

SHAPA

NEWS



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- Designed for the ceramic, chemical, metal powders and pharmaceutical sectors
- Low volume powder production
- Sharp cuts up to 1 micron





By Ian Birkinshaw,
General Secretary – Solids Handling &
Processing Association

ALL CHANGE

In business, looking ahead and successfully developing a strategy is crucial for continued progress and growth. However, predicting the market, customer behaviour, and competitors' actions—especially in today's climate—remains a real challenge.

Over the past two years, significant changes have reshaped how our businesses operate, partly due to the new UK government and the decisions of the last government. Additionally, the recent shift in the US administration, with its use of tariffs as a negotiation tool and its perceived pivot toward Russia and away from Europe, demands greater agility from UK companies. Change may now occur over weeks rather than the months or years we've grown accustomed to.

The UK must navigate a delicate balance between trading with the EU and the US—These being the two economic powerhouses that heavily influence global trade through political pressure and evolving regulations. Simultaneously, the UK government should intensify trade negotiations with far eastern nations such as China, India, and Indonesia, home to over 38% of the global population. These countries are rapidly industrialising, presenting a wealth of emerging opportunities for UK businesses, especially in the solids handling sector.

On a positive note, SHAPA held its first meeting of 2025 with the General Meeting held in February, where 68 member representatives from 40 member companies registered for the meeting. The meeting was held in Stafford where the main speaker engaged the room on the subject of employee's mental health, the main theme being the range of help and assistance that is available from the UK government to increase employee wellbeing. In addition to the main speaker three member presentations were given by WAM Engineering who joined the association at the end of last year, V-i flameless explosion protection from StiF, and AMP & AHS who announced their new name - Akona Process Solutions - and ran through their products and services and how they will be able to



collaborate within the SHAPA community. Prior to the presentations a round table discussion was facilitated by Vice Chairman Russell Davies on the main areas of concern for the membership, these being potential tariffs from the US, export assistance and clarity on CE/UKCA marking.

The association continues to grow and a further four new members have joined the association in 2025, Hargreaves, API UK, EBRO and Berthold Technologies . SHAPA continues to provide an invaluable service for members old and new alike in these times of economic and global insecurity

The next SHAPA event will be the AGM directly followed by the 2025 Solids Handling Industry Awards dinner, which this year is to be held in Stoke on the 6th May. The award categories have once again been heavily subscribed and include the Apprentice Prize Award, Company of the year, Export, Innovation in Technology, Innovation in Training and Development, Innovation in Safety, Newcomer and sustainability. At the time of writing all of the categories have significant and impressive nominations which is testament to the successes of the membership over the last year. Final results will be announced at the Awards Dinner.

In addition to our regular general meetings which take place quarterly in Stoke, SHAPA is also running two training workshops this year, Sales training and planning, aimed at engineers and non sales personnel and the ever popular digital marketing workshop which now is being held for the 17th consecutive year. The first of which is the Sales training workshop on the 19th March followed by the digital marketing workshop in the 3rd Qtr 2025. SHAPA is also looking at creating a higher level Atex course for later in the year to increase the understanding following on from the successful introduction to ATEX and DSEAR workshops held last year.

As we look to the future, we must not forget the past. It has been well over 40 years since SHAPA was established as an industry body to represent its member companies and provide a platform for regular idea-sharing. From its humble beginnings with just six members, the association has grown to well over 100, a figure it has proudly sustained for more than a decade. Throughout this time, SHAPA has become the leading UK authority in providing valuable information to both its members and the wider solids handling community. At the same time, it has fostered a close-knit network of companies, encouraging collaboration, learning, and professional growth.

Business will continue to thrive regardless of political conditions, and SHAPA remains committed to equipping its members with the best information, data, and techniques to sustain and enhance the industry's success. Whether you are a manufacturer, supplier, or end user seeking guidance, we strongly encourage you to visit the SHAPA website at www.shapa.co.uk or contact us at info@shapa.co.uk.



Getting The Right Mix

The terminology 'mixing' and 'blending' is often grouped together as the same process, technically they are slightly different. The process of blending is the homogenous distribution of differing materials and is usually a relatively gentle process. This involves, either solid-solid mixing or the mixing of bulk solids with small quantities of liquid. Whereas mixing is usually a more aggressive process involving the combining of materials through the beating or stirring of the contents within a static vessel. Agglomerators can be included under the description of mixing and blending as the agglomeration process involves the creation of granules from powders through the addition of liquids. In certain circumstances some mixers can also operate as agglomerators and dryers as well.

In an industrial setting blending, often takes place in Double Cone and Vee blenders that gently tumble their contents over and over. Rotating Drum blenders, fountain blenders, low speed ribbon and paddle mixers can also be used for blending too.

Mixing can be achieved by using high speed rotating ribbon blades, ploughshare blades or orbiting vertical screws. 'No-dead pocket' valves with contoured outlets are essential when the entire contents must be fully mixed, otherwise there is a possibility that some



unmixed material will discharge from the mixer each time it is unloaded leading to quality control issues. Blenders that tumble do not suffer this characteristic as the mixture is all funnelled to the outlet. Ribbon mixers, paddle mixers and blenders also can have the ability to mix the ingredients gently so that they do not damage delicate products. Ploughshare mixers, on the other hand, are ideal for mixtures that need to be beaten together or where colourings or other coatings need to be smeared over the entire surface of other materials. Both mixers and blenders can accommodate the addition of liquids to form pastes or slurries. and both can be jacketed for heating and cooling their contents during the process if required.

Mixing in static vessels can either be batch based or used on a continuous process, whereas tumbling blenders are purely batch machines. Mixers and blenders can have heated jackets or have warmed, dried air passing through them so that they become dryers or reactor vessels. It is the aim of all mixer and blender manufacturers to achieve a homogenous mix in the shortest possible time and then to discharge it without any segregation during the process. Such aims have resulted in a multiplicity of variations on

traditional mixer and blender types plus a host of inventive, proprietary mixer and blender designs.

Besides machines that are dedicated to mixing, there are storage silos that mix materials: these are called Live Bins or Fountain Blenders. They use screws, spirals internal baffles and air to continuously recirculate material during storage. Agglomerators fluidise powders so that they can be wetted and combined to form larger particles or granules. The controls associated with the powder flow, fluidisation and liquid injection offer the options of varying particle size, shape and density according to requirements

Allied to mixing and blending are sieves, screens, separators, sifters and shakers, as well as classifiers which reverse the process of mixing and are used to separate products either in size, weight, material type etc and can be used for all materials. Such equipment may be used for QA sampling or production in batches or continuous processes. Because of the very broad applications spectrum, the science of particle separation and classification requires very specialised knowledge of the product characteristics as well as the entire process. Robust screens to progressively separate

quarried minerals, for example from coarse aggregates to fines, obviously require a very different approach to the sieving of delicate pharmaceutical materials. Again, difficult materials may adhere or agglomerate requiring techniques such as ultrasonics to enable successful sieving and accurate size classification. Diverse products such as zinc, powder coatings, gypsum or rice meal need expert treatment.

As can be seen there are many differing processes under the global heading of mixing, blending and sieving, this is where SHAPA can help, with its members many years of expertise through operating and providing solutions for mixing and blending and sieving processes you can be assured that SHAPA members have the right solution for your process. A quick visit to the Equipment Finder section on the SHAPA website www.shapa.co.uk will guide you through the different choices ensuring you have the right solution for your process needs.

For more information and assistance with all your solids and bulk handling requirements, visit the SHAPA website at www.shapa.co.uk or email your requirements to info@shapa.co.uk where our members will be happy to help.





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By Grant Wellwood,
Principal at
Wellwood Associates

CRITICAL CONTROL POINTS -

THE KEY TO SUSTAINING NAMEPLATE FLOW AND REALISING VALUE CHAIN OPTIMISATION

Instalment 2: Setting things up for Success

ABSTRACT

Getting bulk solids to flow correctly is vital for plant operations and revenue. Unlike liquids, they require careful design, as flow problems are difficult to fix after construction and tend to occur in predictable places.

In the previous instalment(1) we introduced the concept of Critical Control Points (CCPs), which are defined as physical locations in the value chain where bulk flow issues have the potential to damage the business (quality, productivity, optimisation); and where preventative control measures can be applied.

This instalment we look at how you can apply this approach to help ensure flow is an integral part of your plant's design and operation without distracting from its primary processing objectives.

