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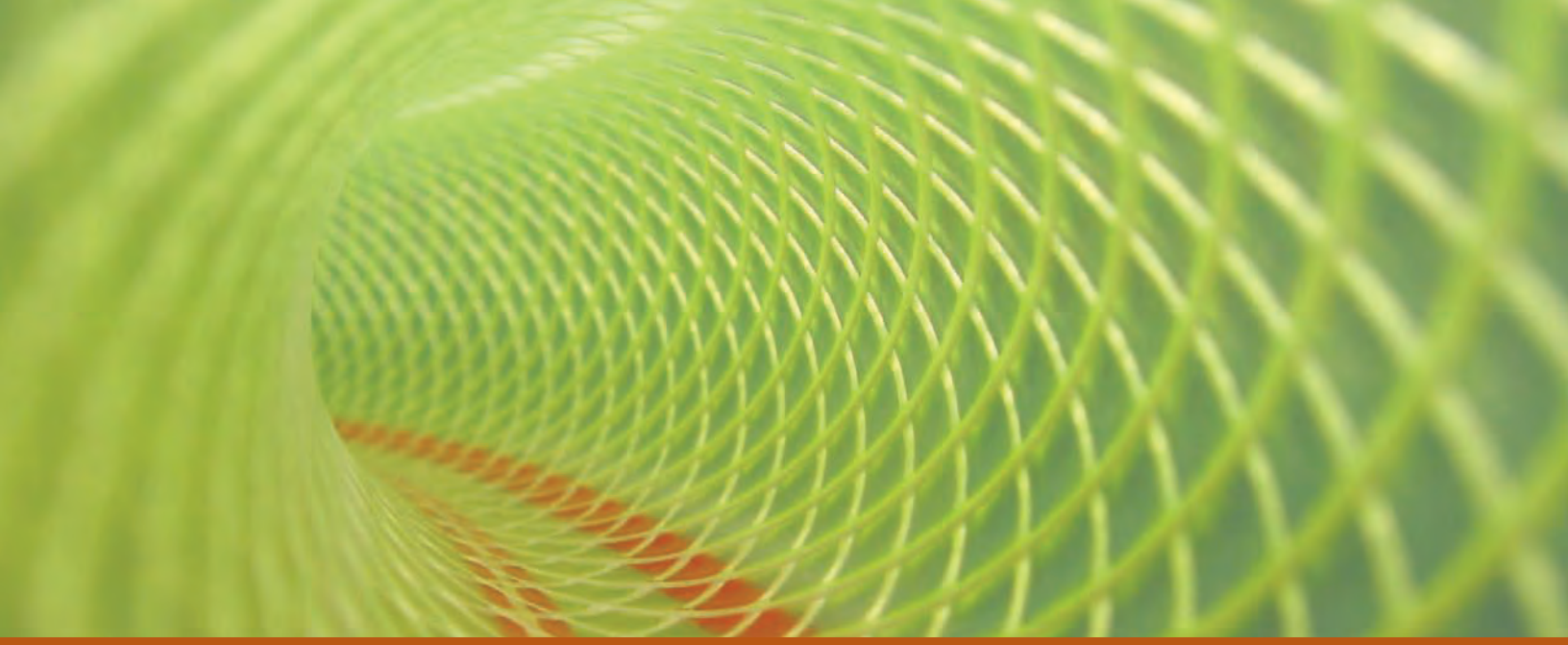
The Selection and Inspection of Hoses

An Integral Component of Everyday Equipment



The Selection and Inspection of Hoses

An Integral Component of Everyday Equipment

Fred Whitford
Coordinator, Purdue Pesticide Programs

Stephen Hawkins
Assistant Director, Purdue Agriculture Centers

John Obermeyer
Integrated Pest Management Specialist, Purdue University

Dennis Westrich
Hydraulic Hose Specialist, Reynolds Farm Equipment

Tom DeMunbrun
Technical Specialist, Lewis-Goetz and Company, Inc.

Brad Peas
Technical Specialist, AgroChem

Robert Wolf
Associate Professor, Application Technology Specialist, Kansas State University

Kevin Leigh Smith
Editor, Purdue Agricultural Communication

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Most discussions about fertilizer or pesticide application equipment focus on tank construction and size, pump output, boom design, nozzle type, and electronic components. But there is little thought or discussion of hoses, which are integral parts of the spraying system on all application equipment.

When worn-out hoses fail or don't work, it becomes very clear how important those inexpensive parts can be. Factor in the time it takes to find and install a replacement, to clean up any spills, and to reschedule the rest of the day's work, and costs for neglecting hoses can quickly mount. If regulatory agencies, the news media, or insurance companies become involved, that seemingly insignificant hose can become a real problem that one will never forget.

The bottom line is that using the correct hoses and inspecting them routinely are the cornerstones to managing these "arteries" of application equipment.

This publication:

1. Describes design characteristics to look for to correctly select a hose
2. Offers inspection guidelines to determine when a hose, clamp, or fitting should be replaced

Follow the recommendations in this publication and reduce the accidents and downtime hose failures cause.

Hose materials, sizes, and colors vary. Determine the application, and then select the proper hose for that use.

Damaged hoses can be costly — cleanups often cost more than repairs.

The number of hoses on this truck demonstrates why hose inspections are important — if just one hose fails, the applicator could have serious problems.

Select Hoses that Perform and Last

The potential for hose failures is real,
and the consequences can be significant.

There is no universal hose that works for all products, in all applications, for all situations. The hose you select depends on the type of service it will perform, and the products it is expected to transport.

Before selecting a hose, there are several factors to consider, including whether the hose will be subject to high or low pressures; performing suction or discharge functions; subject to extreme heat or cold; subject to rolling, flexing, or dragging; or exposed to corrosive materials. Remembering these factors and others will help you select hoses, clamps, and fittings that are designed for specific applications, and help you separate the hoses that do work from those that don't.

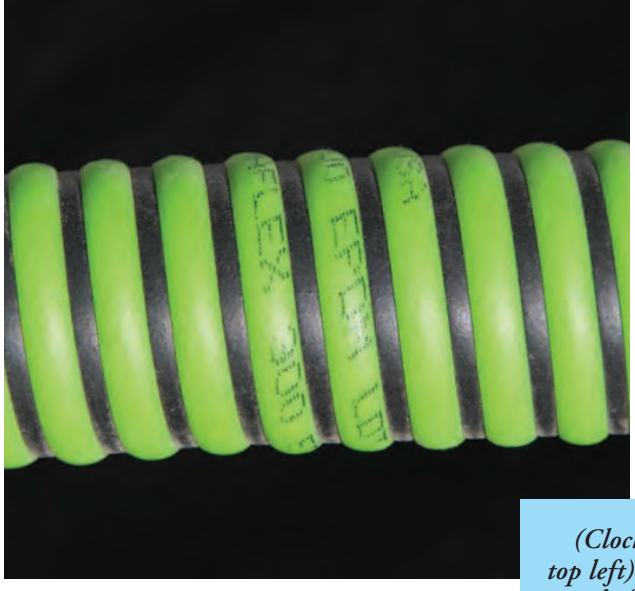
For the purposes of this publication, we have developed 13 questions you should always answer when you select a hose. By answering these questions, your retailer will be able to help you select hoses, clamps, and fittings that are designed for specific applications, will best meet your needs, and provide good value over time.

1. What **Materials** Will the Hose Carry?

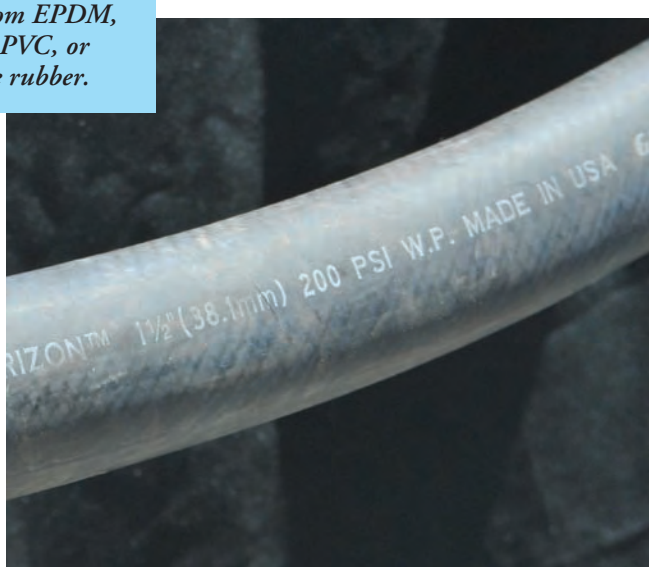
The materials used to make hoses are just as diverse as the products that can be pumped through them. Hoses for application equipment are designed and built to withstand the detrimental effects of the fertilizers, fuels, pesticides, or hydraulic fluids they carry.

