FLAT FREE®

FLAT TIRE PREVENTATIVE

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Reference Manual

FLAT FREE Reference Manual

Contents

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What is Flat Free?

Flat Free is a chemical solution tire sealant that when installed inside a tire, will provide full time protection against air loss for the entire life of a tire!

Flat Free is designed to seal:

- tread punctures
- bead leaks
- rim leaks
- porosity
- tube, tire or wheel-related leaks

Flat Free has a revolutionary chemical structure that causes this tire enhancer to continuously remain fluid so that it will immediately fill and seal any hole (up to ¼") in the tread area where air can escape from the tire.

Because of these functions, Flat Free tire life enhancer gives you the benefit of much longer tire life coupled with lower downtime and maintenance costs.

Characteristics of Flat Free

This space-age product combines an ethylene-glycol based solution with natural fibers, artificial fibers, adhesion agents, drying agents, corrosion inhibitors, and other solids.

Flat Free is designed to keep the fibers and solids in constant suspension. Because there is no settling of the solids and fibers, Flat Free tire life enhancer is always ready to work for you—*no mixing, stirring, or other preparation is necessary.*

The adhesion properties in Flat Free tire life enhancer—coupled with the fact that it remains fluid when installed in the tire—provide constant protection for all parts of the tire.

Flat Free tire life enhancer is *thixotropic*. That is, it thins rapidly when the motion increases, thereby maintaining an even layer of Flat Free tire sealant on all surfaces. Clean up is simple, just rinse with water.

Tools and materials required for installation:

- Flat Free
- Heavy Duty Injection pump with a 10 oz. stroke
- Installation Kit (Valve core remover and 2 in. plastic hose)
- Compressed air to reinflate tire
- Hub cap tool (optional)

Flat Free is ready for use. **NO** mixing or special preparation is required.

How Does Flat Free Work?

Flat Free tire life enhancer is installed quickly and easily through the valve stem. The average installation time is just minutes per tire!

When the vehicle is driven, the fluid action of the solution causes the entire inside treaded surface area of the tire to be coated with Flat Free. The adhesion properties contained in Flat Free keep the solution in place at all times and keep Flat Free ready to seal any source of air loss.

It's that simple. The tire is now protected from any puncture or other leaks for the remaining legal life of the tire!

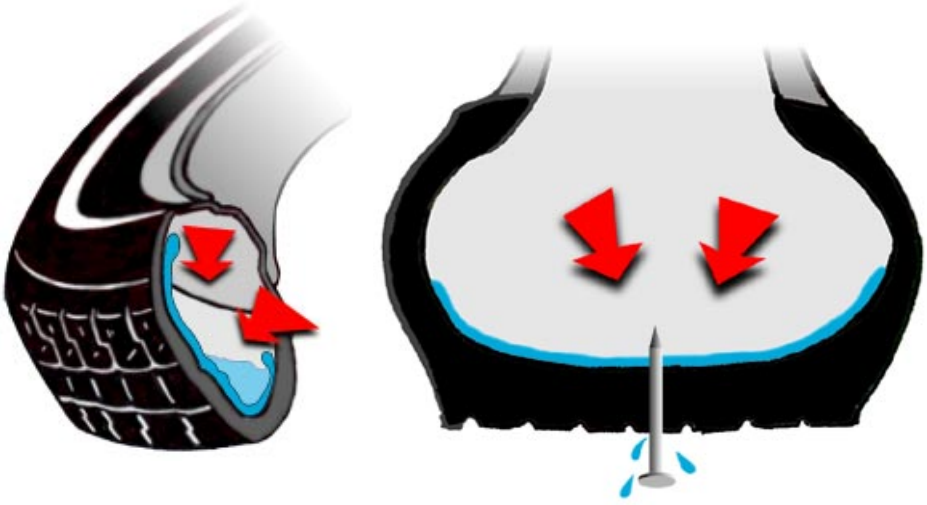
Flat Free tire life enhancer also helps to dissipate the heat caused by road friction. This allows the tire to run much cooler; as a result of proper air pressure and cooler operating temperatures, you can get up to *20%* to *30%* more life from your tire.

When a puncture occurs, the centrifugal force of the rotating tire and internal pressure forces Flat Free into the hole. A permanent seal is caused as the hole is packed with the fibers and other solids. Some of the material will go through the hole to the outside of the tire.

When this material is exposed to air, it dries and forms a permanent seal. When the puncturing object is removed, the vehicle should be driven in order to duplicate the above procedure. Once this has taken place, the seal is permanent and will last for the life of the tire.

Should the puncturing object be found after the vehicle was sitting for a long period of time, drive the vehicle before removing the puncturing object to allow the sealant to loosen up and spread. After about five (5) miles, remove the puncturing object and continue to drive.

Flat Free tire life enhancer easily seals holes up to ¼" in diameter. Larger holes will normally seal if they are near the center of the tread area. A puncture that occurs while driving the vehicle will seal almost instantly and very little air will be lost before a permanent seal is made.



About Tire Sealants...

Tire sealants have been developed in order to seal punctures from within the tire. After removal of the valve core, the sealant is injected into the tire through the valve stem when the tire is deflated.

The three main types available on the market can be characterized as follows:

Based on Rubber – Latex or Liquid

An "After the Fact" Product. Packed in a aerosol can, under high pressure gas (5 aim)) and applied after the tire has been punctured, simultaneously inflating the tire. This type of material solidifies.

Based on Water

Packed in a "squeeze" plastic bottle (no pressure) and injected into the tire, preferably before a puncture occurs. The sealant stays liquid but tends to separate and freeze at low temperatures. Oxidation may also occur due to a water content.

Based on Glycol

Packed in a "squeeze" bottle (no pressure). It is a consistent sealant, and will not separate or dry up. This type of sealant will withstand severe temperatures, and it will not freeze. The sealant will loosen up with heat and expand with motion. It is used to prevent flat tires, but also will extend the life of the tire.

The glycol-based tire sealant Flat Free consists of very fine fibers distributed throughout a "glycol" based adhesive. In total, more than 20 ingredients are contained in the product. Flat Free is the most advanced tire sealant on the market.

Flat Free should preferably be applied to a new, uninflated tire, by injecting the product through the valve stem. The vehicle should then be driven for approximately ten (10) miles to evenly spread the sealant on the inside treaded area of the tire. The sealant then coats the inside of the tire with damp, shredded fibers and an internal atmospheric mist. As soon as a puncture occurs, the compound will flow into the hole and form a "plug" when the liquid is dried by outside air. This plug will permanently (for the legal life of the tire) seal off the puncture under all climatic conditions, resulting in absolutely safe driving even with small punctures (for passenger and truck tires) caused by nails, sharp stones, glass, and other foreign objects.

As a tire life enhancer, Flat Free is an effective tire sealant when a small hole is caused in passenger car tires during operation. Most holes will be sealed without the driver ever knowing a puncture has occurred.

Flat Free will also work as effectively for truck tires. This is based on our evaluation of passenger car tires, where we made 6 mm. punctures—a size equal to the maximum allowable for truck tires as stated by the manufacturer.

Tire Sealants... Good or Bad?

A good tire sealant will definitely eliminate porosity, which is the major cause of underinflation, heat, tread separations, and premature tire failure.

Tire sealants have been around since the invention of the pneumatic tire. In the early days though, tires were never able to maintain air pressure and were notorious for going flat.

As the motor vehicle became more sophisticated and achieved higher speeds, the tire sealant industry could not produce a product that would withstand the tremendous stress found in a tire at speeds over 30 mph.

It wasn't until 1990's that a breakthrough occurred in the automotive tire sealant industry. With the newest space-age technology applied, a tire sealant was developed that would withstand heat, cold, and the shear centrifugal forces which have always prevented tire sealants from performing for any measurable amount of time. A tire sealant that does not affect the tire balance was now developed.

In an age of unprecedented advancement, technology has produced many new and magnificent achievements for mankind. Flat Free is able to perform well, under almost any temperature, and at speeds in excess of 200 mph. Flat Free is compatible with any type of tire construction and composition. It will not only prevent rust or corrosion of metals, but will provide a permanent repair and last for the life of the tire. Flat Free will enhance the life of the tire.

