

Automatic Length Control

Why maintaining a constant parison length is important

Any variation in parison length can cause a number of moulding defects, and for this reason every practical measure should be taken to reduce length variation, or better still eliminate it all together.

What causes length variation?

Unlike “closed processes” such as injection moulding, the parison is influenced by various factors that can affect its length.

Virgin/Regrind Mixture

The biggest single cause of length changes has been traced to changes to the relative proportions of the virgin and regrind materials

A similar effect is also caused if the material proportions remain the same but are mixed differently

The extruder screws ability to transport and melt a constant throughput is affected by any changes in the bulk density of the material it receives.

Barrel/Head temperature changes

Common sense tells you that an increase in temperature will cause the molten to become less viscous and thus stretch more.

Ambient Temperature

Being an “open process” the rate at which the parison loses heat is directly affected by the surrounding air temperature.

Machine Repeatability

Although not strictly a variation in parison length, changes in the machines mechanical movements can cause an apparent change in the parison length.

For example if the mould close speed slows down for any reason the parison tail length will be longer when the mould finally closes on it.

You could be forgiven for thinking that the “parison producing system” had malfunctioned rather than the “parison receiving system”

Die Gap control

Any unwanted variation in the die gap will directly affect the parison thickness, the “die swell” effect and the speed at which it emerges from the die and of course its length.

So what problems do length variations cause?

Container weight variation

Assuming your containers are supposed to be within some kind of weight tolerance length variations will be the direct cause of products being scrapped or rejected by your customers.

Wall Thickness Variations

A longer parison inevitably means a decrease in wall thickness This can mean that the container could fail minimum wall thickness and more seriously in the case of “UN certified” containers a drop test failure.

Shift in program synchronization

The first parison programmers only had three “points” of wall thickness control, a few millimeters of length variation probably didn’t cause any great problems. With the introduction of programmers with 25, 50 64, 100, and even 1000 points have become commonplace.

This added profile definition is wasted in the parison length varies more than an individual point.

To make sense of this statement you need to do some simple calculations:

For example imagine a 200-mm parison with a 200-point programmer.

In this application there are no individual points with extreme settings so there is no major problem if the parison changes by 1 mm.

It is relevant to note that a 10-point programmer would have given the same degree of control because the way parison programmers “interpolate” between the set points.

So why do we have more points than we actually need?

Because it’s better than having less than you need.

So What Can Be Done?

It is not the purpose of this technical bulletin to discuss the pros and cons of the numerous material feed systems.

Generally it is accepted that proportioning the virgin and regrind by weight (gravimetric) combined with a mechanical mixer gives the best results.

You might consider running a critical job on 100% virgin and use the regrind on less demanding mouldings.

Machine Temperature Change

Does your machine hold the temperature settings accurately?

Have you connected a chart recorder or data monitoring system on every zone on every machine?

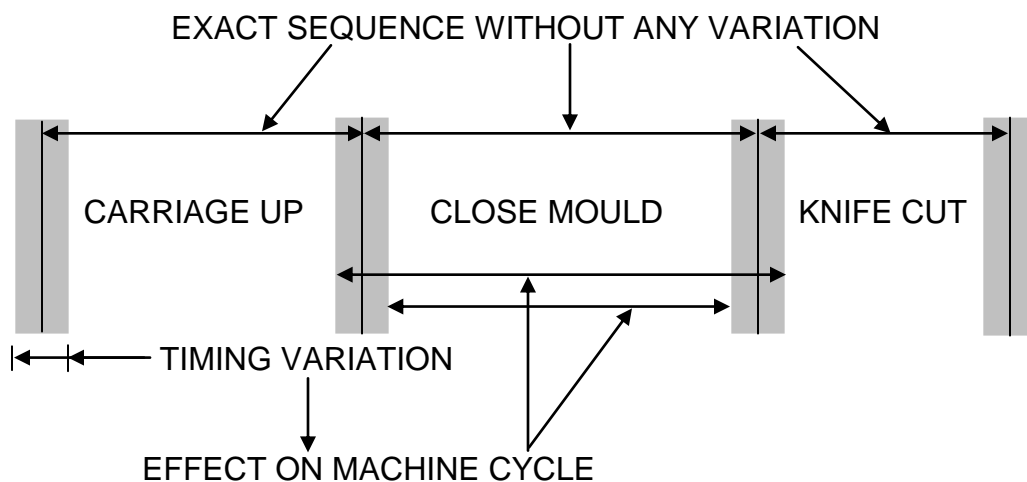
Ambient Temperature variations

Although it is not usually practical to keep a factory at a constant temperature, there is no excuse for allowing massive changes by leaving loading door open on a cold morning or not letting summer heat out of roof vents.

Do your best to minimize temperature variations, remember Blow Moulding is an “open process”

Machine Repeatability

Variations caused by faulty timers, loose or faulty limit switches oil viscosity variations etc can all cause the machine sequence to have some degree of variation.



