



*Proper Hose Use, Care,
and Maintenance*

Duty to Warn

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Smart-Hose Technologies has implemented a quality policy to supply our customers with the safest hose assembly on the market. Consistent with this policy **Smart-Hose Technologies** has prepared this Technical Booklet to assist our customers and users of Smart-Hose assemblies with information regarding the proper use, care and maintenance of our Smart-Hose Assemblies. This booklet also addresses Smart-Hose Technologies' "Duty to Warn" responsibility regarding misuse of these products.

The Information Contained in this booklet is intended as a guide and does not supersede applicable Company, Local or Regional Standards. It is the responsibility of the end user to use the Smart-Hose assembly in a safe manner appropriate to the application and industrial regulations that apply.



Introduction

General Instructions for Hose Use, Care and Maintenance

This Technical Booklet is intended solely for the use of Smart-Hose Technologies' customers and is intended as a guide for the Use, Care and Maintenance of Smart-Hose Assemblies.

Smart-Hose Technologies has developed this Technical Booklet to address the issues relating to the proper use, care and maintenance of a Smart-Hose assemblies. **This information is available to all customers and representatives who sell or use Smart-Hose assemblies.**

Hoses are used as a flexible connection to convey hazardous and/or high pressure products from one container to another. They are routinely handled by people in a dynamic work environment. As a result, the hose assembly represents the weak link in any transfer operation and is a serious safety hazard!

The Smart-Hose safety system adds an additional layer of protection directly inside the hose assembly, protecting the end user at the weakest link.

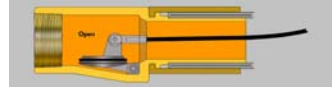
Most hose assemblies are designed and engineered for very specific application requirements and are not interchangeable with other applications. Human error is often the greatest risk when working with hose assemblies, therefore, it is important that all companies, that use hose assemblies on a day-to-day basis, implement a hose safety program for their employees.

Should you have any questions on any topic covered in this Booklet, contact **Smart-Hose Technologies** at phone # (215) 730-9000.

Smart-Hose Operating Instructions



LL1 Valve Design



LL3 Valve Design

Smart-Hose Technologies manufactures the safest hose assembly in the world. Our Smart-Hose Safety system provides an additional layer of protection inside the weakest link, the hose assembly. The Smart-Hose Safety System may be configured with either the LL1 valve or the LL2 valve, which are integrated into each end fitting.

For the safe operations of your Smart-Hose assembly follow the simple instructions listed below:

- Personnel must always wear appropriate personal safety gear when handling any hose. (Example – Goggles, protective clothing, hard hat, etc.)
- When attaching special end connectors or couplings to the NPT threads on the Smarthose End Fittings, always use a **back-up wrench** on the body of the coupling. **Never put the back-up wrench on the ferrule.** (see sample picture page 8).
- Always use Teflon tape or thread compound to seal the NPT threads. **Take care not to over tighten.** If a good seal can not be made within 4-5 turns from the start of the thread, then disassemble the joint and correct the source of the leak.
- Do not use the assembly if the Smarthose End Fittings are cracked, badly worn or dented.
- Inspect the assembly prior to each use. Look for damage to the hose or end connections in accordance with this booklet and any other applicable regulations.
- **Smart-Hose assemblies may contract up to 3% at working pressure.** Always provide enough slack in the hose assembly so that the hose does not pull taught during pressurization. This will prevent excessive stress on the hose assembly that could result in premature hose failure.
- If a Smart-Hose assembly “Checks”, reduces or stops the flow of product, remove it from service and contact Smart-Hose for instructions.

In the event Smart-Hose has shut off the flow of product, the operator should immediately implement all safety procedures to include shutting off the pumping systems associated with this operation.

- When a catastrophic hose failure has occurred, a Smart-Hose will shut off the flow of product from both ends simultaneously. As a result, pressure will be contained between the Smarthose end fittings and the piping system. **This pressure MUST be released before the Smarthose end fittings can be removed.** Follow appropriate procedures and regulations for releasing this pressure prior to removing the Smarthose End Fittings.
- **Smart-Hose Rebuild Program:** When the hose is worn and needs replacement, contact Smart-Hose. You will be instructed to cut the hose 12" from the end of the fittings, remove all chemical residue and return the fittings to an authorized Smart-Hose coupling facility. Smart-Hose will attach the old fittings to a new hose, test and certify the completed assembly at **significant cost savings.**
- **When using a hose, always error on the side of safety –**
“When in doubt remove from service”
- **Never disassemble** any part of the Smart-Hose safety assembly. This will cause the assembly to not work properly and will void any warranties.
- LL1 , 1" & 1 1/4" couplings have a threaded 1/4" NPT port. This port permits the installation of industry required bleeder valve for NH3 applications. **Do not remove this plug if the hose is full of product and do not bleed pressure from this port if a bleeder valve is not installed.**
- When measuring a Smart-Hose for a specific installation, it is important to remember that the tangent point for hose bending is at the end of the hose barb portion behind the Smarthose End Fitting fitting :
(Add 6" to dimension A shown on page 23 for the ID hose used).
It is important to always keep the bend radius within the Smart-Hose bend radius recommendations (see product Eng. Data Sheets).
- If the hose used in potential pull away application, the piping system should buttressed to resist the following loads:

