

**DUO**  
*Safety*



WORLD WIDE DISTRIBUTION

**Ladder Care  
& Maintenance**

**"Use A Good Ladder  
Or Stay On The Ground"**

Duo-Safety Ladder Corporation strongly recommends that your fire department obtain a copy of NFPA 1932-current edition: Use, Maintenance, and Service Testing of Fire Department Ground Ladders **AND** the IFSTA manual for Fire Service Ground Ladders.



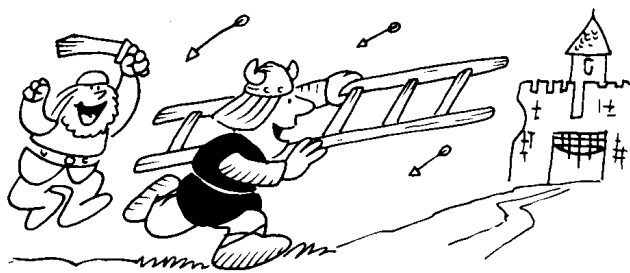
To obtain your copies of the current standards, call or write:

**National Fire Protection  
Association (N.F.P.A.)**  
1 Batterymarch Park  
Quincy, MA 02169  
Ph: 1-800-344-3555  
Fax: 1-800-593-6372  
[www.nfpa.org](http://www.nfpa.org)

**International Fire Service  
Training Association (IFSTA)**  
930 North Willis  
Stillwater, OK 74048  
Ph: 1-800-654-4055  
Fax: 1-405-744-8204  
[www.ifsta.org](http://www.ifsta.org)

## GENERAL - ALL LADDERS

Fire service ladders in general, are simple tools normally used to gain access to levels above the ground; ie: roof access, 2nd or 3rd story windows, etc.



These ladders are generally carried on side mounts on pumpers/ engines or are mounted internally under the turntable of the aerial device/boom of the ladder truck. Maintenance of these ladders is a simple task normally required only once every 6 months UNLESS your department has a higher run frequency than approximately 100 runs a month. In the higher usage bracket, we suggest you increase your maintenance to every 3 months or sooner.

**NOTE:** Training Schools, etc. - We suggest you do your general maintenance at least monthly. General maintenance for ladders is a simple process of taking a little time to visually inspect all the parts, beams, fasteners and rungs for damage or wear and apply wax to all contacting surfaces.

## LADDER INSPECTION LOGS

At the time of inspection, we suggest you start/create a maintenance log for each ladder. This log can then be used to supplement your annual testing reports for each ladder and will provide a useful history to be able to track any and all ladder damages or repairs that may happen.



## SAMPLE LADDER INSPECTION LOG:

As brief or as detailed as you prefer.  
One for each ladder, on each engine or truck.

**Date:** \_\_\_\_\_

**Ladder Type:**

\_\_\_\_\_ Ext. \_\_\_\_\_ Roof \_\_\_\_\_ Other

**Length:** \_\_\_\_\_

**Parts:**

**Feet:** \_\_\_\_\_ OK \_\_\_\_\_ Not OK

**Locks:** \_\_\_\_\_ OK \_\_\_\_\_ Not OK

**Rope/Cable:** \_\_\_\_\_ OK \_\_\_\_\_ Not OK

**Beams:** \_\_\_\_\_ OK \_\_\_\_\_ Not OK

**Rungs:** \_\_\_\_\_ OK \_\_\_\_\_ Not OK

**Noted Problems:** (When and where for future reference)

\_\_\_\_\_

**Visual** (small dents):

\_\_\_\_\_

**Corrections required:**

\_\_\_\_\_

**Date fixed, etc:**

\_\_\_\_\_

**Ladder sections cleaned and rewaxed and returned to service:**

\_\_\_\_\_

**Date and Signature:**

\_\_\_\_\_

**NOTE:** Create your own log form or use ours, it doesn't matter, but please do it.

The idea of regular maintenance and a written log is to be able to track any problems before they can become accidents.