If you select a hose that is incompatible with the material it will carry, the hose lining will become brittle, stiff, or soft, and will deteriorate. This can lead to weak areas in hoses that will be unable to withstand pressure surges and will fail.

Hoses are frequently labeled and designed for specific uses and for particular chemicals or environments.



(Clockwise from top left) Hoses can be made from EPDM, EVA, PVC, or nitrile rubber.



Consider rubber hoses: they may all appear to be similar, but there are many different blends of rubber hoses. EPDM (ethylene-propylene-diene-terpolymer) rubber hoses are inexpensive, durable, strong, and compatible for most fertilizer and diluted chemical solutions. But petroleum products cause EPDM hoses to fail. So if you plan to use a rubber hose to carry petroleum products, use one made of nitrile rubber.

Another important consideration is the product's concentration. Running a concentrated product through a hose it is quite different than running a diluted solution through it.

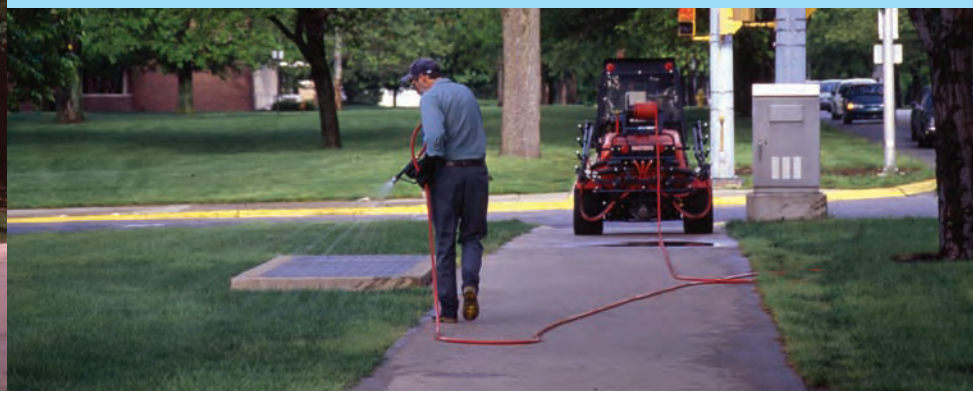
Consider the fertilizer additive N-Serve. It is one of the most corrosive materials that can pass through a hose — it has been known to corrode stainless steel tanks. N-Serve requires a special hose with a hard internal liner. The more concentrated the N-Serve, the more important

It's also important to remember that bulk storage of concentrated pesticides requires special hoses. For bulk storage, hoses usually have inside tubes made of cross-linked polyethylene, which offer additional protection against deterioration. Hoses for bulk storage have heavy-duty reinforcements. Even the hose cover will have a weather and ozone-resistant EPDM covering.

Make sure hoses that carry concentrated products are up to the job.

Certain chemicals can quickly degrade hoses (such as blistering) and cause them to fail. The herbicide in the tank shown here deteriorated the site gauge hose, leading to a spill that went into the city's sewer treatment plant.

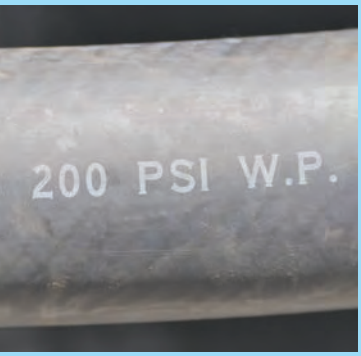
The red hose shows sign of bursting under too much pressure. Some applications (left) require higher pressures than others (below). Never use a hose unless you are sure of its pressure rating.

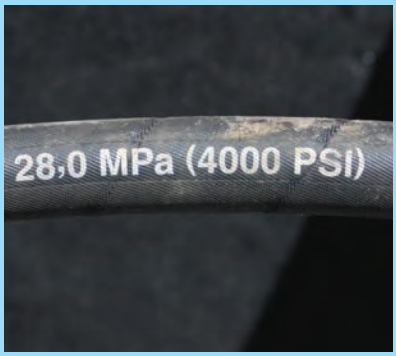


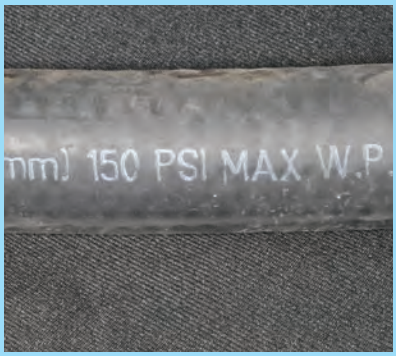
2. Does the Hose Need to Withstand **High Pressure**?

The pressure exerted within a hose depends on the volume a pump can push forward and the diameter of the hose. The more fluid that is pushed into the hose, the more it pushes out on the wall. This internal pressure is measured in pounds per square inch (psi).

Hoses that carry different products can vary in their construction. Avoid failures. Never use a hose for an application or material it wasn't designed for.





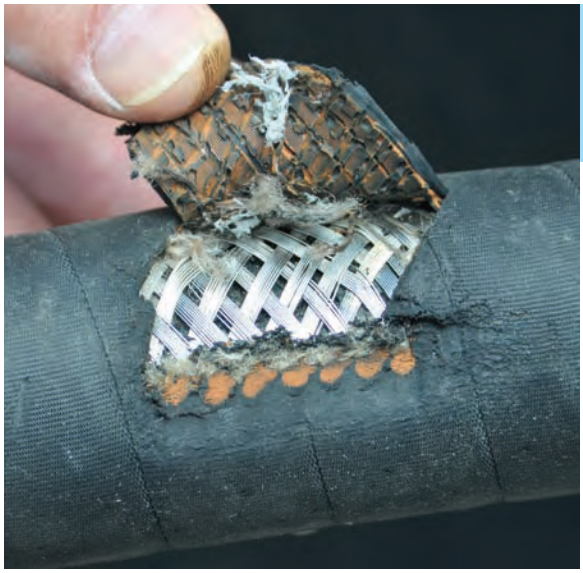


Reinforced hoses may have several layers of wire, textile fibers, or special materials to retain working pressures and allow the hose to perform in the working environment.

In application equipment, the discharge hose is one of two hoses connected to the pump and is always on the out flow. The discharge hose usually experiences the highest pressures when the pump is left running, valves are closed, or the pressure regulator does not react fast enough to divert flow from the nozzles back to the tank.

To understand how different hoses withstand different pressures, it's important to know how hoses are made. Each hose is made of a tube surrounded by a reinforcement layer and a cover. The tube, of course, must be compatible with the material that will flow through it and offer some pressure protection.

To withstand higher pressures, hose manufacturers use various reinforcement materials to hold the core together. Reinforcement materials can be made of stainless steel wire or textile materials combined into single or double braids, depending on expected hose pressures. Greater reinforcements increase the pressure ratings.



Cuts in hose covers expose the reinforcement, which can lead to a premature failure.

All hoses have two pressure ratings: a working pressure rating and a bursting pressure rating.

The working pressure rating represents common pressures a hose experiences each time the equipment is operated. Hoses that operate within their working pressure ratings will move just as much fluid at the end of the day as they did at the beginning.

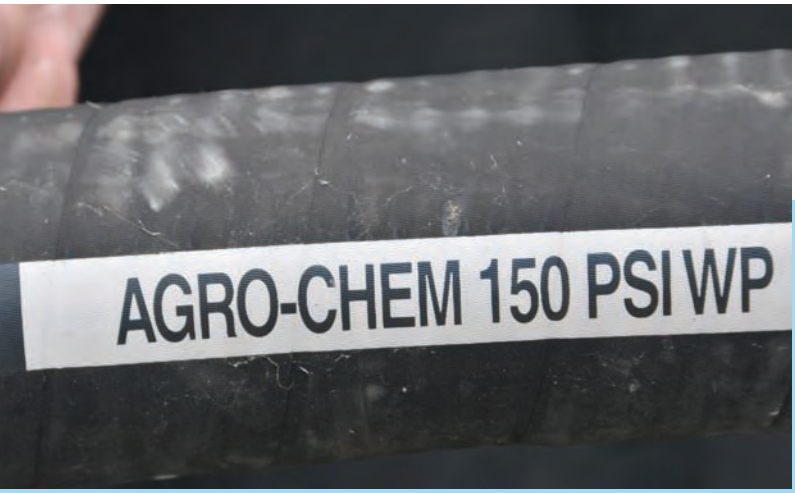
It's important to remember that working pressure is not fixed — higher temperatures affect the materials hoses are made from and can change ratings. When the air temperature is above 80°F, the working pressure rating drops. For instance, a hose with a working pressure rating of 150 psi will actually hold less pressure when it's more than 80°F. Thus, it is very important to select hoses that have working pressure ratings that are higher than the pump pressure. That way, the hoses will still perform even when temperatures are high.

