International Journal of Engineering and Information Systems (IJEAIS)
ISSN: 2643-640X
Vol. 4 Issue 10, October - 2020, Pages: 112-115

Pump Units and Their Characteristics

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***Abstract* —** *This paper provides information about the types of electric pump drives and their applications.*

Keywords — pump station; hydraulic tanks; pneumatic pump; low pressure;

A pumping unit is whose components are mounted according to a certain scheme that ensures the operation of the pump. In Fig.1. the diagram of a pumping unit for pumping liquid is shown. The pump 9, driven by an electric motor 10, sucks the liquid from the flow tank 2 and along the suction line 5 and pressure line 13 pumps the liquid to the receiving tank 16.

You can specify that the pump system has the following elements:

- hydraulic tanks (hydraulic capacity);
- hydraulic line (highways, pipelines);
-control and measuring equipment (pressure gauges, flow meters, electrical measuring devices);
- start-up and control equipment (valves, gate valves, electrical equipment devices);
- fire fighting equipment;
-auxiliary equipment (hoists, crane beams).

The structure of structures, type and quantity of main and auxiliary equipment of the pumping unit is determined based on the purpose of the pumping unit.

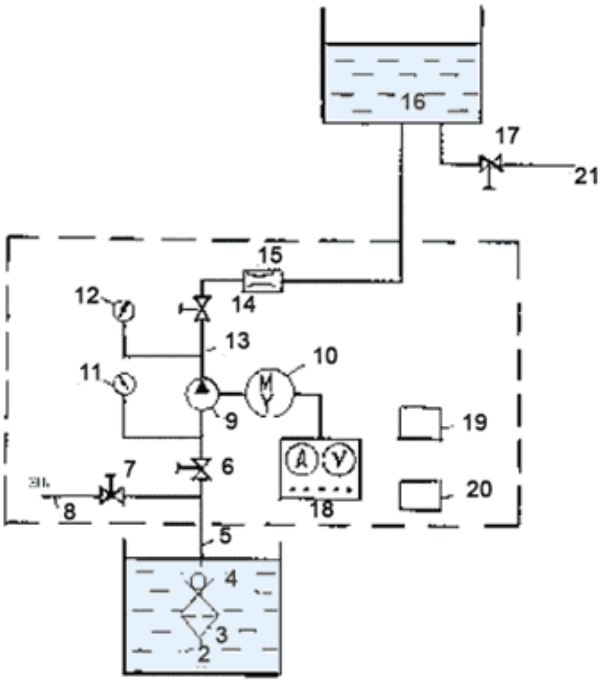

Fig. 1. Diagram of the pumping unit:
1 - building (room) for pumping unit; 2 - flow tank; 3-filter; 4-check valve; 5-suction line; 6, 7, 14, 17 - valves; 8 - line for the fill pumps; 9 - pump; 10 - motor; 11, 12 - manometer; 13 - supply pipe; 15 - meter; 16 - reception capacity; 18 - control panel the pump unit; 19 - fire-fighting equipment; 20 - a auxiliary equipment; 21 - drain line

A log (or passport) is created for each pumping unit, which contains the following sections:

- logging rules;
- carrying out regulations and performing works on the installation (equipment) during operation;
- accounting for the running time of the installation and equipment;

-accounting of technical inspections of the installation and equipment;
- accounting for installation and equipment failures;
- assessment of the state of the installation and equipment;
- registration of changes in the composition of the pumping unit and оборуequipmentдования.

The above types of work are performed on the basis of documents (passports) of elements of the pumping unit.

To use the pump for its intended purpose, it is necessary to supply energy to it. There are different types of energy to drive the pump, for example, electric energy, mechanical energy, thermal energy, solar energy.

A pump unit is a unit consisting of a pump or several pumps connected to each other and a driving motor.

Types of pumping units can be classified:

by type of drive:

an electric pump unit in which the driving motor is an electric motor;
pipe-pumping unit in which the driving engine is a hydraulico- or pneumatic turbine;
diesel-pumping unit in which the driving engine is diesel;
a motor pump unit in which the driving engine is a carburetor engine;
hydraulic pump unit, in which the driving motor is a hydraulic motor;
pneumatic-driven pumping unit, in which the driving motor is a pneumatic motor;

according to the design of the pump with the drive:

electric pump - a pumping unit, driven by an electric motor, the components of which are included in the design of the pump;

turbo pump - a pumping unit, driven by a turbine, the components of which are included in the design of the pump;

steam pump - a pumping unit driven by a steam cylinder, the switchgear of which is included in the design of the pump;

hydraulic drive pump - a pumping unit driven by a hydraulic cylinder, the switchgear of which is included in the design of the pump;

pneumatic pump - a pumping unit with a pneumatic cylinder drive, the switchgear of which is included in the design of the pump.

