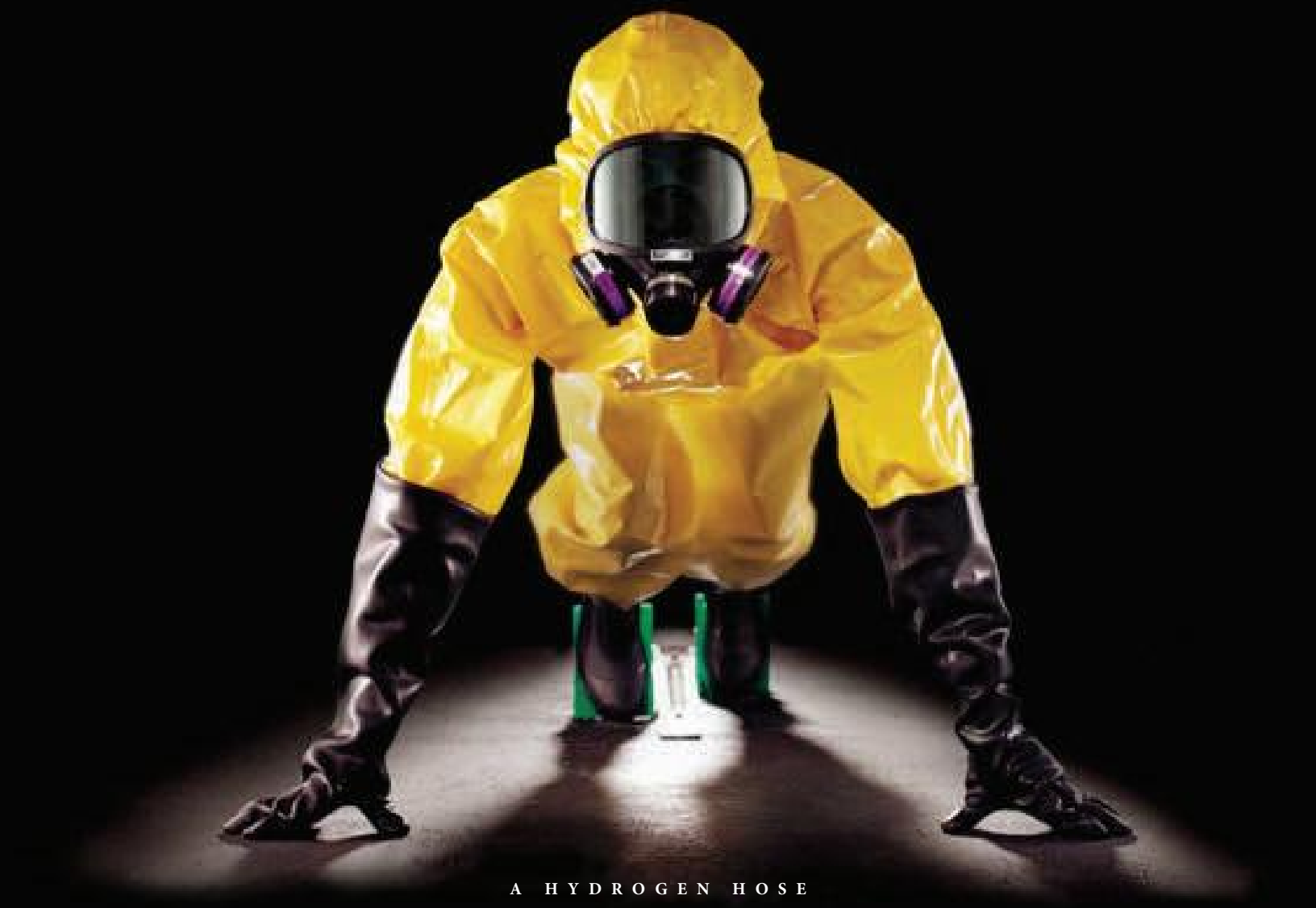
LifeGuard Technologies

The next generation in safety hoses



A HYDROGEN HOSE

BREAKS LOOSE.

YOU HAVE EXACTLY

.005 SECONDS TO

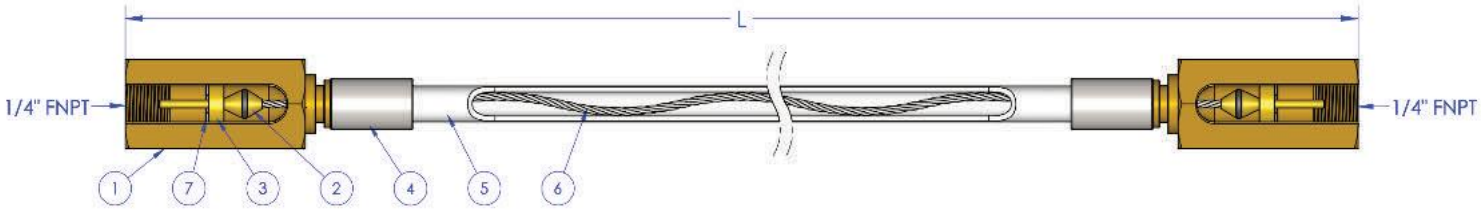
CONTAIN IT. *GO!!!*

LifeGuard Safety Hydrogen Hose

Spills happen in seconds. Now there's a reaction plan that works even faster. LifeGuard Safety Hose Technology's Safety Shut Off System. The hydrogen industry's only hose and coupling system that instantly and automatically shuts off the flow of fluids in both directions. In the event of a hose and coupling failure or excessive stretching, a patented internal cable connected to valves at each end of the hose closes the valves automatically. The result spills are maximized or eliminated before they happen. Along with the price of clean up and increased regulatory involvement.

For a free brochure detailing how cost effective this new technology can be for you, call 855.477.7872 or visit www.thesafesthose.com.

INTERNAL SAFETY SHUT-OFF SYSTEM TECHNOLOGY FROM LIFEGUARD TECHNOLOGY



Tube Trailer Loading and Offloading

Cylinder Filling

Liquid Hydrogen Transfer

Vehicle Filling

LIFEGUARD TECHNOLOGIES

The next generation in safety hoses

info@lifeguard-tech.com | www.thesafesthose.com
Toll Free 855-GPSS-US | 855.477.7872.

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.

LIFEGUARD TECHNOLOGIES
The next generation in safety hoses

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LifeGuard™ Teflon vs. Metal Inner Hose

Gas and cryogenic hoses are available with either Teflon of 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 fatique 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.

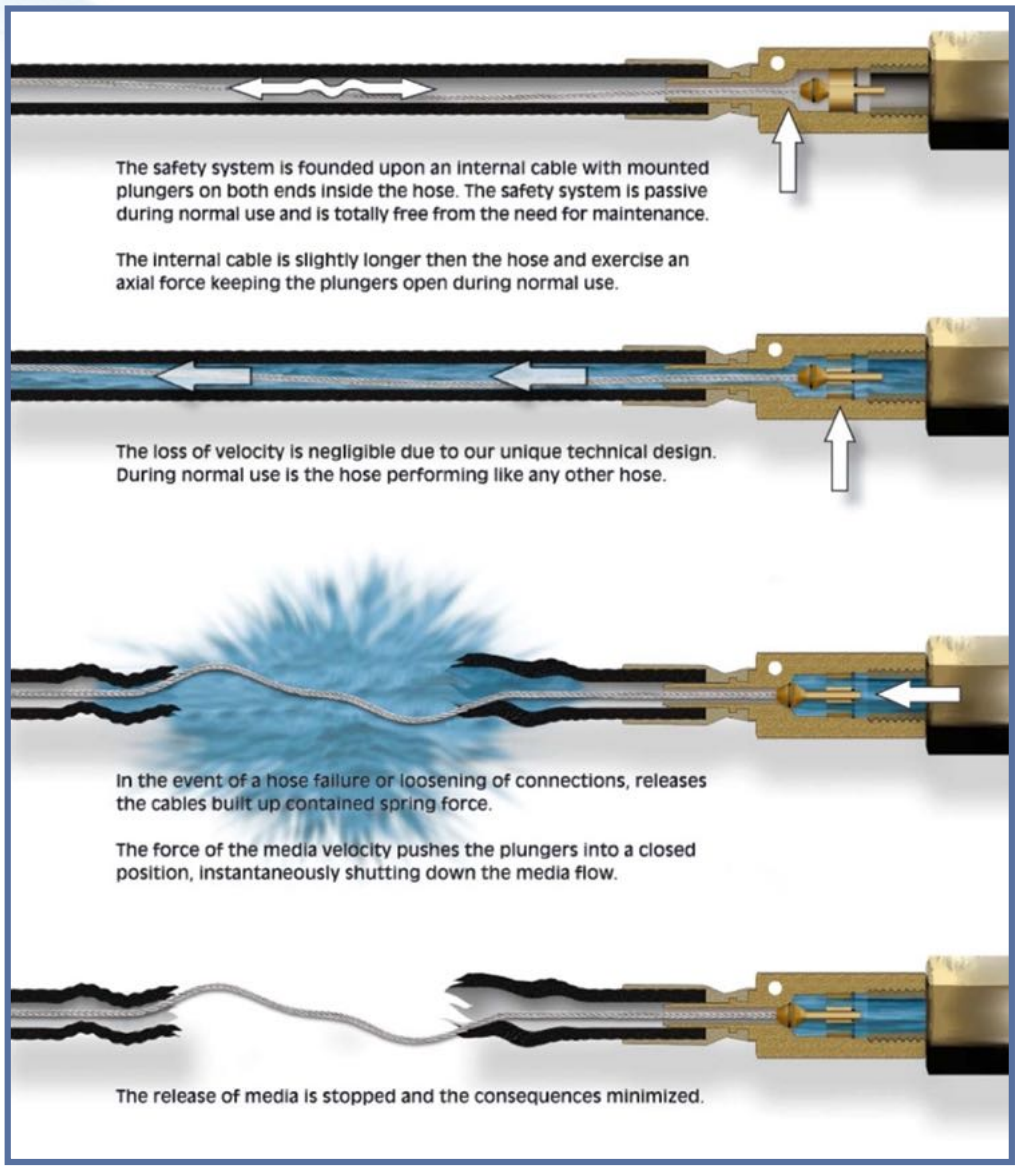
Cryogenic Hose: The low temperature of cryogenic liquids requires the use of a stainless steel inner core type hose.

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

The Function of the LifeGuard Safety Hose System:

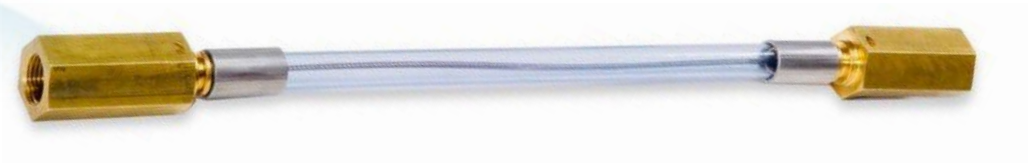


LIFEGUARD™
SAFETY SYSTEM

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

LifeGuard™ 1/2" ETFE (TEFZEL) Bundle/Trailer Hoses

The Next Generation in Safety-Hoses!!!



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.

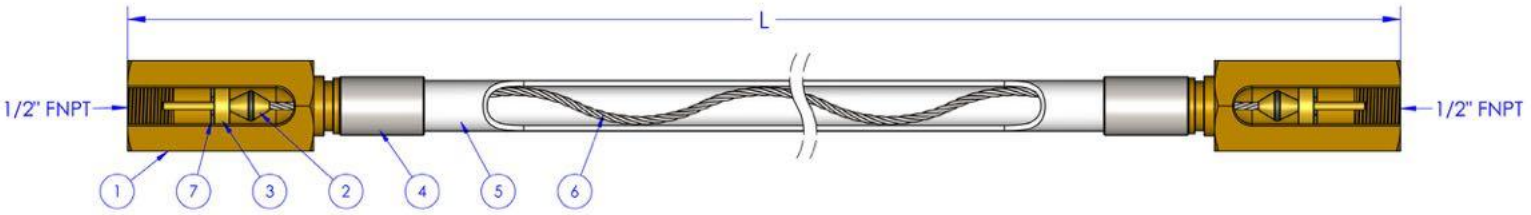
APPLICATION: ETFE TEFZEL® CORE, STAINLESS STEEL BRAID - Designed specifically f or the ultra-hazardous applications of high-pressure hydrogen gas transfer in tube trailers, facilities and cylinders. Whether you prefer metallic or Tefzel®, the LifeGuard hydrogen hose is the Safe-Choice. LifeGuard Tefzel® 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.