The bursting pressure rating is the highest pressure a hose will maintain before it fails. Hoses experience such high pressures when a bypass or relief valve fails. Hoses can take high pressures for a time before the hose's reinforcements fail and the hose bursts.

Bursting pressure ratings are normally four times higher than working pressure ratings. But, depending on the manufacturer, these safety margins may vary. The difference between the working and bursting pressure ratings is a built-in safety margin. When operators keep the hose within the working pressure range, the hose should not fail as a result of pressure alone.

Always remember that pressure ratings are assigned to new hoses. Over time, as hoses wear from both the inside and out, the actual working and bursting pressure ratings will decrease. Routine maintenance on any application equipment should include replacing hoses when necessary.

Manufacturers may or may not stamp pressure ratings directly on hoses. Some manufacturers



Most hoses are labeled with their working pressures.

Uses Dictate Hose Selection

Although the questions in this guide cover specific hose qualities (such as pressure or material), the reality is that many of these qualities are interconnected. Consider hoses that are used for hydraulic fluid and those used for manure.

Hoses for Hydraulic Fluids

Petroleum-based materials must be compatible with the materials a hose is made from. But you also need to consider changes in temperature. During the winter the temperature on a piece of machinery may change from -20°F to 200°F over the course of a few minutes. Make sure the material in the hose is resilient enough for such extreme temperature changes.

The way hydraulic hoses are made greatly influences their ability to bend. These specialty hoses can be manufactured with one, two, four, or six reinforcement wires. One-wire hoses have the lowest working pressures, but have the best flexibility. As the number of wires increase, the hose's flexibility decreases.

Perhaps the most important factor to consider before buying a hydraulic hose, is working pressure. Hoses designed to handle hydraulic fluids must withstand rapid increases in pressure without rupturing. It's not unusual for hydraulic system pressures to fluctuate from 0 to 2,000 psi within seconds. Older hydraulic systems were designed to run pressures up to 1,500 psi, while newer systems can build pressures to 6,000 psi.

Hoses for Handling Manure

Pumping manure requires larger hoses that range from 4 to 6 inches in diameter. These larger sizes mean that almost anything found in the manure will pass through, which can damage the inside of the hose.

For example, a screwdriver, nails, wood, or even a sharp piece of steel dropped in a manure pit could damage the hose's internal lining. That's why hoses designed to handle manure often have an extra lining layer.

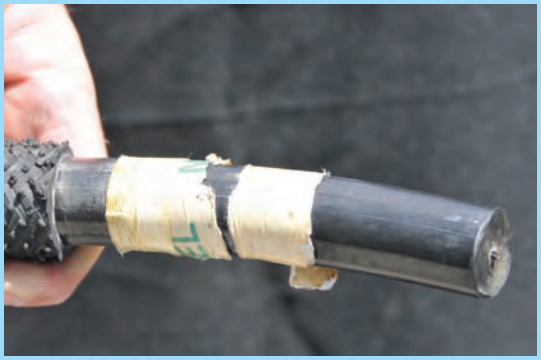
Manure hoses also must withstand external damage. It is common in many livestock situations to pull a half-mile line of hose across a field with a tractor. That dragging can damage hoses that are not protected by durable outside covers.

Some manure hoses have wire reinforcements, while others use single, thin-walled blue or green poly discharge hoses to connect to such pieces of equipment, or to pull a drag hose through the field where flexibility is required.

stamp ratings on their highest quality specialty hoses, but not on the lower grade commodity hoses. The pressure ratings for unmarked hoses can be found in the manufacturer's catalog descriptions.

When selecting hoses, pay particularly attention to anhydrous ammonia supply and transfer equipment. These hoses work under extremely high pressures. They can have working pressure ratings of 350 psi and burst pressure ratings of 1,750 psi; a difference of five times (rather than the common four).

Components of an anhydrous hose:



1. The tube that will transport the actual material.

2. Inner layer of protection.

3. First layer of reinforcing fibers.

4. Second layer of reinforcing fibers.

Replace all ammonia hoses on or before the specified date.

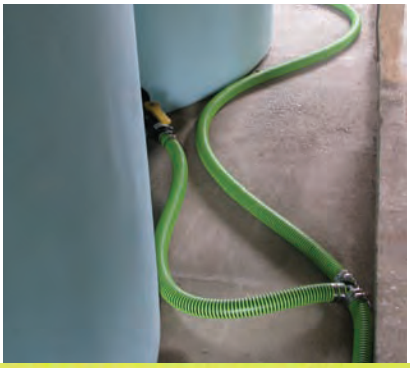
These high-performance hoses will frequently be stamped with the manufacturing date, manufacturer's name, working pressure, and bursting pressure. In some cases, manufacturers will recommend when to replace hoses.

Using outdated ammonia hoses comes with tremendous liability issues. In fact, many states do not allow hoses to be used beyond their expiration date.

3. Will the Hose Operate with **Vacuum Pressure**?

Suction hoses carry material from storage tanks to the pump. Like any hose, suction hoses must be made from materials that are compatible with the product they are transporting.

Unlike the high-pressure hoses described above, suction hoses use vacuum pressure created by the



pump. Suction hoses fail when pumps create more vacuum — more suction — than the hose can resist. When this happens, the hose collapses.

Suction hoses are rigid and reinforced to keep them from collapsing under a vacuum. Usually, manufacturers use two reinforcement methods: reinforcing the internal walls with helix steel wire or integrating a hard plastic ribbing into the outside of the hose. These reinforcements keep the hose open and allow product to flow freely.

Most suction hoses are designed to work under less pressure than similarly sized discharge hoses, although the working pressures are still well within most applications. In many applications, suction hoses are versatile enough to be used on both sides of a pump. But because discharge hoses are not reinforced in the same way as suction hoses, discharge hoses are limited for use on the pressure side only. Discharge hoses could collapse under the vacuum created by a pump.

Suction hoses come in blue, green, yellow, and other colors. The colors are associated with the plastic ribbing that is integrated and embedded into the hose. The color of the plastic reinforcement has no influence on hose performance. It's strictly cosmetic.

Base your hose and tubing selections on inside diameter. If the hose is not marked, consult the manufacturer.

4. What is the **Hose Diameter**?

Hoses have inside and outside diameters.

The inside diameter (ID) is the more important of the two. An application system's delivery rate is a function of its pump's rated capacity and its hose ID. As a general rule, large delivery volumes require high-ID hoses to minimize friction loss and required pressure. In short, your goal is to select a hose that will deliver the needed amount of product at the lowest practical pressure. This keeps costs lower because higher pressures require better, stronger, more expensive hoses.

ID also determines what size fittings the hose should be used with.

The outside diameter (OD) is used to determine the size of the clamp that will secure the hose to the fitting. OD also can be an important consideration if the hose has to go through a hole or be used in tight spaces.

5. How Much **Hose Length** Do I Need?

It's important to account for a little flex (or give) when measuring any hose.

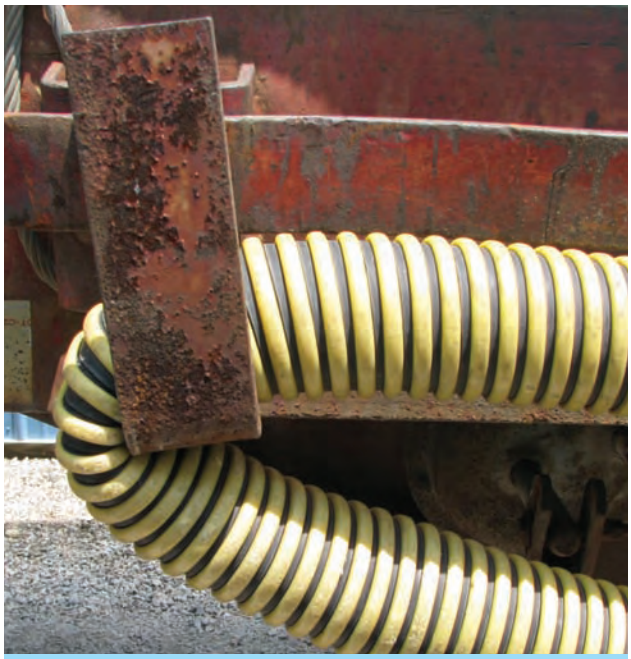
Changes in ambient temperatures, internal temperatures, and vibrations require hoses to be flexible. Hoses shrink and expand slightly based on ambient or internal temperatures. Loads also may shift, so hoses should have slack in them so they won't be stretched, kinked, twisted, or even pulled off.

Working hoses require flexibility. Make sure hoses are long enough for the job.

