

Petrochemicals & Refining

Industrial Weighing and Measuring

5 News



Fast, Reliable, Convenient Secure Safety in Production

INGOLD

Leading Process Analytics

Vinyl chloride monomer is an important intermediate petrochemicals product. Production necessitates careful oxygen monitoring and rapid response to excursions to preserve safety and maximize yield. Probe-type tunable diode lazer sensors are the ideal tool for the job.

Efficient production of VCM

Vinyl chloride monomer (VCM) is a colorless, flammable gas used as feedstock in the production of polyvinyl chloride (PVC) and other resins, as a chemical intermediate, and as an industrial solvent. Originally, acetylene was used as VCM feedstock, but over time this has been replaced by less expensive and less dangerous ethylene. Today, ethylene-based VCM production accounts for more than 80 percent. of global output.

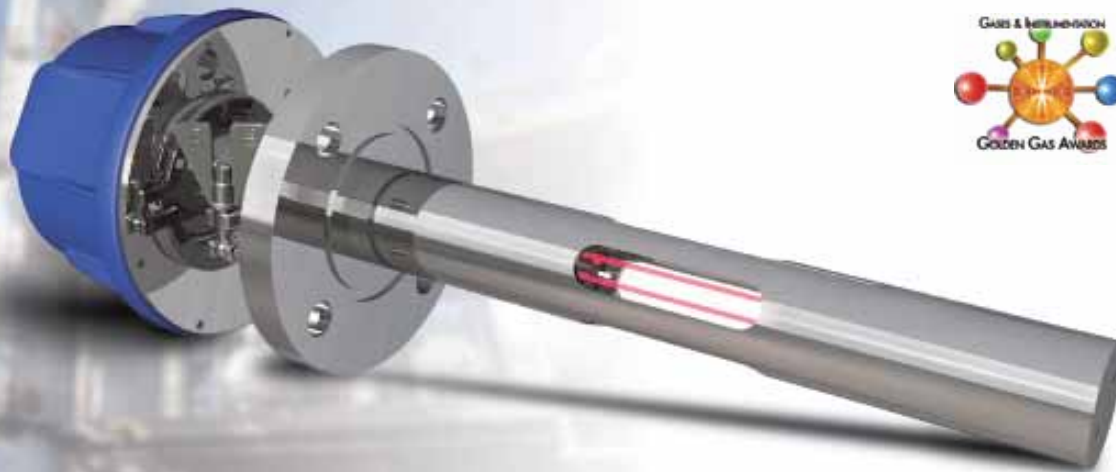
During VCM production, ethylene, chlorine, and oxygen are converted into VCM and water. The three process steps involved in the manufacture are direct chlorination, oxychlorination, and EDC cracking. These three steps are frequently combined in one manufacturing location

and must be finely balanced in order to maximize efficiency and minimize harmful waste.

In direct chlorination, EDC (1,2-dichlorethane – DC-EDC) is formed by a highly exothermal reaction of ethylene and chlorine. In oxychlorination, EDC (1,2-dichlorethane – Oxy-EDC) and water are formed by the catalytic reaction of ethylene with hydrogen chloride and oxygen. The EDC is then cracked at high temperatures in a furnace. VCM and HCl are formed together with various by-products. The HCl is then completely reused for the oxychlorination process described above. Some EDC remains unconverted in this process and is recycled. The three process sections above are combined into one complete VCM synthesis process in which only VCM and water are formed.



METTLER TOLEDO



Oxygen measurement is essential

Ethylene, oxygen, and hydrogen chloride are fed into a fluidized bed reactor for the oxychlorination process. In this reaction, not all components are completely consumed and in some cases “oxygen-slip” can take place at the oxychlorination reactor(s). It is important to optimize the oxygen level for effective formation of EDC but also to keep this slip below the explosion limit. In many cases, the oxygen is controlled not by direct measurement, but in monitoring the stoichiometry of the reaction, and involves the use of large safety factors. In direct chlorination it is important to avoid the excessive intake of oxygen in the chlorine line from any moisture impurities in the HCl. A low level of oxygen is required for optimum catalyst efficiency. A small concentration of oxygen also reduces the formation of detrimental by-products downstream.

