



Industrial & Marine Hose

Correct Hose Use, Care & Maintenance Guide

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The NovaFlex Group has implemented a quality policy to supply to our customers the correct hose or hose assembly for the application.

Consistent with this policy **NovaFlex** has prepared this technical booklet to assist our customers and users of **NovaFlex** hose assemblies with information directed toward maximum safe hose assembly life and user safety. This booklet also addresses **NovaFlex's** "Duty to Warn" responsibility regarding misuse of these products.

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The most current version of this guide is located on our web site at www.novaflex.com, and supersedes all other versions. **(Additional information such as detailed information on Rubber Dock Hose, Composite Dock Hose and Chemical Resistance is on the Novaflex web site).** Please check the version date of any booklet you may have, and always reference the most current.

The information contained in this booklet is intended to be a guide. It is the responsibility of the user to apply this information in the appropriate manner to insure safe operating procedures.

The information provided within is for informational purposes only. We have made every effort to ensure the accuracy of the provided information and assume no responsibility for any loss or damage due to errors or omissions or to the use or misuse of any information supplied. It is impossible to test all products under all conditions to which they might be subjected in the field. It is therefore the buyer and/or end users' responsibility to test all products under the conditions that duplicate the service conditions prior to installation. All improvements, all specifications are subject to change without prior notice. It is the buyer and/or end users' responsibility to review our complete **Terms and Conditions of Sale** located on our web sites at: www.novaflex.com | www.z-flex.com | www.flexmaster.com.

Introduction

General instructions for hose use, care and maintenance. NovaFlex customers have requested information pertaining to the use, care and maintenance of NovaFlex's assemblies. As a result NovaFlex has developed this technical booklet to improve users' understanding.

This technical booklet is intended solely for the use of NovaFlex's customers as a guide for the use, care and maintenance of NovaFlex's hose and hose assemblies.

This information should be made available to all of the customers' representatives who use NovaFlex's hose and hose assemblies.

Hoses are designed to convey products and to operate in a dynamic work environment. This operation can present a serious safety hazard if safe operating procedures are not followed! **"All hose will fail in time!"** Each hose is designed for a specific application, only use the hose for the service marked on the hose.

This booklet is designed to supplement safe operating procedures, not replace them. All hose and couplings are designed for specific uses and it is critical for the user to understand how and what is important for the safe and correct use of a hose assembly. Users of rubber & plastic hose should have in place a preventative maintenance program designed to identify potential problems before failures occur.

It is always necessary to know the data presented in this booklet concerning the intended service and application of any particular hose **before** you use or request a hose. NovaFlex recommends the use of assembly guide lines as published by NAHAD Hose Safety Institute.

It is the responsibility of the hose assembling company to ensure the use of the correct coupling and attachment method based on the coupling manufacturer's recommendations for the specific hose. Always use a coupling attachment method that the coupling manufacturer has assigned a working pressure equal or greater than the hose. Assembly pressure validation should be in accordance with ASDTM D380.

Every hose user must ensure their staff is familiar with this information and have in place a safety procedure to implement in the event of a hose failure (see page 15).

Should you have any questions on any topic covered in this booklet, please contact **NovaFlex at: (905) 731-9411. For up to date technical information, please see our web site at www.novaflex.com**

Warning - In any hose application, there may be inherent risk of bodily injury or property damage and the hose user is responsible for the implementation of adequate safety precautions. It is the responsibility of the person supplying the hose to advise the ultimate user of proper instructions for the adequate safe "Use, Care & Maintenance" of the hose and to warn the user of the consequences of failure to heed such instructions. Should a Hose assembly fail during use because of excessive pressure, damaging chemicals, excess temperature, incorrect material conveyed, serious bodily injury or destruction of property could result from such things as propelled couplings, whipping hose, high pressure or high velocity discharge, chemical contact, release of flammable fluid, high temperature or fire.

| | |
|---|---|
| 'S' Size | The hose inside diameter (I.D.) and length required to meet the applications requirements (i.e. 3" x 10 ft). If OD is an issue, also specify. |
| 'T' Temperature | Maximum & minimum temperature of the product conveyed through the hose assembly. Continuous? (i.e. 200° F) Exterior temperature if present. |
| 'A' Application | Describe the actual use of the hose (i.e. Ship to Shore unloading, LPG transfer, in plant chemical use, etc.) |
| 'M' Material Conveyed, Hours per day | Air, water, the specific chemical, product or material conveyed (i.e. compressed air, chemical transferred, etc.) |
| 'P' Pressure | The maximum pressure or vacuum at which the material is being conveyed through the hose assembly. (i.e. 100 psi., including pressure spikes). Is testing required? |
| 'E' Ends | Type of end connections required to attach the NovaFlex hose to the mating connection (i.e. NPT male, Cam & Groove, Acme swivel etc). |
| 'D' Delivery | Date the product is required (i.e. Nov 6, 2013). |

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 NovaFlex.

"Always use the printed information from NovaFlex to insure accuracy of any recommendation."

Do not exceed the printed, recommended service criteria.