CONSTRUCTION: All LifeGuard ETFE double braided compressed gas hoses come in female NPT or BSP threads.

MAXIMUM WORKING PRESSURE:
½" ID-up to 3500 PSI at 70 F.

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 hose are designed to handle higher velocity gas flow requirements.

LifeGuard ETFE (Tefzel) Bundle/Trailer Filling Hoses – Brass Fittings



ITEM NO.	PART NO.	DESCRIPTION	MATERIAL
1	207 521 112	END FITTING 1/2" BARB, 1/2" FNPT THREAD	BRASS (HEAT TREATED)
2	207 521 902	PLUNGER VALVE 1/2"	BRASS (HEAT TREATED)
3	207 521 901	RETAINING BLOCK 1/2"	BRASS (HEAT TREATED)
4	402308	CRIMP FERRULE	316L. 304L STAINLESS STEEL
5	T1772-08	HIGH PRESSURE ETFE HOSE 1/2"	ETFE, 304L BRAID
6	207 529 999	INTERNAL CABLE	STAINLESS STEEL
7	207 571 911	SNAP RING 1/2"	STAINLESS STEEL

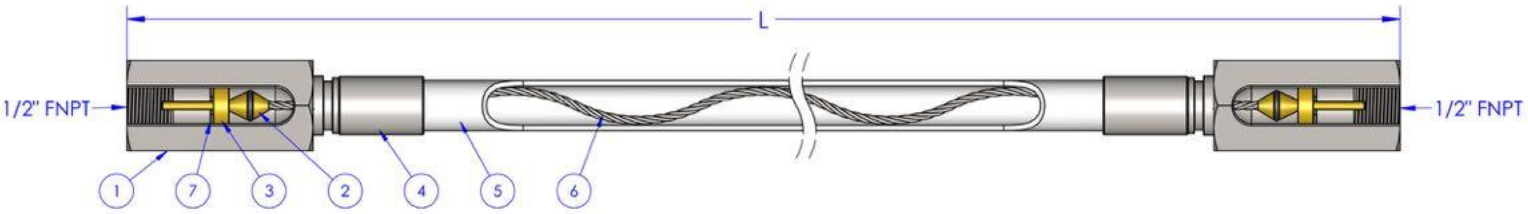
NOTES:

1. Material shall be from solid bar stock.
2. Brass material shall be stress relieved prior to fabrication.
   ** Copper content not to exceed 65%.
3. The lengths are measured in inches and replaces the xx in part no.
4. Manufactured according to ISO EN 14 113

- Maximum working pressure 250 bar, 3650 psi
- Test pressure 375 bar, 5475 psi
- Safety factor: 4
- Degreased for oxygen use

Part Number:	LIFEGUARD SAFETY HOSES, ETFE (TEZEL) 3650 PSI BRASS FITTINGS
TFS1-004-17-36-S	36" x 1/2" NPT, TEZEL LINED, 3650 PSI-BR ENDS
TFS1-004-17-40-S	40" x 1/2" NPT, TEZEL LINED, 3650 PSI-BR ENDS
TFS1-004-17-42-S	42" x 1/2" NPT, TEZEL LINED, 3650 PSI-BR ENDS
TFS1-004-17-48-S	48" x 1/2" NPT, TEZEL LINED, 3650 PSI-BR ENDS
TFS1-004-17-60-S	60" x 1/2" NPT, TEZEL LINED, 3650 PSI-BR ENDS
TFS1-004-17-72-S	72" x 1/2" NPT, TEZEL LINED, 3650 PSI-BR ENDS
TFS1-004-17-84-S	84" x 1/2" NPT, TEZEL LINED, 3650 PSI-BR ENDS
TFS1-004-17-96-S	96" x 1/2" NPT, TEZEL LINED, 3650 PSI-BR ENDS
TFS1-004-17-120-S	120" x 1/2" NPT, TEZEL LINED, 3650 PSI-BR ENDS
	S= FIXED SAFETY LOOPS/ALL HOSES O2 CLEANED AND BAGGED
	OTHER LENGTHS BY REQUEST

LifeGuard ETFE (Tefzel) Bundle/Trailer Filling Hoses – Stainless-Steel Fittings



ITEM NO.	PART NO.	DESCRIPTION	MATERIAL
1	207 521 112	END FITTING 1/2" BARB, 1/2" FNPT THREAD	316L STAINLESS STEEL
2	207 521 902	PLUNGER VALVE 1/2"	BRASS (HEAT TREATED)
3	207 521 901	RETAINING BLOCK 1/2"	BRASS (HEAT TREATED)
4	402308	CRIMP FERRULE	316L. 304L STAINLESS STEEL
5	T1772-08	HIGH PRESSURE ETFE HOSE 1/2"	ETFE, 304L BRAID
6	207 529 999	INTERNAL CABLE	STAINLESS STEEL
7	207 571 911	SNAP RING 1/2"	STAINLESS STEEL

NOTES:

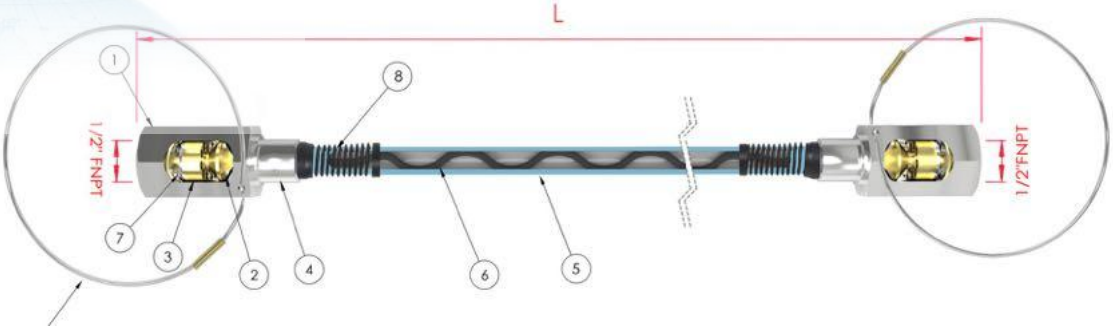
1. Material shall be from solid bar stock.
2. Brass material shall be stress relieved prior to fabrication.
3. The lengths are measured in inches and replaces the xx in part no.
4. Manufactured according to ISO EN 14 113

- Maximum working pressure 250 bar, 3650 psi
- Test pressure 375 bar, 5475 psi
- Safety factor: 4
- Degreased for oxygen use

Part Number:	LIFEGUARD SAFETY HOSES, ETFE (TEZEL) 3650 PSI STAINLESS-STEEL FITTINGS
TFS1-004-11-36-S	36" x 1/2" NPT, TEZEL LINED, 3650 PSI-SS ENDS
TFS1-004-11-40-S	40" x 1/2" NPT, TEZEL LINED, 3650 PSI-SS ENDS
TFS1-004-11-42-S	42" x 1/2" NPT, TEZEL LINED, 3650 PSI-SS ENDS
TFS1-004-11-48-S	48" x 1/2" NPT, TEZEL LINED, 3650 PSI-SS ENDS
TFS1-004-11-60-S	60" x 1/2" NPT, TEZEL LINED, 3650 PSI-SS ENDS
TFS1-004-11-72-S	72" x 1/2" NPT, TEZEL LINED, 3650 PSI-SS ENDS
TFS1-004-11-84-S	84" x 1/2" NPT, TEZEL LINED, 3650 PSI-SS ENDS
TFS1-004-11-96-S	96" x 1/2" NPT, TEZEL LINED, 3650 PSI-SS ENDS
TFS1-004-11-120-S	120" x 1/2" NPT, TEZEL LINED, 3650 PSI-SS ENDS
	S= FIXED SAFETY LOOPS/ALL HOSES O2 CLEANED AND BAGGED
	OTHER LENGTHS BY REQUEST

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

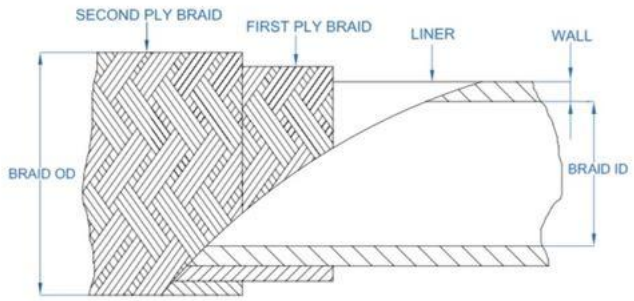
HYDROGEN HOSES | CRYOGENIC LIQUID CYLINDER HOSES | METAL PIGTAILS | LIFEGUARD COMPRESSED GAS HOSES | CARBON DIOXIDE BULK LIQUID TRANSFER HOSES

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

Application	High pressure gas applications where low permeation rates are required
Design	Smoothbore gas quality ETFE tube with aramid braid and high tensile SS 304 braid
Inner layer	Gas quality smoothbore ETFE tube
Outer layer	1 aramid braid and 1 high tensile 304 maypole wound Stainless Steel braid
Temperature Min	-60°C
Temperature Max	+170-180°C
Material	ETFE according to "1S012086, 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. (mm)	(in)	Braid OD Nominal (mm)	(in)	Tolerance +/- (mm)	(in)	Braid ID Nominal (mm)	(in)	Tolerance +/- (mm)	(in)	Max. Working Pressure (psi)	(bar)	Min. Burst Pressure (psi)	(bar)	Min. Bend Radius (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

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The next generation in safety hoses

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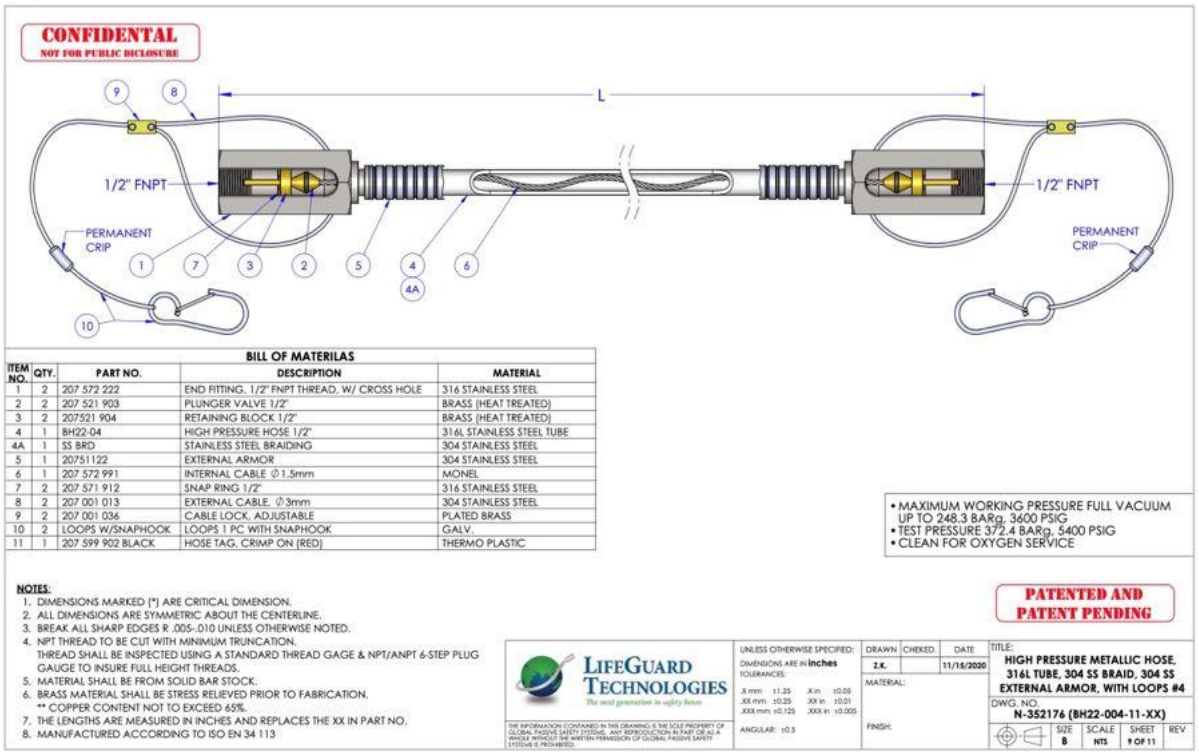
LifeGuard Technologies Safety Hose
What are your Options for Hydrogen and Helium Hoses?