1/2" ID hose - 4,500 lbs	2" ID hose - 24,000 lbs
3/4" ID hose - 5,500 lbs	3" ID hose - 34,000 lbs
1" ID hose - 7,000 lbs	4" ID hose - 44,000 lbs
1-1/4" ID hose - 16,000 lbs	6" ID hose - 56,000 lbs
1-1/2" ID hose - 20,000 lbs	
- In the case of a pull-away accident, the pull force can be greatly reduced if the **hose port is configured at 45° or 90° angle to the direction of pull.**

S·T·A·M·P·E·D

- S Size.....** Hose ID X Assembly length
(i.e. 3" x 10 ft Long)
- T Temperature.....** Maximum temperature of the product conveyed through the hose assembly or the environmental temperature range. (i.e. 200 °F or -40 °F to 120 °F)
- A Application.....** Describe the actual use of the hose (i.e. Ship to Shore unloading, LPG transfer, in plant chemical use, etc.)
- M Material.....** Define the product or material that is to be conveyed through the hose assembly. Be Specific.
- P Pressure.....** The maximum pressure or vacuum at which the material is being conveyed through the hose assembly.(i.e. -25 psi to +100 psi).
- E Ends.....** Type of end connections or adapters required for your specific application. (i.e. FNPT, BSPT, BSPP, Cam & Groove, Acme swivel, CGA 580, etc).
- D Delivery.....** Date the product is required on site.
(i.e. June 6, 2011).

Once the information in the acronym "STAMPED" referenced above is obtained, it is essential that a hose and coupling combination meet all of the "STAMPED" requirements as recommended by Smart-Hose and the hose manufacturer. **"Always use the printed information from Smart-Hose and the hose manufacturer to insure accuracy of any recommendation."** Do not exceed the printed, recommended service criteria.

***Only Smart-Hose assemblies rebuilt with Smart-Hose components can meet the requirements of a "Certified Assembly"**

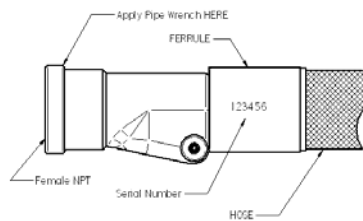
The ABC's of Hose Safety:

1. **Working Pressure (WP)** should never be exceeded. Never leave liquids or gasses trapped in a hose with both ends sealed unless a means for pressure relief is provided. Expansion of some products may cause pressures to exceed working pressure.
2. **Hose Assembly Working Pressure** is defined by the WP of the lowest rated component. (Hose WP or coupling WP which ever is lowest).
3. **Application:** Only use the hose assembly for the service marked on the hose or for the service recommended in the printed literature.
4. **Hose Inspection:** A visual inspection should be made by the operator each time the hose is being placed into service. The operator should visually inspect the hose assembly for excess wear, corroded couplings or any other unsafe condition. If visual defects are found, the hose should be removed from service.
5. **Hose Assembly Testing Procedures:** Smart-Hose assemblies should be inspected and tested in the same manner as a non-Smarthose. Please follow the hose testing procedures indicated by the application or industry related standards. (RMA, ASTM D-380, OSHA, NFPA, LPGA or other regulatory agency).
6. **Education:** All operators need to be educated on the dangers of hose assemblies and hose assembly inspection procedures. The operator represents the last line of defense against spills and injuries associated with catastrophic hose failures.
7. **Chemical Resistant Charts:** Always use appropriate Chemical Resistance Charts to verify that the chemical or product conveyed by the hose is compatible with the hose tube and alloy of the coupling. *"Remember, the temperature and concentration of a chemical / product conveyed must not exceed the manufacturer's recommendations."* It is recommended to always flush out chemicals from a hose after use. In some cases the hose and couplings may handle high concentrations, but low concentrations can cause damage. It is also recommended to cap the hose ends to prevent the atmosphere and moisture from entering the hose.

8. **Alloy Chemical Resistant:** Always use a coupling made from material suitable for the product being conveyed. (Refer to an Alloy/Chemical resistant chart)
9. **Visual Crimp Inspection:** Before each use, always check the coupling for slippage, misalignment of the End Fitting, exposed cover from under the ferrule or a bulge in the hose cover close the ferrule. If there are questions contact Smart-Hose at (215) 730-9000
10. **Excessive Wear Pumping Applications:** In many tank truck loading & unloading applications, excessive wear to the exterior cover of the hose can be caused from the pulsations created from the pump. In these applications it is important that the operator is made aware of the potential damage to the hose and inspects the hose before each use; checking for cutting, gouging and abrasion of the exterior cover that penetrates into the reinforcement.

For an additional cost, your Smart-Hose can be ordered with **Scuff-Guard**. Scuff-Guard is a HDPE wrap which is designed to protect the exterior cover of the hose for high abrasion applications. When the Scuff-Guard becomes worn excessively, the hose should be removed from service and scuff-guard replaced.

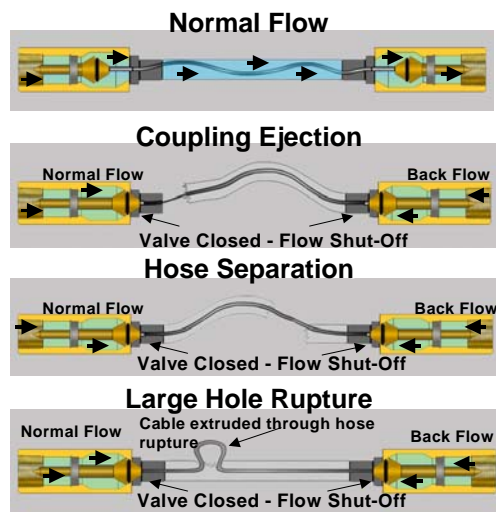
2. **Smart-Hose Limitations:** Smart-Hose assemblies should not be used while on a hose reel or in a coiled condition, as this could prevent the valves from functioning properly. Always use the hose laid out as straight as possible. If necessary, the hose can be laid out in a gentle S or U configuration as shown below.