In water supply, drainage, heating and other systems, electric motors are usually used to drive the pump. Thus, the electric pump unit is the most common element of hydraulic installations.

According to the energy source pump stations are classified into electric and thermal stations. The latter are driven by an internal combustion engine. Pump stations may either be operated seasonally or throughout the year. A distinction is made between pump stations with surface and underground water intake. Stationary pump stations are installed indoors, in rooms or buildings designed for core and auxiliary hydro mechanical, electrical and mechanical equipment, pipeline valves, etc. According to their design features they may be split into above-ground, chamber and modular pumping stations. Stationary pump stations may have either manual or automatic control. The choice of a stationary pump station is determined by several factors as well as technical and economic calculations.

Mobile pump stations as compared to the stationary type are more mobile, maneuverable and 20-25% less expensive. They are used to feed water into the open or closed type irrigation systems, sprinklers and water supply systems. Mobile pump stations are easily transportable, which makes them flexible for different irrigation areas during the entire irrigation season. Their expedient use in irrigation of floodplains, with significant fluctuations in the water level in the source, does not require the construction of expensive water intake devices, and the depth of water source at the site of water intake should not be <0.6-0.8 meters. If the depth is less, a most simple retaining structure or a pit should be used. When choosing a location for the installation of a mobile pumping station, one should look at the water access and the site for the pumping station, which should provide a suction height of max. 1.5 to 3 meters. Mobile pumping stations can be land and floating, they can have their own internal combustion engine and an electric motor driven by a shaft with power take-off from a tractor that transports the pumping station to all water intake points. Land pump stations, in turn, may be classified into suspended or trailer design. Considering their wide range of applications in land improvement, mobile pump stations are mass-produced, easy to install and move in case of changing water level in the source and service several sites.

Power-driven mobile pumping stations are classified according to their capacity: 25 - 750 liters per second, head: 5 - 100 meters, design of the running gear: skids or wheels.

Pump stations are usually installed within a short period using high technologies, advanced unified equipment and innovative construction practices. Pump stations or units include a pump room, water intake systems, intake chambers, diversion chambers and water tanks. Any pump station includes electrical components and a transformer substation which may also be installed in the pump room. Some of the above equipment may be dispensed with or functionally integrated with other equipment. For example, a pump room and a water intake chamber may be combined into the same engineering structure, which is typical for the first stage pumping stations. Water disposal pump stations may have a pump room combined with a receiving tank. Pumping equipment of a pump station may differ depending on its application: there are stations with horizontal and vertical arrangement of pumps, axial and centrifugal pumps, which may be installed with a positive suction height or with flooded suction.

There are the following types of pump stations according to pump room arrangement with respect to the ground level:

- land-type;

- semi-recessed stations;
- recessed;
- underground stations.

Land pump stations are characterized by pump room floor flush with surrounding land surface. Truck access may be available.

In semi-recessed pump stations the floor is recessed relative to the land surface and there is no floor structure between the pump room and the first floor which is typical for recessed pump stations. If the recession is quite deep, additional underground floors for auxiliary equipment may be constructed. Such stations are called shaft-type pump stations.

Underground pump stations are characterized by entirely underground arrangement, compact design and automatic control. They may have a rectangular (easier installation of unified components of equipment), round, elliptical (improved take-up of hydrostatic pressure) or complex shape. According to the type of control pump stations are divided into: - manual control stations, where operators control the station's operation; - automatic control stations, when the station operates automatically and control is performed based on water level in the tank or water pressure in the line, etc.; - semi-automatic control stations, when the station is switched on and off by the operator while all the other operations are performed automatically; - remote control stations operated from remote pulpit. When selecting a pump station, it is common to compare all the technical characteristics and economic indicators of several types of stations, depending on the purpose and future application of the equipment, waste waters are analyzed (for the presence or absence of solid inclusions, viscosity, density, aggressiveness of media and temperature conditions). It is also important to determine the scope of application: whether it is a household or industrial pump unit.

Taking about types of pump stations they may also be subdivided into:

- water pump stations,
- sewage pump stations.

