Mold Temperature Controllers Tested And Reviewed Within

PLASTICS PRODUCT REVIEW

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Is Your Mold the Right Temperature?

A consistent mold temperature is important to your process. It can effect important part variables such as warp and shrinkage, and process variables such as cycle times. Furthermore, if your mold temperature varies, your flow rates and pressures will also vary to a small degree. Consequently an accurate, powerful liquid temperature control system is necessary.

With that in mind we test four separate liquid temperature control systems in this issue. Liquid temperature control systems are also referred to as mold temperature controllers. For simplicity, we will use this term in the remainder of the article.

Mokon of Buffalo, NY produces a powerful 3/4 horsepower, 9KW controller. Marvel Equipment of Farmington Hills, MI markets a compact 6KW, 1/2 horsepower unit produced by Regloplas of Switzerland. Sterling Inc., located in Milwaukee, WI offers a stylish mold temperature controller with 9KW heaters and a 1/2 horsepower motor. Finally, IMS Co. in Chagrin Falls, OH has a compact, easily maneuverable 3/4 horsepower, 7.5KW unit.

Despite the slightly different sizes of equipment the tests are structured in such a way that these small differences do not matter. This is especially true when you take price and energy consumption into effect. For more information on how the test is conducted please see the "How We Test" section on page 30.

Test Results

Overall Use

There really is not a whole lot

The Regloplas P140-S is clearly a compact unit.

to say here. Basically we have found that auxiliary equipment is easy to use once it is set up. For instance, with a mold temperature controller you basically set a temperature and hit start. Sounds a lot like a microwave doesn't it (our apologies to those who can't cook). Also notice that we don't comment on the construction of the basic components. We feel that a salesperson and your own perspective would be better suited for this type of analysis. This said, there are some small differences in the models.

Regloplas produces an extremely compact unit. Picture a computer made in 1994, based on outward appearance it could easily be mistaken for this mold temperature controller. It is the same size and the casing even looks as if it came from a computer manufacturer. This compact size is nice for those concerned about shop floor space. Yet, there are some drawbacks. Our particular controller did not come with casters. This is an option with the P 140S that we would urge you to take advantage of. The piping on the inside of the unit also had to be tightened due to leakage. Finally, as regular readers know, we like the simplicity of separate controllers, but prefer the number of functions and size available with a dedicated, panel mounted microprocessor. The use of controllers does work well with the unit's compact design which is truly impressive when compared with other mold temperature controllers in the industry.

The Sterling unit is well designed. It is larger than the Regloplas, but this is compensated for by the use of casters. This makes the unit easily maneuverable to get it as close to the mold as possible. The microprocessor is easy to use, but powerful. Finally, the incoming and outgoing water lines are marked with pressure gauges so you can visually see that the controller is working. This is particularly advantageous when you know what the pressures should be, based on previous experiences and corresponding flow rates. It probably is not necessary to chart this for every mold, but it definitely couldn't hurt and could be an easy way to determine if your water lines are clogged in some way. Although, based on the chart on page 32 you can see that some mold temperature controllers do not change the pressure because of changing water line diameter. At any rate, a qualified engineer will know what your pressures should be based on previous experience with the mold and they should be checked from time to time. Whether you use the feature or not, it is nice to see that Sterling included it. Overall, the Sterling unit does not really present any problems to speak of.

Mokon's Duratherm is a relatively large unit. Nonetheless, this is appeased by casters and easy of maneuverability. The unit uses a Barber Colman controller to provide for changes in the setup. Generally, we don't favor separate controllers, but this particular style is particularly large and powerful. Furthermore, the manual explains the functions in implicit detail. So in this case we actually see the use of the controller as a bonus. It also takes the pressure gauge concept one step further by placing the gauges directly on the controller itself, separate from the water lines. Finally, taking the panels off to get to the pump does not require any tools. This is also a nice feature.

IMS presents a mold temperature controller that presents a great level of user friendliness. It is light weight, small, and seems to move around as if it had its own propelling power source

Sterling's quality 4411-A is shown with optional controller and pressure gauges.

The powerful Mokon DT 4309-00 is pictured here without the Barber Colman controller.

