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 **The Novaflex Group** has prepared this technical booklet to assist our customers and users of Novaflex Marine 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.

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.

General Instructions for Hose Use, Care and Maintenance

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

Novaflex Marine customers have requested information pertaining to the use, care and maintenance of marine assemblies. As a result The Novaflex Group has developed this technical booklet to improve users understanding of marine hose. This information is available to all users of **Novaflex Marine** products.

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!" This Novaflex 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. 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.

Every hose user should have in place a safety procedure to implement in the event of a hose failure.

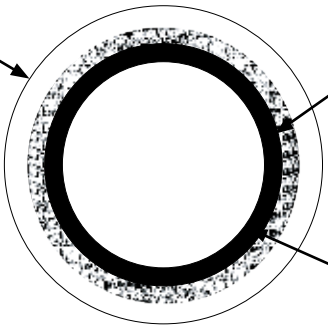
Should you have any questions on any topic covered in this booklet, contact **The Novaflex Group at: (800)334-4270 or (336)578-2161.**

'S' Size	The hose inside diameter (I.D.) and length required to meet the applications requirements *(i.e. 3" x 10 ft)*
'T' Temperature	Maximum & minimum temperature of the product conveyed through the hose assembly. *(i.e. 200° F)*
'A' Application	Describe the actual use of the hose *(i.e. Ship to Shore unloading, LPG transfer, in plant chemical use, etc.)*
'M' Material Conveyed	Air, water, the specific chemical, product *or material conveyed (i.e. compressed air)*.
'P' Pressure	The pressure or vacuum at which the material is being conveyed through the hose assembly. *(i.e. 100 psi)*.
'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. June 6, 2006)*.

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 Marine**.
"Always use the printed information from Novaflex Marine 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 Marine** 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 (WP) 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

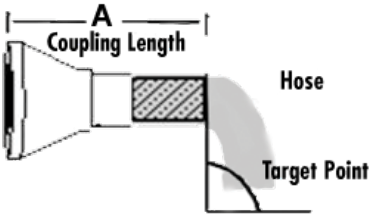
Reinforcement
Provides strength to resist pressure and vacuum. Combinations of textile and wire are used

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

Operator Requirements For A Safe Hose Assembly

1. Working Pressure (WP) should never be exceeded. 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).
3. Only use the hose assembly for the service marked on the hose or for the service recommended in the printed literature.
4. Have a HOSE INSPECTION & TEST PLAN to insure unsafe hoses and / or worn or damaged couplings or clamps are removed from service.
5. Test all hose assemblies as required every six (6) months (or sooner) to insure the assembly is safe for continued use. (Use RMA, USCG, OSHA, NFPA, LPGA , SAE or other regulatory agency recommendation for pressure testing along with these guidelines.) If pressure testing is not possible, the hose should be inspected every 6 months for signs of ageing or damage.
6. Educate your self as to the conditions associated with unsafe hose; develop an inspection program that causes your hose to be inspected on a regular basis. Hose users remember "When in doubt, remove the hose from service!" Maintain a HOSE Inspection & Test Plan that requires a visual inspection at least every 6 months.
7. Always use a coupling made from material suitable for the application and product conveyed. (Refer to alloy Charts).
8. Check the hose attachment for slippage. Look for misalignment, exposed cover from under the clamp. If there are questions contact Novaflex Marine.

9. In many cases hose may be installed through bulk heads or walls, because of vibration on a vessel, the hose cover could be worn excessively over time. If there is this possibility hoses should be protected from this potential damage with a protective cover.
10. 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 catalogue)



11. It is common in some applications to attach hose by sliding the hose over a pipe or other fixed connections and clamping the hose to this attachment fixture. The use of worm gear type hose clamps is recommended for low pressure applications (generally less than 75 psi WP). When hose clamps are employed the installer must follow the recommended installation procedures for correct hose retention. It is best practice to pressure test new applications to verify the attachment method is functional.
12. Use of Worm Gear Clamps— see page 13.

General Instructions for Novaflex Marine Hose and Hose Connection Inspection

(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. When hose hydrostatic testing is not an option to verify hose integrity, it becomes incumbent on the hose user to be more diligent in their visual inspection to identify damaged or aged hose for replacement . **"All hose will fail in time!"**

	INSPECT FOR:	CORRECTIVE ACTION
1	Look for cuts, gouges, cracks, or worn spots, cracks in the hose cover that expose textile or wire reinforcement.	Remove hose from service. Contact Novaflex Marine for instructions
2	Inspect for soft spots, bulges in cover, sections of mashed flat hose or kinked areas.	Remove hose from service. Contact Novaflex Marine for instructions.
3	Carefully examine a length of the hose (18" in length adjacent to where the hose 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 Marine for instructions.
4	Check hose attachment 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 hose.	Remove hose from service. Contact Novaflex Marine for instructions.
5	Check attachments for worn threads, loose clamps or bands, worn gaskets, worn or broken handles & clamps.	Remove hose from service. Remove suspect couplings or clamps from the hose and replace. If hose is damaged or suspect replace.
6	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 Marine for instructions.
7	Inspect couplings & clamps 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 or clamp.	Remove hose from service. If possible remove suspect couplings from the hose, replace with new coupling.
8	Inspect for hardness of the hose cover. Hoses older that 5 years may start to develop cover hardness and crack over time permitting moisture in to the reinforcement.	Replace with new hose.