For hydrogen and helium applications such as tube trailer filling, we now recommend two options – **LifeGuard Metallic Safety Hose** or **LifeGuard Ultra-High pressure ETFE hose 6,000 PSI LifeGuard Safety Hose**. The issue relates to the hose tube. Metal inner core hoses will not a fuse or diffuse gas that is 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 refuse through the wall of ptfe hoses at rates consistent with the gas molecule size and weight and with atmosphere gases this effusion is hardly noticeable. For hydrogen and helium, the ETFE or tefzel hose has typically 1/3 the effusion rate of a PTFE hose so ETFE is the recommended inner core material for hydrogen and helium cylinder filling applications where permeation is not as much of a concern. Since this is a corporate technical preference, I would encourage you to reach out to the appropriate authority for a determination. In the end, I am very confident that the lifeguard safety hose either in that Metallic tube or Tefzel tube, will provide the highest degree of safety for this application.

The **LifeGuard Metallic Safety Hose** was the design adopted by Air Liquide throughout the USA. Below are two images of the hose configuration we developed with your colleagues in the USA and Canada. The USA affiliate has replaced ALL of their hydrogen filling hoses with LifeGuard Safety hoses. This project has included over **700 1/2" x 14', convoluted metallic hoses.** I have attached a drawing of this hose configuration and an article that was written on this project in *Cryogas International* as well.



BILL OF MATERILAS

ITEM NO.	QTY.	PART NO.	DESCRIPTION	MATERIAL
1	2	207 572 222	END FITTING, 1/2" FNPT THREAD, W/ CROSS HOLE	316 STAINLESS STEEL
2	2	207 521 903	PLUNGER VALVE 1/2"	BRASS (HEAT TREATED)
3	2	207521 904	RETAINING BLOCK 1/2"	BRASS (HEAT TREATED)
4	1	BH22-04	HIGH PRESSURE HOSE 1/2"	316L STAINLESS STEEL TUBE
4A	1	SS BRD	STAINLESS STEEL BRAIDING	304 STAINLESS STEEL
5	1	20751122	EXTERNAL ARMOR	304 STAINLESS STEEL
6	1	207 572 991	INTERNAL CABLE ∅1.5mm	MONEL
7	2	207 571 912	SNAP RING 1/2"	316 STAINLESS STEEL
8	2	207 001 013	EXTERNAL CABLE, ∅3mm	304 STAINLESS STEEL
9	2	207 001 036	CABLE LOCK, ADJUSTABLE	PLATED BRASS
10	2	LOOPS W/SNAPHOOK	LOOPS 1 PC WITH SNAPHOOK	GALV.
11	1	207 599 902 BLACK	HOSE TAG, CRIMP ON (RED)	THERMO PLASTIC

- MAXIMUM WORKING PRESSURE FULL VACUUM UP TO 248.3 BARg, 3600 PSIG
- TEST PRESSURE 372.4 BARg, 5400 PSIG
- CLEAN FOR OXYGEN SERVICE

NOTES:
1. DIMENSIONS MARKED (*) ARE CRITICAL DIMENSION.
2. ALL DIMENSIONS ARE SYMMETRIC ABOUT THE CENTERLINE.
3. BREAK ALL SHARP EDGES R .005-.010 UNLESS OTHERWISE NOTED.
4. NPT THREAD TO BE CUT WITH MINIMUM TRUNCATION.
   THREAD SHALL BE INSPECTED USING A STANDARD THREAD GAGE & NPT/ANPT 6-STEP PLUG GAUGE TO INSURE FULL HEIGHT THREADS.
5. MATERIAL SHALL BE FROM SOLID BAR STOCK.
6. BRASS MATERIAL SHALL BE STRESS RELIEVED PRIOR TO FABRICATION.
   ** COPPER CONTENT NOT TO EXCEED 65%.
7. THE LENGTHS ARE MEASURED IN INCHES AND REPLACES THE XX IN PART NO.
8. MANUFACTURED ACCORDING TO ISO EN 34 113

PATENTED AND PATENT PENDING

LIFEGUARD TECHNOLOGIES
The next generation in safety hoses

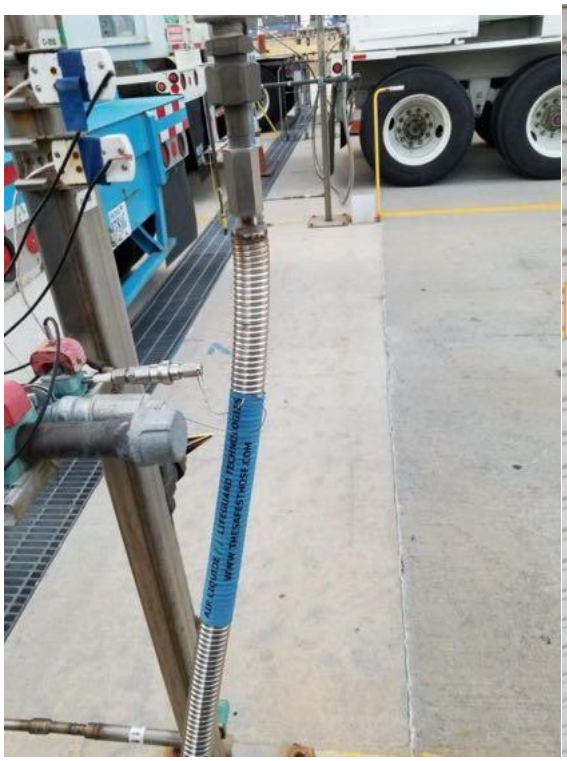
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN Inches
TOLERANCES:
ANGULAR: ±0.5

DRAWN	CHECKED	DATE
Z.K.		11/15/2020

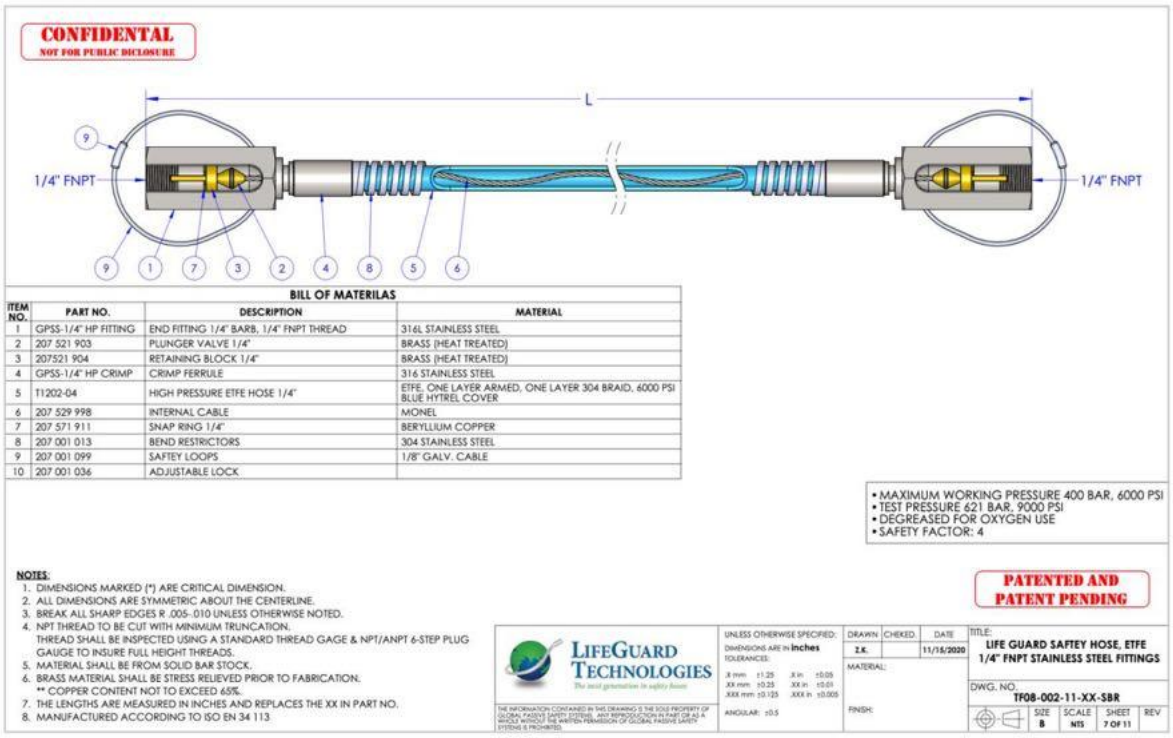
MATERIAL:
FINISH:

TITLE: HIGH PRESSURE METALLIC HOSE, 316L TUBE, 304 SS BRAID, 304 SS EXTERNAL ARMOR, WITH LOOPS #4
DWG. NO. N-352176 (BH22-004-11-XX)

SIZE	SCALE	SHEET	REV
B	NTS	9 OF 11	



This **LifeGuard Ultra-High pressure ETFE hose 6,000 PSI LifeGuard Safety Hose** design was adopted by Praxair and then Linde and Air Products as it provides an Ultra-High pressure ETFE hose design rated for 24,000 PSI BURST.



BILL OF MATERILAS

ITEM NO.	PART NO.	DESCRIPTION	MATERIAL
1	GPSS-1/4" HP FITTING	END FITTING 1/4" BARB, 1/4" FNPT THREAD	316L STAINLESS STEEL
2	207 521 903	PLUNGER VALVE 1/4"	BRASS (HEAT TREATED)
3	207521 904	RETAINING BLOCK 1/4"	BRASS (HEAT TREATED)
4	GPSS-1/4" HP CRIMP	CRIMP FERRULE	316 STAINLESS STEEL
5	T1202-04	HIGH PRESSURE ETFE HOSE 1/4"	ETFE, ONE LAYER ARMED, ONE LAYER 304 BRAID, 6000 PSI BLUE HYTREL COVER
6	207 529 998	INTERNAL CABLE	MONEL
7	207 571 911	SNAP RING 1/4"	BERYLLIUM COPPER
8	207 001 013	BEND RESTRICTORS	304 STAINLESS STEEL
9	207 001 099	SAFTEY LOOPS	1/8" GALV. CABLE
10	207 001 036	ADJUSTABLE LOCK	

- MAXIMUM WORKING PRESSURE 400 BAR, 6000 PSI
- TEST PRESSURE 621 BAR, 9000 PSI
- DEGREASED FOR OXYGEN USE
- SAFETY FACTOR: 4

NOTES:
1. DIMENSIONS MARKED (*) ARE CRITICAL DIMENSION.
2. ALL DIMENSIONS ARE SYMMETRIC ABOUT THE CENTERLINE.
3. BREAK ALL SHARP EDGES R .005-.010 UNLESS OTHERWISE NOTED.
4. NPT THREAD TO BE CUT WITH MINIMUM TRUNCATION. THREAD SHALL BE INSPECTED USING A STANDARD THREAD GAGE & NPT/ANPT 6-STEP PLUG GAUGE TO INSURE FULL HEIGHT THREADS.
5. MATERIAL SHALL BE FROM SOLID BAR STOCK.
6. BRASS MATERIAL SHALL BE STRESS RELIEVED PRIOR TO FABRICATION. ** COPPER CONTENT NOT TO EXCEED 65%.
7. THE LENGTHS ARE MEASURED IN INCHES AND REPLACES THE XX IN PART NO.
8. MANUFACTURED ACCORDING TO ISO EN 34 113

PATENTED AND PATENT PENDING

LIFEGUARD TECHNOLOGIES
The next generation in safety hoses

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN inches TOLERANCES: .X mm ±1.25 .X in ±0.05 .XX mm ±0.25 .XX in ±0.01 .XXX mm ±0.125 .XXX in ±0.005 ANGULAR: ±0.5

DRAWN	CHEKED	DATE
Z.K.		11/15/2020

MATERIAL:

FINISH:

TITLE: LIFE GUARD SAFTEY HOSE, ETFE 1/4" FNPT STAINLESS STEEL FITTINGS

DWG. NO. TF08-002-11-XX-SBR

SIZE	SCALE	SHEET	REV
B	NTS	7 OF 11	

Part No.: TF08-002-11-XXX
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. Thus, able to act-like our normal outer "guard-check" spring protection.
• Extra Long Continuous Lengths up to 150 Feet (45 meters)
• Low Effusion PFA & 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: -50ºF to +275ºF
• With KEVLAR reinforced braid (stronger than stainless steel) has the highest safety rating.

The extra pressure makes this a more robust hose but at minimal cost differential.

As for the Hydrogen hoses, there are several factors that impact the decision of which design to use. The issue relates to the hose tube. Metal inner core hoses will not diffuse gas that is 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 refuse through the wall of ptfe hoses at rates consistent with the gas molecule size and weight and with atmosphere gases this effusion is hardly noticeable.

