

## LifeGuard Technologies

### Fill Plant Hose Selection Information

#### What is LifeGuard™ ?

A flexible “Safety System” for use in the transfer of high-pressure gases and liquids. Protect against the hazardous effects of hose rupture, pull-apart and failure.

The LifeGuard™ design utilizes the unique, patent pending design that eliminates the potential for disaster through the use of an

internal compression spring device connected to specially designed, normally unseated valves located on each end of the spring. In the event of hose separation, stretching to the point of an unsafe condition or coupling-to-hose separation, the valves are released and instantly seat stopping the flow in both directions.



# LIFEGUARD™ SAFETY SYSTEM

HYDROGEN HOSES | CRYOGENIC LIQUID CYLINDER HOSES | METAL PIGTAILS | LIFEGUARD COMPRESSED GAS HOSES | CARBON DIOXIDE BULK LIQUID TRANSFER HOSES

## What is LifeGuard™ Safety Hose Technology?

The *LifeGuard Safety Hose technology* is a proven hose technology designed to counteract the hazardous effect of hose rupture or failure during fluid or gaseous transfer operations. All

**LifeGuard Safety Hose** designs, **LifeGuard Safety Hose I**, **LifeGuard Tri-Bolt Breakaway**

**Safety Hose** utilize the unique, patented and patent pending design eliminating the potential for disaster through the use of an internal cable connected to specially designed, normally unseated valve “flappers or plungers” located on each end of the cable. The “LifeGuard™ Safety” system will shut-off the flow of product conveyed in both directions instantly in the event of a hose coupling ejection, hose stretching to an unsafe condition or hose separation.

### How does *LifeGuard Safety Hose technology* work?

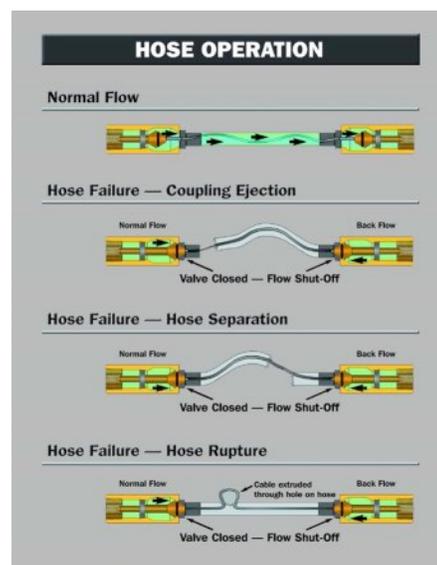
LifeGuard Safety Hose incorporates a coated cable within the hose bore that is connected to the valve plungers, or flappers. This cable acts as a compression spring providing thrust in the direction of both ends of the hose, holding the valves open. Should this thrust be eliminated due to coupling ejection, hose stretching or hose separation, the valves release and instantly seat, stopping flow in both directions.

In the event of hose separation, stretching to the point of an unsafe condition or coupling-to-hose separation, the valve “Flappers or Plungers” are released and instantly seat **stopping the flow in both directions**.

### LifeGuard Safety Hose Features

Some of the elements of our fundamental value proposition - innovation, safety and cost:

1. All major industrial gas producers use LifeGuard Safety Hose with three issuing global specifications!
2. History - Over 400,000 hoses using this technology are in service.
3. No significant cost differential between LifeGuard Safety Hose and Non-Safety-Hoses
4. Eliminate costs associated with environmental damage and remediation - Reduced legal and insurance costs.
5. No additional training required for operators- Many employees will not even know that they are using a LifeGuard SafetyHose!
6. LifeGuard Safety Hose costs slightly more but in all events this cost is immaterial when compared to the safety benefit.
7. Allows industry players to respond to warnings as they relate to reliance upon Excess Flow Valves in the event of hose failure in related applications.



## Typical Questions About LifeGuard

We have been asked many different questions, some of which your company may know but much has been developed over the last several years.

- 1. Is there a flow restriction?** We have had extensive testing performed by Air Liquide, Praxair and Linde and independent laboratories all indicating that nominal flow restriction exists. Please review the attached report for further information.
- 2. If the hose stretches but does not separate, will the flow be stopped?** Hoses are designed to have nominal, if any, stretching. Far too often, hose failure and the attendant results are caused by hoses that have been stretched to a less than optimal operational length and then returned to active service. With LifeGuard, the hose would require a 5% elongation (on average) before our patented internal shutoff mechanisms would function. Therefore a hose that has been stretched to a dangerous length is returned to active service, our system will safeguard its use by preemptively stopping the flow. Should the hose be a rubber or flexible type that returns to its standard length, our system will reset itself and no flow will be stopped. Note: all hoses are tested for cable thrust to insure that all components meet the LifeGuard Safety Hose specifications.
- 3. What holds the “Plunger” in an open position to ensure against accidental closing?** Valve plungers, or flappers installed at both ends of the hose, accomplish closure. During normal operation they are kept open by a coated cable (where appropriate) incorporated within the hose bore. This cable acts as a compression spring providing thrust in the direction of both ends of the hose, holding the valves open. The cable thrust is carefully determined to insure against premature closure. Should this thrust be eliminated due to coupling ejection, hose stretching or hose separation, the valves are released and instantly seat, stopping flow in both directions. The picture above illustrates this principle.
- 4. What applications has LifeGuard Safety Hose been sold for?** LifeGuard Safety Hose is a technology that reduces the consequences, associated with certain hose ruptures. It may also reduce operating costs by eliminating an operator’s position in cases where government regulations require constant personnel attention while using hoses. We have sold in excess of 400,000 hose assemblies over the last eight years for the following applications: High Pressure Cylinder Filling ( $\frac{1}{4}$ ” to 1”), cryogenics transfer ( $\frac{1}{4}$ ” to 1”), cryogenics trailer hose (1”-2”), LP (units from  $\frac{3}{4}$ ” to 3”), NH<sub>3</sub> (in size from 1” to 6”), SO<sub>2</sub> (2”), Metallic hose (from  $\frac{1}{2}$ ” to 2”), CO<sub>2</sub> ( $\frac{1}{2}$ ” to 2”), HCL (at 1”), Chlorine (1-2”), Petroleum Transfer (2-3”), General Chemical (1”-2”) of such hoses to companies like Shell, Dow Chemical, Dow Corning, Amerigas, Linde, Air Liquide, AGA Sweden, BASF, PPG and others.
- 5. What are the various fitting designs?** Three styles of LifeGuard Safety Hose shut off devices, known as Lifeline I, II. Lifeline I is used for most small hose applications,  $\frac{1}{4}$  - inch to 1 $\frac{1}{4}$  - inch. The coupling is constructed of monel, brass, or stainless 316. Lifeline II is used with 1-inch and 2-inch hoses and the coupling is constructed of Monel, stainless 316 steel, or carbon steel. Our Tri-Bolt Breakaway design is used with most large hose diameters, 1 $\frac{1}{2}$  - inch to 6 - inch. The coupling is constructed of stainless 316 for most applications.





# LIFEGUARD SAFETY SYSTEM

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**6. What are the additional benefits of this technology?** A primary benefit of the shut off design used with LifeGuard Safety Hose is the reduction in consequence related to hose separation. After a hose separation occurs, the shut off device stops flow reducing the amount of product that is released. Other potential benefits are:

- When replacing a hose, the couplings (in most applications) can be re-used, thus reducing the cost for replacement hose.
- LifeGuard Safety Hose is certified as a passive shutdown system per CFR 49 paragraphs 171 through 180 for hazardous materials. This allows the attendant during unmetered truck

unloading to move up to 25 feet (7.6 meters) away from the manual shutoff valve rather than remaining within 3 feet (1 meter) where such a system is not provided.

- LifeGuard Safety Hose is an exemption to the attendance requirement for Railcar delivery as required under 49 CFR 174.67 (Exemption No. 12325-N)
- LifeGuard Safety Hose has a pending exemption for the attendance requirement for tank truck delivery for products such as gasoline, chemicals (Exemption No. 12625-N)
- LifeGuard Safety Hose is under consideration by the US Coast Guard for exemption status under 49 CFR 151.

**The following are answers to some common questions about the LifeGuard Safety Hoses:**

Sizes	Available in all sizes between ¼" and 6." A 12" size is in the design phase.
Weight of Assemblies	Comparable to standard hose. See chart below
Limitations on Flow Rates	The hose specified in the design determines the flow limitations. The Lifeline design does introduce a restriction equivalent to 4% reduction in flow area. LifeGuard Safety Hose can be used in any application for liquid or gas including gravity drop
Flow Turbulence	Yes, but unmeasured.
Pressure Drop	Nominal.
Are hose strings acceptable	Yes.
Hose Weight with Product  For Hoses in hanging applications we've engineered the system to accommodate the weight of hose, connections and weight of product in the hose assemblies	Hose designed to address issue.
Leak size required to stop flow through the hose	Will vary, but hose is not designed for leak protection.
Is "back flow" required to close seating mechanisms	No.
Are valves "spring loaded"	No, the internal cable acts as a spring.
What is the valve closure time	Instantly in both directions.
Is the manufacturing site ISO certified	All of our facilities are in compliance



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## OUR PARTS NUMBERING SYSTEM:

<b>Example: from below</b>	
TF04	Designates what type of hose (teflon) and working pressure (4500 PSI)
002	Designates size ( ID ) ( in this case ¼" )
60	Designates material and thread configuration ( in this case BSPP threads)
0036	Designates the length in inches (in this case 36 inches)
<b>TF06-002-11-003-S</b>	
TF06	Designates teflon hose (6000 PSI WP)
002	Size ¼" ID
11	Designates material 316 S/S fitting (in this case ¼") NPT female threads
0036	Designates length in inches (in this case 36 inches or 3 feet)
S	Designates safety loop at each end of hose.
<b>BH22-004-11-0120</b>	
BH22	Designates metal hose (316 S/S core with double braided 304 S/S covering) 3500 PSI
004	Designates size ( in this case ½" ID)
11	Designates material 316 S/S fitting (in this case ½" NPT female threads)
0120	Designates length in inches (in this case 120 inches or 10 feet)
<b>TZ51-02-17-0060</b>	
TZ51	Designates type of hose (in this case tefzel) 3500 PSI
002	Designates size (ID) in this case ¼"
17	Designates material brass (in this case ¼" NPT female threads)
0060	Designates length in inches (in this case 60 inches or 5 feet)
<b>IR01-004-15-0000</b>	
IR01	Designates type of hose (in this case LPG) 350 PSI
004	Designates size (in this case ½")
15	Designates material 316 S/S fitting (in this case ½" NPT threads)
0000	Designates length in inches and in this case no length was given

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## LifeGuard™ LifeGuard Cylinder Plant Fill Hoses The Next Generation in Hose Safety!!!

