DESIGN NOTES FOR AIR INJECTION STATIONS ON SEWAGE FORCE MAINS

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A. NEW INSTALLATIONS

The following should be avoided with receiver-mounted compressors:

1. No drip legs or petcocks for condensate at the low points in the piping, so flowmeter and control valve fill up.

2. Airflow meter too large, sized for ACFM not SCFM, so poor accuracy.

3. No pressure gauge next to flowmeter, so unmeasurable airflow.

4. Single check valve. It is prudent to use double checks to keep sewage out of the air piping. Perhaps safer yet is to have one spring-loaded ball check plus one swing check.

5. Inaccessible isolation or shutoff valve at the main. There may be a corp stop at the main, but normally it is buried. We recommend using a ball valve for isolation. It should be in the vault, not buried.

6. No needle valve. If the selected flowmeter does not contain a needle valve for adjusting the airflow, then one needs to be installed ahead of the meter.

7. Plastic piping and plastic flowmeters are incompatible with hot compressed air. Use copper and pyrex.

8. Oversized needle valve, sized for SCFM not ACFM, so poor flow control in high-head situations.

9. Untouchable plumbing assembly. Provide adequate unions to disassemble the piping for cleaning out the meter, etc.

10. Solenoids and timers in air piping. The design air flow criterion of 2 SCFM per inch diameter is based on air being injected constantly. Delete timers and solenoids.

11. Oversized compressor, sized to deliver 2 ACFM instead of 2 SCFM per inch diameter.

12. No pressure regulator on discharge from the receiver. Receivers often operate around 100-psi. A pressure regulator downstream from the receiver helps control airflows.

13. No muffling options obtained with the compressor, so it may be too noisy.

14. No automatic receiver purge. Receiver tanks fill with condensate that must be purged, often daily. Onerous operator task. Provide automatic purge valve (Smith Corporation or equal) with manual back-up.

15. Wet, slippery floor from condensate. Pipe the purge valve to some disposal location such as a floor drain, the wetwell, a gravel sump, etc.

16. In those rare situations where the discharge head is low enough to use a regenerative blower, many of the above concerns can be avoided.

B. RETROFITS ON EXISTING FORCE MAINS

1. We have had air injection proposed on mains containing air release valves. The ARV's all need to be shut off, or preferably removed. However, this may increase the head on the pumps because the "static head" in a pressurized main equals the sum of all ascending legs in the main, instead of the overall elevation difference between impeller eye and the high point or the discharge point in the main. On retrofit projects, the pump motors may be too small to pump against this extra static head and may have to be changed.

2. On retrofits, air injection will yield poor results without first dosing the force main with hypochlorite to kill the existing culture of sulfide bacteria. An established population of bacteria can be sequestered in slimes, where they may survive aerobic sewage for many weeks. This bacterial layer is too thin and resilient to be destroyed by pigging. Apply a chlorine dose similar to the dose for slug disinfection of water mains (about 50 mg/l). Control pumping to keep all portions of the main dosed for at least 30 minutes. This procedure will normally require some calculations beforehand, as it may involve multiple dosings of a wetwell with measured amounts of hypochlorite, and may entail several timed pump sequences.

C. RECOMMENDATIONS

1. Consider adding an extra check valve in the main to prevent air from blowing back through the pump checks, which can cause loss of prime and may interfere with re-priming.

2. Consider having an adjustable low-flow contact on the flowmeter which is wired to an alarm terminal. This would free the operator from routinely checking the flowmeter for adequate airflow.

3. Size the air injection system for static head instead of total dynamic head at the injection point. A reduced airflow rate during actual pumping should not lead to septic conditions in the force main, and may permit a smaller compressor.

4. Provide operator instructions how to calculate actual airflow (ACFM) @ prevailing static head gauge pressure, converted from design SCFM @ 14.7 psi absolute pressure. An excess airflow rate based on design SCFM instead of desired ACFM can cause blowback and priming problems at the pump.