## LADDER TESTING

Ground ladder testing can become an expensive lesson for the unprepared Fire Department. We suggest all departments considering/or preparing to test their ground ladders do their homework before testing any ladders. With the NFPA 1932 standard -1984 edition changes, requirements for all fire department ground ladders have changed considerably. It became very obvious that some of the ladders manufactured before 1984 may not be able to pass the new required test. The homework we suggest would be to get a copy of the ladder manufacturers current ladder catalog and check the listed sizes against the sizes you have in service.

If the nested height of your ladder is less than the current nested height in the catalog or website for the same length and style of ladder, you can assume yours will NOT pass the tests. We also suggest you check the catalog or website for ladder rail sizes. If the catalog/website sizes are larger than your rail sizes for the same type and length of ladder you probably will NOT pass the tests.

Remember if your ladders are OK, service testing, as required by NFPA 1932 **are not** destructive. The only ladders that will not be able to pass the NFPA 1932 tests are ladders you should not be using in the first place. Fire service ladders are assumed to be able to safely support a 750 lb. working load with a 4:1 safety factor. Industrial ladder equipment uses a maximum load of 300 lbs. with a 4:1 safety factor. Surely, fire service ladders can handle **at least twice** that load.



## ARE YOU SURE?

The only way you and your department can be absolutely sure your ladders are safe to use at 750 lbs. is to test.

### **Why 750 lbs.?** What does this mean?

Any ladder with a 750 lb. in service duty rating and a 4:1 safety factor as required by NFPA 1932 can be used as follows:

Three people at one time:

- Three firefighters with full turnout gear and air packs.
- Two firefighters and an unconscious victim.
- Two firefighters and a charged hose.

### **4:1 Safety Factor?** What does this mean?

The 4:1 safety factor used in the design and manufacture of ladders today means that the ladder, once in perfect erected position, is really able to support 4 times the 750 lb. specified load. (That is 3,000 lbs.)

**Why such a high load rating?** Seems 3,000 lbs. is a bit higher than needed.

**Not true.** The load is a static load only - nothing moving, no shock loads, no dynamic loads. Once a smaller load starts to move on a ladder, the dynamic load increases rapidly. Did you know it is possible for one man to put over a 2,000 lb. load on a ladder by himself? All you have to do is decrease the climbing angle to say, only 45° instead of 75.5° and have the man violently bounce up and down on the ladder. Therefore, when two or three firefighters are moving and working from the ladder, the dynamic loads are way over their simple combined weight. It becomes very obvious that fire service ladders must have at least a 4:1 safety factor to be able to withstand their design loads.

Why does the NFPA 1932 standard require a **500 lb.** horizontal bend test instead of a **750 lb.** test?

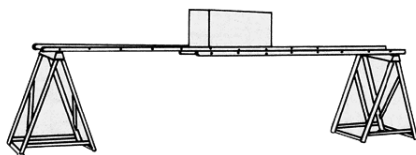
NFPA 1932 standard recognizes the 750 lb. test requirement in the Design Verification part of its standard in NFPA 1931. This standard is a Design Verification standard to be used by Ladder Manufacturers only. The service testing standard - NFPA 1932 uses the 500 lb. test with a pass - no pass permanent set requirement instead of a 750 lb. test which only has to be able to be passed - set in the ladder is allowed, and after the 750 lb. test is passed, the ladder is destroyed.

Therefore, the 500 lb. service test is a ladder test and is **not destructive**. If your ladder can pass the 500 lb. test, you are assured of at least a 500 lb. capacity with a 4:1 safety factor and probably more, and of course, the test has not destroyed the ladder.

## BASIC TESTING PROCEDURE

### Horizontal Bend Test/Visual Inspection

Place the ladder to be tested upon a pair of sawhorses. The horses are placed 6" in from each end of the ladder - top and bottom. Be sure the ladder is fully extended and as level as possible. We suggest you now do your visual inspection of the ladder before the load is placed. Check for any problems noticeable - loose nuts/bolts, bent rungs/loose rungs, any problems/areas that no longer look factory fresh. If everything looks OK - proceed to the load test.