The need for a tire sealant has been ever present. The failure to present an effective tire sealant resulted in many industries being categorized with creators of products much like snake oils. Many con artists found that, with fancy promotion, they could sell their magic potion to the needing motoring public.

With tire problems being a major cost for fleets, fleet operators would vainly attempt anything to keep the air in the tires and vehicles rolling.

Even with the newest and most advanced products on the market, it has not completely eliminated the bad guys who can still be found preying on the weary fleet manager who will buy on sales pitch alone.

Three major factors in obtaining a good tire sealant

SAFETY is number 1

In this day and age of chemical health problems, a tire sealant must be non-toxic, non-flammable, and able to meet all safety requirements. Flat Free is non-toxic, non-flammable, and environmentally safe. It even surpasses the stringent requirements of California Proposition 65 (Clean Air and Water).

COMPATIBILITY is number 2

The sealant should be fully compatible with all components that are present in tires including metal (steel belts and wheels). The specifications require that a tire sealant be tested not only before it is used, but also after 10,000 miles. This assures the sealant will not cause problems later. Flat Free has been tested and meets all specifications required. Flat Free contains rust inhibitors, and anti-bacteriostats to make it compatible with all components in tires.

RELIABILITY is number 3

It is very important to ensure that a tire sealant will last the duration that the manufacturer claims. If a manufacturer claims "life of the tire" then he must provide independent test reports that provide results for a minimum 40,000 mile test. If the manufacturer only claims that his product will last 10,000 miles, then that is what he is required to prove. During a three and a half (3½) year test at Erwin Chemical Laboratories we can prove that Flat Free has maintained in liquid form, has not evaporated, and has no effect on the tire.

These specifications are generic, and fair to any honest tire sealant manufacturer. A fleet manager will receive a good reliable product if he requires a tire sealant manufacturer or representative to produce documentation to prove their products meet or exceed the specifications before beginning an evaluation in their fleet.

What should you expect from a tire sealant?

You should expect exactly what the manufacturer claims! Do not rely on the specifications alone, but require the manufacturer to provide references (which you should check out) with at least two years experience using the product.

Insist that product liability insurance is supplied and maintained. If and when a problem arises in safety, or if your tires or wheels go bad, who is going to be responsible? Be very questionable of a company that has been in business only a short while, and has changed formulations several times.

Throughout this manual we have attempted to provide insights and knowledge that we have gained over a great amount of time. Hopefully, this information will help you achieve longer tire life for your fleet.

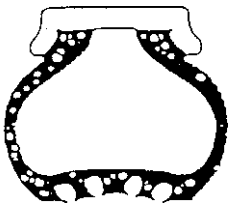
Preventive tire maintenance is not speculative, it is hard fact. Even if you implement only a portion of the information in this manual, or completely install a proven tire sealant, every step will increase tire life. You may not be popular with your tire dealer, but you definitely will experience a drastic reduction in your tire replacement and repair bill at the end of a year.

Remember that all suggestions given on tire sealants require that you establish and keep good records. It is imperative to track performance and maintenance by establishing a preventative maintenance program.

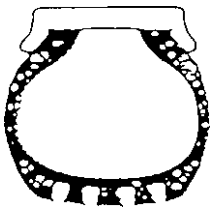
Flat Free vs. Rubber Latex Sealants

	Flat Free Tire Enhancer	*Rubber Latex Sealant*
Base	Fibers in GLYCOL-based adhesive	Rubber Latex and liquid gas
Packaging	Plastic squeeze bottle (no pressure)	Aerosol can (pressure 5 atm)
Storage	Unlimited	Over 1 year
Usage	Before (in new tire) or after puncture	After puncture
Inflation of Tire	To be done separately	Automatically from pressure in can
Condition inside Tire	Stays liquid	Solidifies
Tire Unbalance	No	Possible
Chemical Reaction	No	Yes, rubber coagulates from foam, vulcanizes
Flammable	No	Yes
Permanent Seal	Yes, for the legal life of the tire	No
Freeze Stable	Yes	Yes
Seals Rim Leaks	Yes	No
Types of Tires	All-tubed or tubeless tires: cars, trucks, motorcycles, bicycles, etc.	Car & truck tires only

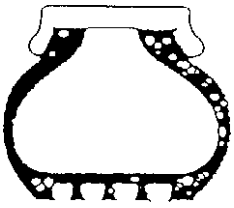
Can Problems Associated with Premature Tire Failure be Corrected?



Underinflated



Overinflated



Normal Inflation

Yes. By eliminating the cause, you will alleviate premature failure.

Underinflation is the most detrimental condition for a tire to endure and rapidly promotes premature tire failure. Did you realize that a fleet can easily obtain an additional 15% to 20% tire life and an additional 5% fuel savings by simply introducing a tire inflation program?

Tire manufacturers, aware that their tires are not capable of maintaining proper air pressure, have been telling the user that it is the users' responsibility to maintain the tire air pressure. We have been given charts and graphs that emphasize the damages which occur from underinflation and overinflation.

But it is difficult to program the human factor of the vehicle (the driver), on the necessity of checking and replenishing the air in the tires on a routine basis.

Remember, without a way to eliminate porosity, it is essential to establish a routine tire inflation and inspection program. Additionally, that program must be followed stringently in order to obtain good results.

The major cause for underinflation is porosity, which is the second portion of this problem although it can be corrected. By curing the cause, you eliminate the problem, and the tires will be able to maintain proper air pressure. The only way to eliminate porosity is to utilize a Glycol-based tire sealant.

Preventive Maintenance is the result of various elements which will provide positive help in extending tire life. The purpose of this manual is to offer various options, resulting in the prevention of premature tire failure.

How can tire cost and wear be tracked and recorded?

With a simple Vehicle Tire Chart, it will be fairly easy to pinpoint a problem. However, this chart must be periodically updated and maintained accurately. With proper data you will be able to easily compare various routes (i.e., determining if a problem results with the driver, the vehicle, the route, or even the equipment).

The time spent maintaining a tire Preventive Maintenance Program will be minimal compared to the resulting maximum data received. There are several items that are required, and must be operational to acquire proper data:

*Each vehicle **must** have a speedometer.* Additionally, the person designated as the maintenance inspector must have a Tire Depth Gauge.

Tire costs must be determined and calculated as to the cost per 32nd of an inch of tread depth. This is the formula to calculate that cost:

Take the cost per tire, then divide by the amount of 32nds per tire. Your tire dealer has the information available as to how many 32nds each tire contains regardless of type, brand or recap. This cost per 32nd will be your basis to track tire costs per mile.

With the information you have accumulated, you will be able to track each vehicle, and pinpoint problem routes, drivers, and/or vehicles. This chart is only a means by which to collect data. Imagine what a tremendous tool this information can be. You will be able to track and determine cost per mile on any tire, any tread design, recaps, or any combination. You will know what type of tire and recap combination works best in your fleet.

In addition, should a mechanical problem arise which is detrimental to the tire wear, the data will pick up any unusual wear problems, then the vehicle can be inspected and repaired before the tire is ruined.

There are additional rules that must be followed:

- A tire assigned to a vehicle must always stay with that vehicle.
- If a tire goes flat and a spare is installed, the repaired tire must be replaced as soon as possible and put in the same location with the spare being returned to the storage rack. (The spare tire is a real cost saving asset and is discussed in the Recapping vs. New Tires section below).
- Tires should be rotated to gain optimum wear. Check your vehicle tire chart for indication on which tires to rotate and when to rotate them.

Many fleet managers insist on putting only new tires on the steering axles of major equipment. They believe this to be a good safety factor. As the original tire wears out and requires recapping, it will then be used as a drive axle tire.

Most people realize how important it is to have the dual drive tires matched as closely as possible. It is equally important that all tires assigned to a vehicle stay with the vehicle.

Tube Tires vs. Tubeless Tires

Many experts say that tubeless tires are worth any additional expense. There should be no hesitation to convert your existing fleet of tube-type rims. Do this as soon as possible.

It has been proven by major fleets that it is cost effective to convert to tubeless tires and rims rather than continue to run with tube-type units.

The liability of split rims is tremendous. This is mostly due to the number of lives lost or people maimed from working with split rims. Most fleets still using tube-type tires have not realized the savings that could be obtained by converting to tubeless tires.

