

## Application of ALPHA6810S Energy Saver in Injection Molding Machine

### I. Introduction

With the fast development of the plastics industry, injection molding technology has also achieved advanced and rapid application, and development of injection molding techniques has entered a new historic period. Our company has conducted serious analysis and study in accordance with the technique and operating mode of injection molding machines, and has developed a special Inverter used in injection molding machines. It has been applied in various enterprises in Zhejiang Province such as the Huangyan Huari Group, Cixi Jinming Electrical Appliance, Luqiao Taizhou Pipe, Yongkang Sifang Group and Zhuji Air Conditioning Filter Net Plant. In its use in the Haitian, Shenda, Deya and Haida injection molding machines, in accordance with the current signals from dynamic circuit output by the Hongxing and Shanxing computers, through detection, calculation and control of motor rotation speed by the inverter, it satisfies the motion, pressure and flow requirements of various processing precisions, and it can conduct synchronous operation. In accordance with the comparison between the variable-frequency fixed displacement pump and variable displacement pump, the energy conservation efficiency of the fixed delivery pump is obviously higher than that of the variable delivery pump with an increase of 7%. In the meantime, it has been promoted and recognized by a vast number of users. Efforts have also been made to improve the product quality, reduce inferior-quality products, reduce cost of production, improve labor conditions, strengthen safety in production, improve the shock from the star-delta start current, reduce the impact and abrasion to the equipment, and to increase the total service life of the equipment.

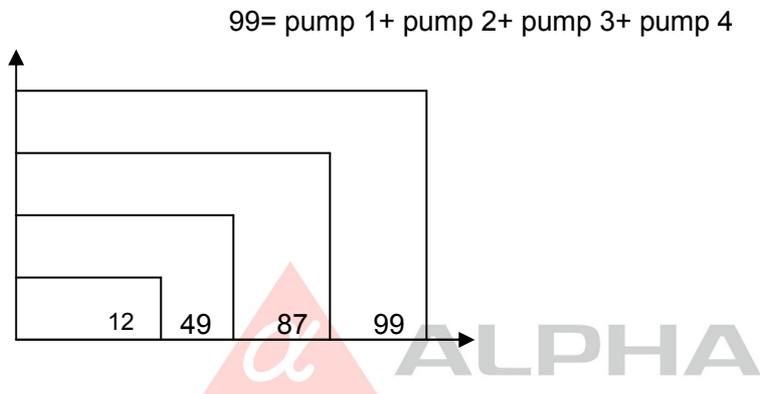
### II. Analysis of the Hydraulic Action System of the Injection Molding Machine

During accurate operation and use of the injection molding machine, in order to realize transmission control of the specification, performance and structure of the injection molding machine, various components such as the pump electromagnetic valves, hydro-cylinder and hydraulic pipes should form a complete system, and the transmission control should be realized through the load which transmits energy through pressurization by the hydraulic oil. This section will analyze the hydraulic action of the FT750 model injection molding machine of Sifang group. In order to prevent impact, abrasion and vibration to the hydraulic system, each action should be slow→ fast→ slow, such as mold-off→ low-pressure mode locking→ fast mold locking→ high-pressure mold locking. The operative mode of the injection molding machine in its product life cycle should be as the following: mold-off→ feed in→ injection→ preplasticizing→ cooling→ dripping prevention → feed out→ mold open→ hydraulic in→ hydraulic off →mold-off. There are two types of hydraulic systems in the injection molding machine: (1) Fixed displacement pump, including fixed vane pump, gear pump, piston pump and screw pump. (2) Variable displacement pump, including axial piston pump, radial piston pump and single-acting vane pump. In accordance with the comparison of the field working conditions, the frequency-conversion fixed displacement pump injection molding machine has an efficiency of energy-conservation 7% higher than that of the variable displacement pump injection molding machine.