Although the individual effects of these variations may be relatively insignificant the total effect can be much worse because some effect can be cumulative nature of a “sequential” system.

How do you check the repeatability of the mechanical movements of a machine? With production monitoring systems, a timer or even a stopwatch.

Die Gap Control

Modern parison programmers are inherently much more accurate than the process demands, but there are fault conditions where the die gap may drift by an unacceptable amount.

LVDT

The linear Variable Displacement Transducer is basically very reliable and very accurate, but a common cause of the LVDT signal drifting is simply that the rod works loose. A “play” of 1mm will cause exactly 1mm of die gap variation!

This may not be a major problem on a 200 Lt. drum but it will be a massive problem on a lightweight dairy bottle

Servo valve

The commonest cause of die gap variation is the result of a faulty servo valve. Even a perfectly normal servo valve will be the cause of a small amount of die gap positional drift, although this will normally be virtually immeasurable. In some critical applications, particularly lightweight containers, it may even be worth replacing the servo valve with a more accurate or lower flow rated type. Contamination and heat are the biggest servo valve killers, and just replacing faulty valves is as dumb as constantly replacing blown fuses without trying to find out what is causing the problem. The cost of servo valve repair is small compared to the lost production and hassle factor.

Automatic Parison Length Control

There is nothing new in the concept of measuring the parison length and automatically making corrections. Such systems have been offered as optional features on parison programmers for over 20 years, and machine manufacturers have had their own "stand alone" control units, or integrated the function into the machine controller. Unfortunately many of the early systems did not work reliably, partly because the available technology was not sufficiently advanced to deal properly with "abnormal" situations. For example in the event of a moulding jamming or the hopper running out of material, most length controllers would make erroneous corrections.

The good news is that with the availability of powerful, reliable, microprocessor chips it has enabled all the necessary features to be implemented with the "intelligence" to prevent corrections being made in abnormal circumstances.

This technical bulletin was meant to give the reader an insight into the importance of parison length control and also serve as an introduction to our new BM -xxx parison length controller.

The BM-xxx was designed as a "stand alone" unit that does not have to be connected to the machines parison programmer or the main control system.

Principle of operation

Photo Cell

The unit accepts a photocell signal whose beam is broken by the emerging parison. Typically the beam has to be set about half to three-quarters down the parison's full length. This setting is necessary because it is important that the beam is only broken by the parison, not by the mould movement.

Relay Outputs

If the beam is broken prematurely the unit will give a relay output whose close time will be proportional to how early the beam break occurred. This relay is connected to the machine's extruder speed control to cause the extruder to speed up. If the beam is broken late another output relay is energized and this relay is used to slow down the extruder.

System Stability

To ensure that the corrections produce a stable change in the extruder speed without "hunting" the system has an adjustment that controls the amount of correction that the system will make in any one machine cycle.

This adjustment only needs to be set during initial installation.

Deadband

To avoid excessive wear on the extruder speed changing mechanism, it is desirable to not make changes for very small length variations.

There is a switch that enables a "deadband" to be set and this is normally calibrated on the initial installation.

Interface to Thyristor/Inverter Speed Controls

Depending on the type of drive we can supply a motorized potentiometer to replace the existing speed control or a direct voltage interface if the unit has an input for this type of signal.

Alarm Output

In the event that the hopper runs out of material the unit will try and keep the parison the correct length by speeding up the extruder every machine cycle. The unit provides an alarm output to warn if the last 6 cycles were all speed up signals. The alarm is in the form of an output relay so its contacts can be connected to any external devices.

What the unit cannot do!

It is not the purpose of this system to correct for a faulty machine. For example if the extruder suffers from "surging" or has difficulties in transporting the material then the length controller cannot give you the results you want.

Another example is when a twin station machine is running in an unbalanced state. This can easily be seen if the parison tail length one side is different to the other. The length controller will make a speed up and then on the next cycle a slow down. The correct solution to this problem is to find out which machine action is different from one side to the other and make the correct adjustment so that the actions of each side are the same.

It has also been found on some machines that a "speed up" correction results in a different speed change than a "slow down" correction. This is particularly true

on old machines that have a motorized slip ring assembly. The reason is that the frictional drag on the brushes causes a preferential bias to any adjustment that is in the same direction that the brushes are being dragged in.

This is more of an interesting effect than a real problem!

Early designs of length controls were unreliable because the photo cell signal did not give repeatable results. Modern photocells are much more reliable but it should still be remembered that getting a good signal that switches on the parison edge is still absolutely essential for reliable operation.

A badly cut parison that has “streamers” hanging down can miss-trigger the photocell early which can result in an unwanted extruder slow down.

At the time of writing this report we testing a “photocell that work on the principle of sensing the heat of the parison. The device works on the same lines as the P.I.R. intruder detectors.