Keywords: Granular solids, flow, Critical Control Point

FAIL TO PLAN?, PLAN TO FAIL!

It may be well worn, but this cliché is very applicable when it comes to bulk flow, where baked in FLOW problems can plague a plant for its often shortened life! Planning for controlled flow starts with an assessment of the "health" of your foundation documents, followed by application of a FLOW Analysis at Critical Control Points (FA@CCP) methodology to help identify gaps. Doing so encourages discussion and resolution at this critical formative stage, before it's literally too late (Figure 1). The first milestone to establish is your process's Flow Objective (in this series we are illustrating points through the lens of one of the biggest class of bulk solid flow processing categories; Mining and Mineral Processing (M&MP)).



Figure 1: The implications of late change in FLOW value-chains

FLOW OBJECTIVE

The cornerstone of any M&MP study is the Basis of Design (BoD); a succinct statement of performance expectations. While BoDs can, and do, change (with sponsor's approval) during study phase in response to study findings, there is always a current-best version to guide decision making activity.

In terms of designing for FLOW, there are three important considerations viz:

- FLOW Context
- Nameplate rate,
- Instantaneous rate,

FLOW Context The flow behaviour of raw bulk solids like ore and its derivatives are very sensitive to context. Without knowing the geometric, compositional and environmental context of a bulk solid and its intended flow path through the entire value-chain, it is impossible to achieve flow by design.

It should be noted that ore flow behaviour is so sensitive to these values that they need to be measured for your actual material. Flow characterisation encompasses elapsed time so it takes time and is a specialised activity. The results are however a life-of-plant asset which can be reused to inform future FLOW (engineering & operational) decisions. Conversely skipping this step in an attempt to save time and money is one of the M&MP industry's biggest false economies, and reverting to "library values" is no better than

ignoring the issue of FLOW completely.

Study phase is an exercise in making the decision that shape and dictate every aspect of a M&MP operation's existence. Cognitive biases in relation to these decisions are the root cause of many of the biggest failures in the history of M&MP development(2).

Nameplate Rate The operation's capability is normally expressed in the form of the number of tonnes of ore that it can process in a calendar year (tonnes/annum), which is colloquially referred to as the operation's "Nameplate". This is the foundation value of the design and is the basis of calculation for the plant's process economics. As it is reasonable easy to quantify and is reported quarterly to investors, it is used as a primary key performance indicator.

Instantaneous Rate Less commonly found explicitly expressed in BoD's, yet far more important in terms of designing for flow, is the operation's instantaneous flowrate. Thanks to the second law of thermodynamics, M&MP operations experience wear continuously hence they need to have their rotatable spares changed out during routine maintenance shutdowns. The number of available operating hours in a calendar year is typically in the range of 70-90% of its absolute hours (8,766 hr/y). The instantaneous flow during

actual operation of the value chain therefore needs to be proportionally higher to ensure the annual nameplate value is achieved.

Usually expressed in the form of tonnes per unit time (e.g. tonnes/hr), the instantaneous rate, should be presented in the form of ranges to cover expected surges and spikes, as well as turn-down ratios, should be the basis of calculation for the detailed design and used to inform equipment sizing and selection decisions. As basic as this seems, historically failure to make the distinction between nameplate and instantaneous rate has led to the construction of operations with (multiple) baked-in flow constraints leading to it being physically incapable of achieving its nameplate (equipment being erroneously sized on the nameplate not instantaneous rate+surge allowance), or equally problematic, operating of the entire value chain on a knife-edge (unable operate outside a very narrow flow range (aka "sweet spot")).

FLOW NARRATIVE

This is a qualitative written description of how the ore and its derivatives are intended to flow through the pit-to-port (or other site boundary) value chain. Unfortunately, like the instantaneous rate above, this simple BoD device is an often omitted from study phase reports. The vacuum this omission creates means there is no overarching flow intent to guide the design process. Instead, the system

Skipping this step in an attempt to save time and money is one of the M&MP industry's biggest false economies, and reverting to 'library values' is no better than ignoring the issue of FLOW completely.

flow narrative evolves in an ad-hoc manner without purpose, oversight or accountability.

If it is not described in the Bankable Feasibility Study (BFS), the study team will (must) fill in the gaps, but usually on a process unit operation by unit operation basis as opposed to the required systems approach. The main issues here are that bulk solid FLOW is a complex system where everything is connected.

In this operating environment it is common for detailed designers to deliver a metaphorical elephant when the owners were expecting/needing a thoroughbred racehorse.

Most of us in M&MP development are “doers”, hard-wired to spring into action and to do something rather than thinking things (like FLOW) through. When you design your plant in writing (using a human language), there are natural prompts that promote thinking about possibilities and options which nearly always act to improve your design. Nobody feels bad when they modify a paragraph in a working document, but once things progress to detailed design the problems of an incorrect narrative start to become baked in and very expensive to rectify (if discovered that is). After the plant is built and constructed, most flow problems

are so constrained they can never be put right and go on to plague the operation for its life (Figure 1), often resulting in operational life “truncation” as a consequence of crippling financial impacts.

The flow narrative should cover all possible operational scenarios starting with the baseline of normal steady-state operation at the instantaneous rate, but then expands to include unsteady-state events and core design intentions like:

- Start-up (from an empty [‘clean’] condition-including pre-requisite conditions),
- Controlled shutdown (ahead of scheduled maintenance for example)
- Emergency (crash) stop,
- Restart (from both a controlled and emergency stop and long-sit initial condition)
- Extreme Conditions
 - Wetter, harder, finer, coarser... ore
 - Weather (temperature, wind, rainfall, humidity..),
- Cost trade-offs
 - Wear,
 - Dust controls,
 - Manual vs Automatic control posture.

The narrative should also describe the flow through the entire value chain covering issues like:

- device sequencing,
- pre-requisite and interlocking events/conditions,

- what to monitor and where?
- what happens when it deviates from expectation?

Finally, the flow narrative should also cover the future. Most plants are designed for 10-20 years of operation so:

- What might happen to the ore characteristics over that time (going below water table, grinding finer to accommodate ore texture changes for example)?
- Are there plans to increase the nameplate capacity (debottlenecking/expansion) at some point (usually a “Yes”)?

Designers need to be cognisant of the plants entire operating life so as not to create expensive bottlenecks and make future-proofing decisions up front. If the process involves reagents in bulk solid form (e.g. quicklime), have they been characterised? What happens if procurement finds a cheaper source during the life of the asset for example?

While all this does take effort, it is mainly just a matter of thinking things through with the sponsor. It is probably the most important element of a design for flow approach, as you can’t meet the sponsors expectations if you don’t know what they are? This aspect of the planning process ensures there are no “elephants in the design room”, so no one has to ride one in the Grand National!



Ignore the “FLOW by design” elephant in the design room? Ride it in the Life of Asset stakes!

Criteria	Metric	Clear Success	Clear Failure	Test/Reference
Safety	Lost time injury	0	>0	Internal reporting to industry standards
FINANCE				
Cost of Execution	\$ (% of approved budget)	<100	>115	Audited accounts
Profitability	NPV (% of BFS base)	>100	<115	Audited accounts

Table 1: Best Practice Success Criteria Table Format (typical)

SUCCESS CRITERIA

Every project should contain a formal Success Criteria table (Table 1) that brings together all the disparate elements upon which the completed project is to be objectively tested against. Because it explicitly spells out what constitutes a success outcome in testable metrics, such a table is another common omission (a casualty of designers angling to maximise the wriggle room in the event of underperformance-human nature and failure of the sponsor to insist).

When such a table is included, it normally covers performance dimensions like capital spend, schedule, operating cost, metallurgical performance, financial returns, safety. They are nearly always silent on the one thread running through all these factors-flow (we have never seen one)!

A best practice Success Criteria table defines “Clear Failure”, “Clear Success”, with performance falling between these limits requiring outcomes to be individually judged and justified. In addition to mandatory sections covering safety and financial considerations, the Success Criteria table needs to include a dedicated section defining metrics that describe flow and its operational impacts. For example:

- Ability to satisfy the flow objective and narrative? (rates: instantaneous, peak, turn-down),
- Abrasive wear rates-spares replacement frequency,

RISK REGISTER

The final element of the foundation documentation set that needs to cover flow is the risk register-the living

document that endures for the project’s entire life to ensures risks like those associated with FLOW, do not fall off the RADAR (especially between stages) and are run to ground.