Smart-Hose End Fitting

Unique Features of a Smart-Hose Assembly

Smart-Hose Technologies produces the world's only industrial hose assembly that is engineered with internal valves integrated in each end fitting. If the hose assembly experiences a catastrophic hose failure (ie. coupling ejection, hose separation or excessive hose stretching) the Smart-Hose Safety System will instantaneously shut down the flow in both directions. **If the hose ruptures the cable must extrude out of the hose for the Smart-Hose System to engage.** Remember Smart-Hose does not protect against small leaks or a hose rupture that is not large enough to allow the cable to extrude out of the hose.



Smart-Hose is not a leak protector, but in the event of a hose rupture, if the hole is large enough, and the reinforcement permits the cable to extrude through the hole, the system will shut off the flow.

Characteristics that are different with Smart-Hose!

1. Smart-Hose may contract (shrink in length) up to 3% when pressurized to working pressure. Take this movement in to consideration when installing the hose.
2. Smart-Hose assemblies have a cable axially compressed into the bore of the hose. This cable causes the hose to have a wavy appearance (it will not lay out in a straight line).
3. The cable inside the hose is designed to align itself with the hose as the hose is moved you may hear a clicking or snapping sound as the cable shifts inside the hose.
4. Smart-Hose should not be used in applications that convey material that may impede the Smart-Hose valve from closing, such as abrasive or granular materials or materials that harden or solidify.

General Instructions for Smart-Hose and Coupling Inspection

(Information obtained from RMA Hose Handbook IP-2 [1987]&
National Propane Gas Association Flyer# 114-91 & # 134-81)

All Smart-Hose assemblies should be visually inspected by the operator prior to each use. Visually inspect for excessive wear, corroded couplings or any other unsafe condition. All hoses that fail the visual inspection should be removed from service.

All Smart-Hose assemblies should be tested to the RMA, ASTM D-380, OSHA, NFPA, LPGA or other regulatory agency recommendation for hose testing procedures (or to the applicable industrial standard.)

	Inspect For:	Corrective Action:
1	Look for cuts, gouges, or worn spots in the hose cover that expose textile or wire reinforcement	Remove hose from service. Contact and Smart-Hose for repair instructions.
2	Inspect for soft spots, bulges in cover, section of mashed or flattened hose or kinked areas.	Remove hose from service. Contact and Smart-Hose for repair instructions.
3	Carefully examine the length of the hose approximately 18" adjacent to where the coupling is attached, for any damage such as kinks, soft spots, cover cracks, or permanent deformation of the hose from its original form.	Remove hose from service. Contact and Smart-Hose for repair instructions.
4	Check couplings for any slippage or evidence of misalignment of the coupling or scored/exposed areas on the hose cover next to the coupling which might indicate movement of the coupling.	Remove hose from service. Contact and Smart-Hose for repair instructions.
5	Check for the cable or valve protruding from the end coupling. This is evidence that the hose has been stretched & damaged.	Remove hose from service. Contact and Smart-Hose for repair instructions.

	Inspect For:	Corrective Action:
6	Inspect Smarthose End Fittings for worn threads, damaged O-rings, and broken or missing components (ie. snap-ring, valve, retainer, O-ring seals, hinge pin or plugs).	Remove hose from service. Contact and Smart-Hose for repair instructions. .Never disassemble the Smarthose End Fittings or attempt to reassemble in the field.
7	Inspect for hose cover blisters or loose outer cover. This may indicate that conveyed product has breached the hose tube.	Remove hose from service. Contact and Smart-Hose for repair instructions.
8	<p>Inspect the inside of each End Fitting. (Some attached couplers or adapters may have to be removed from the end fitting to allow access for inspection.)</p> <p><u>LL1 End Fitting</u> can be checked by using a blunt probe and press inward on the valve stem. The valve stem should move inward and spring back into place with a positive spring pressure.</p> <p><u>LL3 End Fitting</u> can be checked by using a flat tip screw driver. Place the tip under the flapper valve pry up on the valve. The valve should move upward and spring back into place with a positive spring pressure. Take care not to damage the Teflon O-ring.</p>	In both cases the valve should move freely and spring back to the open position. If the Valves are frozen or do not spring back to the open position then, remove hose from service. Contact Smart-Hose for repair instructions.
9	Before using the hose, look down the inside of the Smarthose End Fitting for any blockages or foreign objects lodged in the end fitting.	Remove any blockages or foreign objects prior to using the hose. Never disassemble the Smarthose End Fittings. Contact and Smart-Hose for repair instructions.
10	Inspect the exterior of the Smarthose End Fittings for any unusual wear and tear that may prevent normal function; worn threads, excessive corrosion/rust, cracks or severe abrasion that thins the wall thickness of the Smarthose End Fitting.	Remove hose from service. Contact and Smart-Hose for repair instructions.

General Instructions for Hose Hydrostatic Testing and Inspection

(Information obtained from RMA Hose handbook IP-2 [1987])

All Smart-Hose assemblies should be tested to the RMA, ASTM D-380, OSHA, NFPA, LPGA or other regulatory agency recommendation for hose testing procedures. Use the agency recommendation that directly relate to your specific industry.

