

# Care & Maintenance Of Industrial Hoses

## Agenda

- ✓ Goal
- ✓ Who sets the “standards”
- ✓ Products supplied
- ✓ Common hose installation mistakes
- ✓ Conditions that warrant removing hoses from service
- ✓ How long should hose last?
- ✓ How can service life be improved
- ✓ Actions to increase safety
- ✓ Who is ultimately responsible?

## **Goal of Proper Care & Maintenance**

- **Maximize Safety**
- **Prevent Production Disruptions**
- **Improve Service Life  
(i.e. minimize cost)**

## Who sets the “standards:

- NAHAD (National Association of Hose and Accessories Dealers)
- ARPM (Assoc. for Rubber Products Manufacturers)
- RMA (Rubber Manufacturers Assoc.)

# Chemical:

- Kemflex (UHMWPE tube)
- Super Kemflex (UHMWPE / Synthetic Helix, “Rebound” capability)

# Steam:

- **Super Inferno (Chlorobutyl tube, 20:1 SF)**
- **Dante (Chlorobutyl tube, exceeds 10:1 SF)**
- **Inferno (Chlorobutyl tube, 10:1 SF)**
- **Red & Black Thermoflex (EPDM tube, 10:1 SF)**



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# Air:

- Hardrok
- Air King
- Defender

## Conditions that warrant removing hoses from service:

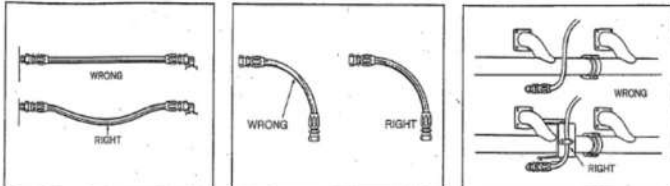
- Leaking
- Cover cuts exposing reinforcement
- Used in service not designed for
- Excessive bending behind coupling
- Broken or missing clamps or bolts
- Bulge behind the coupling.
- Coupling slippage
- Cocked couplings.
- Loose covers, bulges or ballooning, soft spots, cuts,



## Common Routing Issues

**SERVICE LIFE ROUTING/INSTALLATION**

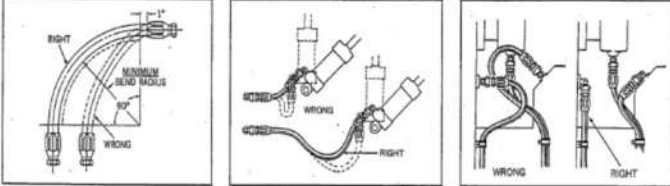
**Hose routing and installation**



Under pressure, a hose may change in length. Always provide some slack in the hose to allow for this shortening or elongation. (However, excessive slack in hose lines may cause poor appearance.)

If a hose is installed with a twist in it, operating pressures tend to force it straight. This can loosen the fitting nut. Twisting can cause reinforcement separation and the hose could burst at the point of strain.

When hose lines pass near an exhaust manifold or other heat source, they should be insulated by a heat resistant boot, firesleeve or a metal baffle. In any application, brackets and clamps keep hoses in place and reduce abrasion. For installations where abrasion to hose cover cannot be prevented with the use of clamps or brackets, a steel protective coil or abrasion resistant sleeve should be placed over the hose.



At bends, provide sufficient hose so that it does not have a bend radius less than its recommended minimum bend radius. Too tight a bend may kink the hose and restrict or stop the fluid flow. In many cases the proper use of adapters and hose fittings can eliminate tight bends or kinks.

In applications where there is considerable vibration or flexing, allow additional hose length. The metal hose fittings, of course, are not flexible, and proper installation protects metal parts from undue stress, and avoids kinks in the hose.

When 90° adapters were used, this assembly became neater-looking and easier to inspect and maintain. It uses less hose, too!



Hose rubbing on another hose



## Conditions that warrant removing hoses from service:

- Kinking behind the fitting or in the hose body
  - (see what happens when left in service)



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- Kinking behind the fitting or in the hose body
  - (see what happens when left in service)



## Conditions that warrant removing hoses from service:

- Kinking behind the fitting or in the hose body



- **Kinking behind the fitting or in the hose body can cause tube separation which will eventually result in a leak.**

Tube buckled  
from kinking

**Inspect the tube / hose bore!!!**



Inside end of  
The coupling



## Conditions that warrant removing hoses from service:

- Cover damage exposing the reinforcement



- **Hose tubes can be degraded from product transferred and service conditions. Continued use will result in leaks or worse.**

Inspect the tube / hose bore!!