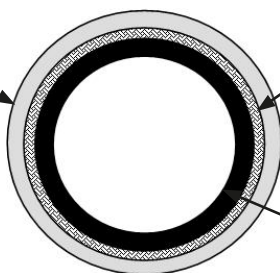
It is the ultimate objective to obtain maximum safe service life for a product; to accomplish this **NovaFlex** recommends the user maintain specific care during the use of the hose assembly **to insure continued safe operations.**

Elements of a Hose

| | |
|----------------------|---|
| Tube | Its purpose is to handle the liquid, solid or gaseous material the hose is transferring. The tube is the innermost element of the hose and is intended to be resistant to the product conveyed. |
| Reinforcement | Its purpose is to withstand the working forces necessary to transfer the product conveyed by the hose tube in the application. Typically this is rated in a maximum rated working pressure (WRP) in pounds per square inch (psi). |
| Cover | Its primary purpose is to protect the tube and reinforcement from external factors such as, abrasion, weather, ozone and external abuse. |

Cover

Provides protection against external elements. Weather & ozone abrasion, cutting & gouging work environment chemicals



Reinforcement

Provides strength to resist pressure and vacuum. Combinations of textile and wire are used

Tube

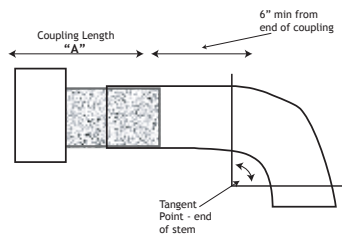
Designed to resist the product to be conveyed through the hose. Can be made from rubber, metal, plastic or Teflon

Operator requirements for safe hose use

1. Working Pressure on hose (WP) should never be exceeded, including pressure spikes. Never leave liquids or gasses trapped in a hose with each end sealed or valves closed. Thermal expansion of some products may cause pressures to exceed working pressure.
2. Always rate the Working Pressure of the coupled hose assembly by the lowest rated element (hose WP or coupling WP which ever is lowest). Try to identify all Critical Applications-those hazardous applications such as: high pressure (over 50psi), petroleum products, chemicals or high heat (over 120°F).
3. Only use the hose assembly for the service marked on the hose or for the service recommended in the printed literature. Have a **HOSE INSPECTION & TEST PLAN** to insure unsafe hoses and/or worn or damaged couplings are removed from service.
5. Inspects and test all hose assemblies as required every six (6) months (or sooner) to insure the assembly is safe for continued use. (Use RMA, ASTM, OSHA, NFPA, LPGA, NAHAD, USCG, SAE, AEYC or other regulatory agency recommendations for pressure testing along with these guidelines.)
6. Educate your Hose Handlers/Users as to the conditions associated with unsafe hose; the operator is the last line of defense against spills and injuries. Teach your employees that: **“When in doubt; Remove the Hose From Service!”**. **Maintain a HOSE Inspection & Test Plan that requires a visual inspection prior to each hose use with pressure test (see Para. #5).**
7. Always use appropriate *Chemical Resistance Charts* to verify that the chemical or product conveyed is compatible with the hose tube and alloy of the coupling. *“Remember, the temperature and concentration of the chemical/product conveyed must not exceed the manufacturer’s recommendations.* It is recommended to always flush chemicals from hose after each use. Different chemical concentrations may cause damage to couplings or to hose. In some situations a hose assembly may be recommended for high (90%) concentrations but low concentrations (30%) may cause damage. After chemical use, cap the hose - prevent atmosphere & moisture from entering the hose.
8. Always use a coupling made from material suitable for the application and product conveyed. (Refer to alloy Chart).
9. **Before each hose use**, always check the coupling for slippage.
10. In many cases the pumping of product develops hose pulsations. This pulsation can cause the hose cover to wear very quickly. It is important to train the hose operators to take care when using hose so that cutting, gouging and kinking can be avoided.

In some cases a NovaFlex Scuff-Guard can be added to the hose to protect the cover from abrasion. This extra guard will wear over time. Operators can add extra life to hose by simply rotating the hose so that cover wear is uniform. Should the Scuff-Guard be worn excessively, the operator should advise management to replace the Scuff-Guard for field inspections.

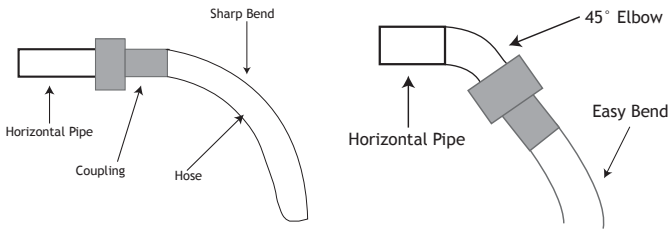
11. If a hose is used to transfer a product at higher temperatures (above 100°F), the hose should not be insulated. It is best to let the heat dissipate to the atmosphere, unless approved by NovaFlex.
12. When measuring a hose for specific installation, it is important to remember that the tangent point for hose bending is at the end of the hose nipple portion inside the hose. It is recommended to add a minimum of 6” to dimension ‘A’ shown below. Always keep the bend radius of the hose within the recommended dimensions published for the specific hose. (See catalog). When flexing short length hose (less than 5’) the bend point should always be centered in the hose length.
13. If there is the potential of a pull-away, buttressing of the piping system is a must. This will prevent piping fracture and make the hose the weakest link, causing it to separate. It is recommended to use a break-away



Operator requirements for a safe hose assembly

devise along with dry-brake couplings for those applications with hazardous chemicals that may cause human injury or environmental damage.

14. If a hose application requires that the hose be electrically conductive, insure that the hose is grounded by using the steel helix wires or the ground wire located in the hose. To ground the hose to the coupling, simply extract enough helix or ground wire so that $\frac{1}{2}$ " can be bent into the hose ID. When the coupling is inserted the coupling stem must be in contact with these wires. Always test the conductivity with an ohm meter; coupling to coupling.
15. Scuff-Guard for field installation. Hose life can be safely extended through this simple maintenance procedure (some users have improvised and placed mats or other protection under hoses in this type application to reduce cover wear).
16. Crushing or kinking of hose can cause serious damage to reinforcement. If the outside diameter (OD) of the hose is reduced more than 20%, the hose must be retired from service. If the outside diameter (OD) is reduced by less than 20% inspect and hydro test. If hose can't be tested, remove from source.
17. Internal & external abrasion results in shortened service life. Care should be taken while handling hose to prevent abnormal wear on the hose cover. In applications that cause internal abrasion, NovaFlex recommends that the hose be as straight as possible to eliminate excessive wear on the outside radius of hose tube in the bend area. Hoses that are bent should be rotated 90° every 3 months to spread the wear on the complete 360° surface area of the hose ID.



