



## PRINCIPLES OF GRIT PIPING

As we all know, a chain is only as strong as the weakest link. This also applies to grit removal. In many cases, the weak link is the grit piping between the grit storage hopper and the grit handling equipment.

Grit plugging can be a real problem if the piping is not laid out correctly. For this reason, Smith & Loveless recommends the use of the Top-Mounted **PISTA® TURBO™** Grit Pump. This arrangement prevents any chance of plugging within the pump suction line because the suction line is in the vertical position, and drains after every pumping cycle.

If a Flooded Suction Remote-Mounted suction-type pump is used, the pump suction line should be as short as possible, preferably less than 10' or 3 m long. The ideal situation is to have a short, straight suction run directly into the side of the bottom of the grit storage chamber with an eccentric plug valve to isolate the pump. Smith & Loveless recommends a slight incline (1/8" per foot or 10 mm/m) up from the pump to the storage chamber. This prevents air entrapment from occurring. Do not use a "turn down" elbow for the suction line in the grit storage hopper. Never have the suction line exit the grit storage hopper vertically down through the bottom, or plugging will occur.

When using the Flooded Suction Remote-Mounted suction **PISTA® TURBO™** Grit Pump, the grit storage hopper should be pumped completely out every cycle. This prevents grit from accumulating within the suction line. A flushing connection should also be incorporated into the grit pump suction line to allow for flushing should plugging occur. Never use elbows in the suction line; however, if elbows are necessary, sanitary tees with clean out capability must be used.

The eccentric plug valve located in the pump suction line should be turned, so that the rubber face seals against the flow from the **PISTA®** Grit Chamber. If it is not turned in this direction, grit will pack around the movable plug, on the backside, and prevent it from turning. Small engineering details such as this can prevent a real problem from occurring.

Smith & Loveless often sees two grit pumps specified in order to provide 100% back-up. Normally when this occurs, the pumps are tied in together. Smith & Loveless does not recommend this because it only provides additional elbows and piping. Bottom line, it creates

additional places for grit to plug the line. Instead, Smith & Loveless recommends specifying a spare rotating assembly for 100% backup. As you know, the Smith & Loveless pump is designed so that the rotating assemblies can be changed out in a matter of minutes, limiting any down time.

The length of the grit discharge line should not exceed 50' (15 m) and should be as straight as possible. Doing this eliminates unnecessary elbows and fittings. The piping must not contain any traps that can accumulate grit. Consult the factory if more than 50' (15 m) is required.

The isolation valve on the discharge side of the pump must be a pinch valve. A pinch valve is preferred because it seals even if grit is present within the valve. The pinch valve must be located in the vertical position to eliminate accumulation of grit within the valve. Check valves must never be used in any grit pumping line. Not only do they provide the opportunity for plugging; but they also very rarely work properly, and will wear quickly due to the presence of grit. The pump must also operate for a sufficient length of time to clear the line entirely of grit.

Another link in the grit removal chain is the use of good screening equipment ahead of the **PISTA®** Grit Chamber, such as the **OBEX™** Spiral Fine Screen. This prevents large debris from entering the system and plugging the pipelines.

Smith & Loveless offers a complete line of grit handling equipment – the **PISTA®** Grit Removal System – along with diagrams showing the best possible arrangement.

In summary, Smith & Loveless recommends the use of the top-mounted **PISTA® TURBO™** Grit Pump, which eliminates the possibility of plugging within the pump suction pipe. The **PISTA® TURBO™** Grit Pump incorporates a recessed Ni-Hard impeller for added wear resistance. Smith & Loveless further recommends coupling the **PISTA® TURBO™** Grit Pump with the **PISTA®** Grit Concentrator, which provides for secondary treatment of residual organics and secondary grit dewatering. The **PISTA®** Grit Concentrator returns 93-94% of the water pumped to it along with 95-96% of the residual organic matter. Along with the **PISTA® TURBO™** Grit Pump and the **PISTA®** Grit Concentrator, Smith & Loveless recommends the use of the new **PISTA® TURBO™** Grit Washer with parallel



plates. The **PISTA® TURBO™** Grit Washer provides unequalled retention of fine grit. When you couple grit-handling equipment, such as this, along with the **PISTA® 360™** with **V-FORCE BAFFLE™** Grit Chamber, you have a grit removal system that was designed specifically for grit removal applications, coordinated to work as a complete system, and is second to none. This system removes more grit from the incoming wastewater than any other system, and provides a low maintenance grit handling system.

The following is a layout checklist for the grit pumping equipment.

1. The Top-Mounted **PISTA® TURBO™** Grit Pump is recommended for use because it limits the possibility of grit plugging within the suction line.
2. If a Flooded Suction Remote-Mounted **PISTA® TURBO™** Grit Pump is used, incorporate the following:
  - a. Plug valves or pinch valves to isolate the pump.
  - b. A flushing connection.
  - c. Slope up the pump suction line from the pump to the **PISTA®** Grit Chamber.
  - d. Never use elbow in the suction line; however, if they are necessary, you must use quick disconnect fittings or sanitary tees with a clean-out.
  - e. Suction line must be less than 10' (3 m) long.
  - f. Discharge piping must be less than 20' (6 m) long.
  - g. All unnecessary elbows, bends, dips or manifolds should be eliminated.
  - h. The discharge valve is recommended to be a pinch valve.
  - i. The grit pumping cycle must be long enough to completely move all of the grit out of the **PISTA®** Grit Storage Hopper and also continue to pump long enough to remove all grit from the line.
- j. Do not locate traps in the suction or discharge line.
- k. Do not use check valves in grit piping.



