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Mark Barton, managing director of Barton Fabrications which has grown to become the UK's principal manufacturer of aluminium silos. As described on p12, this company has recently undertaken pioneering research into the phenomenon of silo honking/quaking, which in the worst case can result in complete silo collapse when PET granules are incorrectly stored.



J-Tec Material Handling recently completed a turnkey blending line in Poland for a key international player within the baby food industry (see p4). A challenge that needed to be overcome was how to raise a large number of small bags from ground level to the upper floor when no elevator was available. J-Tec solved the problem by designing a series of ergonomic, hygienic and movable cages each able to carry up to 450kg of bags which are hoisted vertically. Once a specific cage is in position a unique cage barcode ensures that each consignment is linked to the correct bag dump unit.



BT-Wolfgang Binder recently completed installation in Malaysia of a new mixing plant for dry building materials operated by the MAPEI Group (further details in next issue).



This 5 litre capacity Lödige Ploughshare® laboratory mixer was exhibited at Anuga FoodTec in March (see p8 mixing feature for further details).

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Cuccolini screening machines being assembled at the Virto Group factory in Reggio Emilia, Italy. The company, already one of Europe's foremost manufacturers of vibrating sieves, has set itself the target of becoming the biggest and best separation technology company in the world (see screening feature on p14).

Three Reasons Why You Should Use Dust-Tight Valves.

When it comes to selecting the right valve for your dry process application, there are many slide gates and diverter valves to choose from. Process valves are used to control the material flow in powder/bulk material handling systems (bins, hoppers, silos, downspouts, etc) in a variety of industries such as food, grain, milling, plastics, mining, and pharmaceutical. They can be used in gravity flow or low-pressure systems, as well as negative pressure systems, each system calling out for different equipment requirements.

No matter what type of valve you are considering, certain applications may require a valve that is dust-tight. Dust control has become more critical in many powder/bulk applications for three main reasons:

- 1 Safety hazards & environment
- 2 Maintenance costs
- 3 Plant profitability

Read the rest of this article at:

www.vortexvalves.com/dust



Latest trends and safety concerns

We report two recent UK silo projects and focus on the phenomenon of silo honking/quaking which can affect the structural integrity of aluminium vessels used for storing PET granules.

Achieving reduced environmental impact

Barton Fabrications, Portishead, Bristol, the UK's largest manufacturer of aluminium silos, has recently installed several powder storage vessels at an environmentally sensitive food processing site



in England. They have been designed so as not to intrude above the factory roof line and to be in harmony with the local countryside. The 21m high silos each have a capacity of 90t and are all fitted with maintenance-free beige coloured cladding. Mark Barton, managing director of Barton Fabrications, said: "The client was very conscious of their rural setting and wanted to ensure that the new storage silos were in keeping with the local area. Our environmentally sensitive design met this challenge, giving the required storage capacity, whilst harmonising with the rural landscape."

The Barton half penthouse design supplied to the customer provides safer working conditions at the top of the silos and double doors at the



These Barton silos (left) have been treated with a special coating so as achieve reduced visual impact in an area of natural beauty; they are fitted with double doors (as shown above on a different Barton silo installation) to allow access to the base area.

bottom allow full access to the base. In addition to an environmental design, the silos are also fitted with load cells and a hygienic skirt, which prevents rodents and insects entering via the base.

www.bartonfabs.co.uk

20 steel vessels for concrete batching plants

Portasilo, York, UK, has won a contract worth over £800,000 to supply 20 silos for four concrete batching plants currently under construction by D&C Engineers from Tamworth. D&C's managing director Geoff Chatterley, who is overseeing the project, required a manufacturing company to assist in keeping this project on schedule and that could produce the quality and documentation required to satisfy the nuclear industry. "We are

pleased to say that Portasilo has successfully fulfilled this role for us," he said.

Portasilo will design and build eight 250t capacity and twelve 100t capacity steel silos for delivery in single units, with the final delivery scheduled for July 2015. Portasilo managing director Neil Gardiner said: "A main driver in Portasilo winning this business was our capability to manufacture large quantities of silos in a relatively short period of time. We are proud to be working on what is being described as one of this country's largest construction projects, and looking forward to seeing the batching plants in action later this year."

www.portasilo.co.uk

(Continued in first column next page)



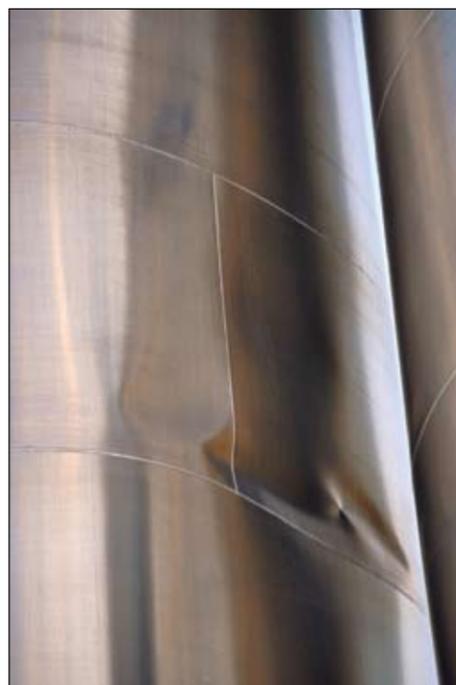
Two of the Portasilo steel storage vessels under construction, showing (right) internal welding inspection.



