VEGA Journal

INTERVIEW: Small adjustments are often all it takes. **INTRODUCED:** Only the best get through. **FIELD REPORT:** Endurance test passed with flying colors. **FIELD REPORT:** Fit for a hard business. **FIELD REPORT:** Under difficult conditions. **TECHNOLOGY:** The application decides. **LOOKING FORWARD:** VEGA grows in Asia.

Issue 1/13

Extreme? No problem!

Even in the most demanding applications and extreme pressures and temperatures, the level and pressure sensors guarantee reliable, accurate results.

The benchmark for modern measuring instruments is very high. They must not only be accurate, safe and reliable, but should also save energy and costs, of course be easy to operate ...

... and in industrial applications, sensors must also withstand the process conditions and prevailing environment. Extreme weather conditions such as frost, heat, wind, rain, snow and ice, as well as the additional stresses and strains of an industrial environment, such as pollution, noise, impact, shock and vibration, do not exactly make life easy for a sensor.

The types of materials measured by level sensors are endless. What is more, process conditions are becoming more extreme. More and more processes take place under high pressure and high temperatures. Measuring equipment has to cope with these conditions and still deliver accurate readings.

Something for everyone

The key to success: the right choice of material for the measuring probe, the process fitting, the seal and the sensor housing. Optimum safety and reliability can then be realized, even under extreme conditions.
Of course, for this to work, a wide range of materials and options has to be available for the instruments – as is the case with plics®. From stainless steel to titanium even gold – only the most durable metals are used today. Ceramic materials and metallic seals allow use under high pressure and high temperature.

Sophisticated polymer seals, like those made of FKM, Kalrez or FEP, resist all kinds of different chemical compounds. Ultra-modern plastics such as PTFE, PFA, ECTFE protect sensitive parts from harsh process environments.
Housing materials such as plastic, aluminum and stainless steel are the first choice for sensors that have to stand up to any kind of conditions. All these materials make it possible to build a safe and secure "home" for the measurement technology inside.

In instruments of the 21st century, the actual measuring tasks are performed by the microelectronics. These not only measure the physical variables such as distance, pressure and temperature, but also enable the transfer of measurement data from the tank to the control room. And, thanks to the simple operating system, setting up and commissioning or troubleshooting is simple.

Delivering simplicity through choice

A typical user has to decide which of the thousands of combinations of measurement principle, sensor material, seal and housing, measuring range and communications protocol is the right one for their particular application. But this selection process does not have to be a pain, the modular instrument system plics® can make life easy.

All components of a plics® sensor are designed by VEGA to meet the toughest requirements for functionality and durability. Each one is perfectly attuned to one another and, when combined to form a sensor, they leave nothing out. A sophisticated system of tests and inspections ensures high quality – from development to production through to final adjustment of the sensors.

The acid test

Even during the development process the sensors are put through stress tests, in order to detect systematic errors at an early stage. The endurance tests in climate chambers is just as much a part of the standard program as the shock and vibration tests. The sensors also have to prove their electric "steadfastness" in immunity tests as prescribed for CE labeling. A number of other tests that are required for certain approvals are carried out by VEGA in its own quality assurance department or in independent test laboratories.

High quality materials and components ensure a long life. During the manufacturing process, all individual components as well as finished instruments are all 100 % tested. The automatic tests conducted after each production step detect the tiniest errors to reveal any "hidden" quality problems. After being put through their paces in this way, the instruments are well prepared for deployment in the "harsh reality" of today's industrial processes.

In this issue of VEGA Journal, we present demanding applications where VEGA measurement technologies are used – e.g. in processing plants in South African mines and sand dredgers for land recovery.



Extreme radar level measurement of red-hot coke: level measurement in the coke oven optimizes the filling process during degassing.

“That’s what I call robust: 25 years of trouble-free operation.”

Andreas Bregger, Service Technician (Schiltach).

VEGA Journal: *Mr Bregger, your service assignments get you around to all kinds of different industries. What are the “extreme applications” for you?*

Bregger: It all depends on how you define it. You can find many “extreme” applications “out there.” Only in a few cases are the sensors conditions ideal. The way I see it, a sensor has to be able to deal with the real world, that’s what makes the difference. Extreme can also mean sensor temperatures up to +400 °C and pressures up to 400 bar. I also consider aggressive and corrosive media as extreme. But it can also be high-frequency vibration, violent oscillations or very fine dust. Once users have to start wearing safety helmets, glasses and as protective clothing, it usually gets uncomfortable for sensors, too.

Is there a prime example of an extreme application?