18. Hose when used in a Horizontal Outlet application will have a shortened service life. This type of application places strain on the sharp bend of the hose. In order to increase service life in this type of application it is recommended to minimize the bend of the hose with a bend restrictor or place a 45° elbow on the piping (see below).
19. It is impossible to test **NovaFlex** hoses under all the conditions to which they might be subjected in the field. It is therefore the buyer and/or end user's responsibility to test all **NovaFlex** hoses under conditions that duplicate the service condition prior to installation.
20. **Novaflex Temperature Safety Guidelines:**

Novaflex designs its hose working pressures in accordance with RMA design and safety factors at ambient temperatures. In many applications requiring higher temperatures resistance, Novaflex has accommodated the higher working temperature by using appropriate compounds and reinforcements to meet these parameters.

Attention: **Never use any Novaflex hose outside the hose temperature limits marked on the hose. It should be noted, that even within these indicated hose temperature limits other factors such as (but not limited to); attached end fittings, different hose installations can place additional stress on couplings (i.e. vertically hung) and hose diameters can impact performance under elevated temperatures. For safety reasons Novaflex recommends that the hose working pressure should be de-rated by the below temperatures ranges:

80° to 150° F – Reduce working pressure by 15%. 150° to 225° F – Reduce working pressure by 30%.

Over 225° F – Reduce working pressure by 50%.

Operator requirements for a safe hose assembly

21. When crimping or swaging on a coupling, always measure the hose OD on each hose end to verify the exact OD of the hose to get a correct crimp based on that OD. Hose ODs can vary!

22. Some hose applications transfer products with higher temperatures, such as Asphalt Hose and Hot Sulfur Hose or other. These temperatures will shorten hose service life when compared to normal dock hose applications. Temperature is a natural enemy of rubber, it causes rubber to stiffen and harden. When a hose operates above 200°F, (92°C) the life of the hose is affected adversely by the amount of time the hose is used at the elevated temperature. It is impossible for Novaflex to project service life of this type product. After 6 months in service, it is incumbent on the user to inspect closely and test the hose before each use to ensure its continued safe operation or retire it should it fail inspection.

General Instructions for Visual Inspection of NovaFlex Hose

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

All hose should be externally inspected prior to each use and thoroughly inspected every six (6) months or sooner. All hose should be hydrostatically tested to 1.5 times working pressure (or to appropriate industry standards) every six (6) months to verify the hose assembly's integrity. Hose, prior to inspection, must be depressurized and laid out straight for inspection. Coupling selection should be made with the intent of providing the maximum level of safety with the best performance capability possible. Daily inspection is a visual inspection for any damage or unusual conditions.

| INSPECT DAILY FOR: | CORRECTIVE ACTION |
|---|--|
| 1. Check to ensure that this is the correct hose for the application. (Review application markings on hose) | If incorrect hose, remove from service. |
| 2. Look for cuts, gouges, kinks or worn spots in the hose cover that expose textile or wire reinforcement. | Remove hose from service. Contact NovaFlex for repair instructions |
| 3. Inspect for soft spots, bulges or blisters in cover, sections of mashed flat hose or kinked areas. | Remove hose from service. Contact NovaFlex for repair instructions |
| 4. Carefully examine a length of the hose (18" in length 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 NovaFlex for repair instructions |
| 5. Check couplings for any slippage which is evidenced by misalignment of the coupling or scored/exposed areas on the hose cover next to the coupling which indicates movement of the coupling. | Remove hose from service. Contact NovaFlex for repair instructions |
| 6. Check couplings for worn threads, loose clamps or bands, worn gaskets, worn or broken handles, cam-arms and pins. | Remove hose from service. Remove suspect couplings from the hose and replace with new coupling. |
| 7. Inspect for hose cover blisters or loose outer cover. This may indicate conveyed product is passing through the carcass of the hose. | Remove hose from service. Contact NovaFlex for repair instructions |
| 8. Before each use look down the inside of the hose couplings damage or blockages. | If broken parts or blockages are found, remove from service. |
| 9. Inspect couplings for any worn parts that may prevent normal function, damage to any safety device that prevents them from working, worn threads, excessive corrosion or rust, or cracks in any part of the coupling. | Remove hose from service. If possible, remove suspect couplings from the hose and replace with new coupling. |
| 10. Look for changes in cover color. This may indicate chemical attack. | Remove hose from service. Contact NovaFlex for repair instructions |

Details of visual inspection should be recorded on an inspection form, indicating location of significant damage or defect. The hose itself should also be marked at these locations prior to hydrostatic testing in order to determine if point of failure corresponds to observed damage.

General Instructions for Hose Hydrostatic Inspection and Testing

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

New Hose

1. All new Rubber hoses are to be hydrostatically tested to 2 times (200%) the working pressure indicated on the hose label for 5 minutes. Other test regulatory agencies have testing requirements that will super seed Novaflex's requirements (such as US Coast Guard, EPA, Military, or others). The hose assembling company must follow the applicable requirements as set forth by the application. The hose should have an external inspection to insure the hose is free of kinks, cover cuts or gouges, loose or damaged hose cover and other external problems that would prevent the hose from being placed into service.
2. All new Composite hoses are to be tested to 1.5 times the working pressure shown on the hose for 5 minutes (dock hose and heavy duty composite hose are tested for 30 minutes). The hose should have an external inspection to ensure the hose is free of cuts, gouges, kinks, bent wires or damages that would prevent the hose from being placed into service.

