Blown Film Internals

D. R. Joseph, Inc. Blown Film Process Systems & Consulting

2125 South Great Southwest Parkway, Suite 101, Grand Prairie, Texas 75051 USA (972)-641-7711

We Are Here To Help

Over the course of the past year D.R. Joseph has spent a great deal of time working to solve difficult bubble instability or layflat consistency problems. We have devoted this newsletter to publishing several of those solutions in the hope that others will be helped as well. If you have a particularly difficult issue with a blown film line, let us know; there is a good chance we can help.

Most problems in the blown film process have some effect on the frost line. Either the frost line height varies (as a whole or in part) or it can develop spikes. Because the Internal Bubble Cooling (IBC) system performance depends on the frost line height and uniformity being stable, any problem that affects the frost line affects the IBC.

The good news is that the D.R Joseph IS-IBC1® Internal Bubble Cooling control unit is designed with many features to help you determine if there is a problem with the IBC system or if you need to look elsewhere. The IS-IBC1® system can be equipped with color touch screen controls that give maintenance personnel access to several tests to determine if there is something wrong with the control unit. The tests cover digital and analog inputs and outputs, sensor setup, bladder valve calibration, and all the parameter settings. Each test includes an online tutor to walk the user through each step.

One common problem we find associated with IBC is getting the blowers balanced properly. Blowers are balanced by setting the flow from the inlet blower to match

(Continued on page 2)

The Forgotten Test

If you are looking for a good way to determine if low speed cyclical layflat variation is coming from the IBC system, don't forget the sheet weight test. The sheet weight test can be very helpful, particularly if the time between the variation peaks and valleys is more than a minute apart. A constant sheet weight verifies that the machine direction thickness is constant. If the machine direction thickness is *changing*, the frost line is moving up and down, which guarantees that the layflat will change. Because the IBC system measures bubble diameter near the frost line, side-effect changes in layflat are the result. The difficulty in spotting a drift in the extrusion rate is more involved than watching or trending the extruder speed, haul-off speed and melt pressure. Noticing the

(Continued on page 4)

Do Sizing Cages Roar?

It is hard to imagine until you have heard it for yourself. A sizing cage roars when the most of the segmented rollers on the cage are rolling at high speed. What really makes it noticeable is when it cycles between the loud roar and the momentary silence. What causes cage roar? Is the sizing cage causing this problem? Some might say that it sounds like a classic breathing problem with the sizing cage roar the obvious side effect of the bubble breathing. Take a look at the following tests designed to verify the cage as the source of the problem.

If the sizing cage on your line roars only after the line speed is increased to a certain level, the sizing cage needs some attention. The first test is to adjust the cage contact to a value between –1.00 and –2.00. (See Tech Tip article- *Using Cage Contact*.) This will cause the bubble to remain undersize within the cage, eliminating all contact between the bubble and the cage. If the bubble-breathing problem is now eliminated at the higher line speeds, check cage

(Continued on page 2)

Table of Contents

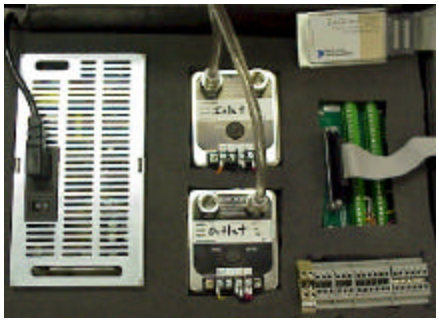
(Here to Help - cont. from page 1)

the flow of the outlet blower. In the past, this was a function the operator had to perform and learn on his own. The IS-IBC1® control unit can be supplied with the now patented automatic blower balance feature that eliminates the need for the operators to learn this activity. This feature gives less skilled operators the ability to achieve the same startup efficiency as the more skilled operators.

Sizing cage issues associated with internal bubble cooling seem to be an annoyance to many operators. However, sizing cages are very important when running IBC. The added internal airflow turbulence created while running IBC can cause added bubble movement (affecting layflat) as compared to running non-IBC, so supporting the bubble within the sizing cage is very important. The IS-IBC1® now has an automatic cage controller feature that allows the operator to enter in the target layflat they wish to achieve and the sizing cage is automatically positioned to provide the correct layflat size.