Bregger: Things get pretty rough for instrumentation on the decks of ships, that’s for sure. Huge, powerful waves break over the decks, subjecting sensors to heavy mechanical stress. The sea air and salt water gnaws away at sensors, even with stainless steel housings. On land, with instruments in cement, aggregate and steel plants, the housings are constantly pummelled by solid bulk materials. This certainly doesn’t make life easy for a sensor!

Do such harsh conditions require special sensors?

Bregger: Yes and no. For example, depending on the process, standard sensors can be easily adapted to the prevailing conditions. Often, it’s the outside of the process where attention is needed But our housings are extremely tough and can handle a lot of abuse, as is demonstrated again and again. In one case, one of our instruments was buried under a pile of rubble and I had to use a shovel to get to it. But the housing was completely intact.

What makes a sensor robust?

Bregger: Sometimes I work on instruments that are over 25 years old, that’s what I call robust. Often some customers don’t know exactly where the sensor is. That means the instrument has been “quietly” delivering reliable measurement data for a very long time.

Are there typical cases of damage or service calls caused by extreme applications?

Bregger: Quite typical are simple Problems, like electronics failures caused by moisture in the housing. Over the course of time, cable shrinkage occurs in the cable gland and, through capillary action, water penetrates into the housing My advice: Just check and tighten the cable gland at regular intervals. Many electronics failures can be easily avoided this way.

Can certain patterns and rules for robust applications be derived from your service call experiences?

Bregger: The best strategy is select the most suitable sensor and its location when a production facility is in the planning stage. These

factors usually decide ultimately the success or failure of a measurement setup. Also, if needed, protect any sensor from mechanical damage by mounting under a protective cover. Most often on service visits, we regularly advise a modification to the existing installation. Sometimes, major changes at the installation site are required to deliver a successful outcome for the customer.

In many cases, a much better measuring result is achieved simply by making small, simple changes, such as realigning the instrument or relocating the mounting position.

Thank you for your answers.

Only the best get through

If a VEGA pressure transmitter kept a diary during development testing, this could be an excerpt, "This heat is almost unbearable, 180 °C and no cooling down in sight, not to mention the high humidity! These high pressures are also causing me a lot of discomfort, this is a really gruelling test!"

Our transmitter continues, "This has been going on for months. But my comrades and I are fulfilling our mission in spite of these adversities. Because this is the job we pressure transmitters were designed for. Only those of us who successfully go through the quality assurance tests receive a test certificate and can proudly call themselves a VEGA instrument."
Quality assurance has many different tasks to fulfill beside these tests, and these begin long before the manufacturing process commences. Together with engineering and product management, quality assurance defines the requirements for future sensors. An instrument's robustness is not a coincidence but a purposeful orientation to real-world application.

Involved from the very beginning

The quality assurance department imparts its knowledge and experience to the development department right at the concept stage of a new instrument series. This includes field reports from the service department, as well as feedback from sales and manufacturing. More and more frequently, computer simulations, e.g. finite element analysis, are being run to determine the mechanical strength of sensor components early in the development stages.
Looking at all the requirements, quality assurance decides which tests the instruments have to pass. The standards that are applicable are selected from a large pool of standards and summarized in a written test report. Truly robust instruments

The pressure test really gets down to business:
Will the sensor hold up under the stress?

are always geared to real life, just as it is out there on the plant. The basis for innovation are often driven by wishes and requirements of customers or to meet new processes and environmental requirements.