A visual inspection of hose as described previously should be made for loose cover, kinks, bulges, and soft spots which might indicate broken or displaced reinforcement. The couplings (or fittings) should be closely examined and, if there is any sign of movement of the hose from the couplings, the hose must be removed from service.

When recommended by the governing agency or association, periodic hydrostatic testing should be completed. During the hydrostatic test, the hose should be straight, not coiled or in a kinked position. Pressurize the hose to the working pressure and hold for 3 to 5 minutes. After a visual inspection and confirmation that the hose is not leaking and the fittings are secure, the hydrostatic test pressure should be increased to 1.5 times the working pressure. Hold for 5 minutes, and complete a visual inspection to confirm the integrity of the hose assembly. For additional info follow the RMA hose testing guidelines.

Hose Testing Safety Warning:

Before conducting any pressure tests on a hose, provisions must be taken to ensure the safety of personnel performing the test and to prevent any possible damage to property. Only trained personnel using proper tools and procedures should conduct any pressure test.

1. Air or other compressed gases should not be used for pressure testing used hose assemblies in the field.
2. Hydro testing with water is the recommended field test method.
3. First, fill the hose with water and be sure to removed ALL air from the hose prior to starting the test by bleeding it through an outlet valve attached to one end of the hose.
4. Restrain the hose that is being pressurized, but DO NOT Crush the hose. Place firmly anchored steel bars or strap on each end, supported above the hose at 2-4ft. intervals to limit hose "whipping" if failure occurs. It is normal for the hose to move slightly as the pressure is applied, so any restraints should allow for this movement.
5. The outlet ends of the hose should be placed so that a coupling ejection will be restrained by a wall, sand bags, etc.
6. Provision must be made to protect test personnel from the forces of the pressurized media if a failure occurs.
7. Testing personnel must never stand in front or in back of the ends of a hose being pressure tested. Personnel must be protected or removed from the area during the pressure test.

General Instructions for Proper Rubber Hose Storage

(Information obtained from RMA Hose Handbook IP-2[1987])

Rubber hose products in storage can be affected adversely by temperatures, humidity, ozone, sunlight, oils, solvents, corrosive liquids and fumes, insects, rodents and radioactive materials.

The appropriate method for storing hose depends to a great extent on its size (diameter and length), the quantity to be stored and the way in which it is packaged. Hose should not be piled or stacked to such an extent that the weight of the stack creates distortions on the hose lengths stored at the bottom. Since hose products vary considerably in size, weight and length, it is not practical to establish definite recommendations on this point. Hose shipped in coils or bales should be stored so that the coils are in a horizontal plane.

Whenever feasible, rubber hose products should be stored in their original shipping containers, especially when such containers are wooden crates or cardboard cartons which provide some protection against the deteriorating effects of oil, solvents and corrosive liquids; shipping containers also afford some protection against sunlight and ozone.

The ideal temperature for storage of hose products ranges from 50–70 degrees F (10-21 degrees C) with a maximum of 100 degrees (38 degrees C). If stored below 32 degrees F (0 degrees C) some products will become stiff and will require warming before bending or being put into service. Rubber product should not be stored near sources of heat, such as radiators, heaters etc. Nor should they be stored under conditions of high or low humidity.

To avoid the effect of ozone, rubber should not be stored near electrical equipment that may generate ozone. Direct or reflected sunlight even through windows should be avoided. Florescent or mercury vapor lamps will create light waves harmful to rubber hose. Protection from such lighting should be provided.

Hoses should always be stored on a first in first out basis. Many Rubber compounds will deteriorated or age over time and have a limited shelf life. Refer to the date code or expiration information embossed in the hose cover.

Do's and Don'ts of Hose Care and Use

Hose assemblies represent the weak link in any transfer operation. **All hose assemblies have one thing in common, in time they will all fail!** Improper storage, abuse, and miss-application can significantly reduce the operational life of any hose assembly.

Smart-Hose Technologies recommends the following hose assembly ordering, handling and maintenance tips to improve hose assembly safety, functionality and extend the useful life of your hose assembly.

Hose Care and Maintenance DO's

- Do** – Use hose designed and recommended for the service intended. Contact Smart-Hose, and our staff will assist you in the selection of the best hose product for your requirements.
- Do** – Make sure the hose is easily identifiable, and can NOT be used in the wrong application. Where the possibility exists for a hose to be used for the wrong application, use different fittings or adapters to prevent cross connections.
- Do** – Make sure your Smart-Hose is the correct length for the job intended. Remember to allow for up to 3% contraction at max working pressure on Smart-Hose assemblies.
- Do** – Set up regular hose inspections before each use so that damaged or worn hose assemblies can be identified and replaced.
- Do** – Attach hose using proper elbows and nipples, so that the unsupported weight of the hose (including the weight of the product and end connections etc.) will not cause it to bend sharply at the coupling. Support hose ends with heavy couplings attached.
- Do** – Avoid horizontal ports when possible.
- Do** – Avoid subjecting hose to damage by vehicles, falling rocks, or other objects.
- Do** – Install protective covers on hose.
- Do** – Check hose & coupling manufacturer's chemical resistant charts to insure the hose is recommended for the specific transfer operation before ordering or placing into service.
- Do** – Store hose in a cool, dry, dark and clean place.
- Do** – Wear safety clothing, gloves, boots, hard hat and eye protection when using a hose with chemicals or compressed gas.

