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Comparative Analysis of Hydropneumatic Systems

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Abstract – *In both domestic and commercial applications, uneven water pressure is a concern. Booster systems are used in houses/villas, high rise buildings, shopping malls, hospitals, hotels, and airports to avoid this issue. These pumps are very powerful and keep the pressure in the pipes constant.*

Key Words: Hydropneumatics, Plumbing, booster pump.

1. INTRODUCTION

The term "booster pump" is more commonly used than "hydro pneumatic system" because it is used to increase or sustain water pressure in pipes. Pressure tank is used to meet initial or temporary requirements by using air under pressure. Ideally hydropneumatic systems are divided into four categories, namely,

- hydropneumatic System of fixed speed boosters
- hydropneumatic pump with variable speed (single VFD)
- variable speed hydropneumatic system, (Multi VFD)
- Jockey pump and variable speed booster system

2. Multi VFD hydropneumatic system

The booster system's main components are,

1) Motorized pump,
2) Pressure transmitter, pressure switch, and control panel,
3) Manifolds,
4) Pressure Tank.

System prerequisites is to maintain a constant pressure despite variations in flow demand.

1) Multistage vertical inline pumps. Impellers, stage casing, and shafts should all be made of stainless steel to ensure corrosion resistance and a longer service life.
2) Since the hydraulic components are made of stainless steel, this type of pump can handle corrosive fluids.
3) A moderately drooping curve with 1.5 bar AP is recommended.
4) To prevent a built-in thrust bearing in the engine, use a standard IEC flanged or face mounting motor.

The optimal specifications for control panel in a multi-variable frequency drive (VFD) are as follows,

1) Smooth operation with PID logic
2) System to maintain steady pressure in pipes with no jerks
3) Human-machine interface (HMI) with pump graphics on a programmable logic controller (PLC).
4) With a sensor on the suction header, low pressure is cut off.
5) Switch off the high-pressure machine
6) To prevent abuse, a multi-level password is recommended from a security standpoint.

Installing a pressure tank with a replaceable bladder surrounded by pressurised air of ample capacity is also recommended based on demand calculations.

In addition, the following points are suggested for a smooth operation:

For smooth operation of the system with no jerks in the main pipeline, it is recommended to use NRV & isolating valve after the distribution header. At most of the locations, the NRV and isolating valve are absent.

When there is a sudden drop or rise in pressure, a common NRV (i.e. NRV after the booster system delivery header) can avoid back pressure in the system.

The shut off head of the pump is the best way to verify the pump's condition. The presence of an isolating valve in the main pipeline aids in the monitoring of the pump shut-off pressure. If the pump's shut head is in good working order, the pump does not need to be dismantled.

3. Fixed speed /variable speed pumps (for OH tank filling)

For overhead tank applications or water transfer applications, the best horizontal SS pump range is for a head of 60 m to 80 m. Horizontal pumps are lightweight and easy to manipulate. Since the motor and pump are directly coupled, no baseplate, coupling, or alignment are needed.

Vertical pumps have a higher initial cost and maintenance cost than horizontal pumps. The pumps should preferably be set to Auto Operation mode. The best way to do this is to synchronise the start and stop of the pumps with the level sensors in the overhead tank.

Pumps with a fixed or variable speed for overhead tank applications
- One overhead tank
- Multiple overhead tanks

The booster system's main components are,

1) Horizontal or vertical centrifugal pump, depending on the duty parameter.
2) Pressure switches and control panel
1) Manifolds are a type of manifold (suction header, discharge header, nonreturn valves, isolating valves, pressure gauge)
3) A pressure tank is used to keep the pump from jerking at start-up.

System prerequisite is to ensure that the OHT is automatically filled or that water is transferred depending on the water level in overhead tanks.

Vertical/horizontal pump

1) Depending on the discharge pressure, horizontal or vertical pumps are used (Complete Stainless-steel pump for longer life & no corrosion).
2) High performance, which is also flow-based.
3) Since the hydraulic components are stainless steel, this type of pump is also suitable for corrosive fluids.
4) A horizontal end-suction pump made of fabricated stainless steel with no welding on the casing is being investigated.
5) To minimise torque on the motor shaft, it is necessary to reduce impeller load; thus, manufactured stainless steel impellers will be a safer option because they are lighter.

Control panel with fixed VFD

6) The panel can work automatically depending on the pressure switches and the water level in the OHT and UGT.
7) To prevent pumps from running out, the water level in the UG tank is controlled using float or conductive level sensors.
8) Pumps may be operated in manual or automatic mode.
9) Overload protection, single phasing, low/high voltage protection

Pressurized air is surrounded by a 200 lit pressure tank with a replaceable bladder. This ensures that the pumps operate automatically based on the water level set in the OHT. It also prevents the pumps from starting and stopping often.

It is recommended that, similar to the booster system, you invest in the following:

For smooth operation of the system with no jerks in the main pipeline, it is recommended to use NRV & isolating valve after the distribution header. At most of the locations, the NRV and isolating valve are absent. When there is a sudden drop or rise in pressure, a common NRV (i.e. NRV after the booster system delivery header) can avoid back pressure in the system. The shut off head of the pump is the best way to verify the pump's condition. The presence of an isolating valve in the main pipeline aids in the monitoring of the pump shut-off pressure. If the pump's shut head is in good working order, the pump does not need to be dismantled.

4. CONCLUSION

It's important to consider the distribution of pressure when making water connections or pipe runs between within your home and in both commercial and domestic applications. to stop noise pollution, house extensions, high rise towers, malls, hospitals, and airports use noise control systems, and pumps will pump the water at various point along with varying demand, keeping the same pressure. In all cases if necessary, precautions are taken then these systems can provide optimum performance

REFERENCES

[1] https://www.iapmoindia.org/
[2] Handbook of Pumps and Pumping, 2006.
[3] https://www.indianplumbing.org/