All projects, especially M&MP based ones, involve uncertainty and risk. Having defined what success looks like in the Success Criteria table, the risk register lists the things that have potential to materially interfere with these objectives. Once again, the risk registers found in most FS’s cover financial, schedule and metallurgical risks but seldom (never in our experience) identify element that could interfere with the FLOW objective. Given M&MP revenue is directly proportional to FLOW, this is another glaring omission. If risks to controlled flow are not on the register, they have no identity and receive not design attention. Even if flow related risks are on the minds of individuals, they usually get lost as the project moves through study phase into detailed design. The risk register is the enduring tracking record and the main legacy document for the detailed design team which should list your project’s CCPs. If it is silent or incomplete with respect to FLOW risks, it needs to be updated at the end of the FA@CCP exercise to ensure all the outcomes are captured. There usually a very satisfying difference between the before and after versions-you feel like you have added significant value and helped the project dodged the proverbial bullet.

NEXT INSTALLMENT

Having covered the concept of CCP and now the foundation documents required to set things up for success, in the next instalment we will show how you can objectively identify the CCPs in your flowsheet.



About the author

Grant Wellwood, PhD (CEng), FICHEME,
An experienced process engineer specialising in the study (trade-off analysis) and innovation of processing flowsheets. His personal goal, to find simplicity in complexity so scarce resources can be used more effectively, has taken him from food to metal and all places in between. Sometimes a proponent, sometimes a customer, his career rotation through the various roles has given him a unique perspective and empathy for everyone in the process innovation ecosystem, especially the customers who need to move from a status quo.

His innate ability to discern signals in noise has led to him holding over 20 processing-related patents, a testament to his deep understanding of the processes and physics involved and a knack for linking them to business value creation opportunities.

His current focus is the development of tools to overcome the biggest roadblocks to realizing the value of processing innovation in the face of incomplete knowledge and high uncertainty.

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SILVERSON'S NEW ANIMATION ON CONTINUOUS POWDER/LIQUID MIXING

Silverson Machines has released a new animation in its *Mixing Science* series, focusing on the challenges of continuous powder/liquid mixing.

Mixing powders into liquids is a tricky process. To do it continuously, both ingredients must be carefully metered into the mixer. However, several issues can arise:

- If the liquid flow is too low, the mixer won't absorb the powder effectively.
- There's a limit to how much powder can be added in a single pass.
- If too little powder is added, the mixer may incorporate air.
- Even a brief blockage in the powder hopper can cause liquid to flow through without mixing with the powder.

Because of these challenges, continuous mixing is often not the best solution. Instead, a batch/

recirculation system is recommended to ensure a smooth, consistent mixture.

Silverson's *Flashmix* powder/liquid mixer is designed for this purpose. Unlike traditional mixers that rely on vacuum suction, the *Flashmix* forces powder into the liquid stream. This allows it to handle larger volumes, work with higher temperatures, and mix more viscous liquids effectively.

Although batch/recirculation is generally preferred, the new animation explores ways to achieve continuous dispersion for specific processes. With over 75 years of experience in powder/liquid mixing, Silverson Machines can help find the right solution for your needs. [Contact us](#) to discuss your application!





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By Adam Evans -
Design & Engineering Manager at
Tapflo UK

SMART SOLUTIONS FOR POWDER HANDLING IN FOOD PROCESSING

Powder handling is a necessary yet often underestimated process within the Food Processing industry. The ability to integrate powders into liquid systems is essential, and with recent technological advancements, modern Powder Handling Systems redefine outdated methods, delivering streamlined, automated, and contamination-free processes.

The Challenges of Traditional Powder Handling Methods

As many food manufacturers and production facilities can attest to, handling powders in a processing environment has consistently been a challenge. Traditional methods regularly involve manual handling, which could lead to process inefficiencies, dust exposure, and product inconsistencies; factors such as poor solubility, particle size differences, and air entrapment can all negatively affect the final product. Additionally, standard methods require excessive time and labour, driving up operational costs and compromising on safety and hygiene.

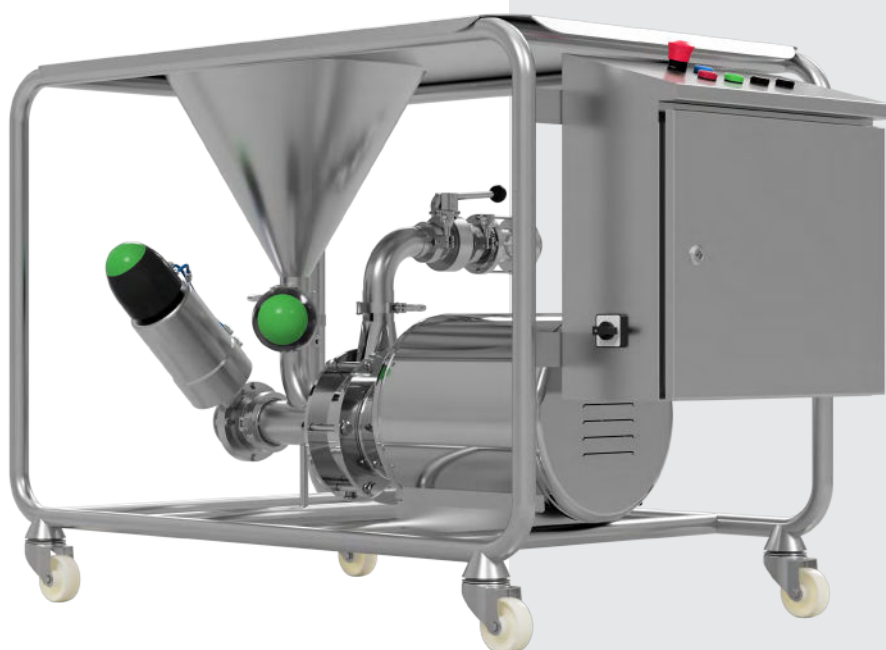
How Modern Powder Handling Systems Overcome These Issues

Powder Handling Systems are addressing these challenges through automation, precision mixing, and enhanced containment. At the core of these systems is the high-shear mixer, a technology that optimises powder-liquid blending to create homogeneous, high-quality mixtures. These mixers work by using a high-speed, high-tolerance impeller within a rotor-stator assembly, breaking down particles efficiently to ensure even dispersion.





Powder handling is a necessary yet often underestimated process within the Food Processing industry. The ability to integrate powders into liquid systems is essential.



Key Features and Benefits of these Systems

1. Precision Mixing and Homogenisation:

High-shear mixers create a powerful energy zone where powder and liquid mixtures are rapidly homogenised. The rotor/stator combination ensures an even distribution of particles, reducing inconsistencies and minimising aeration. Stator options allow for particle size reduction down to 3 microns, achieving uniformity across various applications

2. Customisable for Various Applications:

No two processing lines are identical, which is why flexibility is vital. Powder Handling Systems can be fully customised with various pump configurations, including Progressive Cavity, Lobe, and Twin Screw Pumps, allowing for seamless integration into existing operations. Whether mixing food-grade ingredients or handling high-viscosity pharmaceutical products, these systems can be adapted to meet specific industry requirements

3. Reduced Manual Handling and Increased Safety:

With the inclusion of hoppers and integrated tables, the requirement for manual handling is significantly reduced. This minimises the risk of contamination, improves operator safety, and enhances overall process efficiency. Automated valve control further streamlines the operation, reducing reliance on manual adjustments and ensuring consistency across batches

4. Optimised Powder Dispersion:

The fluid inlet mechanism ensures that powders efficiently enter the system to prevent clumping or sedimentation. As powder integrates with the incoming liquid, it is immediately subjected to high-shear forces, achieving complete dispersion before entering the final processing stage

5. Scalable for Any Production Size:

From laboratory-scale R&D operations to full-scale industrial production, Powder Handling Systems are designed to be scalable. This ensures that companies

can maintain consistency in production quality regardless of batch size

Industry Applications

Powder Handling Systems are integral to a number of industries, each with their own unique challenges and requirements:

- **Food & Beverage:** Ensuring smooth emulsification of oils and powders for dressings, sauces, dairy, and beverage formulations
- **Pharmaceuticals:** Achieving precise granulation and homogenisation for consistent drug formulations and active ingredient distribution
- **Chemical Processing:** Handling particle size reduction and dispersion for coatings, adhesives, and industrial chemicals
- **Plastics & Polymers:** Facilitating uniform blending of resin and additives to enhance product performance

Addressing Safety and Compliance

A major concern when it comes to powder handling is the risk of dust exposure when

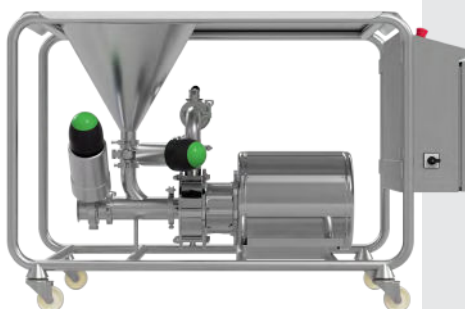
handling hazardous materials. Advanced Powder Handling Systems should incorporate closed-loop containment solutions to minimise airborne particles and ensure a safer working environment. For even greater protection in flammable and explosive settings, high-shear mixers are available in ATEX-certified variants to ensure stringent safety standards are met.