6. Will the Hose Have to **Bend** or **Flex**?

A hose's bend radius is an important consideration when an application requires a hose to be constantly folded and unfolded on a boom sprayer, rolled on a reel, or used in similar applications. Hoses that require continuous folding should be strong and maintain the same inside diameter even when they are frequently folded back and forth.

Many applications call for hoses to bend, but be sure they do not kink or fold.



Make sure a hose does not go beyond its bending radius to keep it from failing prematurely or having its flow restricted. Hose splices are not recommended. The fitting used to fix this hose break (below) will restrict product flow.

Bend radius measures how much a hose can bend without kinking and compromising its integrity. For instance, a hose with a 3-inch bend radius can bend around an object that is 6 inches in diameter (or more) without kinking.

To determine bend radius, take a hose in both hands and form a tighter and tighter circle. When the hose kinks, measure the diameter of the circle and divide by two to get the circle's radius.

The properties that keep hoses from kinking include wall thickness, reinforcement material, and construction material. With some materials, kinked hoses can reassume their original shapes. For instance, rubber hoses have far more elasticity (bendability) than hoses made of PVC and EVA. These semi-translucent rubber hoses are not even assigned a bend radius.

The larger the bend radius, the less bending it can tolerate before it kinks. Hoses with larger outside diameters and thicker materials bend less. If you plan to put a hose on a reel, keep bend radius in mind.

Discharge hoses are designed to bend more easily than more rigid, similarly sized suction hoses. So if your discharge hose needs to bend, substituting a suction hose may be a poor choice. If you still want to use a suction hose on the discharge side of the pump, you may have to use a 45- or 90-degree fitting. However, using fittings to create bends may increase friction, affect flow rates, and create a point where leaks can occur.

Prevent petroleum products from getting on hoses — either by leaks or dripping. Petroleum products can degrade any hose cover.

7. Will the Hose Contact **Petroleum Products**?

When petroleum products such as oil and diesel leak, they can quickly deteriorate hose surfaces and cause the hoses to fail if they do not have petroleum-resistant covers.

Gasoline has less effect on hose covers, because it will quickly evaporate from the surface unless it stays in direct contact. Diesel and oil don't evaporate as quickly and are absorbed into hose exteriors.

Hydraulic or diesel fuel leaks can decrease the life spans and functions of hoses that are used to carry pesticide and fertilizer products. For these reasons, consider repairing leaks, shielding hoses from them, and even rerouting hoses to avoid contact with petroleum products.

Repairing fuel or hydraulic return lines with hoses not designed for use with petroleum products can lead to serious equipment failures. Don't repair low-pressure fuel return lines with hoses designed to be used in sprayer systems — the materials may be incompatible.

8. Will the Hoses Stay **Outdoors**?

Sunlight, ozone, and temperatures all break down (or dry out) hoses. Once a hose dries out, it becomes hard, brittle, and loses its ability to expand under pressure. In extreme cases, dried-out hoses will even crack.

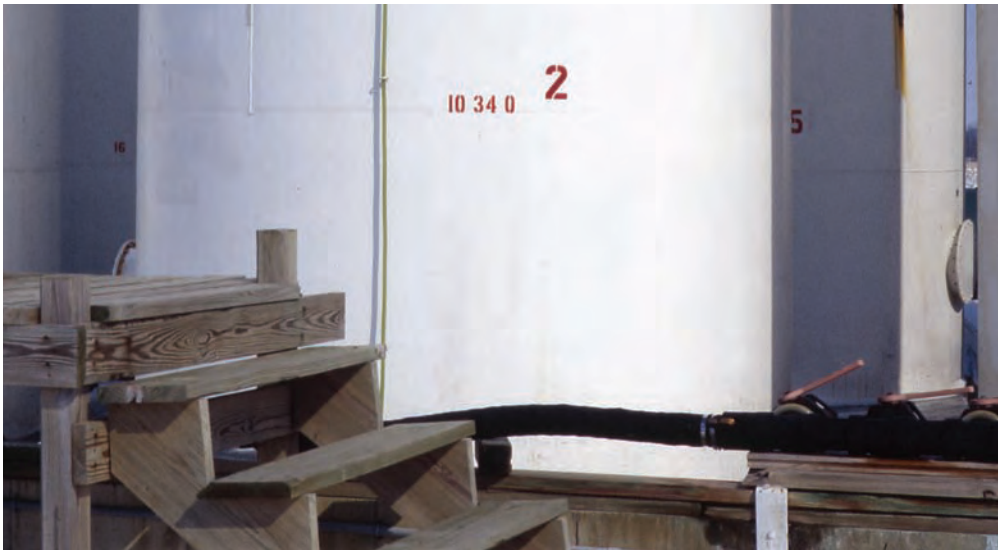
Extreme cold can actually freeze the rubber compound in hoses, causing them to crack when bent. The colder hoses become, the less flexible they are. This is why it is very important to let hoses warm up before operating equipment so the hoses can resist the sudden shock placed on them by the increased pressure.

Plastic hoses made from clear polyvinyl chloride (PVC) and semi-translucent ethyl vinyl acetate (EVA) become hard and brittle when temperatures are cold and soften when temperatures rise. Sunlight can destroy these hose types even though the tubing material may contain an added ultraviolet protective material.

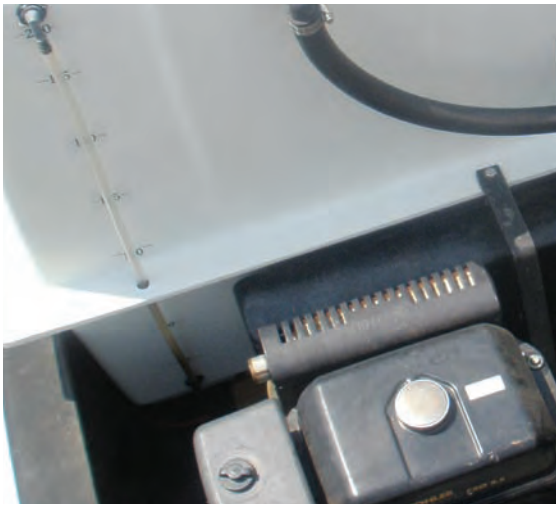
PVC tubing is a clear vinyl product that is widely used, but as a general rule it is rather limited in what it can be used for. PVC tubing is commonly used for sight gauges when one needs to see how much product is in a stainless steel or fiberglass tank. PVC tubing has no pressure rating and is not reinforced.

Over extended periods, PVC tubing is incompatible with most chemicals. Chemicals such as pesticides soften the plastic resin and cause the hose to stretch. Sunlight easily degrades PVC tubing. Since these hoses are left outdoors

Hoses exposed to constant sunlight (like those shown here) will degrade.

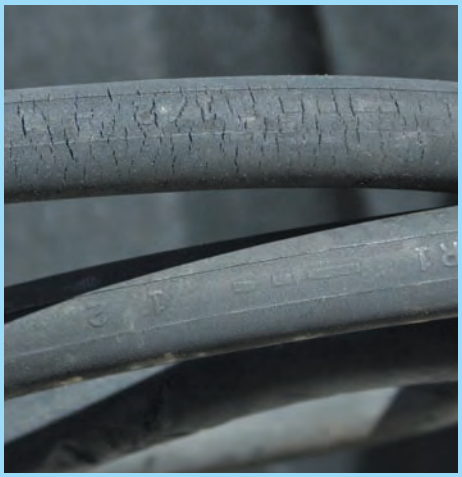


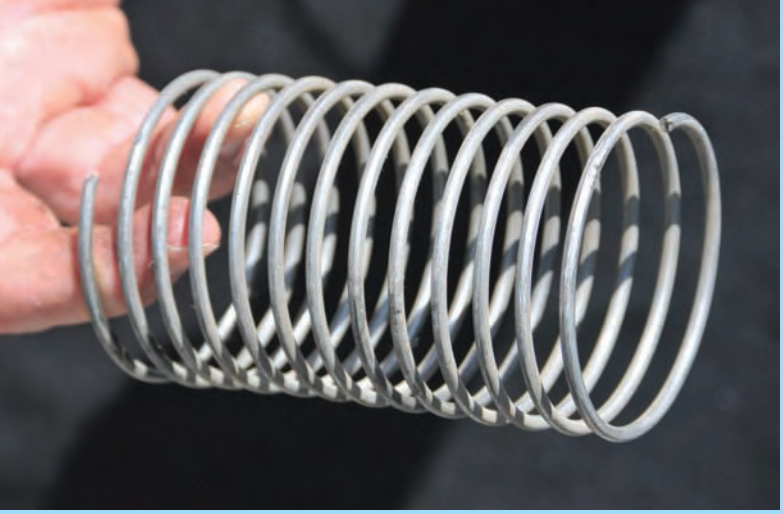
The clear hoses on these tanks gauge the level of fluid they contain. Only open the valve to these hoses when you want to check the level in the tank. If the hose fails when the valve is open, some or all of the tank's contents can be spilled.



year-round, they are subject to the elements. Just the wind will cause wear by friction and possible snagging, which can lead to PVC tubing failure.

