Delta Hybrid Servo System Used with Traditional Injection Machines

Traditional injection machines consist of four parts, that include a hydraulic pump, a heating unit, a cooling system and the control system and components. While each part consumes much energy, the hydraulic pump consumes up to 75% or more of the machine’s total energy requirement. Different amounts of pressure and flows are injected into the claming, injection, pressure holding, cooling and ejection stages. The hydraulic pump is always under an unstable loading status. The overflow valve and the ratio valve adjust the flow and pressure when the system requests more than the set flow and pressure. This process is an example of high-pressure throttle that can cause energy losses up to 40~75%. The energy-saving Delta Hybrid Servo System precisely controls the pressure and flow required at each stage, greatly reducing the amount of energy wasted at high-pressure throttle. At the same time, the oil temperature in the system is lowered.

Application Description

1. Before replacing the system for experienced manufacturers, old system information is provided as a basis for designing the new system. Information includes:
   - Maximum work pressure of the system (kg/cm²)
   - Maximum system flow (L/min), which can also be calculated by: traditional motor revolutions per minute (rpm) x oil pump output (cc/r)
   - Maximum work voltage: Delta’s system provides 220V and 380V

2. Before replacing the old system, An injection molding machine operator must collect the following information by using a hanging meter: operation time per cycle, total mold production quantity, pressure holding time, cooling time, mold reference number, and total power consumption.

3. A week after replacing the old system, observe the results by recording the following information daily: operation time per cycle, total mold production quantity, pressure holding time, cooling time, mold reference number, and total power consumption.
System Structure

Single-drive mode:

Delta high performance field oriented vector control drives are specifically designed for injection molding machines with special parameters and built-in pressure and flow controls (PQC).

Multiple-drives mode:

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**Application Cases**

**Case 1** – Injection Molding Machine: 100T

**System Specification:**

1. Maximum work pressure: 175 Bar  
2. System flow: 100L/min  
3. Voltage: 380V

**Single-drive mode (drives and accessories):**

1. Servo hybrid AC motor drive: 18.5kW  
2. Servo motor: 14 kW  
3. Hydraulic pump: 45 cc/r

**Energy saving results:**

1. Compared with the old high energy consuming injection system, the new system is more productive and precise.  
2. The old injection system was a mold with 2 cavities for half-automated industrial fan production. Power consumed per hour is 7.3 degrees.  
3. The new energy-saving Delta Hybrid Servo System reduces power consumption to 1.78 degrees, which saves up to 76% of the energy required.

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<th>Date</th>
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<th>Part number</th>
<th>Production time per cycle (sec.)</th>
<th>Production Time</th>
<th>Watt</th>
<th>Power consumption per hour</th>
<th>Mold quantity</th>
<th>Product</th>
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<td>606</td>
<td>- A mold with 2 cavities -Half-auto industrial fans production</td>
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**Case 2** – Injection Molding Machine: 140T

**System specifications:**

1. Maximum work pressure: 140 Bar  
2. System flow: 74L/min  
3. Voltage: 380V

**Single-drive mode (drives and accessories):**

1. Servo hybrid AC motor drive: 15kW  
2. Servo motor: 11 kW  
3. Hydraulic pump: 32 cc/r

**Energy saving results:**

1. The old injection system was a mold with 8 cavities that fully-automated the production of RS-232 plugs. Power consumed per hour is 8.7 degrees.  
2. The new energy saving Delta Hybrid Servo System reduces power consumption to 3.45 degree, which achieves energy savings of up to 61%.

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### Case 3 – Injection Molding Machine: 250T

**System specification:**
1. Maximum work pressure: 140 Bar
2. System flow: 144 L/min
3. Voltage: 380V

**Multiple-drives mode (drives and accessories):**
1. Servo hybrid AC motor drive: 15 kW*2pcs
2. Servo motor: 11 kW + 7.5 kW
3. Hydraulic pump: 40 cc/r + 32 cc/r

**Energy saving results:**
1. The old injection system was a mold with 1 cavity for automated plastic box production. Power consumed per hour is 9.3 degrees.
2. The new energy saving Delta Hybrid Servo System reduces power consumption to 3.3 degrees, which saves energy by up to 65%.

### Conclusion

Since 2006, the injection molding machine industry has begun to develop energy-saving servo products. There are rising numbers of energy saving models being invented as the environmental protection issue gains ground. The productivity for machine manufacturing has achieved 80%. Delta has long been dedicated to the mission "To provide innovative, clean and efficient energy solutions for a better tomorrow". The IABU finally contributed energy saving servo control technology in 2009. With years of practice in the market, the energy saving has been outstanding. This hybrid servo energy saving technology will continue to transform the old plastic injection machine with the ultimate goal of reducing energy consumption and bringing about a better tomorrow.