

# ▶ STANDARD OPERATION PROCEDURE: PUMP AND HOSE

For training and beginner operators

Last update: 08/06/2022

## System start-up

|    |                                                                                     |  |
|----|-------------------------------------------------------------------------------------|--|
| 1  | Ensure the pump hopper is clean                                                     |  |
| 2  | Spray form oil on inside of hopper                                                  |  |
| 3  | Grease pump                                                                         |  |
| 4  | Check oil levels                                                                    |  |
| 5  | Check water level inside pump                                                       |  |
| 6  | Close grid                                                                          |  |
| 7  | Pump ON, Start. Pumping ON                                                          |  |
| 8  | Ensure S-valve is switching between pistons                                         |  |
| 9  | Agitator ON                                                                         |  |
| 10 | Vibrator ON                                                                         |  |
| 11 | Test emergency stop, release emergency switch                                       |  |
| 12 | Move pump in place under batch plant                                                |  |
| 13 | Connect printer to pump                                                             |  |
| 14 | Ensure hose is empty (no water)                                                     |  |
| 15 | Ensure steel reducers and bend is debris-free                                       |  |
| 16 | Connect pump to bend, reducer and hose. Remember, coupling pins and whipcheck cable |  |
| 17 | Connect outlet of hose to printhead                                                 |  |

|    |                                           |  |
|----|-------------------------------------------|--|
| 18 | Fill containers with 300 l of clean water |  |
|----|-------------------------------------------|--|

## Operation

|    |                                                                                  |  |
|----|----------------------------------------------------------------------------------|--|
| 1  | Pump ON, Start                                                                   |  |
| 2  | Close hopper gate                                                                |  |
| 3  | Fill pump hopper with slurry                                                     |  |
| 4  | Agitator ON                                                                      |  |
| 5  | Pumping ON. For speed, see the thread of steel adjustor. A value of 2 is typical |  |
| 6  | Stop pumping when agitator shaft becomes visible. DO NOT pump empty              |  |
| 7  | Open hopper gate. Discard remainder of slurry. Close hopper gate                 |  |
| 8  | Discharge concrete mix into pump hopper                                          |  |
| 9  | Communicate with printer operator                                                |  |
| 10 | Switch to remote pumping                                                         |  |
| 11 | Ensure batch plant operator keeps concrete level above agitator shaft            |  |
| 12 | Extrude material through nozzle and monitor consistency                          |  |
| 13 | Activate stiffener pump. Start with 300 ml/h                                     |  |
| 14 | Extrude material until desired consistency is achieved                           |  |
| 15 | Start printing                                                                   |  |
| 16 | Continuously monitor pumping pressure                                            |  |
| 17 | Stop the pump immediately if the pressure exceeds 120 bar                        |  |
| 18 | Normal operation pressure is below 80 bar                                        |  |

## Cleaning

|    |                                                                                                                                         |  |
|----|-----------------------------------------------------------------------------------------------------------------------------------------|--|
| 1  | Pump until concrete level reach top of agitator shaft                                                                                   |  |
| 2  | Pump reverse for two switches of s-valve                                                                                                |  |
| 3  | Stop pumping                                                                                                                            |  |
| 4  | Open hopper gate and remove excess concrete from pump hopper                                                                            |  |
| 5  | Use pressure washer to remove 80% of concrete build-up. Only spend 5 min on this. The hose is priority                                  |  |
| 6  | Close gate                                                                                                                              |  |
| 7  | Fill pump hopper with clean water from containers filled during start-up. Also add water continuously                                   |  |
| 8  | Disconnect hose from steel reducer                                                                                                      |  |
| 9  | Pump until only water is discharged from reducer                                                                                        |  |
| 10 | Insert two cleaning balls                                                                                                               |  |
| 11 | Reconnect hose to reducer. The balls separate the water from mixing with the concrete, this separation is important to prevent clogging |  |
| 12 | Disconnect hose outlet from printhead and place in waste container (bigbag)                                                             |  |
| 13 | Start pumping until balls exit hose                                                                                                     |  |
| 14 | Stop forward pumping. Give two pumps in reverse                                                                                         |  |
| 15 | Open coupling between reducer and hose to inset cleaning balls                                                                          |  |
| 16 | Run cleaning balls again                                                                                                                |  |
| 17 | Stop when pump hopper is empty                                                                                                          |  |

|    |                                                                                                                |  |
|----|----------------------------------------------------------------------------------------------------------------|--|
| 18 | Disconnect all hose couplings                                                                                  |  |
| 19 | Move pump out from under batch plant                                                                           |  |
| 20 | Open gate to remove water                                                                                      |  |
| 21 | Use pressure washer to clean pump hopper and grid                                                              |  |
| 22 | Clean s-valve by inserting pressure washer into pump delivery hole (pump should be switched off at this stage) |  |
| 23 | Reverse pump to ensure pistons are empty                                                                       |  |
| 24 | Ensure s-valve and flange is clean                                                                             |  |
| 25 | Clean reducer and bend                                                                                         |  |
| 26 | Remove any water from hose                                                                                     |  |

## Shut-down

|   |                                                      |  |
|---|------------------------------------------------------|--|
| 1 | Let pump idle for 5 min before shut-down             |  |
| 2 | Lubricate the hopper walls and s-valve with form oil |  |

## Maintenance

### Daily

- Emergency stop test
- Grease
- Check hydraulic oil levels, refill as specified in manual

### Weekly

- Replace lubrication water

### Monthly

- Remove flange