Smart-Hose® TECHNOLOGIES

Proper Hose Use, Care and Maintenance

Duty to Warn

Form #1999-1

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Smart-Hose® Technologies has implemented a quality policy to supply our customers with safe hose assemblies and break-away couplers. Consistent with this policy, Smart-Hose® Technologies has prepared this technical booklet to assist our customers and users of Smart-Hose® Hose Assemblies and Smart-Hose® Break-Away Adapters with information regarding the proper use, care, and maintenance of our products. This booklet also addresses Smart-Hose® Technologies' "Duty to Warn" responsibility regarding misuse of these products.

Note: See **Warranty Terms** on page 30.

The information contained in this booklet is intended as a guide and does not supersede applicable company, local, regional, or industry standards. It is the responsibility of the end-user to use the products in a safe manner appropriate to the application and industrial regulations that apply.

Introduction

Smart-Hose® TECHNOLOGIES

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® Hose Assemblies and Smart-Hose® Break-Away Adapters.

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

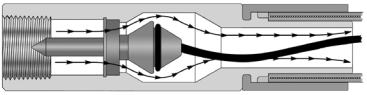
Hoses are used as a flexible connection to convey products from one container to another. They are routinely handled by people in a dynamic work environment. As a result, the hose assembly represents the weak link in any transfer operation and may potentially be a serious safety hazard.

The Smart-Hose® Safety System adds an additional layer of protection directly inside the hose assembly.

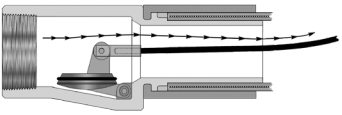
Most hose assemblies are designed and engineered for very specific application requirements and are not interchangeable with other applications. Human error is often the greatest risk when working with hose assemblies. It is important for all companies that use hose assemblies on a day-to-day basis to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

Should you have any questions on any topic covered in this booklet, call **Smart-Hose® Technologies** at 1.215.730.9000.

Hose Operating Instructions



LL1 Valve Design



LL3 Valve Design

Smart-Hose® Technologies manufactures safety hose systems that provide an additional layer of protection inside the hose assembly. The Smart-Hose® Safety System can be configured with either the LL1 or LL3 valve, integrated into each end fitting.

For the safe operations of your Smart-Hose® hose assembly, follow the instructions listed below:

- Personnel must always wear appropriate personal safety gear when handling any hose. (Ex: Goggles, protective clothing, hard hat, masks, gloves, face shields, etc.)
- When attaching special end connectors or couplings to the threads on the Smart-Hose® end fittings, always use a **backup wrench** on the body of the coupling. **Never put the backup wrench on the ferrule**.
- Always use Teflon tape or thread compound to seal the NPT threads. **Take care not to over-tighten.** If a good seal cannot 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 Smart-Hose® end fittings are cracked, worn, or dented.
- Inspect the assembly before each use. Look for damage to the hose or end connections in accordance with this booklet and any other applicable regulations.
- **Smart-Hose® 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® hose assembly "checks," reduces, or stops the flow of product, remove it from service and contact Smart-Hose® Technologies for instructions.

- When a catastrophic hose failure has occurred, a Smart-Hose® hose assembly will, under certain conditions, shut off the flow of product from both ends simultaneously. As a result, pressure will be contained between the Smart-Hose® end fittings and the piping system. **This pressure MUST be released before the Smart-Hose® end fittings can be removed.** Follow appropriate company-established procedures and regulations for releasing this pressure before removing the Smart-Hose® end fittings.
- **Smart-Hose® Technologies Rebuild Program:** When the hose is worn and needs replacement, contact Smart-Hose® Technologies. If eligible, you will be instructed to cut the hose 12″ from the end of the fittings, remove all chemical residue, and return the fittings to Smart-Hose® Technologies. After examination and approval, Smart-Hose® Technologies will attach the old fittings to a new hose, test, and certify the completed assembly.
- **When using a hose, always err on the side of safety –**

“When in doubt remove from service”

- **Never disassemble** or re-work any part of the Smart-Hose® safety hose assembly. This will cause the assembly to not function properly and will void any/all warranties.
- When measuring a Smart-Hose® hose assembly 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 Smart-Hose® end fitting:
  - Add 6″ to dimension A shown on page 24 for the ID hose used.
  - It is important to always keep the bend radius within the Smart-Hose® bend radius recommendations (see product Engineering Data Sheets). Engineering Data Sheets can be obtained by contacting Smart-Hose® Technologies (contact information is on the cover of this booklet) or for quick access, view online at https://smarthose.com/catalog/