Looking Ahead to The Future of Powder Processing

With the powder processing equipment market projected to grow by 5.1% by 2032 (Allied Market Research 2023), companies must prioritise investment in advanced handling systems to maintain a competitive advantage. The future lies in further automation, enhanced customisation, and sustainability-driven designs that minimise waste and energy consumption.



By leveraging expertise in mixing technology and process engineering, companies can seamlessly integrate these solutions into their operations for a more efficient, safe, and scalable future in powder processing.



Traditional methods regularly involve manual handling, which could lead to process inefficiencies, dust exposure, and product inconsistencies.



About the Author

Adam Evans, Design & Engineering Manager at Tapflo UK, has been in the Process industry for over 10 years. Holding a Bachelor's degree in Mechanical Engineering, Adam spent over four years at Babcock, where he specialised in naval systems and cranes, gaining invaluable insights into complex nuclear engineering projects. He then spent over two years at Aquila, where he focused on designing custom nuclear handling systems. This further enhanced his versatility and expertise in engineering solutions for critical applications.

Joining Tapflo in December 2020, Adam has quickly become an essential part of the team. His wealth of experience and technical insights contribute to the development of innovative process solutions and the continuous improvement of engineering processes.



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joe getliffe
1 review

★★★★★ 2 months ago

I recently did the P601 course in Liverpool. The course was very informative and I really enjoyed it. Adrian is a great tutor and kept me engaged throughout. I learned a lot on the course and would recommend.

Like

Josh
1 review

★★★★★ 5 months ago

I recently had the pleasure of meeting Adrian on the P601 course and it was very informative and well structured. All the information is given to you and in a way that is easy to learn and easy to remember for your exams. There is multiple chances throughout the course to go through any concerns you may have whether they're big or small and nothing is ever too much. Highly recommend this course and Adrian himself and will more than likely be coming back for future courses. Thanks.

Like

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Rigid couplings are available in a wide variety of sizes and styles to suit the needs of food packaging applications such as case erectors, cartoners and form-fill-seal equipment. The couplings are ideal for shaft-to-shaft connections and precise servo driven applications, as they do not introduce misalignment, vibration or bearing noise into the system.

They have precision honed bores, anti-vibration hardware and opposing

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Product links:
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By Steve Sherwen –
Principal Consultant
at RPS

MECHANICAL EQUIPMENT SELECTION IN HAZARDOUS AREAS

Introduction

The implementation of DSEAR way back in 2002 placed a requirement on employers to formally manage any ignition sources that could be created from mechanical equipment operating in an atmosphere where combustible dust could be present (i.e. hazardous areas).

In the last 20 years, industry has ironed out many of the early teething problems and the selection and lifecycle management of mechanical equipment in hazardous areas is now trouble free and well understood. Well, there are still issues. This article will point out some golden rules to help unpick user requirements when it comes to managing mechanical equipment installed where combustible dusts are present.

Do you need a zone?

This may sound a strange question but it's

the first thing you should look at following Regulation 6 of DSEAR which puts a responsibility on operators to eliminate flammable atmospheres where possible. This is easier if you are still at the design stage of a project but even mature processes can look into elimination and/ or reduction of risk.

When considering combustible dust hazards, one of the most fundamental things that can be done is ensuring that housekeeping is good. If you can eliminate accumulation of dust in a plant, you may be able to remove external Zone 22 areas. This offers benefits in no longer then needing certified equipment but accumulations of dust can lead to secondary explosions in a process disturbance. It is these secondary explosions that can result in multiple fatalities (Imperial Sugar, Bosley Wood Mill) and so removing this hazardous scenario should always be a priority.



Figure 1 – Dust accumulations. External Zone 22 may be required – Housekeeping improvements would be preferable!



If you can eliminate accumulation of dust in a plant, you may be able to remove external Zone 22 areas.”

Secondly, it is common to see external Zone 21 areas around hoppers and bag handling processes. But ask yourself, how credible is it, during normal operation, to have a dust cloud with a concentration that would result in a dust cloud that you could not see through? If this is the case? How does the operator breath?

Most dusts have a minimum explosive concentration of around 30 g/m^3 . This would be an optically dense cloud and obviously impractical to work in. In fact this level is many orders of magnitude higher than the threshold for dust exposure in the COSHH Regulations. However almost all dust handling equipment will have in internal zone, even if there isn't an external zone where the equipment is installed.

So, before you spend time and money on certified equipment, check that it is needed.

Yes, I have a zone – equipment specification

So, you have established that there is a zone, either a Zone 22, 21 or 22. The next challenge is to establish your dust group and temperature rating. The dust group, IIIA, IIIB or IIIC isn't too hard to establish. Conductive dusts are IIIC and nonconductive ones IIIB. If it is a flying or fibre, it is IIIA.

A bigger challenge is establishing the temperature rating. This is worked out from the layer ignition

temperature and cloud ignition temperature and it's finding these parameters that can be a challenge. The Safety Data Sheet (SDS) for the dust, if you are lucky, might give you an auto ignition temperature but it may not be clear which form of dust this is for.

Once you find these metrics, the temperature limitation is the lower of the layer_{5mm} ignition temperature minus 75 K and the 2/3 of the cloud ignition temperature.

You now have enough information to allow a supplier to specify equipment for you. They will need the equipment category (equipment protection level (EPL)), dust group and maximum allowable temperature. And they will require this for the internals and externals of the equipment.

It is important to note that as a customer, you should tell the supplier the category (EPL) of equipment (1D (Da), 2D (Db) or 3D (Dc)), not the zone. This is because you can install either over or underrated equipment for a zone if a risk assessment is carried out to justify this. The more information you provide the more likely you will get the right equipment for the zone of use.

The information relevant to the certification of the equipment will be on a nameplate and duplicated in any certification or documentation (Declaration of Conformity/ Incorporation) sent with the machine.

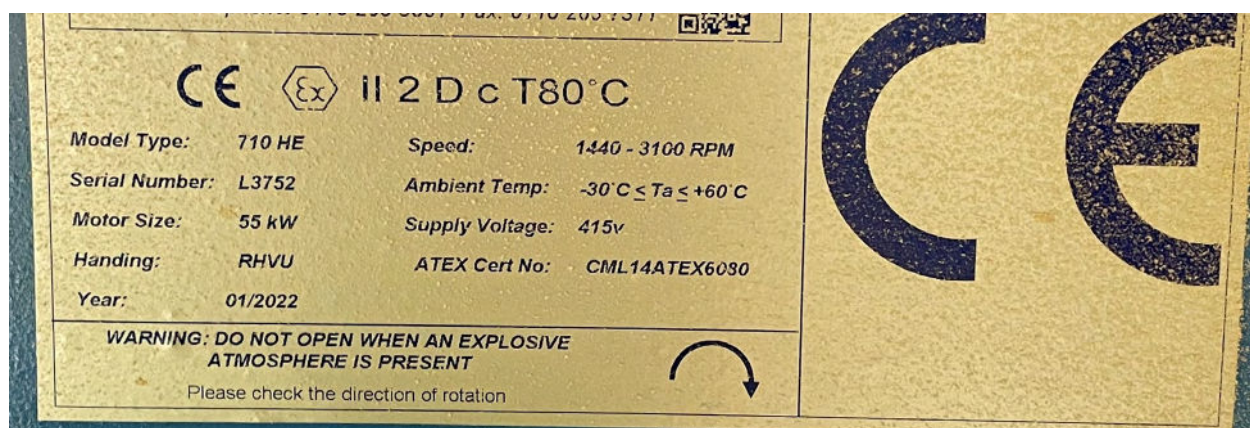


Figure 2 – Photograph of Machine Nameplate, missing the dust group.