Used Hose – Remember if there is an issue or suspected problem always error on the side of safety and remove the hose from service. An inspection and hydrostatic test is to be made at periodic intervals (not exceeding 6 months) to determine if a hose is suitable for continued safe service. *Novaflex only recommends Hydrostatic Testing for rubber hose.*

A visual inspection of the hose as described previously for loose cover, kinked hose, cover bulges, soft spots, displaced wire or any other damage which might indicate damaged hose should be made first. If damage is observed, the hose must be retired from service. The coupling (or fittings) should also be closely examined and if there is any sign of movement of the hose from the couplings, the hose must be rejected and removed from service.

The periodic inspection is to include a hydrostatic test for 5 minutes at 1.5 times the working pressure labeled on the hose. During the test the hose should be straight (not coiled). Water is the recommended media for testing and following the test the hose may be flushed with Alcohol to remove the water (if the hose tube is resistant to Alcohol). If a hose is expected to be electrically continuous or discontinuous, it should be tested at this time. Use an OHMS meter to verify the electrical properties of the hose.

After testing, inspect the hose tube (internally) with a flashlight for tube damage. Tubes that have discoloration, bubbles, cracks or have loose spots must be rejected.

Safety Warning

Air or other compressed gases should not be used for pressure testing due to the explosive nature of this type testing!

When hydro testing, all air should be removed from the hose prior to testing by bleeding it through an outlet valve attached to one end of the hose (elevate this end to bleed off air). The hose to be tested should be completely restrained by enclosing the test area or using tie down straps at 10 ft. intervals along the hose length to prevent whipping should a hose end be ejected. The ends of the hose should be anchored to the test structure in such a manner that they do not restrict the ability of the hose to move, but insure that should a hose coupling be ejected that they are contained.

Provisions must be made to protect personnel from the effects of a hose rupture at the highest pressure tested. Testing personnel, after the hose is taken to test pressure and returned to working pressure, can then perform the necessary hose inspections required (i.e. look for leaks, blisters, loose spots). After testing, the tube should be inspected for hardness, color changes, cracks, blisters, erosion, etc.

If compressed gas testing is used **against** Novaflex's recommendations, all risks for this type testing are assumed by the company performing the compressed gas testing.

General Instructions for Proper Hose & Duct Storage

Some Information obtained from RMA Hose Handbook IP-2[2009] & NAHAD Guideline 520[2009]

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 having a very thin wall will not support as much load as could a hose having a heavier wall or hose having wire reinforcement. Hose shipped in coils or bales stacked to save freight should be stored so that the coils are in a horizontal plane and re-stacked to prevent weight damage.

Whenever feasible, 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. Certain rodents and insects will damage hose, protection from these elements must be provided. The ideal temperature for storage of rubber & plastic hose products ranges from 50° – 70° F (10°-21.2° C), with a maximum limit of 100° F (38° C) for short periods.

If stored below 32° F (0° C) some product will become stiff and will require warming before bending or being put in service. Hose 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 (recommended 30% to 60%).

To avoid the effect of high ozone concentrations, rubber hose products should not be stored near electrical equipment that may generate ozone or be stored for any lengthy period in geographical areas of known high ozone concentrations. Hose should not be stored in locations where the ozone level exceeds the national Institute of Occupational safety & Health's upper limit of 0.10 ppm. (in areas of higher ozone, storage life is greatly reduced). Exposure to direct or reflected sunlight; even through windows should be avoided. Uncovered hose should not be stored under florescent or mercury lamps which generate light waves harmful to hose. . Protection from such lighting should be provided.

To obtain best results storage areas must be cool and dark, free of dampness and mildew. Items should always be stored on a first in first out basis; even under the best of conditions unusually long shelf life could deteriorate plastic or rubber hose. It is incumbent on the storage facility to maintain the correct storage conditions and inspect and manage the products inventoried to insure that they maintain the level of serviceability as set forth by the manufacturer.

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

Hose is a very vulnerable link in most process and transfer applications. **All hose will fail in time!** It handles valuable and potentially dangerous materials, and hose failures can be expensive in terms of lost product, ruined equipment, spill clean up, and — most important personal injuries.

For this reason, hose is carefully designed and built to do a specific job safely and economically. Yet, unfortunately, the years of research and development invested in hose construction can be canceled by improper storage, misuse, and other abuse by the hose user, warehousemen, and other work personnel.

NovaFlex recommends careful observation of the following points to improve service, safety and economy from the hose you use.

Do - Use hose designed and recommended for the service intended. Contact **NovaFlex** and our staff will assist you in the selection of the best hose product for your requirements.

Do - Make sure hose is easily identifiable as to the type and use. Where dangerous misuse can occur, use different fittings or end connections.

Do - Make sure your **NovaFlex** Hose is the correct length for the job intended. Remember to engineer for a possible -4% contraction to +5% elongation at max working pressure on the hose assembly.

Do - Always wear safety clothing, gloves, boots, hard hat and eye protection when using a hose.

Do - Avoid subjecting hose to damage by vehicles, falling rocks, or other objects. It is easy to install protective covers on hose.

Do - Check manufacturer's chemical resistant charts to insure the hose will transfer the chemical at the concentration and temperature **before** it is put in the hose.

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

Do - Insulate a hose to protect it from damage due to external direct or radiant heat sources. (Some hose can be built with insulation.)

Do - Always clean hose before putting it into service to ensure it is clean.

Do - Always clean/sanitize food hoses before putting into service to ensure it is clean.

Do - Always closely inspect before each use of any hose used at high temperatures for signs of heat aging. High heat hoses typically have shorter services lives. Check for cover cracks and hard brittle covers that expose the reinforcement; if found retire the hose from service.

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

Do – Make sure that the hose couplings and their attachment method is correct for the application. Check with the coupling manufacturer's for correct recommendations.

Do – Test hoses every six (6) months or sooner to 1.5 times the working pressure or to industry recommended pressures based on RMA, USCG, OSHA, DOT, API, NPGA or others, NAHAD - Hose Safety Institute.

