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AUTOMATIC SULPHUR SUCTION WITH EDDY PUMP USING DIRECTION CONTROL VALVES IN GODOW

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ABSTRACT- *The transferring of sulphur with the help of cranes, front loaders and conveyors to the acid plant will results in additional cost and energy loss. This is where automatic sulphur suction using control valves comes onto play. The updating of the existing conveyor and crane systems to the automatic vacuum suction pump for sulphur transferring is included. This results in the involvement of various operators for different operations such as the crane operators, front loader operator, conveyor operator etc. along with cranes, front loader and conveyor. Here lays the importance of automatic sulphur suction pump with direction control valves. Automatic sulphur suction pump is the pump that works due to vacuum created inside the pump and the sulphur can be easily pumped to the required destination. Automatic direction control valves are used for the purpose of deciding the direction of the pumping.*

1. INTRODUCTION

Today the transferring of sulphur is carried out with the help of cranes from the barge to the godown, front loader from godown to the conveyor and conveyor to the acid plant. That is there is a lot of sequence in reaching sulphur to the acid plant. This results in the involvement of various operators for different operations such as the crane operators, front loader operator, conveyor operator etc. along with cranes, front loader and conveyor. Here lays the importance of automatic sulphur suction pump with direction control valves. The pump that works due to vacuum created inside the pump and the sulphur can be easily pumped to the required destination. Automatic direction control valves are used for the purpose of deciding the direction of the pumping. The transferring of sulphur with the help of cranes, front loaders and conveyors to the acid plant will results in additional cost and energy loss. This is where automatic sulphur suction using control valves comes onto play. The updating of the existing conveyor and crane systems to the automatic vacuum suction pump for sulphur transferring is included.

Automatic sulphur suction can help to remove the various crane and conveyor operators' effort in transferring the sulphur to the plant. The use of vacuum suction pump enables efficient transferring of sulphur to the acid plant and godown with the help of automatic direction control valves. Automatic vacuum suction pump with control valves for sulphur transferring helps save money, time and resource. The maintenance of crane, front loader etc. is removed and one or two operators are only needed. To reduce working time, operators effort, overall cost and to avoid crane and front loader maintenance.

2. COMPANY PROFILE

2.1 Evolution of Fact

The FACT, India's first large scale fertilizer unit dates its existence from the pre independence years and to be specific from the year 1943. The company's main business is:

- To manufacture and market Fertilizers
- To manufacture and market Caprolactum
- Engineering consultancy
- Fabrication of Equipment's

3. EDDY PUMP

3.1 The 3 Most Common EDDY Pump Setups Are:

- Flooded Suction Pumps
- Submersible
- Self-priming

Flooded Suction EDDY Pumps

When your pumping application involves the target slurry or gravel in a tank, hopper, etc that is positioned above your pump, this usually signifies a flooded suction application. What this means is that the gravel or slurry is positioned in a way where it can gravity feed into the suction of the pump. This then automatically primes the pump and allows it to move the slurry or gravel. Some common applications for this setup are process pump applications that are often found inside of plants and facilities.

Submersible EDDY Pumps

Submersible pump setups mean that the pump is submerged in the gravel or slurry that is being pumped. Since submersible pumps are completely submerged in gravel, they do not need to be primed, which can be an advantage over pumps which are positioned outside of the gravel. Being submerged inside the source material also provides max efficiency and pumping distances when compared to a self-priming unit.

Self-Priming EDDY Pumps

Non-submersible and or barge-based pumps, ideal for portable situations, functioning like an extreme shop-vac. A self-priming pump (as shown in Fig.1) is different from a standard centrifugal or EDDY pump in that it has the ability to remove air from the volute and suction hose. A vacuum-assisted priming unit built into the pump automatically primes the pump by drawing gravel into the pump to prime it. This process repeats if air is introduced into the pump or suction line, ensuring the pump continues sucking target material. All pumps need to have a flooded case, aka the volute, for pumping to take place. Self-priming units ensure the pump is primed when the unit loses suction.

Fig 1. Self-priming EDDY pump

3.2 Critical flow rate estimation:

Critical flow rate is the transition flow rate between a laminar and a turbulent ow and is calculated based on grain diameter (size of slurry particles), the concentration of solids in the slurry and the pipe diameter. For minimal settlement of sediments, the actual pump flow rate of your pump should be higher than the calculated critical flow rate for your application. However, it is important to be careful with the selection of the pump low rate as the increase in flow rate will increase the wear and tear or abrasion of the pump material and hence reduce the lifetime of the pump. Hence, for an uninterrupted performance and extended lifetime, the pump flow rate should be optimized.