Do – Pressure Test hoses every six (6) months or as recommended by the applicable industrial standard or regulating agency related to the specific hose application.

Do – Educate all employees on how to inspect each hose before each use to insure it is safe. Teach employees to “Error on the side of safety!” “**When in doubt, remove the hose from service!**”

Do – Store hose in a flat coils. Be sure the hose is not kinked. Store the coil on the floor, on a shelf or table, or on a hose hanger. Long lengths are best stored on a hose reel.

Do – Protect all hoses from the effects of ozone. Store away from electrical or ozone producing equipment. Paper, wood and rags are good ozone absorbers.

Hose Care and Maintenance Don'ts

Don't – Use the Smart-Hose safety systems in applications that convey abrasive materials or material that will harden or clog the Smarthose Safety System.

Don't – Crush or kink hose. Avoid repeated bending which may eventually break the reinforcement of the hose leading to a rupture.

Don't – Substitute hose types. All hoses are not created equal. Consult Smarthose or your hose supplier for the correct recommendations for your application.

Don't – Use a hose if any of the reinforcement is exposed through the cover due to cuts, gouges or prolonged use.

Don't – Exceed the working pressure of the hose for any reason (including pressure spikes or transients).

Don't – Use damaged or worn fittings. Check to see if the coupling is loose or has moved, has worn threads, worn gasket or is corroded. Periodic hydrostatic testing will help to verify the integrity of the hose assembly.

Don't – Store hose after use without rinsing & draining if it carried substances that can ultimately deteriorate the hose tube over time. It is “Best Practice” to cap hose ends to prevent atmosphere and moisture from entering the hose bore and to prevent product from dripping out of hose ends.

Don't – Use a hose outside its recommended temperature limits.

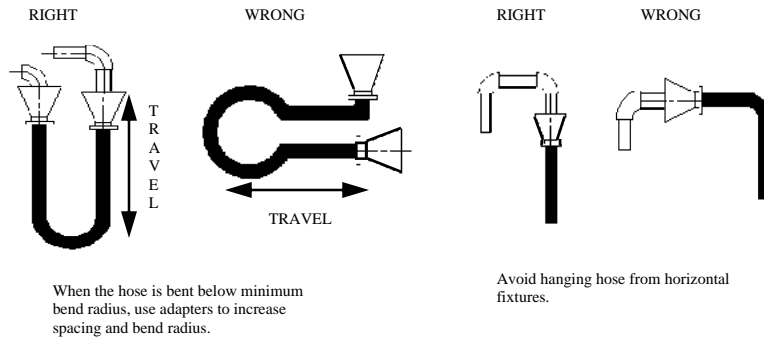
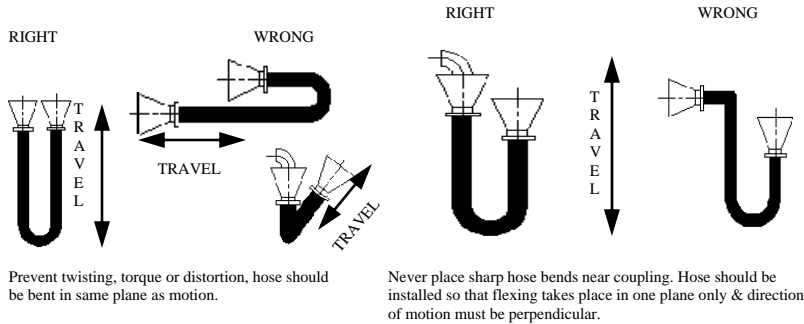
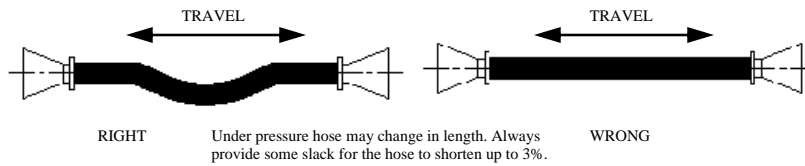
Don't – Use a Smarthose while it is partially stored on a hose reel

***LPG Hose is not recommended for propylene applications.**

Smart-Hose Installation Recommendations

The Smart-Hose Safety System performance depends upon proper hose installation. Excessive length can add unnecessary stress to the Smart-hose assembly which can cause the hose to exceed the maximum bend radius recommendations which can lead to reduced service life. Smart-Hose assemblies of insufficient length may cause coupling ejection or over stress the hose causing short service life (Smart-Hose assemblies can shrink up to 3% when pressurized).

The diagrams below offer suggestions for proper Smart-hose installation (for other configurations contact Smart-Hose Technologies).

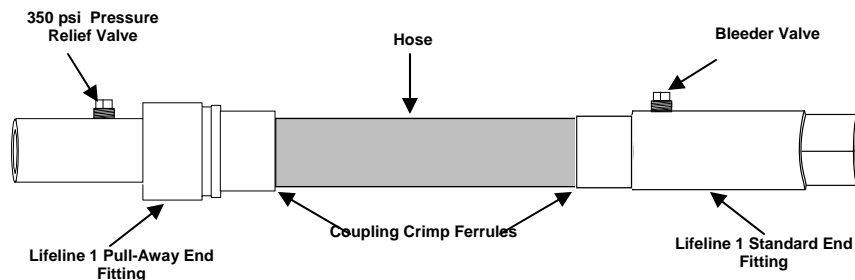


Special Product Instructions

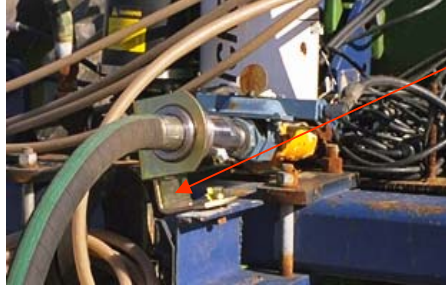
Anhydrous Ammonia Nurse Tank Operating Instructions

Your NH₃ Smart-Hose may be a standard LL1 style hose or a Smart-Hose with a built in pull-away. Both hose types perform similarly, but your Smart-Hose pull-away has a pre-engineered lower pull-away force designed into the special LL1 breakaway end.

