Selecting the correct hose can improve your process

Selecting the correct hose for a particular application is one key element that is often overlooked. Many hose failures are attributed to a mismatch of hose and application. Armed with a little knowledge, it is not difficult to select the best hose option for your customer's specialty gas application.

Application Questions

To select the correct hose, make the following determinations:

- Gas or cryogenic
- Type of gas/grade (argon, helium, hydrogen, oxygen, etc.)
- Required maximum pressure (psig)
- Required maximum flow rate (CFH or CFM)
- Length of hose (give yourself extra length)
- Fitting configuration (1/4" NPT is standard; other fittings available)
- Armor casing (yes or no)
- Cleaned, capped and bagged (for oxygen service)
- Special configuration – CGA nut, hand tight, check valve, etc.

Hoses designed for specialty gas applications should not only provide pressure capacity, but also maintain the purity of gas delivered. For this reason, it is not recommended to use rubber type hoses to supply high purity gas.

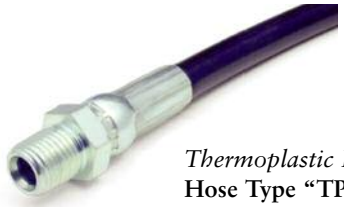
Permeation is the term used to describe how gas molecules pass through the pores of a hose. When gases escape out of a hose, this is called "effusion." If permeation levels are high, ambient gases can enter into the gas stream through "diffusion," thereby adding contaminants. To varying degrees, rubber, PTFE and ETFE hoses all permeate gases. The smaller the gas molecule, the higher the rate of permeation.

"All metal" hoses utilize a corrugated inner core that features "zero permeation." One might conclude that "all metal" hoses are the final answer; however, cost, velocity issues and the application will dictate the best choice. PTFE, PTFE hybrids such as "post sintered," and ETFE thermoplastic hoses maintain pressure capacity while dramatically reducing permeation. Their flexibility and durability are much more appealing than "all metal" hoses when outfitting a high capacity fill plant. It is important to evaluate the requirements of each application and then select the hose that best fits. Selecting the correct hose can maximize gas purity, reduce the risk of contamination and improve a customer's process.

There are several choices of materials to consider when selecting a hose:

Rubber – Inexpensive, high permeation rates, not recommended for high purity applications.

Thermoplastic – Ratermann Mfg. TPL Family of Hoses Durable, economical, flexible and features a low permeation rate. Not recommended for oxygen use.



Thermoplastic Hose
Hose Type "TPL"

PTFE – Ratermann Mfg. FP Family of Hoses
The most popular high-pressure hose in use. Commonly found in fill plants across the country. Durable, flexible, and economically priced.

PTFE Hose
Hose Type "FP" and "FPT"

PTFE "Post Sintered" – Ratermann Mfg. FPT Family of Hoses The "post sintered" process re-bakes the PTFE at a controlled time and temperature, increasing the wall thickness and tightening the molecular bond of the PTFE, which dramatically reduces effusion and diffusion. Economically priced, very flexible and works well with most gases.

Rigid Metal – Ratermann Mfg. PT Family of Rigid Hoses
Economically priced, reduced flexibility, best suited for stationary applications. Rigid hoses will eventually crack as they are bent and flexed.

All Metal Corrugated Hose – Ratermann Mfg. FPS Family of Hoses All metal hoses utilize a metal corrugated inner core (typically 316 stainless steel or Monel). Metal hoses feature "zero permeation" or "no gas loss," which is very important in static gas applications. Metal hose is more costly, and is commonly used with helium and hydrogen. Monel inner core is available for corrosive type gases. Pay close attention to dynamic stress and velocity levels (flow rate) as there are limitations with a metal hose.

All Metal Hose
Hose Type "FPS"

Call us to Help You with Your Gas Hose Needs!

High Pressure Pigtail Selection Guide

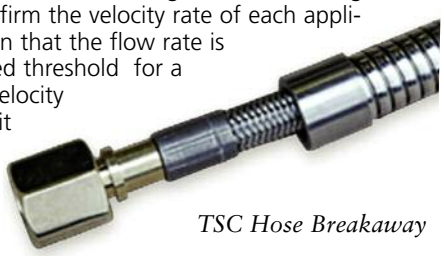
Compatibility Excellent 5 Very Good 4 Good 3 Acceptable 2 Not Acceptable N