**WHAT IS LifeGuard™ ?** A Flexible “SafetySystem” for use in the transfer of high pressure gases and liquids. Protect against the hazardous effects of high pressure hose rupture, pull-apart and failure. The LifeGuard™ design utilizes the unique, patent pending design that eliminates the potential for disaster through the use of an internal compression spring device connected to specially designed, normally unseated valves located on each end of the spring. In the event of hose separation, stretching to the point of an unsafe condition or coupling to-hose separation, the valves are released and instantly seat stopping the flow in both directions.

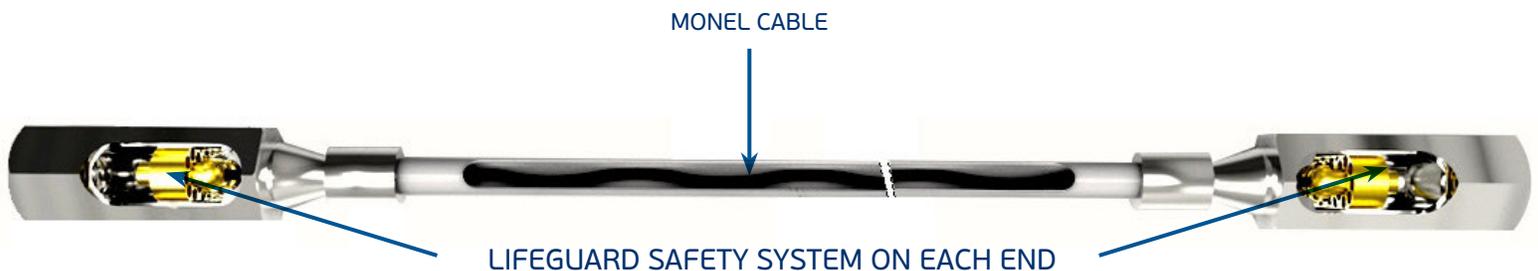
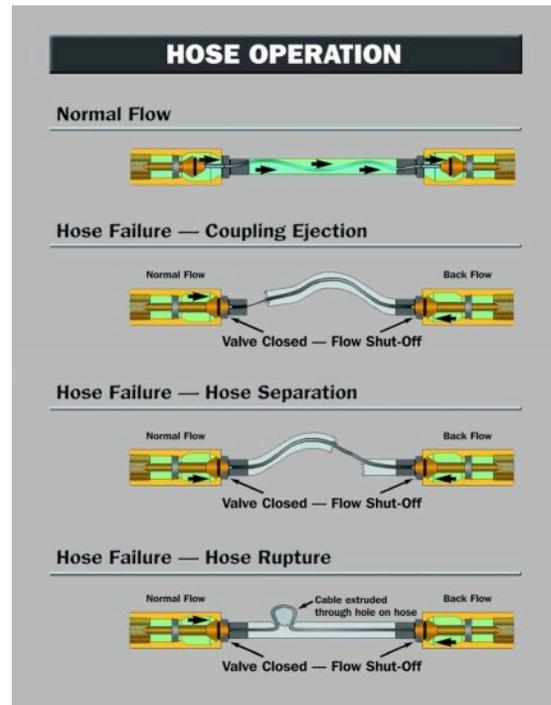
### CYLINDER PLANT FILL HOSES

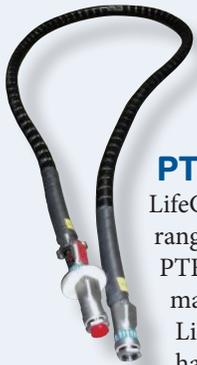
**APPLICATION:** PTFE, Stainless Steel Braid is ideal for a wide range of industrial applications, PTFE is non-porous, chemically inert and requires zero maintenance. PTFE is an FDA approved material. When coupled with the LifeGuard Safety System fitting and cleaned for oxygen use, high temperature capabilities make PTFE the best choice for medical or industrial oxygen filling.

**CONSTRUCTION:** All LifeGuard convoluted stainless steel inner core, double braided compressed gas hoses are tig welded and come in female NPT or BSP threads.

### MAXIMUM WORKING PRESSURE:

¼" - 1" 3000 PSI to 10,000 PSI.





## High Pressure Hoses

### PTFE, STAINLESS STEEL BRAID

LifeGuard Safety PTFE Safety Hoses are ideal for a wide range of compressed gas and industrial applications. PTFE is non-porous, chemically inert and requires zero maintenance. PTFE is an FDA approved material. All LifeGuard Safety Hoses are cleaned for oxygen use, have high temperature capabilities and our internal Monel cable which acts as a heat dissipater make PTFE an approved choice for medical or industrial oxygen filling. LifeGuard Safety Hoses use Konigsberg PTFE which has been tested and approved by Air Liquide and Praxair greater flexibility, kink resistance, longer life and less permeation.

To obtain maximum quality control of the manufactured applications, we burst pressure tests every batch of hose brought into stock. The results are archived for minimum 10 years. Our pressure test certificate of the manufactured batch is sent together with goods. To ensure the purity of the high pressure products sent out, we clean the hoses internally, cap the fittings and pack them individually in plastic bags. We also label all products with a batch number to ensure traceability.

- **PTFE Core, Double SS Braid.** ¼" and ½"NPT, Teflon Lined, 3500 Psi-Brass Ends
  - ¼" - Part Number TF02-002-17-XX-S-XX
  - ½" - Part Number TF02-004-17-XX-S-XX
- **PTFE CORE DOUBLE SS BRAID.** ¼" and ½" NPT, Teflon Lined, 4500 PSI-Brass Or SS Ends
  - ¼" - Part Number TF04-002-17-XX-S-XX
  - ½" - Part Number TF04-004-17-XX-S-XX
- **PTFE Core, Double SS Braid, Double SS Spiral Wrap.** ¼" and ½" NPT, Teflon Lined, 6000 PSI-SS Ends
  - ¼" - Part Number TF06-002-17-XX-S-XX
  - ½" - Part Number TF06-004-11-XX-S-XX

### ETFE TEFZEL® CORE, STAINLESS STEEL BRAID

Designed specifically for the ultra hazardous applications of high pressure hydrogen gas transfer in tube trailers, facilities and cylinders. Whether you prefer metallic or Tefzel®, the LifeGuard hydrogen hose is the Safe-Choice™. The inner hose, braid, armor casing cuffs, weld ring, and ends are all stainless steel. Each finished assembly is pneumatically tested to ensure it will withstand the application requirements.

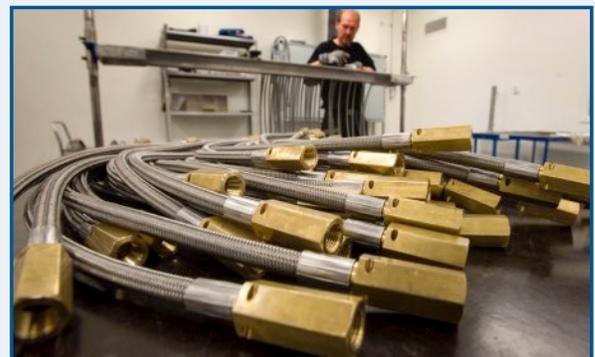
#### LifeGuard Tefzel® ETFE Lined Stainless Steel Braided Hoses

LifeGuard's Tefzel® ETFE inner core has a permeation rate that is approximately 77% lower than PTFE inner core pigtails. This makes it an ideal choice for helium and hydrogen.

#### LifeGuard Metallic Lined Stainless Steel Braided Hoses

LifeGuard's metallic high pressure hose assemblies are specifically designed to transfer gaseous hydrogen to and from a bulk transport truck to the customer facility.

- **ETFE Core, Double SS Braid.** ¼" and ½"NPT, Teflon Lined, 3500 PSI-Brass Ends
  - ¼" - Part Number TF51-002-17-XX-S-XX
  - ½" - Part Number TF51-004-17-XX-S-XX
- **ETFE Core, Single SS Braid.** ¼" and ½"NPT, Teflon Lined, 4500 Psi-Brass Ends
  - ¼" - Part Number TF51-002-12-XX-S-XX
  - ½" - Part Number TF51-004-12-XX-S-XX



Think smarter . . . Think safer!



## METALLIC CORE PIGTAILS

Many applications require a metal "bellows" type hose which provides an all welded, flexible alternative to rigid pipe and tubing with zero permeation even at high pressures and cryogenic temperatures. A variety of alloys, safety features and options are available so that an assembly matching your precise needs can be provided. All hose assemblies are constructed with heavy-gauge end fittings. Maximum allowable working pressure and date of manufacture are permanently marked on each assembly. 316 SS pigtails are designed for strong, safe and flexible operation in demanding specialty gas environments. Zero permeation characteristics do not allow gas or atmosphere to pass through its wall in either pressure or vacuum applications. Ideal for flammable, toxic, high purity and small molecule gases.