Another problem we have solved deals with oscillating dies and the associated oscillating supply and exhaust plenums. All air to and from the bubble has to pass through the oscillating plenums. By using our newly developed pressure scanner tester (pictured here) we determined that it takes only a pressure change of 0.10 inches of water column to create a 0.25-inch (6mm) change in layflat. We also determined that as a plenum oscillates through the 355° of rotation, changes in the internal pressure of up to 0.25 inches of water column are not uncommon. We have been able to solve this problem by having the plenum manufacturer increase the backpressure within the plenum. In cases where the plenum cannot be modified, the layflat controller feature (which adds a second control loop to the process) reduces the swings in layflat.

D.R. Joseph is constantly developing new features and tools to help make your life easier when dealing with problems associated with blown film extrusion. The IS-IBC1® system can be retrofitted to any blown film line equipped with a pre-drilled die for IBC or retrofit to any existing IBC system. Also, all earlier versions of the IS-IBC1® system can be field upgradeable with the latest available options and features. If there are any features or tools that you feel would help make your life easier, please do not hesitate to contact us. ◆



Pressure Scanner Tester

(Sizing Cages Roar - cont. from pg 1)

alignment, roller integrity and support shaft cleanliness. The segmented rollers on all sizing cages are designed to have a certain clearance between segments, a certain clearance with the support shaft and a certain rolling resistance with the support shaft. When low melt strength materials contact rollers that are dragging, sticking or pressing on one side of the cage with more pressure than the rest of the cage, stresses in the film cause the bubble shape to deform. These events start the process we all know as "breathing." Left unchecked, the bubble will eventually tear off.

Do not overlook the related issue of irregular bubble shape. Like a misaligned cage, the irregular bubble shape can press into one side of the cage starting a cage roar/bubble breathing event. Use the cage contact control to get the bubble completely off the cage. If the bubble shape is still irregular, attend to that problem (gauge uniformity, irregular cooling). If the bubble shape is regular when not supported by the cage, the cage alignment is probably still an issue.

If the problem is occurring with a new cage, make sure the cage is properly aligned over the die. Make sure the alignment is done with a hot die if the die cart moves as the adapter pipe expands. Also check to make sure the individual cage arms are properly aligned. Aligning the frame of the cage does nothing to ensure the proper alignment of the cage arms. In most cases, opening the cage to the maximum position will allow easy alignment of each arm.

If the problem is occurring on a relatively new cage, but one where cling or other sticky additives (including slip) are used, check for accumulations on the roller shafts that make the rollers drag. Most cling or stretch films have a very low melt strength, so interaction with sticky rollers can cause cage roar and loss of the bubble.

If the problem is occurring on an old cage, look at everything mentioned above and closely inspect the rollers. Badly worn

(Continued on page 4)

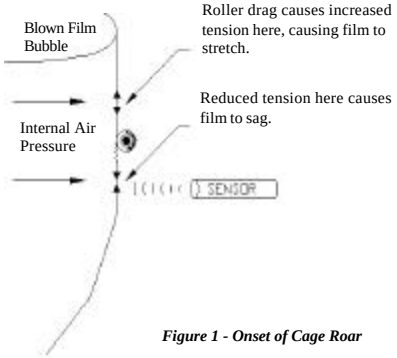


Figure 1 - Onset of Cage Roar

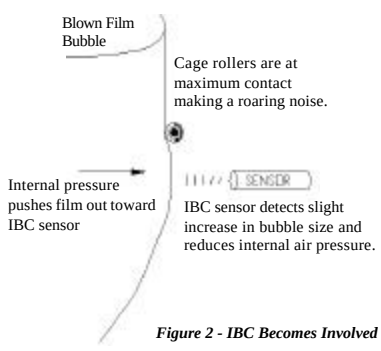


Figure 2 - IBC Becomes Involved

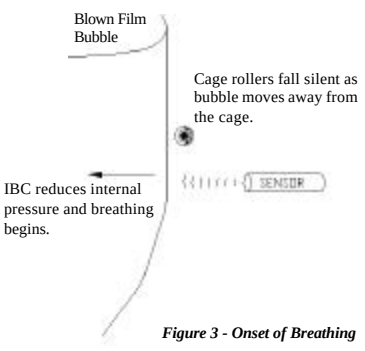


Figure 3 - Onset of Breathing

TECH TIP

Using Cage Contact

All D.R. Joseph IS-IBC1® systems have an electronic method to set the "cage contact." Cage contact is the amount of surface *contact* the bubble has with the *cage* support arms. The cage contact control allows the operator to precisely adjust the position of the bubble relative to the cage. Increasing cage contact causes the bubble to be tighter in the cage; decreasing cage contact causes the bubble to be looser in the cage.