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

S·T·A·M·P·E·D

S Size	Hose ID X Assembly length (i.e. 3" x 10 ft Long)
T Temperature	Minimum & maximum temperature of the product conveyed through the hose assembly or the environmental temperature range. (i.e. 200^{0}F or –40^{0}F to 120^{0}F)
A Application	Describe the actual use of the hose (i.e. Ship to Shore unloading, LPG transfer, in plant chemical use, loading arm, bulk head, railcar, loading/unloading, etc.)
M Material	Define the product or material that is to be conveyed through the hose assembly. Supply MSDS.
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).
D Details	- Date the product is required. - Do you need Break-Away® technology capabilities? - Do you need accessories? (i.e. Spring Guard, Scuff Guard, Bend Restrictors, etc.)

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 to ensure a quality hose assembly. Always use the printed information from Smart-Hose® Technologies and the hose manufacturer to ensure the accuracy of any recommendation. Do not exceed the printed, recommended service criteria.

See notations on next page...

Notations:

— Smart-Hose® Technologies does not warrant the suitability of the product for any particular application. Determining product application suitability is solely the customer's responsibility.

— Smart-Hose® Technologies is not liable for special, indirect, incidental, consequential, or other damages including, but not limited to, loss, damage, personal injury, or any other expense directly or indirectly arising from the use of, or inability to use its products either separately or in combination with other products.

— It is the responsibility of the user to accurately determine the system pressure.

— Smart-Hose® Technologies disclaims any liability for use of its products in applications other than those for which they were designed.

— All information contained in the booklet is subject to change without prior notice.

— Smart-Hose® Technologies makes no warranties, expressed or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose, course of performance, or usage of trade.

— The buyer/end-user is responsible for determining whether the Smart-Hose® Technologies product is fit for a particular purpose and suitable for the buyer's/user's method of use or application.

— Failure to follow procedures for selection, installation, care, maintenance, and storage of hoses may result in the hose's failure to perform properly and may result in damage to property and/or serious injury.

— Smart-Hose® Technologies, or any of its affiliates or subsidiaries, shall not be subject to, and disclaims any obligations or liabilities, including but not limited to all consequential, incidental, and contingent damages arising from claims, including without limitations, negligence, and strict liability or other theories of law.

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 whichever 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 wear, corroded couplings, or any other unsafe condition. If visual defects are found, the hose should be immediately removed from service.

5. **Hose Assembly Testing Procedures:** Smart-Hose® hose assemblies should be inspected and tested in the same manner as a non-Smart-Hose® assembly. Please follow the hose testing procedures indicated by the application or industry-related standards. (RMA, ASTM D-380, OSHA, NFPA, LPGA, CRN, PED, CSA, 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. Do not store wet/charged. In some cases, the hose and couplings may handle high concentrations,

Continued...

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.

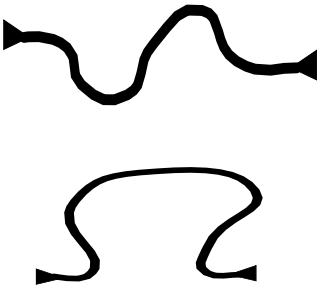
8 **Alloy Chemical Resistant:** Always use a coupling made from material suitable for the product being conveyed. (Refer to an alloy/chemical resistant chart.)

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 to the ferrule. For questions, contact Smart-Hose® Technologies at 1.215.730.9000

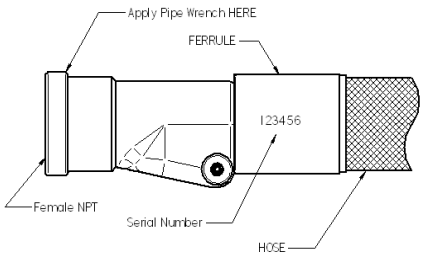
10 **Excessive Wear Pumping Applications:** In many applications, wear to the exterior cover of the hose can be caused by the pulsations created by the pump. It is important that the operator is made aware of the potential damage to the hose and inspects the hose before each use. Check for cutting, gouging, and abrasion of the exterior cover that penetrates the reinforcement.

Smart-Hose® hose assemblies may be ordered with Scuff-Guard or other exterior materials. Scuff-Guard wraps are designed to protect the exterior cover of the hose for high abrasion applications. When the Scuff-Guard becomes worn, the hose should be removed from service and the covering replaced.

