PUMPING LORESCO® TYPE RS.3

A number of different pumping techniques may be employed to successfully pump LORESCO® type RS•3. LORESCO will provide two methods to illustrate the procedure.

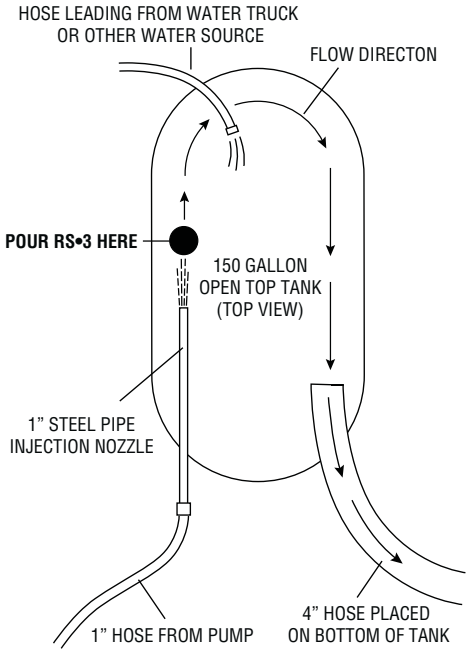
LORESCO recommends the use of a positive displacement pump capable of handling high solids content for pumping. The pump should have a minimum displacement rate of 50 gpm (190 lpm) at a maximum pressure of 150 psi (1000 kPa) or greater for a hole depth of 350 feet (100 m). The maximum pressure available should be greater for deeper holes. A Gardner-Denver duplex 5"x6" piston pump with a maximum flow rate of 150 gpm (570 lpm) at 310 psi (2100 kPa) is an example of a pump with more than sufficient capability. LORESCO recommends a minimum suction of 4 inch nominal (10 cm) with a minimum downhole injection of 1 ¼" nominal pipe size (3 cm).

FLOW STREAM TECHNIQUE

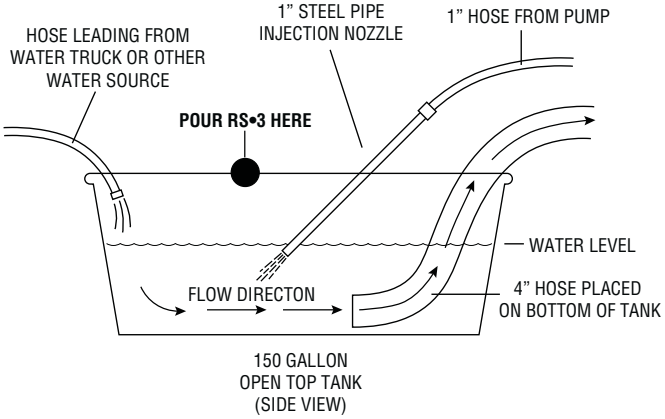
The Flow Stream Pumping technique is based on pouring type RS•3 directly into a water flow stream going directly into the pump suction. For this technique to be successful, the carbon must be wetted quickly and be swept directly into the pump suction. (See schematic.)

Using this technique two flow paths must be established. One closed-loop path through an agitator nozzle and mixing tank is established to facilitate wetting the carbon. The second flow path is established from the mixing tank through the down-hole piping to allow placement of the backfill. Flow through each path is controlled and regulated by in-line flow control valves. The total output from the pump will be divided between the two flow paths in proportion to the flow resistance within each path.

The carbon mixing tank should consist of an open-top tank with a round or oval shape with a capacity of about 150 gallons (500 liters). The closed-loop flow path will be directed into the top of the tank through a nozzle to facilitate agitation and wetting within the tank. The injection nozzle is constructed using a short piece (2 to 3 feet {0.6 to 0.9 m} long) of 1¼(3 cm) in standard black steel pipe coupled to a high-pressure, flexible hose connected to the pump outlet. The injection nozzle will be directed into the top of the tank at an angle of approximately 45 degrees along one side of the tank. The pump suction will be placed at the bottom of the tank along the opposite side. With this arrangement the carbon is poured directly into the water at the end of the agitation nozzle and immediately swept along a path around the tank and into the suction. This wetting flow path for the



FLOW STREAM TECHNIQUE



carbon along the tank bottom from the injection nozzle to the suction should be approximately 3 feet (0.9 m) long to allow adequate carbon wetting prior to being swept into the suction. A clean water inlet must also be provided into the top of the wetting tub with an in-line valve for flow control.