(Follow RMA Hose Technical Bulletin (IP-11-2) for use, maintenance, testing & inspection of NH₃ hose.)



1. Your Smart-Hose has a 1/4" NPT hole drilled & tapped in each LL1 End Fitting. These ports are provided for the installation of Pressure relief valves and bleeders as shown in the figure above
2. Installation for Applicators (Toolbars)
 - Close all valves, wear appropriate safety items, gloves, goggles, face shield, etc.
 - Install or use industry standard mounting plate on frame of the tool bar / applicator (Lifeline 1 Pull-away will fit other standard mounting brackets with a 2 1/2" hole). Make sure all bolts are tight, if bracket is damaged, replace it with a new one.
 - Feed Smart-Hose Standard End Fitting through the bracket until the Collar of the Pull-away End Fitting is fully inserted into the 2 1/2" hole. Secure the Collar with the snap ring provided.
 - Connect hose from meter etc. to Smart-Hose Pull-away End Fitting and connect the other end of the hose to the nurse tank.



Industry Standard
Mounting Bracket

3. **For Nurse Tanks**
 - Close all valves, wear appropriate safety items; gloves, goggles, face shield, etc.
 - Attach Acme adapters to Smart-Hose End Fittings securely, use wrenches etc. **DO NOT USE WRENCH ON COUPLING FERRULE OR HOSE.**
 - Attach Smart-Hose using Acme adapters to the liquid withdrawal valve on the nurse tank. Acme adapters or schedule 80 pipe nipples may also be used as required.
4. **FOR NURSE TANK FILLING RISERS:** The Smart Hose pull-away assembly is not recommended for use on riser installations.
5. *In the event your Smart-Hose Pull-away has been activated and has shut-off product flow, do the following:*
 - Before attempting any inspection or repair put on all appropriate personal safety gear!
 - 1) Shutoff all valves leading to the Smart-Hose—upstream and downstream of the hose assembly.
 - 2) Bleed off any pressure that might be trapped in the piping and hose couplings.
 - 3) Use extreme caution when removing the Smart-Hose assembly from the piping. **ALWAYS LOOSEN THE SMARTHOSE END FITTINGS SLOWLY FROM THE PIPING — THERE COULD BE IN PRESSURE REMAINING IN THE PIPING FEEDING THE SMARTHOSE END FITTINGS AND NH₃ COULD SPRAY ONTO THE OPERATOR AS THE END FITTINGS ARE REMOVED.**
6. **NOTE:** *Standard Smart-Hose with ONLY Lifeline 1 couplings (no breakaway) must be attached to piping structures able to sustain the load factors listed on **PAGE 5** of this pamphlet.*

Smart-Hose Metal Hose Care & Use

Smart-Hose Technologies can offer an additional layer of protection in transfer applications that demand a metal hose assembly. The selection of a flexible metal Smart-Hose for a particular application is influenced by six primary considerations;

1. Temperature
2. Pressure
3. Media
4. Size
5. End Fitting
6. Motion

All safety and maintenance procedures that apply to rubber hose assemblies, also apply to metal hose assemblies. A visual inspection of the hose should be made before each use. If the metal hose assemblies have external metal braids that are broken it should be pulled out of service. All Smart-Hose assemblies should be tested to the RMA, ASTM D-380, OSHA, NFPA, LPGA or other regulatory agency recommendations for hose testing procedures (or to the applicable industrial standard.)

Key Elements to Safe Metal Hose Use

1. Make sure that the media conveyed is suitable for the metal hose tube by consulting the appropriate chemical resistant charts
2. Make sure that the external metal braid for the hose is compatible with the environment that the hose will be operating in.
3. Specific chemical concentrations must be noted to confirm compatibility. Always use best practice by not leaving chemicals in the metal hose, flush & clean hoses before storing.
4. Always cap the ends of chemical hose after use.
5. Metal hose should not be dragged or abused externally. If the braid becomes damaged (broken wires) the hose must be retired from service.
6. Metal hose assemblies utilize a corrugated metal tube. Abrasive materials should not be transferred through a metal hose as this will cause a metal hose assembly to fail prematurely.
7. All Metal hose should be tested to the RMA, ASTM D-380, OSHA, NFPA, LPGA or other regulatory agency recommendations for hose testing procedures (or to applicable industrial standards.)

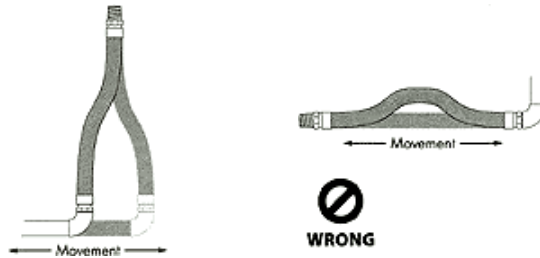
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Metal Hose Care & Use Cont.