11 **Smart-Hose® Limitations:** Smart-Hose® assemblies should not be used while on a hose reel or in a coiled condition. 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



Features & Characteristics

Smart-Hose® Technologies produces industrial hose assemblies that are engineered with internal valves integrated into 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 is designed to 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.

Smart-Hose® hose assemblies do not protect against small leaks or a hose rupture that is not large enough to allow the cable to extrude out of the hose.

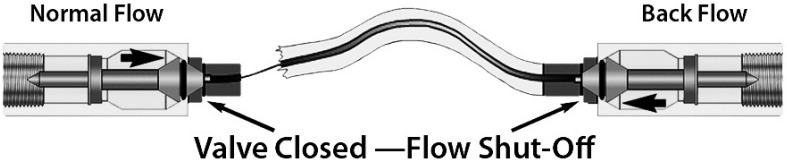
Characteristics of Smart-Hose® Hose Assemblies

- Smart-Hose® hose assemblies may contract (shrink in length) up to 3% when pressurized to working pressure. Take this movement into consideration when installing the hose.
- Smart-Hose® 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.)
- 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.
- Smart-Hose® hose assemblies 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.

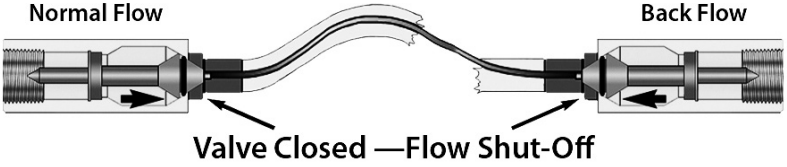
*See diagrams on next page...

Normal Flow

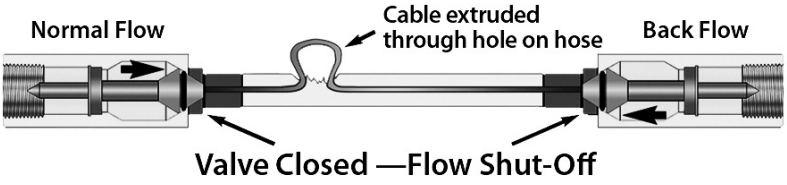
Coupling Ejection



Hose Separation



Large Hole Rupture



The Smart-Hose® hose assembly 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.

General Inspection Instructions

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

All Smart-Hose® hose assemblies should be visually inspected by the operator before 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 immediately.

All Smart-Hose® hose assemblies should be tested to the RMA, ASTM D-380, OSHA, NFPA, LPGA, CRN, PED, CSA, 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 Smart-Hose® Technologies for repair instructions.
2	Inspect for soft spots, bulges in cover, a section of mashed or flattened hose, or kinked areas.	Remove hose from service. Contact Smart-Hose® Technologies 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 Smart-Hose® Technologies for repair instructions.
4	Check couplings for any slippage, 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 Smart-Hose® Technologies 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 Smart-Hose® Technologies for repair instructions.

	Inspect for:	Corrective Action:
6	Inspect Smart-Hose® 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 Smart-Hose® Technologies for repair instructions. Never disassemble the Smart-Hose® end fitting 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 Smart-Hose® Technologies for repair instructions.
8	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.) **LL1 End Fitting** can be checked by using a blunt probe and pressing inward on the valve stem. The valve stem should move inward and spring back into place with a positive spring pressure. **LL3 End Fitting** can be checked by using a flat tip screwdriver. Place the tip under the flapper valve and 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.	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, remove hose from service and contact Smart-Hose® Technologies for repair instructions.
9	Before using the hose, look down the inside of the Smart-Hose® end fitting for any blockages or foreign objects lodged in the end fitting.	Remove any blockages or foreign objects prior to use. Never disassemble the Smart-Hose® end fitting. Contact Smart-Hose® Technologies for repair instructions.
10	Inspect the exterior of the Smart-Hose® 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 Smart-Hose® end fitting.)	Remove hose from service. Contact Smart-Hose® Technologies for repair instructions.

Hose Hydrostatic Testing & Inspection

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

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

A visual inspection of the hose (as previously described) 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. 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 the 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.

- Air or other compressed gases should not be used for pressure testing used hose assemblies in the field.
- Hydro testing with water is the recommended field test method. First, fill the hose with water and be sure to remove ALL air from the hose before starting the test by bleeding it through an outlet valve attached to one end of the hose.
- Restrain the hose that is being pressurized but DO NOT crush the hose. Place firmly anchored steel bars or straps on each end, supported above the hose at 2-4ft. intervals to limit hose “whipping” if a failure occurs. It is normal for the hose to move slightly as the pressure is applied, so any restraints should allow for this movement.
- The outlet ends of the hose should be placed so that a coupling ejection will be restrained by a wall, sandbags, etc.
- Provisions must be put in place to protect test personnel from the forces of the pressurized media if a failure occurs.
- Testing personnel must never stand in front of 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.
- Test one hose at a time.