1. The test load required is 350 lbs for pre-load and 500 lbs for final load.
2. The pre-load of 350 lbs is applied to the center area of the ladder covering 32" in length and at least the width of the ladder section. (Center of the ladder and no more than 16" on each side of the center.)
3. Wait one minute and remove the 350 lb pre-load and measure from the center of the ladder to the ground - record the measurement.
4. Apply the full 500 lb test load to the load area, wait 5 minutes and again remove the 500 lbs.
5. After another 5 minutes, measure from the center of the ladder to the ground - record the measurement.

If the difference between measurements is greater than 1/2" for ladders up to 25 ft or 1" for ladders 26 ft to 34 ft or 1-1/2" for ladders over 35 ft - the ladder has failed. Remove from service and destroy. If the amount of set is less than allowed, you have passed the test.



## GENERAL MAINTENANCE

Tested, clean and maintained ladders last longer and properly lubricated ladder sections slide easier and simply work better. (No DUO-SAFETY ladder requires more than 75 lb. pull to raise any sections). If you have any ladder in service that seems to require more than a 75 lb. pull to raise, we suggest immediate cleaning and waxing of all contact surfaces and lock parts.

Regardless of the manufacturer, age or material, all ladders will extend and retract easier and smoother if the contacting parts have some lubrication on these surfaces. Did you ever notice that a ball bearing rolls much easier and lasts a lot longer if you supply a bit of oil or grease?? Whenever surfaces rub together, you must lubricate or friction increases.

DUO-SAFETY LADDER suggests plain old candle wax or paraffin wax as your best lubrication.



Wax coats and works into the pores of the ladder material and does not easily wash away with frequent water baths. Candle wax is also not costly and is readily available anywhere. We suggest you extend the ladder, and simply rub the candle wax over and onto all of the contacting parts.

**CLEAN** and **WAX** and **INSPECT** every 6 months or sooner based on your run frequency to keep your ladders accident free. Be sure your ladders are ready for each use and they will always be ready to carry you to greater heights.

**NOTE:** Do not forget to coat the lock parts (lock hook and finger) with wax as this reduces the wear on the rungs and these parts move over the rungs every time the ladder is used (see the section on ladder locks/pawls for further details).

## ALUMINUM LADDERS: Solid Beam or Truss Beam



**MATERIAL** - 6061-T6 alloy - minimum yield 38,000 p.s.i.

**CAUTION:** aluminum conducts electricity

**CLEANING:** Mild soap (ex: Ivory dish soap) and water works well - be sure to flush inside the rails and rungs to clear them of road salts, etc. We suggest a plastic scrub pad to buff the surface to a smooth finish. Be sure to **clean** and **rewax** the slide areas at the same time.

Be sure to check any heat sensor labels as you clean and wash and try not to wash away the labels. (Replacement labels are readily available from the ladder manufacturer). **NOTE:** Use of harsh soaps or chemicals can sometimes turn heat sensor labels dark, that is why we recommend using a mild soap for cleaning.

**RAILS AND RUNGS:** Aluminum is a malleable metal and is subject to dents and nicks, etc. **NOTE:** Small dents and/or nicks on the beams and rungs are not uncommon and are not grounds to fail a ladder. If you have any concern about any dents, etc., we suggest a load test to be sure the dents are not serious. Be sure to record the location and size for future reference. **REPEAT:** Be sure the rungs are all tight as the rung to rail joint is the only thing that holds the two beams together. If any rung is loose - remove the ladder from service, repair and service test before further use and putting ladders back into service.

### ALUMINUM RUNG REPLACEMENT

All rungs are 1-1/4" diameter by .065" wall thickness. (Standard Rung), unless your section width is wider than 24". In this case, you probably have heavy rungs - 1-1/4" diameter by .105 wall thickness.

**Note:** All replacement rungs are supplied 24" - standard .065 wall. To remove any welded rung from the rail or plate, you must use a rung reamer tool.