The cost of unreliable tubes should be reason enough to look for an alternative solution. Here's why:

> *When annual expenditures for replacement tubes have been reviewed, the cost effectiveness of tubeless tires should become most apparent.*
>
> *Sum up all repairs made on tubes during the year, the downtime and service calls which are related to a simple flat tire and calculate these into the overall cost of operating on tube tires. You will certainly be convinced to switch to tubeless tires.*

Many fleet operators around the country have confirmed that conversion to bias ply tubeless tires have dropped their fleet's flat rate by 20% to 30%.

This reduction can be mostly credited to the fact that many objects that usually cause puncture damage to tube tires will not cause a tubeless tire to lose air.

Because of the steel belted radials' ability to ward off large puncture-type objects as well as similar blunt objects, flat tires have been eliminated by 50% to 70%.

You can increase that percentage and eliminate 85% to 90% of flat tires in bias or radial tubeless tires by adding a proven tire sealing compound. A tire sealant which conforms to the tire sealant specifications shown in this report will provide positive air retention.

A proven tire sealant will seal most damages caused by any puncture threatening objects up to and including ¼" in diameter.

There are many additional benefits to consider. Another consideration regarding tubeless tires should be that they run cooler and are known to obtain additional mileage.

Recapping vs. New Tires

The recapping industry has come a long way in providing quality tread and variable compounds for special applications.

Recapping is not an option for most fleet managers; rather, it is considered a necessity. Because of the exorbitant replacement costs for tires, it obviously makes more sense to recap good casings.

With today's advancements in the recapping industry it is possible to obtain recapped tires that will outlive comparable new tires. Therefore, every fleet manager employs a "recapper" and fully relies on those skills.

The major problem facing all recappers is a culprit called *porosity*. Porosity is the Achilles heel for the tire industry worldwide. Premature tire failure can be linked to diverse problems to include, porosity, underinflation and heat. Additionally, porosity is a known problem in both recaps and new tires alike.

Even the technology of special ultrasonic scanners used to reveal casing damage will not indicate porosity. Porosity is normally undetected because the air's escape route opens only after the tire heats up under normal driving conditions. As the air expands and the air pressure increases, porosity increases and the air is forced into open passageways between the casing and the tread.

Tire manufacturers have not yet been able to produce a tire that is void of porosity. Normally, the porosity will migrate out of the tire and not be trapped between the casing and the tread. As a tire heats up (recap or new), the porosity passageways open, allowing the increased air pressure to escape through the tire's construction and into the atmosphere, resulting in underinflated tires. If the escaping air cannot work its way out of the tire, it will be trapped in an air pocket and begin expanding.

The end result could mean tread separation, blisters on the sidewalls, and even blowouts over a period of time.

Recaps can be considered reliable and predictable only if a perfect casing can be procured without the element of porosity. The elimination of porosity is addressed later in this manual.

Consider spare tires as another costly yet necessary subject. Take any marginal casing that could be reluctantly considered a "reject" and recap those for spare tires. Since a Preventive Tire Maintenance Program is being implemented, you will have reliable spares to keep the vehicles operational in the interim if you ensure that tires assigned to a vehicle must be replaced after having a flat.

Bias Ply vs. Radial Tires

Which are better, Bias Ply or Radial Tires? The answer to this question depends on the operating conditions of any particular fleet. Certain perspectives must be considered regarding the type and weight of loads a certain fleet must carry, temperature variances, road conditions, speeds, etc.

Tubeless tires should not be regarded as a luxury, but rather a necessity in the modern fleet. The proven advantages of converting any fleet into tubeless tires cannot be stressed enough.

Consider this: Radial tires have a much thinner sidewall construction than Bias Ply tires. Consequently, a fleet with severe sidewall damage must seriously consider this aspect in deciding which tire would be best.

If and when a preventive maintenance program is being implemented, evaluation of any tire, including actual cost per mile can be done. Many fleet managers have stated at various tire-related seminars, "In fleet operation, a consistent preventive tire maintenance program has been saving organizations a great deal of money, and has extended tire life."

In addition, tire maintenance charts indicate that tubeless radial tires produce the lowest cost per mile. It has been emphatically stressed the importance of each fleet manager beginning and maintaining a preventive tire maintenance program individually structured and designed for their own fleet.

In conclusion, *converting to tubeless tires should be a priority, and is highly recommended for any fleet.*

How Many Caps Should Each Casing Provide?

This is a popular question that is difficult to answer due to its broad spectrum of variables. It would be like asking, "What is the life expectancy of a car?" Many cars have survived for 50-60 years, but on the other hand, many cars are being "junked" after only 2-3 years.

The seemingly obvious answer is **preventive maintenance**. If you take care of something, it will definitely last longer—tires are definitely no exception. Properly maintained air pressure within a fleet will increase tire life, thus preventing a majority of the premature tire casing failures.

If air pressure is checked and tire repairs performed, it will add up to a considerable amount of labor annually. However, it is cost effective and necessary, especially if there is no protection from porosity.

Running any tire underinflated, if even for a short time, will weaken the casing and cause irreversible damage. If the tire doesn't fail during normal operations first, a casing may be able to last for 2 recaps after running only slightly underinflated, before being rejected.

Driving on tires with low air pressure or even after a tire has gone flat (i.e., driving back to the yard or to a repair facility) will definitely destroy the casing.

With a preventive tire maintenance program, your fleet will easily gain one, possibly two additional recaps per casing in addition to what you are now receiving.

What About Solid-Fill Tires?

When there is an environment that includes extreme exposure situations where tires are obtaining large cuts and are being ripped open, then it is absolutely necessary to have the tires solid-filled.

However, several drawbacks to solid-filled tires must be considered. First, a tire will weigh 3-5 times as much after being filled and the cost could prove to be excessive and not cost effective. Also, if the process is not correctly performed the first time it cannot be redone. The added weight and rigidity (loss of cushioning) from lack of air in the tire is known to eventually cause equipment failure from metal fatigue. This may also lead to many operators experiencing back problems.

Recapping is virtually out of the question and in most cases, tires must be cut off the rim for the installation of a new tire. Also, remember that no vehicle equipped with solid tires should be driven over 20 mph. The heat buildup and vibrations will damage the tire and eventually damage the vehicle.

How Does Tire Inflation Affect Maintenance Costs?

If a tire is properly inflated, it will have less rolling resistance. This will result in the tire maintaining a cooler operating temperature, longer tire life and better fuel mileage.

Consider the following

No. of pounds underinflated	*Percent of tire tread loss*	*Lost fuel economy*
3 lb	-05%	-1.9%
5 lb	-22%	-3.1%
7 lb	-28%	-4.4%
10 lb	-37%	-6.25%

Lost tire life calculations were obtained from THE RUBBER MANUFACTURERS ASSOCIATION (RMA)
Lost fuel mileage calculations were obtained from AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

The chart below provides annual cost figures and a weekly air pressure maintenance program for your tires. The annual figures have been calculated on an arbitrary figure of $10 per hour. Tire Manufacturers and the Department of Transportation (DOT) officials state that tires should be routinely checked every week.

Trucks

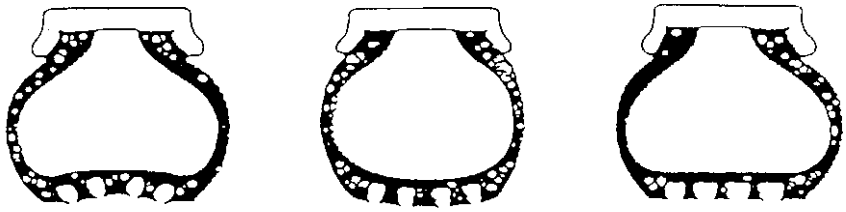
It requires an average of 5 minutes per tire to service the average truck tire.

Size of Vehicle	*Rotation Time X No. of Tires*	*Total Time in Per Vehicle Dollars*
4 wheeled truck	20 min	17.33 hours $173.30
6 wheeled truck	30 min	26.00 hours $ 260.00
10 wheeled truck	50 min	43.44 hours $ 433.30
18 wheeled truck	90 min	78.00 hours $730.00

PASSENGER CARS AND PICKUPS

It requires an average of 3 minutes a tire to service the average passenger car tire.

Size of Vehicle	*Rotation Time X No. of Tires*	*Total Time in Per Vehicle Dollars*
Passenger Car	12 min	10.24 hours $102.40



Underinflated | Overinflated | Normal Inflation

Proper Inflation

Proper Tire Inflation is The Most Important Factor in Tire Life!