Do – Educate all employees on how to inspect a hose before **each use to ensure** it is safe to use along with correct hose use and care. Teach employees to – Error on the side of safety!

“When in doubt, remove the hose from service!”

Do – Store hose in a flat coil. Be sure no kinks are left in the coil. Lay it on the floor, a shelf or table. Long lengths are best stored on hose reels. Store at temperatures between 50°F (10°C) to 70°F (21°C) Maximum 100°F (38°C)

Do – Protect hose from the effects of ozone (O3), the active form of oxygen which is more prevalent than most people think. Store away from electrical or ozone producing equipment.

Do – If a hose is suspended in the air, always attach a safety chain or cable to prevent a hose from falling should a connection separate from the hose.

Don't – Never perform welding of any type on hose that have couplings crimped or attached to rubber or composite hoses due to heat transfer damaging the hose. Welding should be performed on couplings before attachment.

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 equal. Consult your hose supplier for the correct recommendations.

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

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

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. Successful hydro testing will help verify the integrity of the coupled assembly.

Don't – Store hose after use, without rinsing & draining if it carried substances that ultimately deteriorate the hose tube.

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

Don't – Never pull on a hose by its coupling.

Don't – Never kink a hose to stop the flow of product. Kinking can seriously damage the tube and reinforcement.

Don't – Never lift a hose by the middle with the ends hanging down. This can kink the hose in the middle (especially in hoses over 3" ID). Use hose lifting saddles to prevent kinking.

Don't – Never bend a hose beyond its minimum bend radius

Don't – Subject a hose to temperatures above its rated temperature recommendations (especially any hose with plastic parts, PVC, etc).

Don't – Never insulate a hose that is used to transfer heated materials over (100°F). Hose is designed to let heat radiate from the hose cover to the atmosphere.

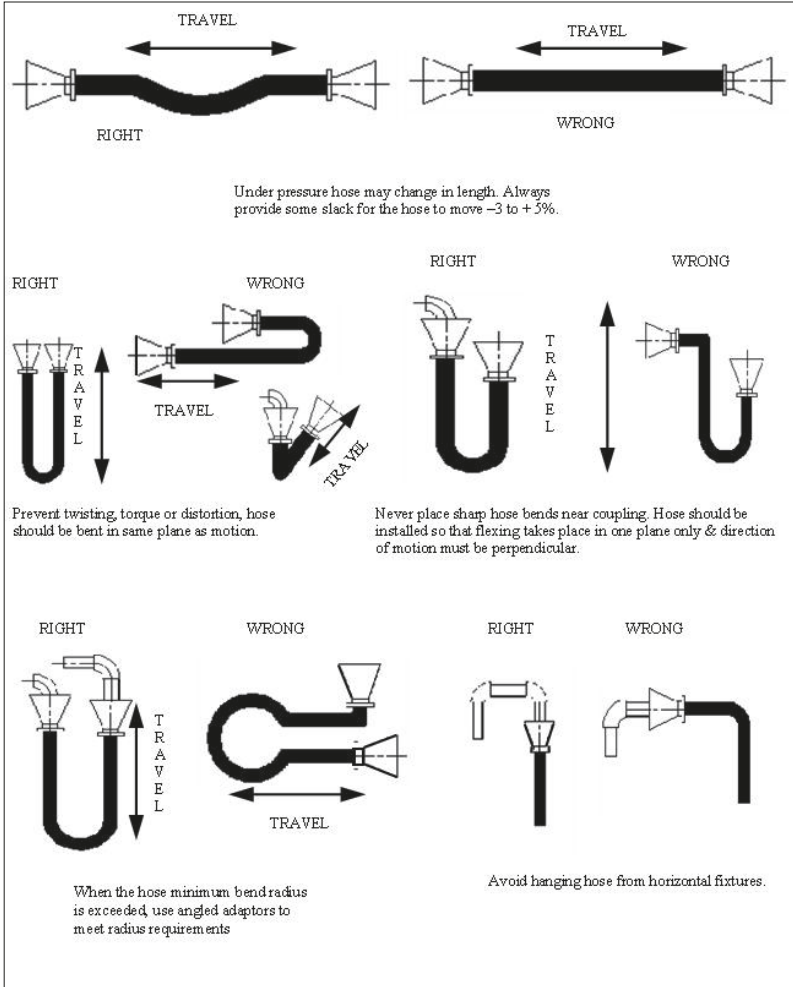
Don't – Never hang a hose by the hose fittings/connections without attaching a safety strap to each end to hold the hose in the case of a coupling ejection. This is to protect staff that may work under the hose.

Don't - Never store a type of hose so the weight of the couplings is a dead weight hanging free. The weight of the coupling over time will weaken the hose at the back of the coupling (this is the reverse of a horizontal outlet problem).



Correct Assembly Installation

Satisfactory performance and appearance depends upon proper hose installation. Excessive length destroys the trim appearance and adds unnecessary stress to the hose if it causes the hose to exceed minimum bend radius. Hose assemblies of insufficient length may cause coupling pull out or over stress the hose causing short service life. The diagrams below offer suggestions (for other configurations contact **NovaFlex**) for proper hose installation.



Hose should never be placed into an application that induces twist, rotation or torques the hose.

Cleaning Tips for NovaFlex Hose

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

1. Long term effects of potentially hazardous chemicals from damaging hose & couplings (even 316 stainless steel is effected over time by some common chemicals).
2. Contamination of product, should one hose be used to convey multiple products.
3. Prevent accidental spillage from chemical residue left in the inside of a hose.

This process is typically accomplished by flushing the interior of the hose with water or a cleaning solution. Cleaning procedures may differ by industry but should at least include the below **NovaFlex** recommendations.

Companies that conform to “Best Practice” programs realize that all safety programs and safety products are only as good as the human element responsible for using and maintaining the products used in the industrial arena. Hose can be dangerous!

