# Solving forming problems for 40 years

Adam Neupert* highlights a selection of case studies where Quantum has worked with glassmakers to solve a variety of forming problems in the glass production process.

▲ Quantum's headquarters in Saxonburg, PA, USA.

Next year will mark the 40th anniversary that Quantum Engineered Products has served the hollow glass industry. The Pittsburgh, Pennsylvania, USA based company began solving glass forming problems for North American manufactures. Since then it has been fortunate to collaborate with glass manufacturers in just about every part of the globe. One of the company's aims has been to help hollow glass manufacturers increase their profitability by eliminating forming problems encountered on the blank side. Blank side forming is arguably the most critical step in the manufacturing of hollow glass containers and Quantum devotes 100% of its engineering time to improve this demanding process. In the past 40 years Quantum has plenty of examples of how it has helped glassmakers bring an end to their forming problems. The following case studies summarise a selection of these projects.

## Case Study 1

**Location:** Latin America
**Container:** Liquor Bottle
**Manufacturing Process:** Blow and Blow
**Forming Problem:** Reoccurring Choked Neck Defects
**Forming Problem Summation:** A choked neck defect can occur due to problems in the blank side forming process. A choked neck defect is an obstruction, restriction, or closure of glass within the neck of the container or bottle. Visibly, excess glass caused by poor glass distribution can be seen inside the neck of the container. The choked neck defect can cause costly problems on a filling line, so it is important to eliminate them from hollow glass production. The Latin American manufacturer was experiencing re-occurring choked neck defects during the production run of a particular liquor bottle, which led to production efficiency losses and reduced pack to melt percentages. Previous attempts to eliminate the defect were unsuccessful and Quantum was approached to help provide a solution.
**Corrective Action Taken:** First, Quantum began an in-depth analysis of all the variables of the job. Since the choked neck defect was more prominent on one specific job (liquor bottle) the analysis focused on the design and setup of that particular job. Quantum constructed a full forming system layout using the mould equipment (plunger, neck ring, guide plate,) overlaid onto the models of the Quantum Forming System to create a 3D view of how the job is setup on the IS machine. Quantum's engineers analysed the 3D model and realised that when the forming plunger was in the counterblow position, the counterblow air was being restricted by interference of the forming plunger itself with the guide plate. If the counterblow air is restricted a cold spot can be created in the parison and this cold spot can be blown into the neck during the counterblow function, thus creating a choked neck. Also, proper glass distribution depends on a uniform counterblow, which cannot be achieved if there are air restrictions, as was occurring on this job.

Quantum hypothesised that because the liquor bottle had such a tall finish that more pullback of the forming plunger was required and that more pullback should solve the choked neck defect. Quantum's 9100 series Blow and Blow Cartridges

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allowed the manufacturer to have various pullback positions to help maximise the counterblow delivery. In the world of hollow glass production there are countless different mould designs and types of finishes, so having the ability to change the counterblow position of the forming plunger is a design feature that tailors the manufacturing process to each job and creates an advanced Blow and Blow Process.

Once the correct counterblow position for the liquor bottle was determined the company advised the customer to install the lock spring piston (spacer) that gave them the correct pullback position. During testing the chocked neck defect was reduced and the problem could be considered solved. The quality of glass distribution and the finished product quality also increased due to the increase in counterblow efficiency.

## Case Study 2

**Location:** Southeast Asia
**Container:** Various
**Manufacturing Process:** Blow and Blow
**Forming Problem:** Stuck Plungers
**Forming Problem Summation:** In the Blow and Blow Process plungers can become 'stuck' or unable to return to the gob loading position. The stuck plunger can occur because of an abnormal relation between the thimble and the forming plunger. If the plunger and/or thimble tilt or deviate from their proper alignment a stuck plunger can occur.

If the forming plunger also completely pulls out of the thimble during the full down position this can create a stuck plunger. When this mechanical failure occurs the glass loads into the thimble, which leads to excessive machine downtime and a negative effect on the bottom line.

**Corrective Action Taken:** Quantum worked with the manufacturer to design a Blow and Blow forming system that did not allow the thimble and plunger to misalign. Quantum designed a thimble with an extended base or 'skirt.' This skirted thimble kept the components of the Blow and Blow Cartridge in precise alignment with every cycle of the IS machine.

The forming system is a pyramid of pieces and it is important to make sure all of the pieces remain in the proper relation or alignment with each other.

The skirt on the thimble acted as a dual function feature. It kept the thimble properly aligned and added length to the thimble which made it impossible for the plunger to completely pull out of the thimble and jam.