Special Conditions

Almost all mechanical equipment will be built to BS EN 80079-36 (Explosive atmospheres Part 36: Non-electrical equipment for explosive atmospheres – Basic method and requirements) and BS EN 80079-37 (Explosive atmospheres – Part 37: Non-electrical equipment for explosive atmospheres – Non-electrical type of protection constructional safety “c”, control of ignition source “b”, liquid immersion “k”). This means that unlike electrical equipment, the protection concept will require manufacture specific maintenance, installation or operational requirements to ensure that the equipment remains safe through its lifecycle.

This can result in very onerous conditions of use. Examples can be the installation of protective instrumentation (temperature monitors, vibration trips, etc.), the imposition of specific operating conditions and the burden of very strict maintenance requirements. Examples of this can include the replacement of bearings on a 6 monthly basis.

Many of these safeguards may well be appropriate and necessary however, it is important that as an end user, you understand these requirements before committing to buying. You may operate a continuous process so the last thing you want to do is impose a shutdown every 6 months to change components. Not only will this disrupt production but if a bearing is working well, the worst thing you can do is strip a machine apart and rebuild it with a few added faults! Plus after a few years, will production be happy to shut down when you never find any faults in the bearing? Can you approach the manufacturer and suggest an alternative such as condition monitoring? Or even look for an alternative supplier.

If additional instrumentation or mechanical safeguards are needed, you want to know about these whilst the plant is being

constructed, not when you read the instruction manual during commissioning.

First Use

Regulation 7 of DSEAR places a requirement on the end user to ensure that everything is suitable and safe before use. For mechanical equipment, this will include ensuring that the machine has been installed, inspected and commissioned correctly. The O&M manual may well list some of these requirements including initial vibration checks, belt tensioning or the filling of oil.

If the equipment is supplied on a skid, there may be a number of equipment items making up the assembly. It is your responsibility to ensure that any overall certification is a worst case. What this means is that if the skid has a certification of 2G, T200 IIIB, there shouldn't be a lower standard of equipment on the skid. For example if there was a rotary valve with name plate saying 2G T250 IIB, this would not be acceptable as it has a temperature rating that is too high.

Happily Ever After

As mentioned previously, unlike electrical equipment, there isn't a standard dictating the hazardous inspection or maintenance requirements for mechanical equipment but guidance is provided by CompEx (Non-Electrical Inspection Schedule CCL 7003, Rev 4 05/24). What you must also do is to extract any maintenance information from the O&M manual and ensure that this is carried out.

There may also be specific parts that are required so rather than using generic off the shelf components, do you need to buy spares from the OEM?

Technical competence needs to be verified. Not only should maintenance technicians be aware of their responsibilities and requirements under DSEAR, but they must also be technically proficient overhauling that equipment. Do they need extra training from the supplier? What about using third parties? What

standard of spares are they using, are they reverse engineering parts? How do you control this. Remember, you can delegate your tasks but not your responsibilities.

Summary

Something to remember with mechanical EX equipment is this simple route to success:-

- Ensure the zones (inside and outside) are right.
- Ensure the equipment specification is correct.
- Check the special conditions of use.
- Check you have received what you ordered!
- Make sure you maintain it correctly and document.



About the author

Steve is a Chartered Mechanical Engineer, specialising in process and industrial safety in the high hazard industries, with many years of operational experience. He has many years of experience in DSEAR (Hazardous Area Classification, Mechanical Source Ignition Risk assessment, Compliance Audits and Risk Assessment), completing a number of complex studies on hydrocarbon liquid and gas systems, solid and dust systems across all industry sectors (offshore, petrochemical, pharmaceutical, energy, metals). He is a principal member of the Energy Institute Working Group authoring the EI15 guidance on Hazardous Area Classification. A background as a maintenance and integrity engineer, working on a top tier COMAH site gave him a thorough knowledge of the operation and failure modes of piping, vessels, rotating machinery and structures, with a strong appreciation of instrumentation and electrical equipment.



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Conveyors

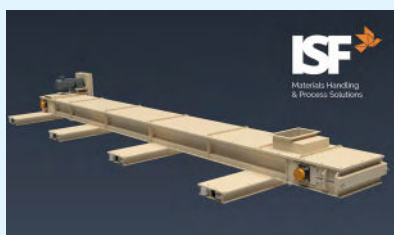
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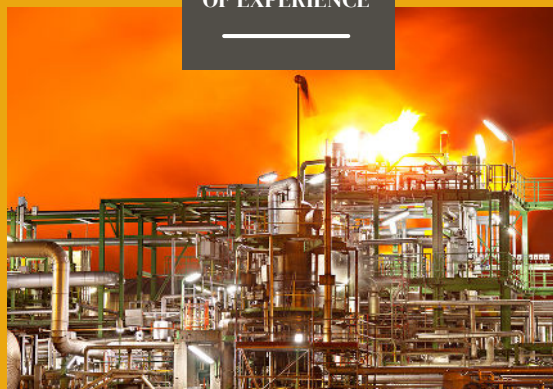
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FUEL - OXYGEN - IGNITION





By Carolin Wolf,
Media Designer and Content Marketing Specialist
at UWT Group

RADAR MEASUREMENT: PRECISE LEVEL MONITORING AND FILL LEVEL CONTROL

Radar measurement has established itself as one of the most reliable technologies for level control in recent years. Its versatility and efficiency make it the preferred solution in industries such as food and beverages, chemicals, pharmaceuticals, and energy supply. This article explores the key principles, advantages, and applications of radar measurement, highlighting the benefits that different technologies can offer for specific challenges.

Basic Principles of Measurement using Radar Sensors

Radar, short for “radio detection and ranging”, operates on the transmission and reflection of electromagnetic waves. A radar sensor emits a focused electromagnetic wave, which is reflected back by objects as an echo and then analysed by the sensor. This principle enables the precise measurement of distances, levels, or

positions. The radar category includes both free-radiating radar sensors and sensors based on guided microwave technology, commonly referred to as guided radar, TDR (Time Domain Reflectometry), or GWR (Guided Wave Radar) sensors.

Free-radiating radar sensors operate contact-free, transmitting electromagnetic waves towards the medium to be measured using specific types of antennas. These



sensors are generally characterised by their frequency, as it plays a crucial role in non-contact level measurement within process or storage containers.

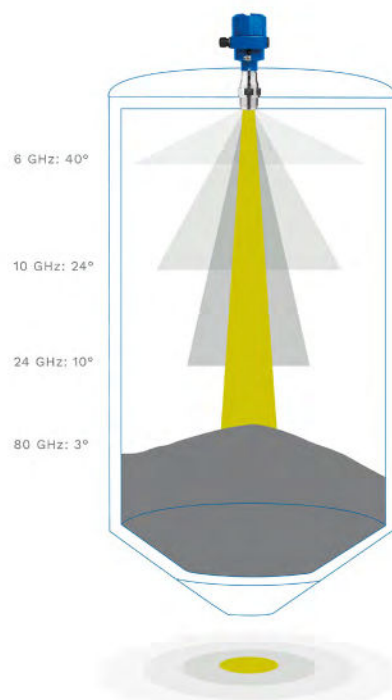
- **High-Frequency Technology:** Radar sensors with high frequencies, such as 80 GHz technology, can be designed compactly, feature narrow beam angles of up to 3°, and provide excellent reflection properties. This enables them to deliver precise and reliable measurement results, even in complex tank geometries or confined shafts and pipes.
- **Typical Applications:** They are ideal for liquids and bulk solids in silos, tanks, and open containers, particularly in situations where non-contact measurement is preferred due to hygiene or process requirements.

Guided radar sensors, also known as TDR or GWR sensors, use a probe (rod or cable) as a waveguide. The signal is directed along this guide directly to the medium. The probe remains in contact with the medium, offering specific advantages in demanding applications.

- **Low-Frequency Technology:** Guided radar sensors often operate at very low frequencies (e.g., 1 GHz), making them particularly resistant to dust, build-up, foam, or steam. This makes them ideal for applications involving moving surfaces or interface measurements.
- **Customisable Probe Types:** Various options, such as rod probes, cable probes, or coated probes (e.g., PA), allow flexible adaptation to specific process requirements.
- **Typical Applications:** They are particularly suited for challenging process environments, such as highly dusty environments within silos or tanks containing aggressive media.