For hydrogen and helium, the ETFE or tefzel hose has typically 1/3 the effusion rate of a PTFE hose so ETFE is the recommended inner core material for hydrogen and helium cylinder filling applications where permeation is not as much of a concern. Since this is a corporate technical preference, I would encourage you to reach out to the appropriate authority for a determination. In the end, I am very confident that the lifeguard safety hose either in that Metallic tube or Tefzel tube, will provide the highest degree of safety for this application.

In sum, customers prefer to use:

for hydrogen and helium applications, ETFE due to its flexibility and high cycle life AND its minimal permeation characteristics.

for inert and some oxygen applications, PTFE due to its flexibility and high cycle life AND its acceptability with oxygen and inert gases (except helium and hydrogen where its effusion is much too high as shown below ;

In oxygen and certain hydrogen and helium service, Metallic due to its minimal permeation AND its acceptability with oxygen and inert gases including helium and hydrogen

In general, we recommend, ETFE hose tube for Hydrogen and Helium. For inert we recommend PTFE and for oxygen we are split between using metallic in medical applications and PTFE for industrial oxygen applications.

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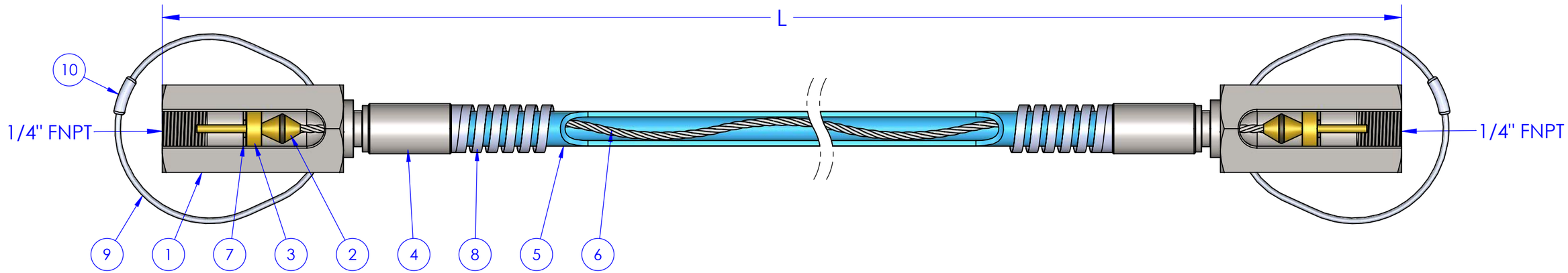
NOT FOR PUBLIC DICLOSURE



BILL OF MATERILAS

ITEM NO.	PART NO.	DESCRIPTION	MATERIAL
1	GPSS-1/4" HP FITTING	END FITTING 1/4" BARB, 1/4" FNPT THREAD	316L STAINLESS STEEL
2	207 521 903	PLUNGER VALVE 1/4"	BRASS (HEAT TREATED)
3	207521 904	RETAINING BLOCK 1/4"	BRASS (HEAT TREATED)
4	GPSS-1/4" HP CRIMP	CRIMP FERRULE	316 STAINLESS STEEL
5	T1202-04	HIGH PRESSURE ETFE HOSE 1/4"	ETFE, ONE LAYER ARMED, ONE LAYER 304 BRAID, 6000 PSI BLUE HYTREL COVER - UV PROTECTED
6	207 529 998	INTERNAL CABLE	304L STAINLESS STEEL
7	207 571 911	SNAP RING 1/4"	BERYLLIUM COPPER
8	207 001 013	BEND RESTRICTORS	304 STAINLESS STEEL
9	207 001 099	SAFETY LOOPS	1/8" GALV. CABLE
10	207 001 036	ADJUSTABLE LOCK	

- MAXIMUM WORKING PRESSURE 414 BAR, 6000 PSI
- TEST PRESSURE 621 BAR, 9000 PSI
- DEGREASED FOR OXYGEN USE
- SAFETY FACTOR: 4

NOTES:

1. DIMENSIONS MARKED (*) ARE CRITICAL DIMENSION.
2. ALL DIMENSIONS ARE SYMMETRIC ABOUT THE CENTERLINE.
3. BREAK ALL SHARP EDGES R .005-.010 UNLESS OTHERWISE NOTED.
4. NPT THREAD TO BE CUT WITH MINIMUM TRUNCATION.
   THREAD SHALL BE INSPECTED USING A STANDARD THREAD GAGE & NPT/ANPT 6-STEP PLUG GAUGE TO INSURE FULL HEIGHT THREADS.
5. MATERIAL SHALL BE FROM SOLID BAR STOCK.
6. BRASS MATERIAL SHALL BE STRESS RELIEVED PRIOR TO FABRICATION.
   ** COPPER CONTENT NOT TO EXCEED 65%.
7. THE LENGTHS ARE MEASURED IN INCHES AND REPLACES THE XX IN PART NO.
8. MANUFACTURED ACCORDING TO ISO EN 14 113

PATENTED AND PATENT PENDING

LIFEGUARD TECHNOLOGIES
The next generation in safety hoses

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN **inches**
TOLERANCES:

.X mm	±1.25	.X in	±0.05
.XX mm	±0.25	.XX in	±0.01
.XXX mm	±0.125	.XXX in	±0.005

ANGULAR: ±0.5

DRAWN	CHEKED.	DATE
Z.K.		2021-06-21

MATERIAL:

FINISH:

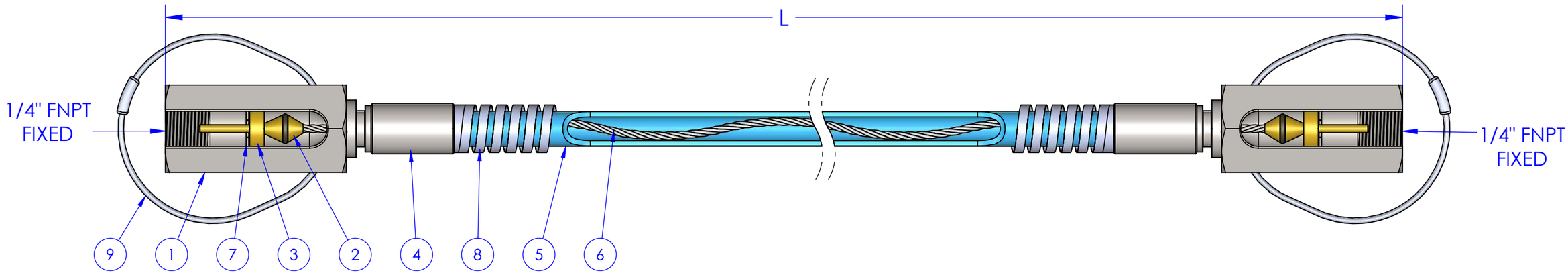
TITLE:
LIFE GUARD SAFTEY HOSE, ETFE 1/4" FNPT STAINLESS STEEL FITTINGS

DWG. NO. **TF08-002-11-XX-SBR**

SIZE	SCALE	SHEET	REV
B	NTS	1 OF 5	

CONFIDENTAL
NOT FOR PUBLIC DICLOSURE

AIR PRODUCTS SPECIFICATION
OPTION A: 5000mm
OPTION B: 5500mm



BILL OF MATERILAS

ITEM NO.	PART NO.	DESCRIPTION	MATERIAL
1	GPSS-1/4" HP FITTING	END FITTING 1/4" BARB, 1/4" FNPT THREAD	316L STAINLESS STEEL
2	207 521 903	PLUNGER VALVE 1/4"	BRASS (HEAT TREATED)
3	207521 904	RETAINING BLOCK 1/4"	BRASS (HEAT TREATED)
4	GPSS-1/4" HP CRIMP	CRIMP FERRULE	316 STAINLESS STEEL
5	T1202-04	HIGH PRESSURE ETFE HOSE 1/4"	ETFE, ONE LAYER ARMED, ONE LAYER 304 BRAID, 6000 PSI BLUE HYTREL COVER - UV PROTECTED
6	207 529 998	INTERNAL CABLE	304L STAINLESS STEEL
7	207 571 911	SNAP RING 1/4"	BERYLLIUM COPPER
8	207 001 013	BEND RESTRICTORS	304 STAINLESS STEEL
9	207 001 099	SAFETY LOOPS	1/8" GALV. CABLE
10	207 001 113	SHRINK LABEL	

- MAXIMUM WORKING PRESSURE 414 BAR, 6000 PSI
- TEST PRESSURE 621 BAR, 9000 PSI
- DEGREASED FOR OXYGEN USE
- SAFETY FACTOR: 4

NOTES:

1. DIMENSIONS MARKED (*) ARE CRITICAL DIMENSION.
2. ALL DIMENSIONS ARE SYMMETRIC ABOUT THE CENTERLINE.
3. BREAK ALL SHARP EDGES R .005-.010 UNLESS OTHERWISE NOTED.
4. NPT THREAD TO BE CUT WITH MINIMUM TRUNCATION.
   THREAD SHALL BE INSPECTED USING A STANDARD THREAD GAGE & NPT/ANPT 6-STEP PLUG GAUGE TO INSURE FULL HEIGHT THREADS.
5. MATERIAL SHALL BE FROM SOLID BAR STOCK.
6. BRASS MATERIAL SHALL BE STRESS RELIEVED PRIOR TO FABRICATION.
   ** COPPER CONTENT NOT TO EXCEED 65%.
7. THE LENGTHS ARE MEASURED IN INCHES AND REPLACES THE XX IN PART NO.
8. MANUFACTURED ACCORDING TO ISO EN 14 113

PATENTED AND PATENT PENDING

LIFEGUARD TECHNOLOGIES
The next generation in safety hoses

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN **inches**
TOLERANCES:

.X mm	±1.25	.X in	±0.05
.XX mm	±0.25	.XX in	±0.01
.XXX mm	±0.125	.XXX in	±0.005

ANGULAR: ±0.5

DRAWN	CHEKED.	DATE
Z.K.		2021-06-21

MATERIAL:

FINISH:

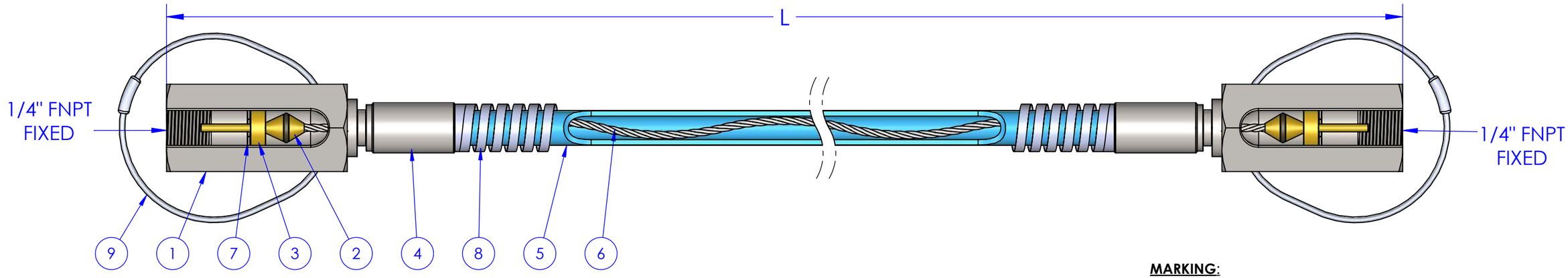
TITLE:
LIFE GUARD SAFTEY HOSE, ETFE 1/4" FNPT STAINLESS STEEL FITTINGS

DWG. NO. **TF08-002-11-5000-SBR**
TF08-002-11-5500-SBR

SIZE	SCALE	SHEET	REV
B	NTS	2 OF 5	

CONFIDENTAL
NOT FOR PUBLIC DICLOSURE

AIR PRODUCTS SPECIFICATION
OPTION A: 5000mm
OPTION B: 5500mm



BILL OF MATERILAS

ITEM NO.	PART NO.	DESCRIPTION	MATERIAL
1	GPSS-1/4" HP FITTING	END FITTING 1/4" BARB, 1/4" FNPT THREAD	316L STAINLESS STEEL
2	207 521 903	PLUNGER VALVE 1/4"	BRASS (HEAT TREATED)
3	207521 904	RETAINING BLOCK 1/4"	BRASS (HEAT TREATED)
4	GPSS-1/4" HP CRIMP	CRIMP FERRULE	316 STAINLESS STEEL
5	T1202-04	HIGH PRESSURE ETFE HOSE 1/4"	ETFE, ONE LAYER ARMED, ONE LAYER 304 BRAID, 6000 PSI BLUE HYTREL COVER - UV PROTECTED
6	207 529 998	INTERNAL CABLE	304L STAINLESS STEEL
7	207 571 911	SNAP RING 1/4"	BERYLLIUM COPPER
8	207 001 013	BEND RESTRICTORS	304 STAINLESS STEEL
9	207 001 099	SAFETY LOOPS	1/8" GALV. CABLE
10	207 001 113	SHRINK LABEL	

MARKING:
EACH LENGTH OF HOSE WITH A COVER OF RUBBER OR PLASTIC SHALL BE PERMANENTLY MARKED WITH THE FOLLOWING INFORMATION:
(a) THE NUMBER AND DATE OF THIS INTERNATIONAL STANDARD ISO 14113:2013.
(b) THE MAXIMUM WORKING PRESSURE IN BAR AND BETWEEN BRACKETS IN MEGAPASCALS.
(c) THE NOMINAL BORE SIZE.
(d) THE MANUFACTURER'S NAME OR MARK.
(e) THE YEAR OF MANUFACTURE.
(f) THE NAME OF THE GAS OR GASES FOR WHICH THE HOSE ASSEMBLY IS SUITABLE.
(g) FOR FLAMMABLE GASES ONLY, THE ELECTRICAL "CONDUCTIVE" SYMBOL Ω.

