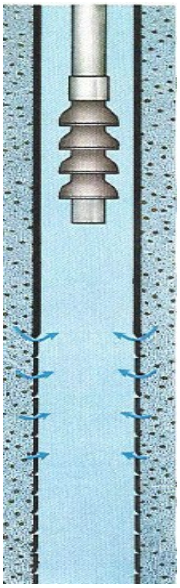
MEMO: Lamnaflo™ Theory, Installation, Startup Procedures and Warranty Information

Theory:



In a typical deep well pump application, a multistage centrifugal pump is used to extract water from the well. The rotating action of the impellers delivers water flow up the column or drop pipe. The negative or suction energy on the inlet side of the pump induces flow from the saturated interval of the well. The water can flow in an uncontrolled fashion from the water bearing formation by taking the path of least resistance to satisfy the suction energy of the pump. Often, this uncontrolled flow will be produced by the formations closest to the suction inlet, or through the most prolific zones. If the entrance flow has excessive energy, it may begin to erode the formation causing the gradual wearing away of the frail rocks, sediment and soils by the aggressive action of the water. The fine particulates (sand, clays, etc.) can become entrained in the water flow and delivered to the pumps suction inlet. As these particulates pass through the pump, they can cause mechanical damage to the impeller surfaces and wear journals throughout the pump. These particulates are ultimately discharged from the pump into the distribution system, potentially causing additional mechanical and sediment deposition issues. Theoretically if we can reduce the entrance velocities from the water bearing zones, we can approach laminar flow. This slow, efficient flow may have insufficient energy to cause erosion of the formation or entrain particulates. Therefore, the formation remains intact and the particulates in place. In addition, the reduced flow rates may minimize any pressure drop as the water passes through the formation or screen which may reduce the potential for the precipitation of minerals which can cause plugging.

The Lamnaflo™ systems consists of an assembly of specifically engineered elements positioned at intervals throughout the water bearing zones of a well. The elements are designed through hydrological engineering calculations and fluid mechanic principles to minimize the amount of water flow that can pass through each element based upon the apparent suction energy perceived at that location. Each sequential element then has a separate calculation to determine the required design to limit the flow that can pass through based upon the apparent suction energy perceived at that location, and so forth. A common misconception of the Lamnaflo™ elements is that they act as a “filter” to capture or remove the sediment in the water flow. This is incorrect and is not the theoretical intent. Each element is specifically designed to control the inlet flow through that element based upon the suction energy at that interval. The intended design of the system is to promote a more laminar style flow from all available water bearing zones. It is critical for the installer to understand that to achieve proper dissipation of suction energy throughout the well, that the entire water bearing strata must first be prepared and conditioned to encourage flow. This may be achieved through the proper development of a newly constructed well, or through complete rehabilitation of an existing well. (Lamnaflo™ can provide rehabilitation sequence recommendations upon request.) To maximize the success of proper suction flow control, the bore hole must also be sterilized to eliminate the presence of biological activity. And to promote longevity, a preventative maintenance cleaning schedule should be considered. As with all technologies, there are inherent deficiencies caused by the environment in which they are applied. Borehole management and preparation are paramount for the success of the theoretical dissipation of suction energy with a Lamnaflo™ assembly.

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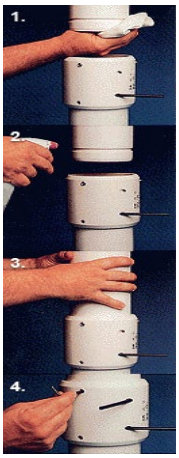
Installation:

Lamnaflo™ pioneers the advancements in suction flow technology and has continued to improve the design to create a more durable but cost-effective product. Proper care must be taken during shipping, handling and installation to avoid damage to the fragile gravel bedding on the exterior of the Lamnaflo™ elements as well as the PVC components themselves. Upon request, an installation record can be provided by Lamnaflo™. The elements will be numbered such that the element labeled number one will enter the well first, followed by the next sequentially numbered element. The elements may be interspaced with Lamnaflo™ PVC blanks of varying lengths to position the elements throughout the water bearing zone to further dissipate suction energy. The elements with the greatest slot spacing will be positioned toward the top of the system and trend closer toward the bottom. An end cap may or may not be provided to further control inlet flow suction dissipation based upon design criteria. The end cap will be perforated to minimize the development of negative internal pressure on startup, and to minimize positive pressure on shut down as well as to discharge any sediment. These internal pressure variations have proven destructive to the elements and must be minimized. A distance (sump) between the bottom of the well and the bottom of the Lamnaflo™ assembly must be maintained to protect the assembly during installation, as well as allow for the settling of any sediment that may enter the well through natural formation development. During installation, the descent rate and rotational movement of the assembly should be minimized to avoid damage to the Lamnaflo™ elements/assembly. Damage can occur from excessive friction or contact with irregularly shaped boreholes or ledges. Well alignment in compliance with the AWWA standard to the full setting depth is required to facilitate installation. Any physical force due to alignment, pressure variations, vibration, etc. may prove harmful to the assembly.