(almost literally). All of the electrical components are concealed under the flip up top which makes for another nice feature. Instead of having to kneel on the floor to work with the electronics and wiring, you can sit in a chair. Considering the wiring fiascoes (with other types of products) we had this issue, our testers will be sending IMS a Christmas card this year. However, every rose has its thorn, and IMS does use a small microprocessor controller instead of a dedicated panel microprocessor and does not include pressure gauges on the particular unit that we tested.

All of the units include a warranty of some sort. Mokon has an extensive warranty with a lifetime guarantee on the heater canister, flow diverter and all fittings. A five year warranty is also included on the pump housing, relief valve, high temperature switch, and casters. Almost everything else is covered by a two year warranty. Sterling offers a remarkably comprehensive warranty of five years for the heater tank, pump casting, pressure switch, and sensing probes. A three year warranty is included for almost all other components. Finally, Sterling provides some unique bonuses such as a one year risk free replacement program and a temperature control unit loaner program. IMS has a straightforward warranty of two years for parts and labor. Finally, Regloplas features a unique warranty of one year for parts if the unit is run eight hours a day, and six months if it is run twenty-four hours a day.

Flow And Pressure With Seven Different Molds

This test is thoroughly explained in the "How We Test" section. Here is a more concise explanation: this test looks at flow and pressure as you change the size of water lines. As a molder you would like for every water line to be the same size. Unfortunately we are still trapped here on earth and this is not always the case. So we look for the next best thing, consistent flow from our mold temperature controller. If the flow and temperature are consistent you will receive the same level of cooling despite a difference in water line area. In our test we also look at the pressure coming into the mold and going out of it. Based on the formula presented in the "How We Test" section, the greater the pressure drop, the higher the level of flow (if all other things are equal). This test is a bit exaggerated because the water lines used for testing have a wide range of sizes, but this will serve to make the results easily noticeable.

If you look at the Total Flow Data on page 32 you will see a concise presentation of the results. The standard deviation of the seven flow rates is divided by the average. This will normalize the data to put everyone on the same playing field. You want a mold temperature controller with the lowest value possible for this number. A low number signifies a greater level of consistency from mold to mold. The same holds true for the other two pieces of data. The range divided by the average normalizes the range of flows you will experience. Finally, the average percentage change signifies the average percentage change of flow experienced from one mold to the next. This data should all correlate, and it does. Clearly in this case Mokon provides the most consistent flow rate across a variety of molds. Although, Regloplas does do an excellent job on the high end repeatability.

Speed Of Heat Up And Cool Down

This test is a performance test similar to seeing how fast your car will go up to 100 miles per hour and then stop. There is really not much to say here, the results are self explanatory. Mokon has the most speed on heat up and Sterling has the most speed at cool down.

Temperature Consistency

This measures the mold's ability to maintain consistent and accurate temperatures over a period of time. The actual mold temperature is measured and recorded every five minutes. Both the high and low temperature readings are measured for the twenty-five second cycle. There are several things to look at in this seemingly simple test. First it is important to look at the difference between the high and the low temperature throughout the cycle. This will give you an idea of how much cooling the controller can provide despite the presence of heat. The Total Temperature Data will provide you with a concise outline. The average range is just that, the smaller this number the better. We also analyze the standard deviations in each temperature. This is also a measure of consistency over time. Here the Regloplas and IMS units excel by keeping the temperatures consistent. The second equally important data is the deviation from the temperature set point. A direct measure of the "power" of the mold temperature controller, this does not test consistency, but instead accuracy. If you set your water temperature at a certain level, how close is the corresponding mold temperature going to be? We try to answer that question by looking at the average temperature and its difference from the set point. Here the Sterling and Mokon units are the "victors."

In its entirety the temperature data is somewhat inconclusive. IMS and Regloplas keep the mold temperature very consistent, but they are further from the set point. Sterling and Mokon are able to come close to the set point, but are somewhat more inconsistent. What does all this mean? It is almost impossible to draw any definite conclusions from this data. All four units exhibited a great degree of competency in this test.

The IMS P75 mold temperature controller is compact and lightweight.

Energy Consumption

This data is self explanatory. Mokon used the lowest amount of energy in our thirty minute test. At ten cents a kilowatt hour this unit will save you approximately $500 a year over the unit with the highest consumption.