Parts catalogs will describe the external and internal temperature extremes a hose can withstand. When selecting hoses, make sure to account for the extreme temperatures to which they may be exposed. Certain applications can expose hoses to extreme cold (like anhydrous ammonia applications at -40°F) and extreme heat (like hydraulic applications approaching 180°F).





A number of devices can help protect hoses against abrasion. The hose on the ground (below) is rubbing against stone and has no protection.

9. What **Physical Environment** Will the Hose Be In?

Hoses need protection against external heat sources, abrasions from dragging, vibrations, and rubbing against equipment frames. Some hoses are surrounded by springs that help protect against falling objects, while others have plastic rings around them to protect them when they rub against other objects. Other products, such as plastic sleeves and steel encasements, help protect hoses from rubbing damage.

Rubber hoses near heat sources (such as engines) can prematurely break down. In some cases, a thicker hose may be enough to protect it from the heat of the engine. Other options to avoid heat include placing an old hose as a sleeve over a working hose to take the brunt of the heat from the engine; rerouting hoses away from heat sources; and installing steel heat shields that will not impair equipment operation.

A plastic sleeve protects this fuel hose from the hard surface.

(Above) The hose on the left is not protected and rubbing against a metal bolt, which and can cause it to break down prematurely.

Many options can protect hoses from abrasion damage. However, be sure to routinely examine all hoses.

10. Will the **Hose's Weight** Be an Issue?

EPDM hoses are very dependable products; however, the larger these hoses become, the heavier they get.

If weight is an issue, then look for alternatives that weigh less. If heavy hoses are required for specific applications, then you can install proper supports according to the manufacturer's recommendations.

11. What Type of **Hose Clamps** Are Needed?

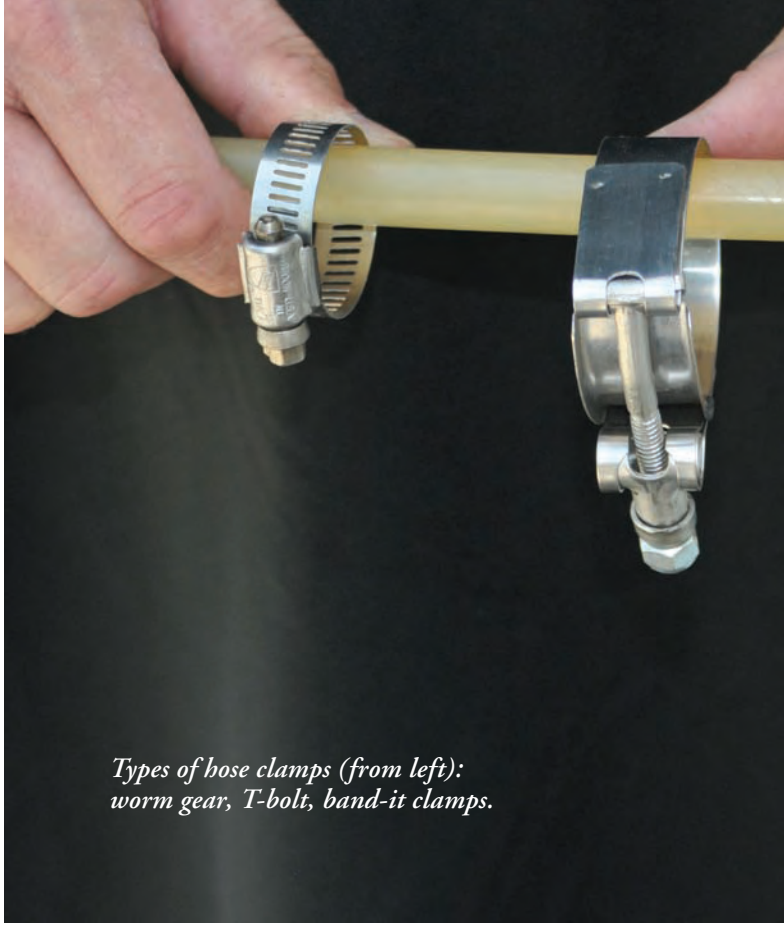
Like hoses, clamp designs serve specific purposes and the best clamp to choose depends on the application. This is especially true as pressures increase. Without the right clamps securing hoses to the fittings, high pressures can blow hoses off fittings — leading to potentially dangerous situations.

Hose clamps are sized to fit over a hose's external diameter, and are categorized by the minimum and maximum hose diameters they fit. For example, a clamp may be described as fitting hoses with an outside diameter between 1/2 inch and 29/32 inch. Another clamp may fit hoses with outside diameters between 1 3/8 inches and 1 9/16 inches.

Remember that clamps have to slide over the hose and fitting barbs. This means clamps have to fit over a slightly larger outside diameter than what the hose alone calls for. Make sure to account for this when selecting the appropriate hose clamp.

Two other factors to consider when selecting clamps are the corrosiveness of the material and the working pressure.

The five most common kinds of clamps are



Types of hose clamps (from left): worm gear, T-bolt, band-it clamps.

Mild Steel Worm Gear Clamp

Mild steel worm gear clamps are among the least expensive all-purpose clamps in the marketplace. These clamps are especially effective when they will be permanently placed on hoses. Removing and refastening these clamps weakens the metal. Over time, the gears and teeth no longer fit snuggly into the grooves and the clamps become ineffective.

Do not use mild steel clamps with corrosive materials such as fertilizers. Corrosion on any part of the clamp means part of the metal is worn away, which decreases its holding power. Always replace corroded clamps.

Clamp marks (right) and fitting marks (below) on hoses.

Corroded clamps (right) can fail.

Two clamps (below) provide additional protection inexpensively. Throughout the season, make sure worm gear and T-bolt clamps are properly tightened.

All-stainless steel worm gear clamps last longer than mild steel clamps.

An advantage of band-it hose clamps is that they will not catch on other objects when the hose is mobile.

All-stainless Steel Worm Gear Clamp

Clamps made entirely from stainless steel last longer than mild steel clamps, protect against corrosion, and can be taken on and off with minimal metal fatigue. Just be sure the entire clamp — the band, screw, and housing — is made of stainless steel.

Band-it Hose Clamp

Band-it hose clamps use a tool to cut off any excess at the band. Once cut and banded, these clamps are not reusable. They can be made of mild or stainless steel.

Selecting and properly using a clamp is just as vital as selecting the proper hose for the application.

T-bolt Clamp

Actual bolts tighten T-bolt clamps around hoses that have an outside diameter of 1 1/4 inches or more. A T-bolt clamp pulls directly against the other side of the clamp, allowing more tension to be placed on it than a worm gear clamp.

Use T-bolt clamps when the material flowing in a hose could create a significant environmental problem if spilled. When working around corrosive materials, make sure that all T-bolt clamp components are manufactured with stainless steel.

Pressed Fittings

Pressed fittings are used on high-pressure hoses such as anhydrous ammonia and hydraulic hoses. They are permanently crimped on both ends of the hose.

These permanent fittings hold better under high pressure than clamps. They are installed by the hose manufacturer or by distribution centers that have the special tools and knowledge to install them properly on high-pressure hoses.

Hose crimping machines can help crimp hoses properly.

It's important to know whether you will use steel or plastic fittings when selecting a hose. Placing a clamp between barbs helps strengthen the seal.

12. Will I Need **Fittings**?

The fittings on your application equipment need to be compatible with the material being applied and the pressures used. Fittings can be made of PVC, polypropylene, nylon, brass, mild steel, stainless steel, and even special alloys. Make sure fittings are not only compatible with the material being applied, but that they have pressure ratings to meet the specific application.

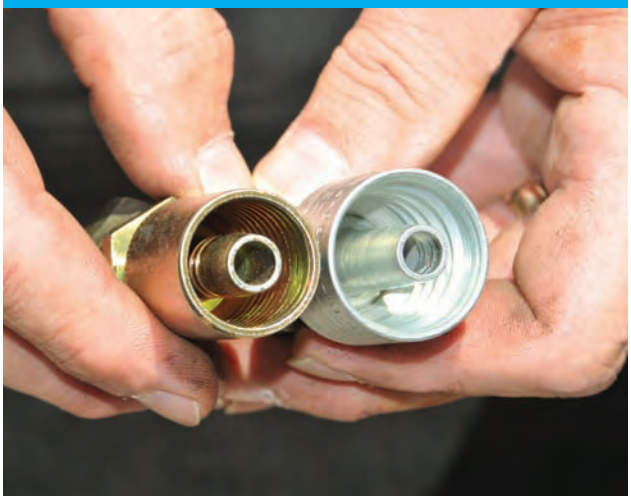
Fittings come with or without barbs. Barbed fittings provide extra protection by helping to keep the hoses on the fittings. Barbs have low profiles for low-pressure uses, or rather substantial profiles for high-pressure uses.