• **SS Core, Double SS Braid.** ¼" and ½"NPT, Teflon Lined, 3600 PSI-SS Ends

- ¼" - Part Number BH09-002-11-XX-S-XX
- ½" - Part Number BH22-004-11-36 -XX-S

The convoluted inner tube is made in stainless steel, material grade AISI 316L, and the braid in stainless steel, material grade AISI 304. The convoluted profile makes the hose flexible even under high pressure. The braid is closely wrought over the tube, making the high pressure hose suitable for very high pressures. The stainless steel alternative is often used when the demands are high regarding purity, because of the fact that the stainless steel high pressure hose is 100% free from permeation.

To obtain maximum quality control of the manufactured applications, we burst pressure tests every batch of hose brought into stock. The results are archived for minimum 10 years. Our pressure test certificate of the manufactured batch is sent together with goods. To ensure the purity of the high pressure products sent out, we clean the hoses internally, cap the fittings and pack them individually in plastic bags. We also label all products with a batch number to ensure traceability.



## SPECIFICATIONS – PTFE AND ETFE

Hose Style	Size ID (in)	Size OD w/o Armor (in)	Size OD w/ Armor (in)	Inner Core Wall Thick	MAWP (PSIG)	Min Bur Pressure (PSIG)
TF02	0.250	0.375	0.560	0.040	3500	14500
TF04	0.250	0.400	0.625	0.040	4500	18000
TF06	0.220	0.500	0.725	0.040	6000	24600
TF51	0.250	0.375	0.560	0.030	3500	13500

## MATERIAL PREFERENCES – PTFE AND ETFE VS

**Teflon vs. Metal inner hose:** gas and cryogenic hoses are available with either teflon or metal inner hoses. To ensure long life, it is very important that you select the correct material for each application.

**Corrugated vs. Smooth bore inner core:** one of the most common causes of metal hose failure is "high velocity" gas flow. Because of the ribs on the corrugated type hose, high velocity flow (above recommended levels) can damage or crack a metal type hose. To avoid hose damage, it is important to know the velocity of gas flowing through the hose. We have provided charts that will help you determine velocity flow levels. If you find that a particular application requires a higher than recommended gas flow velocity, in this case we would suggest that you switch to a smooth bore PTFE or ETFE type hose (dependent on the gas). Smooth bore hoses are designed to handle higher velocity gas flow requirements.

**Effusion:** metal inner core hoses will not effuse or diffuse gas. I.E. They have zero permeation: this is why they are preferred for high purity and hazardous specialty gases, as well as hydrogen and helium when in a constant pressurized application. Pressurized gas will permeate or effuse through the wall of the PTFE hose at rates consistent with the gas molecule size and weight, and with atmospheric gases this effusion is hardly noticeable and minimal. For hydrogen and helium, the ETFE or hose has typically 1/3 the effusion rate of a PTFE hose, so ETFE (or "post sintered") is the recommended inner core material for H2 and He cylinder filling applications.

**Flexibility:** teflon hoses tend to be a bit more forgiving in terms of flexibility than all metallic hoses. If an application requires constant flexing, a PTFE or ETFE type hose will work best.

**Trailer transfill/cylinder filling, cylinder cradles - high velocity:** the inside of a teflon gas service hose is smooth bore, whereas a metal inner hose is convoluted (ribbed). In high velocity applications (tube trailer transfill, cylinder fill) a smooth surface will work best. A convoluted hose in a high pressure drop (high velocity up to critical velocity) can experience internal hose vibration and leading to cracking of the corrugated inner core.

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## LifeGuard PTFE and Metallic Cylinder Plant Fill Hoses

### The Next Generation in Safety-Hoses!!!

### LIFEGUARD™ SAFETY HOSE HIGH PRESSURE HOSE LIST

HIGH PRESSURE SAFETY HOSES/TEFLON AND TEFZEL		SPECIALTY GASES HIGH PRESSURE SAFETY HOSES/TEFLON AND TEFZEL	
LGT PART NO		LGT PART NO	
TF02-002-17-24	24" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS	TF02-002-19-24	24" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF51-002-17-24	24" X 1/4" NPT, TEFZEL LINED, 3500 PSI-BR ENDS	TF51-002-19-24	24" X 1/4" NPT, TEFZEL LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF51-002-11-24	24" X 1/4" NPT, TEFZEL LINED, 3500 PSI-SS ENDS	TF51-002-18-24	24" X 1/4" NPT, TEFZEL LINED, 3500 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF04-002-12-24	24" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS	TF04-002-21-24	24" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF06-002-11-24	24" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS	TF06-002-18-24	24" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF07-002-11-24	24" X 1/4" NPT, TEFLON LINED, 7500 PSI-SS ENDS (3/1 WP/BURST RATIO)	TF07-002-19-24	24" X 1/4" NPT, TEFLON LINED, 7500 PSI-SS ENDS (3/1 WP/BURST RATIO) WITH HEAT DISSIPATERS E/E
TF02-002-17-36	36" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS	TF02-002-19-36	36" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF02-002-17-36-SBR	TEFLON HOSE, BRASS FITTINGS, FNPT, 1/4" X 36" 3500 PSI, W/BEND RESTRICTORS AND SAFETY LOOPS	TF02-002-19-36-SBR	TEFLON HOSE, BRASS HEATSINK FITTINGS, FNPT, 1/4" X 36" 3500 PSI W/BEND RESTRICTORS AND SAFETY LOOPS
TF51-002-17-36	36" X 1/4" NPT, TEFZEL LINED, 3500 PSI-BR ENDS	TF51-002-19-36	36" X 1/4" NPT, TEFZEL LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF51-002-11-36	36" X 1/4" NPT, TEFZEL LINED, 3500 PSI-SS ENDS	TF51-002-18-36	36" X 1/4" NPT, TEFZEL LINED, 3500 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF51-002-11-36-SBR	TEFZEL HOSE, BRASS FITTINGS, FNPT, 1/4" X 36 INCHES, 3500 PSI W/BEND RESTRICTORS AND SAFETY LOOPS	TF04-002-21-36	36" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF04-002-12-36	36" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS	TF06-002-18-36	36" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF06-002-11-36	36" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS	TF07-002-19-36	36" X 1/4" NPT, TEFLON LINED, 7500 PSI-SS ENDS (3/1 WP/BURST RATIO) WITH HEAT DISSIPATERS E/E
TF51-002-17-36-SBR	36" X 1/4" NPT, TEFLON LINED, 3500 PSI-SS ENDS, CFOS, CAPPED AND BAGGED WITH BEND RESTRICTORS AND SAFETY LOOPS	TF02-002-19-48	48" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF07-002-11-36	36" X 1/4" NPT, TEFLON LINED, 7500 PSI-SS ENDS (3/1 WP/BURST RATIO)	TF51-002-19-48	48" X 1/4" NPT, TEFZEL LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF02-002-17-48	48" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS	TF51-002-18-48	48" X 1/4" NPT, TEFZEL LINED, 3500 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF51-002-17-48	48" X 1/4" NPT, TEFZEL LINED, 3500 PSI-BR ENDS	TF04-002-21-48	48" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF51-002-11-48	48" X 1/4" NPT, TEFZEL LINED, 3500 PSI-SS ENDS	TF06-002-18-48	48" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF04-002-12-48	48" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS	TF07-002-19-48	48" X 1/4" NPT, TEFLON LINED, 7500 PSI-SS ENDS (3/1 WP/BURST RATIO) WITH HEAT DISSIPATERS E/E
TF06-002-11-48	48" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS	TF02-002-19-60	60" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF07-002-11-48-S*	48" X 1/4" NPT, TEFLON LINED, 7500 PSI-SS ENDS (3/1 WP/BURST RATIO)	TF51-002-18-60	60" X 1/4" NPT, TEFZEL LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF02-002-17-60	60" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS	TF51-002-21-60	60" X 1/4" NPT, TEFZEL LINED, 3500 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF51-002-17-60	60" X 1/4" NPT, TEFZEL LINED, 3500 PSI-BR ENDS	TF04-002-18-60	60" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF51-002-11-60	60" X 1/4" NPT, TEFZEL LINED, 3500 PSI-SS ENDS	TF06-002-21-60	60" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF04-002-12-60	60" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS	TF02-002-19-72	72" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF06-002-11-60	60" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS	TF51-002-19-72	72" X 1/4" NPT, TEFZEL LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF02-002-17-72	72" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS	TF51-002-18-72	72" X 1/4" NPT, TEFZEL LINED, 3500 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF51-002-17-72	72" X 1/4" NPT, TEFZEL LINED, 3500 PSI-BR ENDS	TF04-002-21-72	72" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF51-002-11-72	72" X 1/4" NPT, TEFZEL LINED, 3500 PSI-SS ENDS	TF06-002-18-72	72" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF04-002-12-72	72" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS		
TF06-002-11-72	72" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS		
TF03-003-11-24	24" X 3/8" NPT, TEFLON LINED, 4000 PSI-SS ENDS		
TF03-003-11-36	36" X 3/8" NPT, TEFLON LINED, 4000 PSI-SS ENDS		
TF03-003-11-48	48" X 3/8" NPT, TEFLON LINED, 4000 PSI-SS ENDS		
TF03-003-11-60	60" X 3/8" NPT, TEFLON LINED, 4000 PSI-SS ENDS		
<b>METALLIC COMPRESSED GAS HOSES</b>			
BH09-002-11-24	1/4" X 24" NPT, CONV.SS METAL LINED, 3500PSI		
BH09-002-11-32	1/4" X 32" NPT, CONV. SS METAL LINED, 3500PSI		
BH09-002-11-36	1/4" X 36" NPT, CONV. SS METAL LINED, 3500PSI		
BH09-002-11-48	1/4" X 48" NPT, CONV. SS METAL LINED, 3500PSI		
BH09-002-11-60	1/4" X 60" NPT, CONV. SS METAL LINED, 3500PSI		
BH09-002-11-72	1/4" X 72" NPT, CONV. SS METAL LINED, 3500PSI		
<p><b>Other diameters, lengths including 1/2," 3/4," and 1" are available</b></p> <ul style="list-style-type: none"> <li>• Other lengths – 24"-15'</li> <li>• Other options – European, metric, CGA, end connections available</li> <li>• Safety Loops</li> </ul>			

