movement to eliminate binding. The "VibraSnub" snubber is designed to control dynamic vibration and shock loads. For continuously applied static loads, use Hyspan Barco "Ball Type" Flexible Strut Joints.

Advantages

- Lower cost — simplicity and long life, with minimal maintenance compared to other vibration and shock control mechanisms
- Reliable, long service life — proven superior through years of testing and installed use
- Fast, positive action — resists and dampens shock and vibration loads instantaneously
- Eliminates binding — permits ±10° angular and conical movement of the supported structure while dampening vibrations and shock loads
- Handles slower thermal and seismic movements — only a nominal pressure drop created across the bypass orifice against slower thermal movements
- Simplifies design and installation — compared to other more complicated motion control systems

NOTE: The reaction of VibraSnub™ snubbers to total applied loads with respect to travel and vibration are shown in the graphs on page 11 of the original catalog. Applications outside of the range of this data should be referred to Hyspan.

Design Features



Cylinder: Bored, honed, polished chrome-plated bore.

Pistons: Furnished with metal piston rings, O-rings, and a fluid bypass orifice.

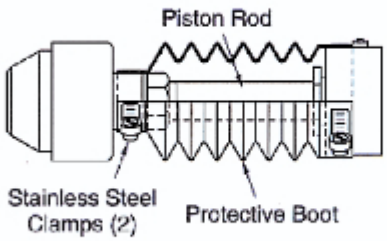
Piston Rods: Double-ended, ground, polished, hard chrome plated.

Cylinder Heads: 1/4" (8mm) standard pipe tap ports for filling with fluid; internal bleed duct for air elimination; fitted with gland packing nuts.

Hydraulic Fluid: High-grade, petroleum-base fluid similar to U.S. Govt. Spec. MIL-H-6083 for -20°F (-29°C) to +200°F (93°C).

Strut Joints: Joints permit +/−10° angular or conical movement; ends bevelled for butt-welding.

Available Option



Neoprene boot to protect exposed piston rod area against damage from dust, weather and corrosive atmosphere.

Cylinder Repair Kits are available. For fabricated assemblies complete with extension pipe, inquire Hyspan.

Table 4 — Specifications

VibraSnub Size: **in** **(mm)**	1½" (40mm)	2½" (65mm)	4" (100mm)
Nominal Pipe Size of Extension **in** **(mm)**	2" (50mm)	2½" (65mm)	4" (100mm)
Maximum Load: **lb** **(kN)**	7,000 (31.2)	12,000 (53.4)	30,000 (133.5)
Frictional Resistance:* **lb** **(kN)**	75 (.33)	100 (.45)	200 (.90)
Shipping Weight: **lb** **(kg)**	70 (32)	90 (41)	175 (79)

*Due to mechanical parts

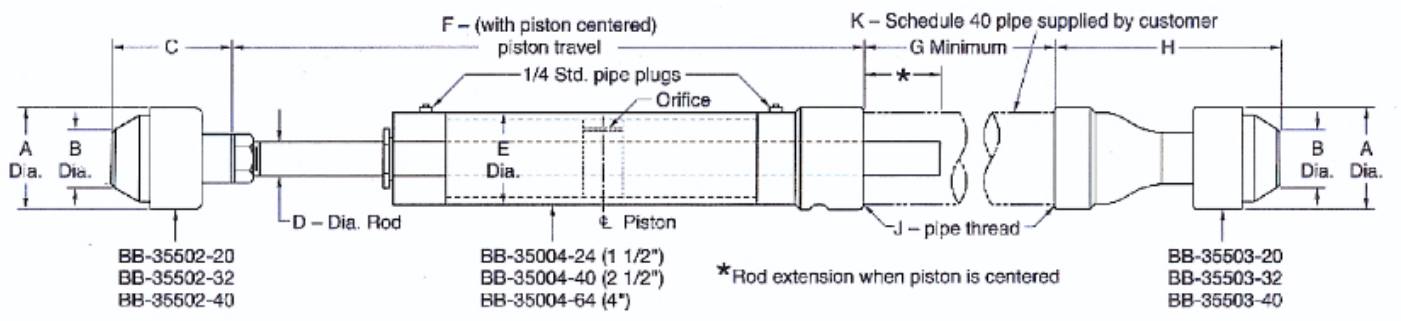


Table 5 — Dimensional Data

Size: in(mm)	Part Number	Piston Travel in(mm)	A	B	C	D	E	F	G Min.	G Max	H	J	K	Overall dimension with full load (C.F.) at travel Min.*	Overall dimension with full load (C.F.) at travel Max.**
1½ (40)	BB-35001-24	±4 ±(101.6)	3.25 (82.6)	1.56 (42.2)	4.25 (108.0)	1.00 (25.4)	2.50 (63.5)	22.50 (571.5)	6.00 (152.4)	96.00 (2,438.4)	9.00 (228.6)	2.00 (50)	2.00 (50)	41.75 (1,060)	131.75 (3,346)
2½ (65,0)	BB-35001-40	±6 ±(154.4)	4.25 (108.0)	2.38 (60.5)	5.76 (146.3)	1.13 (28.7)	3.00 (76.2)	28.00 (711.2)	8.06 (204.7)	112.00 (2,845.3)	10.69 (271.5)	2.50 (65)	2.50 (65)	52.51 (1,333.8)	156.51 (3,975.4)
4.0 (100,0)	BB-35001-64	±6 ±(152.4)	5.00 (127.0)	2.88 (73.2)	6.00 (152.4)	1.50 (38.1)	4.75 (120.7)	29.19 (741.4)	6.75 (171.5)	181.25 (4,603.8)	11.63 (295.4)	4.00 (100)	4.00 (100)	53.56 (1,360.4)	228.06 (5,792.7)

*1½" size travel is ± 4". 2½" & 4" sizes travel is ± 6". Increased stroke available on special request.

**The maximum overall dimension given above (C+F+G+H) can be increased, but only with a decrease in the allowable load in keeping with the increased L/R of the unit as a column under possible vibration.