Sewage pump stations are designed for waste water disposal: storm, sewage, industrial waste waters. They are noted for the following advantages:

- extended service life; this is often explained by the use of fiberglass for the component parts, which does not rust and does not decay;
- safe operation due to pressure and level sensors, which control the system's operation;
- compact design;
- possibility of a completely automatic operation mode;
- environmental approach to operation: no foul smell or uncontrolled discharge of waste waters.

A sewage pump station is installed inside a housing and includes pumps (main and auxiliary), sensors, pipeline and connection piping. The main distinctive feature of a sewage pump station is the availability of a special container for removing large particles contained in the waste water. The container is regularly removed and emptied, then cleaned. Sewage pump stations may function in almost all atmospheric conditions, which is also a positive aspect.

In today's independent water supply system, the most important component is a pumping unit, which is either purchased ready-made or is assembled by the user, if it is a compact installation for a private house. In order to avoid any problems with the operation of the pumping unit, one should understand the principle of its operation. To select a pump station according to your needs, one should bear in mind two factors: technical parameters of the pump station and specifics of the well. Among the technical specifications delivery rate is of primary importance. It means that the station should lift the volume of water sufficient to cover all the household and related needs. Among the characteristics of the well an important role is played by its capacity, depth, static water level (pump out of operation), dynamic water level (pump in operation), filter type and pipe diameter. Standard pump stations efficiently lift water from wells up to 9 meters deep. They may be equipped either by a self-priming centrifugal pump or a self-priming vortex pump. With respect to the station's flow rate the practice shows that: for a residential building housing a family of four a pump station of low or medium flow rate (2-4 m^3/h) and head of 45-55 m may be sufficient.

Pump stations with an accumulation tank are considered obsolete, but they still exist. Accumulation tank is very bulky, its water level and pressure are controlled by a float, the data are displayed on a sensor which signals for water make up. It has always been a popular water supply system, however it had a lot of drawbacks:

- always low pressure, as water enters the tank by gravity;
- large size of a tank;
- complicated installation since the tank has to be located higher than the station itself;
- if the overflow sensor fails, water starts overflowing into the room.

State-of-the-art pump stations are equipped with a hydraulic accumulator. The idea is that a pressure switch is installed at the station. The stations that are equipped with a hydraulic accumulator are considered advanced and have less drawbacks. The switch controls the upper pressure limit of the ambient air, which is compressed in the hydraulic accumulator under water pressure. After the required pressure is achieved, the pump switches off to switch on only upon receiving a signal from the pressure switch on the lower pressure threshold.

References

[1] Mirzaev, Uchkun, Mathematical Description of Asynchronous Motors (April 15, 2020). International Journal of Academic and Applied Research (IJAAR), 2020, Available at SSRN: https://ssrn.com/abstract=3593185 or http://dx.doi.org/10.2139/ssrn.3593185

[2] Mirzaev, Uchkun, Choice For Electric Power Unit Smoke Exhausts №1 Tolimarjon Thermal Electric Power Plant (April 30, 2020). International Journal of Engineering and Information Systems (IJEAIS), 2020, Available at SSRN: https://ssrn.com/abstract=3593125

[3] Mirzayev Uchqun, Tulakov Jahongir. The Research of the V-I Characteristics of Solar Panel Using a Computerized Measuring Bench "EPH 2 Advanced Photovoltaics Trainer". Automation, Control and Intelligent Systems. 2019; 7(3): 79-83. doi: 10.11648/j.acis.20190703.11 ISSN: 2328-5583 (Print); ISSN: 2328-5591

[4] Mirzaev, Uchkun, Experiment of Open-circuit Voltage in 'EPH 2 Advanced Photovoltaics Trainer' Laboratory and Types of PV Cell (April 30, 2020). International Journal of Engineering and Information Systems (IJEAIS) Vol. 4, Issue 4, April – 2020, Pages: 41-46; ISSN: 2643-640X, Available at SSRN: https://ssrn.com/abstract=3623014

[5] Mirzaev, Uchkun, Study of the Electrical Characteristics of a Solar Panel for Multi-Residential Apartments Using a Computerized Measuring Stand 'Eph 2 Advanced Photovoltaic Trainer' (2020). International Journal of Academic Engineering Research (IJAER) ISSN: 2643-9085 Vol. 4, Issue 4, April – 2020, Pages: 59-61 , Available at SSRN: https://ssrn.com/abstract=3622045

[6] Acarnley PP. Stepping Motors: A Guide to Modern Theory and Practice. 4th ed. London, IET; 2002. Pages: 85-86

[7] Hendershot JR, Miller TJE. Design of Brushless Permanent-Magnet Motors. LLC. Motor Design Books;