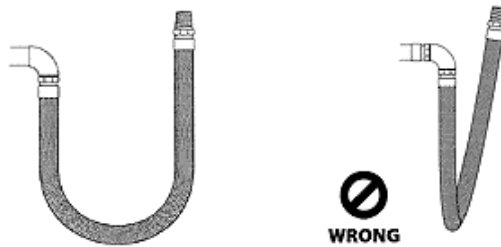
6. Never install a metal hose so that torque is applied to the hose. Use a swivel adapter whenever that application may apply a torque to the hose assembly. Contact Smart-Hose for available Swivel adapters.



7. Do not compress or extend metal hose axially. Metal hose installed in-line with the longitudinal axis of the piping should not be subject to axial movement.

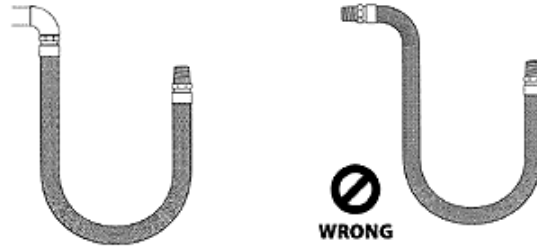


11. Flexing a metal hose in two separate planes of movement will torque the hose assembly. Always install the metal hose so that flexing occurs in one plane or install with a swivel adapter attached to one end

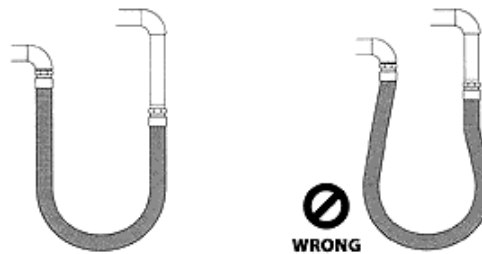


Metal Hose Care & Use Cont.

12. Avoid sharp bends when installing metal hose. Stay within the bend radius recommendation of the metal hose to eliminate damage to the hose and premature failure.



13. Maintain a Minimum centerline bend radius. The centerline bend radius must stay within the bend radius recommendation of the metal hose to eliminate damage to the hose and premature failure.



15. The operating temperature of a metal hose may effect the type of hose assembly required. Always specify the normal temperature vs. max operating temperature when ordering metal hose assemblies.

Cleaning Tips for Smart-Hose

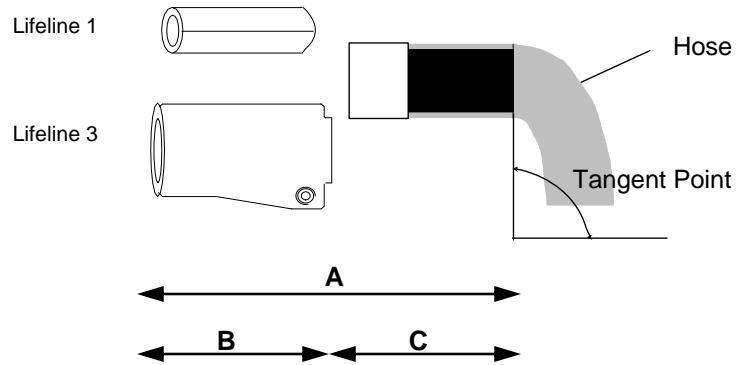
In many hose applications it is “Best Practice” to clean the hose after each use. To prevent:

1. Long term effects of potentially hazardous chemicals from damaging hose & couplings
2. Cross contamination of product
3. Accidental spillage from chemical residue left in the hose.

This process is typically accomplished by flushing the interior of the hose with water or a cleaning solution. Cleaning procedures will differ by industry but should at least include the below Smart-Hose recommendations:

- All staff must wear personnel protective gear, i.e. eye protection & hard hat, gloves, protective clothing, etc.
- Cleaning solutions must be compatible with the hose tube & couplings.
- All material flushed along with the cleaning solution must be processed in accordance with EPA requirements.
- Never insert cleaning devices in to the ID of a Smart-Hose, such as brushes, steam wands etc.
- The use of open end, low pressure steam (200° F or less) can be use to clean Smart-Hose.
- To insure no residue is left in the coupling, care should be taken to permit fluid in the valve area of the coupling to drain. Hose ends can be held vertical for a brief time to drain. It is common to hang hose to facilitate draining (metal and other hose with a rough corrugated tube will require this method).
- Warm air (120° F) can be circulated through the hose for drying.

Smart-Hose Coupling Data



End Fitting Inside Diameter	Type	A"	B"	C"	316 S/S Wt. (Lbs)	Std. End Styles
1/4"	LL 1	2.26	1.6	.665	0.4	NPT Female
3/8"	LL 1	3.50	2.20	1.30	0.6	NPT Female
1/2"	LL 1	4.08	2.40	1.68	0.8	NPT Female
3/4"	LL 1	5.72	3.60	2.12	1.6	NPT Female
1"	LL 1	6.68	4.40	2.28	2.5	NPT Female
	LL 1 BA	7.94	5.39	2.55	4.5	NPT Female
1 1/4"	LL 1	8.50	5.42	3.08	2.9	NPT Female
	LL 1 BA	9.08	6.26	2.82	6.2	NPT Female
1 1/2"	LL 3	7.82	4.74	3.08	3.4	NPT Male
2"	LL 3	9.28	5.36	3.92	4.7	NPT M or F
3"	LL 3	12.87	8.21	4.66	12.1	NPT M or F
4"	LL 3	14.35	9.1	5.35	20.75	NPT M or F
6"	LL 3	25.30	13.3	12.10	45.43	Flange
8"	LL 3	w/a	w/a	w/a	w/a	Flange
10"	LL 3	w/a	w/a	w/a	w/a	Flange
12"	LL 3	w/a	w/a	w/a	w/a	Flange