ADAPTING TO DIFFERENT MEDIA

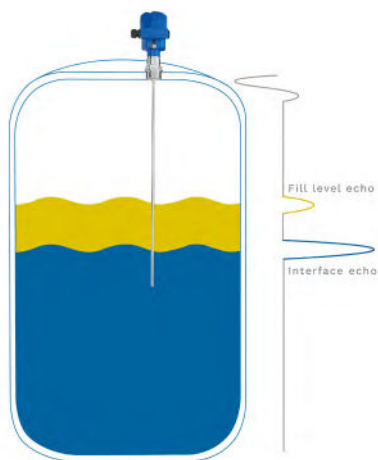
In addition to the measurement principles, distinctions are also made based on the various properties of the measured media:



Illustrative example - bulk solids measurement with pouring cone:
The beam angle increases significantly as the frequency decreases – the 80 GHz technology offers the highest precision with just 3°

Liquids

80 GHz radar technology provides versatile solutions for the precise level measurement of liquids. Smooth surfaces and high reflectivity ensure clear signals and straightforward measurement. The narrow beam angle of high-frequency radar sensors enables accurate detection, even in narrow tanks or with turbulent surfaces.



Interface measurement of liquids with different DK values:
The microwave pulse reflects off the upper layer (e.g., oil), penetrates it, and is reflected at the lower layer (e.g., water) back to the sensor.

Bulk Solids

Bulk solids pose greater challenges to sensors due to irregular surfaces, dust generation, and material cones. Modern radar systems excel in these conditions with robust signal processing that delivers precise measurements even under such demanding circumstances. The combination of high temperature and pressure resistance, minimal dead zones, and measurement accuracy of up to ± 2 mm makes this technology the ideal choice for dusty environments within silos or complex bulk material processes.

ADVANTAGES OF RADAR TECHNOLOGY

Radar measurement offers numerous advantages, making it particularly attractive for demanding applications:

High Measurement Accuracy: Radar sensors provide precise results, even under challenging conditions such as extreme temperatures, high pressure, or aggressive media. This ensures reliable process control and quality assurance.

Non-Contact Measurement: Radar technology is characterised by exceptionally high measurement accuracy and delivers precise results without requiring physical contact with the medium.

Maintenance-Free Operation: Since measurement is either non-contact or conducted via a guided wave, wear and mechanical failures are virtually eliminated. This extends the lifespan of the systems and minimises maintenance costs.

Resistance to Contamination: Radar sensors measure reliably even when dirt or build-up forms on the sensor. Optimised signal processing filters out interference, eliminating the need for cleaning.

Independence from Process and Environmental Influences:

Temperature, pressure, vacuum, and challenging conditions such as fog, wind, or rain do not affect measurement accuracy. The sensors provide reliable results under all environmental conditions.



Radar measurement is an indispensable key technology for modern process industries. It combines accuracy, reliability, and flexibility, proving its worth in a wide range of applications.

High Level of User-Friendliness:

The simple setup and optional sensor configuration, such as via an app, save time and enable quick commissioning and diagnostics.

Measurement in Flooding

Conditions: Radar sensors enable reliable measurement up to the sensor antenna, even in flooding situations. They have no dead zone, require no protective covers, and remain operational even in such extreme conditions.

Excellent Signal Focusing:

The 80 GHz technology enables pinpoint alignment of the radar beam on the medium to be measured. This simplifies the separation of measurement and interference signals, making measurement easy and accurate even in narrow shafts or with installations such as pipes and pumps.

Flexibility:

Radar technology is highly versatile, suitable for a wide range of applications - from silos containing solids and liquid tanks to complex process systems or open-air applications like outdoor stockpiles. This reduces the need for multiple sensor types and simplifies system planning.

Applications in Various Industries**Food and Beverage Industry**

In food production, hygiene and accuracy are top priorities. Radar sensors are often used to measure liquids such as milk, juices, or sauces. Their non-contact operation minimises the risk of contamination. Additionally, their resistance to temperature fluctuations and foam formation ensures reliable process control. The benefits include maintaining consistent product quality and reducing production downtime.

Chemical Sector

In chemical production, sensors must operate under extreme conditions. Radar technology excels in handling high temperatures, aggressive media, and explosive atmospheres. A typical application is measurement in reactors or storage tanks for acids and solvents. Here, radar measurement helps minimise safety risks and improve the efficiency of complex processes.

Pharmaceutical Industry

Precise measurements and easy cleaning are crucial in this sector. Guided radar sensors, designed to meet the high demands of sterile processes, deliver excellent

results. They are often used in fermentation processes or for level monitoring of active ingredients. The greatest advantage is their ability to support strict regulatory requirements and ensure the highest product purity.

Energy and Utilities Sector

In coal power plants or biogas facilities, sensors often need to handle abrasive or difficult-to-measure materials. Radar sensors have proven effective in measuring coal, ash, or biomass, contributing to increased efficiency and operational safety. This enables optimised resource utilisation and a reduction in operating costs.

Radar Technology – Future-Proof and Versatile

In summary, radar measurement is an indispensable key technology for modern process industries. It combines accuracy, reliability, and flexibility, proving its worth in a wide range of applications - from hygiene-sensitive processes to extreme industrial environments. With the continuous advancement of radar sensors, this technology remains a cornerstone for process optimisation and efficiency improvements across industries.

**About the author**

Carolyn Wolf has been working as a Media Designer and Content Marketing Specialist at UWT Group since early 2024 – the experts in all types of level measurement technology, operating regionally and globally since 1977. With over 13 years of experience in content creation, including specialised articles for industry-specific magazines, she brings extensive expertise to the communication of technical topics.

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In pharmaceutical manufacturing, maintaining the highest quality standards for oral solid dosage (OSD) forms is essential. Gericke's **GSV Sampling Valve** plays a key role in continuous production, ensuring precise and reliable quality control.

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Gericke's GSV is the only sampling valve on the market capable of taking a truly representative sample from a material flow. By capturing the entire cross-section, it guarantees product consistency and safety while helping to reduce drug shortages and speed up development times.

Key Features & Benefits

- **Precise & Reliable Sampling** – Ensures accurate quality checks before further processing.
- **Seamless Integration** – Works effortlessly with continuous manufacturing systems for automated, interruption-free sampling.
- **cGMP Compliant** – Designed for fast cleaning and easy product changeovers.
- **Adjustable Sample Size** – Meets unit dose requirements while

minimising material waste.

- **Versatile & Safe** – Suitable for various OSD forms, including high-containment applications with an optional **Wash-in-Place (WIP)** system for safe dismantling.

Designed for Continuous Manufacturing

The **GSV Sampling Valve** is part of Gericke's **Formulation Skid (GFS)**, a fully integrated system combining high-precision loss-in-weight feeders and compact blenders. These components work together seamlessly and are available for testing at Gericke's global facilities or for on-site trials.

A Smarter Approach to Pharmaceutical Production

By incorporating Gericke's sampling valve, pharmaceutical manufacturers can enhance quality assurance,



Gericke Sampling Valve GSV

ensuring every dose is **safe, effective, and consistent**. This commitment to excellence helps build trust with healthcare providers and patients, ultimately leading to better health outcomes.

With Gericke's global support network, manufacturers can take full advantage of **continuous manufacturing technology**, making pharmaceutical production more **efficient, reliable, and high-quality**.

INDUSTRY TRENDS DRIVING BULK BAG HANDLING EQUIPMENT UPGRADES

A new report from global powder handling and dry bulk solids processing specialist **Spiroflow**, an **Akona Process Solutions** company, reveals key industry trends shaping investment in bulk bag handling equipment. The **2024 State of Bulk Bag Handling** report presents a promising outlook, with **77% of industry professionals** considering upgrades or replacements within the next two years. Business growth remains strong, with **98% of respondents** reporting increased activity over the past year, and more than half (52%) experiencing growth rates exceeding **11%**.

Efficiency and Performance at the Forefront

Enhancing operational efficiency is a major priority, with **44% of respondents** seeking equipment upgrades to boost performance. Modern bulk bag systems are enabling companies to **maximise loads**, particularly for materials with **bulk densities under 30 lb/ft³**, leading to **significant cost savings** in transport and storage. At the same time, **42% of professionals** aim to **reduce downtime** by investing in advanced equipment designed for **easier maintenance** and **quicker part replacements**—ensuring continuous operation and extending equipment lifespan.