Barbs protrude into the interior of the hose material. In some cases, crimp fittings force barbs to extend through the rubber and into the nylon braid, holding the hose more securely onto the barb during use. The only way to remove hoses from crimped fittings is to cut off its sides of the fitting and barb.

Don't forget that hose fittings require extra hose length — so account for fittings when measuring and cutting hoses.

Aggressive Crimp Fittings

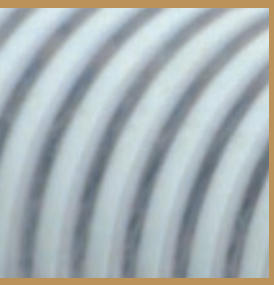
In the photo below, the crimp fitting on the right is more aggressive than the other. More aggressive fittings "bite" into the hose cover and hold the hose in place. Consider using more aggressive fittings in high-pressure applications.



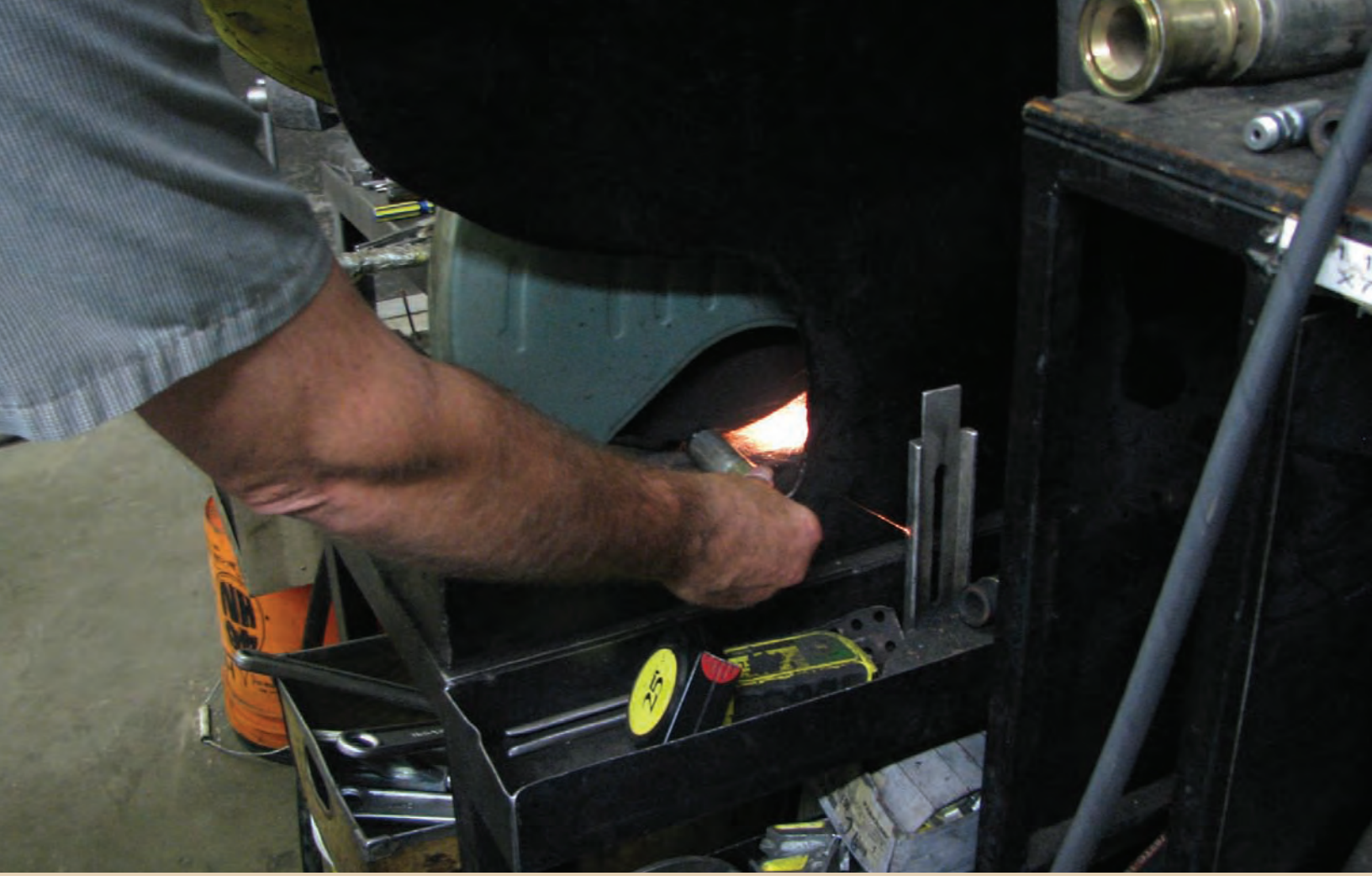
13. What Will the Hose **Cost**?

It's very likely you will have a good, better, and best option when buying a hose. It makes sense for you to invest in your most critical applications.

When weighing cost and quality, consider how much it will cost to clean up any spill, as well as the effects such spills would have on people and the environment. Spending a little extra money on better hoses, clamps, and fittings can be a good investment — cheap insurance against potential catastrophes. In some cases (like filling nurse tanks with water), buying a top-of-the-line product might not be worth the investment when a less expensive hose will work well.



Cut and Install Hoses Accurately



Cutting hoses requires the right tools.
Don't forget that hose fittings require extra length — so account for fittings when measuring.

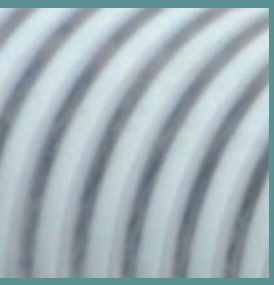
When hose lengths have to be exact, then the old carpenter's saying applies: "Measure twice, cut once."

Remember that under pressure a hose may increase its length by about 2 percent, so adding some slack might be beneficial. Take care to cut hoses straight across and provide enough length to fit over fittings completely with room for clamps. If you cut hoses at an angle, you may not be able to make use of the full shanks on the fittings.

When cutting an EPDM suction hose, you may need to cut a helix or double wire several different times as you slice through the hose. Hydraulic hoses may have braided steel that will make cutting them rather difficult — but not impossible with the proper tools.

After cutting any hose, flush it with water or air to remove any rubber or metal debris. Flushing will prevent debris from getting into the fluid system.

A fairly common practice is to heat up rubber hoses to soften them up so they will fit easier over a fitting. You should avoid this because the heat may damage the hose. A better option would be to use a non-petroleum lubricant (soap) to help the hose fit over the fitting. For PVC hoses, a common practice that works is to put the hose in heated ethylene glycol for two to three seconds before inserting the fitting into the hose. When the PVC cools it will form snuggly around the fitting.



Store Hoses Properly

Environmental factors can damage hoses. Hoses on equipment stored indoors (away from sun, heat, rain, ice, and snow) should last longer than hoses on equipment stored outdoors. That's why some companies remove hoses from outdoor equipment and store them inside.

In any case, inspect hoses during early spring or late fall when equipment has been idled or stored for a long time.

If you store hoses indoors, consider the following:

- Keep temperatures between 35°F and 80°F
- Rinse and dry hoses before storing them
- Hang hoses where they can maintain their integrity and shape without kinking
- Keep hoses in a dark area
- Keep hoses away from heat sources
- Keep humidity levels from becoming too low or too high
- Do not store hoses under fluorescent lights
- Make sure the top layer of hoses does not distort hoses stored below them
- Keep hoses away from oil and grease

Do not store hoses outdoors. Exposing hoses to the elements can damage them.

The hoses shown here are stored indoors, but hanging them like this may stretch them — the outside covers could come loose from the inside cores.

An example of storing a hose on its reel. Extreme temperature and humidity fluctuations might reduce the life of the hose.

Inspect and Replace Hoses Regularly

No manufacturer or distributor can tell you exactly how long a hose will last before it needs to be replaced.

What is certain is that hoses begin wearing out as soon as they are put to use, so they are guaranteed to fail at some future time. The million-dollar question is, "How long will the hose last?" The answer is: it all depends.