# LIFEGUARD SAFETY SYSTEM

HYDROGEN HOSES | CRYOGENIC LIQUID CYLINDER HOSES | METAL PIGTAILS | LIFEGUARD COMPRESSED GAS HOSES | CARBON DIOXIDE BULK LIQUID TRANSFER HOSES

## LifeGuard™ High Pressure and Cryogenic Assemblies



LifeGuard CO2 Assemblies



LifeGuard High Pressure PTFE Assemblies



LifeGuard Cryogenic Delivery Hose



LifeGuard Hydrogen



LifeGuard Safety Hose in Action



LifeGuard Hydrogen



# LIFEGUARD™ SAFETY SYSTEM

HYDROGEN HOSES | CRYOGENIC LIQUID CYLINDER HOSES | METAL PIGTAILS | LIFEGUARD COMPRESSED GAS HOSES | CARBON DIOXIDE BULK LIQUID TRANSFER HOSES

## LifeGuard™ PTFE High Pressure Hoses The Next Generation in Hose Safety!!!



Open Flow (Valves Kept Open by Internal Cable)



Coupling Failure (Valves are Closed by Separation and/or Back Pressure)

**WHAT IS LifeGuard™?** A Flexible “SafetySystem” for use in the transfer of high pressure gases and liquids. Protect against the hazardous effects of high pressure hose rupture, pull-apart and failure. The LifeGuard™ design utilizes the unique, patent pending design that eliminates the potential for disaster through the use of an internal compression spring device connected to specially designed, normally unseated valves located on each end of the spring. In the event of hose separation, stretching to the point of an unsafe condition or coupling to-hose separation, the valves are released and instantly seat stopping the flow in both directions.



### APPLICATION:

PTFE, Stainless Steel Braid is ideal for a wide range of industrial applications, PTFE is non-porous, chemically inert and requires zero maintenance. PTFE is an FDA approved material. When coupled with the LifeGuard Safety System fitting and cleaned for oxygen use, high temperature capabilities make PTFE the best choice for medical or industrial oxygen filling.



**CONSTRUCTION:** All LifeGuard convoluted stainless steel inner core, double braided compressed gas hoses are tig welded and come in female NPT or BSP threads.

### MAXIMUM WORKING PRESSURE:

¼" - 1" 3000 PSI to 10,000 PSI.



# LIFEGUARD SAFETY SYSTEM

HYDROGEN HOSES | CRYOGENIC LIQUID CYLINDER HOSES | METAL PIGTAILS | LIFEGUARD COMPRESSED GAS HOSES | CARBON DIOXIDE BULK LIQUID TRANSFER HOSES

## PTFE Pigtails

The Next Generation in Safety-Hoses!!!

### LIFEGUARD™ SAFETY HOSE HIGH PRESSURE HOSE LIST

LGT PART NO	HIGH PRESSURE SAFETY HOSES/TEFLON AND TEFLON	LGT PART NO	SPECIALTY GASES HIGH PRESSURE SAFETY HOSES/TEFLON AND TEFLON
TF02-002-17-24	24" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS	TF02-002-19-24	24" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF51-002-17-24	24" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS	TF51-002-19-24	24" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF51-002-11-24	24" X 1/4" NPT, TEFLON LINED, 3500 PSI-SS ENDS	TF51-002-18-24	24" X 1/4" NPT, TEFLON LINED, 3500 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF04-002-12-24	24" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS	TF04-002-21-24	24" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF06-002-11-24	24" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS	TF06-002-18-24	24" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF07-002-11-24	24" X 1/4" NPT, TEFLON LINED, 7500 PSI-SS ENDS (3/1 WP/BURST RATIO)	TF07-002-19-24	24" X 1/4" NPT, TEFLON LINED, 7500 PSI-SS ENDS (3/1 WP/BURST RATIO) WITH HEAT DISSIPATERS E/E
TF02-002-17-36	36" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS	TF02-002-19-36	36" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF02-002-17-36-SBR	TEFLON HOSE, BRASS FITTINGS, FNPT, 1/4" X 36" 3500 PSI, W/BEND RESTRICTORS AND SAFETY LOOPS	TF02-002-19-36-SBR	TEFLON HOSE, BRASS HEATSINK FITTINGS, FNPT, 1/4" X 36" 3500 PSI W/BEND RESTRICTORS AND SAFETY LOOPS
TF51-002-17-36	36" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS	TF51-002-19-36	36" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF51-002-11-36	36" X 1/4" NPT, TEFLON LINED, 3500 PSI-SS ENDS	TF51-002-18-36	36" X 1/4" NPT, TEFLON LINED, 3500 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF51-002-11-36-SBR	TEFLON HOSE, BRASS FITTINGS, FNPT, 1/4" X 36 INCHES, 3500 PSI W/BEND RESTRICTORS AND SAFETY LOOPS	TF04-002-21-36	36" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF04-002-12-36	36" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS	TF06-002-18-36	36" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF06-002-11-36	36" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS	TF07-002-19-36	36" X 1/4" NPT, TEFLON LINED, 7500 PSI-SS ENDS (3/1 WP/BURST RATIO) WITH HEAT DISSIPATERS E/E
TF51-002-17-36-SBR	36" X 1/4" NPT, TEFLON LINED, 3500 PSI-SS ENDS, CFOS, CAPPED AND BAGGED WITH BEND RESTRICTORS AND SAFETY LOOPS	TF02-002-19-48	48" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF07-002-11-36	36" X 1/4" NPT, TEFLON LINED, 7500 PSI-SS ENDS (3/1 WP/BURST RATIO)	TF51-002-19-48	48" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF02-002-17-48	48" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS	TF51-002-18-48	48" X 1/4" NPT, TEFLON LINED, 3500 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF51-002-17-48	48" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS	TF04-002-21-48	48" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF51-002-11-48	48" X 1/4" NPT, TEFLON LINED, 3500 PSI-SS ENDS	TF06-002-18-48	48" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF04-002-12-48	48" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS	TF07-002-19-48	48" X 1/4" NPT, TEFLON LINED, 7500 PSI-SS ENDS (3/1 WP/BURST RATIO) WITH HEAT DISSIPATERS E/E
TF06-002-11-48	48" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS	TF02-002-19-60	60" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF07-002-11-48-S*	48" X 1/4" NPT, TEFLON LINED, 7500 PSI-SS ENDS (3/1 WP/BURST RATIO)	TF51-002-18-60	60" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF02-002-17-60	60" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS	TF51-002-21-60	60" X 1/4" NPT, TEFLON LINED, 3500 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF51-002-17-60	60" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS	TF04-002-18-60	60" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF51-002-11-60	60" X 1/4" NPT, TEFLON LINED, 3500 PSI-SS ENDS	TF06-002-21-60	60" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF04-002-12-60	60" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS	TF02-002-19-72	72" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF06-002-11-60	60" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS	TF51-002-19-72	72" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF02-002-17-72	72" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS	TF51-002-18-72	72" X 1/4" NPT, TEFLON LINED, 3500 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF51-002-17-72	72" X 1/4" NPT, TEFLON LINED, 3500 PSI-BR ENDS	TF04-002-21-72	72" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS WITH HEAT DISSIPATERS E/E
TF51-002-11-72	72" X 1/4" NPT, TEFLON LINED, 3500 PSI-SS ENDS	TF06-002-18-72	72" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS WITH HEAT DISSIPATERS E/E
TF04-002-12-72	72" X 1/4" NPT, TEFLON LINED, 4500 PSI-BR ENDS		
TF06-002-11-72	72" X 1/4" NPT, TEFLON LINED, 6000 PSI-SS ENDS		
TF03-003-11-24	24" X 3/8" NPT, TEFLON LINED, 4000 PSI-SS ENDS		
TF03-003-11-36	36" X 3/8" NPT, TEFLON LINED, 4000 PSI-SS ENDS		
TF03-003-11-48	48" X 3/8" NPT, TEFLON LINED, 4000 PSI-SS ENDS		
TF03-003-11-60	60" X 3/8" NPT, TEFLON LINED, 4000 PSI-SS ENDS		
<b>METALLIC COMPRESSED GAS HOSES</b>			
BH09-002-11-24	1/4" X 24" NPT, CONV.SS METAL LINED, 3500PSI		
BH09-002-11-32	1/4" X 32" NPT, CONV. SS METAL LINED, 3500PSI		
BH09-002-11-36	1/4" X 36" NPT, CONV. SS METAL LINED, 3500PSI		
BH09-002-11-48	1/4" X 48" NPT, CONV. SS METAL LINED, 3500PSI		
BH09-002-11-60	1/4" X 60" NPT, CONV. SS METAL LINED, 3500PSI		
BH09-002-11-72	1/4" X 72" NPT, CONV. SS METAL LINED, 3500PSI		
<b>OTHER DIAMETERS, LENGTHS, AND OPTIONS AVAILABLE</b>			
*Safety Loops			

# LIFEGUARD SAFETY SYSTEM

HYDROGEN HOSES | CRYOGENIC LIQUID CYLINDER HOSES | METAL PIGTAILS | LIFEGUARD COMPRESSED GAS HOSES | CARBON DIOXIDE BULK LIQUID TRANSFER HOSES

## LifeGuard™ LPG/CNG Autogas Hoses

### The Next Generation in Hose Safety!!!



Open Flow (Valves Kept Open by Internal Cable)



Coupling Failure (Valves are closed by separation and/or back pressure)

according to regulation R. 110 – 00 Class 2 and R 67 – 01 Class 2. In order to ease installation in difficult conditions and with very low bending radius, the hose can be manufactured already curved preformed. To guarantee a perfect use the hose has to be installed using the curving from the concave part.