How It Works

When the IS-IBC1® system is first installed, the IBC sensor is positioned relative to the sizing cage position, so the bubble just comes in contact with the cage arms when the cage contact value is set to 0.00. This commissions or calibrates the cage contact control. The operator can then make small changes to the contact value as required for different products. For example, suppose that the bubble is on size and stable, but there are some small marks on the film caused by one or more cage rollers. The operator can reduce cage contact by very small amounts until the marks are gone.

On the standard (non-touch screen) systems, this will have the side effect of slightly decreasing the bubble layflat or width, so the operator may have to open the cage slightly after making this adjustment. On fully automatic systems with automatic cage control, when the operator changes the cage contact value, the IS-IBC1® system automatically adjusts the cage to maintain the target layflat while achieving the desired cage contact.

Some products (different materials, thickness, line speed, etc.) require more or less contact than others. Some films are very tacky and may stick to the cage rollers, causing the bubble to breathe and eventually blow out (see the article *Do Sizing Cages Roar?)*. Other products, such as high percentage LLDPE at thin mils can exhibit the same problem. In both cases, the process would benefit from less contact with the cage. Some materials have sufficient melt strength to allow significant amounts of air ring and IBC airflow. The high amounts of airflow will produce bubble flutter. These products may run better with more cage contact, allowing the cage to better support the bubble.

Cage contact can also be used to *temporarily* compensate for problems such as die alignment, damaged or misaligned cages, or irregular shaped bubbles. If the cage and die are not aligned properly, or if there is a bulge in one side of the bubble, one side will press against the cage more than the others. The operator may reduce the cage contact to reduce the pressure on that side until the problem is corrected.

On basic systems without automatic cage control, cage contact can be used for very small layflat changes. For example, suppose the actual layflat is 42.15 inches, and the target is 42.00 inches. It would be very difficult to move the cage in a small enough step to make a 0.15-inch change.

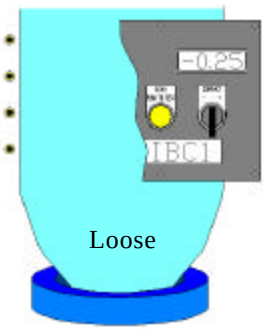
On the standard non-touch screen systems, the operator can decrease the cage contact slightly to reduce the layflat. Note that the desired cage contact value will not be –0.15; a change in *layflat* of –0.15 would require a change in *cage contact* of *approximately* -0.05 (divide –0.15 by pi to get -0.05) because changing contact is changing bubble diameter, not layflat.

Troubleshooting with Cage Contact

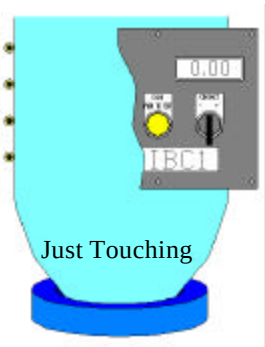
The cage contact setting can also be changed in the process of troubleshooting bubble problems:

A **bulging or irregular shaped bubble** may be caused by poor gauge distribution, but it can also be caused by misalignment between the die and the cage. To check for this, reduce cage contact to the point where the bubble is not touching the cage (a setting of –2.00 is usually enough); if the bubble shape improves, the cage is probably causing the bulge.

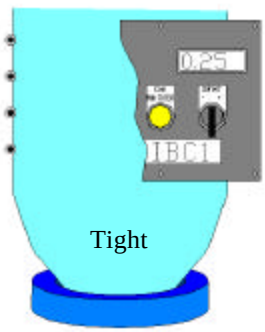
A **breathing bubble** may also be caused by too much or too little cage contact. If there is too much pressure against the cage, the film may hang on the cage and blow out slightly, then the IS-IBC1® system compensates by closing the valve. When the bubble reinflates, it hangs again. This would start a cycle where the layflat varies up and down, or breathes. Reduce the cage contact to see if the breathing problem gets better. If the bubble is too loose in the cage, to the point where the bubble is unsupported, the bubble may move around in the cage. This would show up as a layflat variation. Try increasing the cage contact to keep the bubble steady. ◆



Loose



Just Touching



Tight

Upgrade Corner

The following is a list of all the upgrades that are now available:

1. **Handheld** now allows full sensor monitoring and error reset. If you already have a handheld, contact us about the handheld update kit.
2. **Big bubbles** – Cage and Layflat control systems now support maximum layflat of over 500 inches (12.7 meters)!
3. **Cage Controller systems** get a backlash control to compensate for cage drive train slack.
4. **Diagnostics 2 Interface Software**: this is a compatibility upgrade that allows D2 to work with Microsoft Windows NT and Windows 2000 operating systems.

