

Hose Selection and Safety in Concrete Pumping

By Andy Kultgen

There are many options for hoses to use for the concrete pumping portion of wet-process shotcrete application, and because of the high working pressures involved and the limited life span of all hoses, each member of the shotcrete team should be aware of the limitations of the hose they are working with and keep alert for the signs of impending failure.

Safe concrete pumping begins with hose selection to meet the job requirements. The American Concrete Pumping Association recommends using a hose no less than three times and preferably four times the diameter of the largest aggregate in your mixture. Knowing what pump you are using, and particularly the maximum pressure this pump is capable of producing, will dictate what type of hose you will need. Many pumps commonly used for shotcrete work can produce up to 1000 psi (7 MPa) of pressure on the concrete; however, there are pumps capable of exceeding 2000 psi (14 MPa) at the concrete piston face. Every hose should be labeled to indicate what the maximum working pressure is for that hose (Fig. 1). Most hoses used in shotcrete work are rated between 500 and 1300 psi (3.5 and 9.0 MPa). If your pump is capable of producing a greater concrete pressure than your hose is rated for, you must switch to a hose with a higher rating or a pump with a lower maximum pressure on the concrete. A plug in the hose or at the nozzle can result in a nearly instantaneous spike to the pressure limit at the pump, possibly resulting in a catastrophic failure of a hose. Ensuring the pump pressure will not exceed the pressure rating of the hose and couplings is of utmost importance to the safety of everyone working near the pump, hoses, and nozzle.

The rugged nature of the job site environment, including loading and unloading frequently and being dragged across gravel and exposed reinforcing bar, can quickly damage a hose, even with proper precautions. This tough working environment necessitates regular inspections to catch any impending failures before they happen. A great time to perform a visual inspection is when you

are laying out the hose at the beginning of a job, and there are three areas to check: the outer jacket, the liner, and the ends.

Any damage to the reinforcing plies (either wire or fabric) will severely reduce the ability of the hose to withstand pressure. The outer jacket of the hose is there to protect the reinforcing plies from the typical nicks, scrapes, and gouges experienced on the job site. When examining the cover, pay close attention to bulges, kinks, soft spots, cuts, or abraded areas, which may indicate broken or displaced reinforcement. If the hose cover has been damaged to the point where the reinforcing plies are visible, the hose must be either discarded or returned to the factory for the damaged area to be removed (Fig. 2).

Hoses with areas where the liner is excessively worn must be discarded. Typically, the first 1 to 2 ft (0.3 to 0.6 m) from the end of the hose is the highest wear area for the liner. However, smaller-diameter hoses are often difficult to inspect, even with a flashlight. In those applications, some external clues can predict heavy liner wear. Check



Fig. 1: All hoses should be labeled with maximum working pressure. This hose is labeled for a working pressure of 1250 psi (8.6 MPa)

Safety Shooter

the weight of a hose and compare to a new hose. Check the feel of a hose. Is it “flimsy” when compared to a new hose? A hose that exhibits



Fig. 2: The jacket on this hose has been damaged enough to expose the reinforcing cables, compromising the pressure capability of the hose. This hose needs to be replaced immediately

these characteristics probably has had its liner worn past its practical life span.

The steel hose ends are typically the greatest wear points on hoses. Examine the hose body for excessive wear at the inlet and outlet faces, and for any signs of the hose barbs beginning to show on the inside of the hose body. Examine the hose ferrule for any movement between it and the hose body and hose. These are indications that the steel is worn out and the hose should be discarded. Many hoses have a sight hole located in the ferrule so you can check to make sure the hose isn't pulling out of the ferrule (Fig. 3). Also, remember to examine the surfaces where the coupling gasket seats for dents, damage, or concrete buildup.

Hose failure can result in a plugged line in the best case; and injury or death to a shotcrete crew member or anyone else on the job site is a very real scenario. Routine inspections of your pumping hose are crucial to catching worn parts before they fail on the job. A few minutes spent checking over the hoses as they are being laid out or packed up can save a lot of time, effort, and cost spent dealing with a failed hose at a job site.