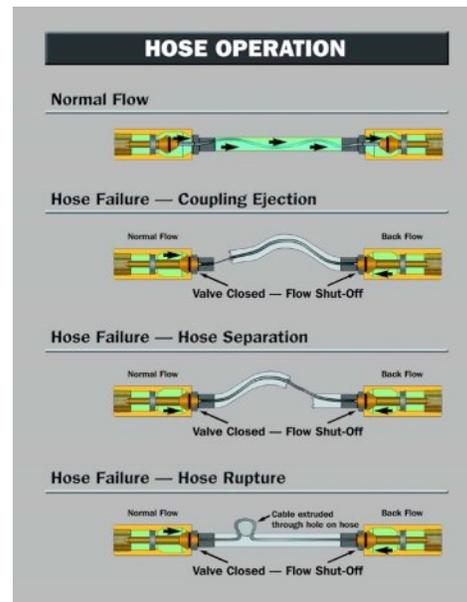


#### WHAT IS LifeGuard™?

A Flexible “Safety System” for use in the transfer of high pressure gases and liquids. Protect against the hazardous effects of hose rupture, pull-apart and failure.

All LifeGuard™ designs all utilize the unique, patented and patent pending design eliminates the potential for disaster through the use of an internal cable or engineered compression spring connected to specially designed, normally unseated valves located on each end of the cable or spring. In the event of hose separation, stretching to the point of an unsafe condition or coupling-to-hose separation, the valves are released and instantly seat stopping the flow in both directions.

Low pressure hose, long length, used in vehicles for methane gas CNG and LPG installations



#### Technical Characteristics

Tube	Synthetic black rubber, not permeable, resistant to gases, heat and ageing
Reinforcement	High strength textile yarn
Cover	Black smooth rubber, resistant to heat, oil, fuel, lubricants, abrasion, ageing and weather. Pin pricked cover
Temperature	- 20 °C + 125 °C
Marking	ACCORDING NORM (in white letters)
Homologation:	E 13*110R-00 0017 / 67R-01 0145* CLASS 2

# LIFEGUARD SAFETY SYSTEM

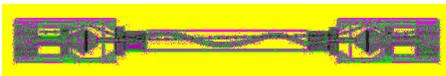
HYDROGEN HOSES | CRYOGENIC LIQUID CYLINDER HOSES | METAL PIGTAILS | LIFEGUARD COMPRESSED GAS HOSES | CARBON DIOXIDE BULK LIQUID TRANSFER HOSES

## LifeGuard™ PTFE Acetylene Hoses The Next Generation in Hose Safety!!!



**WHAT IS LifeGuard™?** A Flexible “Safety System” for use in the transfer of high pressure gases and liquids. Protect against the hazardous effects of hose rupture, pullapart and failure.

All LifeGuard™ designs all utilize the unique, patented and patent pending design eliminates the potential for disaster through the use of an internal cable or engineered compression spring connected to specially designed, normally unseated valves located on each end of the cable or spring. In the event of hose separation, stretching to the point of an unsafe condition or coupling-to-hose separation, the valves are released and instantly seat stopping the flow in both directions.



Open Flow (Valves Kept Open by Internal Cable)

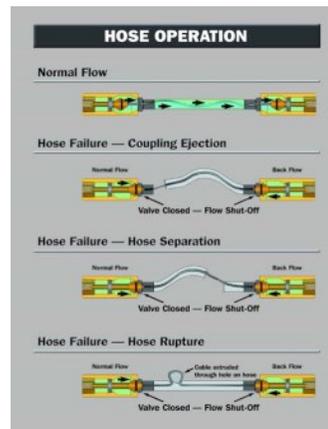


Coupling Failure (Valves are closed by separation and/or back pressure)

**APPLICATION:** PTFE, Stainless Steel Braid is ideal for a wide range of industrial applications, PTFE is non-porous, chemically inert and requires zero maintenance. PTFE is an FDA approved material. When coupled with the LifeGuard Safety System fitting and cleaned for oxygen use, high temperature capabilities make PTFE the best choice for medical or industrial oxygen filling.

**CONSTRUCTION:** All LifeGuard PTFE Acetylene Hoses are PTFE inner core, double braided compressed gas hoses and come in female NPT or BSP threads.

**MAXIMUM WORKING PRESSURE:**  
1/4" - 1/2" ID-up to 3500 PSI at 70 F.



Part No.	ACETYLENE HOSES	APPLICATION
TF02-002-17-24-ACET	1/4" x 24"NPT, TEFLON LINED, SS SNAP RINGS, 3500 PSI-SS ENDS	Acetylene Compressed Gas Assemblies
TF02-002-17-36-ACET	1/4" x 36" NPT, TEFLON LINED, SS SNAP RINGS, 3500 PSI-SS ENDS	Acetylene Compressed Gas Assemblies
TF04-002-12-36-ACET	1/4" x 36" NPT, TEFLON LINED, SS SNAP RINGS, 4500 PSI-SS ENDS	Acetylene Compressed Gas Assemblies

# LIFEGUARD SAFETY SYSTEM

HYDROGEN HOSES | CRYOGENIC LIQUID CYLINDER HOSES | METAL PIGTAILS | LIFEGUARD COMPRESSED GAS HOSES | CARBON DIOXIDE BULK LIQUID TRANSFER HOSES

## LifeGuard™ Tri-Bolt Metallic Hose for Cryogenic and Co2 Service

The LifeGuard Safety System and Lifeguard Tri-Bolt Safety System are built into a metallic hose assembly that uses a 316L Stainless Steel Tube and 304 Stainless Steel Reinforced braid.

Designed specifically for the tough demands of bulk tank and trailer loading and unloading. The inner hose, braid, armor casing cuffs, weld ring, and ends are all stainless steel. Each finished assembly is hydrostatically or pneumatically tested to ensure it will withstand the application requirements.

- FEATURES-1-1/2" or 2" I.D. close pitch corrugated 304 stainless steel inner core.-Full coverage heavy-duty braid.-Heavy-duty fully machined female NPT end fittings.-18" armor casing cuffs (bend restrictors) each end.-Cryogenic to 1500 degrees F
- STYLES 1-1/2" I.D., 450 psi -2" I.D., 675 psi. Contact us for additional sizes available.
- FITTINGS Pipe Butt Weld, JIC Female Swivel Hex Male NPT Plain Male NPT Plain Female NPT Hex Female NPT Floating Flange Weld Neck Flange CGA 440 for O2 and 295 for AR and N2 Service



### HOSE DATA

#### Construction:

- T321 and T316L stainless steel hose
- Series 300 stainless steel braid
- Direct braided 1/4" through 2" on reels
- Annular construction

**Sizes:** 1/4" through 3"

**Maximum Working Pressure:** Full vacuum up to 3190 psig depending on size and braid configuration

**Temperature:** Cryogenic to 1250°F  
Model of Hose Material: UFBXO Unbraided/  
UFBX1 One Braid/UFBX2 Two Braid

The UFBX product is designed and certified to ISO 10380 specifications.

### LifeGuard LPG and NH3

GPS-AU-LP-32-18-F

2" x XXX Lifeguard Rubber Transport Hose, UL-21 LPG with Hi-break Tri-Bolt Breakaway (female) NPT Safety fitting X standard (female) NPT Safety fitting-350 PSI WP-1750 PSI burst-525 PSI test. Electrically conductive.



Tri-Bolt System



Lab Tested



Safety at the Highest Level

# LIFEGUARD SAFETY SYSTEM

HYDROGEN HOSES | CRYOGENIC LIQUID CYLINDER HOSES | METAL PIGTAILS | LIFEGUARD COMPRESSED GAS HOSES | CARBON DIOXIDE BULK LIQUID TRANSFER HOSES

## LifeGuard™ Metal Pigtaills The Next Generation in Safety-Hoses!!!



Open Flow (Valves Kept Open by Internal Cable)



Coupling Failure (Valves are Closed by Separation and/or Back Pressure)

### WHAT IS LIFEGUARD™ ?

A Flexible “Safety System” for use in the transfer of high pressure gases and liquids. Protect against the hazardous effects of high pressure hose rupture, pull-apart and failure.

The LifeGuard™ design utilizes the unique, patent pending design that eliminates the potential for disaster through the use of an internal compression spring device connected to specially designed, normally unseated valves located on each end of the spring. In the event of hose separation, stretching to the point of an unsafe condition or coupling-to hose separation, the valves are released and instantly seat stopping the flow in both directions.

**APPLICATION:** For certain applications, customers choose a metal “bellows-type” pigtail which provides an all welded, zero permeation and flexible alternative to pipe and tubing, even at cryogenic temperatures. The metal lined pigtail is reinforced with two layers of type 304 stainless steel braid (Monel® braid is optional) and is designed to provide maximum flexibility. In cases where adiabatic compression in PTFE is a concern, LifeGuard Metallic Pigtails are an excellent solution.

**CONSTRUCTION:** All LifeGuard convoluted stainless steel inner core, double braided compressed gas hoses are tig welded and come in female NPT or BSP threads.

### MAXIMUM WORKING PRESSURE:

¼” -½” ID-up to 3500 PSI at 70 F.