- MAXIMUM WORKING PRESSURE 414 BAR, 6000 PSI
- TEST PRESSURE 621 BAR, 9000 PSI
- DEGREASED FOR OXYGEN USE
- SAFETY FACTOR: 4

NOTES:
1. DIMENSIONS MARKED (*) ARE CRITICAL DIMENSION.
2. ALL DIMENSIONS ARE SYMMETRIC ABOUT THE CENTERLINE.
3. BREAK ALL SHARP EDGES R .005-.010 UNLESS OTHERWISE NOTED.
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5. MATERIAL SHALL BE FROM SOLID BAR STOCK.
6. BRASS MATERIAL SHALL BE STRESS RELIEVED PRIOR TO FABRICATION.
   ** COPPER CONTENT NOT TO EXCEED 65%.
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8. MANUFACTURED ACCORDING TO ISO EN 14 113

PATENTED AND PATENT PENDING

LIFEGUARD TECHNOLOGIES
The next generation in safety hoses

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN **inches**
TOLERANCES:
.X mm ±1.25 .X in ±0.05
.XX mm ±0.25 .XX in ±0.01
.XXX mm ±0.125 .XXX in ±0.005
ANGULAR: ±0.5

DRAWN	CHEKED.	DATE
Z.K.		2021-06-21

MATERIAL:
FINISH:

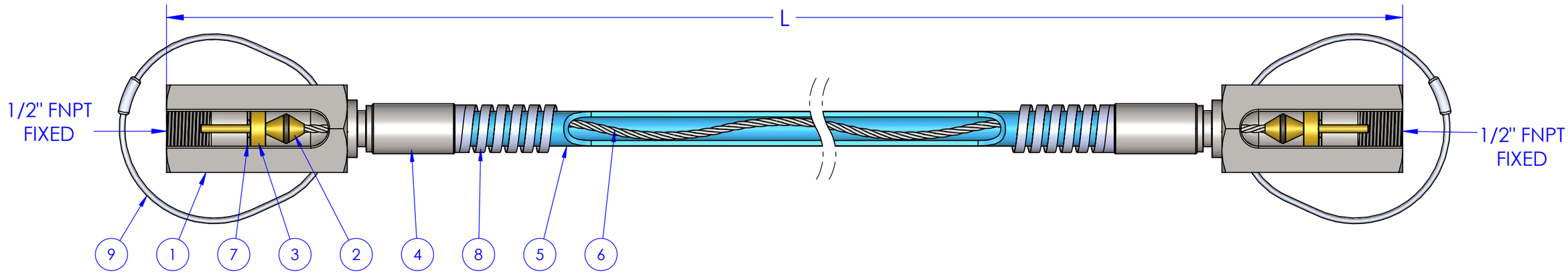
TITLE:
LIFE GUARD SAFTEY HOSE, ETFE 1/4" FNPT STAINLESS STEEL FITTINGS

DWG. NO. **TF08-002-11-5000-SBR**
TF08-002-11-5500-SBR

SIZE	SCALE	SHEET	REV
B	NTS	3 OF 5	

CONFIDENTAL
NOT FOR PUBLIC DICLOSURE

AIR PRODUCTS SPECIFICATION
OPTION A: 5000mm
OPTION B: 5500mm



BILL OF MATERILAS

ITEM NO.	PART NO.	DESCRIPTION	MATERIAL
1	GPSS-1/2" HP FITTING	END FITTING 1/2" BARB, 1/2" FNPT THREAD	316L STAINLESS STEEL
2	207 521 903	PLUNGER VALVE 1/2"	BRASS (HEAT TREATED)
3	207521 904	RETAINING BLOCK 1/2"	BRASS (HEAT TREATED)
4	GPSS-1/2" HP CRIMP	CRIMP FERRULE	316 STAINLESS STEEL
5	T1202-04	HIGH PRESSURE ETFE HOSE 1/2" (12.7mm)	ETFE, ONE LAYER ARMED, ONE LAYER 304 BRAID, 6000 PSI BLUE HYTREL COVER - UV PROTECTED
6	207 529 998	INTERNAL CABLE	304L STAINLESS STEEL
7	207 571 911	SNAP RING 1/2"	BERYLLIUM COPPER
8	207 001 013	BEND RESTRICTORS	304 STAINLESS STEEL
9	207 001 099	SAFETY LOOPS	1/8" GALV. CABLE
10	207 001 113	SHRINK LABEL	

- MAXIMUM WORKING PRESSURE 414 BAR, 6000 PSI
- TEST PRESSURE 621 BAR, 9000 PSI
- DEGREASED FOR OXYGEN USE
- SAFETY FACTOR: 4

NOTES:

1. DIMENSIONS MARKED (*) ARE CRITICAL DIMENSION.
2. ALL DIMENSIONS ARE SYMMETRIC ABOUT THE CENTERLINE.
3. BREAK ALL SHARP EDGES R .005-.010 UNLESS OTHERWISE NOTED.
4. NPT THREAD TO BE CUT WITH MINIMUM TRUNCATION.
   THREAD SHALL BE INSPECTED USING A STANDARD THREAD GAGE & NPT/ANPT 6-STEP PLUG GAUGE TO INSURE FULL HEIGHT THREADS.
5. MATERIAL SHALL BE FROM SOLID BAR STOCK.
6. BRASS MATERIAL SHALL BE STRESS RELIEVED PRIOR TO FABRICATION.
   ** COPPER CONTENT NOT TO EXCEED 65%.
7. THE LENGTHS ARE MEASURED IN INCHES AND REPLACES THE XX IN PART NO.
8. MANUFACTURED ACCORDING TO ISO EN 14 113

PATENTED AND PATENT PENDING

LIFEGUARD TECHNOLOGIES
The next generation in safety hoses

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.X mm	±1.25	.X in	±0.05
.XX mm	±0.25	.XX in	±0.01
.XXX mm	±0.125	.XXX in	±0.005

ANGULAR: ±0.5

DRAWN	CHEKED.	DATE
Z.K.		2021-06-21

MATERIAL:

FINISH:

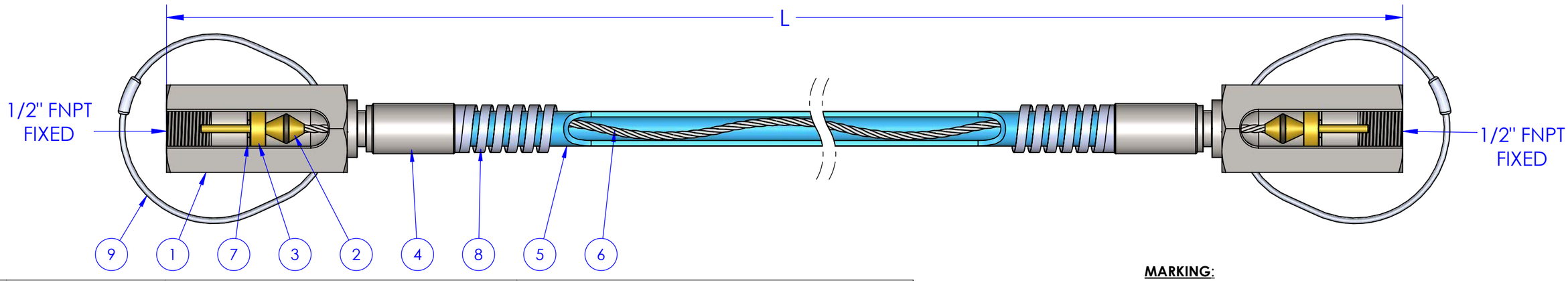
TITLE:
LIFE GUARD SAFTEY HOSE, ETFE 1/2" FNPT STAINLESS STEEL FITTINGS

DWG. NO. **TF08-004-11-5000-SBR**
TF08-004-11-5500-SBR

SIZE	SCALE	SHEET	REV
B	NTS	4 OF 5	

CONFIDENTAL
NOT FOR PUBLIC DICLOSURE

AIR PRODUCTS SPECIFICATION
OPTION A: 5000mm
OPTION B: 5500mm



BILL OF MATERILAS

ITEM NO.	PART NO.	DESCRIPTION	MATERIAL
1	GPSS-1/2" HP FITTING	END FITTING 1/2" BARB, 1/2" FNPT THREAD	316L STAINLESS STEEL
2	207 521 903	PLUNGER VALVE 1/2"	BRASS (HEAT TREATED)
3	207521 904	RETAINING BLOCK 1/2"	BRASS (HEAT TREATED)
4	GPSS-1/2" HP CRIMP	CRIMP FERRULE	316 STAINLESS STEEL
5	T1202-04	HIGH PRESSURE ETFE HOSE 1/2" (12.7mm)	ETFE, ONE LAYER ARMED, ONE LAYER 304 BRAID, 6000 PSI BLUE HYTREL COVER - UV PROTECTED
6	207 529 998	INTERNAL CABLE	304L STAINLESS STEEL
7	207 571 911	SNAP RING 1/2"	BERYLLIUM COPPER
8	207 001 013	BEND RESTRICTORS	304 STAINLESS STEEL
9	207 001 099	SAFETY LOOPS	1/8" GALV. CABLE
10	207 001 113	SHRINK LABEL	

MARKING:
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(b) THE MAXIMUM WORKING PRESSURE IN BAR AND BETWEEN BRACKETS IN MEGAPASCALS.
(c) THE NOMINAL BORE SIZE.
(d) THE MANUFACTURER'S NAME OR MARK.
(e) THE YEAR OF MANUFACTURE.
(f) THE NAME OF THE GAS OR GASES FOR WHICH THE HOSE ASSEMBLY IS SUITABLE.
(g) FOR FLAMMABLE GASES ONLY, THE ELECTRICAL "CONDUCTIVE" SYMBOL Ω.