The reamer tool pilots itself in the rung hole, and cuts only the old rung away, thereby leaving the proper size hole for the new rung to be welded in place. If our standard reamer tool will not fit inside your rung - be sure the ladder is a Duo-Safety Ladder and check the width of the section. If the section width is over 24" wide - you have heavy rungs in that section. Heavy rungs are supplied to meet the NFPA 1932 load rating in all sections wider than 24" wide. In these cases you must order our Heavy Rung Reamer Tool and heavy rungs for replacements.

Duo-Safety Ladder Corp. ladders all depend 95% on the welded rung joints to hold all ladders together. The minimum yield of our welded joint is 8,000 P.S.I.

The expansion process on the inner plates is a 5% back up system to help protect the weld joint from flexing and cracking.

Thus - if you only replace a few rungs per section - you do not need the expander tool. But if you replace more than 3 rungs per section, we suggest you use the expander tool.

## **FIBERGLASS LADDERS:**

**MATERIAL:** Vinyl ester, high temperature resin system with ultraviolet inhibitors, flame retardant additives and continuous strand rovings pultruded to create a non-conductive ladder rail system.

**CLEANING:** Mild soap and water works well - be sure to flush inside the rails to clear them also of road salt, etc. We suggest any car wax available as a suitable surface restorer. Use approximately the same care and clean up required as any automotive finish would require. Be sure to check all rungs and other parts for tightness when cleaning and be sure to re wax so the sections will slide easily.

Fiberglass ladders are **not** malleable and do not dent; however, nicks and scratches and scrapes can be very common. If you have any doubts, we suggest a load test to be sure the nicks and scratches are not serious. Repairs of small surface nicks and scratches generally require only slight sanding and an application of clear epoxy glue to the nick or scratch. Be sure to sand smooth after the glue dries. **NOTE:** This type of repair is only to be used for small surface scratches, etc. and only after a load test has been passed.

## **WOOD LADDERS: Solid Beam Models**

**MATERIAL:** Wood - generally West Coast Douglas Fir with hickory rungs; however, some models may have aluminum rungs. Wood is a non-conductive material when dry and clean.

**CLEANING:** Mild soap and water works well to clean all surfaces. Do not soak wood ladder rails or rungs with excessive water or water pressure as this tends to swell the wood and/or peel the finish from the wood. Wood ladders are normally coated with a clear varnish finish to protect the wood from the elements and to help it remain non-conductive. After cleaning, be sure to rewax all contact surfaces so they will slide easily. If the varnish finish has become scratched, nicked, dented or damaged, we suggest immediate spot repair of the bare wood to preserve the wood and keep the ladder non-conductive.

**FACT:** Wood rails and wood rungs expand and contract with changes of both humidity and temperatures. Because of this problem, it is very important that rung tightness is checked regularly and any and all rung tie rods be checked to be sure they are tight.

**REMEMBER:** Only the rung to rail joint holds the side beams together. In cold regions of the country, the heating of the fire station causes the rungs to become loose as the wood shrinks from the loss of moisture.

## **Wood Beam Truss Models:**

These wood models are constructed with top and bottom wood pieces and truss blocks/rung blocks between the top and bottom wood truss rails.

**WARNING:** The wood joints/glue joints between the blocks and strips are very likely to fail if the bolts and nuts are not kept tight. You must be sure these bolts are tight before any load testing is ever done. If you test without tight bolts, you will fail your glue joints and fail your ladder. These glue joints must have the tight bolt assemblies as a back up to support the glue joints during any load testing that approaches the maximum capacity of the ladder - 500 lb. horizontal load test/annual load test.

**REMEMBER:** It is 4 times harder to carry the load horizontally/flat than it is at 75 degrees or in erected position.

The visual inspection part of your maintenance program becomes very important on any wood ladder as most noticeable damaged areas require immediate attention and repair just to maintain the varnish finish and keep the wood from deteriorating.