HOSE SAFETY GUIDELINES

- Always wear proper personal protective equipment (PPE) on concrete pumping job sites!
- Always use the correct hose for the job. A hose should not be used in applications where its rated working pressure is exceeded.
- Never kink the hose. Kinks cause blockages and pressure spikes. The hose may straighten violently and cause personal injury.
- Always verify that a blocked hose is not pressurized before opening any coupling.
- Never look into a hose that is plugged.
- Never use a hose with frays or breaks, or with the braiding or reinforcing exposed. Check both the outer cover and inner liner. A hose with exposed braiding is a guarantee it will not support its rated capacity.
- Never sit, straddle, or stand on a hose.
- Never use compressed air to clean a hose.
- Never drag the hose by the coupling or drag the hose sideways with a manlift or crane.
- Never beat on concrete pumping hose with a hammer or other object. This impact damages the reinforcing material and will lead to premature hose failure and rupture.
- Hoses should be inspected on a daily basis.
- Check the inside surface of the hose body. If there is excessive wear or exposed hose barbs, the hose must be discarded or returned to the factory for re-coupling.
- Verify that the hose cover is visible through the ferrule inspection hole.
- Typical concrete pumping hoses have rubber properties that resist sun damage and oxidation. To maximize the life span of a concrete pumping hose, store unused hoses in a clean, dry, dark place.
- Concrete pumping hoses are designed for pumping concrete. Consult the hose company if any other product is pumped through its hoses.

Safety Shooter



Andy Kultgen is an Engineer at Construction Forms, Inc., based in Port Washington, WI. Since 2011, he has been involved in research and development as well as technical and field engineering for the concrete pumping and mining

industries. He has worked on customized products and layout plans for concrete pumping on several record-setting projects in the United States and around the world. Kultgen received his BS specializing in machinery systems engineering from the University of Wisconsin. He is active in ASA and ACI, and is focusing on furthering research in wet-mix nozzle performance and developing improved nozzle designs, as well as encouraging safe practices in the concrete pumping industry.

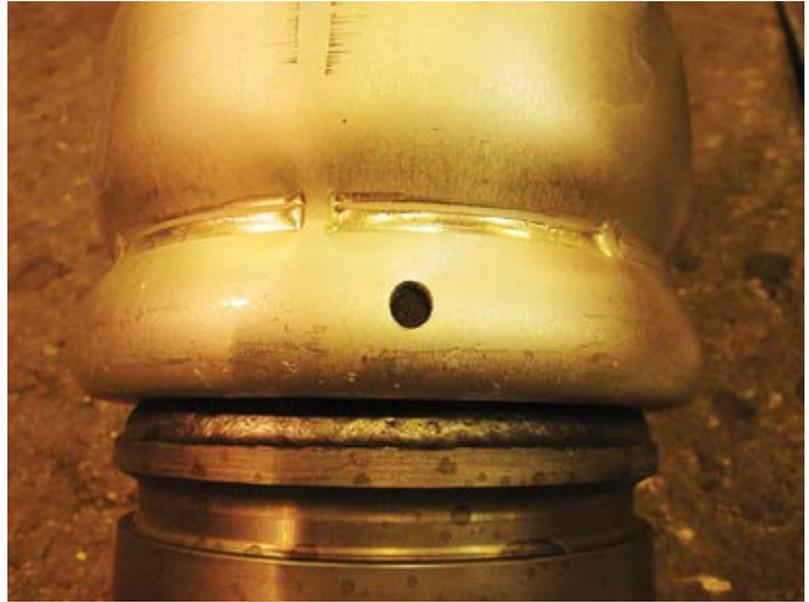


Fig. 3: Many hoses have a sight hole so you can check if the hose is seated all the way to the end of the ferrule and is not pulling out