3.3 Discharge head estimation:

Total discharge head is a combination of static head (actual elevation difference between the surface of the slurry source and the discharge) and friction loss in the pump. Along with dependence on the geometry of the pump (pipe length, valves or bends), friction loss is also affected by the pipe roughness, flow rate and slurry concentration (or percentage of solids in the mixture).

The friction losses increase with the increase in pipe length, the speci c gravity of the slurry, concentration of the slurry or the slurry flow rate. The pump selection procedure requires that discharge head of „your" pump is higher than the calculated total discharge head. On the other hand, it is crucial to note that the discharge head should be kept as low as possible to reduce the pump abrasion due to slurry.

3.4 Pump power rating:

Pro Tip – How to Choose a Pump

Essential Questions

1. What type of material will be pumped? (sand, mud, coarser particles, sludge, etc)
2. Flow rate target goals? (400 GPM, e.g.)
3. Length of pipeline? (700 FT or M, e.g.)
4. Elevation rise of pipeline? (20 FT or M, e.g.)
5. Type of pipeline? (plastic, metal, e.g.)
6. What is the density of the material?
7. What is the viscosity of the material

The power consumption by the dredge pump is estimated from the discharge head, low rate and special gravity of pumped slurry. It is critical to verify that power rating of the selected pump is higher than the calculated power consumption after taking into account reasonable variations in operating conditions.

3.5 Material selection:

Typical material used for the construction of slurry pumps are cast iron, stainless steel, and high chrome steel. Some slurry pumps come with a lining to better deal with problems of slurry abrasion. A few elastomers which are used in the lining material are natural rubber, polyurethane or neoprene. The selection of lining material depends on the operating temperature, pH of slurry and the presence of special abrasive fluids used in the dredging process.

4. BLOCK DIAGRAM OF SULPHUR TRANSFER

Fig 2 illustrate the block diagram of sulphur transfer image

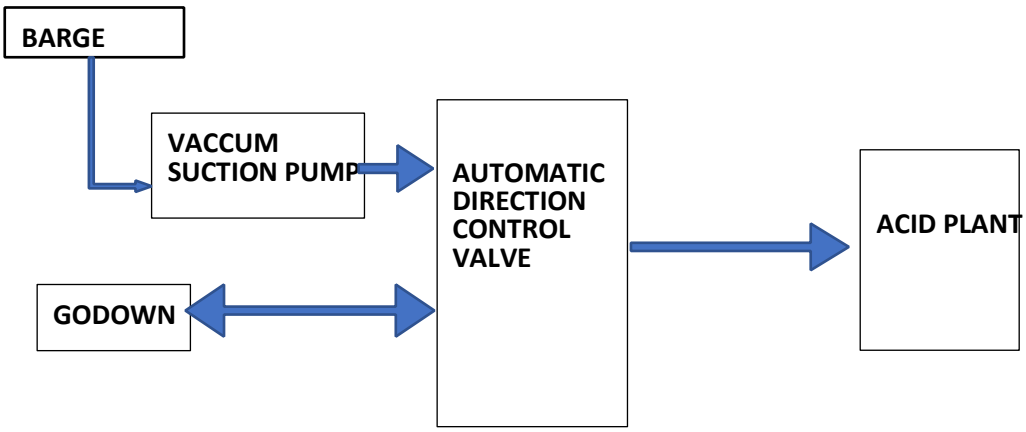

Fig 2. Block diagram

5. DIRECTION CONTROL VALVE

Directional Control Valves can be classified according to:

- number of ports
- number of positions
- actuating methods
- type of spool

Example: A 4/2 directional control valve would have four ports and two spool positions.

Ports are located on the manifold to which the directional control valve is mounted, and are used as connection points to the system. In general, there are 4 ports; P-pump (Supply), T-tank or oil sump (Return) and lastly A and B, which are the outputs to the actuator the valve is controlling.

5.1 Number of positions

Including the normal and working positions, which a valve spool can take, there are valves with two position and three position. Proportional valves operate over an electric variable input signal, and the position of the spool is proportional to the command signal.

- Actuating methods.
- Manual, spring, electrical, pneumatic, and hydraulic.

5.2 Manually operated

Manually operated valves work with simple levers or paddles where the operator applies force to operate the valve. Spring force is sometimes used to recover the position of valve. Some manual valves utilize either a lever or an external pneumatic or hydraulic signal to return the spool.

5.3 Mechanically operated

Mechanically operated valves apply forces by using cams, wheels, rollers, etc., hence these valves are subjected to wear.