How to Install

The VibraSnub™ assembly can be installed in any position from horizontal to vertical. They should be used in pairs with an acute (less than 90°) interior angle. If only one snubber is installed, it must be installed directly in line with the thrust force and the moving member must be guided to eliminate any possible lateral movement.

The Strut Joints at the end of each VibraSnub™ assembly can be welded to pipe or steel structure. The anchor points should be designed to withstand the total loadings and minimize secondary vibrations.

The VibraSnub™ cylinder should be isolated from heat (or hot member of structure) with the pipe extension toward the heat source to prevent cylinder temperature from exceeding +150°F (+66°C).

Designing for VibraSnub™ Snubbers

Situation #1: A hot stack is found to vibrate excessively and is also subject to considerable thermal movement.

Problem: Eliminate excessive vibration of hot stack and provide for thermal movement during heat-up and cool-down.

Solution: Predetermined Facts:

Total vibration load	8000 lbs (35.6kN)
Piston travel due to thermal movements	5 inches (127mm)
Heat-up and cool-down time	20 minutes
Frequency of vibration	60 cycles/min.
Total allowable vibration movement at point of snubber attachment without damage to stack	.125 inches (3.2mm)

From the specifications table, it is seen that one 2 1/2" (65mm) "Vibrasnub" with a maximum allowable load of 12,000lbs (53.4kN) is sufficient. However, two are recommended for better installation (see Typical Installations).

In this example, the required rate of piston travel is 5" (127mm) in 20 minutes or 1/4" (6.4mm) per minute. Graph #1 shows that the resistance to movement is less than 200lbs (.9kN) for each unit (the point of intersection with the slanting rate line is off the graph) and is negligible.

Graph #2 shows that the total vibration movement permited by a 2 1/2" (65mm) "Vibrasnub" snubber (using 2 units, each with 4000lbs (17.8kN) load at 60 cycles/min.) is approximately .08" (2.03mm). That movement is well below the stated allowable movement of .125" (3.2mm). If the frequency of vibration had been 30 cycles/min. the total allowable movement would then be approximately .18" (4.6mm) which is greater than that allowed for a 2 1/2" (65mm) unit. A 4" (100mm) "Vibrasnub" would be required.

Situation #2: A hot process vessel is developing excessive vibration in a large pipe that leads horizontally out of the vessel and then is directed upwards.

Problem: Eliminate excessive vibration in the pipe and provide for differential thermal movement of the pipe and vessel.

Solution: Predetermined facts:

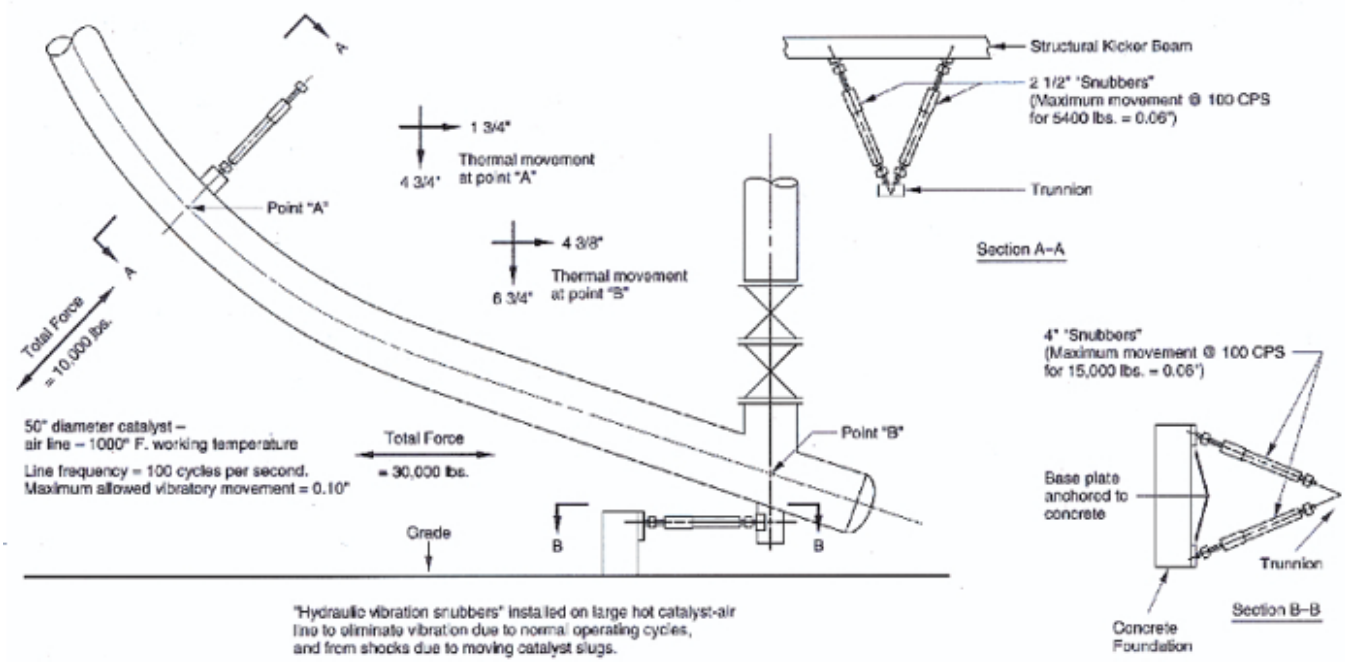
Total vibration load	40,000 lbs(178kN)
Piston travel due to thermal movements	5 inches (127mm)
Heat-up time	10 minutes
Frequency of induced vibration	120 cycles/min.
Total allowable vibration movement without damage to pipe	.15inches (3.8mm)

From the specifications table, the maximum allowable load for a 2 1/2" (65mm) "Vibrasnub" is 12,000lbs (53.4kN). A 4" (100mm) snubber can accommodate 30,000lbs (133.5kN). By using two (2) 4" (100mm) "Vibrasnub" snubbers, the vibration load on each one is 20,000lbs (89kN), well below the maxium load allowed.