Proper Rubber Hose Storage

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

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

The appropriate method for storing a hose depends to a great extent on its size (diameter and length,) the quantity to be stored and how it is packaged. Hoses 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 definitive recommendations. 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. Wooden crates or cardboard cartons provide some protection against the deteriorating effects of oils, solvents, and corrosive liquids. Shipping containers also provide 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 products 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 effects 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 hoses. Protection from such lighting should be provided.

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

Hose Care and Use

Hose assemblies represent the weak link in any transfer operation. Improper storage, abuse, and misapplication can significantly reduce the operational life of any hose assembly.

Smart-Hose® Technologies recommends the following 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.

Do – Make sure the hose is easily identifiable, and CANNOT 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® hose assembly is the correct length for the job intended. Remember to allow for up to 3% contraction at max working pressure on all Smart-Hose® hose assemblies.

Do – Set up regular hose inspections before each use.

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 and bend restrictors on the 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 it into service.

Do – Store hose in a cool, dry, dark, and clean place.

Do – Wear safety clothing, gloves, boots, hard hat, masks, face shields, 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 industry standard or regulating agency related to the specific hose application.

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Do - Immediately remove hose assemblies or break-away couplers from service in the event of a partial or full pull-away incident.

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

Do – Store hose in a flat coil. Be sure the hose is not kinked. Store the coil on the floor, on a shelf or table, or 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 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.

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, 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 Smart-Hose® hose assembly while it is wholly or partially stored on a hose reel.

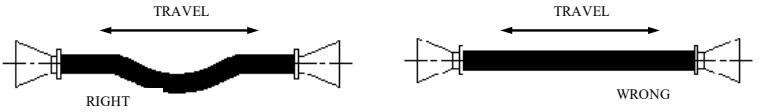
Don't store hose charged/wet after use.

Note* LPG Hose is not recommended for propylene applications.

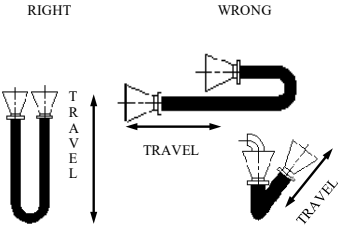
Installation Recommendations

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

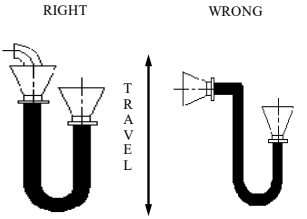
The diagrams below offer suggestions for proper Smart-Hose® hose assembly installation. For other configurations, contact Smart-Hose® Technologies.



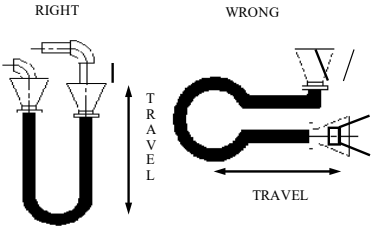
Under pressure hose may change in length. Always provide some slack for the hose to shorten up to 3%.



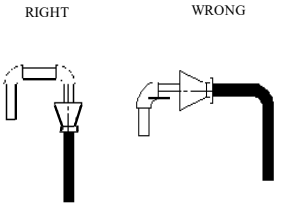
Prevent twisting, torque or distortion, hose should be bent in same plane as motion.



Never place sharp hose bends near coupling. Hose should be installed so that flexing takes place in one plane only & direction of motion must be perpendicular.



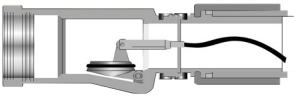
When the hose is bent below minimum bend radius, use adapters to increase spacing and bend radius.



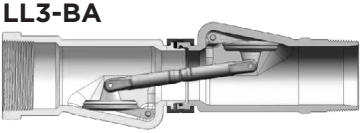
Avoid hanging hose from horizontal fixtures.

Smart-Hose® Break-Away Safety System

LL3-B



LL3-BA



Hose assemblies represent the weak link in any transfer operation except when a pull-away incident 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.

Duty to Warn: The Smart-Hose® Break-Away Safety System is designed to minimize the potentially devastating consequences associated with an unintentional pull-away incident. In the event of a pull-away incident, the Smart-Hose® Break-Away Safety System is designed to fail-safe at a predetermined pull force (Note A).