## RECOMMENDED APPLICATION OF FLUSH WATER FOR NEW AND EXISTING VORTEX CHAMBER INSTALATIONS

### INTRODUCTION

Grit particles need to be fluidized to allow them to be pumped. As grit settles in the grit storage hopper, water is forced from between the particles, which restricts the ability of the particles to move effectively. The grit is compacted from the overburden of additional grit particles settling. Once the grit is compacted, it is very difficult to move, and most likely will require mechanical means to remove the grit. This can happen at any point in the storage hopper, pump suction line and discharge lines where grit will tend to settle. Therefore, it is important to keep the grit fluidized, so that it can be pumped. This allows it to flow and not become compacted. The pump cycle should be such that all of the grit captured in the storage hopper is completely pumped out, clearing the suction and discharge lines.

### TERMINOLOGY

The terminology commonly used:

- **Fluidizing:** This term consists of the addition of water (or of mechanical action) to the captured grit, to fill the interstices between the particles, and allow them to flow and pump more effectively.
- **Flush Water:** The feeding of clear water into the suction line of the grit pump to flush the line.
- **Fluidizing Water:** Water added to the grit bed inside the **PISTA®** hopper, via a separate and dedicated pipeline. This source is not fed through the pump suction line.
- **Air Scour:** Air scour is the direct injection of air into the **PISTA®** grit hopper. Used on some early **PISTA®** installations, it is generally not effective and should not be used. Air tends to lift the liquid from the grit causing further compaction.

### RECOMMENDED PRACTICE

Feeding flush water into the grit pump suction pipe, plus the use of the **PISTA®** Grit Fluidizer Vanes to stir up grit in the hopper is the recommended practice. Fluidized grit slurry will aid in reducing the abrasive characteristics of grit and will reduce the pump power requirements. In addition to fluidizing the grit, flush water aids in clearing out pipelines or areas where grit can deposit and build up, leading up to plugging conditions.

### DESIGN RECOMMENDATIONS

The Smith & Loveless, Inc. **PISTA® TURBO™** Grit Pump suction lines for Top-Mounted **PISTA® TURBO™** Grit Pump contains a coupling that allows flush water. The coupling (provided by S&L) on the Top-Mounted Vacuum Primed **PISTA® TURBO™** Grit Pumps is located in the suction pipe below the pump. On Flooded Suction **PISTA® TURBO™** Grit Pumps the coupling (not provided by S&L) is located in the horizontal line before the pump. The coupling sizes and flow specifications are listed below.

Flooded Suction <b>PISTA® TURBO™</b> Grit Pump	Coupling (NPT)*	Flow Range
250 GPM (15.8 lps) (4" or 100 mm S&L <b>PISTA®</b> <b>TURBO™</b> Grit Pump)	1 ½" (38 mm)	50 - 75 GPM (3.2 - 4.7 lps)
500 GPM (31.5 lps) (6" or 150 mm S&L <b>PISTA®</b> <b>TURBO™</b> Grit Pump)	2" (50 mm)	100 - 150 GPM (6.3 - 9.5 lps)

\*Coupling not provided by S&L on Flooded Suction Remote-Mounted **PISTA® TURBO™** Grit Pumps

The flush water range listed above should not be exceeded since it can reduce the amount of grit slurry pumped from the hopper, and can cause a separate water column.

Plant effluent water can be provided for this service.

Installing the flush water connection in the Top-Mounted suction pipe provides both flush and fluidizing water to the suction line and grit hopper, respectively.

Flush water can be fed for 5 minutes prior to running the grit pump, during the grit pump operation, and for 5 minutes after the pump stops. Flush water flow control

# ENGINEERING DATA



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**PISTA**® Grit Removal System  
Principles of Grit Piping  
Flush Water  
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will be based on the grit pump timer located in the control panel. Providing the water to the line prior to the pump starting will allow the water to fluidize the grit surrounding the suction line, and aid in initiating the pump cycle. Providing the water during the pump cycle will continue to fluidize the grit being pumped through the suction line. Continuing to provide water after the pump cycle will aid in flushing out the suction line from any build up that may have occurred.

An automatic valve (not by S&L) may be installed between the water supply and the **PISTA**® connection to control the flush water operation. It is recommended that a manual valve (not by S&L) be installed in the flush water line to adjust the flow as required.

The above specified flow range for the flush water is broad to allow for variation in the amount of grit captured by the **PISTA**®. A larger amount of grit requires a larger flush water flow. The amount of flush water varies per **PISTA**® installation, and can only be determined after the initial run period of the **PISTA**®. The maximum flow shown should not be exceeded.

Available flush water pressure and conditions can vary for each **PISTA**® installation. Higher available pressures provide higher flows. The flush water line diameter and length will also affect the flow. Smaller diameters and longer flush lines will increase friction losses reducing pressure and flow. The flush line connection coupling provided by Smith & Loveless, Inc. is sized large enough for a wide range of conditions. However the flush line connected to the coupling may or may not need to be this size.

The consulting engineer should review flush line sizing and plumbing construction to assure that adequate but not excessive flush water flow is provided. A reducing bushing can be installed in the coupling to downsize flush water inlet pipe connections as required.

## **NOTES FOR FLOODED SUCTION REMOTE-MOUNTED PISTA® TURBO™ GRIT PUMPS**

S&L does not provide the suction piping for Flooded Suction Remote-Mounted **PISTA**® **TURBO**™ Grit Pumps. A flush water line connection needs to be installed by the contractor in the horizontal suction line before the pump isolation valve. The flush water flow and timing requirements for Flooded Suction Remote-Mounted **PISTA**® **TURBO**™ Grit Pumps defined above are the same as for the remote Top-Mounted **PISTA**®

**TURBO**™ Grit Pumps. It is essential that the flush water provided after the pump cycle be capable of clearing out the horizontal suction line.