General Instructions for Hose Hydrostatic Testing and Inspection

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

Hydrostatic testing is the recommended practice to verify hose serviceability. The hose user must determine when testing is not practicable and implement the best alternative, a visual inspection. A visual inspection of hose as described previously should be made for loose cover, kinks, bulges, soft spots, cover hardness and/or cracks which indicate conditions that require hose to be replaced. In addition the attachment method (clamps or couplings) should be closely examined for damage or movement.

When periodic inspection includes a hydrostatic test, pressure the hose assembly for one minute at 150% of the recommended working pressure of the hose. During the hydrostatic test, the hose should be straight, not coiled or in a kinked position. Water is the usual test medium . Never exceed working pressure (25% of the rated burst pressure).

Safety Warning:

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

1. Air or other compressed gases should not be used for pressure testing.
2. 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.
3. Hose to be pressure tested should be restrained by placing steel rods or strap close to each end and at approximate 10 foot intervals along its length to keep the hose from "whipping" if failure occurs. The steel rods or straps are to be firmly anchored to the test structure in such a manner that they do not restrict the movement of the hose under pressure.
4. The outlet ends of the hose should be placed so that an ejected fitting will be restrained by a wall, sand bags, etc.
5. Provision must be made to protect personnel from the forces of the pressure media if a failure occurs. Personnel must never stand in front or in back of hose ends during test.

General Instructions for Proper Hose Storage

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

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 (plastic hoses are very susceptible to this on hot days).

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 light wall will not support as much load as a hose having a heavier wall or hose having a wire reinforcement. Hose shipped in coils or bales should be stored so that the coils are in a horizontal plane.

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 should be provided.

The ideal temperature for storage of hose products ranges from
50° – 75°F(10°-24°C) with a maximum of 100°F (38°C). If stored below 32°F (0°C) some products 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.

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

Items should always be stored on a first in first out basis, even under the best of conditions, unusually long shelf life can deteriorate plastic or rubber hose.

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 Marine & The Novaflex Group recommends careful observation of the following points to improve service, safety and economy for the hose you use.

Do – Use hose designed and recommended for the service intended. Contact Novaflex Marine 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 Marine 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 – Set up regular hose inspections before each use so that damaged or worn hose assemblies can be replaced.
Do – Attach hose using proper elbows and nipples, so that its operation (including its own weight and heavy end connections) will not cause it to bend sharply at the coupling. Support hose ends with heavy couplings attached.
Do – Avoid placing hose in applications in which vibration, rubbing or damage from other external materials may occur. It is easy to install protective covers on hose.
Do – Check manufacturer's chemical resistant charts to insure the hose will transfer the products before it is put in the hose.
Do – Store hose in a cool, dry, dark and clean place.
Do – Only use hose that is rated for below the water line applications, by the manufacture .
Do – Wear safety clothing, gloves, boots, hard hat and eye protection when using a hose.

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

Do – Inspect and or 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.

Do – Be educated on how to inspect a hose before each use to insure it is safe to use along with correct hose use and care. – 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.

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. Paper, wood and rags are good O3 absorbers.

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, cracks 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.

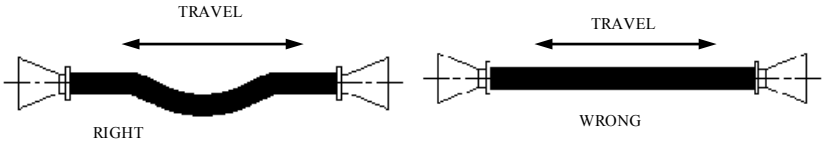
Don't – Take short cuts, use the correct hose and attachments methods as required by USCG, NMMA, SAE & ABYC.

Don't– Use hose in an area that has higher levels of ozone. Ozone will cause rubber and plastics to deteriorate. Ozone is produced by electric motors and other electrical equipment. In areas of above normal ozone, rubber & plastic product life will be shortened and will void Novaflex Marine warranties.

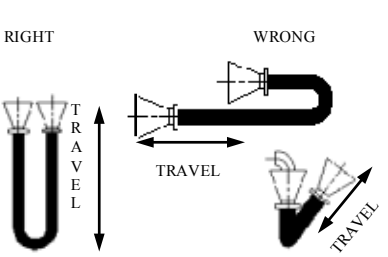
Don't— Store hose below –20°F. Boat storage in the winter can subject plastics and rubber products to temperatures below their lowest rating. Inspect all hoses if the craft may have seen temperatures below –20°F.

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.