Advantages of tunable diode lasers

In both the EDC and VCM applications measurement accuracy and speed of response are vital. The time delay inherent

in extractive measurement systems makes them less than ideal for use in EDC production. Tunable Diode Laser (TDL)-based oxygen analyzers, on the other hand, are very well suited for O_2 monitoring in these processes.

As their name suggests, TDL sensors use a laser beam that is “tuned” to identify and quantify the unique absorption lines of a gas species in a very narrow range of the electromagnetic spectrum. The scan range is so narrow that it excludes influence of other absorption lines in the background gas mixture. TDL analyzers measure in situ, without the need for sample extraction and conditioning, and provide real-time, continuous data allowing immediate response to out of spec conditions. However, many TDL analyzers are of a cross-stack design where the laser beam sender and detector units are positioned in flanges on opposite sides of the stack. This set up requires very careful alignment at installation and perhaps periodic verification and realignment, involving costly process shutdown.

In-line sensor plus powerful analyzer

METTLER TOLEDO's GPro 500 TDL oxygen sensor circumvents this problem through the use of a probe that protrudes into the gas stream. A corner cube at the end of the probe directs the laser beam back to the detector in the sensor head. Alignment is never required and because the laser beam travels twice through the process gas, measurement accuracy is very high. Oxygen determination is enhanced further by use of the unique SpectraID™ advanced signal processing technology.

Sensor maintenance is minimal, amounting to annual verification and periodic cleaning of the optics. The predictive diagnostics of METTLER TOLEDO's Intelligent Sensor Management (ISM) continuously monitor the optical path quality and determine the cleaning schedule.

If you need a powerful gas analyzer with in situ sensor convenience at your facility, go to:

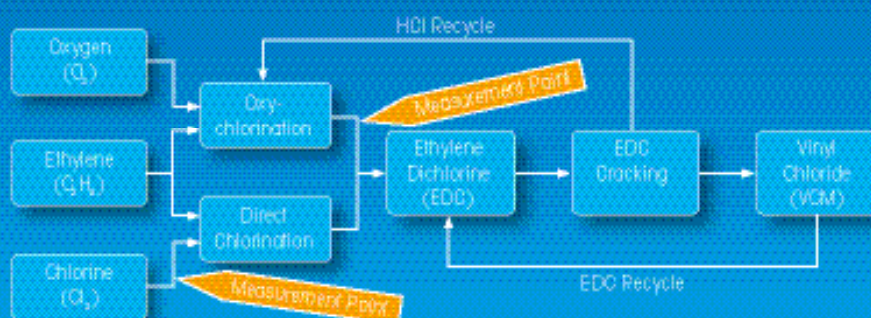
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Schematic Illustration of the EDC/VCM production process



Lower Costs, Higher Productivity Sensor Diagnostics over HART®

The M400 2-wire, multi-parameter ISM transmitter provides the highest reliability and easiest handling in hazardous area applications. Advanced sensor diagnostic tools available over HART or via the transmitter's second analog output, lead to reduced operating costs and help improve productivity.

Outstanding reliability

With its rugged design and approvals for hazardous area use, the new M400 2-wire transmitter series provides operating assurance even in the most challenging conditions. In combination with METTLER TOLEDO's advanced Intelligent Sensor Management (ISM) technology, this means the M400 2-wire unit offers greater process reliability in chemical, pharmaceutical and gas phase applications.

Fits to your process

The M400 2-wire transmitter is a single-channel unit for pH/ORP, oxygen and conductivity sensors. Its multi-parameter ability ensures the new series' suitability for a wide variety of applications. Thanks

to the mixed-mode input, which accepts analog or ISM sensors, the M400 offers a seamless technology transition from conventional to digital sensors and provides a future-oriented investment in your plant.

Quick and simplified sensor handling

With the advanced ISM functionality implemented in the M400, the transmitter series provides additional valuable benefits. Using METTLER TOLEDO's iSense Asset Suite software, sensors can be accurately pre-calibrated in a workshop and stored for later use. When a pre-calibrated probe is connected to the M400, the calibration data is automatically up-

loaded to the transmitter and the system is ready to measure in a few moments. This Plug and Measure feature minimizes the risk of installation troubles and simplifies sensor commissioning and replacement.