Nominal 3 cm (1 ¼ in) standard black steel pipe is recommended as the minimum size down-hole piping used to pump the backfill into the deep anode system. A transition fitting is necessary to allow coupling the pumping pipe to the drill stem swivel. This arrangement allows the pumping pipe to be supported and retrieved using the drill rig mast, and the carbon slurry to be pumped by the rig mud pump.

To begin the mixing tank is filled with clean water. Both the closed loop and down-hole valves are opened so as to produce sufficient agitation within the mixing tank while flowing approximately 20 gallons per minute (75 lpm) into the down-hole piping. The pump speed will also need to be increased at this point to provide sufficient flow through each path.

When the water in the mixing tank has been pumped down to approximately one-half full, begin to pour type RS•3 directly into the water at the outlet of the injection

nozzle. RS•3 can be poured at a rapid rate at this point as long as the RS•3 is not settling out and building up within the tank. By stirring using a shovel around the suction inlet settling can be detected and rapidly eliminated if necessary. Clean water should be added continuously at the top of the tank to match the pumping rate so that the overall water level is maintained at approximately one-half full. This addition of water and RS•3 is continued until all of the RS•3 has been placed in the tank. After the last RS•3 had been added to the tank, momentarily shut off the incoming water flow to allow slurry in the tank to pump down. Just before the end of the suction hose is exposed, turn the water flow on again at maximum rate to allow approximately 30 gallons (100 l) of clean water to circulate through the pump and down-hole piping (1 ¼ inch pipe).

Immediately after the above clean water has been pumped, the valve controlling the down-hole flow path should be closed and water flow diverted into the tank for adequate pump cleaning. As soon as the down-hole flow valve is closed, removal of the pumping pipe should begin to avoid entrapment of the pipe by the settling RS•3. The pipe removal does not have to be rapid, but does need to be done with continuous, steady progress until the pumping pipe is above the anticipated carbon level.

WATER INJECTION TECHNIQUE

This technique is based on providing a direct clean water injection into the pump suction to aid pumping. Although the RS•3 mixing procedure within the mixing tank is still important, it becomes less critical using this method. With this method a mechanical stirring / agitation is employed to wet the RS•3 using the same type mixing/wetting tank as previously described.

First the pump suction will be modified by installing a 1" (2.5 cm) nominal pipe nipple directly into the end of the suction hose to supply clean water. This can be accomplished by connecting two (2) 1" (2.5 cm) 90 degree u-bends in series to make a 180 degree fitting. This is then coupled to a 1" (2.5 cm) flexible supply hose connected to a clean water supply. With the end of the 1" supply line feeding into the open suction hose, clean water is allowed to gravity flow continuously into the suction stream from a water supply tank as the RS•3 is pumped. (See schematic.)

In the mixing tank the RS•3 can be stirred mechanically using a hydraulically driven motor or manually using men with shovels or by any other technique to mix and force the RS•3 into the suction area. It is important to make sure that the RS•3 does not accumulate in a mass at the suction. This is achieved by continuously agitating the slurry in this area.

CAUTION: Since LORESCO® type RS•3 is designed for rapid, compact settling, the pumping characteristics of this formulation are significantly different from LORESCO® types SC•2 and SC•3. Type RS•3 is NOT designed to remain in fluid suspension for any length of time. Therefore, water mixing techniques commonly used with types SC•2 and SC•3 are NOT effective with type RS•3.

WATER INJECTION TECHNIQUE