Goodall's Super Inferno, 250 psi steam hose  
after 1000 hrs. of steam testing



Competitor's 250 psi  
steam hose after 1000  
hrs. of steam testing



### Cover cuts exposing the reinforcement

- Cuts and tears on the cover of any hose allow moisture to seep in to the reinforcement areas causing degradation and ultimately failure of the hose



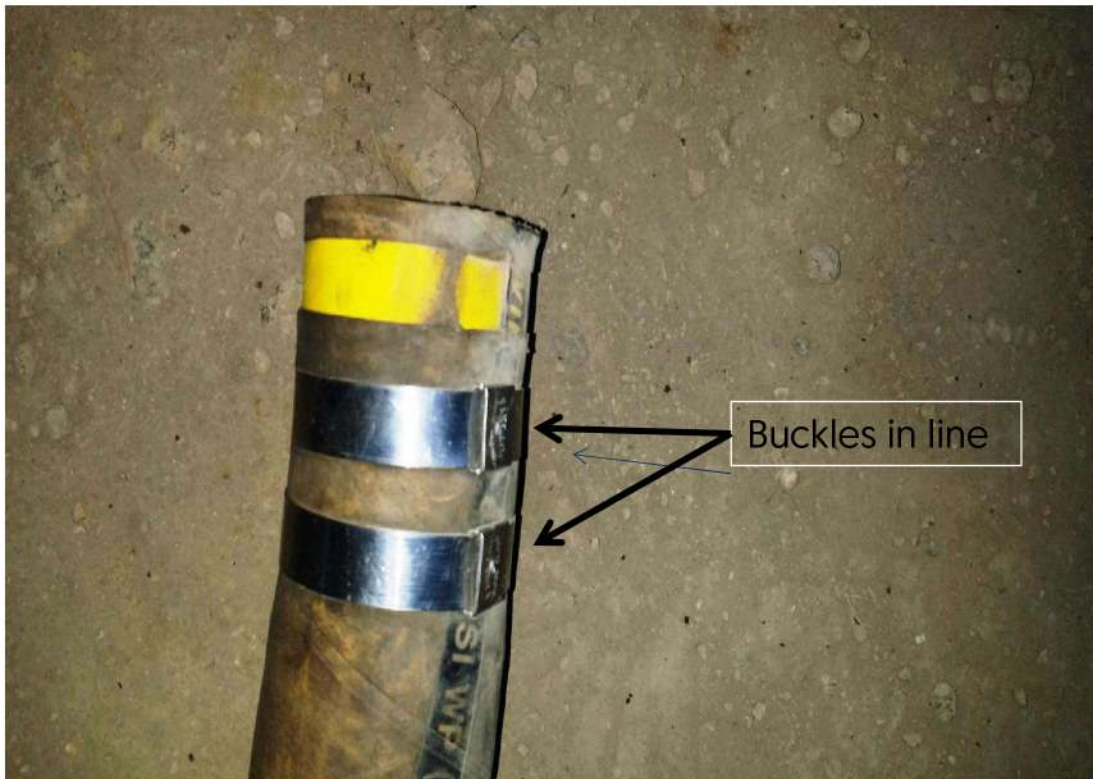
■ Coupling slippage



■ Improper Coupling Attachment



- Improper Coupling Attachment





## Conditions that warrant removing hoses from service:

- Using hose for inappropriate service (i.e. use steam hose as a hydrocarbon drain hose)

# How long should hose last?:

The lifespan of a hose is dictated by the care it receives during storage, how often it is used, service conditions and its proper or improper use.