Part Number:	Standard Sizes
BH09-002-11-24-S	1/4" x 24" NPT, CONV.SS METAL LINED, 3500PSI
BH09-002-11-32-S	1/4" x 32" NPT, CONV. SS METAL LINED, 3500PSI
BH09-002-11-36-S	1/4" x 36" NPT, CONV. SS METAL LINED, 3500PSI
BH09-002-11-48-S	1/4" x 48" NPT, CONV. SS METAL LINED, 3500PSI
BH09-002-11-60-S	1/4" x 60" NPT, CONV. SS METAL LINED, 3500PSI
BH09-002-11-72-S	1/4" x 72" NPT, CONV. SS METAL LINED, 3500PSI
BH22-004-11-60-S	1/2" x 5' NPT, CONV. SS METAL LINED, 3500PSI
BH22-004-11-120-S	1/2" x 10' NPT, CONV. SS METAL LINED, 3500PSI
BH22-004-11-180-S	1/2" x 15' NPT, CONV. SS METAL LINED, 3500PSI
BH22-004-11-240-S	1/2" x 20' NPT, CONV. SS METAL LINED, 3500PSI





# LIFEGUARD SAFETY SYSTEM

HYDROGEN HOSES | CRYOGENIC LIQUID CYLINDER HOSES | METAL PIGTAILS | LIFEGUARD COMPRESSED GAS HOSES | CARBON DIOXIDE BULK LIQUID TRANSFER HOSES

## LifeGuard™ Hose Material Specifications

NORMAL HOSE ID	HOSE TYPE	HOSE O.D.	WEIGHT PER FT	MIN LIV LENGTH FOR VIBRATION	MINIMUM BEND RADIUS		MAXIMUM WORKING PRESSURE	MAXIMUM TEST PRESSURE	NORMAL BURST PRESSURE
					STATIC BEND	INTER-MITTENT FLEXING			
	UFBX0	0.4	0.05	3	0.63	4.3	145	218	—
	UFBX1	0.45	0.11	3	1	4.3	2420	3630	968
1/4"	UFBX2	0.5	0.16	3	1	4.3	3190	4785	12760
	UFBX0	0.59	0.11	3.5	0.87	6	80	120	—
	UFBX1	0.64	0.18	3.5	1.5	6	1450	2175	5800
3/8"	UFBX2	0.69	0.25	3.5	1.5	6	2580	3870	10320
	UFBX0	0.77	0.11	4.25	0.94	6.5	80	120	—
	UFBX1	0.83	0.22	4.25	1.75	6.5	1075	1615	4300
1/2"	UFBX2	0.88	0.33	4.25	1.75	6.5	1500	2250	6000
	UFBX0	1.02	0.18	4.5	1.2	8	60	90	—
	UFBX1	1.08	0.27	4.5	2.75	8	950	1425	3800
3/4"	UFBX2	1.14	0.39	4.5	2.75	8	1250	1875	5000
	UFBX0	1.33	0.34	5.5	1.7	8	60	90	—
	UFBX1	1.41	0.6	5.5	3.5	8	725	1087	2900
1"	UFBX2	1.49	0.86	5.5	3.5	8	1110	1650	4470
	UFBX0	1.62	0.27	6	2.2	10	50	75	—
	UFBX1	1.7	0.57	6	4.5	10	563	845	2252
1 1/4"	UFBX2	1.78	0.93	6	4.5	10	825	1237	3300
	UFBX0	1.88	0.45	6.25	2.7	10	35	53	—
	UFBX1	1.95	0.8	6.25	5	10	500	750	2000
1 1/2"	UFBX2	2.05	1.1	6.25	5	10	800	1200	3200
	UFBX0	2.45	0.55	7.5	3.5	14	15	23	—
	UFBX1	2.53	1	7.5	7.63	14	478	717	1912
2"	UFBX2	2.61	1.5	7.5	7.63	14	638	957	2552
	UFBX0	3.01	1.3	7.5	4.5	16	15	23	—
	UFBX1	3.09	1.9	7.5	7.9	16	377	566	1508
2 1/2"	UFBX2	3.18	2.5	7.5	7.9	16	667	1001	2668
	UFBX0	3.54	1.5	8.75	5.1	18	15	23	—
	UFBX1	3.62	2.2	8.75	9	18	320	480	1280
3"	UFBX2	3.7	3	8.75	9	18	580	870	2320

# LIFEGUARD SAFETY SYSTEM

HYDROGEN HOSES | CRYOGENIC LIQUID CYLINDER HOSES | METAL PIGTAILS | LIFEGUARD COMPRESSED GAS HOSES | CARBON DIOXIDE BULK LIQUID TRANSFER HOSES

## LifeGuard™ Hydrogen Hoses™ The Next Generation in Hose Safety!!!



Open Flow (Valves Kept Open by Internal Cable)



Coupling Failure (Valves are closed by separation and/or back pressure)

**WHAT is LifeGuard™?** A Flexible “Safety System” for use in the transfer of high pressure gases and liquids. Protect against the hazardous effects of hose rupture, pull-apart and failure.

The LifeGuard™ design utilizes the unique, patent pending design that eliminates the potential for disaster through the use of an internal compression spring device connected to specially designed, normally unseated valves located on

each end of the spring. In the event of hose separation, stretching to the point of an unsafe condition or coupling-to-hose separation, the valves are released and instantly seat stopping the flow in both directions.



Designed specifically for the ultra hazardous applications of high pressure hydrogen gas transfer in tube trailers, facilities and cylinders. Whether you prefer metallic or Tefzel®, the LifeGuard hydrogen hose is the Safe-Choice.™ The inner hose, braid, armor casing cuffs, weld ring, and ends are all stainless steel. Each finished assembly is pneumatically tested to ensure it will withstand the application requirements.



### • LifeGuard Tefzel® ETFE Lined Stainless Steel Braided Hoses

LifeGuard’s Tefzel® ETFE inner core has a permeation rate that is approximately 77% lower than PTFE inner core pigtails. This makes it an ideal choice for helium and hydrogen.

### • LifeGuard Metallic Lined Stainless Steel Braided Hoses

LifeGuard’s metallic high pressure hose assemblies are specifically designed to transfer gaseous hydrogen to and from a bulk transport truck to the customer facility.





# LIFE GUARD SAFETY SYSTEM

HYDROGEN HOSES | CRYOGENIC LIQUID CYLINDER HOSES | METAL PIGTAILS | LIFE GUARD COMPRESSED GAS HOSES | CARBON DIOXIDE BULK LIQUID TRANSFER HOSES

## LifeGuard™ Teflon vs. Metal Inner Hose

Gas and cryogenic hoses are available with either Teflon or Metal inner hoses. To ensure long life, it is very important that you select the correct material for each application.

**Corrugated VS. Smooth Bore Inner Core :** One of the most common causes of metal hose failure is “high velocity” gas flow. Because of the ribs on the corrugated type hose, high velocity flow (above recommended levels) can damage or crack a metal type hose. To avoid hose damage, it is important to know the velocity of gas flowing through the hose. We have provided charts that will help you determine velocity flow levels. If you find that a particular application requires a higher than recommended gas flow velocity, in this case we would suggest that you switch to a smooth bore PTFE or ETFE type hose (dependant on the gas). Smooth bore hose are designed to handle higher velocity gas flow requirements.

**Effusion:** Metal inner core hoses will not effuse or diffuse gas. i.e. they have zero permeation: this is why they are preferred for high purity and hazardous specialty gases, as well as hydrogen and helium when in a constant pressurized application. Pressurized gas will permeate or effuse through the wall of the PTFE hose at rates consistent with the gas molecule size and weight, and with atmospheric gases this effusion is hardly noticeable and minimal. For hydrogen and helium, the ETFE or hose has typically 1/3 the effusion rate of a PTFE hose, so ETFE (or “post sintered”) is the recommended inner core material for H2 and He cylinder filling applications.

**Flexibility:** Teflon hoses tend to be a bit more forgiving in terms of flexibility than all metallic hoses. If an application requires constant flexing, a PTFE or ETFE type hose will work best.

**Trailer Transfill/Cylinder Filling, Cylinder Cradles - High velocity:** The inside of a Teflon gas service hose is smooth bore, whereas a metal inner hose is convoluted (ribbed). In high velocity applications (tube trailer transfill, cylinder fill) a smooth surface will work best. A convoluted hose in a high pressure drop (high velocity up to critical velocity) can experience internal hose vibration and fatigue leading to cracking of the corrugated inner core.

**Trailer Transfill Liquid - Low velocity :** When hydrogen or helium tube trailers are being filled at the plant in a slow volume method such as with a pump or compressor, the volume flow through the hose is typically within the velocity limitations to allow the use of a metal inner core hose. Typically lower pressures and temperatures are used in the transfer of liquid cryogenics. A metal hose will perform this job much better than a Teflon hose. However, it is important to ensure that the hose is not bent in more than one plane at a time. Failure to do so will result in premature hose failure.

**Static State:** Static state would include applications where the gas remains in the hose over a long period of time. Polymer inner core hose will effuse gas. Whereas metal inner core hose has zero effusion. This becomes critical when the application involves smaller molecule gases, flammable, or toxic gases. Hydrogen, helium, and specialty gases are best delivered in a metal liner core hose. When delivering corrosive gases, Monel inner core hose is recommended.

**Cryogenic Hose:** The low temperature of cryogenic liquids requires the use of a stainless steel inner core type hose.

**Metal Hose Limitations:** It is important to ensure that the hose is not bent in more than one plane at a time. Such action will set up an inherent torque, which can contribute to premature hose failure when the hose is pressurized. When the hose is connected from one static point to another static point, it should make the bend easily without forcing the hose to arrive at its position to make the connection. Also as mentioned previously: Metal inner core hoses have a velocity limitation of 100 feet per second for a straight run, 50 fps for a 90degree bend, and 25 FPS for a 180 degree bend according to metal hose manufacturer’s rules of thumb. Calculations are available to project velocity data.