A tire is an air envelope consisting of materials forming a long chain of macro molecules. The tire itself does not carry the load. It is the air within the tire which carries the load and provides the only support between the vehicle and the highway. The complex chemistry of a modern tire is dependent on correct air pressure within the tire and all manufacturers agree that under or overinflation will severely restrict tire life. About 80% of premature tire failure is due to incorrect inflation.

According to Goodyear, "Proper inflation is the most important fact in tire life. Neglect of tire maintenance, and especially tire pressure maintenance, has cost fleets thousands of dollars. Underinflation should never be permitted."

Underinflation

The consequences of underinflation are:

- Excessive flexing, leading to excessive temperatures
- Reduction in resistance of cuts and punctures
- Increased rolling resistance, leading to higher fuel consumption
- Destruction of casing carcass, making retreading impossible
- Ply separation
- Poor pavement grip, decreasing safety
- Blowout risk, due to over heating

Retreads

Heat generated from the underinflated tire frequently contributes to retread separations. Tubeless retreads are particularly vulnerable to tread separations. Frequently, small holes in the inner liner are missed in the pre-retread inspection. High pressure air passes through the hole to the new rubber of the tread. With the escape route cut off, it spreads out between the old casing and the new tread until separation and failure occurs. By effectively sealing these small liner holes, Flat Free reduces the pressure on the new tread, so that full service life is achieved without incident.

Please Note: Flat Free is water dispersible and should be completely washed out of the tire before sending it for retreading. You have received the benefit of the savings gained through Flat Free and should not expect your retreader to clean out your tires. Once the tires have been cleaned out there is nothing to prevent the normal retreading process.

Flat Free Monthly Inspection Report

Date_____

Type of Vehicle_____

ID #_____

Mileage_____

Tire #	Air Pressure	Tread Depth	Maintenance Description
1	lbs.	32nds	
2	lbs.	32nds	
3	lbs.	32nds	
4	lbs.	32nds	
5	lbs.	32nds	
6	lbs.	32nds	
7	lbs.	32nds	
8	lbs.	32nds	
9	lbs.	32nds	
10	lbs.	32nds	

1 Inspect tires for objects that threaten puncture. If using a tire sealant, remove the object that threatens puncture and immediately rotate the tire or drive the vehicle.

NOTE: *Drive vehicle with puncture object for about five (5) miles and allow sealant to loosen and spread prior to pulling out a puncturing object. Large objects should be left in place and reported to the proper personnel for repair.*

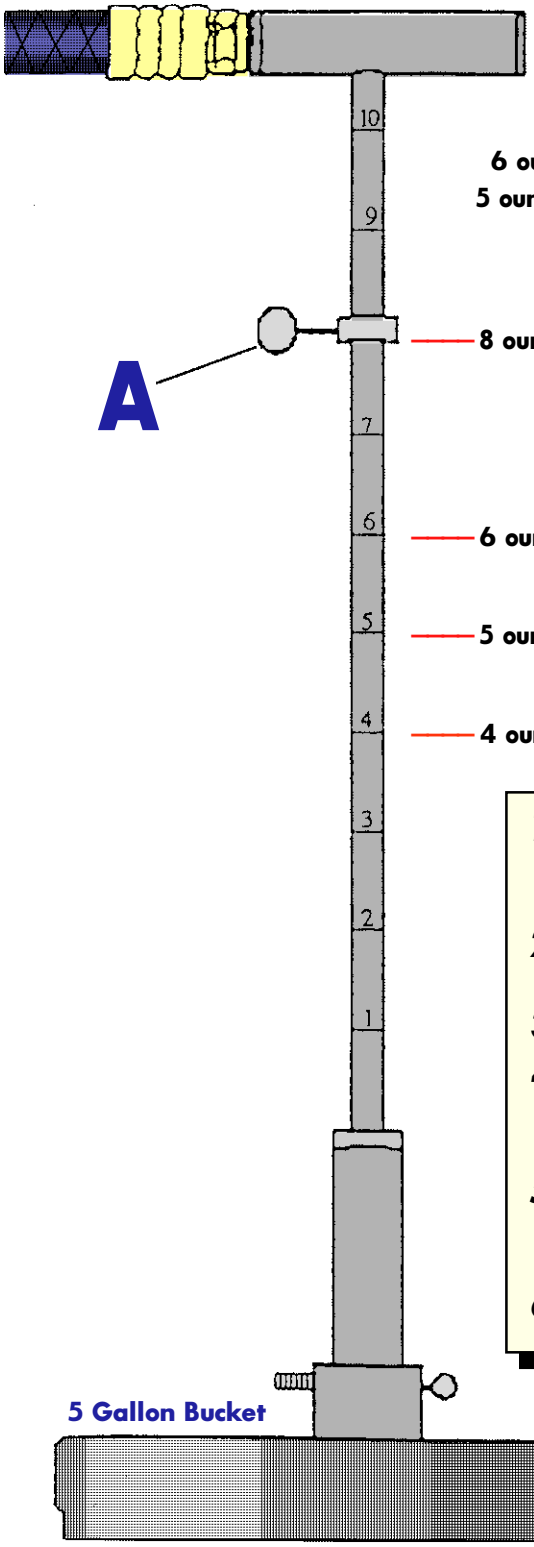
If the tires have not been treated with a tire sealant, request a temporary replacement. This request should be done prior to incurring downtime. This will also ensure the prevention of damage to the casing.

2 Air pressure checks. Ensure that tires are cold prior to checking air pressure. Insert a slight amount of air into the tire. This should clear the valve stem. Check and note air pressure. Remember to replace the protective valve cap.

3 Flat tire reports. Report and document any air loss or any other essential circumstances related to air loss.

4 Excessive tire wear. Any unusual tire wear is necessary to note. Note on chart any mechanical problems suspect of causing unusual tire wear and advise proper personnel.

Flat Free Recommended Installation Chart

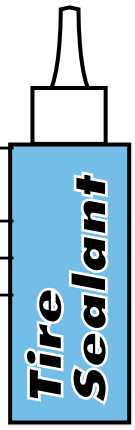


8 ounces* – *All* large pickups & 4X4 Tires

6 ounces* – *Wide Tread* 15 inch and *All* 16 inch tires

5 ounces* – *All* 14 inch tires and *Regular* 15 inch tires

4 ounces* – *All* 13 inch tires



8 oz. Bottle

8 ounces* – *All* large pickups & 4X4 Tires

6 ounces* – *Wide Tread* 15 inch and *All* 16 inch tires

5 ounces* – *All* 14 inch tires and *Regular* 15 inch tires

4 ounces* – *All* 13 inch tires

1. Prime pump before installing in car to assure an exact amount is installed into tire. Make sure nozzle is attached to container so liquid returns to container.
2. Set adaptor (A) on proper amount to be installed in tires, based on chart above.
3. Remove valve core from tire and allow tire to deflate.
4. Attach Quick Disconnect Valve to tire valve, pull pump handle up all the way (make sure adaptor is on correct amount) then press pump handle down.
5. Remove Quick Disconnect Valve from tire, put back the valve core and inflate to proper tire pressure based on recommended manufacturers requirements.
6. Repeat same procedure on other tires.

* *Used Tires may require one extra ounce dur to porosity.*

Bottled Flat Free Installation Instructions

1. Snip ¼ inch off tip spout.
2. Position valve stem at 7 o'clock, remove valve core and deflate the tire. Attach the plastic hose over the spout. Attach the other end of the hose to the valve stem.
3. Squeeze the bottle until the appropriate amount of Flat Free has been installed into the tire. (See installation instructions inside kit.)
4. Replace valve core and inflate to recommended tire pressure.

KEEP OUT OF REACH OF CHILDREN.

Important: After the initial insertion of Flat Free, you may experience some vibration during the first few miles driven. This is a normal condition, and will subside once Flat Free evenly distributes throughout the tire.

Installation Ties & Installation Amounts

The application chart for automobiles (on Page 15) lists the amount to install in passenger vehicles. Remember, after first installing Flat Free in your vehicle, you may sense a slight vibration as you drive the vehicle. The sealant will evenly spread and adhere to the inside treaded area of your tire. Flat Free's thixotropic formulation requires that a specific amount of Flat Free be administered to effectively provide a sufficient coating in the total area of the tire and wheel's inner surface.