# How long should hose last?:

**The short answer is:**

**The lifespan of an assembly cannot be accurately predicted because of each user's variability of conditions to which it is exposed.**

## **Actions to increase safety:**

- **Prior To Each Use  
Inspect (by trained  
personnel)**
- **Periodic testing**

## How to increase service life?:

- Use for intended service
- Use within design parameters (i.e. pressure, temp. & bend radius)
- Avoid excessive bending behind the coupling
  - Vertical outlets
  - Avoid kinks & cuts



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## Metal Hose

- **The age of metal hose can be difficult to determine.** Unless Stainless Steel tags are affixed to a metal hose assembly, the age of a metal hose is usually a best guess. Tags can be used to identify composition of the tube and ends, pressure and temperature allowances and specific unit designations.
- **Do the basic principals of industrial hose apply equally to metal hose?** Although the pressure and temperature allowances may differ greatly, the same manner of specifying what the appropriate hose to use in a given application is virtually identical.
- **What happens when a bend radius is exceeded on metal hose?** Usually you will see the metal braid pulling out of the ferrule, bunched or bubbled near the ferrule or discoloration on the braid at the ferrule.
- **Manufacturing differences in metal hose: hydraulic vs. mechanically formed.** Mechanical formation of the corrugated tube can create thin spots on the peaks and valleys of the tube itself, thus promoting a shorter life-span. Hydraulically formed tubes avoid this problem by the uniform formation of the corrugations- in that the wall thickness does not vary upon manufacture.
- **62% of the unserviceable hoses were 1% of your population.** Of the red tagged hoses at Shell PSR, 62% were metal hose, although they made up less than 1% of all industrial hose on site.
- **Most common installation mistakes:** Routing was by far the biggest problem area. Following that closely was improper length and fitting selections.
- **Cost of Metal Hose:** Pound per pound, metal hose is inherently more expensive than rubber hose. However, with proper fittings and routing instructions, metal hose can have a life-span that far exceeds rubber hose. Metal hose is designed to absorb vibration, resist high temperatures, superior resistance to the elements and a variety of chemicals.



## Bend Radius

- **Age of hose:** Indeterminate. Metal tags are especially helpful in avoiding hoses that are too short, ends that are not functionally correct and can specify what temperatures and pressures are allowed.
- **Braid status:** This hose is the right length, but should have a 45 degree fitting. The 45 degree fitting will help to eliminate the "bunching" on the ID, and the tearing or extraction of the braid on the OD. Once the braid on the ferrule has pulled out enough, the fitting's ability to "hold" on to the hose will be greatly reduced.
- **S/S fittings vs. C/S:** Stainless ends are always more expensive than carbon steel, and will have superior resistance to chemicals. However, in this case, the assembly is hooked up to a steel pipe. Cost vs. benefit should always be taken in to consideration.



## Bend Radius

- **Age of hose:** Indeterminate. It looks old, and certainly worn out, but no one can tell for sure.
- **Fitting selection:** C/S pipe end; adding a 90 degree fitting i/o a straight end will alleviate the hard turn the hose is being forced to make.
- **Braid failure:** The braid is bunched on the ID and tearing on the OD. This hose is also too short. It is in imminent danger of failure. Note how the OD has flattened out a bit, thus constricting the flow of the product. There should be at least some slack in the hose so as to absorb a minor impact w/o tearing the hose out of the ferrule.





## Bend Radius

- **Ferrule cracking:** The ferrule is cracking- this is what holds the braid to the tube. Without it, the hose will fail.
- **Discoloration on braids:** The discoloration on the braid shows how far it has pulled out of the ferrule. Notice that the braid has begun to “bubble” at the ferrule.
- **Loose braid- does it affect pressure?** A loose braid is synonymous with no braid. A three inch hose with a single braid is rated at about 320 PSI @ 70 degrees F. A loose braid or no braid reduces the effective working pressure to about 14 PSI. As temperature increases, it is de-rated further.



## Horizontal Manifolds

- **Bend radius:** The steam hose at a 90 degree angle will have its life-span cut dramatically.
- **Nitrogen hose:** Top left; and is at a 90 degree angle.
- **Bands:** Single bands offer less resistance to leak paths.
- **Whip checks:** Whip-check installed correctly on the Nitrogen hose, none on the air hose.
- **Bend restrictors:** Completely ineffective on the steam hose. Pressure and temperature focused on an area the size of a nickel.