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 separate at a determined pull force and that the pull force is directly related to the angles of pull away. (See diagrams on page 20.) The end-user must verify that the strength of the facility piping is greater than the **Smart-Hose® Break-Away** forces.

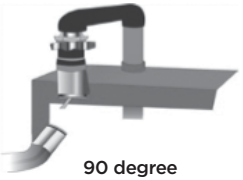
Note: If the hose will be used in a potential pull away application, the piping system should buttressed to resist the following loads:

½″ ID - 4,500 lbs	1-1/4″ ID - 16,000 lbs	3″ ID - 34,000 lbs
¾″ ID - 5,500 lbs	1-1/2″ ID - 20,000 lbs	4″ ID - 44,000 lbs
1″ ID - 7,000 lbs	2″ ID - 24,000 lbs	6″ ID - 56,000 lbs

In the case of a pull-away event, the pull force can be greatly reduced if the **hose port is configured at a 45^0 or 90^0 angle to the direction of pull** (Note A).

Horizontal or straight line hose port pull-away: 8,900 lbs. of pull force

45 degree hose port pull-away: 1,300 lbs. of pull force



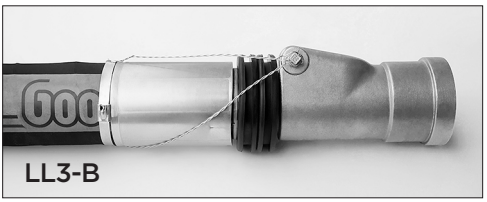
90 degree hose port pull-away: 900 lbs. of pull force

The Smart-Hose® Break-Away Safety System is configured in LL3-B and LL3-BA systems. Smart-Hose® Break-Away hose assemblies, LL3-B, are Smart-Hose® hose assemblies that contain valves in each end to protect against catastrophic hose failure, with the added feature of a break-away fitting on one end, designed to separate at a pre-determined pull force. Smart-Hose® Break-Away Couplers LL3-BA (Adapters) are fully assembled break-away couplers designed to separate at pre-determined pull forces. The LL3-BA can be used in conjunction with Smart-Hose® hose assemblies, conventional hose assemblies, or where no hose attachments are required.

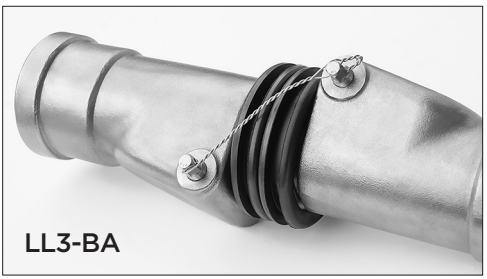
Note A: Independent testing conducted at the Smart-Hose® Technologies Engineering Facility typically yielded repeatable results. However, actual results may vary from facility to facility.

Caution: <u>DO NOT</u> use the Smart-Hose® Technologies Break-Away System as a swivel device for installation.

*A safety wire assembly has been added to the two-piece break-away system to prevent the assembly from being used as a swivel during facility installation. Using the break-away system as a swivel device can compromise the integrity of the internal seals. **DO NOT remove the wire.** All Smart-Hose® Technologies' warranties will be void if the safety wire is cut and/or removed.



LL3-B



LL3-BA

Metal Hose Care & Use

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

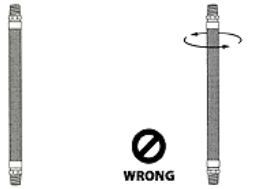
1. Temperature	**3. Media**	**5. End Fitting**
2. Pressure	**4. Size**	**6. Motion**

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 a metal hose assembly has external metal braids that are broken, it should be pulled out of service. All Smart-Hose® metal hose assemblies should be tested to the RMA, ASTM D-380, OSHA, NFPA, LPGA, CRN, PED, CSA, or other regulatory agency recommendations for hose testing procedures (or to the applicable industry standard.)

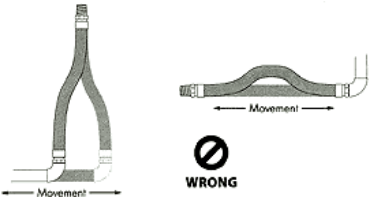
Key Elements to Safe Metal Hose Use

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. Do not store wet/charged.
4. Always cap the ends of a 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 taken out of service immediately.
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, CRN, PED, CSA, or other regulatory agency recommendations for hose testing procedures (or to applicable industry standards.) Continued...