Eng. Data subject to change

LL 1 BA = Lifeline 1—Breakaway

w/a = will advise

Hose Safety Program

Hose assemblies represent the weak-link in any transfer operation. Smart-Hose Technologies offers you the ability to add an additional layer of protection inside the hose assembly. In addition, to our Smart-Hose Technology, we recommend that each company that utilizes hose assemblies in their day-to-day operation institutes a hose safety program.

Hose assemblies, when not properly maintained and handled, can be very dangerous. Therefore, it is important that companies take a reasonable care to educate their employees on the correct use and maintenance of hose assemblies and we recommend that the employer institute a hose safety program for their employees.

Elements of a hose safety Program

In an effort to provide assistance for hose safety, Smart-Hose recommends that a safety program include (but not be limited to) these key elements:

1. Hose identification system (color code hoses by application)
2. Coupling identification system (different thread or end connections by application)
3. Hose application identification program (charts, pictures of product and in plant training programs).
4. Employee training program on Hose Care, Use and Maintenance.
5. Root Cause Analysis of ANY Hose failure.
6. Hazardous Application Hose Failure Action Plan (Risk Management Plan per EPA for all applications).

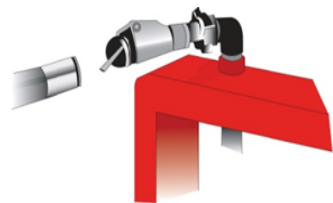
**701 Ashland Avenue , Building 22, Suite 11
Folcroft, PA 19032
Ph. (215) 730-9000 Fax (215) 730-0558**

Smart-Hose Break-Away Hose Safety System Duty to Warn

Smart-Hose Technologies has developed this technical cut sheet to address the proper installation, care and maintenance of the Smart-Hose Break-away safety system.

Hose assemblies represent the weak-link in any transfer operation except when a pull-away accident occurs. During a pull-away incident, a 2" textile braided hose assembly can be exposed to 12,000 to 15,000 lbs. of pull force before it fails. Under these circumstances, the hose assembly may not be the weak-link during a pull-away incident which can result in damage to plant piping, bulk-head piping, tank truck piping and loading arms and can lead to an uncontrolled release of hazardous material.

The Smart-Hose Break-away Safety System is designed to minimize the potential devastating consequences associated with a pull away incident. In the event of a pull-away incident the Smart-Hose Break-away safety system is designed to fail at a predetermined pull force and works in conjunction with our Smart-Hose safety system. As with all break-away technology, **the amount of pull force that it takes to separate the Smart-Hose Break-away Safety System is directly related to the angle of the pull away.** It is important to note that the Smart-hose Break-away is designed to fail at the following pull force and that the pull force is directly related to the angles of pull away:



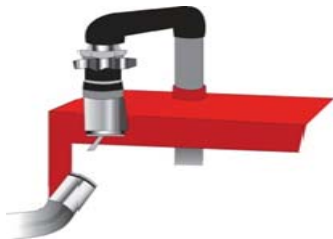
**Horizontal or straight line hose port
pull-away:**

9,000 lbs. of pull force



45 degree hose port pull-away*:

1,300 lbs. of pull force



90 degree hose port pull-away*:

900 lbs. of pull force

Smart-Hose Break-Away Hose Safety System General Instructions

- Always connect the Smart-Hose Break-away fitting to the bulk-head or plant piping when applicable.
- Do not remove the rubber bumper. Removal of the rubber bumper will void all warranties.
- Avoid horizontal hose ports whenever possible. We recommend a 45 or 90 degree hose port when possible.
- All 45 or 90 degree hose ports should be of either one piece construction or the fittings should be welded together to eliminate the possibility of pivoting or twisting*.
- Load the Smart-Hose Break-away fitting into the Transport hose storage tube last whenever possible.
- Remove the Smart-Hose Break-away fitting from the Transport hose storage tube first whenever possible.
- Avoid dropping the Smart-Hose Break-away fitting from a height greater than 5 feet.
- All Smart-Hose Break-away assemblies should be tested to the RMA, ASTM D-380, OSHA, NFPA, LPGA or other regulatory agency recommendation for hose testing procedures. Use the agency recommendation that directly relates to your specific industry.
- In the event of a partial Pull-away, where the hose is stretched but the Smart-Hose Break-away does not break, take the hose assembly out of service and return it to Smart-Hose for inspection, testing and recertification.
- If a pull-away occurs and the Smart-Hose Break-away separates, cut the hose 6"-12" from the back end of the ferrule and return the cut ends to Smart-hose for rebuild. Smart-hose can recondition the used fittings and build them into a rebuilt Smart-Hose Break-away hose assembly at a significant cost savings. Be sure to Contact your distributor or Smart-hose for an RGA # prior to returning the fittings so that we can properly track the fittings during the rebuild process.
- A visual inspection should be made by the operator each time the hose is being placed into service. The operator should visually inspect the hose assembly for excess wear, corroded couplings or any other unsafe condition. If visual defects are found, the hose should be removed from service.

Notes:

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