- MAXIMUM WORKING PRESSURE 414 BAR, 6000 PSI
- TEST PRESSURE 621 BAR, 9000 PSI
- DEGREASED FOR OXYGEN USE
- SAFETY FACTOR: 4

NOTES:
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8. MANUFACTURED ACCORDING TO ISO EN 14 113

PATENTED AND PATENT PENDING

LIFEGUARD TECHNOLOGIES
The next generation in safety hoses

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.XX mm ±0.25 .XX in ±0.01
.XXX mm ±0.125 .XXX in ±0.005
ANGULAR: ±0.5

DRAWN	CHEKED.	DATE
Z.K.		2021-06-21

MATERIAL:
FINISH:

TITLE:
LIFE GUARD SAFTEY HOSE, ETFE 1/2" FNPT STAINLESS STEEL FITTINGS

DWG. NO. **TF08-004-11-5000-SBR**
TF08-004-11-5500-SBR

SIZE	SCALE	SHEET	REV
B	NTS	5 OF 5	

CONFIDENTAL
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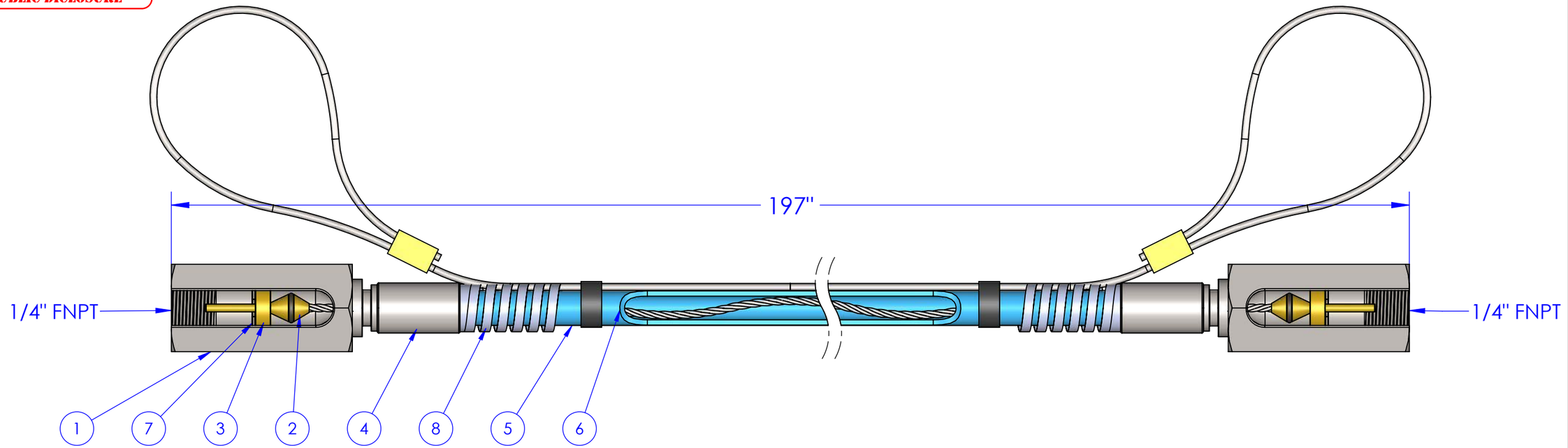

BILL OF MATERILAS

ITEM NO.	PART NO.	DESCRIPTION	MATERIAL
1	GPSS-1/4" HP FITTING	END FITTING 1/4" BARB, 1/4" FNPT THREAD	316L STAINLESS STEEL
2	207 521 903	PLUNGER VALVE 1/4"	BRASS (HEAT TREATED)
3	207521 904	RETAINING BLOCK 1/4"	BRASS (HEAT TREATED)
4	GPSS-1/4" HP CRIMP	CRIMP FERRULE	316 STAINLESS STEEL
5	T1202-04	HIGH PRESSURE ETFE HOSE 1/4"	ETFE, ONE LAYER ARMED, ONE LAYER 304 BRAID, 6000 PSI BLUE HYTREL COVER - UV PROTECTED
6	207 529 998	INTERNAL CABLE	304L STAINLESS STEEL
7	207 571 911	SNAP RING 1/4"	BERYLLIUM COPPER
8	207 001 013	BEND RESTRICTORS	304 STAINLESS STEEL

- MAXIMUM WORKING PRESSURE 414 BAR, 6000 PSI
- TEST PRESSURE 621 BAR, 9000 PSI
- DEGREASED FOR OXYGEN USE
- SAFETY FACTOR: 4

NOTES:

1. DIMENSIONS MARKED (*) ARE CRITICAL DIMENSION.
2. ALL DIMENSIONS ARE SYMMETRIC ABOUT THE CENTERLINE.
3. BREAK ALL SHARP EDGES R .005-.010 UNLESS OTHERWISE NOTED.
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5. MATERIAL SHALL BE FROM SOLID BAR STOCK.
6. BRASS MATERIAL SHALL BE STRESS RELIEVED PRIOR TO FABRICATION.
   ** COPPER CONTENT NOT TO EXCEED 65%.
7. MANUFACTURED ACCORDING TO ISO EN 14 113

PATENTED AND PATENT PENDING

LIFEGUARD TECHNOLOGIES
The next generation in safety hoses

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN **inches**
TOLERANCES:

.X mm	±1.25	.X in	±0.05
.XX mm	±0.25	.XX in	±0.01
.XXX mm	±0.125	.XXX in	±0.005

ANGULAR: ±0.5

DRAWN	CHEKED.	DATE
Z.K.		2021-07-07

MATERIAL:

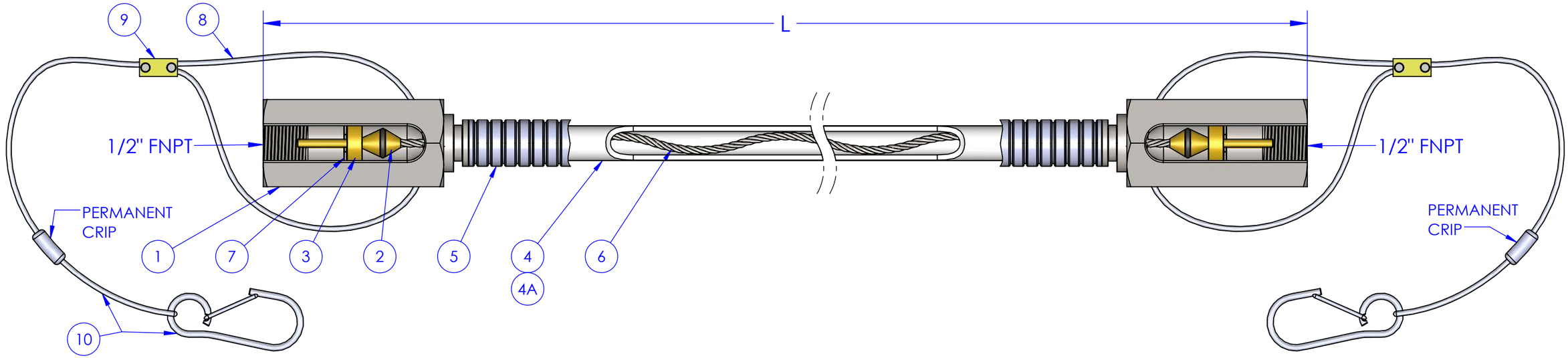
FINISH:

TITLE:
LIFE GUARD SAFTEY HOSE, ETFE 1/4" FNPT STAINLESS STEEL FITTINGS

DWG. NO. **TF08-002-11-197-CBR**

SIZE	SCALE	SHEET	REV
B	NTS	1 OF 5	

CONFIDENTAL
NOT FOR PUBLIC DICLOSURE



BILL OF MATERILAS

ITEM NO.	QTY.	PART NO.	DESCRIPTION	MATERIAL
1	2	207 572 222	END FITTING, 1/2" FNPT THREAD, W/ CROSS HOLE	316 STAINLESS STEEL
2	2	207 521 903	PLUNGER VALVE 1/2"	BRASS (HEAT TREATED)
3	2	207521 904	RETAINING BLOCK 1/2"	BRASS (HEAT TREATED)
4	1	BH22-04	HIGH PRESSURE HOSE 1/2"	316L STAINLESS STEEL TUBE
4A	1	SS BRD	STAINLESS STEEL BRAIDING	304 STAINLESS STEEL
5	1	20751122	EXTERNAL ARMOR	304 STAINLESS STEEL
6	1	207 572 991	INTERNAL CABLE ∅1.5mm	MONEL
7	2	207 571 912	SNAP RING 1/2"	316 STAINLESS STEEL
8	2	207 001 013	EXTERNAL CABLE, ∅3mm	304 STAINLESS STEEL
9	2	207 001 036	CABLE LOCK, ADJUSTABLE	PLATED BRASS
10	2	LOOPS W/SNAPHOOK	LOOPS 1 PC WITH SNAPHOOK	GALV.
11	1	207 599 902 BLACK	HOSE TAG, CRIMP ON (RED)	THERMO PLASTIC

- MAXIMUM WORKING PRESSURE FULL VACUUM UP TO 248.3 BARg, 3600 PSIG
- TEST PRESSURE 372.4 BARg, 5400 PSIG
- CLEAN FOR OXYGEN SERVICE

NOTES:

1. DIMENSIONS MARKED (*) ARE CRITICAL DIMENSION.
2. ALL DIMENSIONS ARE SYMMETRIC ABOUT THE CENTERLINE.
3. BREAK ALL SHARP EDGES R .005-.010 UNLESS OTHERWISE NOTED.
4. NPT THREAD TO BE CUT WITH MINIMUM TRUNCATION.
   THREAD SHALL BE INSPECTED USING A STANDARD THREAD GAGE & NPT/ANPT 6-STEP PLUG GAUGE TO INSURE FULL HEIGHT THREADS.
5. MATERIAL SHALL BE FROM SOLID BAR STOCK.
6. BRASS MATERIAL SHALL BE STRESS RELIEVED PRIOR TO FABRICATION.
   ** COPPER CONTENT NOT TO EXCEED 65%.
7. THE LENGTHS ARE MEASURED IN INCHES AND REPLACES THE XX IN PART NO.
8. MANUFACTURED ACCORDING TO ISO EN 34 113

PATENTED AND PATENT PENDING

LIFEGUARD TECHNOLOGIES
The next generation in safety hoses

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN **inches**
TOLERANCES:

.X mm	±1.25	.X in	±0.05
.XX mm	±0.25	.XX in	±0.01
.XXX mm	±0.125	.XXX in	±0.005

ANGULAR: ±0.5

DRAWN	CHEKED.	DATE
Z.K.		11/15/2020

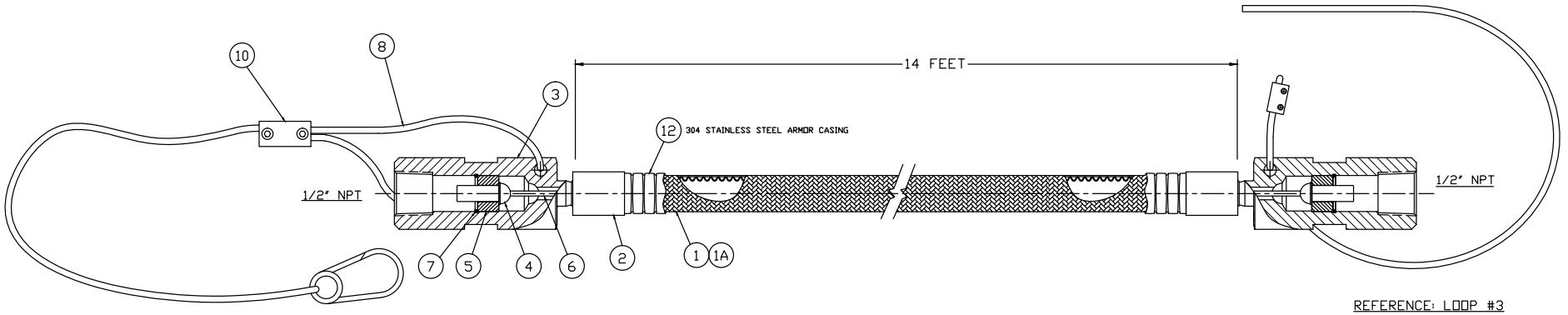
MATERIAL:

FINISH:

TITLE:
HIGH PRESSURE METALLIC HOSE, 316L TUBE, 304 SS BRAID, 304 SS EXTERNAL ARMOR, WITH LOOPS #4

DWG. NO.
N-352176 (BH22-004-11-XX)

SIZE	SCALE	SHEET	REV
B	NTS	9 OF 11	



REFERENCE: LOOP #4

REFERENCE: LOOP #3

BILL OF MATERIALS

ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	BH22-04-11-XXX	HIGH PRESSURE HOSE, 1/2" STAINLESS STEEL, 316L TUBE
1A	1	SS BRD	STAINLESS BRAIDING
2	2	4600-06-4	WELD FERRULE, 304 STAINLESS STEEL
3	2	207 572 222	SAFETY HOSE FITTING, 1/2" WITH CROSS HOLE, 316SS
4	2	207 521 903	PLUNGER VALVE, 1/2" BRASS
5	2	207 521 904	RETAINER, BRASS
6	1	207 572 991	CABLE, 1.5 mm DIA., MONEL
7	2	207 571 912	CIRCLIP RETAINING RING, 316 SS
8	1	207 001 013	EXTERNAL CABLE, 3 mm DIA., 304 STAINLESS STEEL
10	2	207 001 036	CABLE LOCK, ADJUSTABLE, PLATED BRASS
11	1	207 599 902 BLACK	HOSE TAG, CRIMP ON (RED)
12	1	20751122	EXTERNAL ARMOR
LOOP 4	1	LOOPS W/SNAPHOOK	LOOPS 1 PC WITH SNAPHOOK
LOOP 3	1	LOOPS ADJUST	LOOPS 1 PC WITH ADJUSTABLE LOOPS