Improved process control at lower cost

Measurement data and sensor diagnostics tools such as the Dynamic Lifetime Indicator (DLI), Adaptive Calibration Timer (ACT) and Time to Maintenance (TTM) can be output to the process control system via two 4 to 20 mA analog output signals. Together with the M400's HART communication capability, system integration is easily achieved, enabling more efficient maintenance of the measurement system. Unplanned shutdowns due to unforeseen sensor failure no longer occur, and the resulting increase in process availability and reduced maintenance lead to improved productivity and lower operating costs.

Find out more:

► www.mt.com/M400-2wire-petr5



M400 2-wire transmitter

A Matter of Accuracy and Safety: Efficient Propane Bottle Filling

Since 1984, Handygas Corporation in York, Pennsylvania has been serving the cylinder exchange industry and has become a pioneer in the industry in North America. The fast growing nature of this business prompted Handygas to design and build special equipment to overcome the labor intensity of cleaning, repairing, re-certifying, painting and filling these cylinders in mass production. But for matters of accuracy and safety, they relied on the expertise of METTLER TOLEDO. Handygas was able to design a line of equipment to process and fill these cylinders in compliance with applicable legal for trade and safety regulations. Their new HG560E-1 electronic filling system takes advantage of the advanced features offered by METTLER TOLEDO's IND560x weighing terminal.

Industry leader for propane filling equipment

For 12 years, Handygas Corporation has relied on METTLER TOLEDO to provide quality equipment for their propane filling business. With the propane cylinder exchange market driving them to move from mechanical / pneumatic systems and controls to electronic, they turned to METTLER TOLEDO to update their process. Their timing could not have been

better — Handygas served as a beta test site for the IND560x, a new intrinsically safe weighing terminal certified for use in Division 1, Zone 1 and 21 classified areas. The METTLER TOLEDO team worked to design a new process, first for a single-station and eventually for a multi-station carousel propane-filling system.

New hazardous area weighing solution

The solution includes the intrinsically safe IND560x terminal connected to a custom cylinder scale featuring an FM-approved METTLER TOLEDO load cell. Installed inside the IND560x is a discrete input/output option that works in conjunction with the advanced filling logic of the IND560x and directly controls the gas filling process. The intrinsically safe classification of the IND560x permits installation in close proximity to the filling process. The customized heavy-duty cylinder scale is the right size for the process and a more economic alternative to off-the-shelf bench scales that could not have held up to the utilization rate.

With the new solution in place, Handygas Corporation is set to increase business opportunities from the new propane filling solution.

"At Handygas, we have become known in the industry as the go-to company in North America for equipment capable of filling gas grill propane cylinders," explained company President, Mike Smith. "Now we're able to expand our line to include propane-filling equipment for RV's, forklifts and floor buffers, and yet still fill gas grill cylinders at the same system. We're excited to see where this new solution takes us in the propane filling industry!"

Handygas was using and still offers solutions with mechanical dial scales which are only capable of filling 20-lb gas grill cylinders. Their new HG560E-1 electronic filling system based on METTLER TOLEDO's IND560x weighing terminal now accommodates a much larger variety of cylinders. These new filling systems can fill 20-, 30-, and 40-lb cylinders equipped with a QCC valve. The same system can also fill 33-lb forklift and 20-lb floor buffer cylinders using the same filling valve and a revolutionary adjustable scale base to accommodate the taller cylinders.

