

## Equipment Maintenance

by Ray Schallom III

**T**his article touches on both wet- and dry-mix shotcrete equipment maintenance that is not typically in the owner's manual. Equipment manuals for the dry- and wet-mix machines have a section on maintenance that tells you what to grease and check on a daily basis. Wet-mix shotcrete pump manuals will have a section on oil and filter changes needed at designated running hours.

For the most part, routine maintenance upkeep is usually followed on a daily basis by most shotcrete crews. For dry-mix guns, the operator should look for any unusual wear on the bowl or barrel steel and friction seal (rubber pads) during clean-up. These signs can indicate that the clamping system may have been too tight during operation, the bowl needs to be shimmed, or the barrel may be slightly off-center. Any excess blow by of material between the pads and steel while in operation will cause damage that will be costly to repair.

A few areas of interest should be taken into account while you are applying wet-mix shotcrete. Pumps need to be checked daily for any leaks

between the swing tube and cutting plate, excess cement paste in the wash box, and fitting leaks from everyday vibration. These items are usually found in the troubleshooting portion of the manual rather than in the maintenance section. In any case, these checks should be part of a daily check-off list prior to shooting. Taking the extra time to ensure that your machines are running properly will save you hours of downtime and money.

One aspect that some shotcrete crews fail to address properly is having extra spare parts and wear items on the job.

The lists shown are items that routinely create the most delays or job shut-downs.

These lists are for contractors who are just getting into the business as well as reminders to those who are experienced. Most of these items listed are relatively inexpensive replacement items, but when you have to shut down a job for any length of time while waiting for a missing part, it becomes very costly. If your work area is more than 5 min away from the truck, trailer, gang box, or parts bin, it's good practice to have a few of

### Wet-Mix Shotcrete Checklist

- Air-hose grommets
- Hose bands
- Air hose repair ends
- Whip checks
- Water-hose washers
- Water-hose repair ends
- Concrete clamps
- Concrete clamp gaskets
- Concrete clamp safety pins
- Nozzle tips
- Nozzle tip clamps
- Pipe fittings for the nozzle
- Ball valves
- Nozzle body repair kits
- Nozzle air rings
- Hose adapters for specific jobs
- Fuel filters for the compressor and shotcrete pump
- Hand tools to repair hoses and some fluid leaks

### Dry-Mix Shotcrete Checklist

- Material hose fittings
- Screws to fasten the fittings to the hose
- Water-hose gaskets
- Water hose repair ends
- Bull hose whip checks
- Two in. (50 mm) hose gaskets if you have the four-prong air fitting
- Hose bands
- Nozzle tips
- Water rings
- Nozzle body backup washers
- Needle valves for the nozzle
- Nozzle body backup
- Rubber wear pads for the gun
- Bowl or barrel wear steel plates
- Goose neck liners
- Conical spout liners (barrel-type rotary gun)
- Spare nuts and bolts for the guns
- Hand tools to repair hoses and tighten leaks
- Air motor oil
- Spare parts for the water trap and oiler on the gun

# Technical Tip

## Daily Wet-Mix Shotcrete Checklist

- Grease daily
- Check cement paste in the wash box
- Check engine and hydraulic and fuel levels
- Check excess dust in the air filter
- Check fluid leaks
- Make sure the front and back of the radiator is not clogged with dirt to prevent overheating
- Make sure the outriggers are down before pumping
- Make sure the hopper is free of any loose hardened concrete
- Make sure the hopper grate is functioning properly
- Make sure the hopper vibrator is working
- Spray form-release liquid over the hopper and back splash (note: use water-soluble liquids that are environmentally friendly)
- Check clamps and gaskets for any excess wear or damage
- Make sure the manual and remote controls are working properly
- Make sure the hopper cleanout is put back in place
- Check engine and hydraulic hoses for any excess wear or weakness
- Check for excess wear on the cutting ring and swing tube
- Make sure water-hose for cleanup is in good working condition with no leaks
- Check air compressor fluid levels
- Check air hose connections for leaks or bad gaskets
- Check whip checks on all air hoses
- During the startup of the air compressor check for excess water or oil spitting out of the nozzle hose
- Check shotcrete pipe and hoses for any excess wear spots (rotate the pipe hoses daily)
- Check the compression ends on the concrete hose for any signs of tearing or weak spots
- Check all concrete clamps to make sure the safety pins are installed properly
- Make sure the air hose is properly taped to the nozzle hose
- Make sure the nozzle is cleaned and the air ring holes are open
- Prime the hoses and concrete pipe
- Clamp the nozzle to the hose
- Open the air slightly and begin pumping
- Make sure all the line primer is out before aiming the nozzle toward the receiving surface in the work

these repair items near the gun or pump for a quick fix and minimal downtime.

Material hoses are items that are sometimes overlooked. Hoses should be checked on a daily basis for weak spots, loose fittings (dry-mix), excess wear on the outside of the hose, and hose clamps/gaskets (wet- and dry-mix). On dry-mix shotcrete jobs that have shooting on a daily basis without moving, you should check and rotate the hose. This will reduce excess wear on the inside of the hose if there are any bends in the hose. Even tying the hose off to scaffolding or a man lift will cause unusual wear on the inside of the hose.

Wet-mix shotcrete hose needs to be looked at a couple of different ways. One should inspect the pressed-on ends daily to make sure there are no tears, or weak or worn spots. Remember pump pressures can easily split and blow hoses when you least expect it. The bodily injury the hose and material can cause from a blowout should be a daily safety item for every shotcrete job.

Nozzles and nozzle bodies are the final maintenance item that needs daily attention. Cleaning the water ring (dry-mix) or air ring (wet-mix) holes at the end of each shift should be routine for the nozzleman. This is essential to start off the next morning without delay. Checking or replacing the worn or damaged backup washers will prevent water leaks as well as damage caused by the flow of the material through it. Nozzle tips require visual inspection for weakness, excess wear, and opening diameter. Worn-out nozzle tips will increase the width of the spray pattern, which

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# Technical Tip

could result in lower impact velocity voids behind the reinforcing bar.

Wet-mix nozzle tips are easier to verify for weakness and excess wear by looking at and squeezing them. When wet-mix tips begin to wear, the rubber begins to stretch and swell a little bit more on every stroke of the pump. Worn tips in wet-mix shotcrete will also increase the width of the spray pattern, which forces the nozzleman to move closer to the receiving surface.

Please note the Daily Wet-Mix Shotcrete checklist on the previous page. A similar checklist can be made for the dry-mix shotcrete process.

In conclusion, contractors and crews need to make a daily equipment/accessories check-off list that can be used from job to job. Make this Checklist part of your safety program by including it in your weekly job talks. Most mining companies have a check-off book for each miner to fill out on their equipment prior to startup. Remember, equipment safety and maintenance work hand-in-hand on every shotcrete job.



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