It is important that companies take reasonable care to educate their employees to correctly use hoses in their respective work environments. To this end it is incumbent on the employer to institute the simple elements of a hose safety program to maintain safe hose operations by their work staffs.

All staff must wear personnel protective gear, i.e. eye protection & hard hat, gloves, protective clothing, etc.

Cleaning solutions should be able to dissolve or remove the residue material in the hose assembly and must be compatible with the hose tube & couplings.

All material flushed along with the cleaning solution must be processed in accordance with EPA requirements.

Extreme care must be taken when inserting cleaning devices in to the I.D. of a **NovaFlex** hose, such as brushes, steam wands etc. **Novaflex** does not recommend this because hose tubes can be damaged during this process.

1. Steam cleaning is not the preferred method for cleaning any hose due to the possibility of overheating the hose and coupling. If steam cleaning is necessary the procedure, as below, is recommended:
2. The hose should be placed in a straight line with one end higher in elevation to permit draining from the lower open end.
3. Never use super heated steam (steam temperature going into the hose should not exceed the max temperature of the hose to be cleaned -212°F is recommended).
4. Use a steam supply line not larger than ¾" ID into an adaptor to match the ID of the hose to be cleaned.
5. The hose to be cleaned must have the other end open to the atmosphere. Care must be taken to ensure that the velocity of steam in the hose to be cleaned is minimal (steam [jets] velocities will damage the hose tube (liner). The use of wand ends or nozzles in the hose ID is not authorized.
6. Steam cleaning duration of 15 minutes or less is recommended.
7. The hose should be flushed with clean water after cleaning.

To insure no cleaning chemical residue is left in the hose assembly, the hose can be hung vertical for a brief time to drain. It is common to hang hose to facilitate draining (hose with a convoluted tube surface may require this method).

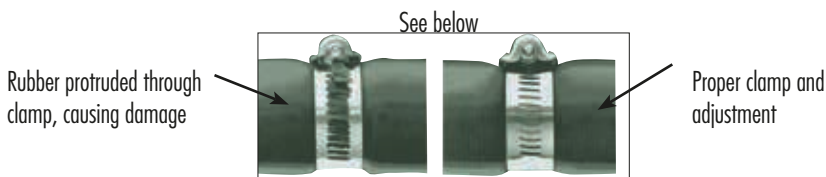
Warm air (120°) F can be circulated through the hose for drying.

If hose is cleaned in a dip tank, do not exceed the maximum temperature marked on the hose. Cleaning time in the dip tank should not exceed 15 minutes.

General Instructions for Hose Clamps and Marine Hose

There are numerous manufactures of hose clamps, Novaflex Marine does not recommend any particular brand. There are common practices for the use of clamps and preferred clamp styles. Improperly attached clamps can cause damage to hose; hose ejection from the fixture or leaky connections resulting in spills. A superior type of hose attachment method is a permanently attached crimped or swaged coupling system. Due to the vastly different hose attachment applications common in boat building, worm drive bands have become the convenient method of choice.

1. Each manufacture of hose clamps rates their clamps differently. Novaflex Marine recommends that a worm gear type hose clamp not be used on any hose with working pressures over 75 psig with out the manufactures approval. This max working pressure will change by hose ID.
2. Novaflex Marine recommends clamps that are made with an inner liner to prevent rubber extrusion through the screw slots.



3. All hose is subject to cold flow. This is the loss of compression over time due to stress placed on rubber or plastic over time. Clamps should be re-tightened periodically, inspect for leaks and tighten to stop a leak. Replace if leak persist.
4. Do not over tighten clamps, this could cause the clamps to cut into the rubber or plastic resulting in shortened service life. Never exceed the torque rating recommended by the manufacture of the clamp!
5. Use 2 clamps per connection end to obtain a safe seal or meet industry requirements (USCG, SAE, NMMA or ABYC). It is incumbent on the installer to know the requirements and use correct procedures. When 2 clamps are used, offset the screw tightening head approximately 180° to get the best seal.
6. Use only marine grade stainless steel clams to resist the effects of corrosion.
7. Always inspect hoses used on the boat at least every six months.

Examples Of Common Damage That Signal Rubber & Plastics Should Be Replaced

The below examples are the most common visual signs that a hose is demonstrating danger signals. Examples of hose damage are not limited to what is shown, there may be other situations that can result in severely shorting hose life. When inspecting hose, tubing, ducting or other rubber or plastic product always err on the side of safety! "When in doubt, remove from service".



Hose cover melted due to contact with high heat of hot engine parts



Hole in hose cover that exposes reinforcement



Hose bent too tight, damaged at end of coupling



Plastic hose kinked



Exhaust hose with cover worn, exposing reinforcement



Crushed vent ducting, will impede proper and safe venting of fumes. Replace damaged duct

Examples of Common Damage that Signal Rubber & Plastics Should Be Replaced



Hard wall hose kinked flat. Hose needs to be replaced.



Clamps installed with screw tightening heads in line. It is recommended to offset as see below.



Hose with cover charred area from high heat or extreme aging due to heat or ozone



Hose with cover cracks due to age or the effects of ozone. Hose covers over time harden and should be replaced if this condition is found. (note: if boat has an ozone generator on board this could accelerate this condition

Elements of a Hose Safety Program Rubber Hose - Conductivity

Rubber hose can be made to meet conductive and non-conductive requirements. It is important that the specific electrical requirements be conveyed to **NovaFlex** so the correct hose construction can be supplied. Always test the finished hose assembly to insure that the electrical requirements have not been impeded due to damage or wear. The use of an ohm meter can be used to insure the hose meets the specific specification.

In an effort to provide assistance for hose safety, **NovaFlex** recommends that a safety program involving (but not limited to) these key elements be used.