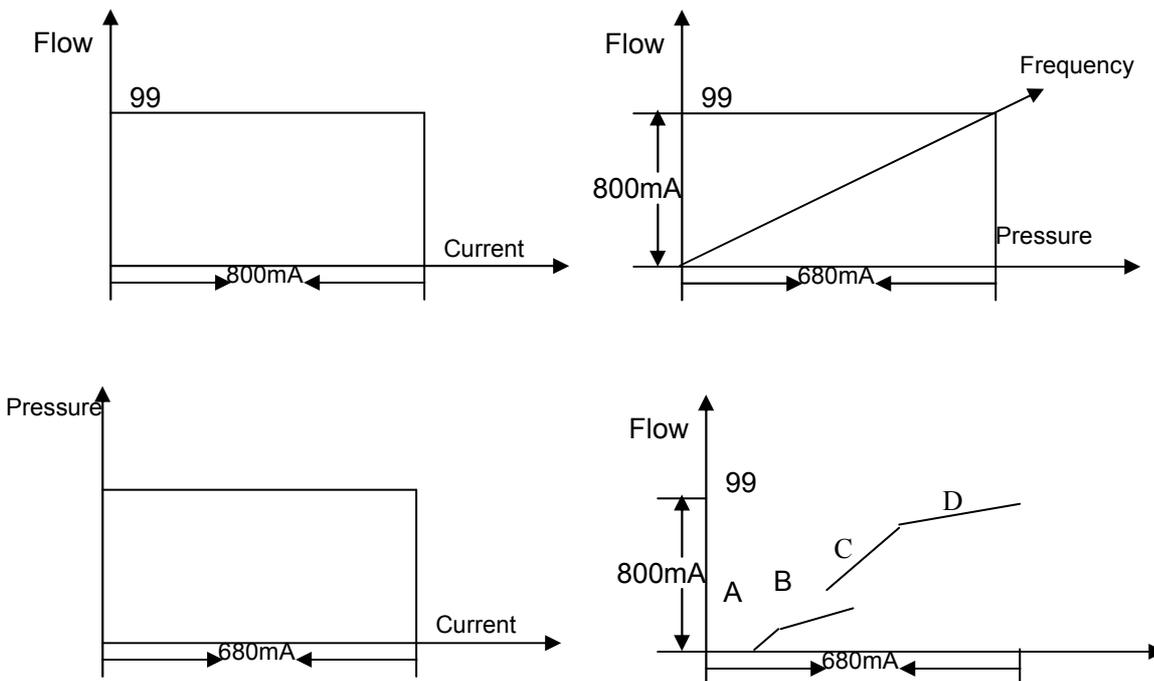
### III. Proposal for the ALPHA6810 series energy saver and Haitian HT750 Model Injection Molding Machine

In accordance with the pressure, flow and dynamic input current signal of the injection molding machine, control the inverter frequency and change the motor rotation speed to make the outlet oil flow be able to change in accordance with the actual operating condition and also reduce energy consumption of the machine to the maximum extent, and for the controllable extreme low-speed operation of the motor such as cooling, motion delay and cycle pause, the rotation can even stop. In this way, the operation efficiency of the machine can be significantly increased, and the energy can be saved. Furthermore, it also has soft start, which can protect the power system, reduce impact from the start current and expand the installed capacity of the transformer. The specific analysis and control diagram is as the following:

**FIG. I:** Oil pump oil volume assembly diagram: 12= pump 1 49= pump 1+ pump 3 87= pump 1+ pump 3+ pump 4



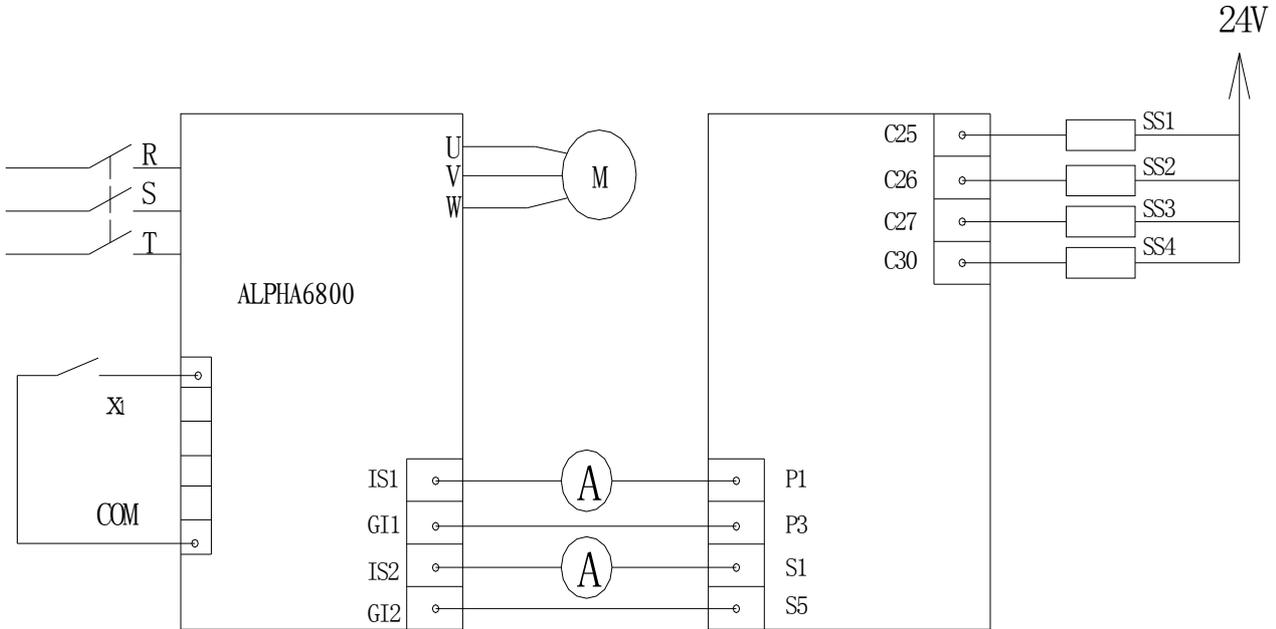
**FIG. II:** Frequency-conversion pressure flow assembly diagram: flow current (180-800mA), pressure current (200-680mA)



**Note:** The maximum load of the injection molding machine has a pressure of 140kg, a flow of 99 and a

frequency of 50HZ. In accordance with the change of its dynamic current and variable frequency of flow, its frequency changes as well, pressure increases/flow increases/frequency increases.

**FIG. III:** Variable- Frequency Transformation Diagram of Injection Molding Machine



**IV. Parameter Setting:**



P0.01=2

P0.04=1

P0.19=5

P0.21=1.2

P0.22=1.5

P4.01=0.5 (regulated in accordance with the performance of the injection molding machine)

P4.03=7.5 (regulated in accordance with the performance of the injection molding machine)

**V. Return on Investment**

In accordance with the processing of a motorcycle baffle by Haitain HT750 model injection molding machine, it consumes 43.7 kilowatts of electricity every hour. Through transformation by using the ALPHA6810-3093Z model inverter for energy conservation, it consumes 24.5 kilowatts of electricity every hour, which has an efficiency of energy-conservation of 43%. If we calculate by assuming that it

works 22 hours a day, the electricity is RMB 0.6 Yuan per kilowatt hour, and it works 28 days every month, we have:

Electricity cost saved everyday:  $(43.7 - 24.5) \times 22 \times 0.6 = 253.44$  Yuan

Electricity cost saved every month:  $(43.7 - 24.5) \times 22 \times 0.6 \times 28 = 7096.32$  Yuan

Electricity cost saved every year:  $(43.7 - 24.5) \times 22 \times 0.6 \times 28 \times 11 = 78059.52$  Yuan

It can save electricity cost as much as RMB 78,059.5 Yuan every year. After transformation of the injection molding machine by using an inverter, the overall investment can be recovered in 8 months.

## VI. Performance Characteristics of Injection Molding Machine after Transformation

1. It has the function of soft start, and there is no impulse current during the start. In addition to save energy, it can also significantly reduce the requirement for installed capacity of the power supply transformer, and it can also determine the operation state of the power system.
2. A super silenced high carrier IGBT device has been adopted, which makes the motor able to operate stably with extremely low noise and low vibration. It can also reduce the oil temperature and operation noise of the machine, reduce abrasion of the mechanic and hydraulic parts, increase the replacement cycle of hydraulic oil, reduce the use of cooling water and increase the service life of the motor and oil pump, in this way realizing the purpose of energy conservation, water conservation and increasing the service life of the injection molding machine.
3. It has a power frequency/variable frequency system, as well as convenient and flexible operation, debugging and application; in addition, it also has various protection functions against over-voltage, under-voltage, over-current, overheat and connection failure; in the meantime, it also has advanced intelligent failure diagnosis system for the convenience of fast troubleshooting for the user.
4. Use of this variable-frequency energy-efficient injection molding machine does not require changing the preset process parameter and operation habits of the injection molding machine. It won't reduce the productivity, it has the same product passing rate as traditional molding machine, and it can adapt to any plastic pellets and molds.