After Flat Free has been installed into the tire, it will lay dormant on the bottom of the tire until the tires have been installed on the vehicle and driven a minimum of ten (10) miles, which will disperse the Flat Free throughout the entire inner treaded area of the tire. The flexing of the tire and the normal heat buildup will allow Flat Free to locate and eliminate porosity and air loss problems, transforming the tire and wheel into a sealed air chamber that will be capable of maintaining proper air pressure, thus provides additional longevity and cooler running tires. Thereafter, Flat Free begins conditioning the casing in order to retard dry-rot and the hardening of the casing.

Then, Flat Free stands on guard to seal punctures as they occur. If a tire receives a puncture, the Flat Free formula will also coat the surface of the penetrating object protecting against air loss.

When the puncturing object is removed, the rubber recovers and the wound begins to close. Any escaping air will siphon the Flat Free into the wound. The fibers begin to collect and are designed to entwine and create a blockage preventing additional air from escaping. The recovery of the rubber closes the wound and holds the repair in place. The specialized fibers begin to clot and along with the polymers, form an airtight repair.

The small amount of Flat Free that penetrates through the casing, past the belts and out through the tread area is then exposed to the atmosphere and begins to cure. As the clot cures it becomes a permanent repair that is impervious to water and protects the belts and inner casing from outside contaminants and corrosion.

Flat Free has a formulation which—a closely guarded secret—gives Flat Free the ability to withstand heat, cold, and the shear forces created within a rotating tire. The formulation has the ability to stretch and recover under mild to severe exposures of adverse shear forces. The ability to stretch and cling to the entire inner surface of the tire (inner air cavity) is part of the reason that Flat Free will never break down and never quits providing protection within a tire. Flat Free's operating temperatures range from -40° to +302° Fahrenheit.

5 Gallon Container Installation Instructions

1. The tire sealant is ready for use. There is *no* mixing required.
2. Remove small vent cap on top of the pail. Pull rings and unscrew the large cap. Remove the inner seal and insert pump.
3. Connect the hose to the metal vent on top of the pail and operate the pump to initially fill the pump and hose.
4. Tire should be properly balanced prior to installation (if required). There is no need to deflate the tire. The pump will work against 50 to 60 psi. You will need to reduce the air pressure in some tires to the operating range of the hand pump.
5. Remove the valve core and attach the hose connector to the valve stem on the tire.
6. Stand over the pail and pump the recommended amount of the tire sealant into the tire with firm, smooth, full strokes. If the pump jams, DO NOT FORCE THE PUMP, as damage to the pump may occur.

   Simply disconnect the hose from the valve stem and allow the air pressure from the tire to push the plug from the valve stem. Sometimes in low pressure tires, it may be necessary to use a small diameter drill bit to work the plug free. Reconnect the hose and continue pumping.
7. After the installation is complete, disconnect the hose from the valve stem and reconnect it to the metal vent. Replace the valve core and inflate the tire to its correct pressure.
8. If the tire has a puncturing object, drive a short distance (4-5 miles) to allow the sealant to loosen and evenly spread. Remove the puncturing object and continue to drive. This will allow the sealant to work into the puncture to form a permanent seal.

Do not remove the puncturing object without first driving the vehicle to allow the sealant to loosen and spread within the treat.

NOTE: Should the tire be low of air, with the puncturing object in it, drive the vehicle to an air source. Put in the approximate air pressure required by the tire manufacturer before removing the puncturing object. Then follow above instructions by first driving the vehicle.

Flat Tire Repair (Tubeless)

Flat Free can be used as a repair method on tubeless tires when after inspection, it is determined that the wound was caused by a puncturing object less than ¼" in diameter; the cords were not severely damaged; the tire had not been run flat (this will cause a badly damaged inner casing with no visible damage); and the wound was free of any foreign objects (grease, oil, etc.)

To accomplish this, install the proper amount of Flat Free, remove the puncturing object and immediately drive the vehicle allowing the tire to flex. Reinflate the tire to the proper air pressure. It is important to remember that in order to check air pressure after the installation of Flat Free, it will be necessary to blow some air into the valve stem. This clears any Flat Free that may be in the valve stem protecting the valve core against air loss.

Do not use Flat Free to repair tubes. It is not recommended to use Flat Free as a repair on tubes that are already flat. It is impossible to know how badly the tube may have been damaged. Since 1969, experienced tire professionals have stated that Flat Free has eliminated 75% of the flats in tube-type tires. Tubes are very unpredictable. A small puncturing object may rip a tube far beyond Flat Free's warranty coverage. A tube will squirm in a tire on a high speed vehicle (35 MPH and up). This squirming action may cause a puncturing object to rip the tube. To obtain a higher than 75% reliability factor, it is recommended that a tire inspection program be established. The puncturing objects should be removed and the vehicle immediately driven assuring that Flat Free's repair clot will be forced well into the wound as the tire flexes (routine tire inspections would assure increased reliability).

Although Flat Free can't guarantee it will always work with tubes, a tubed tire treated with Flat Free while in motion will hold and maintain air pressure. Once you have reached your final destination or the vehicle has sat for a couple of hours, you may lose air slowly. All this depends on the condition of the tube.

Retreading Compatibility

It is common courtesy to rinse out the tires prior to sending them to the retreader; it is not the retreader's job to wash out your tires. Flat Free is fully compatible with all retreading methods. In fact, a tire that has been treated with Flat Free will provide an airtight casing. All porosity and average wounds will have been eliminated. The retreader need only inspect for major casing damage. After your casing has been retreaded, it will be a far superior tire than a retread that has never been treated with Flat Free.

Safety Advantages

The limit of Flat Free's abilities to permanently seal punctures larger than ¼" in diameter has been established to provide a safety factor in Flat Free's formulation. It has been established that a tire receiving a wound larger than ¼" could, in fact, be dangerous. Therefore, Flat Free's formulation was designed to bleed through any wound if the structural integrity of the tire was weakened. Flat Free cannot mask or hide any major damage. Any tire receiving a wound that has been structurally weakened, regardless of how small the wound is, will slowly lose air. This safety factor alerts the driver that he has a major problem with the tire, and must have the problem fixed right away.

Operation at High Temperatures

Flat Free has the ability to cool tires. Flat Free provides a coating throughout the inner surface of the tire (inner air cavity). This coating acts as a heat exchanger, absorbing heat from the tire, passing it to the wheel which in turn dissipates the heat. Heat is considered the #1 enemy of tires. Flat Free can withstand high temperatures, even short durations of over 300 degrees. Extreme heat exposure for an extended period of time will severely damage the tire and the Flat Free formulation.

Operation at Low Temperatures

FLAT Free's formulation will not be affected by low temperatures. The formulation is designed to operate at temperatures as low as -40° Fahrenheit. Any exposure to colder weather will cause Flat Free to thicken, but never to freeze solid. In extremely cold weather, the heat generated from friction in a rotating tire will return the Flat Free to normal consistency after driving a very short distance. Any previous repairs made by Flat Free will remain as permanent as before the exposure to the cold. Flat Free's cured repairs are impervious to moisture, heat, and cold. The repair will flex just as the tire will in high or low temperatures.

Air Source Requirements

Flat Free will never fail to perform as claimed provided that a few guidelines are followed. Flat Free's formulation can withstand many adversaries with a major exception: *water*. It is imperative that water traps or air dryers be installed on all the air compressors and drained daily to assure that water is not introduced into the tire along with the air. Flat Free's formulation can tolerate a small amount of water, but an excessive amount of water or oil will break down the thixotropic properties and render the composition useless.

Clearing the Valve Stem

After installing Flat Free, it is a good idea to clear the excess Flat Free from the outer portion of the valve stem. There are several ways to effectively do this. The best way is to blow air into the tire, which will clear all the Flat Free from the valve stem, install the core, then fill tire to proper air pressure. If air is not readily available use a squirt bottle to squirt water on the end of the valve stem. This will wash out all the Flat Free that is outside the valve core. Another way is to get a small sharp object (stick, wire, pipe cleaner, paper clip) and a rag and wipe the excess from the inside edge of the valve stem.