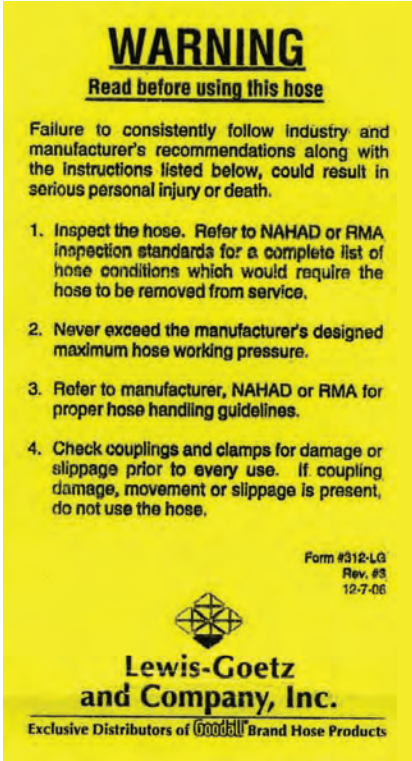
Compare replacing hoses with replacing truck tires. Obviously, a tire's life depends on the quality of the tire, number of miles driven, frequency of tire rotation, how well pressure was maintained, and how much weight it carried. These, and many other, variables make predicting exactly how long a tire will last almost impossible. The only way to know for sure is to visually inspect tires for wear.

Evaluating hoses involves similar considerations.

Prevent Hose 'Basketing'

When stainless steel braided anhydrous ammonia hoses balloon or mushroom out behind the coupling, it is called "basketing"(left). This occurs when anhydrous ammonia is left in the line, heats up in the sun, and expands. By design, manufacturers allow hoses to expand behind couplings so the hoses don't burst. Prevent basketing by completely emptying hoses after each use.

Some manufacturers evenly space pinpricks on hoses to help prevent gas buildup.



WARNING

Read before using this hose

Failure to consistently follow industry and manufacturer's recommendations along with the instructions listed below, could result in serious personal injury or death.

1. Inspect the hose. Refer to NAHAD or RMA inspection standards for a complete list of hose conditions which would require the hose to be removed from service.
2. Never exceed the manufacturer's designed maximum hose working pressure.
3. Refer to manufacturer, NAHAD or RMA for proper hose handling guidelines.
4. Check couplings and clamps for damage or slippage prior to every use. If coupling damage, movement or slippage is present, do not use the hose.

Form #312-LG
Rev. #3
12-7-06

Lewis-Goetz and Company, Inc.

Exclusive Distributors of Goodall Brand Hose Products

Hose manufacturers provide important information with their hoses. Read this information to prevent injuries and avoid environmental contamination.

Daily Inspections

Quickly inspect your equipment before starting any application. These inspections may uncover problems that can easily be addressed and save valuable time.

Walk around the unit and look for leaks. Start the unit and check for problems. Look at known wear points such as bend/flex areas, nozzles/bodies, and connections.

Off-Season Inspections

In addition to daily inspections, take time to thoroughly inspect your equipment during the off-season. Over time, the inside layers of hoses can disintegrate, allowing hose pieces to be sucked into the pump and throughout the machinery. Remove and examine hoses before each season. Hoses can look good from the outside, but the insides may have deteriorated from being under high pressure or a constant vacuum, or from using incompatible products.

Use a flashlight to help determine whether the inside is rough rather than smooth, and if the hose is partially collapsed. The 13 questions discussed earlier should help you keep hoses from failing due to exceeding their manufacturing design specifications.

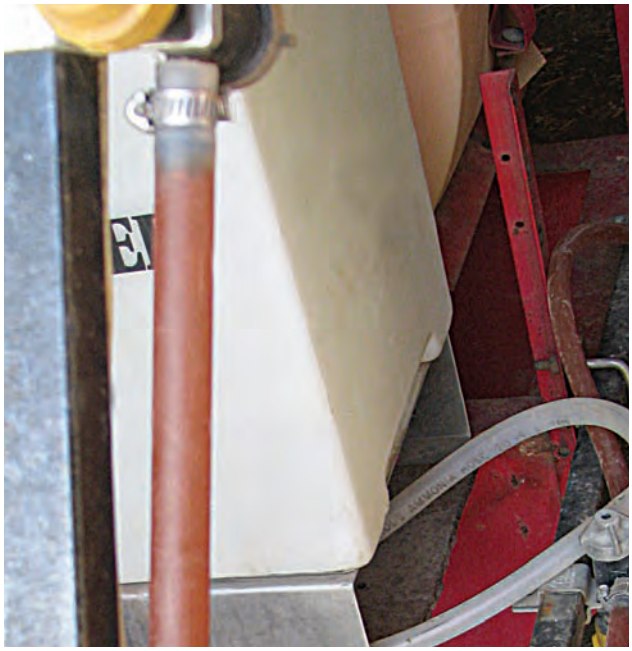
There are two primary reasons why hoses fail.

First, they fail from the inside, out when used outside design specifications. For example, using a hose that has a working pressure rating of 40 psi in an application that generates 60 psi will cause the hose to degrade quickly from the inside, out. Or using a hose with incompatible chemicals can cause it to fail from the inside, out.

Repair Hoses with Caution

Damaged hoses can be cut and reused. But be careful that the part you reuse is not worn. Spliced hoses and fittings may reduce flow if you use a fitting to make the splice. In general, we recommend replacing hoses instead of repairing them in any application that uses pesticides, is under high pressure, is flammable, or uses anhydrous ammonia.

Hoses can wear from the inside, out. Proper hose inspection includes hose interiors and exteriors. If the tube cover separates from the inner hose, it is time to replace the hose.



When clear hoses turn color, be safe and replace them.

Second, hoses fail from the outside, in. How long a hose will last depends on its quality, what it is used for, and if it remains outdoors year round. For instance, a hose that remains straight will last longer than one that has been folded and unfolded, kinked and unkinked. A discharge hose continually dragged on gravel or pavement without a plastic cover will break down quicker than one protected by a plastic coil or covering.

These external factors demonstrate why visual and thorough inspections are so important. As discussed earlier, the number of years of useful life depends on what reinforcement materials were used on the hose cover.

Remember, you should always follow manufacturer recommendations for replacing hoses. For example, manufacturers suggest when to replace anhydrous ammonia hoses. Always follow such suggestions.

As a rule of thumb, replace clear and inexpensive PVC tubing (sight gauges on tanks) each year. Replace EVA hoses within two years. These are inexpensive hoses that do not wear well in sunlight, heat, and cold.

Other hoses require frequent inspections to look for defects, cracking, or corrosion. Hoses need to look as close to new as possible. Many people put some type of protection around hoses to protect them from to protect them from rubbing against metal. Take these wraps off and inspect behind them to see if hoses have any abnormal wear out of sight.

If you have to stare at a hose and ask whether it needs replacing, change it. If you are trying to find reasons why you ought to keep a hose, replace it.

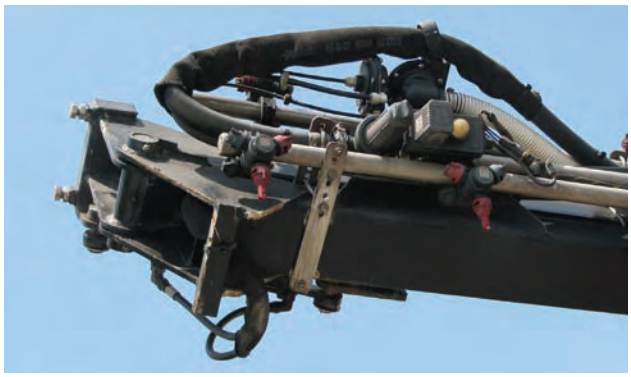
When inspecting hoses, look for these defects and replace any that may have one or more of them:

- Hoses that are stretched, caught, or pulled as equipment is folded and unfolded
- Cuts and scrapes
- Nylon or steel braiding can be seen through the rubber
- Kinked hoses where the wire braid is permanently pinched
- Scuffed and rubbed areas
- Burn spots on hoses near a muffler or engine
- Any permanent deformations on the hose
- Clear tubing that has turned cloudy and discolored
- Blisters and bubbles
- Soft spots where oil and grease have weakened the hose's integrity
- Dry rot of rubber or cracking of plastic caused by sunlight
- Hose ends that bulge from chemical deterioration
- Clamps that have moved
- Clamps that are collapsing the hose
- Loose clamps should be retightened or replaced if unable to be refastened
- Rusted or broken clamps
- Worn clamp housing, screw, or band
- Fittings with undue strain, seepage around them, chaffed, or abraded

This hose failed where it kinked behind the fitting.

This hose failed where it was subject to continuous abrasion.

Kinking can permanently pinch the wire braid in hoses.

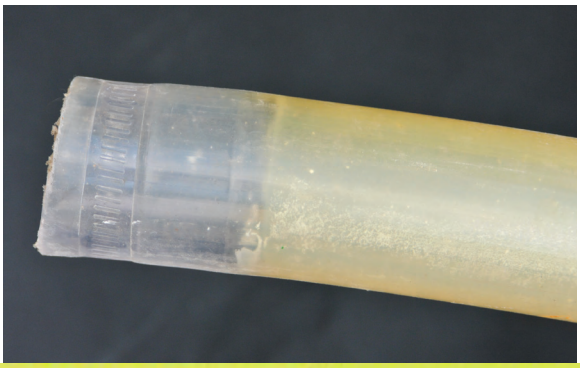


Improperly installed hoses can kink and fail.