NOTE:
CLEAN FOR OXYGEN SERVICE

CTE TEST F0351

MAXIMUM WORKING PRESSURE:
FULL VACUUM UP TO 3600 PSIG [248.3 BARg]
TEST PRESSURE 5400 PSIG [372.4 BARg] WITH NITROGEN

ISSUE NO.	DATE	DESCRIPTION	BY

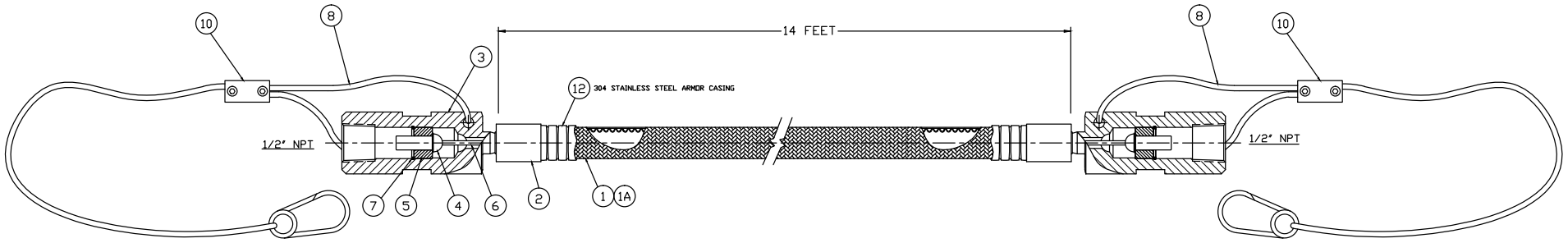
LIFEGUARD SAFETY SYSTEM

LIFEGUARD TECHNOLOGIES

BREAK ALL SHARP CORNERS
TOL. FRAC. ± ANG. ±
CONCENTRICITY T.I.R.
INSIDE CORNERS RAD.

TITLE
HIGH PRESSURE HOSE, 316L TUBE, 304SS BRAID
304SS EXTERNAL ARMOR, WITH LOOPS 3,4

DATE 5/14/2013	JOB STD	DWG. NO. HPH-.50-LP3,4	REV.
BY GR	ASSY.		
CH.	SCALE		
QA	PE	SHEET 1 OF 1	



REFERENCE: LOOP #4

REFERENCE: LOOP #4

BILL OF MATERIALS

ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	BH22-04-11-XXX	HIGH PRESSURE HOSE, 1/2" STAINLESS STEEL, 316L TUBE
1A	1	SS BRD	STAINLESS BRAIDING
2	2	4600-06-4	WELD FERRULE, 304 STAINLESS STEEL
3	2	207 572 222	SAFETY HOSE FITTING, 1/2" WITH CROSS HOLE, 316SS
4	2	207 521 903	PLUNGER VALVE, 1/2" BRASS
5	2	207 521 904	RETAINER, BRASS
6	1	207 572 991	CABLE, 1.5 mm DIA., MONEL
7	2	207 571 912	CIRCLIP RETAINING RING, 316 SS
8	1	207 001 013	EXTERNAL CABLE, 3 mm DIA., 304 STAINLESS STEEL
10	2	207 001 036	CABLE LOCK, ADJUSTABLE, PLATED BRASS
11	1	207 599 902 BLACK	HOSE TAG, CRIMP ON (RED)
12	1	20751122	EXTERNAL ARMOR
LOOP 4	1	LOOPS W/SNAPHOOK	LOOPS 1 PC WITH SNAPHOOK

NOTE:
CLEAN FOR OXYGEN SERVICE

CTE TEST F0351

MAXIMUM WORKING PRESSURE:
FULL VACUUM UP TO 3600 PSIG [248.3 BARg]
TEST PRESSURE 5400 PSIG [372.4 BARg] WITH NITROGEN

ISSUE NO.	DATE	DESCRIPTION	BY

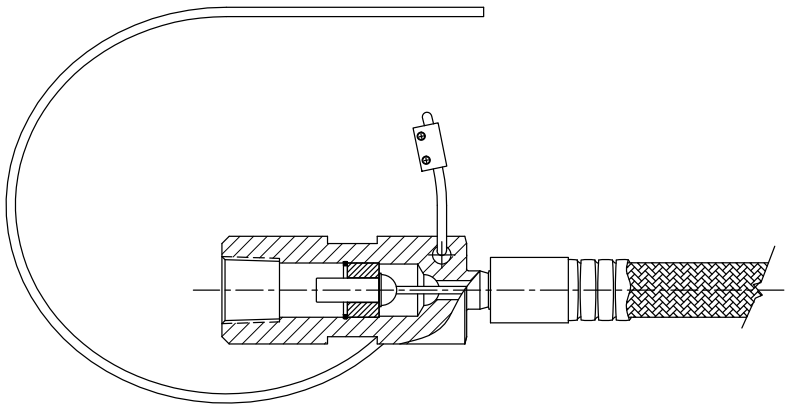
LIFEGUARD SAFETY SYSTEM

LIFEGUARD TECHNOLOGIES

BREAK ALL SHARP CORNERS
TOL. FRAC. ± ANG. ±
CONCENTRICITY T.I.R.
INSIDE CORNERS RAD.

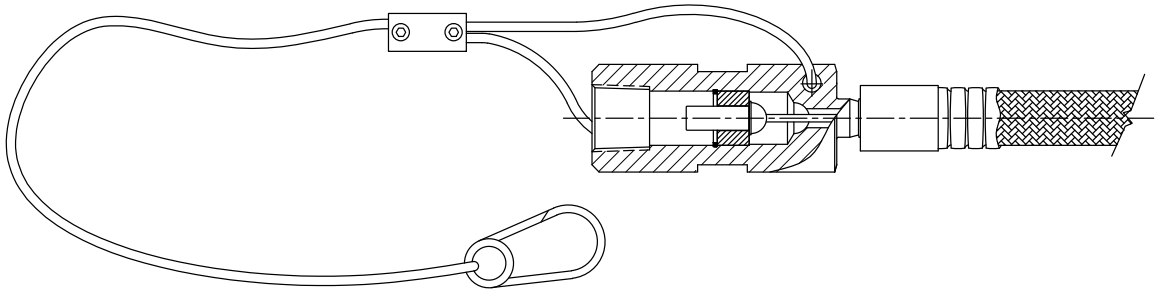
TITLE
HIGH PRESSURE HOSE, 316L TUBE, 304SS BRAID
304SS EXTERNAL ARMOR, WITH LOOPS #4

DATE 5/14/2013	JOB STD	DWG. NO. HPH-.50-LP4	REV.
BY GR	ASSY.		
CH.	SCALE		
QA	PE	SHEET 1 OF 1	



REFERENCE: LOOP #3

PART NO.: LOOPS ADJUST DESCR: LOOPS 1 PC WITH ADJUST. LOOPS



REFERENCE: LOOP #4

PART NO.: LOOPS W/SNAPHOOK DESCR: LOOPS 1 PC WITH SNAPHOOK

REV	DATE	DESCRIPTION	BY	QA	PE

U.O.N.

FINISH ✓

BREAK ALL SHARP CORNERS

TOL. FRAC. ± ANG. ±

CONCENTRICITY T.I.R.

INSIDE CORNERS RAD.

LIFEGUARD-TECH

TITLE

CABLE LOOP DIAGRAMS

DATE 9/9/77	JOB STD		DWG. NO.
BY GZ	ASSY.		CLD-101-3,4
CH.	SCALE		
QA	PE	DATE	SHEET 1 OF 1

LifeGuard Supplies Hydrogen Filling Hoses to Air Liquide US

A Case Study in Improving Safety

By Melanie Gogan

LifeGuard Technologies, specializing in its patented and patent-pending safety hose technology, with North American headquarters in Newtown Square, Pennsylvania, recently completed a project for Air Liquide U.S. Industrial LP (Air Liquide US), or the replacement of all of their hydrogen filling hoses. The project included over 550, one-half inch x 14 feet convoluted high pressure metallic LifeGuard safety hoses.

Air Liquide's Requirements

Based in Houston, Texas, Air Liquide US specializes in the delivery of innovative gas solutions and technologies to a wide range of industries. In the fall of 2014, Air Liquide US made a request to replace all of their hydrogen filling hoses with LifeGuard Safety hoses with its internal shut-down system.

Hazards associated with handling gaseous hydrogen are fire, explosion, and pressure. Although hydrogen tends to dissipate quickly, its minimum ignition energy is extremely low, allowing relatively easy ignition of hydrogen mixtures in the flammable range. Hydrogen is easily ignited by open flames, electrical sparks and static electricity. It may also detonate and ignite when rapidly vented into the air. Burning with an almost invisible flame, severe burns can easily result from unknowingly walking into a hydrogen fire. A hose failure can literally be catastrophic.

Chad Laflin, P.E. Air Liquide US Industrial, Manager, Engineering Technologies, who was directly involved in the design and implementation of this project, comments, "Not only does this project display Air Liquide's commitment to safety — but it also represents a standard for safe hose design for the industry. Air Liquide strives to promote a high level of safety for our employees and customers as well as the entire industry."

Convoluted Stainless Steel Hose vs Other Tube Materials

Appropriate hose specifications for hydrogen gaseous service has been an area of debate for a considerable amount of time. There are two fundamental schools ETFE [a polymer whose source-based name is poly (ethene-co-tetrafluoroethene) and trade name is TEFZEL™] tube versus metallic tube.

The Case for ETFE

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 LifeGuard Technologies provides charts that will help determine velocity flow levels. Since hydrogen gas flow velocity is very high, it is argued that a smooth bore PTFE (polytetrafluoroethylene) or ETFE type hose is considered by some to be most appropriate. Metal inner core hoses have a velocity limitation of 100 feet per second (FPS) for a straight run, 50 FPS for a 90 degree bend, and 25 FPS for a 180 degree bend according to metal hose manufacturer's rules of thumb. Smooth bore hose are designed to handle higher velocity gas flow requirements.

The Case for Metallic Hose

Metal inner core hoses will not effuse or diffuse gas, that is, 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 one-third the effusion rate of a PTFE hose, so ETFE (or "post sintered") is the recommended inner core material for hydrogen and helium cylinder filling applications.

The Choice

In the end, the decision of which hose to use can be based upon either of these two independent and valid schools of thought. Air Liquide opted to use metallic hoses for the above mentioned reasons.

A long-standing global supplier of hoses to Air Liquide since 1992, LifeGuard provided 550+, one-half inch x 14 feet convoluted metallic hoses. Built to stand up to hazardous gases, like hydrogen, LifeGuard's metallic safety hoses utilize a patented and patent-pending design that 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, instantly "seat-stopping" the flow in both directions. Including delivery and installation, the project was successfully completed in the span of six months.

Andy Abrams, Executive Vice President for LifeGuard Technologies, commented on the project saying, "We have collaborated with Air Liquide on a global basis for more than 20 years because they have taken a highly progressive approach to safety. This project is consistent with their safety stewardship position in our industry." ■

Melanie Gogan is Editor of *Hose & Coupling World.*

Staying safe with hydrogen

LifeGuard Technologies explains the benefits of its ultra-high pressure ETFE hydrogen and helium transfer safety hose

By Molly Burgess

LifeGuard Technologies believes that significant enhancements to hose safety are achieved with the use of its ultra-high pressure ETFE hydrogen and helium transfer safety hose, released in January (2019).

The patent-depending 24,000 psi burst pressure ethylene tetrafluoroethylene (ETFE) tube, stainless steel braid hose assembly (¼ inch and ½ inch diameter), incorporates LifeGuard's patented safety hose technology for use with hydrogen and helium.

The global industrial safety hose manufacturer has more than 120 years of experience in the industrial gas and petrochemical industries having sold more than 400,000 safety hoses. LifeGuard Technologies has many strong supply relationships working together to develop safety solutions within in the industry, including with Tier One companies Air Liquide, Praxair and Linde. **gas**world spoke to LifeGuard Technologies' Executive Vice-President Andy Abrams to gain a deeper insight into LifeGuard Technologies and the Philadelphia-based company's product line.

"LifeGuard Technologies recognized the critical need to deliver a consistent product upon a global delivery platform. Following the aggregator model, LifeGuard Technologies has established joint ventures with highly qualified factories and maintains an ownership position in several of them, utilizing their infrastructure to manufacture its patented and patent pending design in a logistically advantageous but cost-effective manner," Abrams said.

