PISTA® Grit Removal System Outperforms Aerated Grit Chambers

One of the most frequently asked Smith & Loveless questions is "How can you prove the **PISTA®** Grit Removal System is indeed the best alternative for my grit problems?" Obviously, we must accentuate the superior grit removal efficiencies offered by the **PISTA®**. But the answer can also be strongly expressed in simple financial terms. If you install a Smith & Loveless **PISTA®** Grit Removal System, not only will you be obtaining a proven, top-of-the-line system, but you will be doing it for a lower price than the other older and unreliable systems. The proof, as they say, is in the numbers. Let's start by reviewing the ingenuity behind the **PISTA®** Grit Chamber and comparing its benefits to another conventional system: the aerated grit chamber.

PISTA® Grit Removal Systems

All models of the **PISTA®** Grit Removal System work on the principle of a forced vortex. The incoming flow is straightened in the inlet flume to minimize turbulence at the inlet of the chamber. The end of the inlet flume is a ramp, which causes grit that may already be on the flume bottom to follow the ramp to the floor of the chamber and be captured. At the center of the chamber are rotating paddles, which maintain the proper circulation in the chamber at all flows. This combination of paddles, inlet baffle and inlet flow produces a toroidal flow pattern.

The **PISTA® 360™** with **V-FORCE BAFFLE™** is our most recent innovation further enhancing the world's best grit removal scheme. The **PISTA® 360™** with **V-FORCE BAFFLE™** is designed to direct the inlet flow into the chamber in a manner that ensures proper vortex flow and prevents short-circuiting, allowing for a full 360° rotation from the inlet to the outlet. By increasing chamber velocity during low flow periods, the **V-FORCE BAFFLE™** extends the grit extraction path with the vortexing grit chamber. This is key because a longer grit path within the flow pattern increases the effectiveness of grit being captured on the chamber's flat-floor.

The toroidal flow pattern in all **PISTA®** Grit Removal Systems maximize the number of times a grit particle can be subjected to hitting the chamber floor for grit capture. Once captured on the flat floor of the chamber, the grit is moved along the floor toward the center hopper by the bottom velocity created by the toroidal flow pattern. A flat chamber bottom is essential to maintaining the toroidal flow pattern at its maximum efficiency. A sloping bottom would decrease the intensity of the toroidal flow pattern, reducing the grit capture efficiency and increasing the amount of organics that will be captured and contained in the grit.

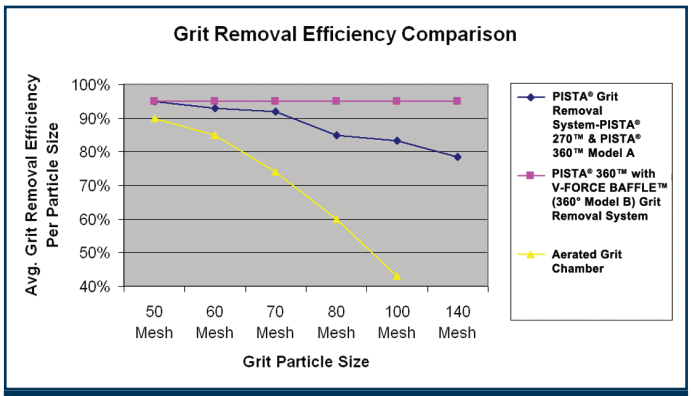

Fig. 1 – Grit Removal Efficiency Comparison

As the solids are moved along the flat floor of the chamber toward the center, the rotating paddles maintain a velocity such that the lighter organic materials are lifted and returned to the flow passing through the **PISTA®** Grit Chamber. The grit then moves towards the center and drops into the bottom storage chamber through a small opening between the paddle drive shaft and the steel cover plate. All grit passes under the paddles to remove organic materials before being allowed to fall into the storage chamber. When sufficient grit has accumulated in the storage chamber, the grit is then removed and transferred to the dewatering device by means of a top-mounted, vertical, Ni-Hard **PISTA® TURBO™** Grit Pump. Typically, grit is removed automatically from the storage chamber every four (4) hours.

Aerated Grit Chamber

The system we will compare with the **PISTA®** is the aerated grit chamber. In the aerated grit chamber, the flow enters the tank directly in the circulation pattern provided by the air diffusion equipment. The aeration and the spiral circulation of the wastewater cause the separating and settling of the grit particles on the sloped floor. The spiral circulation also scours and washes the grit from the floor and into the grit hopper, located under the air diffusion header. In an aerated grit chamber, the grit is removed from the storage hopper fairly frequently by means of an auger screw, tubular conveyor, clamshell bucket, chain and flight scraper system or an airlift system.

Grit Removal Efficiency

Figure 1 compares the grit removal efficiency versus grit particle size for the three (3) grit removal systems. The **PISTA® 270™**, **PISTA® 360™ Model A** and **PISTA® 360™** with **V-FORCE BAFFLE™** Grit Chambers all have a higher grit removal efficiency over the full range of grit particle sizes than the aerated grit chamber.