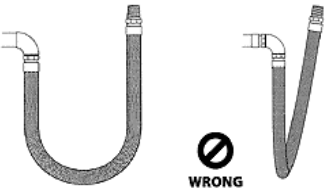
8 Never install a metal hose so that torque is applied to the hose. Use a swivel adapter whenever that application may apply torque to the hose assembly. Contact Smart-Hose® Technologies for available Swivel adapters.



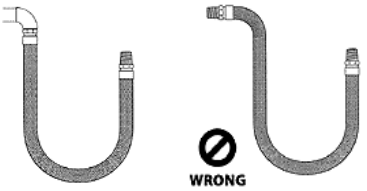
9 Do not compress or extend metal hose axially. Metal hose installed in line with the longitudinal axis of the piping should not be subject to axial movement.



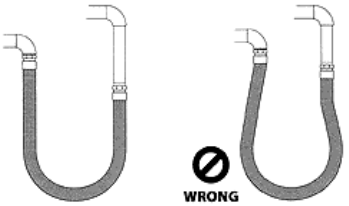
10 Flexing a metal hose in two separate planes of movement will torque the hose assembly. Always install the metal hose so that flexing occurs in one plane, or install with a swivel adapter attached to one end.



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



12 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.



13 The operating temperature of a metal hose may affect the type of hose assembly required. Always specify the normal temperature vs. maximum operating temperature when ordering metal hose assemblies.

Cleaning Tips

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 a chemical residue left in the hose.

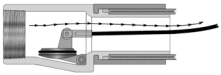
This process is typically accomplished by flushing the interior of the hose with water or a cleaning solution. Cleaning procedures will differ by industry/application, but should at least include the below recommendations from Smart-Hose® Technologies:

1. All staff must wear personal protective gear. (i.e. eye protection & hard hat, gloves, protective clothing, masks, face shields, etc.)
2. Cleaning solutions must be compatible with the hose tube and couplings.
3. All material flushed along with the cleaning solution must be processed in accordance with EPA or other government requirements.
4. Never insert cleaning devices into the ID of a Smart-Hose® Technologies product. (Such as brushes, steam wands, etc.)
5. The use of open-end, low-pressure steam (200^{0} F or less) can be used to clean Smart-Hose® hose assemblies and coupler/adapter products (if applicable).
6. To ensure 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 a hose to facilitate draining. Metal and other hoses with a rough corrugated tube will require this method.
7. Warm air (120^{0} F) can be circulated through the hose for drying.

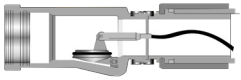
Smart-Hose® Coupling Data

LL1

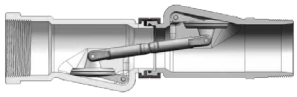
LL3

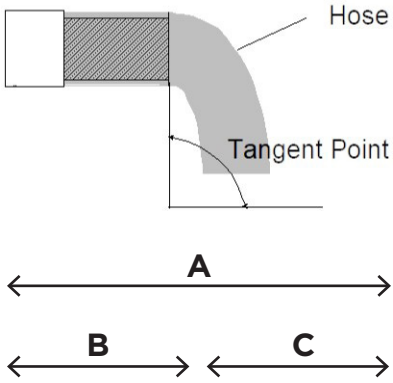


LL3-B



LL3-BA





End Fitting ID	Type	A″	B″	C″	316 S/S Wt./lbs.	Std. End Styles
1/4″	LL1	2.26	1.6	.665	0.4	NPT Female
3/8″	LL1	3.50	2.20	1.30	0.6	NPT Female
1/2″	LL1	4.08	2.40	1.68	0.8	NPT Female
3/4″	LL1	5.72	3.60	2.12	1.6	NPT Female
1″	LL1	6.68	4.40	2.28	2.5	NPT Female
1 1/4″	LL3	7.04	3.97	3.08	2.6	NPT Female
1 1/2″	LL3	7.82	4.74	3.08	3.4	NPT Male
2″	LL3	9.28	5.36	3.92	4.7	NPT M or F
3″	LL3	12.87	8.21	4.66	12.1	NPT Male
4″	LL3	14.35	9.1	5.35	20.75	NPT Male
6″	LL3	25.30	13.3	12.10	45.43	Flange
8″	LL3	W/A	W/A	W/A	W/A	Flange
Break-Away Hose Assembly						
1 1/4″	LL3-B	8.37	4.79	3.90	1.546	NPT Female
2″	LL3-B	10.73	6.29	4.77	3.1	NPT M or F
3″	LL3-B	14.98	9.52	5.94	11.2	NPT Male
Break-Away Adapter (Coupler)						
2″	LL3-BA	12.03	6.40	5.80	8.54	NPT M or F
3″	LL3-BA	19.15	9.52	8.96	22.86	NPT Male

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 Smart-Hose® Technologies products,) we recommend that all companies utilizing hose assemblies in their day-to-day operations institute a hose safety program for their employees.