5.4 Hydraulically operated

A hydraulically operated Directional control valve works at much higher pressures than its pneumatic equivalent. They must therefore be far more robust in nature so are precision machined from higher quality and strength materials.

5.5 Solenoid operated

Fig 3 illustrate directional valve, 5/3 sliding spool type, solenoid operated, showed on neutral position. P is pressure inlet, A and B are utilization ports, TA and TB are return ports. When solenoid (magnet) A is energized, the spool is pulled to left, connecting the ports P to A and the ports B to TB. When solenoid B is energized, the spool is pulled to right, connecting P to B and A to TA.

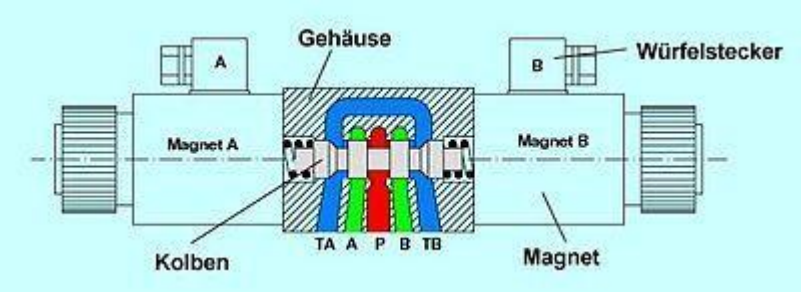

Fig 3. Solenoid valve

5.6 Gate Valves

The Gate valves are characterized by a siding gate which is moved by the stem perpendicular to the direction flow (as shown in Fig.4). Application - It is used for on-off application. Suited for high temperature and pressure use with variety of fluids. They are not primarily used for slurries, viscous fluid etc. Advantages of Gate Valve - Low pressure drop when fully open and tight sealing Disadvantages of Gate Valve - Causes vibration, seat disc wear in partial open condition. Slow response characteristics and require large actuating force.

Fig 4. Gate valve

5.7 Final Control Element

Final Control Element refers to the high-performance equipment needed to provide the power and accuracy to control the flowing medium to specific service conditions (as shown in Fig.5).

- Part of the control loop, which consists of at least two other elements besides the control valves:
- Sensing element
- Controller
- Control valve makes a change automatically, based on a signal from the controller, and the sensor measures and verifies the change
- Control valves are the most common final control element

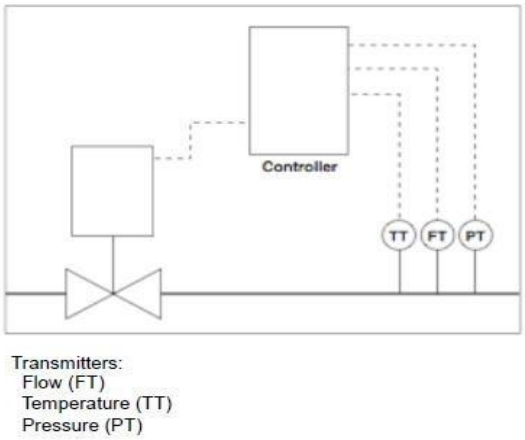

Fig 5. Final control element

5.8 2-inch EDDY Pump

Fig 6 illustrate the non-Clog, High Viscosity, High Specific Gravity, High Abrasives, Low pH Pumping Design. 40-70% Solids Pumping by Volume. Ability to pump objects of up to 1-inches in diameter. 3100% American Built. 4State-of-the-Art Research and Development Facilities on site. Easily process rags, string, rocks and foreign objects. Vertical / Horizontal Mounting. Submersible / Immersible. Electric / Hydraulic. Various Metals Available. Variable Speed Control. Self-Priming. Trailer / Skid Mounted. Bearing House / Close-Coupled. Automated Controls. Pump Benefits: Ideal for Process, Slurry Applications, Open Rotor For Lowest Wear Possible, Lower Total Lifecycle Cost, No Critical Tolerances, Low Maintenance, Minimal Downtime

