Rail Depot Solutions

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Holding Tank Pumping Principles

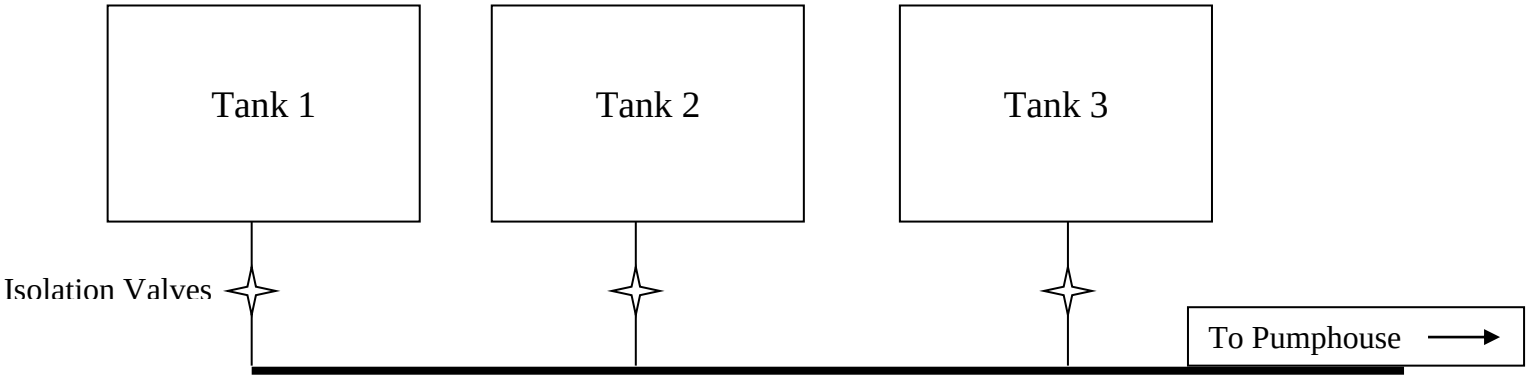
These principles have been put together to provide a greater understanding of pumping technology and how it is used when emptying effluent from on board holding tanks, when used in railway or marine applications.

For ease of understanding at all levels, simple explanations will be given to understand the physics and limitations of this type of system.

What To Consider?

In addition to the normal factors taken into consideration when selecting a pump for a system, i.e. friction losses, static head, pipework sizes and lengths, surface liquid pressure etc, when extracting from multiple points there are additional factors to be taken into consideration.

Example 1: Pumping from multiple tanks with a common suction line



In theory all tanks can be emptied simultaneously, however in practice this is not usually possible.

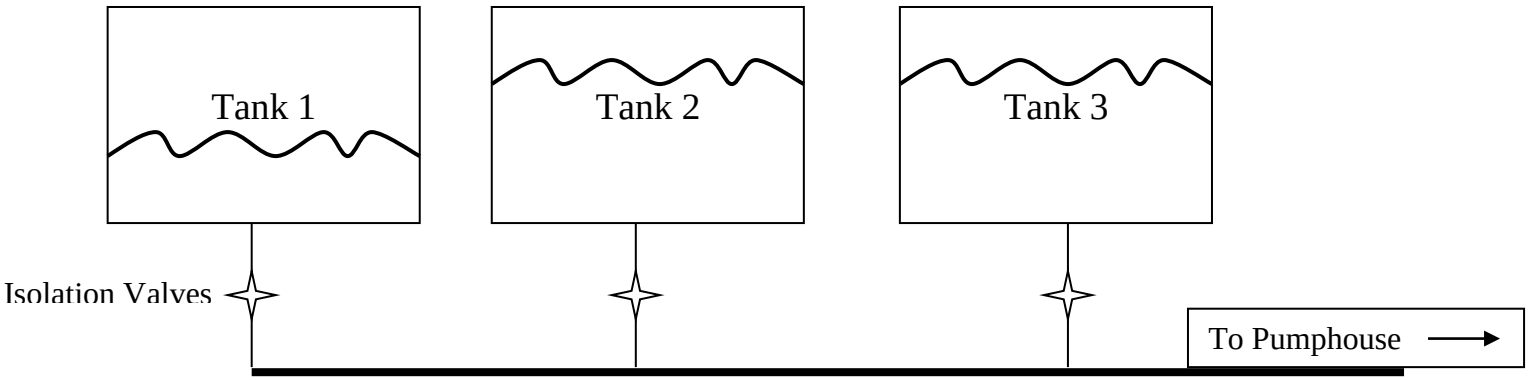
Before the pump can commence pumping, the suction line to the tanks must be evacuated of air, thus creating a vacuum that will be used to draw the effluent quickly from the tank, minimising solids settling within the tanks.

How Does This Affect an Actual System?

The vacuum can only be maintained with all valves closed or the end of all lines sealed by liquid.

Therefore, if any of the tanks has a different amount of liquid in it, once it is emptied the vacuum will be lost.

Example 2: Different Levels within tanks



In the above example, if all valves are opened simultaneously Tank 1 will empty first and then the system will stop pumping until such a time as the valve is closed and the vacuum is recreated.

If all tanks are manned by an operator who can observe when a tank is empty by a sight glass or the movement of the flexible hose, it would be possible to close a manual valve and continue pumping after the vacuum has been recreated.

However, the reduction in velocity caused by this method of operation could cause settlement of solids in the tank, which may not become apparent for a considerable amount of time and would require the tank to be stripped and cleaned.

So What is The Quickest Way to Empty Multiple Tanks?

When long suction runs are involved, for example in Large Marinas or Railway Depots, a method of emptying the tanks in as fast a time as possible is required to move the Boats/Trains away from the pumping system and allow more to be brought in.

The fastest way to achieve this is with an automated system controlled by a Programmable Logic Controller (PLC) which can reduce the labour element of the works to a minimum.

The principle of such a system is that the operator need only connect the hose, start the system that would open an actuated valve and then walk to the next tank and repeat the operation. The PLC would control the start of the subsequent valves after each previous one was completed.

This would continue until the last hose was connected and the operator would then return to the first hose connected and start disconnecting the hoses that are now completed.

The same result can also be achieved with the use of additional operators, in radio contact to confirm completion of cycles at each point.

When working out timings it is worth considering that, on a correctly designed system, worst case priming time should be no more than 40 seconds and pumping should be 8-12 l/sec. Therefore a tank of 450 litres could be emptied in less than 2 minutes, from start of the pumping equipment.

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