



Fig. 1: Fabric reinforcement exposed, inner wear liner missing

Shotcrete Hoses

SELECTION, INSPECTION, AND SAFE INSTALLATION

By Michael Cetnar

Hoses play a crucial role in efficient shotcrete placement for any job site. The operator and jobsite personnel are either near or in direct contact with many hoses, and as it is difficult to track hose wear using yardage figures, it's very important to inspect every hose every time it is used.

Three key considerations should be kept in mind when working with shotcrete hoses: Select the proper hose for the application, conduct a thorough inspection before use, and adhere to safe jobsite practices while using them.

SELECTING THE RIGHT HOSE

Using the wrong hose for the job can have significant safety implications and negative consequences.

- **Certified Product:** The Concrete Pump Manufacturers Association (CPMA) performs independent audits of products and manufacturers to confirm that all certified hoses and pipes meet safety standards. Start with a CPMA-certified product that is designed specifically for the severe wear and rugged usage of shotcrete placement.
- **Length:** Flexible hose can be up to four times harder to pump concrete through than steel pipe due to differences in friction, which means the pump must work four times harder and consume significantly more fuel. The pressure required to pump will drastically increase, taxing every component in the system and

creating the potential for a blowout if any component is unfit to withstand the load. The higher internal friction can also increase the risk of having the concrete mixture plug in the line. In all laydown applications, use the minimum length of hose necessary to reach the point of placement.

- **Site Requirements:** The need for hose flexibility and radius of curvature varies depending on the application. Laydown lines may need to avoid obstacles along the path or be easily positioned when relocating on top of rebar sleds. All premium hoses are manufactured with an internal liner, layers of reinforcement (typically fabric or steel cord), and a tough weather- and wear-resistant outer wrap. Your manufacturer should be able to match the hose design, materials, and fabrication to meet your application requirements.
- **Working Pressures:** The compatibility of the hose with the pump and concrete mixture design is essential. The smaller the hose diameter, the higher the pumping pressure required to pump a given mixture at the same volume output rate. The aggregate in the concrete must also not be larger than 1/3 of the hose's inside diameter. For the best results, size the system to the largest diameter that is practical for the application. Always use a hose rated for working pressures that exceed the pump's rated output.



Fig. 2: Hose body worn through, exposing the hose beneath it; can be seen and felt as a bumpy wear pattern by using your fingers

INSPECTION OF HOSES

Shotcrete hoses are constantly subjected to wear, both internally from the concrete being pumped and externally from the punishing construction environment. Because they are made from rubber (which is more easily damaged than steel pipes), it is essential to regularly inspect them for damage that could result in decreased efficiency, costly downtime, and unsafe conditions leading to potential accidents.

A thorough pre-pumping inspection is the first step in guaranteeing that everything runs smoothly. The following guidelines outline the steps for conducting an effective inspection.

OUTSIDE COVER

Examine the outside cover for bulges, folds or kinks, and soft spots. These defects may indicate that the inside reinforcement layer could be broken or displaced due to overinflation, deterioration, or side-loading trauma (such as using a heavy sledgehammer to clear a plug). The result is a weak point that will not perform as expected during operations. These hoses should be replaced.

Check for cracks, tears, abrasions, missing material, or exposure of the inner reinforcement layer. Over time, this may cause deterioration of the reinforcement layers, resulting in full-blown ruptures under pumping pressures, and should be monitored for near-term replacement.

INNER LINER

Examine the inner liner for localized wear areas that indicate wall thinning, paying special attention to the first twelve inches adjacent to the metal hose body.

Use a flashlight to examine the entire length for signs of exposed reinforcement (sometimes referred to as bird nesting or spider webbing), loose plies, or cuts and gouges. When working with a steel-reinforced hose, avoid reaching into a damaged hose to prevent cuts. Exposed materials indicate a worn patch that is weakened and cannot withstand full pumping pressures. This can also interfere with the smooth flow of concrete.

Excessive, dried concrete residue inside the hose can restrict flow and increase pumping pressures. Also be aware of any discoloration or corrosion, particularly at the hose ends, which can point to chemical degradation or exposure to harsh environments.

METAL ENDS (HOSE BODY)

Examine the inlet face of the metal hose body for the wear known as bell-mouthing. Excessive material loss is detrimental to its functionality. Periodically measure the inside opening diameter with a bore gauge and verify with the manufacturer to determine what level of wear is acceptable.

Examine the inside of the hose body, particularly under the barb area, for signs of wear. This can be seen and felt as a bumpy wear pattern using your fingers. This indicates the hose body has worn completely out, and the hose assembly

must be retired immediately.

Verify that the hose is visible through the ferrule inspection hole. If it is not, the hose may have started to slip out of the hose body assembly.

ADDITIONAL SAFETY CONSIDERATIONS

- Hoses can get soft and flimsy over time. A flimsy hose can kink more easily, and more care must be taken to prevent a kickback.
- Repetitive pressure pulses can cause a hose to lose its pressure-handling capability over time. Even though a hose passes visual inspection, its age or usage may hurt its ability to handle pressure (especially fabric-reinforced hoses).
- Hoses that have experienced heavy sun damage can dry out, causing the hose to lose flexibility and increasing the effort required by crew members in the field.
- It's good practice to document a complete inventory of your hoses every six months. Thorough inspections should be completed and manufactured dates documented; remove any damaged or old hoses from service. Consult your manufacturer for information on production dates and the expected shelf life of your specific hose model.

INSPECTION OF COUPLINGS & GASKETS

The metal ends of the rubber hose and the connecting components are crucial to its safe and effective operation. Proper inspection of all connections is necessary.

- Examine the surface of the hose body assembly (where the rubber gasket attaches) for damage such as nicks, dents, and abrasions. Ensure the area is free of concrete buildup, which may indicate prior gasket leakage or inadequate sealing action by the coupling.
- Ensure that the mating parts are correctly aligned. Poorly connected hose ends or misaligned couplings can cause serious accidents or leaks.
- Ensure that couplings are securely fastened and free from damage or wear. The coupling must make a tight and flush fit to avoid leaks or detachment during pumping. Remember to use safety pins in all snap couplings.
- Before making every connection, inspect the gasket, clean out the grout, and ensure the gasket can seal the joint.

HOSE JOBSITE SAFETY

The best shotcrete hoses in the world should be matched with the best job-site operational practices.

- Never kink the hose to stop the flow of concrete. Kinks cause blockages and pressure spikes that can violently and uncontrollably straighten out under pressure. Kinking also damages the reinforcement elements of the hose.



Fig. 3: Bulge in outer hose jacket exposing a 'soft spot' in the hose

- Do not attempt to resolve a hose kink by crushing the sides; this will damage the reinforcing materials and lead to a faster failure.
- Only use hoses with a working pressure rating that meets or exceeds the maximum pressure rating of the concrete pump with which it is being used.
- Extreme care must be taken before opening any coupling when dealing with a plugged system.
- Never look into a hose that is plugged.
- Never sit on or stand on a hose while it is in operation.
- Never use a hose with frays, breaks, or exposed braiding/reinforcement on either the inside liner or outside shell.
- Only use compressed air to clean out a hose, exercising extreme care and confirming the ends of the hose are firmly tied down. Water cleanout is much preferred.
- Never drag a hose by pulling on the attached coupling.
- Never beat on a hose with a hammer or other blunt object. The impact risks damaging the built-in reinforcing material, potentially leading to premature failure.
- Always perform the internal and external visual inspections before every shoot, even if this is the second shoot of the day.

CONCLUSION

By following the above steps, proper care and regular inspection of your shotcrete hoses will provide a safer job site for you and your customers.



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