Since Flat Free does not contain toxic or corrosive chemicals, no harm will come to the valve stem or core if it has not been cleaned. The worst thing that can happen is that the FLAT FREE would cure on the outside portion of the valve core and might prohibit adding air or checking air pressure at a future date. If this were to happen, simply remove the valve core, wash with water and reinsert.

Checking Air Pressure

It is very important to blow a slight amount of air into the tire prior to checking air pressure. The reason being that Flat Free has coated the entire inner surface of the tire and wheel including the inside of the valve stem. When air is escaping from the valve stem past the valve core, Flat Free does not differentiate between checking air pressure or if the valve core is leaking. Flat Free will stop the air loss.

Tire Balance Problems

Flat Free cannot cause a tire balancing problem if it is properly installed. Tires should be in balance *prior* to installing Flat Free. It is recommended that these procedures be followed prior to installing Flat Free:

- Check for out-of-round wheels
- Check for out-of-round tires
- Spin balance tires—do not bubble balance
- Check suspension for worn and loose parts

Flat Free may accentuate an existing problem. This is another safety factor in Flat Free's design, alerting the driver that there is a major problem in the tires, wheels and/or front suspension.

Spin Balancing Tires with Flat Free

Normally, tires should be balanced before the addition of Flat Free. However, should a tire become out of balance, it may become necessary to balance the tire with Flat Free inside.

Such balancing is possible through the proper use of spin balancers, although the normal techniques used must be adjusted or varied to allow for the Flat Free that is now inside the tire. Computerized spin balancers usually accelerate very rapidly to a speed of about 55 mph, then instantly shut off, registering the imbalance condition of the tire on a digital scale.

When the tire to be balanced contains Flat Free, the automatic shut-off mechanism of the machine must be defeated or turned off so that the operator can control the duration of the rotation. The Flat Free must have time to circulate around the entire tire and wheel area evenly. A mallet or hammer should be used to help distribute the product. It may take several minutes for even distribution of Flat Free to occur, then the machine should be allowed to shut off, registering any imbalance of the tire. The imbalance should be noted and the machine then allowed to start and stop in its normal way until the registered imbalance is repeating. The appropriate weights are to be added to the tire in the normal manner. The tire balance should then be rechecked and any further adjustments made if any are indicated. The tire is now in proper balance.

The starting and stopping of the machine, because of its rapid acceleration, followed by sudden braking during its normal operation cycle can also speed up Flat Free distribution around the tire's inner cavity, so this action may be intermixed with the period on continuous high speed rotation of the wheel on the balancing machine as indicated above.

Once a tire is properly balanced and contains Flat Free, the resultant balance condition is more nearly perfect than can be achieved with lead weights alone. This is because lead weights are usually calibrated in fractions of an ounce, whereas Flat Free distribution is very minute. In addition, as a tire wears from normal use, which in itself can alter the balance, Flat Free will continuously and automatically compensate for such wear maintaining perfect balance. Longer tire life is the reward.

Use and Care of the Flat Free Tire Puncturing Display (Counter and Floor Models)

The following are hints on the correct use and care of the Tire Puncturing Display.

- **ADD** 20-24 OZ. of Flat Free
- **DO NOT** put holes on the same line, this will preserve your tire display and it will hold air longer.
- **SPINNING** the tire will only superficially cover the hole made by the nail. Regularly remove the tire and bounce it smartly on the floor. This will enable the fibers and particulants to enter the cavity in the tire and permanently stop air-loss.
- **ADD** air periodically—remember that the tire will be frequently punctured and not rotated to ever superficially cover the cavity, let alone enter the cavity. CHECK WEEKLY.
- **DO NOT** over inflate the tire. See tire for air pressure recommendations.
- **ADD** a few ounces of Flat Free after continual usage because some of the sealant will have exited the tire, and it needs to be replaced. Do this as needed (once every 3 or 4 months). If the tire has a special valve that will not allow the introduction of Flat Free, you may have to remove the tire from the rim.
- **WIPE OFF** the tire and shelving of drippage—keep the equipment tidy.
- **DO NOT** reopen a hole. This will cause leaks as the tire will not properly slow seal due to previous seal covering the rubber.

If the tire display has been punctured to the limit, and is continually losing air, you must change the tire. Tires for the displays (size 480 x 12) are available through your Flat Free distributor.

Bulletin

Important Tips for Post-Installation

The specific amounts ascertained for each tire size are calculated to allow a completed coating within the tire/wheel air cavity, having approximately 25% allowed to make a reserve in order to complete the moisture to air saturation and allow for sealing numerous punctures. The reserve disperses throughout the inner air cavity when the tire is in motion.

The reserve should seal approximately 2-5 average punctures. Approximately 15% of the Flat Free is allotted for this, while the majority of the Flat Free is used for coating, absorbing (within the rubber's natural porosity) and holding the balance formulation in readiness of an air loss.

To create a step-by-step application amount to a tire not in our manual, one must install an approximate amount by using our measuring guide. Then, drive the tire approximately five (5) miles to thoroughly coat the inner air cavity. Then break the tire/wheel down, calculating the reserve.

NOTE: A balance problem may occur is not enough Flat Free is applied to a tire, as this will not allow the Flat Free to disperse throughout the inner air cavity.

A balance problem has occurred on tires that have large ribs on the inner casing and some low profile tires. These ribs do not allow the Flat Free to flow and disperse without splashing inside the tire.

Questions & Answers

Q What is Flat Free?

A Flat Free is a tire life enhancer. It is a chemical solution that when installed inside a tire, will provide full-time protection against air loss for the legal life of the tire as well as extend the life of the tire.

Q How does Flat Free seal a hole in the tread of the tire?

A Flat Free is drawn to the area of the escaping air. As the tire rotates and strikes the surface of the road, the hole is stretched open and the polyethylene chips and fibers enter in the cavity. The fibers wrap around the polyethylene chips and form a plug, similar to the action of a beaver dam. The fluids evaporate from the outer surface of the resulting flexible plug.

Q How does Flat Free prevent rim/bead leaks?

A The escape of high pressure air from the tire into the atmosphere draws Flat Free to the area of the escaping air. The leak is thus located and sealed.

Q What is the shelf life of Flat Free?

A The shelf life of Flat Free is practically indefinite as long as the container is closed and no evaporation occurs.

Q Does a nail or other projective object in the tire need to be removed even though Flat Free has prevented a flat tire?

A Always. The Flat Free has effectively sealed around the penetrating object but is the object is left in the tire, it will move in the tire as the tire rotates and will eventually create a larger and larger hole until air loss is suffered. If the object is a screw, you must unscrew it. Yanking or pulling will tear the rubber and possibly the steel belts. Also remember that you must drive the vehicle after pulling out the puncturing object to allow the friction to cause heat and loosen the Flat Free to effectively perform.

Q Must a tire be run after a penetrating object has been removed?

A Yes. Flat Free covers the area of the cavity left by the removal of the object but it has not entered therein. The tire must be run on the vehicle in order to snap open the cavity to permit the entrance of Flat Free. If the tire is not run at once, air seepage will occur.

Q Will the Flat Free settle in the pail and need to be stirred?

A Never! Flat Free is a homogeneous mixture with the ingredients bonded together in such a manner that it is impossible for the ingredients to settle to the bottom. This is a big advantage over other Glycol-based sealants or a latex or water based sealant.

Q Does Flat Free react Chemically with the rubber tire?

A Not at all. Flat Free is chemically inert.

Q Is Flat Free affected by extreme temperatures?

A Flat Free has been tested to -45° F. (the maximum testing ability of the laboratory) and has not frozen. This is 77° F. below the freezing point of water. Further, the sealant will remain in stable condition until heat so extreme the tire itself will disintegrate.

Questions & Answers

Q Is Flat Free water dispersible?

A Yes, since there is no chemical bonding of Flat Free to the tire, it can easily be removed from the tire by hosing it out with water. This is important because a tire may be washed out, recapped and retreated with Flat Free. Further, if the tire gets a hole too large for sealing by Flat Free, Flat Free can be washed out, the tire repaired and Flat Free re-applied.

Q Will Flat Free rust the rim of the tire?

A Not at all. Flat Free contains anticorrosive agents to prevent corrosion from occurring as well as to deal with any corrosion on the tire prior to installation.

Q Does Flat Free run to the bottom of the tire when the tire is not in motion?