Addressing PET storage problems in silos

In this report Mark Barton, managing director of UK-based Barton Fabrications, details how growth in the use of PET plastics has led to an increase in noise and structural problems reported in storage silos. The properties of the material, particularly its relatively high poured bulk density and co-efficient of friction, can result in silo overloading and phenomena known as honking and quaking. In the worst case this can cause complete silo collapse when storing PET granules. These issues are outlined by the head of the UK's largest aluminium silo manufacturer who concludes with details of how these problems can be overcome.

Polyethylene terephthalate or PET is one of the most common types of plastic in use. It is popular as a general engineering plastic and, in particular, for packaging. It has been predicted that the global consumption of PET packaging will grow to almost 19.1 million tonnes by 2017, with an annual growth rate of 5.2% between 2012 and 2017. In the UK, 70% of soft drinks containers use PET plastic bottles and nearly 35% of PET plastic bottles in the household



Close-up of silo wall showing the extent of buckling.

waste stream are now being collected for recycling, in 2001 this figure was just 3%. In summary, there is a considerable and growing tonnage of both raw and recycled PET plastic being processed.

The increase in the use of PET feedstock has led to greater storage of the material both in greenfield manufacturing facilities dedicated to PET and in the conversion of plant from other plastic types. Unfortunately, the material properties of PET are quite different to many commonly used plastics and three main problems can arise when storing/discharging PET: silo honking, silo quaking and silo overloading.

1) **Silo honking**, also known as silo noise or music, occurs when the PET material is moving within the silo and generates a low frequency (>20Hz) sound. This noise is intermittent (with intervals between seconds or hours), unpredictable and typically sounds like a truck horn. The volume of this noise is sufficiently loud to be of concern where silos are installed close to environmentally sensitive or residential areas and has led to noise abatement orders being issued.

2) **Silo quaking**, also known as silo thumping, again is related to the movement of PET granules within the silo but, in this case, the movement and rapid deceleration of a greater

mass of material can cause buckling of the silo wall or even catastrophic failure of the silo's structure.

3) **Silo overloading**. If silos have been designed to suit most common plastics, stress calculations are likely to have been made using a bulk poured density of around 600kg/m³. Filling them with PET, which has a bulk poured density of 850kg/m³, will result in serious overloading of the silo. This can be over 40% more than the original design stress and can lead to the complete collapse of the discharge cone or skirt region of the silo.

The picture, below left, shows two, one-year old silos used for storing PET granules. The vessels had not been designed with any anti-honking / quaking protection and serious buckling damage can clearly be seen on the third and seventh panels of the left-hand silo and the seventh panel of the right-hand silo. These silos were replaced by Barton Fabrications' PET storage silos and have operated successfully for over four years without re-occurrence of noise or structural damage.

Silo honking and quaking has been recognised for many decades and although there has been considerable research carried out, and papers written, the exact mechanisms are still not fully understood. The phenomenon occurs with other materials, including other plastics. However, PET seems to be the only commonly used plastic where the author has seen problems reported. It is believed that key factors include materials with a relatively high poured bulk density and co-efficient of friction. Table 1 shows the range of density, coefficients of friction and poured bulk densities for a number of common plastics. It can be seen that PET has relatively high friction and poured bulk density compared to the other polymers.

Solving the PET problem

Although the exact cause and modelling of the problem is incomplete, there is sufficient practical knowledge of the issue for silo

manufacturers to be able to offer silo solutions which avoid honking, quaking and overloading problems. These involve changing the way material flows inside the silo, particularly increasing the friction between the material and the silo wall, combined with increasing the silo strength to be able to resist any high transient stresses and the higher bulk density of PET. In practice, it is very difficult to predict when silo honking or quaking will occur, but Barton Fabrications' anti-honking ring silo design has been widely and successfully adopted, addressing every silo honking/quaking issue that the company has encountered. Barton's anti-honking ring design can be specified and fitted in both new silos or retrofitted to existing vessels which need to be used for PET granule storage.

Rather than risk serious safety issues, or the high cost of a new silo installation, suitable silos can generally be upgraded to include anti-honking rings and stronger base sections offering a more cost-effective solution for PET storage to the plant manager.



Vertical view showing the distortion from cylindrical shape caused by silo quaking.



PET storage vessels showing wall buckling caused by silo quaking.

Table 1: Density and co-efficient of friction values for common plastics.

Plastic type	Density, g/cm ³	Coeff of friction Value	Form	Poured bulk Density, kg/m ³
PET (PETP)	1.37 – 1.45	0.18 – 0.22	–	850
PE (LDPE / HDPE)	0.91 – 0.96	0.08 – 0.22	Pellets	561
PVC	1.30 – 1.58	0.20 – 0.30	Pellets	625
PP	0.57 – 0.92	0.10 – 0.30	Pellets	513
PA (Nylon)	1.11 – 1.29	0.16 – 0.35	Pellets	561
PTFE	2.10 – 3.90	0.06 – 0.35	–	–
PEEK	1.31 – 1.51	0.38 – 0.43	–	–