

### **GENERAL GUIDELINES**

#### **Pumping and Shotcreting RESCO Castables**

##### **A. STORAGE:**

1. RESCO castables should be stored in a covered, dry place, free from moisture or dampness, such as an enclosed warehouse. Storage on dry concrete, asphalt, or other impervious surface is recommended and will prevent moisture from the ground condensing under the plastic pallet cover and wetting the bags of material.
2. If pumping and shotcreting EZ EST castables, the EZ ADD liquid binder must NOT be exposed to freezing temperatures while in storage or during installation. EZ ADD will be rendered ineffective if frozen. Ideally, EZ ADD binder should be stored at room temperatures or between 50°F and 90°F.
3. If shotcreting, RESCO SC-1 Shotcrete Activator must NOT be exposed to freezing temperatures while in storage or during installation. Ideally, RESCO SC-1 Activator should be stored at temperatures between 50°F and 90°F.

##### **B. PREPARATION:**

1. Use clean tools, pipe sections, hoses and equipment. The mixer must be thoroughly cleaned out.
2. Waterproof all forms and surfaces if used.
3. Use only clean, drinkable water with a pH ranging from 7 to 8.
4. For best results, the dry material should be between 50°F to 85°F (10°C to 29°C) during mixing, placing, and curing.
5. A paddle-type or pan-type mixer, with a digital water meter, is preferred. Use a mixer with a bulk bag splitter and enough mixing capacity to keep up with the pump output.
6. The pump should be a double piston, swing valve pump with a 3-inch or 4-inch (75 to 100 mm) diameter pump cylinders. Pumps from commercial manufacturers such as Blastcrete, Whiteman-Conspray, Schwing, and Putzmeister, have been successfully used when pumping and shotcreting refractory castable. Many models of pumps have the mixer mounted on the top of the pump.
7. When shotcreting, use an air compressor capable of minimum 750 cfm output. Sufficient air pressure is needed to shotcrete overhead and achieve optimum shotcreted properties in the lining.
8. The activator pump, used to add the shotcreting activator to the nozzle, can be a rotor stator pump, diaphragm pump, or a drum pump (such as a Fireball pump from Graco) used for grease. Prior to use, the activator pump must be thoroughly cleaned out. When using RESCO SC-1 activator, vegetable oil should be pumped through the activator pump and activator hoses to remove any water in the pump and hoses.

## ***Technical Information***

- The pumping hoses and pipe sections must be cleaned prior to use, using water. Hose and pipe clamps should be workable and have safety pins. After cleanout, a hose lubricant, such as bentonite slurry can be used.

### **C. PIPE AND HOSE SETUP:**

- The pump should be located near the installation site as close as practical. The ideal pumping line setup is using as much steel pipe as possible with the last section consisting of a rubber pumping hose.
- Ideally, any pipe and hose diameter reduction should be done near the end of the pumping line. For the example of a 3 inch diameter pump hopper outlet, 3 inch diameter pipe should be run from the pump to close to the end of the pumping line as possible.
- When using pipe and hose diameter reducers, use reducers that are as long as possible. Also, the pumping line diameter reduction should be done in increments. Too much reduction over a short distance can cause the refractory aggregate to pack in the reducer and clog the reducer.
- When changing direction, use steel elbows for turning corners but try to keep the number of elbows used to a minimum. Also, do not use an steel elbow as the first section of pipe out of the pump hopper or immediately before or after a reducer. Elbows are a location where aggregate can pack and clog the pumping lines.
- Use as much steel pipe as possible, when pumping vertically.

### **D. MIXING:**

- Know the % water to add to the specific refractory castable and the gallons to add for the bag weight prior to mixing:

Castable Brand:	% Water (By Weight) To Add for Pumping	Gallons of Water for 1000 lb bulk bag
R-MAX PC	6.5%	7.8 gallons

- Add the dry material to the mixer. For calculating the water addition from weight percentage to gallons, use 8.3 lbs. per gallon as the weight of water to determine gallons of water to add. Measure the proper amount of water and then quickly add the amount of water to the mixer while the mixer is operating.
- Mix the dry material and the water for 5 minutes. If mix appears too dry after 5 minutes of mixing, Allow 1 to 2 minutes of additional mixing time between binder additions. Once an acceptable water addition is reached, use that amount as the starting point for the next batch.

## ***Technical Information***

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### **E. PUMPING**

1. Discharge two mixer loads into pump hopper prior to pumping to fill the pump hopper.
2. Start pumping slowly until mixed material flows out of end of hose. Make sure the pumping lubricant (typically a clay slurry) is pumped into a bucket so the clay slurry is not mixed into the pumped castable.
3. If shotcreting, turn on air at nozzle before pumped material gets to the end of hose so pumped castable does not clog air holes in nozzle. The activator line should be turned on when pumped castable is spraying from nozzle with air turned on.
4. When stopping, first, turn off the activator line but maintain air flow through the nozzle. Then, stop pumping the castable while leaving the air pressure turned on for several minutes in order to clear the air holes in the nozzle. Then, turn off the air pressure as the last action in the shutdown.

### **F. CLEAN UP**

1. When using RESCO SC-1 as the shotcrete activator, **DO NOT USE** water to flush the activator hose and pump. Water will create a gel with the RESCO SC-1 activator and clog the activator hoses and pump. To clean out RESCO SC-1 activator, pump vegetable oil or 10W-30 or 10W-40 motor oil through the activator hoses and pump. Then, purge the activator hoses with compressed air to clear out any liquids.
2. Water should be used to flush and clean the pumped castable out of the pumping pipes, hoses, and pump hopper. Make sure the material cylinders (at bottom of pump hopper), are cleaned out with water until the water runs clear.
3. When cleaning out the shotcrete nozzle, make sure the air holes, in the nozzle, remain open for the next use. If any air holes are closed or partially closed, it is important to fully open the holes prior to the castable setting hard. If castable in holes is hard, the air ring should be replaced.

### **G. CURING:**

1. Do not disturb pumped or shotcreted lining during the first 24-hour period after installation. After curing for a minimum 24 hours, check the castable set to assure that a hard set has been achieved prior to form removal and subsequent heatup.
2. Pumped or shotcreted castables **MUST NOT** be exposed to cold or freezing temperatures during the curing period. Cold temperatures will extend the castable setting. Freezing temperatures will lower strengths and delay setting.