## Horizontal Manifolds

- **Manifold is at ankle level:** Putting a 90 degree fitting on this manifold will create more problems unless the discharge point on the manifold is raised up.
- **Whip-check:** No whip-check installed.
- **Tube and cover failure:** The bend radius of this air hose is being exceeded, thus contributing to its premature failure. Also of note, the use of Class "C" rated air/water hose has been discontinued. Class "B" rated hoses have replaced them- they have a Nitrile tube/cover offering substantially more resistance to oil in the air system and incidental contact in the refinery.



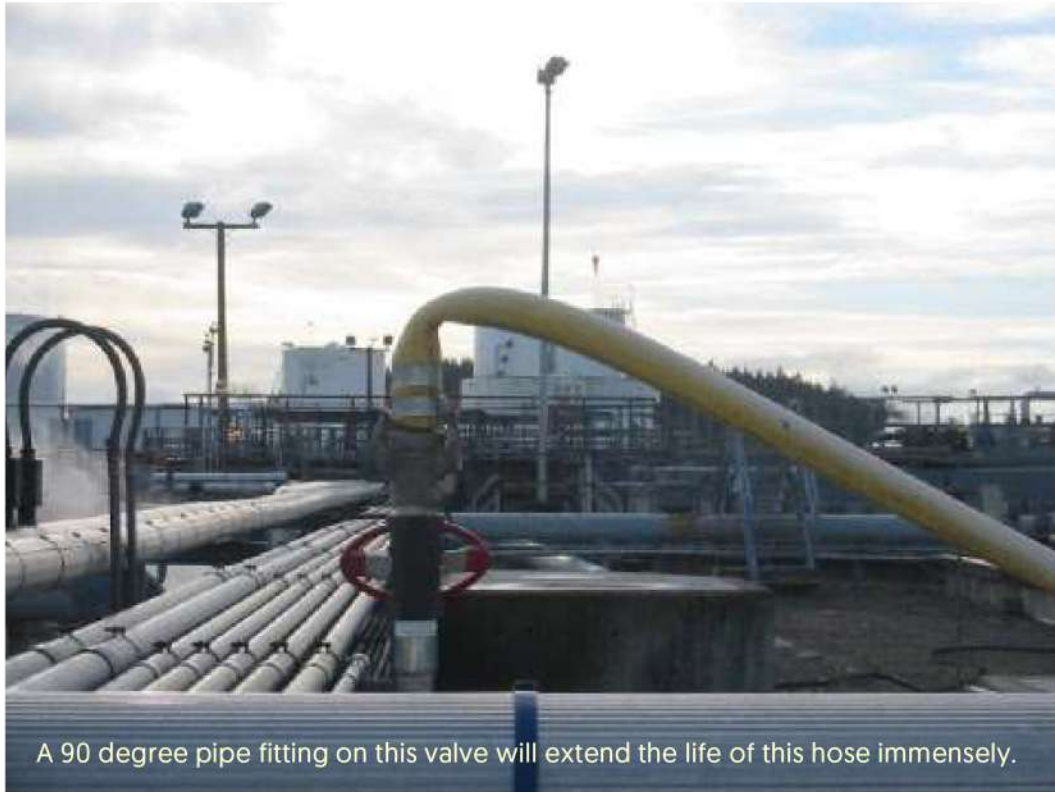


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A 90 degree pipe fitting on this valve will extend the life of this hose immensely.





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Bands applied with different tensions [note different squeeze on hose]



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Single bands can allow leak paths to form.





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Bands should be affixed uniformly if used. Not centered or otherwise out of alignment

Bands should be affixed uniformly if used.

## Bands and their placement

- Is uniformity important? **Always.** Note this assembly has 2 bands on one end, and one band on the other.
- How many bands? **Two bands will always offer more resistance to leak paths.**
- What creates a leak path? **Buckle alignment and/or single bands.**
- Punch-lock vs. mechanically folded type:  
**Punch lock bands have a single point of contact, where mechanically folded ones use the entire band for strength.**





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Aside from the fact that the bend radius is exceeded, rope or wire  
should never be used to secure a hose assembly in this fashion.

## Who Is Ultimately Responsible?:

Only the end user has:

- full knowledge of all service conditions to which the hose is exposed
- the opportunity to inspect the hose prior to each use
- and the capability to effectively perform proper care and maintenance in a timely manner.



# **Hose “Reclamation”: What is it?**

**It is the Periodic  
Inspection & Tested of  
Used Hose**