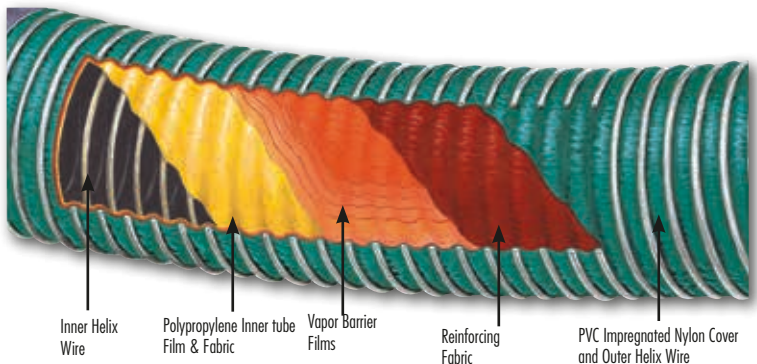
- Hose identification system
- Coupling identification system
- Hose application identification program
- Employee training program on Hose Care, Use and Maintenance.
- Root Cause Analysis of hose failures
- Hazardous Application Hose Failure Action Plan

Composite Hose Information

Composite hose is a unique hose composed of many layers of special materials, held together between an inner and outer wire. This type of hose is still subject to the same operational parameters as regular hose.

This type of hose can be maintained in accordance with the instructions in this booklet. The only additional points are: Care should be taken to not damage the exterior of the hose. If the outer wire is broken or damaged, the hose should be replaced.

If the outer cover plies are abraded to the point the inner carcass plies are exposed, the hose should be replaced. Insure the hose is used to transfer products in accordance with the chemical resistance chart.



If thick highly viscous materials are heated to remain fluid, it is incumbent on the user to insure the product conveyed is free of solids due to coagulation due to cooling.

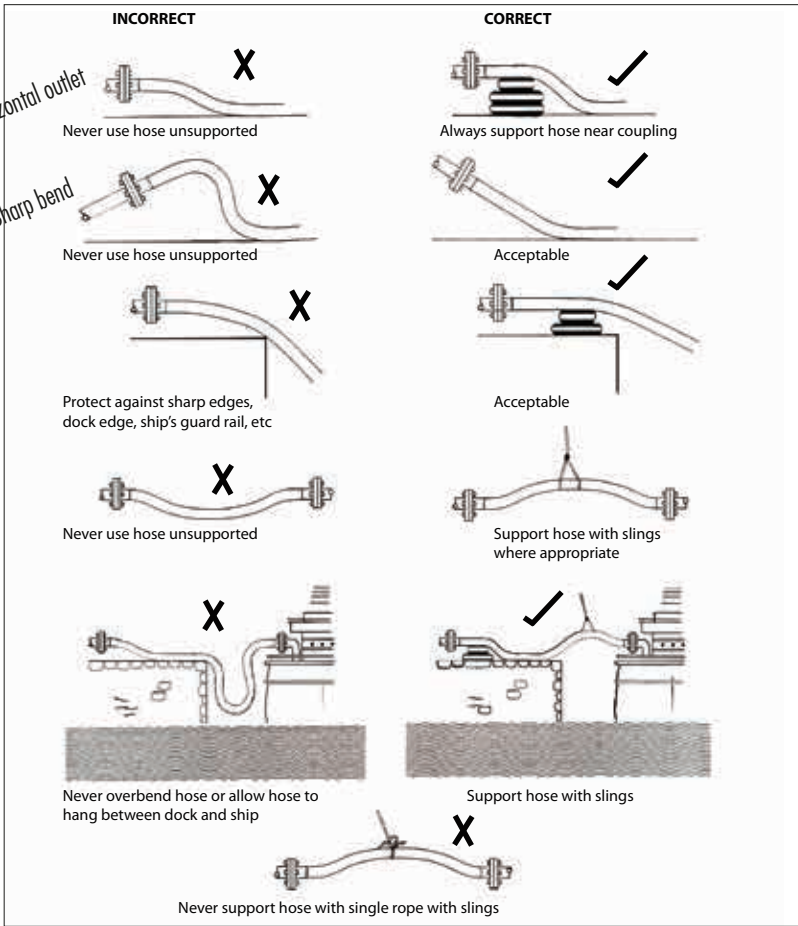
Inspection And Testing Of Composite Hose

This document provides procedures for the inspection and testing of composite hoses in-service, as well as criteria for their retirement. These include visual inspection, hydrostatic testing and service/age retirement criteria.

In the case of damaged or defective hose that may pass the hydrostatic test but does not satisfy the remaining criteria, burst testing of the hose is suggested to assess remaining hose strength as well as the mode of failure. This data is useful to verify or re-assess the current retirement criteria.

To ensure long trouble free service with NovaFlex composite and rubber hoses, it is recommended that the following installation and maintenance procedures be followed:

| ALWAYS | NEVER |
|--|--|
| Support the hose near flange connections | Use the hose unsupported. |
| Support the hose at the appropriate points | Support the hose with a single rope. |
| Cushion the hose against sharp edges, dock edges, ship's rail etc. | Allow the hose to hang unsupported between ship and dock |



Use a **BEND RESTRICTOR** to prolong hose life when hose is used on horizontal outlets or sharp bends. (See also page 6)

Note: Due to the inherent nature of composite hose it is susceptible to stretching in length while pressurized. Hose elongation while under pressure is not an indication of failure of films and fabrics. It is therefore critical that this be taken into consideration when calculating the overall length for a hose assembly in operation.

Hose should never be placed into an application that induces twist, rotation or torques the hose.

Details of visual inspection should be recorded on an Inspection Form, indicating location of significant damage or defects. The hose itself should also be marked at these locations prior to hydrostatic testing in order to determine if point of failure corresponds to observed damage.