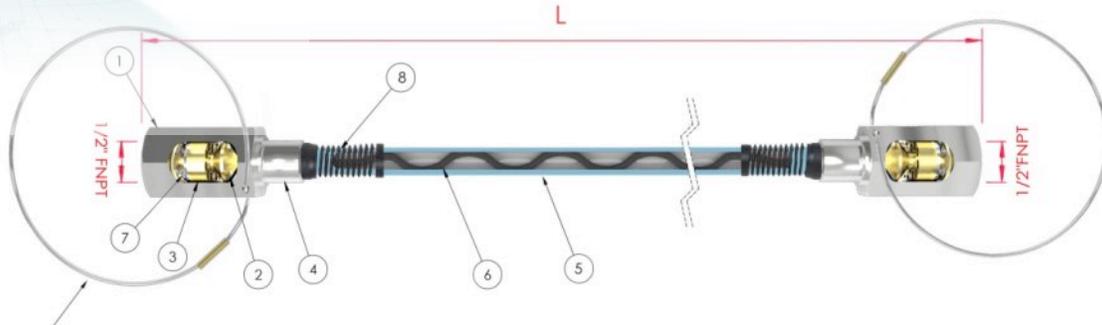
Metallic Hoses	
BH22-004-11-60	5' x 1/2" NPT, CONVOLUTED SS METAL LINED, 3500PSI, 14000 BP
BH22-004-11-120	10' x 1/2" NPT, CONVOLUTED SS METAL LINED, 3500PSI, 14000 BP
BH22-004-11-180	15' x 1/2" NPT, CONVOLUTED SS METAL LINED, 3500PSI, 14000 BP
BH22-004-11-240	20' x 1/2" NPT, CONVOLUTED SS METAL LINED, 3500PSI, 14000 BP

Tefzel Hoses	
TF51-004-17-6	6.0' X 1/2" NPT,TEFZEL LINED, 3500 PSI, 14000 BP
TF51-004-17-10	10.0' X 1/2" NPT,TEFZEL LINED, 3500 PSI, 14000 BP
TF51-004-17-15	15.0' X 1/2" NPT,TEFZEL LINED, 3500 PSI, 14000 BP

# LIFEGUARD SAFETY SYSTEM

HYDROGEN HOSES | CRYOGENIC LIQUID CYLINDER HOSES | METAL PIGTAILS | LIFEGUARD COMPRESSED GAS HOSES | CARBON DIOXIDE BULK LIQUID TRANSFER HOSES

## LifeGuard™ Ultra-High Pressure ETFE (TEFZEL) Hose The Next Generation in Hose Safety!!!



**Part No.:** TF08-002-11-XXX (1/4") and TF08-004-11-XXX (1/2")

**Construction:** Smoothbore

**Profile:** High Flexibility/High Pressure

**Tube Available:** ETFE Virgin/Anti-static Inner Tube

**Cover:** 1 Aramid braids (BLUE) and 1 high tensile 304 maypole wound Stainless steel braid

**Size Available:** 1/4" – 1/2"

**Temperature:** -60°C +260°C

**Ultra-High Pressure Smoothbore ETFE Use:** Ultra high pressure smoothbore ETFE is the lightest weight ETFE Hose on the market. Performing well above its weight due to its excellent routability, bend radius and reduced OD. Used for High pressure gas or fluid applications.

This New design combining superior strength aramid fiber braid with highly abrasion resistant Hytrel Jacket outer cover.

- Extra Long Continuous Lengths up to 150 Feet (45 meters)
- Low Effusion ETFE Fluoropolymer Inner core produced by Hot-Melt Fluoropolymer manufacturing process with seamless bond. And able to be used with corrosive gases (subject to certain corrosive gas may require different alloy for safe corrosion resistance)
- Proprietary Engineering LifeGuard Safety Hose Fitting Design Assures Integrity of Hose to Fitting Joint
- Temperature rating: -50°F to +275°F
- With KEVLAR reinforced braid (stronger than stainless steel) has the highest safety rating.

Part No.	ACETYLENE HOSES	APPLICATION
TF08-002-11-24-S	LifeGuard Safety Hose, 1/4" x 24 FNPTxFNPT, TEFZEL LINED, 6000 PSI-BR ENDS	Helium/Hydrogen
TF08-002-11-36-S	LifeGuard Safety Hose, 1/4" x 36 FNPTxFNPT, TEFZEL LINED, 6000 PSI-BR ENDS	Helium/Hydrogen
TF08-002-11-48-S	LifeGuard Safety Hose, 1/4" x 48 FNPTxFNPT, TEFZEL LINED, 6000 PSI-BR ENDS	Helium/Hydrogen
TF08-002-11-60-S	LifeGuard Safety Hose, 1/4" x 60 FNPTxFNPT, TEFZEL LINED, 6000 PSI-BR ENDS	Helium/Hydrogen
TF08-002-11-72-S	LifeGuard Safety Hose, 1/4" x 72 FNPTxFNPT, TEFZEL LINED, 6000 PSI-BR ENDS	Helium/Hydrogen
TF08-004-11-24-S	LifeGuard Safety Hose, 1/2" x 24 FNPTxFNPT, TEFZEL LINED, 6000 PSI-BR ENDS	Helium/Hydrogen
TF08-004-11-36-S	LifeGuard Safety Hose, 1/2" x 36 FNPTxFNPT, TEFZEL LINED, 6000 PSI-BR ENDS	Helium/Hydrogen
TF08-004-11-48-S	LifeGuard Safety Hose, 1/2" x 48 FNPTxFNPT, TEFZEL LINED, 6000 PSI-BR ENDS	Helium/Hydrogen
TF08-004-11-60-S	LifeGuard Safety Hose, 1/2" x 60 FNPTxFNPT, TEFZEL LINED, 6000 PSI-BR ENDS	Helium/Hydrogen
TF08-004-11-72-S	LifeGuard Safety Hose, 1/2" x 72 FNPTxFNPT, TEFZEL LINED, 6000 PSI-BR ENDS	Helium/Hydrogen

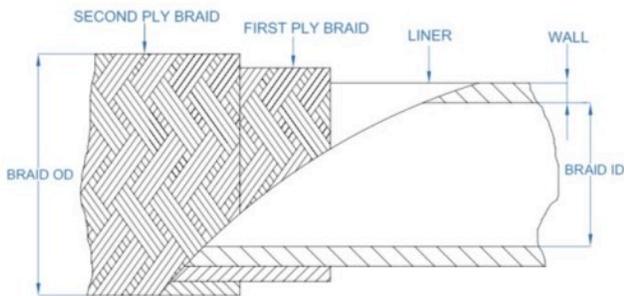
# LIFEGUARD SAFETY SYSTEM

HYDROGEN HOSES | CRYOGENIC LIQUID CYLINDER HOSES | METAL PIGTAILS | LIFEGUARD COMPRESSED GAS HOSES | CARBON DIOXIDE BULK LIQUID TRANSFER HOSES

## LifeGuard™ Ultra-High Pressure ETFE (TEFZEL) Hose The Next Generation in Hose Safety!!!

### Kevlar Gas Range

By using aramid in replacement of stainless steel we can reduce the weight of the hose whilst increasing the working pressure. This gives an extremely high pressure, low weight gas hose that has excellent flexibility.



### Properties

<b>Application</b>	High pressure gas applications where low permeation rates are required
<b>Design</b>	Smoothbore gas quality ETFE tube with aramid braid and high tensile SS 304 braid
<b>Inner layer</b>	Gas quality smoothbore ETFE tube
<b>Outer layer</b>	1 aramid braid and 1 high tensile 304 maypole wound Stainless Steel braid
<b>Temperature Min</b>	-60°C
<b>Temperature Max</b>	+170-180°C
<b>Material</b>	ETFE according to "ISO12086, Part1, ETFE-E.P.D.M 1.61.C.E.4_12"



Open Flow (Valves Kept Open by Internal Cable)



Coupling Failure (Valves are Closed by Separation and/or Back Pressure)



### ETFE Hose Range

### Gas Hose Aramid Yarn Braid 1 Wire Braid + Polyester Cover Range

USA Part Number	Part Number	Description	Tube Wall Thickness Nom.		Braid OD Nominal		Tolerance +/-		Braid ID Nominal		Tolerance +/-		Max. Working Pressure		Min. Burst Pressure		Min. Bend Radius	
			(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(psi)	(bar)	(psi)	(bar)	(mm)	(in)
TSGV6.6B23C42	TSGV6.6B23C42	1/4" GAS (1KB, 1WB, H)	1.02	0.040	12.60	0.496	0.50	0.020	6.60	0.260	0.30	0.012	6,000	414	24,000	1654	76	2.992
TSGV8.1B23C42	TSGV8.1B23C42	5/16" GAS (1KB, 1WB, H)	1.02	0.040	14.00	0.551	0.50	0.020	8.05	0.317	0.30	0.012	5,500	379	22,000	1516	102	4.016
TSGV10.3B23C42	TSGV10.3B23C42	13/32" GAS (1KB, 1WB, H)	1.02	0.040	17.15	0.675	0.50	0.020	10.30	0.406	0.30	0.012	4,500	310	18,000	1241	133	5.236

# LIFEGUARD SAFETY SYSTEM

HYDROGEN HOSES | CRYOGENIC LIQUID CYLINDER HOSES | METAL PIGTAILS | LIFEGUARD COMPRESSED GAS HOSES | CARBON DIOXIDE BULK LIQUID TRANSFER HOSES

## LifeGuard™ Tri-Bolt Metallic Hose for Cryogenic and Co2 Service

The LifeGuard Safety System and Lifeguard Tri-Bolt Safety System are built into a metallic hose assembly that uses a 316L Stainless Steel Tube and 304 Stainless Steel Reinforced braid.

Designed specifically for the tough demands of bulk tank and trailer loading and unloading. The inner hose, braid, armor casing cuffs, weld ring, and ends are all stainless steel. Each finished assembly is hydrostatically or pneumatically tested to ensure it will withstand the application requirements.

- **FEATURES**-1-1/2" or 2" I.D. close pitch corrugated 304 stainless steel inner core.-Full coverage heavy-duty braid.-Heavy-duty fully machined female NPT end fittings.-18" armor casing cuffs (bend restrictors) each end.-Cryogenic to 1500 degrees F
- **STYLES** 1-1/2" I.D., 450 psi -2" I.D., 675 psi. Contact us for additional sizes available.
- **FITTINGS** Pipe Butt Weld, JIC Female Swivel Hex Male NPT Plain Male NPT Plain Female NPT Hex Female NPT Floating Flange Weld Neck Flange CGA 440 for O2 and 295 for AR and N2 Service



### HOSE DATA

#### Construction:

- T321 and T316L stainless steel hose
- Series 300 stainless steel braid
- Direct braided 1/4" through 2" on reels
- Annular construction

**Sizes:** 1/4" through 3"

**Maximum Working Pressure:** Full vacuum up to 3190 psig depending on size and braid configuration

**Temperature:** Cryogenic to 1250°F  
Model of Hose Material: UFBX0 Unbraided/  
UFBX1 One Braid/UFBX2 Two Braid

The UFBX product is designed and certified to ISO 10380 specifications.