RV = Recreational Vehicle

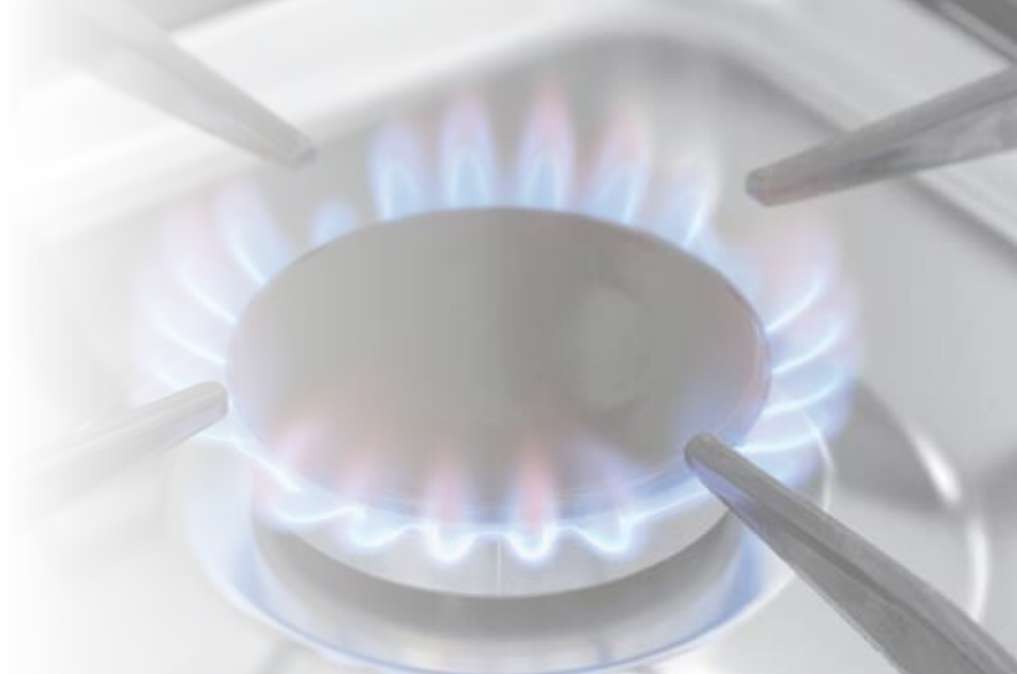
QCC = Quick Closing Coupling



About Handygas Corporation

When Don Smith bought a small company in 1989, it was a fledgling propane tank exchange business. He created Handygas Corporation to promote the at-the-time very new propane cylinder exchange business, plus design and build special labor saving equipment for that industry.

Now Handygas supplies specialty equipment to the cylinder exchange industry for filling, refinishing, and re-certifying a multitude of propane tanks.



Key benefits of the solution:

- High accuracy and high speed filling solution
- Maximized uptime
- Minimized under-/overfilling
- Easy compliance with law regulations
- 100 % record of all operations and processes
- Full compliance with safety regulation Zone 1/21 and Division 1



The new IND560x brings uncompromised performance and productivity into Division 1, Zone 1 and 21 classified areas. Intrinsically safe design, high speed process control and internal active/active I/O control set the benchmark for weighing in explosive areas. The IND560x is designed for both process control and manual weighing operations. Some key features are:

- Easy to operate filling and batching solution: the 560Fill application software allows prompt configuration of sequences for filling, blending, dosing and dispensing
- TraxDSP™ noise filtering system provides accurate measurements in unstable environments with noise and vibration.

- High reliability: calibration management monitors performance and alerts operators of maintenance needs
- Minimized operating costs through In-Site™ tool for off-line or ahead of time configurations

For more information log onto:

► www.mt.com/IND560x-petr5

Higher Yield and 75 % Less Maintenance in Propylene Oxide Manufacturing

Efficient production of propylene oxide depends on tight pH control. Harsh process conditions make reliable in-line pH measurement a significant challenge – a challenge the InPro 4800i is well prepared for.

Widely-used intermediate

Propylene oxide (PO) is a large-volume intermediate chemical used as a building block in the manufacture of many chemicals, varying from propylene glycol (antifreeze and deicing fluids) to polyurethanes to cosmetics. Currently, the world annual PO capacity is roughly 8 million metric tons and growing. Shortages in propene feedstock have resulted in an increase in manufacturing costs for PO and maintaining margin is a challenge for producers.

PO production process

Unlike in ethylene oxide production, there seems to be no successful way to manufacture PO by direct oxidation of propene without producing many by-products. However, several indirect methods of oxidation have been found, with the chlorohydrin process being one of the predominant technologies.

The chlorohydrin process involves the reaction of propene and chlorine in water and is a simple process consisting of two reaction steps, chlorohydrination and epoxidation, followed by a purification step.