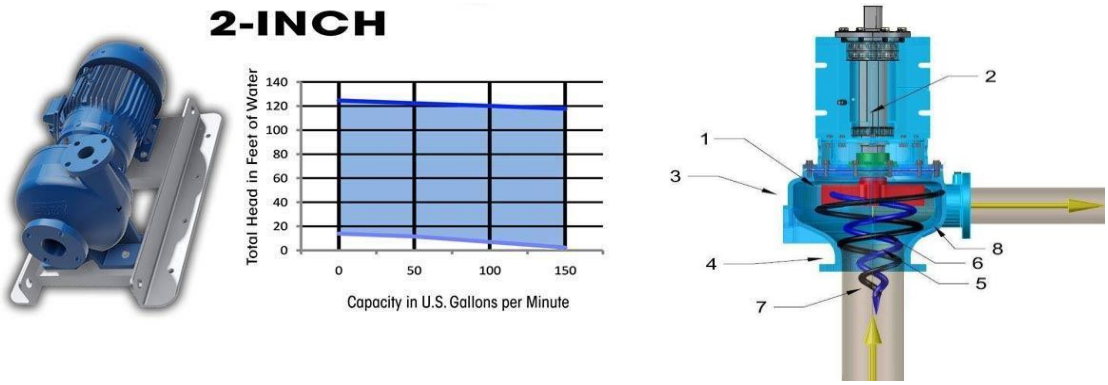

Fig 6. 2-inch EDDY pump

6. HOSE

Selecting the best hose for your pump relies on knowing several variables relating to aspects of the operation (as shown in Fig.7). While the cost of a new hose might be a drop in the bucket compared to the overall cost of the operation, when a hose stops functioning, it can bring the entire operation to a grinding halt, significantly affecting production rates. Therefore, selecting the correct hose initially could actually improve production rates from sheer lack of maintenance.

6.1 Why Use a gravel Hose?

Gravel hoses are the tough alternative to rigid and heavy steel pipelines. They are easy to maintain and install, often on-site with basic tools. Pipelines work great for moving material, but they are inflexible, offering little in the way of customizing once installed. Hoses offer much-needed mobility in contrast to pipelines, working great for applications which require frequent relocation of the pump, like dredging. The slurry hose can bend and easily fit into existing pipe structure with no welding necessary. Additionally, gravel hoses help to absorb system vibration, saving wear on crucial equipment.

Benefits of a gravel Hose vs Hard Pipes: Reduced vibrations and noise, Compensates for heat and cold expansion, Able to be fitted on-site, Flexible movement, Constructed from a variety of compounds depending on need.

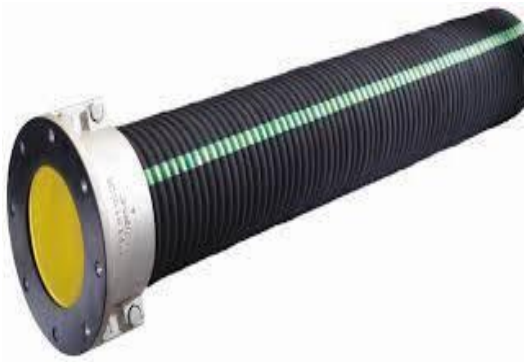

Fig 7. Hose

6.2 Selection Factors

One of the better ways to remember the factors and variables that go into selecting a proper slurry hose is to use the acronym STAMPED, which stands for:

S: Size (Size of inside diameter, outside diameter, and total length including fittings and tolerances)

T: Temperature (Ambient temperature as well as the temperature of the material)

A: Application (Configuration, routing, orientation of the hose)

M: Material (Type of material, concentration of solids, pH level, flow rate, and velocity)

P: Pressure (Max pressure within a system. The hose and hose end should not be rated to a pressure less than the maximum operating pressure system.) **E** – Ends (Hose style, type, orientation and attachment methods, coupled or uncoupled)

D: Delivery (How quickly the job must be completed)

By compiling the above data about the project, you are now primed for selecting the correct type of slurry hose.

7. ARDUINO

Fig 8 illustrate the arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices. Its products are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL),[1] permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form or as do-it-yourself (DIY) kits.

Fig 8. Arduino

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards ('shields') or breadboards (For prototyping) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers.

The microcontrollers can be programmed using Cand C++ programming languages. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project. The Arduino project started in 2005 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy,[2] aiming to provide a lowcost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats and motion detectors. The name Arduino comes from a bar in Ivrea, Italy, where some of the founders of the project used to meet. The bar was named after Arduino of Ivrea, who was the margrave of the March of Ivrea and King of Italy from 1002 to 1014.

8. CONCLUSION

Hopefully, we have a better understanding of the elements needed for proper pump selection. EDDY Pump are committed to providing best-in-class dredge pumps to the customers; hence, each component is thoroughly tested to deliver supreme quality, reliability and versatility. The unique technology provides us with an extraordinary capability to easily handle materials with enormous volumes and high specific gravity in tough conditions. Thus the transferring through the conveyor with front loaders and cranes can be overcome with the help of automatic vacuum suction pump with direction control valves.

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