Hose assemblies, when not properly maintained and handled, can be very dangerous. Therefore, companies must take reasonable care to educate their employees on the correct use and maintenance of hose assemblies.

Elements of a Hose Safety Program

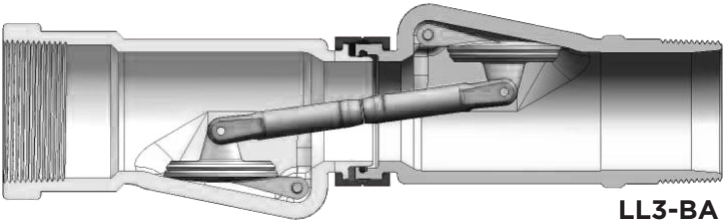
To assist with hose safety, Smart-Hose® Technologies recommends that a safety program include (but not be limited to) these key elements:

1. Hose identification system.
   (Color code hoses by the application.)
2. Coupling identification system.
   (Different thread or end connections by the 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 and other regulatory bodies for all applications.)

For additional information, contact:

Smart-Hose® Technologies
701 Ashland Avenue
Building 22, Suite 11
Folcroft, PA 19032
P: 215.730.9000
sales@smarthose.com
https://smarthose.com

Break-Away Riser (Adapter) Installation



LL3-BA

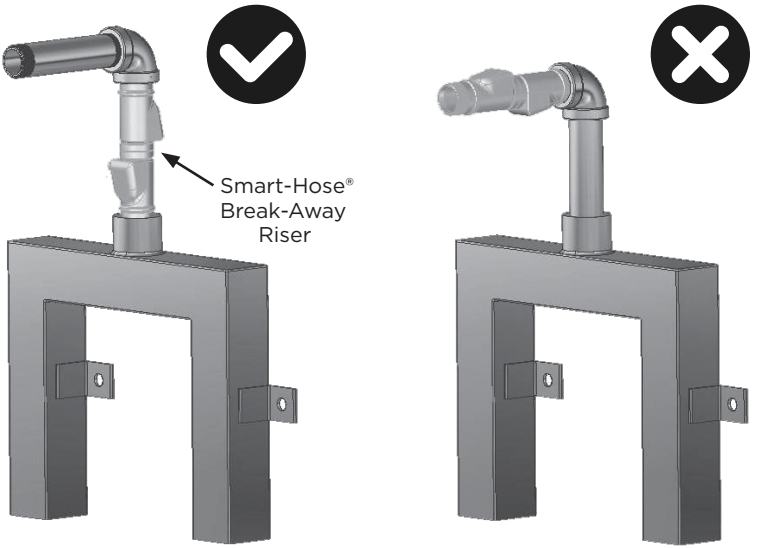
Instructions: Your Smart-Hose® Break-Away Riser has been designed for product transfer applications at facility bulkhead locations. The Smart-Hose® Break-Away Riser comes completely assembled and ready for installation. Any tampering with the product can result in a premature failure and void all warranties. To ensure that the product functions as intended, adhere to the following installation instructions.

- Before starting any work, wear appropriate safety items – gloves, goggles, face shields, masks, etc. and adhere to all safety requirements as spelled out in local, state, or federal regulations.
- Inspect all threaded areas for dirt, debris, slag, or any foreign materials that may impede the proper thread engagement.
- Inspect any mating threads before installing the Smart-Hose® Break-Away Riser. Smart-Hose® Technologies recommends using the properly sized ring gage, plug gage, or 6-step gage. Damaged threads can not only create a hard to seal leak path but can also inhibit the product from functioning as intended when in a pull-away incident.
- Apply Teflon tape or paste sealant to MNPT sides of the mating Smart-Hose® Break-Away Riser or bulkhead weldment.

Continued...

- Install any elbows or other threaded coupling components to the riser assembly before installing onto the bulkhead, following NPT thread tightening guidelines (see note 1 below). Place the riser in a vise with the fitting end on the component that will be threaded in the vise; do not hold the riser by the opposite fitting to install any components.
- Install the riser on the bulkhead, tightening (clockwise rotation) the riser using the end fitting that is being threaded into the bulkhead. Follow NPT thread tightening guidelines (see note 1 on page 28) to ensure that the threads are not stretched during installation.