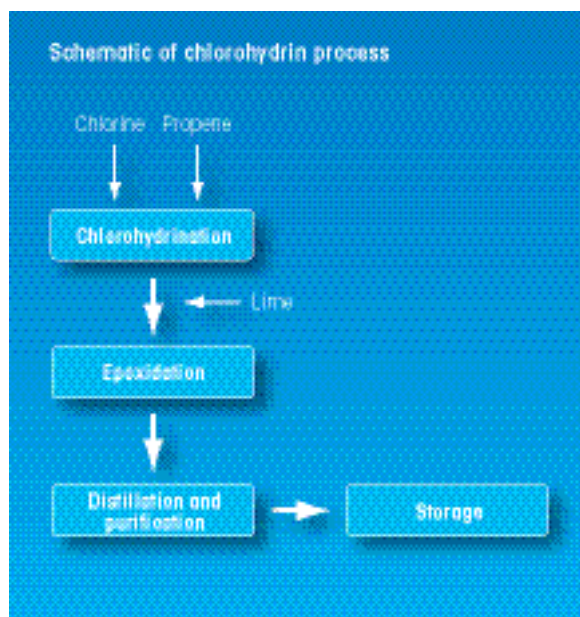
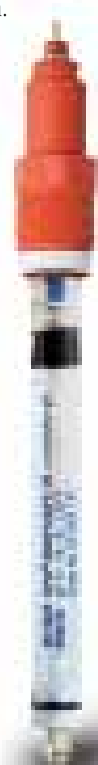
• Step 2: Epoxidation

The effluent of the first process step containing roughly 5 percent propylene chlorohydrin reacts with a 10 percent excess caustic or lime for both the epoxidation (or dehydrochlorination) step and the neutralization of the acid. To maximize yield, the process pH is kept above 12. The formed propylene oxide is quickly steam stripped from the brine solution to avoid further reaction of the oxide to propylene glycol. Further purification of propylene oxide is done by distillation.

• Step 1: Chlorohydrination

In a reaction column, propene reacts with an aqueous chlorine solution at 3 bar pressure and approximately 50 °C. In the chlorine solution, hydrochloric acid and hypochlorous acid are in equilibrium. This is necessary, as otherwise chlorine will react with propene to mainly form 1,2-dichloropropane rather than propylene chlorohydrin, which is the desired intermediate.

To optimize the content of hypochlorous acid, the pH of the chlorine solution is brought to a range of 3 to 6 through the addition of an alkali, such as caustic soda or lime. Too high or too low a pH will result in undesired by-products, the waste of chlorine and a low propylene chlorohydrin yield.


ISM


InPro 4800i
pH electrode



Challenging measurement

The presence of chlorine, a large amount of different chlorinated hydrocarbons, and precipitating salts make in situ pH measurement a major challenge. For those reasons, accurate pH control is vital to the process and to secure profitability. Therefore, most plants running the chlorohydrin propylene oxide process have often equipped their critical control loops with three or fourfold pH measurements. However, due to the process conditions the majority of available pH electrodes have severe difficulties with the environment and require very frequent cleaning and recalibration, which places a burden on maintenance staff.

Process resilient system

METTLER TOLEDO's InPro 4800i pH electrode, with its annular PTFE diaphragm and extra-long diffusion path, is especially designed for this type of application. It measures accurately in oxidants, such as chlorine as well as hydrocarbons, providing the highest possible accuracy and fast response time, and therefore enables reliable process control. Featuring METTLER TOLEDO's Intelligent Sensor Management (ISM) technology, the sensor provides sophisticated predictive diagnostics and allows pre-calibration in the workshop. These features make servicing particularly easy, and reduce maintenance time by up to 75 percent.

The M400 two-wire transmitter is the ideal instrument to complete the measurement system. Certified for hazardous area use and offering full ISM functionality, the M400 two-wire transmitter provides a best-in-class solution for critical pH measurement. ISM diagnostics are communicated via HART protocol and may be accessed remotely with the help of asset management software.

Discover more:

► www.mt.com/InPro4800-petr5



POWERCELL® PDX® — The Future Is Here

The future of vehicle weighing has arrived. The all new POWERCELL® PDX® sets new standards in vehicle weighing.

- **No more junction box wiring**
- **Unmatched lightning protection**
- **Built in predictive diagnostics**

No more junction box wiring

Prior to the introduction of POWERCELL PDX, all load cell systems required a junction box to bring together all of the weighing signals and transmit them to the terminal. These boxes are wired at the construction site and are exposed to the weather. The process is riddled with potential errors and is the most common source

of truck and rail scale failures. POWERCELL PDX load cells are connected together in series so that no junction box is required. The cables use submersible quick-disconnect connectors that provide an IP68 and IP69k seal. The entire network is a sealed system from the terminal in the scale house out to all of the load cells in the scale (see picture opposite).

