efesotomasyon.com

Constant-Pressure Water Supply and Energy Saving Rebuilding Plan

I. Principle for Energy Saving

According to the theory of hydrodynamics, the relationship among motor shaft power (P), air quantity (Q), and pressure (H) is defined by the following formula:

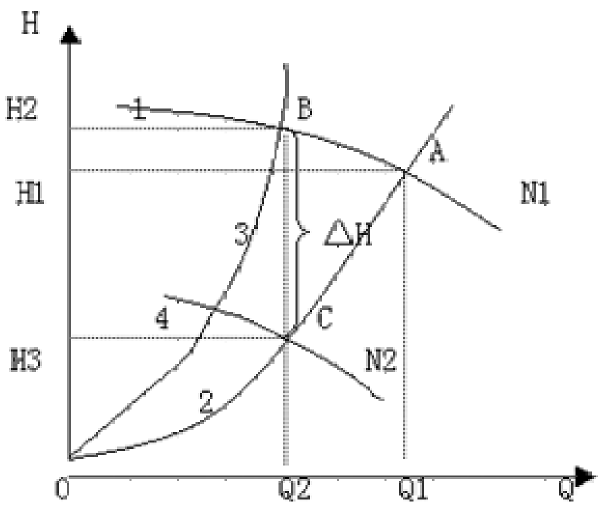
$P=K*H*Q/\eta$

Where, K is a constant;

η indicates efficiency.

Their relationship with rotation speed N is as follows:

$Q1/Q2=N1/N2$
$H1/H2= (N1/N2)^2$
$P1/P2= (N1/N2)^3$



Curve 1 in the above figure represents the characteristic curve for pressure (H) and air quantity (Q) of the fan at a constant speed. Curve 2 indicates the wind resistance characteristic of the pipeline network (valve opening: 100%). Suppose the fan is designed to work at its highest efficiency at point A, and the output air quantity Q1 is 100%. At this time, the shaft power P1=Q1*H1, in direct proportion to the area AH10Q1. If the air quantity is required to decrease from Q1 to Q (70%, for example) according to technologic requirements, the pipeline network resistance can be increased by adjusting the valve. At this time, the resistance characteristic of the pipeline network changes to curve 3, and the system operates at point B instead of the original point A. In this case, we can see from the above diagram that the air pressure increases, and shaft power P2 is in directional proportion to the area BH20Q2, with slight decrease. If the rotation speed of the fan is decreased from N1 to N2 by the use of an inverter for speed regulation, based on the proportion law of the fan, we can draw the characteristic curve for pressure H and air quantity Q for the fan at the speed of N2, as shown in curve 4. At the same air quantity Q2, pressure H3 decreases sharply and the power P3 (equal to the area CH30Q2) also decreases drastically. The saved power △P=△HQ2, in direct proportion to the area BH2H3C. The energy saving effect is obvious.

Based on hydrodynamics, air quantity Q is in direction proportion to the rotation speed, pressure H is in directional proportion to the square of the rotation speed, and shaft power P is in directional proportion to the cube of rotation speed. When the air quantity decreases and the rotation speed of fan drops, the shaft power decreases sharply.

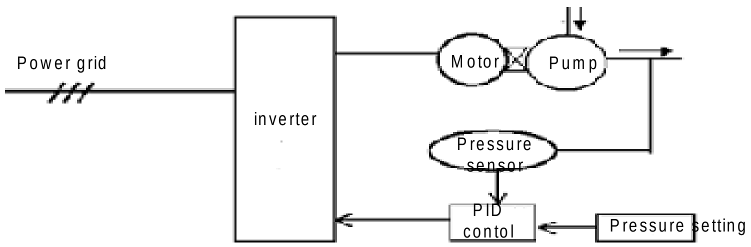
For example, when the air quantity drops to 80% and the rotation speed to 80%, the shaft power decreases to the 51% of the rated power. When air quantity drops to 50%, the power P drops to the 13% of the rated power. The power actually saved may not be so drastic due to the influence of actual working conditions, but the energy will be considerably saved.

Therefore, in mechanical equipment with fans and pumps, the use of inverters to adjust air quantity and flow rate is the most effective way of energy saving.

II. Working Principle

With the application of the latest computer control technology, INVT energy saving controller uses pressure sensor signals and related electric control signals to keep the pressure at a desirable value according to the rotation speed of the motor of the pressure control pump for water supply pipelines, thus saving unnecessarily consumed energy and saving electricity.

2. Block diagram of basic working principle



3. Features of INVT energy saving controller

• Reserving original control program and easy to install; adopting mains/energy saving control mode to prevent fault from affecting production;

• Electric control, changing on/off pressure control into continuous pressure control; more precise pressure control and more stable water pressure;

• Soft start device, stepless speed regulation, avoiding impact of starting current;

• Remarkably improved system power factor, nearly no power loss;

• Easy to operate, highly efficient computer control, nearly zero fault rate; synchronous operation without the need of any adjustment.

III. Predication of Energy-saving Effect

INVT energy-saving controller can minimize power consumption of the pump. Due to the implementation of stepless speed regulation, power consumption of the pump is closely related to the use of the equipment. After energy-saving rebuilding with INVT energy-saving controller, it is anticipated that the electric power can be saved by 25% to 65%, or even higher.