Only a load test can tell you if any ladder can still carry the load it was designed to carry, and only a 500 lb. center load test can tell you if you really have a fire service ladder with a 4:1 safety factor. (Please refer to the ladder testing section and NFPA 1932-current edition-for further information on horizontal bend test instructions)

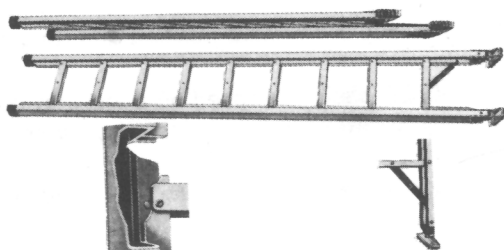


## **SPECIAL TYPES OF LADDERS**

**ROOF LADDERS:** Maintenance on roof ladders is the same as already covered under the previous sections. Please refer to the proper section that covered the type of material you have in service.

**ROOF HOOKS:** Fire service roof ladders are supplied with spring loaded, directionally swiveling and locking hook assemblies capable of 1,000 lb. load per hook/2,000 lb. load per pair. These roof hooks normally only require occasional cleaning to maintain proper operation - mild soap and water works well. If the points are dull - file sharp and cover with a bit of paint. If the springs become weak - please call the factory for replacements and instructions.

**FOLDING LADDERS:** Maintenance is again the same as the general maintenance covered earlier - refer to the proper section covering the type of material you have in service. Mild soap and water works well for cleaning purposes. We suggest you check the rung assembly rivets regularly to be sure they are not worn excessively.



When several rung mounting rivets become sloppy and loose, we suggest you replace the ladder as these rivets are **brass** and are meant to provide a hinge/bearing assembly for this folding ladder. These are not easily field replaceable without special tools, and these tools are not available because of cost.

Be sure the lock assembly is tight and properly locks the ladder in the open position. These lock assemblies can be tightened - carefully - with a hammer and punch. Please call us if you are not sure.

**WARNING:** This ladder folds side to side (together) watch carefully where you place your hands/fingers when closing and opening ladder. (please refer to the IFSTA-Fire Service Ground Ladder manual for proper use and training information.) If the lock assembly rung is bent or does not properly lock **DO NOT USE LADDER** as it may not be safe to climb.

**A-FRAME/COMBINATION LADDERS:** Please refer to the earlier covered sections for general maintenance in reference to materials of the ladders you have in service.



**HINGES/LOCK ASSEMBLIES:** Be sure to inspect the hinge hardware and fasteners and replace anything that appears to be worn, damaged or rusty. A few drops of any type of oil works well on the hinges and of course, mild soap and water works well on all the other parts. Be sure to check the spreader arms, bars and parts to be sure everything still works and fits together properly. These parts are vital in the A-frame position and must be able to properly engage before the ladder would be safe to use in the A-frame position.

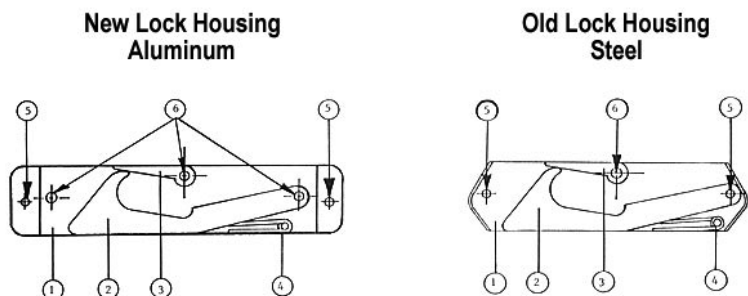
**35-B JACKKNIFE LOCKS:** Locks must be engaged before using the ladder as a single ladder. Please note that the hinge on this model must be under the ladder/bottom side as you climb to be in the proper use position. This allows the butt ends of the rails to pinch together under load rather than allowing all the load to be on the locks. **WARNING:** Use with the hinge on top of rails is not safe. (Please refer to the IFSTA Fire Service Ground Ladder manual from proper training and use of ladders)

**POMPIER LADDERS:** Pompier hook maintenance basically consists of cleaning, sharpening with a file and painting to stop any rusting that occurs over time.