Workplace Safety and Operator Comfort

Beyond efficiency, workplace ergonomics is a growing concern. Nearly **one-third (31%)** of respondents are prioritising **operator safety and comfort**, recognising that upgraded bulk bag handling systems help **minimise manual handling, bending, and stretching**, thus **reducing the risk of workplace injuries**.

Spiroflow's Innovative Solutions

In response to these evolving industry needs, Spiroflow continues to push the boundaries of innovation. The **Cone Table Elite (CTE) Bulk**

Bag Filler sets new performance standards, filling over **40 bags per hour**—double the conventional rate of **20 bags**. It also delivers **weighing accuracy of +/- 1-2 lbs** and utilises advanced **densification technology**, increasing bag capacity by **up to 25%**. These advancements **optimise container and truck utilisation**, significantly cutting **shipping costs**.

Additionally, Spiroflow has introduced a **new sack tip station**, designed to enhance **air quality** and **material handling efficiency**, addressing common challenges in bulk bag operations.

With industry demand for smarter, safer, and more efficient bulk bag handling solutions on the rise, Spiroflow remains at the forefront, delivering innovative technologies that **drive productivity and cost savings** for businesses worldwide.

[Download the full report](#)



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By Craig Ayling,
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REGULATORY COMPLIANCE IN DUST HAZARD MANAGEMENT – MEETING ATEX AND DSEAR STANDARDS



Combustible dust hazards pose significant risks in industrial environments, making regulatory compliance a critical aspect of process safety management. The ATEX (Atmosphères Explosibles) directives and the DSEAR (Dangerous Substances and Explosive Atmospheres Regulations) establish strict requirements for identifying, assessing, and mitigating dust explosion risks. An in-depth understanding of these regulations reveals key compliance steps, risk assessment methodologies, and control measures aimed at minimizing dust-related hazards. Practical approaches to zoning classification, explosion protection, and documentation requirements are also examined, helping industries align with legal obligations while enhancing workplace safety. As enforcement tightens and penalties for non-compliance grow, adopting a proactive regulatory strategy is essential for operational continuity and risk reduction.

What is DSEAR/ATEX and what does it really want me to do with my dust hazards?

DSEAR and ATEX came into force in 2003 and relates to the protection of workers in a workplace handling any dust, whether in the form of solid particles or fibrous materials or otherwise, which can form an explosive mixture with air or an explosive atmosphere.

Many of the underlying principles for compliance had been in practice within industry for many decades before, however the ATEX directive set a requirement for EU member states to enshrine such practices into law. Most EU member states adopted ATEX directly, and in the UK it was adopted as DSEAR (Dangerous Substances and Explosive Atmospheres Regulations). When it comes to DSEAR and ATEX most people are familiar with concepts such as hazardous area classification and the use of specially certified (EX) equipment within said areas. Whilst these are key elements of DSEAR and ATEX compliance, they are just that, elements. If we were to zoom out and look for a headline objective for DSEAR/ATEX, it can be summarised as follows (as per the UK's HSE approved code of practice L138):

"to assess all potential risks to employees and others whose safety may be affected by the use or presence of a dangerous substance at the workplace."

This means we must understand to a suitable and sufficient extent the likelihood of fire/explosion events and their anticipated effects which could result from handling dangerous substances.

At a high-level, compliance with DSEAR/ATEX means demonstrating that the risks associated with handling combustible dusts are acceptable and have been reduced to as low as is reasonably practicable. The measures we use to reduce risk must then also be applied as per a strict hierarchy:

1. Do not have a flammable atmosphere, but if you do...
2. Do not ignite it, but if you do...
3. Do not hurt anyone.



Figure 1: Optically dense dust cloud

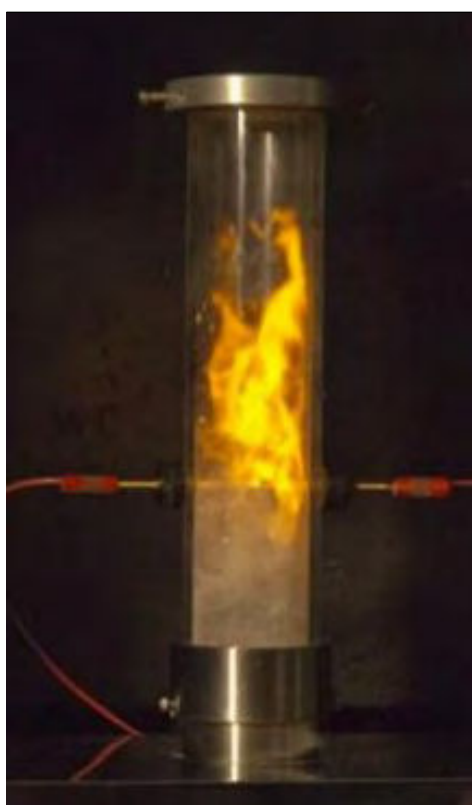


Figure 2: Hartmann tube used for laboratory dust flammability testing

Know your material and process

To demonstrate compliance, we must first lay a solid foundation. This foundation is formed of a solid understanding of our processes/activities and the materials we are handling in order to define normal operation.

Whilst this sounds simple, it often proves a big blocker when completing an assessment and demonstrating compliance.

Dusts, unlike their liquid and gas counterparts, can be a little bit more unpredictable when it comes to physical properties. This is because solid materials can be the same chemically but have different properties due to variations in the particulate form. Particle size, morphology, density and moisture content can all have a significant impact on the ability of a dust to form flammable atmospheres, its sensitivity to ignition and the severity of consequences should an ignition occur. It is also because of these anticipated variations that suppliers of powder material will seldom provide the required data for a DSEAR/ATEX assessment, and instead testing or more rigorous literature searches are required.

Key material information for DSEAR/ATEX assessments are material dispersibility (in air), particle size, combustibility (A/B testing), minimum explosible concentration, minimum ignition energy,



minimum ignition temperature and layer ignition temperature. Additional data points may be required such as conductivity or explosion severity, however their relevance will be dependent on the strategy of prevention/protection deployed.

When it comes to process information, there needs to be sufficient to ensure that we are able to identify where dusts could be present during both normal and abnormal operation.

Understanding and reducing the likelihood of explosive atmosphere formation

The second step, and perhaps the more defined step towards DSEAR/ATEX compliance, is identifying where and when explosive atmospheres may form within our process. It is within this step that hazardous area classification is mandated.

Hazardous area classification is essentially a structured approach that places identified explosive atmospheres into four pots based on likelihood:

- Those that arise frequently during normal operation – Zone 20
- Those that arise only occasionally during normal operation – Zone 21
- Those that arise only during expected abnormal operation and for short periods of time – Zone 22
- Those that only arise as a result of rare (or less likely) failure whereby formal hazardous area classification is not required – Non-hazardous

Furthermore, the dispersion of an explosive atmosphere is also evaluated to estimate the extent of the identified hazardous areas.

The core standard and methodology for conducting hazardous area classification for dusts is BS EN 60079: Explosive atmospheres - Part 10-2: Classification of areas - Explosive dust atmospheres.

Housekeeping is King when Working with Dusty Processes

Good housekeeping is vital in preventing dust explosions in the workplace. Dust layers are extremely dangerous and are

known as a major source of secondary dust explosions. Also, layers of dust on items of equipment act as insulators which can cause an item of equipment to overheat, and this can lead to smouldering of the dust layer in contact with the surface of the equipment. Smouldering dust layers are potential ignition sources of explosive dust atmosphere.

BS EN 60079-10-2 defines three levels of housekeeping as follows.

- **Good:** Dust layers are kept to negligible thickness or are non-existent of the grade of release. In this case, the risk of the occurrence of explosive dust clouds from layers and the risk of fires has been removed.
- **Fair:** Dust layers are not negligible but are short-lived (less than one shift). The dust is removed before any fire can start.
- **Poor:** Dust layers are not negligible and persist for more than one shift. The risk may be significant, and this should be controlled by selecting equipment according to BS EN 60079-14.

Leaks from equipment should not be left to persist. Instead, these should be cleaned up as soon as possible using a suitable vacuum cleaner (and not by sweeping or blown off with compressed air). If vacuum cleaners are to be used within a Zone 22, they should be ATEX compliant to Ex II 3D. If the vacuum cleaners are to be used within non-hazardous areas, it is important that the vacuum cleaners have multi-stage filtration upstream of the motor (at least two individual layers of filtration before the motor). This minimises the risk of dust entering the motor if one of the filters were to fail. Furthermore, it is advisable that only vacuum cleaners that are of a metal construction are used, as these will provide some form of containment in the event of a fire in the collection bag.