Composite hose retirement criteria based on visual inspection includes the following:

1. Dents or kinks in the carcass and the inner or outer wire.
2. Displacement of 2 or more adjacent inner or outer wire helix from their normal pitch.
3. Corrosion or abrasion of the outer wire.
4. Displacement of end fittings or signs of leakage from the ends.
5. Damage to the outer cover and underlying reinforcement fabric.
6. Moderate abrasion of the outer cover is acceptable and repairable if the reinforcing fabrics below the cover are not damaged.

Hydrostatic Test

The hydrostatic test shall be performed as described below. Electrical continuity checks, as per part 6, shall also be done during the test. Hose assembly lengths shall be measured between flange faces. (NAHAD 600. Guidelines 2005).

Warning

The use of a compressed gas is not authorized because of the risk to operators. Any failure during gas testing is likely to be of a highly explosive nature. Water is the approved test liquid.

It shall also be stressed that when a liquid is used as the test medium it is essential that all air is expelled from the hose or hose assembly because of the risk of injury to the operator due to the sudden expansion of trapped air being released when the hose bursts. Always ensure testing staff wear appropriate safety equipment and that during testing they are protected from possible coupling ejection and hose rupture.

1. Lay the hose straight out and permit free movement under pressure. (Hose will elongate under pressure.)
2. Place blanks over both ends and fill the hose with fresh water.
3. Vent the trapped air by raising one end of the hose.
4. Pressure test requirements: 1" to 4" I.D. test hose to 150% of working pressure for 5 minutes.
5. Check for electrical continuity
6. If length measurements are required:
 - a. Pressurize the hose to one time working pressure, hold for 30 seconds, release pressure to 10psi and take the initial length measurement at 10psi. $Lo = \underline{\hspace{2cm}}$.
 - b. Measure the hose length at test pressure (150% of hose WP), $Lt = \underline{\hspace{2cm}}$. Calculate the temporary elongation as follows: $Lt - Lo \times 100 = \underline{\hspace{2cm}}\% Lo$
7. Composite carbon and stainless steel couplings are designed to match the working pressure (WP) of NovaFlex hoses. When using polypropylene/plastic couplings the working pressure of the hose assembly is reduced to the below WP by hose ID:
1", 1½" and 2" - max 100 psi WP. 2" 2½" & 3" - max 75 psi WP
8. Based on the type hose tested, a hose can elongate up to 15%.

Electrical Continuity

Composite Hose

NovaFlex's composite hose is designed to be electrically conductive. Assemblies are conductive through the use of hose couplings connected to various wires that run the length of the hose. All **NovaFlex** composite hose is designed to provide an electrical ohm resistance that does not exceed 10 ohms. The user should always test the conductivity of the hose when the hose safety pressure test is made. This test can be easily accomplished using an ohm meter. If conductivity is a major concern, the user of the hose can test for conductivity as often as deemed necessary.

Rubber Hose

When using rubber hose, different hose applications may require a conductive hose. All hose applications transferring any product that can build up a static charge in the hose must be grounded. All hoses transferring chemical or flammable products must be grounded. Grounding the hose can be accomplished by using the helix wire or a ground wire that is built into the hose. This hose end is cut away so that the wires are extended from each end of the hose and folded into the hose ID about ½" so that when the coupling is inserted into the hose ID it is clearly in contact with the respective wires. Use an OHM meter to check for conductivity for each length.

Conductivity should be verified at least every six (6) months when in service.

Cleaning All Types of Hose:

Hoses should be thoroughly flushed out and drained before testing and after service or prolonged storage.

1. Flush with fresh water, detergent or suitable solvent at ambient temperatures.
2. Cleaning fluids should be flushed out to avoid chemical reactions with service products.
3. During steam cleaning composite hose, the temperature of the steam must not exceed 212°F (100°C). Care must be taken to insure plant steam (which is generally above 300°F) is not directly injected to the hose ID.

Note: *Hoses should be electrically grounded during cleaning. When cleaning, to avoid internal damage to hose do not exceed maximum working temperature and pressure.*

Other Novaflex products data sheets:

1. Dock hose "Care and Maintenance Guide"
2. Heat Traced "Care and Maintenance Guide"
3. Marine hose "Care and Maintenance Guide"

Novaflex Temperature Safety

You can extend the safe operating service life of hose by implementing simple safe operating procedures.

Novaflex® designs its hose working pressures in accordance with RMA design and safety factors at ambient temperatures. In many applications requiring higher temperatures, Novaflex® has accommodated the higher working temperature by using appropriate compounds and reinforcements to meet these parameters.

Never use any Novaflex® hose outside the hose temperature limits marked on the hose.

It should be noted that even within these hose temperature limits, attached end fittings differ. Different hose installations can place additional stress on couplings (i.e. vertically hung) and hose diameters can impact performance under elevated temperatures.

For safety reasons Novaflex® recommends that the hose working pressure/vacuum should be de-rated by the temperature ranges hereby listed below:

| | |
|----------------------|---|
| 125° to 175°F | - Reduce working pressure by 15% |
| 176° to 225°F | - Reduce working pressure by 30% |
| Over 225°F | - Reduce working pressure by 50% |

NovaFlex® Returned Material Authorization (RMA)

1. To return a product, the customer must be issued with a NovaFlex RMA#.
2. Products returned without a NovaFlex RMA# will be refused by the shipping department.
3. After the issuance of the RMA # the customer has 30 days to have the product returned to the NovaFlex site specified on the RMA.
4. All returned hoses must be clean and free of any materials transferred. Should a hose be returned and found not to have been cleaned and is deemed contaminated with chemicals, NovaFlex will dispose of the hose in accordance with NovaFlex's Environmental Hazard Waste protocol without approval by the customer. NovaFlex is not in a position to handle or store contaminated product.
5. Once the product is received by NovaFlex, the RMA will be processed, inspected and a determination will be made in a timely manner.