The required rate of piston travel is 5" (127mm) in 10 minutes, or 1/2" (13mm) per minute. Graph #1 shows the resistance shows the resistance to thermal movement at 1/2" (13mm) per minute is less than 300lbs (1.34kN) for each snubber unit (the point of intersection with the graph is actualy off the graph, to the left). This low resistance would impart no undue strain on the piping system.

From Graph #3 it is seen that the total movemetn permitted by a 4" (100mm) "Vibrasnub" under 20,000lbs (89kN) vibration load, at a rate of 120 cycles/min., is approximately 0.04" (1.0mm). This is much less than the allowable movement of .15" (3.8mm).

It is possible to use four (4) 2 1/2" (65mm) snubbers. But it is more practical to install only two (2) 4" (100mm) snubbers and this is the proper solution.

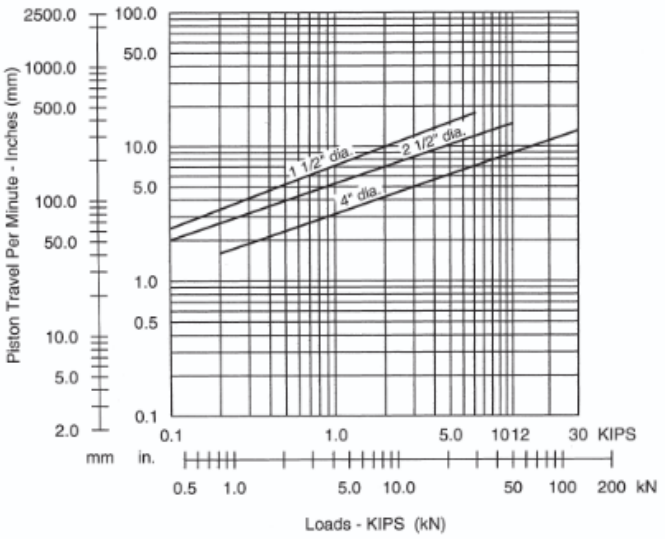


"Hydraulic vibration snubbers" installed on large hot catalyst-air line to eliminate vibration due to normal operating cycles, and from shocks due to moving catalyst slugs.

Force-Frequency-Amplitude Data

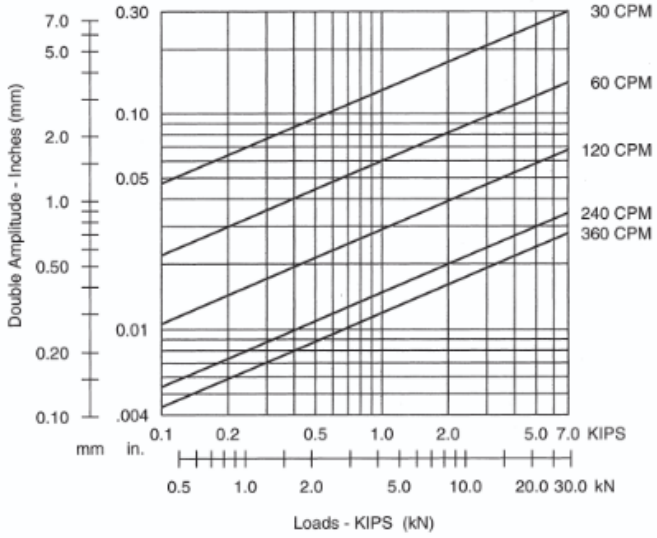
Graph #1

Force Travel Data
1-1/2" (40mm), 2-1/2" (65mm), 3" (80mm), 4" (100mm)



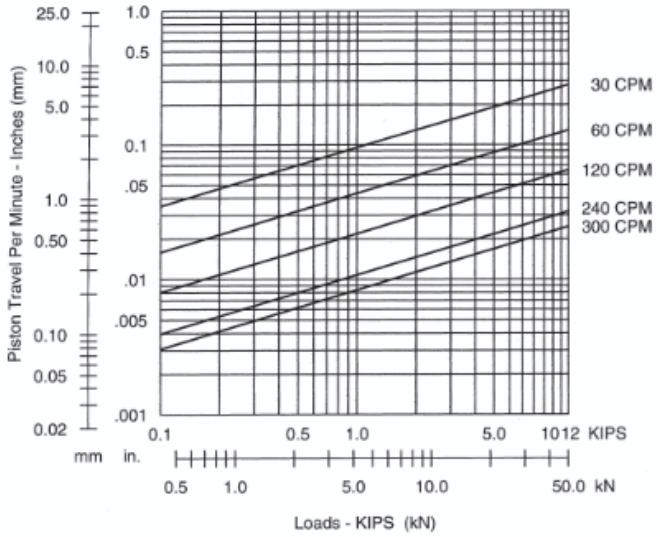
Graph #2

Force-Frequency-Amplitude Data
1-1/2" (40mm)



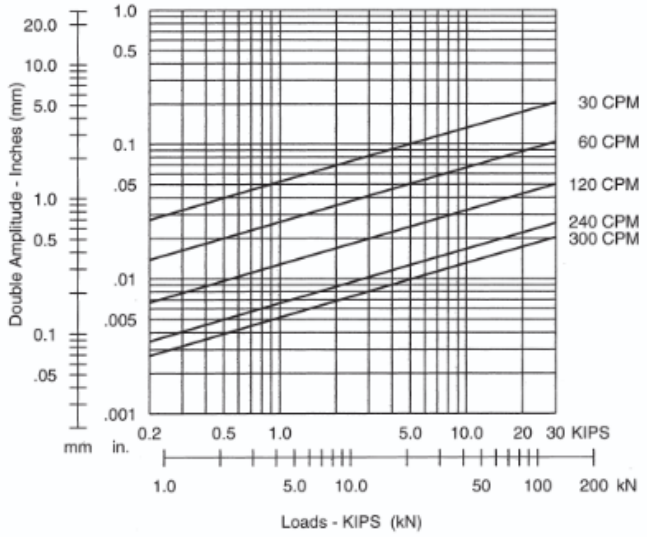
Graph #3

Force-Frequency-Amplitude Data
2-1/2" (65mm)