Ignition Source Control - Not just ATEX Equipment

Thirteen ignition categories need to be considered and are listed in BS EN 1127-1. They are summarised as follows:

1. Hot surfaces.
2. Flames and hot gases (including hot particles).
3. Mechanically generated sparks.
4. Unsuitable or malfunctioning electrical apparatus.
5. Stray electrical currents, cathodic corrosion protection.
6. Static electricity.

7. Lightning.
8. Radio frequency (RF) electromagnetic waves.
9. Visible light electromagnetic waves.
10. Ionising radiation.
11. Ultrasonics.
12. Adiabatic compression and shock waves.
13. Exothermic reactions, including self-ignition of dusts.

An ignition source assessment is governed by the following two considerations:

- The probability that the ignition source is present. This depends on the severity of the hazardous area (whether it is a Zone 20, 21, or 22).
- The probability that the identified ignition source is effective enough to ignite the materials. The answer to this question depends on two sub-aspects, these are:
 - i. The strength of the ignition source, which is either indicated by the temperature produced or an amount of energy dissipated. This will be judged on a case-by-case basis for each identified ignition source.
 - ii. The ignition sensitivity of the materials represented by the minimum ignition energy (MIE).



Hazardous area classification is essentially a structured approach that places identified explosive atmospheres into four pots based on likelihood.



Figure 3: Two examples of ignition sources

Explosion Protection

The final backstop we have when trying to achieve an acceptable basis of safety in relation to explosive dust atmospheres is explosion protection. If risk cannot be adequately controlled by means of explosion prevention, the detrimental effects should be *mitigated* by one or more of the following:

1. Explosion relief arrangements, or
2. Explosion suppression, or
3. Containment

We may also seek to remove employees from the hazard range entirely, or as far as is practicably possible. This is required even if an explosion protection system is deployed. Explosion protection systems are not inherently safe and, especially in the case of venting, will present external hazards. Furthermore, such systems are not infallible. Whilst a sufficient level of reliability will be designed into the system, it is always best to keep operators away from areas where there is an explosion hazard.

For any explosion protection system applied, it must be suitably designed and certified in accordance with relevant standards. The explosion risk assessment should demonstrate that this is the case.

When explosion protection is deployed, we must also ensure that systems are designed to prevent the propagation of fires and explosions up or down stream. When an explosion propagates from one vessel to another, pressure piling and flame jet ignition can occur, leading to a far more severe explosion in the second vessel. Isolation devices/systems include:

- Extinguishing barriers
- Rapid-action valves
- Rotary valves / double butterfly valves
- Chokes (powder barrier) e.g., heap beneath silo, screw conveyor with baffle plate
- Flap valves

When implementing an explosion isolation system (much the same as for the primary explosion protection system), it must be suitably designed and certified in accordance with relevant standards.

Organisational Measures to Ensure Everything We've Done Stays in Place

Applying the technical measures required by DSEAR is just one half of compliance, and arguably the easiest half to implement. An ATEX-certified item of equipment only remains ATEX-certified so long as it is used, inspected and maintained correctly. A static electricity control system will only work so long as it is used, inspected and maintained correctly. A chemical suppression explosion protection system can only be expected to work providing that the same as above is applied.

Failure to uphold these elements will rapidly undo a basis of safety for managing fire and explosion risks. It is because of this that organisational measures and process safety management underpin fire and explosion safety and are frequently mentioned in both the DSEAR approved code of practice as well as the ATEX non-binding guide.

This includes, training, competency management, contractor management, planned preventative maintenance, control of spares, management of change and permit to work systems. Getting these elements right brings a DSEAR or ATEX basis of safety to life.



About the author

Craig Ayling is a Technical Manager for the Explosion Safety team and he has worked both in the Regulatory Testing Laboratory, focussing on UN transportation and dust industrial explosion hazard testing, and in the consultancy team at DEKRA. His focus is now on the development of industry and internal positions and the development of junior safety specialists. He can be contacted via email at craig.ayling@dekra.com.

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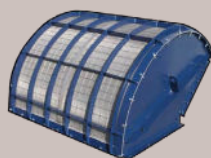
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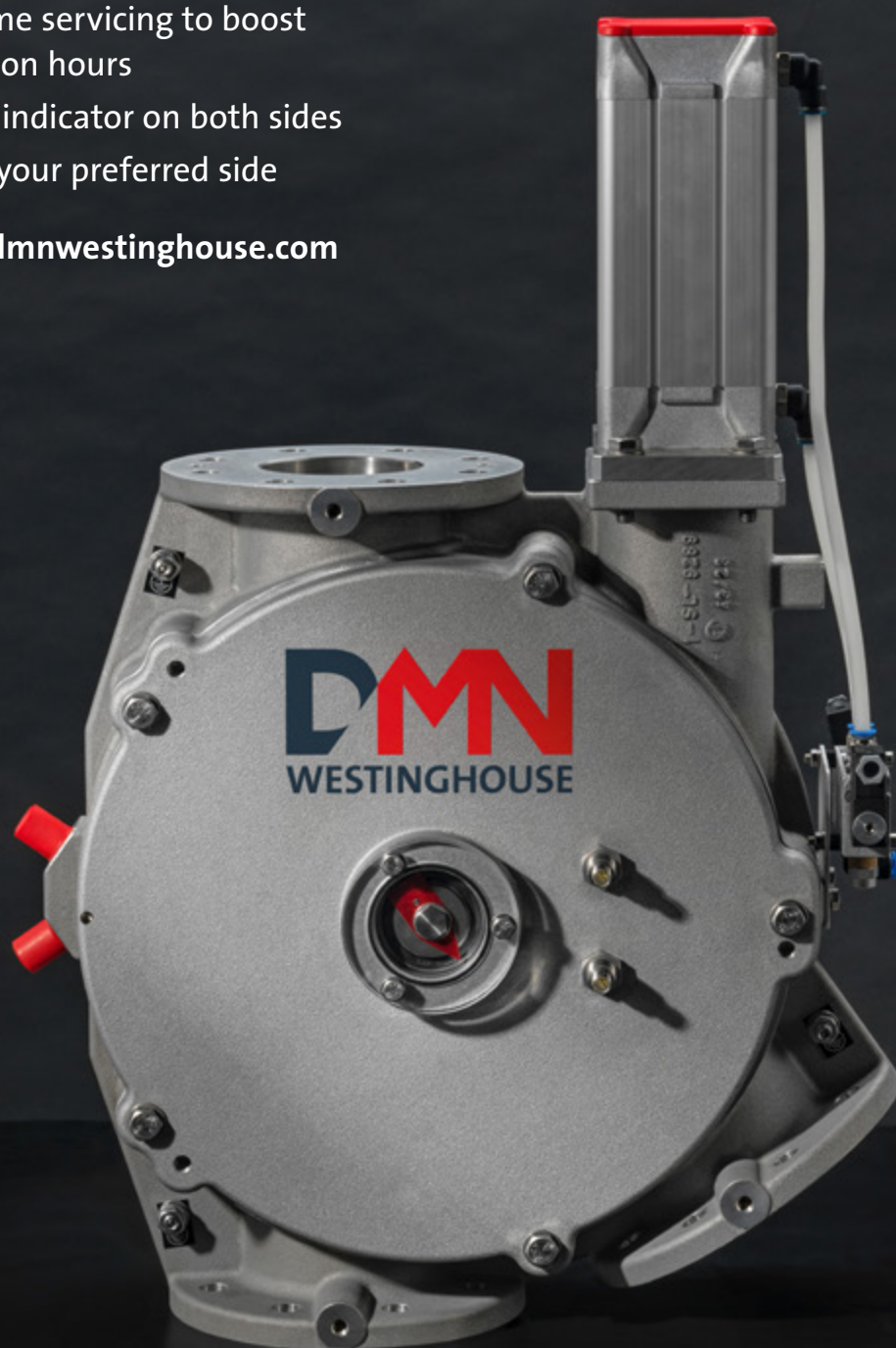
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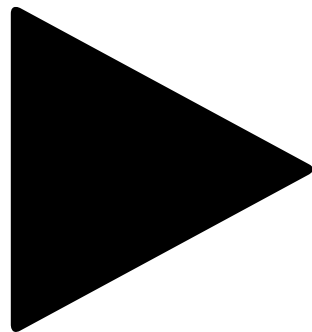
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