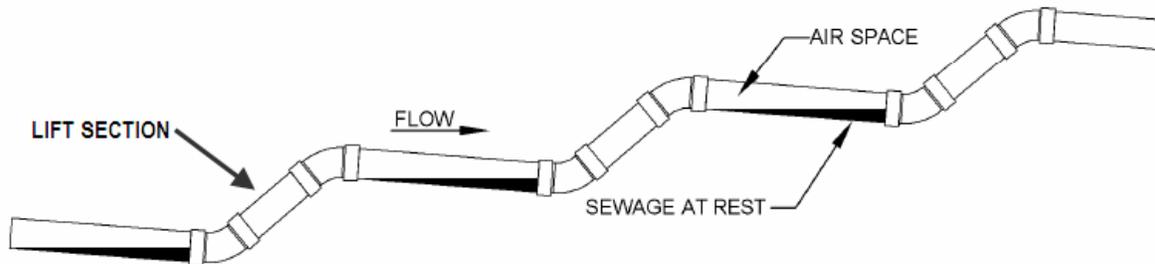


Vacuum Sewer Monitoring System Sawtooth Lift Kit

The purpose of this document is to introduce the ability of the IP Sensing Vacuum Sewer Monitoring System to identify a problem that is developing in a vacuum sewer system by monitoring the air-to-liquid ratio in the sewer mains, detecting waterlogged lines and sensing water infiltration due to sewer main leaks.

Vacuum sewers are a mechanized system of wastewater transport. Unlike gravity flow, vacuum sewers use differential air pressure to move the sewage. Sewer main lines are laid out in a sawtooth profile design so that the wastewater does not completely fill or “seal” the pipe bore. By doing this, air flows above the liquid and the vacuum that is created at the vacuum station can be transferred along the length of the vacuum sewer mains to every valve pit.



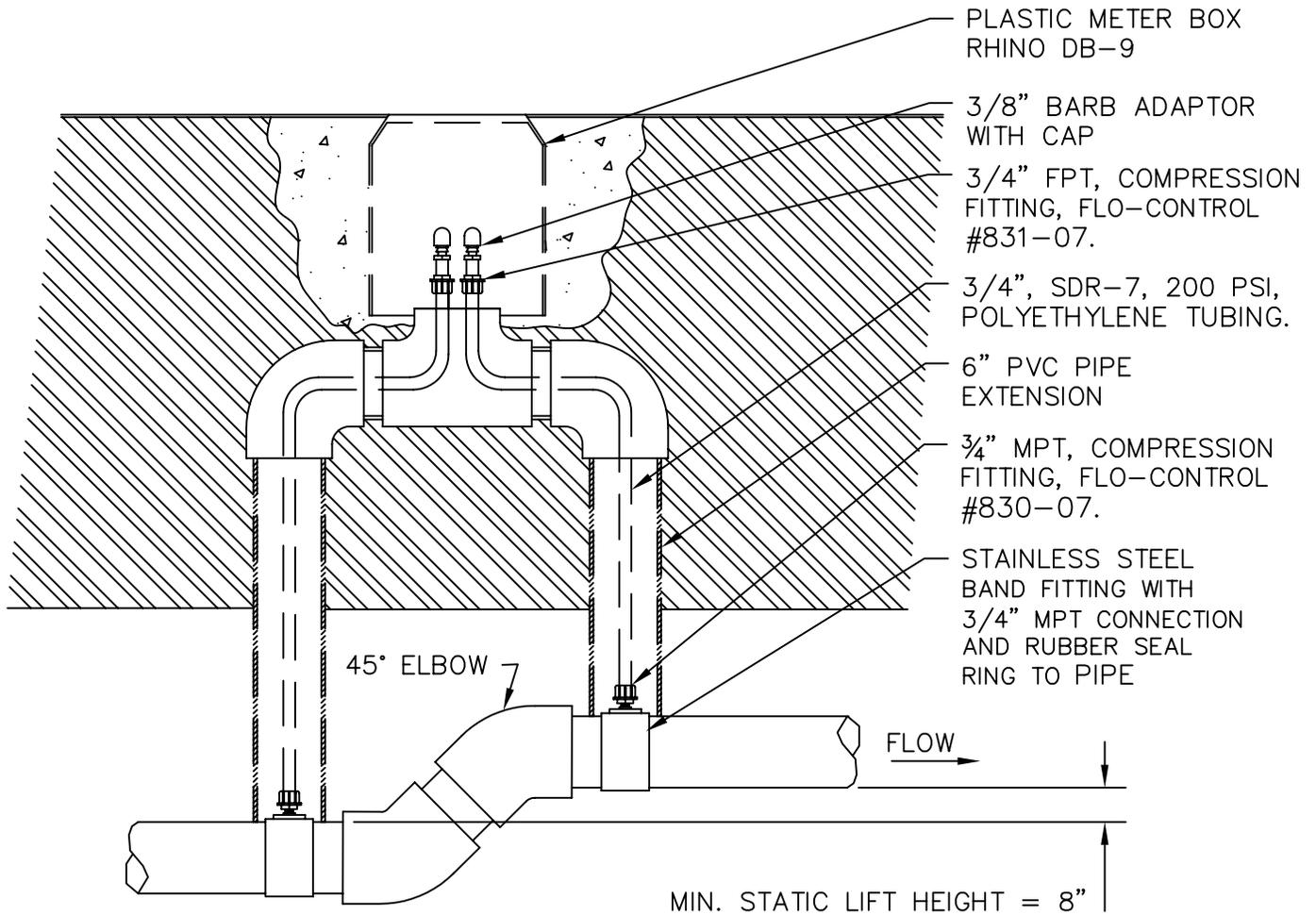
The vacuum produced by a vacuum station is generally capable of lifting 13 feet of sewage. Lift is achieved through a sawtooth layout of the lines consisting of two 45-degree fittings connected with a short length of pipe, creating a sawtooth “lift section”. Should the lift section be sealed for any reason, liquid is suspended on the downstream side of the lift and an associated vacuum loss is incurred. For every lift section filled with water, about 1 to 2 feet of lift is lost from the modest initial 13 feet of lift, leading to a waterlogged sewer main.

Culvert and utility crossings often dictate numerous variations in the burial depth of sewer mains, resulting in many sags and summits. These sags and other poorly constructed sections are the weak points of a system and will be the first lift sections trapped with sewage when the system is stressed, e.g. during periods of high sewage surge flow or extremely low sewage flow. Monitoring the status of these weak points will indicate the overall health of the vacuum sewer system and provide the operator with a preemptive maintenance tool.

It's impossible to know if a lift section underground is waterlogged without the aid of monitoring equipment. However, a simple measurement of pressure drop across the lift section will indicate whether air or liquid is present in the lift section; and while simple in application, it is an otherwise impossible task without installed equipment. The IP Sensing Sawtooth Lift Kit is a monitoring solution that simply measures the conditions of a lift section, and then uses a battery powered Pit-Bull Radio to wirelessly notify the operator of the status, e.g., a waterlogged lift section.

In a more advanced analysis, measuring the presence of gas and liquid masses in a lift section allows the Pit-Bull Radio's computer to calculate the air-to-liquid ratio in the sewer main. Further calculations define the total flow of sewage through the sewer main line, and when compared to the total valve pit's sewage flow the operator can locate water infiltration areas due to sewer main leaks.

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DETAILS BASED ON
 IP SENSING, INC.

VACUUM SEWER MONITORING SYSTEM



SAWTOOTH LIFT KIT
 PIPE INSTALLATION

SCALE: N.T.S.

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