Miscellaneous Information

We have also collected some miscellaneous information on each controller. Regloplas has a slight variation in the temperature set point from the actual value of the water. The high end is two degrees low and the low end is five degrees high. The Sterling model produces an overshoot in temperature in the heat up and cool down test. It overshoots on the high end by two degrees for about two minutes and on the low end by eight degrees for approximately four minutes. Mokon also overshoots the high end temperature by one degree for one minute and on the low end by three degrees for three minutes. The IMS unit has temperatures that are dead on a majority of the time. However, every few minutes the temperatures will swing by about five degrees for less than a minute. Essentially, every unit has its own little quirks. These quirks will have a minimal effect on the overall ability of the unit, but they are still important to note for those who will be purchasing a particular unit. For instance, if you know its actual temperature is two degrees low you simply increase the set point by two degrees.

Conclusions

It is hard to draw any cut and dried conclusions. Each mold temperature controller is good at different things. Regloplas keeps the high end flow and temperatures consistent. Sterling is quite quick at heat up and cool down, maintains flow relatively consistently, and keeps the actual mold temperature close to the set point. IMS may not be the best at everything, but it doesn't have any noticeable deficiencies and its data is always near the top. This may be the way to go. **Finally, Mokon provides the most consistent flow, high speed heat up, mold temperatures close to the set point, and the lowest energy consumption. Considering this data we highly recommend a purchase of this mold temperature controller.** However, the competition was close and all competitors deserve consideration. Unlike some of our other tests, the field is fairly uniform.

How We Conduct Our Mold Temperature Controller Tests

What We Test

We conduct four main tests when evaluating a mold temperature controller.

Flow And Pressure With 7 Different Molds- PPR tests this because custom molders often use a variety of molds with the same mold temperature controller. We looked specifically at how well the mold temperature conditioner was able to repeat flow in gallons per minute. Flow is what you are looking for, the pressure drop is what causes the flow to occur. The less deviation in flow the better.

Speed Of Heat Up And Cool Down- For this test we look at both the speed of water and mold temperature changes. This is a performance aspect similar to seeing how fast your car can go.

Temperature Consistency- This is a test of the mold temperature controller's ability to keep a stable mold temperature. To make the test more realistic we apply heat to the mold at a regular basis. This test is important because anything that can make your process more stable is valuable.

Energy Consumption- Energy consumption is measured in KWH.

Variables such as temperature overshoot, water temperature deviation, and anything else that might be detrimental to a stable process are also noted.

How We Test

Flow And Pressure With 7 Different Molds- For this test we use two Omega Engineering pressure gauges. In between these two pressure gauges we insert an area control device. This device uses a knob to adjust the area of the space through which the water can flow. The knob is numbered from 0 to 9 so that changes will be consistent each and every time. This area control device is used to simulate seven different molds. By changing the area it simulates the different sizes of water lines in different molds. We also place an Omega Flow Meter after the second pressure gauge. Testing is started with the largest flow area possible. Pressures and the flow rate are then recorded. The flow area is decreased and the process is repeated until seven different molds are simulated. Flow is the key variable. PPR is looking to see how well the mold conditioner can repeat flow from mold to mold. Remember, flow follows the following formula:

Flow=K (a constant) * Area * the square root of the change in pressure.

Therefore, to keep flow consistent, a larger pressure drop is needed to compensate for a smaller area. That is why we also measure the two pressures.

Speed Of Heat Up And Cool Down- The temperature setting is increased from 80 degrees Fahrenheit to 120 degrees Fahrenheit. Then we look at temperature thermocouples to see how long it takes both the water and mold temperatures to come up to the set point. The mold temperature is monitored at the face of a mold provided by custom molder ACRA Inc. of Traverse City, MI. For the cool down portion we simply reverse the process.

Temperature Consistency- Using the mold and thermocouple described above we look at the consistency of the mold temperature over a period of thirty minutes. To make the test more difficult and realistic we apply heat, with a heat gun, to the mold face. The heat gun heats the mold about four inches from the thermocouple so wild swings do not occur. To start the test the water temperature is set at 80 degrees Fahrenheit. Using timers, the heat gun is set up to be on for eight seconds and off for seventeen seconds. Every five minutes the mold temperature is recorded until the test is completed. When looking at mold temperature, both the low and high temperatures are recorded for each twenty-five second cycle.