Rung to shaft hardware - inspect and tighten or replace if anything becomes loose. Be sure to check the solid steel rivets that hold the hook to the shaft. If any looseness starts at this point, tighten the fasteners at once. If this is no longer possible - shaft enlarged - we suggest you drill out the rivets and cut the shaft back approximately 6" and redrill and refasten with at least 5/16" steel bolts and lock nuts. Call the factory for further information.

## LADDER PARTS/ACCESSORIES:

**LADDER LOCKS/PAWLS:** Spring operated, automatic lock assemblies that engage and lock upper sections to lower sections, always operating in pairs.



### Duo-Safety Spring Lock Assembly:

1. Lock Housing
2. Lock Hook
3. Finger - (note position)
4. Spring
5. Mounting Bolt Holes (2)
6. Shoulder Bolt Hole

Lock assemblies always have a rung mounted between them. The rung that is used between the locks is the only rung (except for some roof hook models) that is not fastened to the side rails. Because these rungs are not mounted to the side rails, we are forced to use a special rung mount bracket. The rung is fastened to this by 4 each rivets, which must be removed and replaced if you remove the locks. We suggest you request our lock housing repair kit before you remove the locks. This kit has all the replacement fasteners and new springs that are normally required, plus instructions. Please follow the instructions closely so proper lock function can occur.

**NOTE:** Lock assemblies are to be tight, but you can crush the housing and pinch the lock parts if you over tighten the mounting bolts. Be sure to flush the housings with mild soap and water and apply some oil to the pivot points before you return the ladder to service.



**NOTE:** If the rung mount bracket (called a Lock Rung Holder) and used on older model ladder locks) cracks or becomes broken, please remove and replace with the new factory replacements available. You only have to remove these brackets to replace - do not remove the lock housings to replace only the rung brackets. Please call if you have any questions.

**PRONG FEET/SPIKES/BUTT SPURS and END CAPS:** These parts are either aluminum or steel (on older models) and are fastened to the side rails with rivets and/or bolts. Be sure to check these parts for shape and tightness and replace or tighten as needed when you are checking the rest of the ladder assembly. Bolts and rivets have been known to be sheared off and/or loosen after walking a ladder or using it to break windows and doors. Please check these parts. **NOTE:** Most replacement End Caps and Prong Feet are now all Aluminum extruded parts for replacement.

**SAFETY SHOES:** A rubber padded optional swivel foot or shoe mounted to the bottom of the section. These rubber safety shoes are offered as a ladder option to the standard prong foot/spike. The rubber safety shoe is meant to be used on hard, smooth surfaces where spikes may slip because they cannot dig in. These safety shoes also may rust, and because of this, they require cleaning and checking at least yearly. **NOTE:** Replacement rubber pads are available from the factory.

**PULLEYS and HALYARDS:** All larger extension ladders are supplied with halyards (rope) and pulleys so the upper sections can be easily extended.

**PULLEYS:** The present pulleys are all aluminum with brass oil-lite bushings supplied either as single or double sheave. These pulleys are available as replacements for all of our older models. Please call for exact application details as we use several configurations with and without rope mounting features. Cleaning and lubricating of pulleys is a good idea - recommended at least once a year.

**HALYARDS/ROPE:** All rope furnished with all Duo-Safety Ladders as standard still continues to be pure 3/8" manila rope. The factory uses manila rope because it offers the least expensive and best combination of desirable features available in rope today:

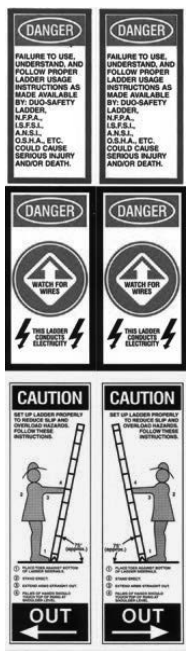
- Soft - not stiff
- Abrasive - does not slip in gloves
- Will not stretch with heat exposure
- Has a minimum yield/tensile strength of at least 825 lbs. (No ladder requires more than 75 lbs. to raise)
- Readily available for replacement in any local hardware store - when it wears out

However, halyard replacement can be any rope material you choose - as long as it meets the minimum yield requirements per NFPA.

