LyondellBasell Technical Tip

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Protective and Switching Devices in the Blow Molding Machine

Two important classes of electrical devices in the blow molding machine are those that protect circuits against overloads and those that switch circuits on and off. These devices, like all man-made products, occasionally fail and have to be repaired, replaced or reset. Follow all equipment manufacturer's recommendations for safe operation.

Electricity is dangerous and deserves respect when you are working with or about electrical components; the combination of high voltage and current is lethal. To play it safe:

1. Shut off mains
2. Lock off the mains to prevent a would-be helper from getting the machine up and running before you are ready.
3. With a voltmeter, check to be sure there is no residual live voltage by touching one of its leads to the electrical contact of the component to be worked on and grounding the other lead to the frame of the machine.
4. Make the repair or replacement.

Other safety precautions are simply part of good practice:

1. Check the surfaces of contacts to see that they are bright and free of oxidation. Copper oxidizes readily and the oxide is a poor electrical conductor. The more oxide, the greater the resistance, which produces heat; the greater the heat, the more the cooper oxidizes. By removing the oxide with very fine emery paper or cloth, resistance is lowered and current carrying capacity raised.
2. Tighten all electrical connections securely to produce a low-resistance conducting path. A loose connection means heat, oxide build-up, etc.
3. Maintain an adequate spare parts inventory to avoid a prolonged shutdown.

FUSES

Fuses are widely used to protect electrical circuits and components in the molding machine. Fuses are rated according to the maximum current they are meant to carry and vary in load rating from a few to several hundred amperes. Fuses protecting indicating and recording instruments, however, are often rated in fractions of an amp. Fuses are designed to open the circuit if the rated amperage is exceeded. Failure of the fuse is almost instantaneous, as intended.

If a blow-molding component fails and if a blown fuse can cause the failure, then the fuses are the first things to be checked. Sometimes it is obvious which fuse may be the offender, but other cases, the wiring schematic for the machine must be studied to determine fuses involved.

To safely check a fuse, shut and lock off mains and test for voltage. Remove the fuse with a fuse puller and check for an open circuit between the two ends of the fuse with an ohmmeter or a continuity test instrument.

Once the blown fuse is detected, replace it with another of the same rating. Never try to cure a problem by using a fuse of greater current rating. Using a higher rated fuse defeats the purpose of the fuse and can cause a more important, and more expensive, element of the blow molding machine to fail.

The blown fuse may be the result of some transient overload; in this case, the new fuse should not blow on restarting the machine. If the new fuse quickly blows, then a search is in

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CIRCUIT BREAKERS

Performing the same function as fuses, the circuit breaker opens a circuit when its rated capacity is exceeded. Unlike fuses, the breaker can be reset by throwing its switch to the off-position, then back to the on-position. Some circuit breakers reset automatically after an internal element has cooled down. There is no need to shut down the machine unless the circuit breaker has become defective a relatively rare occurrence. Should the breaker immediately trip and open the circuit after being reset, then, as with fuses, the cause must be traced.

RELAYS

A relay basically consists of an electromagnet and one or more sets of contacts that open or close when the coil of the electromagnet is energized. A low wattage signal energizes the unit, while the contacts of the relay may handle moderate to very heavy currents. The energizing current is turned on or off by a variety of devices - push buttons, timers, limit switches, etc. The relay contacts, in turn, open or close circuits to heaters, motors and other heavy current-consuming elements.

Total failure of a relay is rather uncommon and is generally due to a burned-out coil. The machine should be shut down and safety steps taken before the relay is replaced. Much more common is sluggish action or momentary and intermittent failure that is due to pitted or dirty contacts in the relay or to a weak coil.

In replacing contacts, make certain that they are correctly positioned. Some are normally open, some normally closed. "Normally" means when no current is applied to the relay coil. Often, normally open and normally closed contacts appear in the same relay and if they are incorrectly replaced some functions can be damaged.

CONTACTORS

Essentially identical to relays, a contactor is designed to handle heavy currents when its coil is energized by an electrical signal, usually from a push-button. While the relay remains energized only as long as current is applied to the coil, the contactor, by means of a by-pass circuit, remains energized after the push-button is released. The contactor is de-energized only when an “off” button is pressed. The contactor handles such loads as heaters, magnetic brakes and other high-demand equipment.

Failure of a contactor can be partial or total for the same reasons that apply to relays - pitted or dirty contacts or weak or burned-out coils. Shut down, observe safety precautions and replace the entire unit or the contacts according to the need. Use care to make the correct connections when replacing the unit and replace only with a contactor of the same rating.

MAGNETIC MOTOR STARTERS

Similar in working principle to the contactor, a magnetic motor starter uses a low-wattage, operating current to switch on power to a large motor. A burned-out coil is easily detected – the motor it controls simply does not function. An intermittent-type failure can result from a weak coil that is not pulling in the contacts firmly, or from dirty or pitted contacts. Handle the problems as with contactors.

Magnetic motor starters usually have overload protection. If the motor for some reason becomes overloaded, its temperature rises, as does the temperature of the working element of the overload relay. The latter opens the circuit

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Should the overload switch fail to reset, or if it quickly retrips and shuts down the motor, the cause of the overload must be detected and eliminated.

SOLENOIDS

A solenoid consists of an insulated wire-wound coil with a hollow center through which an iron plunger can pass. When the coil is energized, the plunger is made to travel in a straight line. In heavy-duty relays and in contactors and magnetic motor starters, the plunger causes contacts to open and/or close. However, the solenoids discussed here do not make or break electrical contacts; their straight-line motion directly and mechanically actuates valves, clutches, clamps or other devices.

Failure can be gradual if a few windings in the coil short out and weaken the thrust, or complete if the coil burns out. Detection is simple since it can be traced from the failure of the component it is expected to operate.

Use the normal safety precautions when replacing a solenoid and make certain the replacement has the same current rating and is designed for the same duty - continuous or intermittent.

LIMIT SWITCHES

The position of various mechanical parts in a blow-molding machine is detected and their motion controlled by limit switches. Such a switch can control the extent to which a mold may open. A limit switch can detect an open safety gate and prevent mold close until the gate is in the guarding position.

The limit switch is a push-button switch, although the push is applied by some machine element, not manually. Failure can result from mechanical damage to the part that is pushed or from pitted or dirty contacts in the switch. Detection usually is simple, since the switch fails to perform a single, specific function: permitting a device to function or preventing it from functioning.

Observe the usual safety precautions as well as care in replacing with an identical unit. Failure can be rather common, so an adequate supply of switches should be maintained. The position of some limit switches is adjustable. Positioned improperly, the switch may fail to perform or it may be damaged by over-travel of the actuating element.

For more information about blow molding, contact your LyondellBasell sales or technical service representative.

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