9503-1 ©2019 Smith & Loveless Inc.

The **PISTA®** Grit Removal Systems are not only highly effective for removing larger particles, but also have much higher grit removal efficiency for the finer grit particle sizes. This is true for all flows.

The efficiency of the aerated grit chamber falls off dramatically for grit smaller than 50 mesh (300 microns). This occurs because the air flow from the diffusers controls the particle velocity, and can be set for only one grit particle size.

No other grit removal system can claim Smith & Loveless' success in grit removal efficiencies.

Energy Consumption

The difference in power consumption is large, as shown in **Table 1**. The following explains why the **PISTA®** is a superior system. With the **PISTA®** Grit Chamber, a very small horsepower motor drives the paddles. The **PISTA® TURBO™** Grit Pump and dewatering device operates only during the grit removal cycle, intermittently as called for. This compares to an aerated grit chamber which requires a blower operating continuously 24 hours per day.

Table 1 shows typical yearly energy usage for the two types of grit removal devices (includes the combined energy usage for grit chamber operation, grit removal equipment and grit dewatering equipment). The **PISTA®** Grit Chamber requires significantly less energy than the other device, and the difference becomes more pronounced for the larger grit chambers.

Another major concern with the aerated grit chamber is the nuisance created by the constant release of volatiles in the air.

Space Requirements

The **PISTA®**'s unique design allows for significantly less space requirements for a grit removal system. For example, a Model 12 unit (12 MGD/45.4 MLD) will require a concrete tank 11'-6" (3.5 m) in diameter and 11' (3.4 m) deep. A typical aerated grit chamber for the same application will require a tank 17' (5.2 m) long, 16'-6" (5 m) wide and 15'-6" (4.7 m) deep. This space saving translates directly into installation cost savings. The smaller tank requires less concrete and less field labor for installation. The smaller space also means less land usage which can mean a smaller initial site required or allows a **PISTA®** retrofitted to an existing site where many times space is not available for a conventional type grit chamber.

Table 2 demonstrates the significant differences in space requirements at various unit sizes between the **PISTA®** Grit Chamber and the standard aerated grit chamber.

Table 1 - Energy Costs

	PISTA®		Aerated GC
Design Capacity (MGD / MLD)	Model	Energy Usage (KWH/Yr.)	Energy Usage (KWH/Yr.)
1 / 3.8	1.0/1.0A/1.0B*	6,900	10,400
2.5 / 9.5	2.5/2.5A/2.5B*	7,700	14,000
4 / 15.1	4.0/4.0A/4.0B*	8,600	20,500
7 / 26.5	7.0/7.0A/7.0B*	9,400	34,000
12 / 45.4	12.0/12.0A/12.0B*	10,200	51,500
20 / 75.7	20.0/20.0A/20.0B*	12,000	67,000
30 / 113.6	30.0/30.0A/30.0B*	13,500	103,000
50 / 189.3	50.0/50.0A/50.0B*	14,300	150,000
70 / 265	70.0/70.0A/70.0B*	15,100	205,000
100 / 378.5	100.0/100.0A/100.0B*	16,800	274,000

Table 2 - Space Requirements

	PISTA®		Aerated GC
Design Capacity (MGD / MLD)	Model	Excavation (ft^3 / m^3)	Excavation (ft^3 / m^3)
1 / 3.8	1.0/1.0A/1.0B*	353.2 / 10	1,094.8 / 31
2.5 / 9.5	2.5/2.5A/2.5B*	388.5 / 11	2,224.8 / 63
4 / 15.1	4.0/4.0A/4.0B*	494.4 / 14	3,284.3 / 93
7 / 26.5	7.0/7.0A/7.0B*	847.6 / 24	5,297.3 / 150
12 / 45.4	12.0/12.0A/12.0B*	1,200.7 / 34	8,652.2 / 245
20 / 75.7	20.0/20.0A/20.0B*	1,907 / 54	13,561 / 384
30 / 113.6	30.0/30.0A/30.0B*	2,613.3 / 74	19,776 / 560
50 / 189.3	50.0/50.0A/50.0B*	3,354.9 / 95	30,865 / 874
70 / 265	70.0/70.0A/70.0B*	4,661.6 / 132	39,623 / 1,122
100 / 378.5	100.0/100.0A/100.0B*	12,431 / 352	47,605 / 1,348

*Model B signifies **PISTA® 360™** with **V-FORCE BAFFLE™**

Clearly, the **PISTA®** Grit Removal System is indeed the best alternative for any grit problem. If customers need further convincing, perhaps they could visit one of the more than 2,500 **PISTA®** Grit Removal Systems installed worldwide for all kinds of environments and applications.

Brochure 9503-1 © Smith & Loveless Inc., 2012

Smith & Loveless Inc. **Phone:** (913) 898-5201
www.SmithandLoveless.com **Fax:** (913) 888-2173