The legacy continues

Back in 1988, METTLER TOLEDO introduced the POWERCELL load cell, the first digital load cell for truck scale applications. The innovations in POWERCELL were like no other in the industry. It provided accuracy and reliability beyond all other methods available for the harsh environments where truck scales are required.

Nearly 1,000,000 POWERCELL load cells have been sold globally in every corner of the world and in every possible environment from deserts to the arctic.

The POWERCELL PDX load cell system is the latest generation of the POWERCELL legacy. The innovations provide another leap forward in reliability while maintaining the best accuracy in the industry and offering the security of predictive diagnostics.



POWERCELL PDX load cell under laboratory testing of a simulated lightning strike.



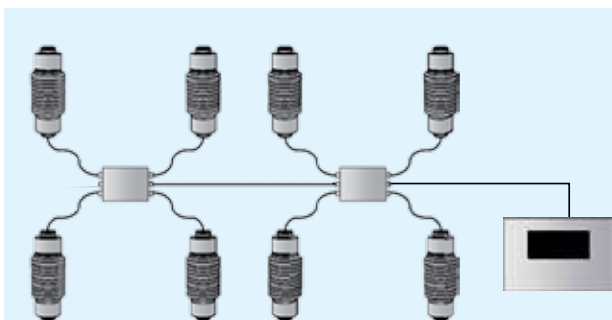
Unmatched lightning protection

A lightning strike can put a vehicle scale out of service in an instant. Lightning damage can be very costly, requiring the replacement of unprotected electronic equipment. Even if a warranty covers repair costs, you still face the cost of the

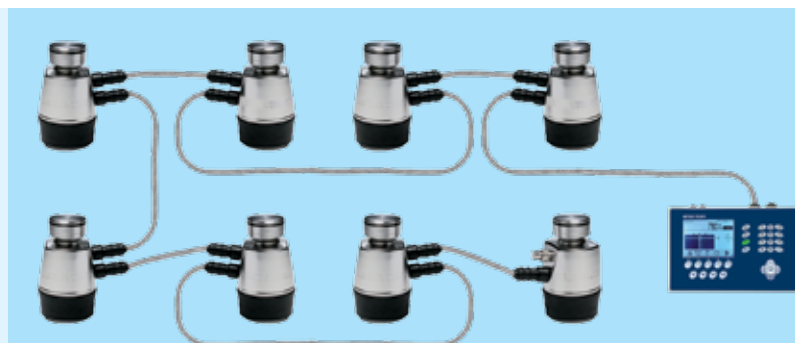
business you lose every day that your scale is not operating.

METTLER TOLEDO provides complete protection against lightning damage. The StrikeShield™ protection system is designed to be the main line of defense for your entire vehicle scale system: load

cells, cables, and terminals. The average lightning strike is approximately 30,000 amperes. The POWERCELL PDX load cell system has been tested by independent laboratories and survived multiple lightning strikes up to and beyond 80,000 amperes.



Conventional Load Cell Wiring (Junction Boxes Required)



POWERCELL PDX Load Cell Network (No Junction Boxes)

Predictive diagnostics

With other load cell technologies, problems can go undetected for long periods. In those cases, weighing errors add up until a load cell fails and shuts down your scale. The POWERCELL PDX load cell eliminates these concerns. The system has self-monitoring capability that is designed for proactive service, alerting you to potential problems before they occur. It helps you avoid unplanned downtime and inaccurate weighing. If these occur the diagnostic tools enable service technicians to make the right repairs the first time and make them quickly.

The scale system provides you with a proactive way to keep your scale running:

- Assuring you that your scale is working properly.
- Alerting you to potential problems so they can be prevented.
- Pinpointing the source of a problem for quick intervention.

Proactive maintenance plans perfectly complement the POWERCELL PDX load cell system to deliver unmatched reliability and longevity for your scale.