Graph #4

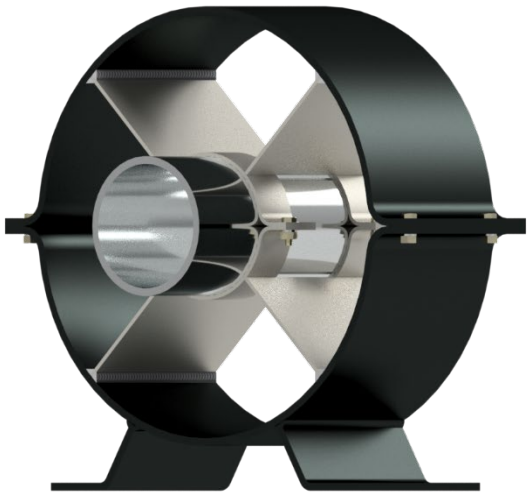
Force Frequency-Amplitude Data
4"(100mm)



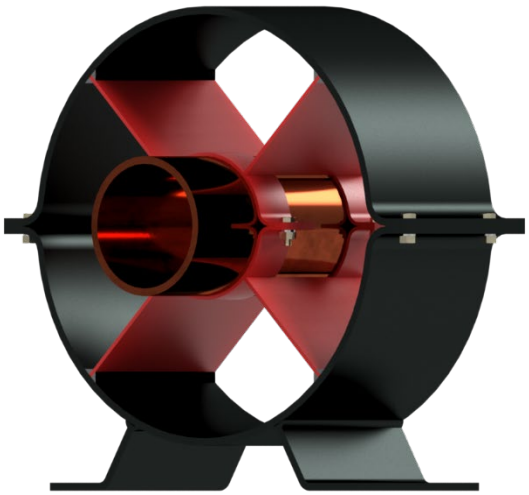
Series 9500 – Alignment Guides

Hyspan Series 9500 Alignment Guides are designed to be installed adjacent to expansion joints and as intermediate guides in steel pipe and copper tube runs to control and limit lateral movement and maintain alignment of the pipe/tube centerline relative to expansion joints. They are also used in pipe loop systems to provide stability and motion direction control.

These state-of-the-art alignment guides are advanced, large-structure, low-mass technology resulting in minimum weight while providing three-dimensional alignment using the conservative Spider & Cylinder arrangement.



Steel Pipe Alignment Guide



Copper Tube Alignment Guide

System Requirements

Pipe or copper tube systems that incorporate expansion joints, ball joints, or loops to absorb expansion must include three additional major elements:

- Main and/or intermediate anchors
- Supports
- Alignment guides

Main Anchors

Required in systems that include unrestrained expansion joints to react pressure thrust, the expansion joint spring or friction force, and the friction force of the guides and supports.

Intermediate Anchors

Required in systems where pressure thrust is restrained, but the expansion joint or loop spring or friction force, guide, and support friction forces must be reacted.

Supports

Must be designed to react the weight of the pipe/tube and media.

Alignment Guides

Required to maintain the pipe/tube centerline axis to expansion joints and throughout the intermediate portion of the run to also help resist bowing and buckling when properly applied with anchors and supports.

Note: Alignment guides are not designed to react pressure thrust or dead weight of the piping system. Proper anchors and supports must be provided by others in accordance with the system design.

Alignment Guide Placement Requirements

The alignment guide requirements for Hyspan products follow the Standards of the Expansion Joint Manufacturers Association, Inc. (EJMA).

Expansion Joints without Internal Guides

Two alignment guides are required:

- First guide: located 4 pipe/tube diameters from the face of the expansion joint.
- Second guide: located 14 diameters from the first guide.

Expansion Joints with Internal Guides

One alignment guide is required, located 10–14 pipe/tube diameters from the expansion joint.

Intermediate Guide Spacing

The maximum alignment guide spacing in the intermediate portion of the run is a function of:

- Pipe/tube properties (modulus of elasticity and moment of inertia)
- Design pressure
- Expansion joint effective area and spring force

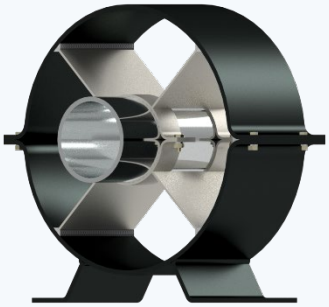
Refer to the Applications section of Hyspan expansion joint catalogs for individual product guiding requirements.

Steel Pipe Alignment Guides

Hyspan manufactures and inventories standard alignment guides for nominal pipe size (NPS) steel pipe from 3/4" through 14" with varying insulation thickness.

