Step by Step Maintenance Guide for Mast Hose

Used in Over-the-Sheave Applications

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Mast Hose Maintenance Guide

For over-the-sheave applications

Greg Hayes

Article contributed Gregory J. Hayes, OEM Sales Manager for the Parflex Division Parker Hannifin

Mr. Hayes has worked with thermoplastic hose and tubing for more than 20 years. Today, his primary focus is helping customers solve application-specific problems where thermoplastic hose and tubing are used in pneumatic and hydraulic industrial and mobile applications. Mr. Hayes has undergraduate degrees in Engineering from Kent State and Youngstown State Universities as well as an MBA from Youngstown State University.

Introduction

Mast hoses are used in a variety of demanding heavy equipment applications associated with continual flexing over sheaves such as fork lifts, booms, aerial lifts, cranes and tree delimbers. Using equipment outdoors means the hoses must be able to withstand UV, high temperatures from the sun and extreme cold in northern climates. And when used in cold storage areas or flash freezers, where temperatures reach extremely cold levels, the hose takes on constant abuse. In all of these applications, the hose needs to be able to continuously flex without the risk of delamination.

If a hose fails, it not only results in costly downtime and maintenance, but it also creates a potentially hazardous situation for equipment operators and other workers in close proximity. While hose maintenance is often part of a scheduled preventative maintenance plan, operators need to also plan on regular visual inspections. These inspections don't take long and they could be the difference between an unexpected hose burst and an operator going home with injuries. Mast hoses are pressurized and the internal force can cause a devastating burst, sometimes without much warning. By visually inspecting the hose, you can often spot any indications of trouble in advance.

The Problem: Hose Failure

Causes and repercussions

Hoses play a vital role in the operation of equipment. Their proper function is critical to productivity. Equipment downtime associated with hoses results in substantial maintenance expenses through lost productivity and revenue. And if a compromised hose is left unattended or improperly fitted, it could result in serious injury.

Hoses are enclosed in a jacket that protects the internal structure and they are extremely vulnerable to external damage if the protective jacket is compromised. A crack in or a missing portion of the hose exposes the braid to the environment, chemicals, and abrasives that will degrade its integrity and drastically increase the probability of rupture.

Temperature, dirt, movement and contact with other working surfaces and materials being transported are some of the factors that can impact a hose's integrity.

The mast hose transfers liquids under high pressure and temperature. Sudden failure of a hose can expel hot hydraulic oil at a high rate of speed and distance. Anyone nearby, particularly at eye level with the damaged section, would be in danger of serious injury from burns or oil injection from a puncture wound. In addition, a hose that breaks free from one of its fittings may thrash about, potentially striking a worker and causing injury. Spilled oil is also responsible for many slip and fall accidents in the workplace.

The Occupational Safety and Health Administration (OSHA) records indicate a substantial history of injuries caused by hose failure. [1]Many hose failures could be avoided through routine inspection, eliminating injuries and lost productivity.

> *"Safety and downtime can be greatly affected by regular inspection. Many preventive maintenance programs alert users when these inspections should be performed."*
>
> **— Greg Hayes, OEM Sales Manager, Parker Hannifin**

[1]Hydraulic Hose Injuries www.osha.gov

Tips for proper hose inspection

The cases of industrial accidents associated with failed hoses are substantial. In most cases, they are preventable. Below are eight simple tips that can assure the safe use of hoses in material handling equipment.

1 Review the hose periodically

Consult your owner's manual for appropriate intervals based on equipment and usage. An inspection of the hose jacket, the outermost layer of the structure, is the first step. Its main job is to protect the structural member of the system and the braided reinforcement. If the hose jacket is damaged, there is an increased chance of damage to the less rugged inner layers.

2 Inspect the entire length of the hose

If sections of jacket are missing, discard and replace the hoses. Missing jacket portions drastically increase the probability of rupture. Never use your hand to "feel" for a leak as that can lead to an injection injury. A mirror can be used for viewing or a piece of paper or cardboard can be used in areas where vision is impaired.

3 Check for cracks perpendicular to the hose, specifically on the outside bend radius

This could indicate that the hose being used does not have a low enough cold temperature rating. Consult your hose supplier for a lower temperature product. If the hose cracks, it exposes the braid to the environment, chemicals and abrasives that harm its integrity. If a hose ruptures, it can spray hot hydraulic oil in any direction at a high velocity, exposing the operator to severe injury from burns or from oil injection.

4 Look for cuts and gouges on the jacket of the hose

Cuts that are parallel with the hose may indicate the hose is coming into contact with the material being transported. Care should be taken to load the material in a manner that limits contact with the hose. Replace the hose if the reinforcement is exposed or damaged.

5 Check the hose tension

Mast hoses are often shipped under tension to prevent damage in transfer. Care should be taken to reduce tension in proper manner to eliminate excessive stress on the hose. Adjust the tension per the owner's manual.