A No. Flat Free contains specially selected adhesives which prevent this from happening. The sealant remains in place covering the interior of the tread area at all times. The tires must be run for approximately 200 miles before the Flat Free adheres.

Q Can Flat Free be used in a tube tire?

A Yes. However, it is vital to remove the penetrating object. Failure to do so will result in the object flexing in the tire and shredding the tube until it is destroyed. Although we can't guarantee the sealant to always permanently seal a puncture due to the condition of the tube, we do guarantee that as long as the tire is in motion, you will reach your destination, and then should some damage have occurred to the tube, it may lose air.

Q Will Flat Free seal a puncture in the sidewalls of the tire?

A No. Flat Free may seal the puncture, however there is too much flexing in the sidewalls and a temporary plug would be a safety factor.

Q Does Flat Free create a hard plug in the tread area of the tire?

A No. The plug is designed to be flexible. This is purposely done because the tire flexes, and if the plug is hard and does not flex with the tire, leakage will eventually occur.

Q Will Flat Free dry out in the tire?

A No. Flat Free will always stay in the same condition as it was when it was inserted into the tire because the tire is a closed container and no evaporation of the liquid can occur.

Q Can Flat Free plug up the tire valve while it is being inserted?

A Occasionally. But infrequently, a polyethylene chip will tumble in such a manner as to create a blockage in the tire valve by preventing the entrance of the fibers. When this occurs, remove the connector of the pump from the valve stem, permit a short blast of air to blow out to clear the plug and then reattach the hose connector and continue pumping. If the air is out of the tire, use a paper clip or similar object to clear entrance.

Questions & Answers

Q Can I pump against a truck tire pressure of 100 lbs. with the hand pump?

A No. The tire pressure must be lowered to a maximum of 60 lbs. for ease of installation. After Flat Free is installed, the tire can then be reinflated to the proper air pressure.

Q Can the Flat Free be pneumatically installed?

A Yes, we have a heavy duty pneumatic pump available which can be used to pump against high pressure tires. In this case, no air needs to be drained from the tires to facilitate the installation of Flat Free. This pump is of particular use to those companies with large fleets of trucks, and other heavy equipment.

Q Who are some of the users of Flat Free?

A Users are many and varied. They include: construction companies, police forces, municipalities, golf courses, pallet manufacturers, truck fleets, airports, quarries, industry, utilities, RV manufacturers, new car dealers, used car dealers, and many more.

Q Is Flat Free covered by product liability insurance?

A Yes, we have $3,000,000 worth of product liability insurance.

Q What tools do I need for the installation of Flat Free?

A The tools needed are:

- Valve core remover
- Tire pressure gauge
- Extra valve cores
- Valve stem covers
- Extension tool for inside dual wheels, when necessary
- Injector pump or Flat Free Installation Kit

Q How many ounces are delivered by a full pump stroke of the hand pump?

A Ten (10) ounces are delivered by a full pump stroke of the hand pump. Remember, when the pump is installed, to attach the pump to the air release (small metal valve) in the middle of the pail top, and to circulate Flat Free into the tire. Further, always clip the hose to the valve after each installation. This prevents dirt from attaching to the hose connector and entering into the tire valve. The pump is engineered for a tight fit and requires some effort to install into the pail.

Q What is the difference between Flat Free and other products which prevent flats and/or seal tires?

A Liquid tire sealants are either paste, solvent, gel or glycol-based which consequently dries out at low temperatures. Many of the liquid tire sealants congeal, which can cause balancing problems and alteration of the rubber composition. That, in turn, shortens the life of the tire. Flat Free is Glycol based and will not break down or dry up inside the tire. Flat Free, if properly installed, will not affect the balance.

Questions & Answers

Q What is the difference between Flat Free and other products, sold in aerosol cans?

A Aerosol products treat tires only after a puncture has occurred. Even then, they offer no more than a temporary seal. The tire will still have to be taken to a repair shop, where it will be broken down, the seal removed, the puncture patched and the tire remounted, all at the customer's expense. (The average cost for this service is $20.) If the flat tire resulted in damage to the rim or sidewalls, the costs will be even higher.

In respect to safety hazard, aerosol products are usually highly flammable. Flat Free is a preventative installed before the fact.

Q Is Flat Free flammable?

A No. Flat Free contains Glycol. Glycol is a type of organic compound with two hydroxyl groups attached to separate carbon atoms. Glycol is related to alcohol, which has one hydroxyl group attached to one carbon atom. The simplest glycol is ethylene glycol, a thick, colorless liquid that has a high boiling point and can be mixed with water. It is used as a permanent anti-freeze for automobile cooling systems.

Q Is Flat Free toxic?

A No. Flat Free is environmentally friendly, nonhazardous, nontoxic and non-flammable.

Q How does Flat Free affect the manufacturer's warranty?

A Flat Free exceeds the tire manufacturer's warranty by committing to a full reimbursement to the tire user who, after using Flat Free, experiences blow-out or puncture. Flat Free will NOT affect the Tire Manufacturer's Warranty (see manufacturers' letters). In fact, Flat Free far exceeds requirements of the manufacturer's warranty.

Q What guarantees does Flat Free offer to its customers?

A Flat Free's Warranty states:

1) Your tire will not go flat due to puncture wounds up to ¼" in diameter in the tread area of the tire during the time your tire may be legally used in your state (does not cover puncture wounds outside of the tread area)

2) Your tires will not go flat due to porosity leaks or bead leaks;

3) Flat Free will remain fluid inside your tires, providing continuous protection.

This will be in effect for so long as the tire or tires have 2/32" of tread or the minimum amount of tread prescribed by the laws of the state of purchase, which ever occurs first.

Q What is the effect of Flat Free on the tires?

A Flat Free extends the life of the tire. Being a Glycol-based product, it maintains the tire from excessive heat, prevents porosity, dry rot, and bead and rim leaks.

Questions & Answers

Q How does Flat Free perform under extreme temperatures?

A Flat Free contains a compound called ethylene glycol, which when mixed with the right amount of water, freezes at -50° F. and boils at 366° F. (Other products can claim a far smaller temperature range, generally between -20° F. and 250° F.).

Flat Free also reduces heat buildup, which accounts for more tire destruction than any other single factor. Considering that normal driving during the summer months can subject tires to a heat buildup of 300° F., Flat Free's extended range means more life for the tire.

Q Does Flat Free extend the life of the tire? If yes, in what way, and why? How does it perform?

A Yes. After application, Flat Free remains liquid for the life of the tire and rim installation. As the tire rotates, centrifugal force spreads the solution evenly over the tread area of the tire. When any puncture occurs, thousands of interlocking fibers seal the opening and prevent any loss of air. The process is repeated each time a puncture occurs.

Q How do you install Flat Free and how long does it take?

A Flat Free tire enhancer is installed quickly and easily through the valve stem (average installation time is just minutes per tire). See Flat Free installation amounts on page 15, bottled Flat Free installation instructions on page 16, and 5 gallon pail installation instructions on page 17.

Q Since Flat Free is a relatively new product, what is the difference between Flat Free and other similar products that have been on the market for 20 years?

A Flat Free is a *preventative*, Glycol-based product that will enhance the life of your tire. It is Non-Flammable and Non-Hazardous. Flat Free will not harden inside the tire and will not cause balance problems.

Q Can Flat Free installed in used tires?

A Yes, however if the tires are used, you should add approximately one more ounce of Flat Free than the chart indicates. Due to open pores of the used tire, some of the Flat Free will be absorbed.

Q What type of tires can Flat Free be used on?

A Flat Free can be used on any pneumatic tire. However, please ask your distributor about industrial use.

Q What quantities of Flat Free should be applied to all the different types of tires?

A See the tire chart for installation amounts on a variety of tire sizes and types.

Q How many different sizes and containers are used for the marketing of Flat Free?

A Flat Free comes in 8 oz. bottles, 16 oz. bottles, 5 gallon containers, and 55 gallon Containers.

Q If Flat Free a registered trademark?

A: Yes. Flat Free is a registered trademark, registered to American Sealant International, Winter Haven, Florida.

Questions & Answers

Q What occurs in a tire when Flat Free is installed?

A When the tire starts in motion, centrifugal force distributes the measured dose evenly inside the tire.

Q When the tire is punctured, what happens?