**SPECIAL NOTE:** The factory is not able to provide larger diameter pulleys because the space between sections is so small. Our standard pulleys accommodate 3/8" - 1/2" diameter ropes and may cause rope to wear rapidly. If in doubt of any rope quality, **always** replace the rope with new!

**ROPE END FASTENERS:** Always be sure the rope thimble is in place at the end where the rope attaches to the rung so the rope will not be cut by any sharp corners. The factory has always opened the twisted rope and passed the rope back through itself at least twice to secure it. This method of fastening is as strong as the rope itself.

**SAFETY NOTE:** Safety is a shared responsibility between the product manufacturer and the user. The factory can not make any ladder accident free if proper use and training is not followed first!



**FIRE LADDER LABELS:**

One set/pair of Danger/Electrical/Angle labels are required for each ladder. The labels should be placed at the bottom of the ladder, outside the rail of the base section, both sides, between the 4th and 5th rung up from the bottom. Be sure the left label is placed on the left side, and the right label is placed on the right side. If placed on the wrong sides of the ladder, they will not make sense for proper ladder placement.

**HEAT SENSOR LABELS:** These are visual warning labels furnished on all aluminum and fiberglass ladders since January, 1984.



These labels are heat sensitive material that turn black if any heat is ever present that is greater than approximately 300° F. The 300 ° F temperature is used because once aluminum fire ladder materials (6061-T6 alloy) reach this 300° F (even if only for a moment), the ladder material may have lost at least 25% of its load capacity. This heat exposure effect is not reversible in the ladder and can continue to accumulate over its entire life.

**WARNING:** All ground ladders Aluminum and Fiberglass should never be placed near apparatus exhaust systems. Placing any ladder near an extreme heat source can turn heat labels black without the ladder even being used in a fire scene. Many different heat sources from any part of an apparatus can expose a ladder and weaken its strength. Use caution when removing a ladder from apparatus for proper placement on ground and at a fire scene.

**NOTE:** If any heat sensor label becomes black - remove the ladder from service at once and have the ladder load tested before the ladder is ever used again. If the ladder passes the load test, replace the heat sensors and return the ladder to service. Replacement heat sensor labels should **only** be placed on ladders that have passed the load test. If the ladder does not pass the test, remove from service and destroy immediately. Call the factory for details on replacement labels available.

**REMEMBER:** Heat sensor labels that look OK do not make the ladder safe to use. **ONLY** a ladder test can determine if any ladder is safe for use.

**NOTE:** As of 1994, NFPA 1932 now requires 4 heat sensors per ladder section. Each heat sensor has an expiration date printed on it. Any expired labels must be replaced **ONLY** after a horizontal bend test has been performed on the ladder. Place 2 heat sensor labels below the 2nd rung from the top of each section inside the beam. (1 inside the right beam - 1 inside the left beam) Place the other 2 heat sensor labels (one with instruction label) below the approximate middle of the section inside the beam. (1 inside the right beam - 1 inside the left beam)

## **CONCLUSION:**

Only by passing the load test can you be sure the ladder is indeed a 750 lb. or 300 lb. duty rated fire service ladder with a 4:1 safety factor and still safe to use. Duo-Safety Ladder Corporation suggests and recommends that all fire departments obtain and fully read and understand all the requirements of the current applicable standards and training instructions as released by the National Fire Protection Association (NFPA) 1932-current edition, and the International Fire Service Training Association (IFSTA) Fire Service Ground Ladders.

If we can be of any further help or you wish additional copies of this booklet, please call, email or write our office. This booklet is also available to be downloaded from our website. We grant permission to reprint this information for safety and training purposes if needed as long as proper credits are given.



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