Upon implementation of the new thimble the problems of stuck plungers and unforeseen machine downtime were resolved. The absolute alignment of Quantum's forming system was achieved by design and not by the machine operator or setup of the equipment.

The solution brought about stronger ware with less finish defects and a more reliable production line.

## Case Study 3

**Location:** North America
**Container:** Various
**Manufacturing Process:** Blow and Blow
**Forming Problem:** Air leaking into the parison during the Plunger Up function
**Forming Problem Summation:**
Quantum collaborated with a North American hollow glass manufactur to solve an air leakage problem that plagued its production.

Process air was leaking into the blank mould and parison during the Plunger Up function. The air leak was coming from a gap between the cooler tube seal and the inner diameter of the Piston Rod. The leaking air entered the Piston Rod during Plunger up and made its way out of the Piston rod, up through the counter blow holes of the forming plunger and into the blank mould. When leaking air entered the blank mould, it created poor gob loading and unnecessary actions, such as excessive settle blow, to form a proper container.

▲ Process equipment.

▲ Plunger mechanism.

**Corrective Action Taken:** Quantum supplied the manufacturer with its Plunger Mechanisms that include the Tube-within-a-tube (TWT) Cylinders. The TWT is a sealed forming system that eliminates air leakages in the forming process. The sealing technology within the TWT solved the air leakage problems that the manufacturer had struggled with for years. Gob loading improved and the related defects were eliminated.

The pack to melt percentage on the production line increased with the addition of the Quantum forming system and the TWT.

## Case Study 4

**Location:** Latin America
**Container:** Hot Sauce Bottle
**Manufacturing Process:** Narrow Neck Press and Blow
**Forming Problem:** Overheating of the forming plunger and a loss of cooling air capacity
**Forming Problem Summation:** The manufacturer was struggling with overheated forming plungers that were causing defects and limiting the speeds that the IS machine could achieve. The cooling air was leaking from the current forming system, which created a drop in cooling air efficiency. Also, the overall design of the plunger cooling system needed improvement.

**Corrective Action Taken:** At the request of the manufacturer, Quantum agreed to participate in a side-by-side test to evaluate the Plunger cooling capacity of Quantum's QH9000-OS cylinder versus the cylinders that the manufacturer was currently using.

The results of the test proved that the Quantum cylinder cooling system was more efficient than the competitive system. The forming plungers on the Quantum cylinders were cooler by an average of 126 degrees Celsius. There are multiple reasons why the test resulted in the favour of the Quantum cylinder.

First, the area of the cooling air inlet on the Quantum cylinder is larger than competitor systems. Quantum's OS style Piston Rod has an inlet area of 19mm and a cooling air pathway that delivers the cooling air with maximum efficiency.

Second, the Quantum cylinder is a sealed system that eliminates any leakages of the cooling air.

The entire blankside forming system can be a network of possible leak points and any small leak compromises the inlet volume of the process air and the integrity of the forming process. Quantum's TWT cylinder and the various features of the Narrow Neck Press and Blow Positioners work together to eliminate the leak points.

Lastly, Quantum and the manufacturer worked together to improve the comprehensive design of the plunger cooling system.

The project incorporated Quantum's cooler tube design, which includes a swaged tip, a spiral to promote cyclonic action and air movement, and the proper balance of inlet versus outlet cooling air to create backpressure in the system.

All of the design features and mould design recommendations led to a successful test and the manufacturer began to implement the Quantum Forming System as standard.

In response to the cooling efficiency testing results, the manufacturer chose to swap its plunger mechanisms and upgrade its forming process with the Quantum system. The customer was able to achieve the production speeds it desired without experiencing the overheating of forming plungers and the related ware defects.

The variables that can negatively affect the manufacturing process of hollow glass containers are many and can change every day.

The only way to minimise the challenges in the manufacturing process is to use the right tools and rely on the right people to do the right things. Many manufacturers rightly invest in improvements to their furnaces, forehearths, or batch plants so they can have the highest glass quality.

Glassmakers also allocate attention towards inspection machines and cold end processes to make sure they are releasing a safe and high quality product to their customers, which is paramount.

However, thought must be applied to the critical blank side forming process where the glass begins to take the shape of a final product and where many defects can either be created or avoided.

Having the best glass means nothing if it cannot be properly formed and it is always better to prevent the formation of defects rather than detect them. ■

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**Qauntum will be exhibiting on stand D10 at Glassman Latin America in Guadalajara, Mexico Sept 22 and 23.**
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