### LifeGuard LPG and NH3

GPS-AU-LP-32-18-F

2" x XXX Lifeguard Rubber Transport Hose, UL-21 LPG with Hi-break Tri-Bolt Breakaway (female) NPT Safety fitting X standard (female) NPT Safety fitting-350 PSI WP-1750 PSI burst-525 PSI test. Electrically conductive.



Tri-Bolt System



Lab Tested



Safety at the Highest Level

# LIFEGUARD SAFETY SYSTEM

HYDROGEN HOSES | CRYOGENIC LIQUID CYLINDER HOSES | METAL PIGTAILS | LIFEGUARD COMPRESSED GAS HOSES | CARBON DIOXIDE BULK LIQUID TRANSFER HOSES

## Instruction of installation and use of LifeGuard Safety Hoses®



This instruction manual deals with a proprietary hose design used to drain or fill cylinder(s) or bundle(s) of compressed, liquefied and dissolved gases. It includes Oxygen and Air for medical/breathable application as well as inert gases.

### What is LifeGuard Safety Hose?

**LifeGuard Safety Hose®** is a safety device built into a hose fitting and that is internal to a typical industrial hose that will shut off the flow of product transferred in both directions in the event of a hose coupling ejection, hose stretching to an unsafe condition, and hose separation minimizing the release of gas or liquid being transferred. **LifeGuard Safety Hose®** is a transfer hose assembly that includes a hose with couplings on each end and a cable

routed through the hose connecting a plunger, wedge, or flapper in each coupling. The cable provides force in the direction of both ends of the hose, holding the shut off device open. Should the force be eliminated due to coupling ejection, hose stretching, or hose separation, the shut off devices are released and seat, stopping flow in both directions.



# LIFEGUARD SAFETY SYSTEM

HYDROGEN HOSES | CRYOGENIC LIQUID CYLINDER HOSES | METAL PIGTAILS | LIFEGUARD COMPRESSED GAS HOSES | CARBON DIOXIDE BULK LIQUID TRANSFER HOSES

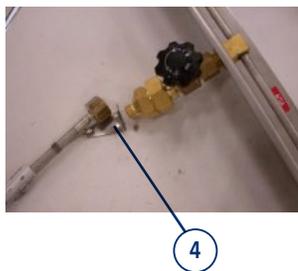
## Fitting of high pressure hoses to valve

1. Place the loop [1] on the safety wire over the hand wheel on the cylinder or cylinder bundle valve.
2. Fit the bent reinforced pipe [2] to the valve by hand. See picture below.
3. Adjust the loop [3] so that it is impossible to take the loop off when the high pressure hose is connected to the valve. NOTICE! The loop must be big enough to pass the hand wheel when the high pressure hose has been loosened from the valve.
4. Fit the straight end of the hose, to the shut-off valve on the connecting pipe, by entering the fixing bracket [4], at the end of wire, before the coupling nut. The nut is adapted to fix the bracket.
5. Tighten the connections. Use leak detection spray
6. The hose may not be exposed to other force then internal pressure.

## Normal tightening torque 50-60 Nm.

When changing cylinders or cylinder bundles always replace the old washer.

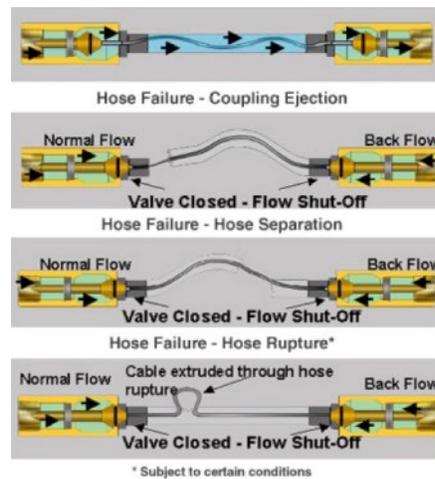
For part details, please read the hose label.



## Safe-Loops

**All LifeGuard Safety Hoses®** come with Safe-Loops® which are attached to both the cylinder valve and the manifold valve to protect against hose thread failures. In some cases, the Safe-Loops will come unattached end to end so that you can attach them at the customer location.

### GRAPHIC EXPLANATION



### SIDE-BLOW OUT DURING CTE TEST



## The Do's and Don'ts of Hose Installation

### THE DON'TS Hose Installations at customer sites



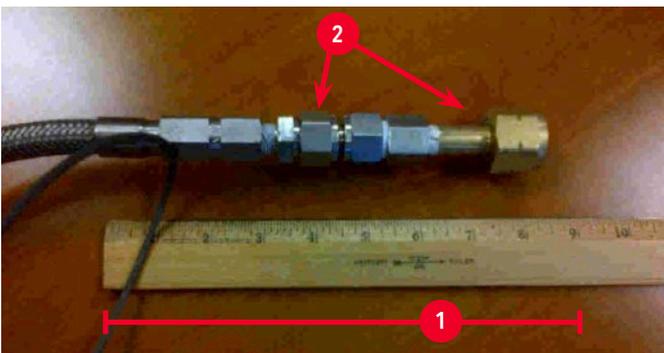
PIGTAIL IS TOO SHORT, TOO MANY FITTINGS.



1 GOOD INSTALLATION NOTICE THE "SLACK" IN THE HOSE

- 2
- PIGTAIL IS TOO SHORT. REPLACE WITH 60" HOSE.
  - NOTE LENGTH OF OTHER PIGTAIL.
  - SAFETY LOOP SHOULD BE INSTALLED OVER VALVE.

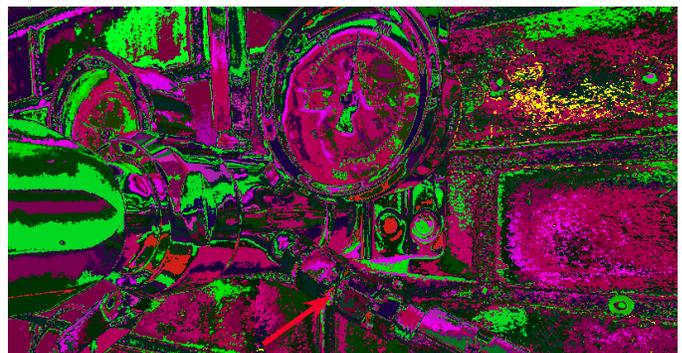
#### PACK END – FAILURE AT CGA NIPPLE



1 INSTALLATION HAD 9 INCHES OF ADAPTORS

- 2
- MINIMIZE ADAPTORS AT BOTH ENDS
  - USE STAINLESS CONNECTORS, EXCEPT FOR O2.
  - USE 90 DEG STREET ELBOW ON THE CGA NIPPLE

#### HOUSE END CONNECTOR



DUE TO TOO MUCH HOSE STRESS CONNECTOR BENT.

CONNECT HOSE (WITH PLENTY OF SLACK) DIRECTLY TO C/O VALVE

# LIFEGUARD SAFETY SYSTEM

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## THE DO'S Hose Installations at customer sites Summary

- Hoses should hang loosely from the pack to the house connection.
- Minimize adaptors at both ends. Adaptors add unnecessary leak points and stress on the hose.
- Always use safety loop – should drape over valve.
- For hydrogen and inert products, use 316 Stainless fittings. May still use the bronze nut. 316 Stainless steel is stronger than bronze, and compatible with hydrogen, as it is non-sparking. **Use bronze or copper for Oxygen.**
- Install a 90 degree street elbow on the pack end so that the hose hangs from the fitting, and does not protrude outward. See hose installation guidelines.
- **If the installation at your delivery does not meet these requirements, report the situation to your supervisor as an accident prevention technique – APT.**
- Disconnect any hoses before placing Moffett forks under packs.
- Walk around the cylinder pack before driving off with it to ensure that you have the right one, and that it is disconnected.
- Always Notify Company Contact to verify that Pack or Packs are empty and ready to be exchanged.

## Hose Installations at customer sites guidelines

### Avoid Torque

Torque or twisting is harmful to hose and substantially reduces service life. Installation torque can be avoided by using a floating flange or union at one end of an assembly in place of a rigid connection. Always install hose so that flexing takes place in one plane.

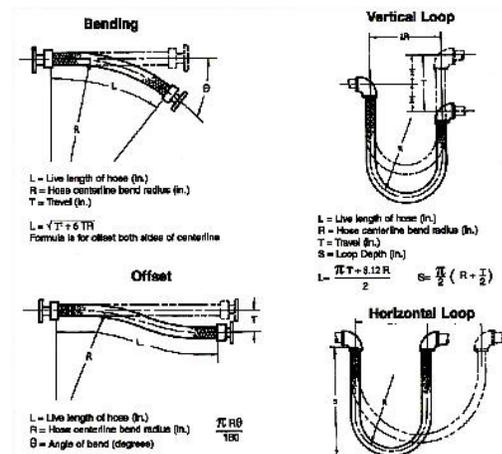
### Avoid Over Bending

If metal hose is bent below the minimum recommended bend radius, fatigue and premature failure can result. This bending often occurs at end connections and can be avoided by installing an interlock guard or elbow.

### Avoid Improper Handling

Always lift hose, do not drag. Do not permit hose to be stored in an area where it is subject to spills, corrosive sprays, etc.

## Proper Installation Formulas and Diagrams



**HOSE SHOULD BE INSTALLED TO DRAPE OR LOOP FROM ONE CONNECTION TO ANOTHER. USE 90 DEGREE STREET ELBOWS IF NEEDED.**