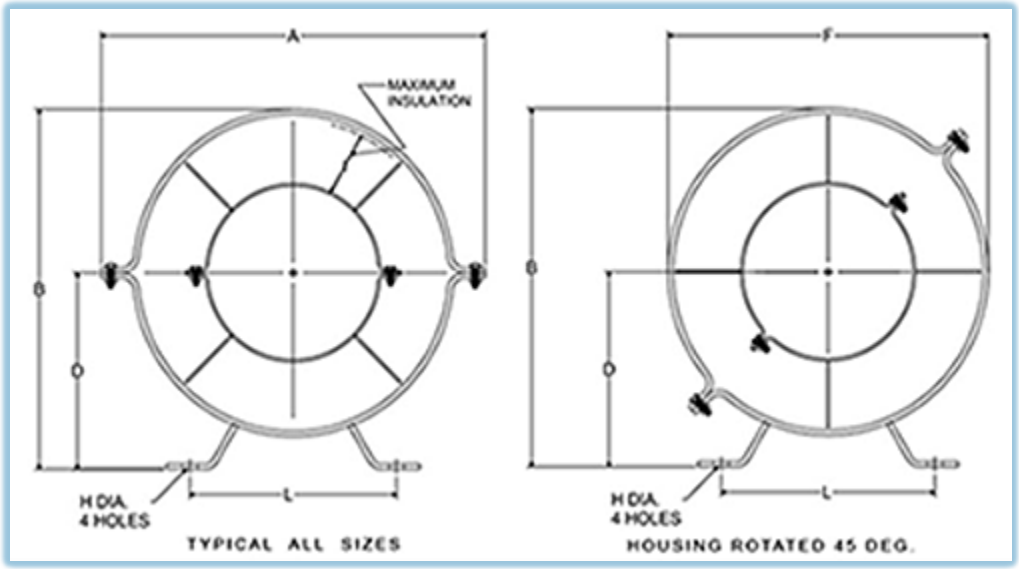
Specifications

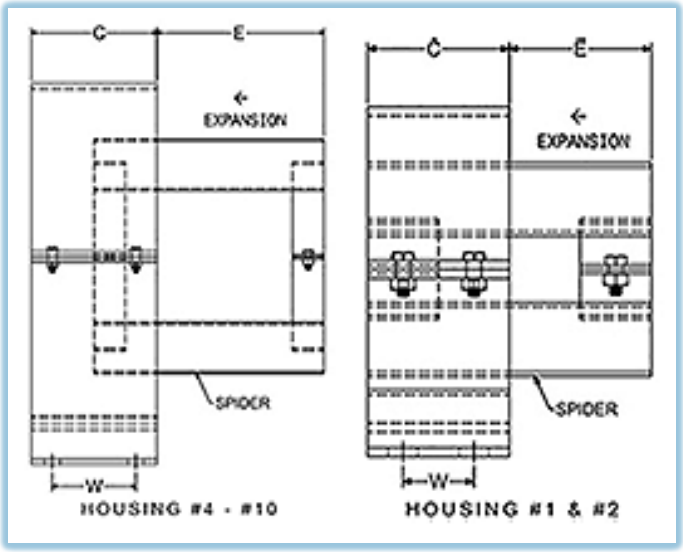
Pipe Size Range: 3/4" – 14" NPS
Construction: Heavy-gauge pressed steel
Bolting: Precision drilled
Finish: Protective black enamel paint
Max Operating Temp: 500°F
Options: Hot-dip galvanized, All stainless steel, Rotated housing



Steel Pipe Guide — Selection Tables

Refer to the tables below for part numbers, dimensions, insulation clearances, and travel ranges.





Copper Tube Size (in)	Actual OD Tube (in)	Part Number	I Maximum or Insulation (in)	E Expan. or Travel (in)	Hous-ing (#)	Centerline Height (in)	D Maximum Width (in)	A Maximum 45° Width (in)	F Maximum Height (in)	B Housing Length (in)	CL Hole Spacing (in)	L Hole Spacing (in)	W Hole Diameter (in)	H Weight (lbs)
3/4	7/8	9512-2-03-3	2.03	3	1	3.5	8.44	5.77	6.34	3.00	7.06	1.5	0.625	6
		9512-2-56-3	2.56	3	2	3.88	9.50	6.84	7.25	3.00	7.81	1.5	0.625	9
		9512-3-09-6	3.09	3	4	4.88	10.63	8.00	8.81	6.00	8.75	4.0	0.625	13
		9512-3-84-6	3.84	6	5	5.5	12.13	9.50	10.19	6.00	7.50	4.0	0.625	17
		9512-4-65-6	4.65	6	6	6.5	13.75	11.12	12.00	6.00	7.16	4.0	0.625	20
1	1 1/8	9516-1-90-3	1.90	3	1	3.5	8.44	5.77	6.34	3.00	7.06	1.5	0.625	8
		9516-2-44-3	2.44	3	2	3.88	9.50	6.84	7.25	3.00	7.81	1.5	0.625	9
		9516-2-96-6	2.96	3	4	4.88	10.63	8.00	8.81	6.00	8.75	4.0	0.625	13
		9516-3-71-6	3.71	6	5	5.5	12.13	9.50	10.19	6.00	7.50	4.0	0.625	17
		9516-4-52-6	4.52	6	6	6.5	13.75	11.12	12.00	6.00	7.16	4.0	0.625	20
1 1/4	1 3/8	9520-1-77-3	1.77	3	1	3.5	8.44	5.77	6.34	3.00	7.06	1.5	0.625	8
		9520-2-31-3	2.31	3	2	3.88	9.50	6.84	7.25	3.00	7.81	1.5	0.625	9
		9520-2-84-6	2.84	6	4	4.88	10.63	8.00	8.81	6.00	8.75	4.0	0.625	14
		9520-3-59-6	3.59	6	5	5.5	12.13	9.50	10.19	6.00	7.50	4.0	0.625	17
		9520-4-40-8	4.40	6	6	6.5	13.75	11.12	12.00	8.00	7.16	4.0	0.625	20
1 1/2	1 5/8	9523-1-55-3	1.55	3	1	3.5	8.44	5.77	5.84	3.00	7.06	1.5	0.625	8
		9523-2-18-3	2.18	3	2	3.88	9.50	6.84	7.25	3.00	8.25	1.5	0.625	9
		9523-2-71-6	2.71	6	4	4.88	10.63	8.00	8.81	6.00	8.75	4.0	0.625	14
		9523-3-46-6	3.46	6	5	5.5	12.13	9.50	10.19	6.00	7.50	4.0	0.625	17
		9523-4-27-6	4.27	6	6	6.5	13.75	11.12	12.00	6.00	7.16	4.0	0.625	20
2	2 1/8	9529-1-93-3	1.93	3	2	3.88	9.50	6.84	7.25	3.00	7.81	1.5	0.625	9
		9529-2-46-6	2.46	6	4	4.88	10.63	8.00	9.81	6.00	8.75	4.0	0.625	14
		9529-4-10-6	4.10	6	5	5.5	12.13	9.50	10.19	6.00	7.50	4.0	0.625	17
		9529-5-53-6	5.53	6	7	8.5	17.38	14.25	15.53	6.00	11.00	4.0	0.750	35
2 1/2	2 5/8	9533-1-68-3	1.68	3	2	3.88	9.50	6.84	7.25	3.00	7.81	1.5	0.625	9
		9533-2-18-6	2.18	6	4	4.88	10.63	8.00	8.81	6.00	8.75	4.0	0.625	14
		9533-2-93-6	2.93	6	5	5.5	12.13	9.50	10.19	6.00	7.50	4.0	0.625	17
		9533-3-88-8	3.88	6	6	6.5	15.63	12.00	12.00	8.00	11.00	4.0	0.750	35
		9533-5-25-8	5.25	6	7	8.5	17.38	14.25	15.53	6.00	11.00	4.0	0.750	35
3	3 1/8	9537-1-93-6	1.93	4	4	5.5	10.63	8.00	8.81	6.00	8.75	4.0	0.625	20
		9537-2-68-6	2.68	6	5	5.5	12.13	9.50	10.19	6.00	7.50	4.0	0.625	17
		9537-3-49-6	3.49	6	6	6.5	13.75	11.12	12.00	6.00	7.16	4.0	0.625	20
		9537-5-00-6	5.00	6	7	8.5	17.38	14.25	15.53	6.00	11.00	4.0	0.750	35
4	4 1/8	9545-2-18-6	2.18	6	5	5.5	12.13	9.50	10.19	6.00	7.50	4.0	0.625	17
		9545-2-99-8	2.99	6	6	8.5	13.75	11.12	12.00	8.00	7.16	4.0	0.625	20
		9545-5-00-8	5.00	6	7	8.5	17.38	14.25	16.00	8.00	11.00	13	0.625	14
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Steel Pipe Alignment Guides – Previous & New Part Number Reference