"The new UHP ETFE hose offers the industrial hose and petrochemical industry an ultra-high-pressure functionality design with minimal effusion and flexibility that a polymer-based hose provides – all combined for the first time within the LifeGuard Safety Technologies' patented and patent pending internal shut-off system."

Hydrogen is one of the lightest gases, one liter of the gas weighs 90mg under normal atmospheric pressure, meaning it is 11 times lighter than the air we breathe. A volume of around 11m³ (the volume of the trunk of a large utility or commercial vehicle) is needed to store just 1kg of hydrogen, which is the quantity needed to drive 100km. "For this reason, its density must be increased by ultra-high-pressure storage in the gaseous form and safer form of transfer needed to be developed – the LifeGuard ultra-high pressure ETFE hose assembly is the safest form of transfer," Abrams said.

The LifeGuard safety hose incorporates a monel cable within the hose bore that is connected to the valve plungers, which acts as a compression spring of both ends of the hose providing thrust in each direction, with this the valves remain open.

Abrams added, "Should this thrust be eliminated due to coupling ejection, hose stretching or hose separation, the valves release and instantly seat, stopping the flow in both directions. The transfer of high-pressure gases and liquids remain the most vulnerable points in safe handling of the compressed gases. Hazards associated with the handling of gaseous hydrogen are fire, explosion, and pressure."

Hydrogen is easily ignited by open flames, electrical sparks and static electricity. The gas burns with an invisible flame, meaning, a worker may be unaware of a hydrogen fire. A hose failure can be disastrous, and the traditional hoses have no safety features.

"At a time when the industry across the globe is moving towards additional safety, LifeGuard Technologies provides customers with an opportunity to significantly lower their safety risks associated with the unloading operations of the product at a nominal incremental cost and thus build a compelling case for adoption to add an extra layer of safety to all," Abrams told **gas**world.

"The company has hoses that are manufactured worldwide in all in industries and applications. Its long history and reputation for innovation has fostered acceptance, and the company continues to play a key role in establishing safety protocols for its customers."

LifeGuard Technologies currently has manufacturing facilities in Bethlehem in Pennsylvania, Sweden, India, Canada, Australia and sales offices in Egypt and now in Brazil.

All facilities are ISO 9000 approved and Sweden, India, and the US have been approved by Air Liquide and Praxair.

CASE STUDY: LifeGuard supplies hydrogen filling hoses to Air Liquide Industrial U.S. LP

The advantages of passive hose safety technology combined with convoluted stainless steel hose, in hydrogen service

By Melanie Gogan, Editor, Hose & Coupling World

LifeGuard safety hose with "valve block" technology

LifeGuard Technologies, a company specializing in safety hose technology, with North American headquarters in Newtown Square, Pennsylvania, recently completed a project for Air Liquide Industrial U.S. LP, for the replacement of all of their hydrogen filling hoses. The project included over 550, 1/2 inch. x 14 ft. convoluted high pressure metallic LifeGuard safety hoses.

Air Liquide's requirements

Based in Houston, Texas, Air Liquide delivers innovative gas solutions and technologies to a wide range of industries, including energy, chemicals, pharmaceuticals, food and beverage, metal fabrication, manufacturing, material handling, laboratories and research, aeronautics and space. In 2015 Air Liquide made a request to replace all of their hydrogen filling hoses with LifeGuard Safety hoses with their internal shutdown system.

Hazards associated with handling gaseous hydrogen are fire, explosion and pressure. Although hydrogen tends to dissipate quickly, its minimum ignition energy is extremely low, allowing relatively easy ignition of hydrogen mixtures in the flammable range. Hydrogen is easily ignited by open flames, electrical sparks and static electricity. It may also detonate and ignite when rapidly vented into the air. Burning with an almost invisible flame, severe burns can easily result from unknowingly walking into a hydrogen fire. A hose failure can literally be catastrophic.

Chad Laflin, P.E. Air Liquide Industrial U.S. LP, Manager, Engineering Technologies, who was directly involved in the design and implementation of this project, commented: "Not only does this project display Air Liquide's commitment to safety – but it also shows competitors and customers our standard for this application. Eventually, it may entice movement to adopt a similar standard of improving safety across the industry."

"Not only does this project display Air Liquide's commitment to safety – but it also shows competitors and customers our standard for this application. Eventually, it may entice movement to adopt a similar standard of improving safety across the industry."

- Chad Laflin, P.E. Air Liquide Industrial U.S. LP, Manager, Engineering Technologies

The safety advantage

A long-standing global supplier of hoses to Air Liquide since 1992, LifeGuard provided more than 550, ½ inch. x 14 ft. convoluted metallic hoses. Built to stand up to hazardous gases, like hydrogen, LifeGuard's metallic safety hoses are unique in that they utilize a patented and patent-pending design that 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, instantly "seat-stopping" the flow in both directions.

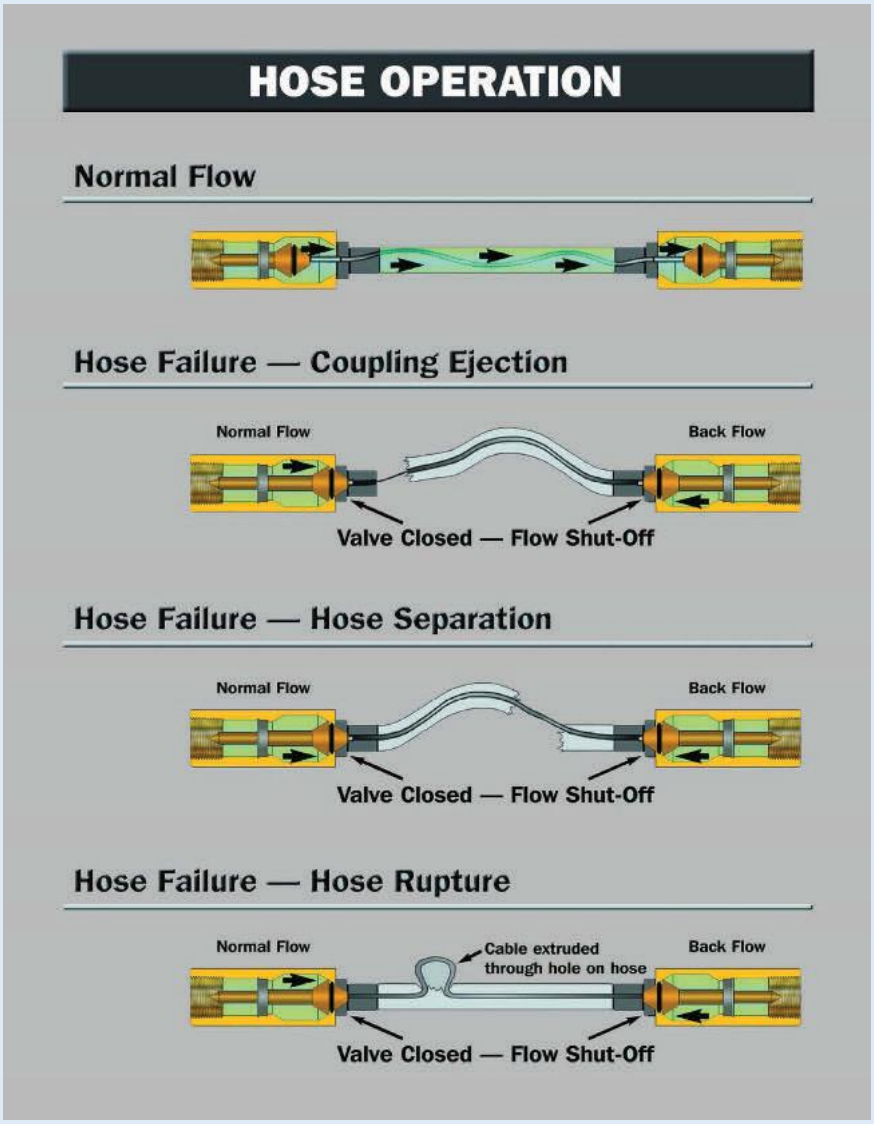


Diagram: LifeGuard safety feature in the event of hose failure

The choice of convoluted stainless steel hose vs other tube materials

Appropriate hose specifications for hydrogen gaseous service has been an area of debate for a considerable amount of time, according to Andy Abrams, Executive Vice President of LifeGuard Technologies. There are two fundamental schools of thought, Abrams elaborates: ethylene-tetrafluoroethylene (ETFE) or polytetrafluoroethylene (PTFE) tube versus metallic tube.

The case for ETFE or PTFE

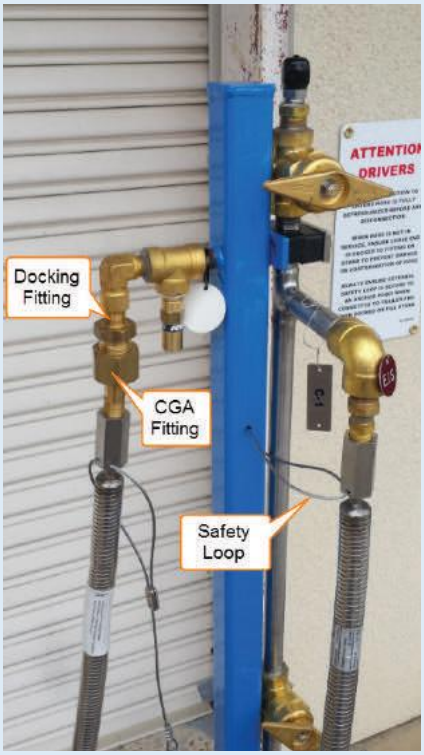
One of the most common causes of metal hose failure is "high velocity" gas flow. Because of the ribs on the corrugated type hose, high velocity flow (above recommended levels) can damage or crack a metal type hose. To avoid hose damage, it is important to know the velocity of gas flowing through the hose. Since hydrogen gas flow velocity is very high, it can be argued that a smooth bore ETFE or PTFE type hose is most appropriate. Metal inner core hoses have a velocity limitation of 100 feet per second (fps) for a straight run, 50 fps for a 90 degree bend, and 25 fps for a 180 degree bend, according to metal hose manufacturers' rules of thumb. Smooth bore hose are designed to handle higher velocity gas flow requirements.

The case for metallic hose

Metal inner core hoses will not effuse or diffuse gas. In effect, they have zero permeation. This is why they are often preferred for high purity and hazardous specialty gases, including hydrogen and helium when in constant pressurized applications. 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.

In the end, the decision of what hose to use can be based upon these two independent and valid schools of thought. Air Liquide opted to use metallic hoses, to ensure zero effusion or diffusion of gas, while maintaining recommended flow levels. Including delivery and installation, the project was successfully completed in the span of six months.

Andy Abrams, Executive Vice President for LifeGuard Technologies commented on the project: "We have collaborated with Air Liquide on a global basis for more than 20 years because they have taken a highly progressive approach to safety. This project is consistent with their safety stewardship position in our industry."



LifeGuard convoluted stainless steel hose installation at Air Liquide facility

LifeGuard Technologies introduces ultra-high pressure ETFE hydrogen and helium transfer safety hose

By Molly Burgess | 10 January 2019

LifeGuard Technologies has introduced and filed for patent protection for a new multi-diameter 24,000 psi burst pressure ethylene tetrafluoroethylene (ETFE) tube, stainless steel braid hose assembly (1/4" and ½" dia) incorporating LifeGuard's patented safety hose technology for use with hydrogen and helium.

The new hose offers the industrial hose and petrochemical industry a first combining ultra-high-pressure functionality with the minimal effusion and flexibility that a polymer-based hose provides.

Hydrogen is the lightest gas and a volume of around 11m^3 (the volume of the boot of a large utility or commercial vehicle) is needed to store 1kg of hydrogen, the quantity needed to drive 100km, meaning its density must be increased by ultra-high-pressure storage in the gaseous form and safer forms of transfer must be developed. The LifeGuard Ultra-High pressure ETFE hose assembly offers a safe form of transfer.

"This LifeGuard Safety hose is designed to withstand constant pressure of up to 8000psi and burnt in excess of 24,000psi," said Joseph Abrams, Director of Engineering Emeritus.

"The combination of the ultra-high-pressure capabilities, its superior non-effusion internal tube and combination with our internal LifeGuard Safety technology gives the user an important new option as our industry migrates to much higher working pressure for hydrogen and helium," Abrams continued.

Pennsylvania-based LifeGuard Technologies manufactures its hoses in the USA, Canada, Sweden, India and Australia.