Ratermann Hose Style Working Pressure (MAWP) Core or Liner		FP / FPT 3000/3600 PSIG PTFE	FPS-60P 6000 PSIG PTFE	FPS 4250 PSIG 316L S.S.	FPS-45P 4500 PSIG 316L S.S.	FPS-C 4250 PSIG Monel	TPL 3000 PSIG Polyester
Gas	Connection						
[1]Acetylene	510	4	5	3	3	3	2
Air	346	5	3	3	3	3	2
Argon	580	5	3	3	3	3	2
[1]Arsine	660	N	N	N	N	3	N
Carbon Dioxide	320	5	3	3	3	3	N
Carbon Monoxide	350	4	4	5	5	3	N
Chlorine	660	N	N	N	N	4	N
Fluorine	679	N	N	N	N	4	N
Freon 12	660	5	4	5	5	5	N
Helium	580	4	3	5	5	4	2
Hydrogen	350	3	3	4	4	3	N
Methane	350	5	4	5	5	5	N
Natural Gas	350	3	5	5	5	3	N
Nitrogen	580	5	5	3	3	3	2
Nitrous Oxide	326	5	3	3	3	3	N
Oxygen	540	5	3	3	3	4	N

Dynamic Stress and Velocity

Pressure flow characteristics are important factors when using an all metal hose. Dynamic stress is an important consideration when selecting an all metal hose. The hose must not be bent on more than one plane at a time or restricted (over-bent) in any way.

All metal Corrugated hoses are not designed to handle high velocity flow rates. Confirm the velocity rate of each application, and make certain that the flow rate is below the recommended threshold for a given size hose. If the velocity exceeds this threshold, it will establish a resonant frequency that will prematurely crack the hose.



TSC Hose Breakaway

When the velocity flow rate exceeds the recommended threshold, consider using a PTFE lined hose. Tube trailer transfer is one application that often exceeds the recommended threshold rate.

Medical Gases – It is very important that you select the correct hose for medical applications. One should consult an expert prior to installing pigtails. Care should be taken with Oxygen pigtails to the heat associated with "adiabatic compression." We highly recommend the use of an extended brass volume piece on oxygen manifold pigtails.

Braiding – The stainless steel braid encases the inner core and gives the hose its strength to hold pressure. A high pressure hose can have from one (3,000 psig) to four braids (5,000 psig) depending on pressure requirements.

Armor Casing – Armor casing can easily be installed over the braided hose. It will prevent hose kinking and whipping in the event of a hose burst, and also protects the exterior of the hose.

Fittings – Swivel fittings, hand tights, 90 degree elbows and brass heat sinks for adiabatic compression are a few of the more popular fittings in use.

Selecting the Best Hose

In the specialty gases industry, there are several choices when considering a hose. Here are some of the basic factors that one should take into consideration.

Pressure – Make certain that the average working pressure of the hose is well above the required maximum pressure of the application.

Molecular Weight – Hydrogen and helium have the smallest molecular weight, and therefore present a higher risk of permeation loss.

Permeation – If permeation is a concern, consider using an all metal hose. Make certain that the flow rate is below the suggested threshold level. Other options would be an ETFE or PTFE post sintered type hose. These hoses will reduce effusion by approximately 75 percent.

Purity – Hoses that effuse gases can also diffuse gases. Diffusion can introduce contaminants that could effect the high purity gas stream. If this is a concern, consider using an all metal hose.

Static State – If a gas is used in a static state, there will be times when the gas is not being used (off hours, weekend). In this case, gases trapped inside the hose could effuse out. The amount lost is minimal, but over time this loss can add up.

Fill Manifolds – Hoses used on fill manifolds are typically cycled (attached and disconnected from the cylinder) several times a day. The hose is exposed to continual flexing, and then disconnected (handing open to the air). As a result, permeation of a fill manifold is of minimal concern. PTFE hoses work well in this application.

Laser Cutting Systems – Using the wrong hose to supply a laser can be detrimental to the operating efficiency of the laser, depending on permeability of the hose, a high permeation hose will contribute contamination, resulting in increased down-time. Ultimately this will effect the quality of cut.

For Hose Maintenance *information, see pages* **16A-20-21**

Tube Trailer Hose Selection Guide

Compatibility Excellent 5 Very Good 4 Good 3 Acceptable 2 Not Acceptable N

Ratermann Hose Style Working Pressure (MAWP) Core or Liner	TT 5000 PSIG PTFE	TTS 3700 PSIG PTFE	TTM 2500 PSIG Monel
Gas			
Air	4	3	4
Argon	4	3	4
Carbon Dioxide	4	5	2
Helium	3	5	4
Hydrogen	3	5	4
Natural Gas	4	3	3
Nitrogen	4	3	4
Nitrous Oxide	3	3	3
Oxygen	3	3	5