6 Inspect the sides of the hoses that come in contact with the sheaves

If the outside diameter of the hose is too large, the jacket will show excessive wear. Consult your hose supplier for a lower profile hose.

7 Search for broken wires when using rubber hoses

Some rubber hoses are wire-reinforced. Look for broken wires protruding through the jacket by running a cloth over the hose and feeling as you go. DO NOT use your hand (wires are sharp). If wires are broken, the cloth will snag on the wire and you will need to replace the entire hose because the jacket and strength members have both been compromised. If sections of the jacket are missing, discard and replace the hose. Missing jacket portions drastically increase the probability of rupture. As mentioned before, never use your hand (even with a glove) to "feel" for a leak as that can lead to an injection injury. A mirror can be used for viewing or, in areas where vision is impaired, a piece of paper or cardboard is run down the back of the hose to check for oil.

The Solution

Other considerations and hose replacement

8 Check end connections for leaks

Fluid can leak from a loose or damaged fitting on the end of the hose. Inspect the areas where the fittings attach to the hose for visible leaks and/or an ill-fitted interface between hose and fitting. If either are evident you can attempt to disassemble and reassemble the hose. However, it may be the best practice, fastest and most effective, to replace the hose entirely. If there is fluid coming from the shell end of the fitting, discard the hoses and replace them.

Other considerations

In addition to regular inspection for damage, another factor to consider to ensure superior hose performance is the material of the mast hose. In the past, the majority of hoses were made from rubber but today, thermoplastic hose out performs conventional rubber products for several reasons:

Some hoses cannot withstand the rigors of an over the sheave applications. The hose will delaminate, leading to jacket failure and wire fatigue. With Parker thermoplastic hoses, the layers are thermally attached during the manufacturing process, creating a hose and jacket that are seamless.

- Standard rubber will crack from low temperature embrittlement and does not work well in freezers and cold weather. Thermoplastics are designed to handle temperatures as low as -70ºF.

- Thermoplastic hose can have a fiber reinforcement that is bonded between the core, reinforcement and cover to handle constant flexing for superior fatigue resistance.

Hose replacement

If you discovered during inspection that a mast hose needs to be replaced, one of the most important factors to consider is the sheave width. This is especially critical if the OEM installed a thermoplastic hose, because rubber hoses have much larger outside diameters (O.D.). A larger O.D. (rubber or thermoplastic) causes additional wear on the hose as it passes through the sheave, shortening the hose life. When mast hose is pressurized, the internal force from the pressure causes it to change in length and diameter. A hose that fits snugly in the sheave at rest becomes very tight during operation and may ride out of the sheave, bow out or possibly come in contact with the machine or environment. Also, a tight sheave fit causes added tension on the system and increases wear directly on the hose and sheave.

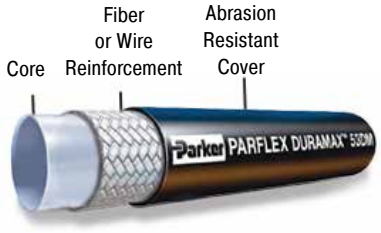
Most material handling mast manufacturers install mast hose at a tension measured in “stretch of the hose.” The stretch specified can vary greatly depending on whether the OEM installed thermoplastic or rubber.

Recommendations and Conclusion

Recommendations

The Parflex division of Parker Hannifin Corporation manufactures thermoplastic hose built with a high level of contact strength between the layers of core, braid and jacket. This contact is generated because thermoplastic materials can be re-melted during the production process allowing for both a chemical and mechanical bond. This unique bonding process creates projections on the outside of the core that extend up into the braid, while the jacket material is forced down into the braid from the outside.

Parker Parflex over-the-sheave hoses are tested under extreme conditions to withstand temperatures as low as -70°F and show no fatigue after more than 250,000 flexing cycles. The strength member is offered in high tensile fibers or high tensile brass plated wire, and the jacket is specially formulated to offer a high level of UV protection for optimal weather resilience and low coefficient of friction to improve wear. All Parker mast hoses for over-the-sheave applications meet various SAE specifications and pressure ratings between 0 to 5,000 psi.



Conclusion

Hoses do their work in relative obscurity, often being overlooked. Proper hose selection, preventive maintenance and regular inspection will extend hose life, keep equipment operational, reduce maintenance costs, and ensure a safe work environment.

For more information about Parker over-the-sheave hoses, please visit parker.com/parflex or call 330-296-2871.

> *"Material handling customers have reported to us that their number one failure mode is hoses getting cut during operation by shifting loads that fall against the hoses. That is why we recommend a high durometer material like urethane for these applications."*
>
> **— Greg Hayes, OEM Sales Manager, Parker Hannifin**

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