OLD Part Number	Nominal Pipe Size (NPS)	Housing Number	E Expansion or Travel (inches)	NEW Part Number	Nominal Pipe Size (NPS)	Housing Number	E Expansion or Travel (inches)
9514-1	3/4	1	3	9514-1.94-3	3/4	1	3
9514-2		2	3	9514-2.47-3		2	3
9514-4		4	6	9514-3.00-6		4	6
9514-5		5	6	9514-3.75-6		5	6
9514-6		6	6	9514-4.56-6		6	6
9519-1	1	1	3	9519-1.81-3	1	1	3
9519-2		2	3	9519-2.34-3		2	3
9519-4		4	6	9519-2.87-6		4	6
9519-5		5	6	9519-3.62-6		5	6
9519-6		6	6	9519-4.43-6		6	6
9524-2	1 1/4	2	3	9524-2.17-3	1 1/4	2	3
9524-4		4	6	9524-2.70-6		4	6
9524-5		5	6	9524-3.45-6		5	6
9524-6		6	6	9524-4.26-6		6	6
9527-2	1 1/2	2	3	9527-2.05-3	1 1/2	2	3
9527-4		4	6	9527-2.58-6		4	6
9527-5		5	6	9527-3.33-6		5	6
9527-6		6	6	9527-4.14-6		6	6
9531-2	2	2	6	9531-1.78-8	2	2	8
9531-4		4	6	9531-2.31-8		4	8
9531-5		5	6	9531-3.06-8		5	8
9531-6		6	6	9531-3.87-8		6	8
9531-7		7	6	9531-5.37-8		7	8
9535-4	2 1/2	4	6	9535-2.06-8	2 1/2	4	8
9535-5		5	6	9535-2.81-8		5	8
9535-6		6	6	9535-3.62-8		6	8
9535-7		7	6	9535-5.12-8		7	8
9540-4	3	4	6	9540-1.75-8	3	4	8
9540-5		5	6	9540-2.50-8		5	8
9540-6		6	6	9540-3.31-8		6	8
9540-7		7	6	9540-4.81-8		7	8
9548-5	4	5	6	9548-2.00-8	4	5	8
9548-6		6	6	9548-2.81-8		6	8
9548-7		7	6	9548-4.31-8		7	8
9555-6	5	6	6	9555-2.28-8	5	6	8
9555-7		7	6	9555-3.78-8		7	8
9555-8		8	6	9555-4.84-8		8	8
9560-6	6	6	6	9560-1.74-8	6	6	8
9560-7		7	6	9560-3.25-8		7	8
9560-8		8	6	9560-4.31-8		8	8
9567-7	8	7	6	9567-2.25-8	8	7	8

OLD Part Number	Nominal Pipe Size (NPS)	Housing Number	E Expansion or Travel (inches)	NEW Part Number	Nominal Pipe Size (NPS)	Housing Number	E Expansion or Travel (inches)
9567-8		8	6	9567-3.31-8		8	8
9567-9		9	6	9567-4.93-8		9	8
9574-8	10	8	6	9574-2.25-8	10	8	8
9574-9		9	6	9574-3.87-8		9	8
9574-10		10	6	9574-4.87-8		10	8
9580-9	12	9	6	9580-2.81-8	12	9	8
9580-10		10	6	9580-3.81-8		10	8
9581-9	14	9	6	9581-2.18-8	14	9	8
9581-10		10	6	9581-3.18-8		10	8
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**

Copper Tube Alignment Guides

Hyspan manufactures and inventories standard alignment guides for standard size copper tube from 3/4" through 4" with varying insulation thickness.