Previous Upgrades:

1. **Color Touch Screen – 6 inch** (160mm): New TFT technology provides the widest viewing angle possible with a brighter screen, double the memory and faster response time.
2. **New Digital Ultrasonic Sensors -** Now available in a convenient upgrade package. Ask for the PP4 upgrade package.
3. **Automatic Blower Balance -** Eliminates the need for operators to balance or null blowers prior to every startup of the line. The system also automatically rebalances the blowers if needed.
4. **Layflat Control** – Adds a second control loop to the IBC system that reduces the time to achieve a desired layflat, with or without gusseting.
5. **Cage Control** – Adds the ability for the system to automatically position the cage diameter to the correct size to produce the desired layflat. ◆

(Cage Roar - cont. from page 2)

rollers need to be replaced. Be sure to inspect the support shaft integrity. If the shafts are worn, replace those as well.

Sizing cage manufacturers have a variety of new style cages designed to work with low melt strength and tacky materials. If a new cage is in the budget, ask your vendor to quote one of these types of cages. If you can't find one, contact DR Joseph and we'll help you get in touch with one or more manufacturers. Regardless of the sizing cage you have, the proper upkeep will prevent cage roar from knocking down your line. ◆

(Forgotten Test - cont. from page 1)

extremely slow rate of change that can cause variations in layflat is like trying to detect the movement of a minute hand on a clock. The only difference is that you know for certain the minute hand is moving.

Slow speed cyclical changes in layflat variation are easy to solve if the IBC system is causing the problem. First, stop any rotating equipment. If the problem disappears, either equipment alignment or uneven airflow in one or both of the IBC oscillating airflow chambers is the problem. If the problem persists, it is time to take several sheet weights to ensure that the extrusion rate is not cycling. To make it easier to spot the peaks and valleys, take trim and edge guide from more than one side. After the roll has had a chance to build up at least 5 peaks and valleys, cut the roll down and take three to five samples from three peaks and three valleys. Use your normal procedure for measuring sheet weight. The thing to look for is a correlation between the width and the sheet weight. If the sheet weights from the peak samples are all similar but different from the valley samples, then there is a possible problem with the machine direction thickness of the material.

The first items to check are the stability of the screw and the line speed. Do not forget to check things like fluff hoppers or feed hoppers. If the hoppers are nearly going empty before the resin system refills the hopper, there will be a change in the extrusion rate. Also, look for barrel zones that are constantly overriding (always significantly hotter than the zone setpoint).

Some will try to run the line in the non-IBC mode in an attempt to discover if the IBC is causing the problem. Unfortunately, when running in non-IBC mode, a varying extrusion rate problem will generally be less noticeable. This is because when running non-IBC, there is no frost line dependent layflat control mechanism involved. There are times when removing the IBC system is a warranted test, but not before performing the sheet weight test. ◆

The Last Word

We are with you. All of us at DRJ want everyone reading this newsletter to know that. This year has been a test of monumental proportions. We have all been tested in one way or another but I think I like what I see. I see people who are not afraid to stand united and fight for what is right. I see people who are not afraid to say who their God is. I see people who are giving of their time and resources to assist those injured in the fray. I see a reawakening to patriotism. I see an outpouring of kindness - especially in public places - by strangers for strangers. There is no better type of kindness than when it is offered to someone you do not know. Finally, but definitely not least, I see people remembering that our families are more important than our jobs.

I want to encourage everyone to keep it up. Do not let the humanity part of being human escape you anymore. Get involved, help someone, pray for someone, defend someone, and make sure your family knows how much you love them. That is how we survive the tests that come our way. ◆

Blown Film Internals is published biannually by D. R. Joseph, Inc., 2125 S. Great Southwest Parkway, Suite 101, Grand Prairie, Texas USA Email: admin@drjosephinc.com, Telephone (972) 641-7711 or (800) 767-4470, Fax (972) 641-8747. D. R. Joseph, Inc. manufactures the internal bubble cooling and layflat control systems for blown film extruders. President: Daniel Joseph; Managing Editor: Tamara Handley