For more information log onto

► www.mt.com/POWERCELL-petr5



Maximize Drum Filling Productivity Increase Your Efficiency

By using METTLER TOLEDO weighing solutions, the customer benefits from minimized handling time, decreased risk of errors and product losses. This solution reduces process costs and maximizes productivity.



METTLER TOLEDO designs solutions to optimize productivity throughout your value chain and ensures that the product quality meets your end-user's requirements.

That is the reason why the Antwerp Distribution and Product Operations (ADPO) chose a drum filling solution with weighing technology from METTLER TOLEDO. ADPO offers services such as stainless steel filling lines for pails, drums and IBCs. ADPO expanded its existing infrastructure with a highly automated system for the storage and handling of chemicals and petrochemicals to better serve their customers.

Minimize product losses during the filling process

In one of their facilities, ADPO fills 200 liter drums at the rate of 100 drums per hour. The environment is a hazardous area ATEX Zone 2. They chose an IND780 weighing indicator and 300kg high-precision floor scales to meet the requirements for efficiency and quality. The system is highly accurate, ensures fast material transfer and allows tracking and tracing of each drum. The system is controlled with a PLC which communicates

with the IND780 via Profibus. The flexible IND780 with its graphical display and freely programmable multi-function keys is used for the man machine interface of the system.

ADPO benefits by minimizing handling time, decreasing the risk of errors and product losses, thus reducing process costs and maximizing productivity.

The entire drum-filling solution was made by a system integrator in close co-operation with METTLER TOLEDO.



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Learn about various topics from choosing the right technology to process optimization.

We offer both live webinars, in which you can speak directly with our specialists and recorded on-demand webcasts, which are available at your convenience, 24 hours a day.



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- ▶ www.mt.com/ind-haz-advanced-petr5
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Zone 1/21

Zone 2/22

Would your plant pass an inspection by your local authorities?

Would it pass if they told you that they were looking for potential combustible dust hazards?

Don't wait until you have a surprise during an inspection, or even worse, an incident with dramatic consequences. Take the proactive approach and address the "hazardous area risk" in your facility.

METTLER TOLEDO has provided intrinsically safe weighing equipment for more than 20 years. Our best-in-class product portfolio combined with our knowledge and experience enables companies, uncompromised weighing in all hazardous areas.

▶ www.mt.com/ind-hazrisk-petr5



Click here to risk assess your hazardous area

▶ www.mt.com/ind-hazrisk-petr5

Key benefits for drum filling:

- Freely programmable terminals can be programmed as men machine interface for the whole system
- Communication via Profibus, Profinet, DeviceNet, Ethernet IP or Ethernet for easy integration into PLC or ERP environment
- Large product range of weighing technology for hazardous areas ATEX Zones 1/21 & 2/22 and FM Division 1 & 2
- High-quality platforms with high weighing resolution, repeatability and linearity for a precise filling range from 1% to 100% of the capacity.
- Global service availability of METTLER TOLEDO to support system integrators in export situations

Sharing Our Knowledge

Learn from our specialists – our knowledge and experience are at your disposal in print or online.

Learn more about all of our solutions for the petrochemicals and refining industries at our website. Here you can find information on a wide range of topics to improve your process, including case studies, appli-

cations stories, plus all of the product information you need to make an informed buying decision.

► www.mt.com/industrial-petr5

Brochures/Catalogs/Booklets:

1. Hazardous Area Competence Brochure

► www.mt.com/ind-hazbrochure-petr5

2. Hazardous Area Catalog

► www.mt.com/ind-hazcat-petr5

3. Weighing Components Catalog

► www.mt.com/ind-weighing-component-catalog-petr5

4. Industrial Weighing Catalog

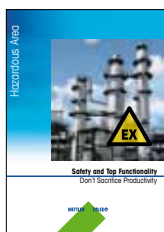
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5. Process Weighing Brochure

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Tunable Diode Laser Spectroscopy: Theory and Background

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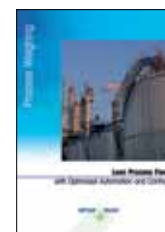
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5



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For more information

Mettler-Toledo AG
CH-8606 Greifensee
Switzerland
Tel. +41 44 944 22 11
Fax +41 44 944 30 60

Mettler-Toledo AG
Process Analytics
Im Hackacker 15
CH-8902 Urdorf
Switzerland