Specifications

Tube Size Range: 3/4" – 4" standard copper tube

Construction: Heavy-gauge pressed steel

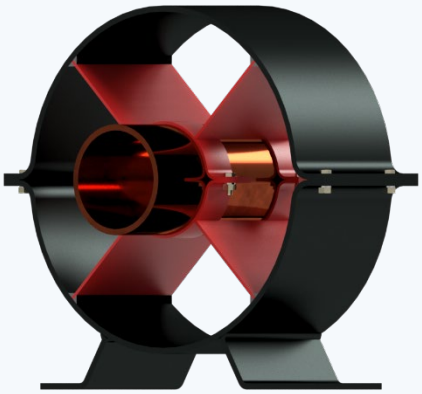
Bolting: Precision drilled

Finish: Protective black enamel paint

Tube Interface: Permanent heavy dielectric coating

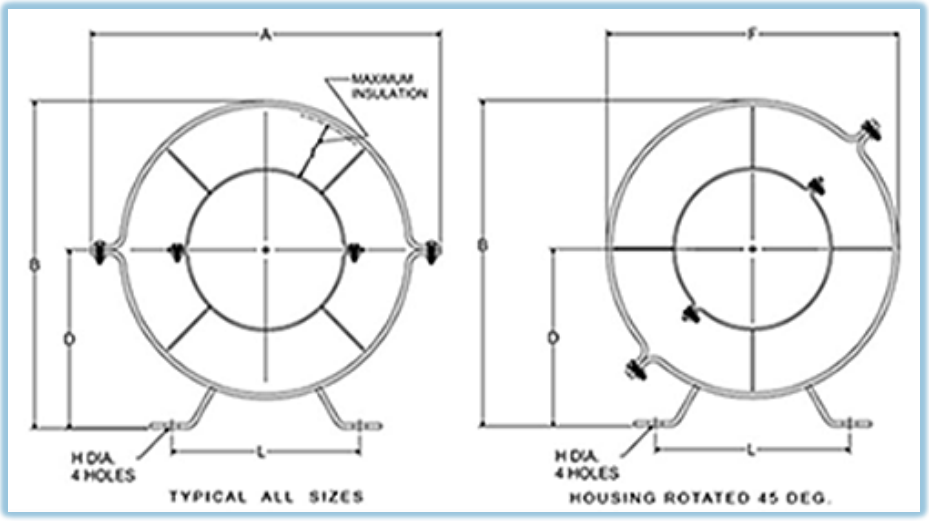
Max Operating Temp: 400°F

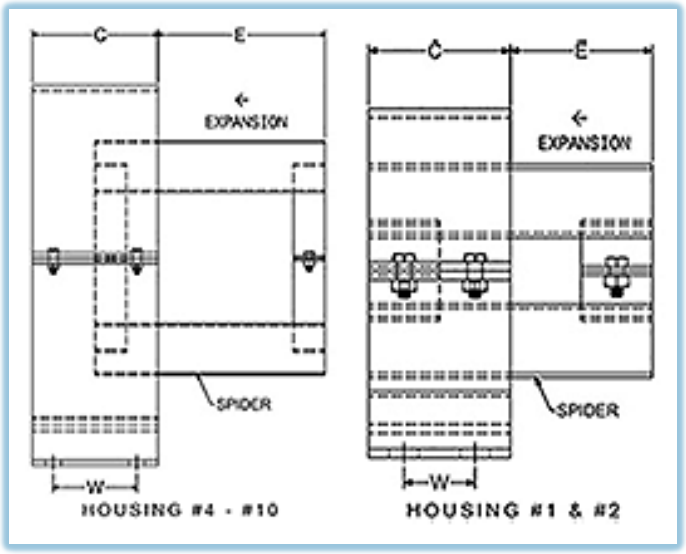
Options: Hot-dip galvanized, All stainless steel, Rotated housing



Copper Tube Guide — Selection Tables

Refer to the tables below for part numbers, dimensions, insulation clearances, and travel ranges.





Copper Tube Size	Actual Tube OD (in)	Part Number	I Maximum Insulation (in)	E Expan. or Travel (in)	Housing (#)	Centerline Height (in)	D Maximum Width (in)	A Maximum 45° Width (in)	F Maximum Height (in)	B Housing Length (in)	CL Hole Spacing (in)	L Hole Spacing (in)	W Hole Diameter (in)	H Weight (lbs.)
3/4	7/8	9512-2.03-3	2.03	3	1	3.5	8.44	5.77	6.34	3.00	7.06	1.5	0.625	6
		9512-2.56-3	2.56	3	2	3.88	9.50	6.84	7.25	3.00	7.81	1.5	0.625	9
		9512-3.09-6	3.09	3	4	4.88	10.63	8.00	8.81	6.00	8.75	4.0	0.625	13
		9512-3.84-6	3.84	6	5	5.5	12.13	9.50	10.19	6.00	7.50	4.0	0.625	17
		9512-4.65-6	4.65	6	6	8.5	13.75	11.12	12.00	6.00	7.16	4.0	0.625	20
1	1 1/8	9516-1.90-3	1.90	3	1	3.5	8.44	5.77	6.34	3.00	7.06	1.5	0.625	8
		9516-2.44-3	2.44	3	2	3.88	9.50	6.84	7.25	3.00	7.81	1.5	0.625	9
		9516-2.96-6	2.96	6	4	4.88	10.63	8.00	8.81	6.00	8.75	4.0	0.625	13
		9516-3.71-6	3.71	6	5	5.5	12.13	9.50	10.19	6.00	7.50	4.0	0.625	17
		9516-4.52-6	4.52	6	6	6.5	13.75	11.12	12.00	6.00	7.16	4.0	0.625	20
1 1/4	1 3/8	9520-1.77-3	1.77	3	1	3.5	8.44	5.77	6.34	3.00	7.06	1.5	0.625	8
		9520-2.31-3	2.31	3	2	3.88	9.50	6.84	7.25	3.00	7.81	1.5	0.625	9
		9520-2.84-6	2.84	6	4	4.88	10.63	8.00	8.81	6.00	8.75	4.0	0.625	14
		9520-3.59-6	3.59	6	5	5.5	12.13	9.50	10.19	6.00	7.50	4.0	0.625	17
		9520-4.40-8	4.40	6	6	6.5	13.75	11.12	12.00	8.00	7.16	4.0	0.625	20
1 1/2	1 5/8	9523-1.65-3	1.65	3	1	3.5	8.44	5.77	6.34	3.00	7.06	1.5	0.625	8
		9523-2.18-3	2.18	3	2	3.88	9.50	6.84	7.25	3.00	7.81	1.5	0.625	9
		9523-2.71-6	2.71	6	4	4.88	10.63	8.00	8.81	6.00	8.75	4.0	0.625	14
		9523-3.46-6	3.46	6	5	5.5	12.13	9.50	10.19	6.00	7.50	4.0	0.625	17
		9523-4.27-6	4.27	6	6	6.5	13.75	11.12	12.00	6.00	7.16	4.0	0.625	20
2	2 1/8	9529-1.93-3	1.93	3	2	3.88	9.50	6.84	7.25	3.00	7.81	1.5	0.625	9
		9529-2.46-6	2.46	6	4	4.88	10.63	8.00	8.81	6.00	8.75	4.0	0.625	14
		9529-3.21-6	3.21	6	5	5.5	12.13	9.50	10.19	6.00	7.50	4.0	0.625	17
		9529-4.02-6	4.02	6	6	6.5	13.75	11.12	12.00	6.00	7.16	4.0	0.625	20
		9529-5.53-6	5.53	6	7	8.5	17.38	14.25	15.53	6.00	11.00	4.0	0.750	35
2 1/2	2 5/8	9533-1.65-3	1.65	3	1	3.5	8.44	5.77	6.34	3.00	7.81	1.5	0.625	8
		9533-2.18-6	2.18	6	4	4.88	10.63	8.00	8.81	6.00	8.75	4.0	0.625	14
		9533-2.93-6	2.93	6	5	5.5	12.13	9.50	10.19	6.00	7.50	4.0	0.625	17
		9533-3.74-6	3.74	6	6	6.5	13.75	11.12	12.00	6.00	7.16	4.0	0.625	20
		9533-5.25-8	5.25	6	7	8.5	17.38	14.25	15.53	6.00	11.00	4.0	0.750	35
3	3 1/8	9537-1.93-6	1.93	6	4	5.0	10.63	8.00	8.81	6.00	8.75	4.0	0.625	14
		9537-2.68-6	2.68	6	5	5.5	12.13	9.50	10.19	6.00	7.50	4.0	0.625	17
		9537-3.49-6	3.49	6	6	6.5	13.75	11.12	12.00	6.00	7.16	4.0	0.625	20
		9537-5.00-6	5.00	6	7	8.5	17.38	14.25	15.53	6.00	11.00	4.0	0.750	35
4	4 1/8	9545-2.18-6	2.18	6	5	5.5	12.13	9.50	10.19	6.00	7.50	4.0	0.625	17
		9545-2.99-8	2.99	6	6	6.5	13.75	11.12	12.00	8.00	7.16	4.0	0.625	20
		9545-4.50-8	4.50	6	7	8.5	17.38	14.25	15.53	6.00	11.00	4.0	0.750	35
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Copper Tube Alignment Guides – Previous & New Part Number Reference