To install the Certa-Lok couplings on the elements and blanks, first thoroughly clean all sediment or debris from the components. Lamnaflo™ recommends the removal of the rubber O-rings from the couplings. A watertight seal is not critical for the successful operation of the Lamnaflo™ assembly and O-ring removal will assist with insertion of the PVC pipe into the coupling. A small film of NSF approved food grade lubricant can be applied to the surface of the exterior of the pipe and to the interior of the coupling to reduce friction. Insert the pipe into the coupling until the spline grooves align. Place a backup chain wrench on the coupling to restrain. Use a second chain wrench on the pipe to allow rotation while the spline is inserted and forced into the spline groove. The rotation of the pipe will promote spline insertion. The spline may also be coated with a film of food grade lubricant to reduce friction. Once the spline achieves refusal, the remaining protruding spline may be cut off so that a minimal (1) inch protrusion remains to facilitate eventual removal. A small stainless-steel screw or pipe tape may be installed as a locking mechanism to hold the coupling in position and inhibit rotation to hold the spline in place.

The installer will notice the gravel substrate is purposefully positioned closer to one end of the PVC pipe. The end with the greatest distance from the pipe end to the gravel is consider the “top” end and will be closest to the ground surface upon installation. This extra space has been created to allow the use of a hairpin slip to hold the element just below a properly installed coupling when suspended vertically in the well during installation. This technique is often necessary in a system that has little or no PVC blank sections and the only means of support is at the elements itself. While the hairpin slip method can facilitate installation, Lamnaflo™ recommends connecting an element to the bottom end of a blank, and then lifting this assembly into place within a pipe elevator positioned on the blank just below the top coupling to support the entire assembly at the ground surface.

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To lift the components into place, Lamnaflo™ highly recommends the use of a steel lifting bails specifically designed as the female pipe end that can be securely inserted into a Certa-Lok coupling. Lamnaflo™ brand steel lifting bails are available for purchase. Lamnaflo strongly discourages the use of homemade PVC lifting bails.

A stainless-steel suction adapter, or stainless-steel or PVC submersible pump shroud can be provided by Lamnaflo™ to create the final connection to the pumping equipment. The installer should consider the weight applied to the suction adapter or conductor pipe by the Lamnaflo™ assembly during pump selection and design. The installer must also consider the design of a submersible pump shroud to ensure proper connection as well as flow requirements for motor cooling. The motor manufacturer should be consulted to confirm proper flow velocities for motor cooling.

Startup:

Lamnaflo™ recommends that all pumping equipment be operated by a variable frequency drive (VFD) mechanism to ultimately control pump startup and shut down flow capacities. Control of the initial startup flow sequence to allow for the proper development of the water bearing formation is important. The operator must understand the suction flow control device may now cause flow throughout the entire strata and from formations that may not have been exposed to flow prior to the Lamnaflo™ installation. Great care must be taken to slowly develop out the formation by gradually increasing the discharge flow rate as sediment dissipates in the discharge water. Lamnaflo™ recommends the use of a Rossum Sand Tester to measure and record the sediment in the discharge water. Incremental increases in the flow rate should only be allowed once the discharge water is relatively free of sediment (refer to AWWA A100-20 Sec. 4.8.2.1 “Sand content shall average not more than 5 mg/L …”) Increases in flow should continue up until a maximum rate of 120% of the design flow is achieved at an acceptable sediment level. For subsequent startups a VFD or similar device should be programmed to slowly increase flow to minimize the impact of in-rush flows. Excessive startup in-rush flows may cause damage to the Lamnaflo™ elements.

Similar pump shut down procedures should be followed whereas the VFD is utilized to gradually reduce the pump’s flow. In high-capacity and/or deep-set conditions a back-flow restriction device may be necessary. Acceptable backflow devices such as a non-reverse ratchet mechanism, or bleed-back style check valve should be considered to control excessive backflow rates. Excessive backflow rates and extreme internal pressures may cause damage to the Lamnaflo™ elements.

Warranty:

In closing, while the theory and practice of dissipating suction energy for the reduction of sand in the discharge water has been successful time and again, there can be no implied warranty or guarantee for the sand content or operation of the system. Each well will ultimately determine the maximum flow it will allow in a “sand free” condition based upon the well’s formation types, construction and developmental state. Therefore, the Lamnaflo™ warranty can only cover manufacturer defects during construction of the components. Although, through the proper installation and operation of the Lamnaflo™ Suction Flow Control System, the operator will enhance the opportunity for sediment free water and minimize deposition of sediments to the well bottom. Should further information be required please visit www.lamnaflo.com . The installer should provide this memo to all clients during the marketing and sales process to ensure proper understanding of the theories as well as expectations for performance. We look forward to being of service.

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