Illustration:



The Smart-Hose® Break-Away Riser is a direct one-for-one replacement for the standard 12.0″ pipe riser currently used and approved by the guidelines of the Railroad Commission of Texas (RRCT.) Mount/Install the Break-Away Riser directly to any standard bulkhead in lieu of the current 12.0″ pipe riser.

Continued...

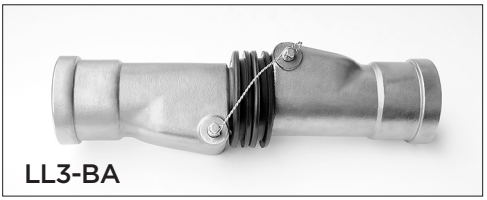
Notes:

1. Do not overtighten the riser NPT threads; the riser could become compromised and not function as intended.
   - **A** If both threads are cut properly, tighten by hand until you cannot turn any further - This is the hand-tight engagement point.
   - **B** Use a wrench to further tighten the threaded joint. For NPT fittings smaller than 1", this is typically about (2) full turns. You can refer to the Machinery's Handbook for the exact wrench tight distance.
2. Do not tighten threaded ends from opposite end fitting. Seal damage could occur which could cause immediate leakage or premature failure.
3. Do not apply excessive bending moment loads to the riser. Seal damage could occur which could cause immediate leakage or premature failure.
4. Avoid dropping or striking the break-away riser with anything. Large impact forces can cause the break-away ring to fail prematurely.
5. End Configurations: MNPT, FNPT, Fixed/Floating Flange.
6. See page 19 for pipe system/bulkhead buttressed information.

Caution: DO NOT use the Smart-Hose® Technologies Break-Away System as a swivel device for installation.

*A safety wire assembly has been added to the two-piece break-away system to prevent the assembly from being used as a swivel during facility installation. Using the break-away system as a swivel device can compromise the integrity of the internal seals. **DO NOT remove the wire.** All Smart-Hose® Technologies' warranties will be void if the safety wire is cut and/or removed.

LL3-B



LL3-BA

General Instructions

Smart-Hose® Break-Away Hose Safety System

- 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.
- Remove the Smart-Hose® Break-Away fitting from the transport hose storage tube first.
- Avoid dropping or striking the Smart-Hose® Break-Away fitting as this may cause premature failure.
- All Smart-Hose® Break-Away hose assemblies should be tested to the RMA, ASTMD-380, OSHA, NFPA, LPGA, CRN, PED, CSA, or other regulatory agency recommendations for hose testing procedures. Use the agency recommendations that directly relate to your specific industry.
- In the event of a partial or full pull-away incident, take the Smart-Hose® hose assembly or Break-Away Adapter® out of service and return to Smart-Hose® Technologies for inspection, testing, and recertification.
- A visual inspection should be made by the operator each time the Smart-Hose® hose assembly or Break-Away Adapter® is being placed into service. The operator should visually inspect the hose assembly or adapter for excess wear, corroded couplings, or any other unsafe condition. If visual defects are found, the hose should be removed from service.

Warranty Terms

- Smart-Hose® Technologies does not warrant the suitability of the product for any particular application. Determining product application suitability is solely the customer's responsibility.
- Smart-Hose® Technologies is not liable for special, indirect, incidental, consequential, or other damages including, but not limited to, loss, damage, personal injury, or any other expense directly or indirectly arising from the use of, or inability to use its products either separately or in combination with other products.
- It is the responsibility of the user to accurately determine the system pressure.
- Smart-Hose® Technologies disclaims any liability for use of its products in applications other than those for which they were designed.
- All information contained in the booklet is subject to change without prior notice.
- Smart-Hose® Technologies makes no warranties, expressed or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose, course of performance, or usage of trade.
- The buyer/end-user is responsible for determining whether the Smart-Hose® Technologies product is fit for a particular purpose and suitable for the buyer's/user's method of use or application.
- Failure to follow procedures for selection, installation, care, maintenance and storage of hoses may result in the hose's failure to perform properly and may result in damage to property and/or serious injury.
- Smart-Hose® Technologies, or any of its affiliates or subsidiaries, shall not be subject to, and disclaims any obligations or liabilities, including but not limited to all consequential, incidental, and contingent damages arising from claims, including without limitations, negligence and strict liability or other theories of law.