OLD Part Number	Nominal Pipe Size (NPS)	Housing Number	E Expansion or Travel (inches)	NEW Part Number	Nominal Pipe Size (NPS)	Housing Number	E Expansion or Travel (inches)
9512-1	3/4	1	3	9512-2.03-3	3/4	1	3
9512-2		2	3	9512-2.56-3		2	3
9512-4		4	6	9512-3.09-6		4	6
9512-5		5	6	9512-3.84-6		5	6
9512-6		6	6	9512-4.65-6		6	6
9516-1	1	1	3	9516-1.90-3	1	1	3
9516-2		2	3	9516-2.44-3		2	3
9516-4		4	6	9516-2.96-6		4	6
9516-5		5	6	9516-3.71-6		5	6
9516-6		6	6	9516-4.52-6		6	6
9520-1	1 1/4	1	3	9520-1.77-3	1 1/4	1	3
9520-2		2	3	9520-2.31-3		2	3
9520-4		4	6	9520-2.84-6		4	6
9520-5		5	6	9520-3.59-6		5	6
9520-6		6	6	9520-4.40-6		6	6
9523-1	1 1/2	1	3	9523-1.65-3	1 1/2	1	3
9523-2		2	3	9523-2.18-3		2	3
9523-4		4	6	9523-2.71-6		4	6
9523-5		5	6	9523-3.46-6		5	6
9523-6		6	6	9523-4.27-6		6	6
9529-2	2	2	3	9529-1.93-3	2	2	3
9529-4		4	6	9529-2.46-6		4	6
9529-5		5	6	9529-3.21-6		5	6
9529-6		6	6	9529-4.02-6		6	6
9529-7		7	6	9529-5.53-6		7	6
9533-2	2 1/2	2	3	9533-1.65-3	2 1/2	2	3
9533-4		4	6	9533-2.18-6		4	6
9533-5		5	6	9533-2.93-6		5	6
9533-6		6	6	9533-3.74-6		6	6
9533-7		7	6	9533-5.25-6		7	6
9537-4	3	4	6	9537-1.93-6	3	4	6
9537-5		5	6	9537-2.68-6		5	6
9537-6		6	6	9537-3.49-6		6	6
9537-7		7	6	9537-5.00-6		7	6
9545-5	4	5	6	9545-2.18-6	4	5	6
9545-6		6	6	9545-2.99-6		6	6
9545-7		7	6	9545-4.50-6		7	6
1	2	3	4	5	6	7	8

Available Options

The following suffix codes may be appended to the standard part number to specify optional materials or configurations:

Option Code	Description
-GV	Hot dipped galvanized structural components
-SS	All 304 stainless steel construction
-45	45-degree housing and spider

Product Selection & Ordering Instructions

- Select Steel Pipe or Copper Tube, then locate the correct Table.
- Select the size.
- Select insulation clearance: a maximum value equal to or greater than the insulation thickness to be installed.
- Verify the Alignment Guide Expansion/Travel stated is equal or greater than the motion occurring at the guide location. For additional expansion, increase the last part number indicator as needed.
- For hot dipped galvanized steel or stainless steel materials, select the appropriate option suffix (-GV or -SS).
- Confirm the guide housing "A" spacing will fit into the system. If it does not, select the "-45" degree housing and spider option and re-verify the spacing.

Contact & Additional Instructions

Hyspan Precision Products, Inc.

Website: www.hyspan.com

For ordering instructions and terms of sale, visit the Hyspan website or contact your local agent.

Resources

- Agent Locator available at www.hyspan.com
- Technical Assistance — contact Hyspan directly
- Refer to individual product catalogs for expansion joint Applications sections

Hyspan

Hyspan Precision Products, Inc. · 1685 Brandywine Avenue · Chula Vista, CA 91911
+1 619.421.1355 · websales@hyspan.com · hyspan.com