Energy Consumption- Energy consumption is measured in KWH for the entire "Temperature Consistency" test.

Mold Temperature Controller Test Results

	Regloplas	Sterling	Mokon	IMS
Mold Temperature Specifications				
Model Number	P140-S	4411-A	DT 4309-00	P75
Motor H/P	1/2	1/2	3/4	3/4
Heater KW	6	9	9	7.5
Power	480	480	480	240
Max Temp.	284° F	250° F	250° F	250° F
Price	$3141	$1,990	$2,150	$2,149
Temperature Consistency				
5 Minutes				
High Temperature	31.0	30.0	30.3	30.8
Low Temperature	30.2	29.0	29.5	30.2
10 Minutes				
High Temperature	31.3	29.4	30.0	30.7
Low Temperature	30.6	28.7	29.0	29.8
15 Minutes				
High Temperature	31.2	30.0	29.6	30.3
Low Temperature	30.6	28.9	29.3	29.5
20 Minutes				
High Temperature	31.2	28.5	28.8	30.6
Low Temperature	30.4	28.3	28.6	30.0
25 Minutes				
High Temperature	31.2	29.3	29.7	30.4
Low Temperature	30.4	29.1	28.6	30.1
30 Minutes				
High Temperature	31.2	29.9	28.7	30.3
Low Temperature	30.4	29.1	28.5	30.1
Total Temperature Data				
Average Range	.75	.67	.67	.57
St. Deviation High Temperature	.10	.58	.64	.21
St. Deviation Low Temperature	.15	.31	.48	.26
Total Average Temperature	30.85	29.19	29.19	30.25
Difference From Set Point	4.18	2.52	2.52	3.58
Speed of Heat Up (80° F - 120° F)				
Water	2:08	1:47	1:43	2:54
Mold	17:57	17:12	16:46	16:52
Speed of Cool Down (80 °F - 120 °F)				
Water	2:15	0:52	2:33	0:57
Mold	13:57	4:37	6:14	6:52

Mold Temperature Controller Test Results

	Regloplas	Sterling	Mokon	IMS
Testing on 7 Different Molds with Varying Water Line Diameters				
1 is Smallest-7 is Largest				
Mold 7				
Pressure 1 (psi)	64.0	68.0	80.0	66.0
Pressure 2 (psi)	32.0	61.0	64.0	54.0
Flow (gpm)	4.0	1.6	2.6	2.1
Mold 6				
Pressure 1 (psi)	78.0	66.0	80.0	66.0
Pressure 2 (psi)	31.0	59.0	62.0	54.0
Flow (gpm)	4.0	1.4	2.4	1.9
Mold 5				
Pressure 1 (psi)	81.0	64.0	82.0	66.0
Pressure 2 (psi)	30.0	58.0	61.0	53.0
Flow (gpm)	3.8	1.3	2.2	1.8
Mold 4				
Pressure 1 (psi)	89.0	65.0	82.0	66.0
Pressure 2 (psi)	24.0	57.0	59.0	52.0
Flow (gpm)	2.6	1.1	1.8	1.5
Mold 3				
Pressure 1 (psi)	91.0	66.0	83.0	68.0
Pressure 2 (psi)	18.0	56.0	56.0	50.0
Flow (gpm)	1.8	0.7	1.4	1.0
Mold 2				
Pressure 1 (psi)	99.0	66.0	85.0	69.0
Pressure 2 (psi)	13.0	54.0	55.0	47.0
Flow (gpm)	1.0	0.4	0.7	0.6
Mold 1				
Pressure 1 (psi)	101.0	66.0	79.0	69.0
Pressure 2 (psi)	12.0	54.0	46.0	46.0
Flow (gpm)	0.3	0.2	0.6	0.2
Total Flow Data				
St. Dev./Average	.61	.56	.48	.55
Range/Average	1.48	1.46	1.20	1.46
Average Percentage Change	30	23	18	25
Energy Consumption (KWH)	.7877	.5958	.4646	.5815