A The escaping air draws the sealing liquid into the opening. The gathering fibers and liquid seals the opening.

Q How many punctures will a measured dose seal?

A This cannot be predetermined as size of opening, air pressure, tire surface area and when the puncture occurs in relation to rotation will vary the results.

Q If I continuously puncture the tire, what will happen?

A Eventually enough liquid will be lost and air pressure will drop to a point where a good seal is no longer possible. At that point, the tire needs to be retreated with Flat Free.

Q Is there air pressure loss when using a tire gauge?

A There could be; if the gauge is not seated properly air will escape. You should not hear any air when you check tire pressure.

Glossary

Air Migration
Air Migration is the result of porosity. Pneumatic tires have weak pores that allow air to travel between the belts and through the tire walls.

Antioxidant
Specialized chemicals designed to retard oxidation.

Antiozidant
Specialized chemicals designed to retard ozone contamination.

Bead
The portion of the tire that seats against the rim of the wheel. Made of high tensile steel wires wrapped and reinforced by plies.

Bead Leaks
Refers to air leakage from inside the tire that escapes between the tire and the wheel.

Bleeding
The emission of air and/or Flat Free from a wound.

Belts
In a tire's construction there are several belts of steel or fabric that encircle the tire and are sandwiched in rubber. The belt is considered the strength of the tire and retains the tire's shape.

Casing
The tire structure, less the tread and sidewall rubber.

Checking
Minute cracking in the rubber caused by aging and oxidation.

Cling
Describes the unique ability of Flat Free to stay coated throughout the inner surface of the tire and the wheel.

Clot
When Flat Free is forced into a wound, the fibers entwine and prevent air from escaping as the rubber recovers from the removal of a puncturing object.

Coat
When the proper amount of Flat Free is installed into a tire, there will be a sufficient amount of product to cover the entire inner treaded air surface of the tire and wheel.

Cords
The strands forming the tire plies.

Cost per Mile
Total cost, including any repairs and recaps, divided by total tire mileage. In some cases, down-time may also be taken into consideration.

Crown / Shoulder
The portion of the tire that is the area between the sidewall and the tread on both sides of the tires.

Curing Process
Flat Free's unique ability to cure (when exposed to ambient air) on both sides of the tire.

Downtime
The vehicle operating time loss due to maintenance difficulties and tire or tube failures.

Glossary

Dry Rot
As a tire ages, the tire's composition is attacked by road contaminants, oxidation and ozone which reduce the flexibility and rubber recovery of all tires. This aging process is inevitable, but with the addition of antioxidants and antiozidants by tire manufacturers and Flat Free the tire and casing is able to last much longer.

Dynamic Balance
Balancing a tire while it is spinning. This is the preferred method of tire balancing.

Flexing
The distortion and twisting of the tire as it rolls along the road with the vehicle's weight and the uneven surface of the pavement. Turning also causes flexing. Flexing may be induced by hitting a tire with a mallet or by bouncing the tire.

Inner Air Cavity
The total surface of the inside of the tire and wheel. Every portion of the tire and wheel that comes into contact with the air inside the tire.

Inner Air Surface
(See Inner Air Cavity)

Life of the Tire
Refers to tread depth. The actual amount of tread left on a tire that is required by the individual state law to be legal. A tire worn beyond this measurement is past its legal life.

Mask
To cover, to hide, or to obstruct internal damage of a tire.

Memory
The ability of a tire to recover to its original shape after being subjected to adverse situations. Example: a rubber band that is stretched and when it is released, it will return to its original molded shape.

Migration
(See Air Migration)

Miscible
Capable of mixing in any ratio without separation of two phases.

Permanent Repair
To achieve a repair that is not only airtight, but also will not dissolve from exposure to water and road contaminants. An attribute found only in Flat Free.

Ply
A layer of rubber-coated parallel cords.

Ply Separation
A parting of the rubber compound between adjacent plies.

Pneumatic
Tires that contain air. Also any tire that utilizes air as a factor to achieve a cushioning effect between the road and the vehicle.

Porosity
Rubber is not solid. It contains many pores. These pores are known to link together to create a passageway (porosity) for air to escape from within the tire.

Glossary

Porosity Leaks
Refers to the air that is escaping from a tire with no apparent damage. (See Porosity)

Premature Tire Failure
Any tire that does not achieve the maximum mileage as rated by the tire manufacturer.

Radial Ply
Refers to the ply or plies in which the cords run at right angles to the bead.

Repaired Tire
Any tire with punctures, cuts, or other types of injuries that has been reconditioned with Flat Free or tire patch materials to provide additional safe service life.

Reserve
Every tire requires a specific amount of Flat Free depending on size. The required amount has been carefully calculated to provide an adequate coating plus an additional amount that will move freely around the inner surface to assure that there will always be a sufficient amount of Flat Free in the tire.

Retread Tire
A tire rebuilt from a used casing. The worn tread is replaced with new tread which extends its usable life. A casing in good condition can be retreaded many times.

Return Spout
A special collar was designed to hold the Flat Free pump in place. This collar contains a tank valve. This tank valve is referred to as a “Return Spout” which will: provide a place to secure the hose, protect against damage, provide a sealed unit, prevent Flat Free from curing in the application tools, provide a way to return the excess Flat Free to the pail and release air pressure that is in the hose, as a result of applying Flat Free to an inflated tire. (See Shut Off Valve)

Rubber Recovery
When a tire is stretched or is distorted it will recover to its molded shape. When a tire receives a puncture, the puncture object merely rips a small hole and stretches the rubber in order to achieve penetration. When the puncturing object is removed, the rubber returns to its original state. (See Memory)

Sealed Air Chamber
Flat Free’s ability to transform the tire and wheel into a single until that will hold the air at the pressure that has been set.

Self-Sealing Tire
The ability of Flat Free to transform any tire into a “super tire” capable of maintaining proper air pressure and sealing punctures as they occur.

Separation
Pulling apart, such as ply separation (from each other) or tread separation (from plies).

Glossary

Shut-Off Valve
A component of the tools needed to install Flat Free. This unit is connected to the outer end of the pump hose between the hose end and the Quick Disconnect. Its sole purpose is to trap the pressure that is accumulated in the hose and the pump after servicing a tire filled with air. By trapping the pressure, the Shut-Off Valve will prevent Flat Free from squirting onto the tire and wheel when the VCR is removed from the valve stem and placed on the Return Spout. (See Return Spout) SIDEWALL The portion of the tire that is between the bead and the crown.

Static Balance
Wheel balancing on a non-rotating tire. Not recommended by Flat Free.

Temporary Repair
If Flat Free is used to repair a tire that is already flat, and the tire is not installed on the vehicle and driven a minimum of 3 miles, the Flat Free may not be worked well enough into the wound to build a sufficient clot for a satisfactory repair. To achieve a permanent repair, the tire must flex properly and force the Flat Free well into and through the wound.

Thixotropic
The ability to stretch and recover from repeated high speed tire rotation (centrifugal force) including high temperature variances. Only Flat Free has been proven to be able to sustain these adverse conditions for the life of the tire.

Tire Bleeding
(See Bleeding)

Tire Flexing
(See Flexing)

Tire Life Extender
The exclusive ability of Flat Free to prevent premature tire failure by maintaining proper air pressure, cooling tires, preserving casing integrity, preventing belt separations, eliminating porosity and transforming any tire into a self-sealing tire.

Tire Sealing Process
Flat Free's trade name, established to differentiate the capabilities of Flat Free over tire sealants.

Tire Air Cavity
(See Sealed Air Chamber)

Toe-In
Alignment of wheels so that they are closer together at the front than at the back.

Toe-Out
Alignment of wheels so that they are closer together at the back than at the front.

Glossary

Tread Area
The surface of the tire that is in contact with the road. The area that is between the inner and outer crown. (See Crown)

Tread Depth
The distance measured at the center of the tread, from the base to the top of the tread.

Tread Design
The pattern of the tread.

Tread Separation
Pulling away of the tread from the tire casing, normally caused by porosity (air migration).

Valve / Valve Core
One way valve used to prevent air pressure loss.

Valve Stem
This is the rubber-coated stem that is attached to the wheel which allows tires to be inflated. The valve core is located inside the valve stem.

Volatile
readily vaporizable at a relatively low temperature.

Weather Checking
A condition that appears as cracks in the sidewall.