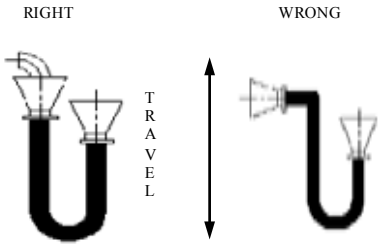
The diagrams below offer suggestions (for other configurations contact **Novaflex Marine** for proper hose installation).



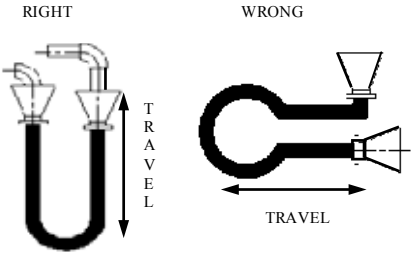
Under pressure hose may change in length. Always provide some slack for the hose to move –4 to + 5%.



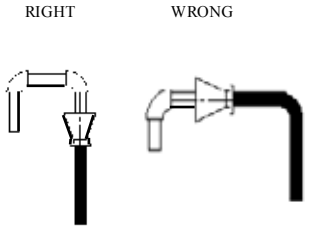
Prevent twisting, torque or distortion, hose should be bent in same plane as motion.



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 minimum bend radius is exceeded, use angled adaptors to meet radius requirements

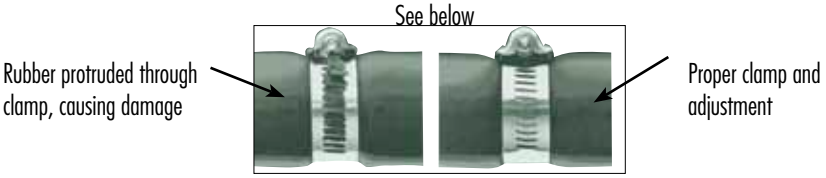


Avoid hanging hose from horizontal fixtures.

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. In many applications it is prudent to 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. If 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.

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 error 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 ti 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

Silicon Rubber & EPDM Molded or Reinforced Connectors

Novaflex Marine Extender silicone and EPDM rubber products are for use as described. Products with textile reinforcement can be used in wet exhaust systems and used on engine coolant systems. It is incumbent on the user or installer to insure the product is used in applications that do not exceed the rated working pressure or temperature of the product.

1. When installing the Extender Silicon or EPDM units in wet exhaust systems, place the unit downstream from the water injection point so that the maximum continuous temperature at its location does not exceed the rating of the Expender unit.
2. Install the unit over rigid piping with enough over lap to use 2 marine grade stainless steel worm gear clamps (minimum ½" wide). For additional safety ⅝" & ¾" clamps are recommended.
3. Inspect all rubber & plastic products every 6 months for serviceability. In case of an engine backfire, inspect the entire exhaust system for damage, leaks or separated connections. All inspection information in this booklet can be applied to connectors.

Molded parts have no reinforcement. It is important to strap and support all parts to prevent movement and possible disconnection due to vibration. In addition it is important to insure that the weight of hoses and other equipment attached to connectors do not place forces on the connectors that will promote disconnection at the attachment point.

LIMITED WARRANTY

NOVAFLEX MARINE warrants its marine products to be free from defects in material and workmanship under conditions of normal use and service when installed and used in its proper non-commercial marine application in accordance with all applicable federal, state and local laws. This warranty shall be for the term of up to ten years from date of purchase according to our literature, on the date of purchase. This warranty does not apply to products which have been damaged for any reason after leaving the control of NOVAFLEX MARINE, including but not limited to damage caused by abuse, misuse, negligence, accident, modification, installation, alteration, repair, or excessive temperature, ozone or pressure. During the warranty period, if a product is found to be defective in material or workmanship, it will be replaced or repaired without charge if returned, with prior approval, in accordance with NOVAFLEX MARINE'S return good policy. Damage to the product incurred during packing or return shipping of the product is not covered under this warranty. Proof of purchase must accompany the return. The forgoing obligations state NOVAFLEX MARINE'S entire and exclusive liability and the buyers exclusive remedy for any claim or damages in connection with the sale or furnishing of products or parts, their design, installation or operation. NOVAFLEX MARINE IN NO EVENT WILL BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR BREACH OF ANY WARRANTIES, EXPRESS OR IMPLIED IN FACT OR BY LAW WHATSOEVER, AND ITS LIABILITY UNDER NO CIRCUMSTANCES WILL EXCEED THE PURCHASE PRICE FOR THE PRODUCT. LIABILITY OF NOVAFLEX MARINE UNDER ANY WARRANTY WHICH MAY BE IMPLIED BY LAW, INCLUDING WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, IS LIMITED SOLELY TO THE PERIOD OF TIME SET FORTH IN THIS WARRANTY. This warranty is designed as a LIMITED WARRANTY under the provisions of applicable federal law. Some states do not allow limitations on how long an implied warranty lasts or do not allow exclusion or limitation of incidental or consequential damages. So the above limitations and exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.