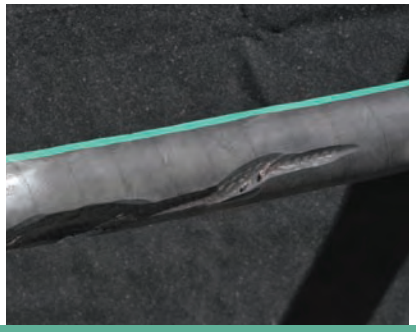
Kinked hoses can restrict the proper flow of product and shorten the working life of hoses.

When hoses are abraded like these, their pressure ratings fall.

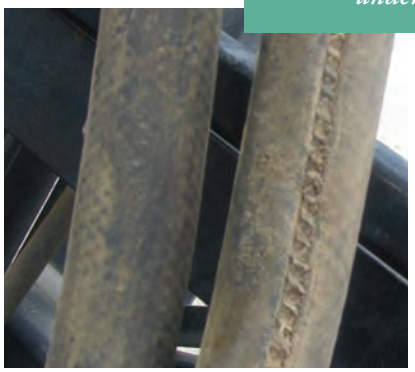
This hose has blisters and bubbles.

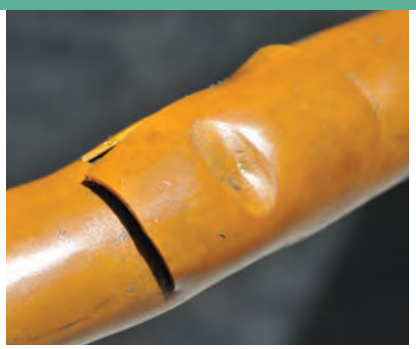


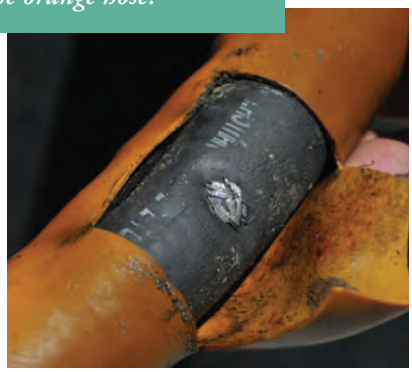
When clear tubing is discolored, the safest approach is to replace it.



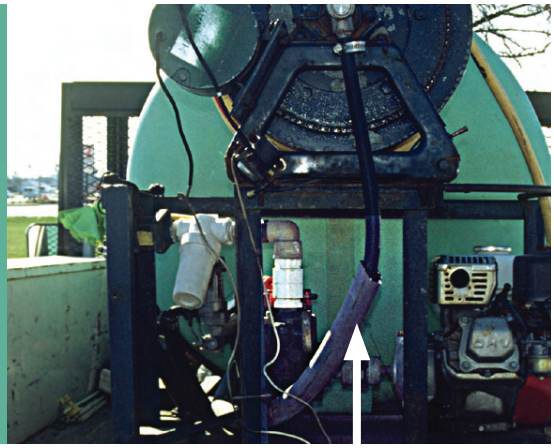
These photos show hoses worn from rubbing. Even covers might not protect underlying hose layers as shown in the photo of the orange hose.

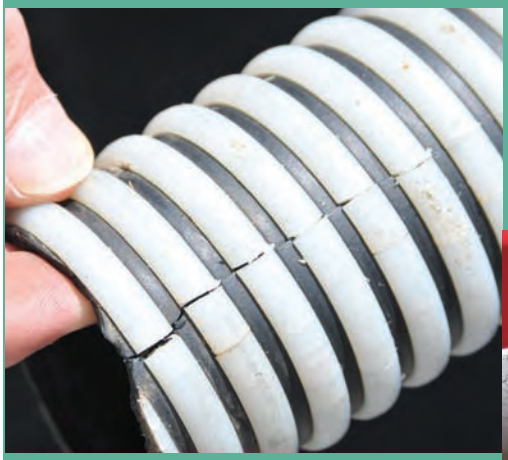




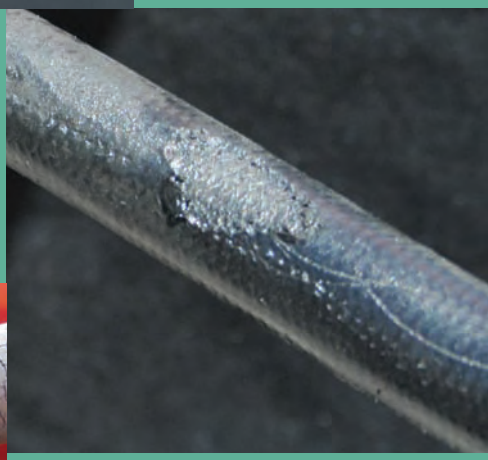


Another hose helps shield the pressure-carrying hose from the heat of the engine.



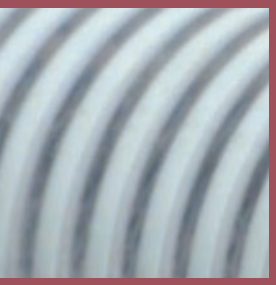


Sunlight can cause dry rot of rubber or cracking of plastic.



Watch out for:

- Hose ends that bulge from chemical deterioration
- Clamps that have moved
- Clamps that collapse hoses
- Clamps that are loose, rusted, or broken
- Clamps with worn housings, screws, or bands
- Fittings with undue strain, that have seepage around them, or that are chafed or abraded



Take Special Care with Hose Reels

Most commercial operations roll their hoses on reels. Commercial operators can use the hoses that apply pesticides nearly year round. To help prevent spills in populated areas, there are a few tips specifically for hoses used on reels:

- Select hoses with burst strengths no less than double the pump's maximum pressure.
- Replace all hoses (regardless of use) at least every three years.
- Each year, unroll every hose from the reel, disconnect it from the reel, and reverse the hose. If you have reusable couplers, cut off about two feet of hose from each end. Hoses experience the most wear at the shut-off valve. Reversing and trimming hoses helps avoid hose memory problems.
- Install a hose guide on the reel.
- Spray and wipe off a little lubricating oil on the hose during reeling or unreeling. This keeps the hose clean and helps it roll neatly on the reel.
- Lubricate the inside and outside hose covers with hand soap to reduce the possibility of hose barbs and couplers twisting or tearing and causing bubbles in the outer cover.
- Do not over tighten couplers.

Watch Your Hoses

Being careful where you run your hoses is important for extending their life and being safe.

Running hoses over sidewalks or other high-traffic areas can damage the hoses or injure people who might trip over them.

Dispose of and Recycle Hoses Properly

When handling chemical hoses, always wear the personal protective equipment required by chemical labels. Before removing hoses, make sure they are completely purged. And when replacing any hose, make sure to save any liquid it contains — plan ahead to catch the liquid so it does not spill in the shop or on the ground.

When you dispose of hoses, there are a few simple steps you always ought to follow.

1. Drain

Allow hoses to drain overnight.

2. Rinse

Rinse all pesticide hoses and reuse the water as part of a legal application.

3. Bundle

Tie up hoses together so they will take less space in the trash container.

4. Recycle

Check with local recyclers or your hose suppliers to see if they recycle rubber hoses.

5. Dispose

Check to see if your waste hauler has any specific disposal requirements for rubber products before discarding large quantities of hoses in the trash. If allowed, place all hoses in bags and discard in trash.

Conclusion

Inexpensive hoses connect the more expensive components of application equipment into a working system. Operators often overlook hoses even though the consequences of failures are serious.

No one wants to experience the results of a hose failure: down time, wasted product, lost revenue, environmental damage, and human injury. Purchase and inspect hoses, fittings, and clamps with the same care you use for sensors, nozzles, and pumps.

It is important to have a basic understanding of hoses so you can purchase the right hoses for specific applications. Not every salesperson is going to have the knowledge or the experience to offer the best advice on which hose is best for your specific application. But by understanding what you need from the start, and by performing routine inspections, you can maximum hose life, and minimize failures.

Select the right hose for the job to keep the operation moving forward, protect people from injuries, and prevent contamination.

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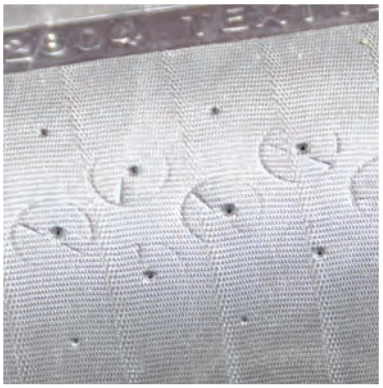

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