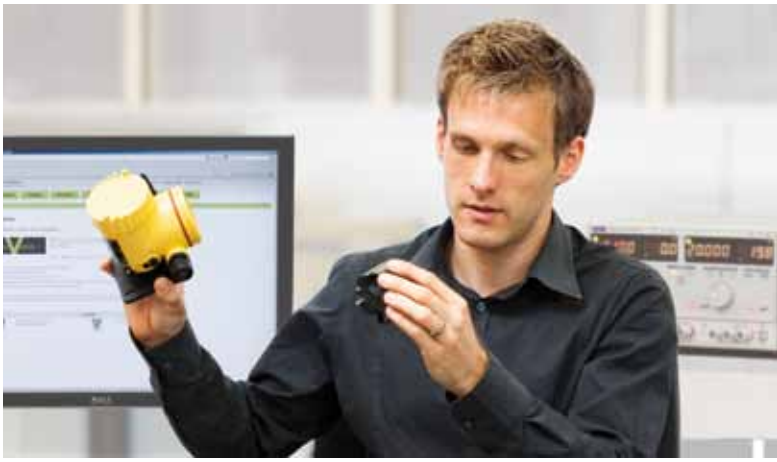
Putting the sensors through their paces

When the first prototypes are finished, things gets serious. The tests demand everything from the instruments. These include temperature tests with extreme, constantly changing temperatures that push solder joints, seals and adhesive bonds to their limits. The humidity test discovers any weaknesses the seals and bushings may have. The mechanical shock test stresses the instruments with forces up to 100 g (10 m/s²). A surge pulse generator simulates lightning strikes up to 24 MW. During the vibration test, vibrations up to 4 g, as they occur e.g. on vehicles or ships, are produced. The test specimen is subjected to different frequency ranges, including its own resonance frequency. Diffusion resistance is tested under steam pressure, temperatures of 180 °C and pressures up to 40 bar over a period of several months are quite common. In the magnetic field test, magnetic fields up to 3000 A/m are generated – fields of such intensity exist, for example, in the vicinity of transformer stations or in steel works. Finally, last but not least, an X-ray microscope is used to check solder joints and examine welds or feed-throughs for cracks and voids.

Proven quality, signed and sealed.

Continuous improvement

These hard tests, which the test specimens do not always pass, provide an opportunity to improve the instruments while they are still in the development phase. Field tests of prototypes and subsequent field observation over a long period give clues on long-term behavior and durability and feed into the production process. As a result, quality assurance is often a “motor” for product improvement. The goal: to build the most effective and reliable sensors possible at reasonable cost – no matter how tough the application is.



Visual inspection misses nothing: left, an X-ray microscope for solder joints; right, a trained eye examines the finished electronics module.

Extreme conditions: Intermediate storage tank with VEGAPULS 68 radar sensor.

Endurance test passed with flying colours

The production of magnesia is a dusty affair. Add to that outrageously high temperatures. Not only is it hot in the furnaces, but in the production areas, sauna-like conditions prevail. Good thing there are instruments that work reliably even under such extreme conditions, so that people only rarely have to be directly on site to look after things.

The raw material that NEDMAG Industries Mining and Manufacturing processes lies underground in the northern part of the Netherlands at a depth of about 1,500 m. These especially pure magnesium chloride deposits are salt formations that are quite unique in the entire world. The company extracts about half a million tons of this material every year. About 10 years ago, a production facility for calcium chloride was added.

NEDMAG is the leading supplier of high-purity Dead Burned Magnesia (DBM) in Europe. The sintered magnesia is processed at temperatures around 2,200 °C. Applications of this refractory raw material range from cement and steel production to furnace linings to production of non-ferrous metals, steel stabilizers and glass.

Everything depends on the level

The paste-like base material is extracted from the mine and passed on to the production unit, where it is mixed with dolomite. In the ensuing reaction, magnesium hydroxide is precipitated. This is then dried in a calcining furnace at 900 °C. The resulting powder is transported by a conveyor belt to two storage containers 6 m high and 4 m in diameter. These are made of stainless steel, which is actually hard to

see due to the thick layer of original material on the containers. But: this is actually intentional. The top of the container has a temperature of over 100 °C, yet is safe to access for service purposes thanks to the thick, heat-resistant material layer.

Any disruption of the ongoing production, i.e. the burning process, costs the company a lot of money. These intermediate storage containers play an important role in preventing the furnace from being shut down for lack of storage space.

They serve as a buffer for continuous, efficient operation of the kiln, and indeed the whole production facility. Level information is thus an essential requirement for automating the magnesium oxide burning process.

Standard instruments brave heat and dust

The measuring task here is very challenging. The bulk mineral has a low density (only 500 g/l), raises strong dust and flows almost like a liquid. But that's not all – the material is also highly abrasive and still has a temperature of up to 700 °C after the firing process. A high-temperature radar sensor of type VEGAPULS 68 is used for level measurement here.

Numerous VEGASWING and VEGAFLEX sensors have also been operating flawlessly in the production facilities of NEDMAG for many years. The employees of NEDMAG have had very good experiences with them and appreciate the simple adjustment and operation of plics® instruments.

Despite heat, dust and strong abrasion, the VEGAPULS sensor installed on the storage container has been delivering reliable measurement data for six years and continues to ensure smooth operation of the plant. Those responsible for the plant were surprised that VEGA could solve this challenging measuring task with a standard instrument.

Info

NEDMAG Industries Mining and Manufacturing B.V. is owned by the Lhoist Group, the world's largest producer of limestone and dolomite products, and NOM, a private investment and development company for the northern provinces of the Netherlands.

NEDMAG is the leading manufacturer and supplier of high-purity, dead burned magnesia (DBM) in Europe. In 2011 the company produced 170,000 t of refractory compound. With 140 employees the company generated a turnover of € 100 million last year.

The NEDMAG Industries plant in Veendam, The Netherlands.

Lonmin mining facilities in the Bushveld Complex, South Africa.

Fit for a hard business

Lonmin operates several mines in the Bushveld Complex in South Africa. The company is one of the world's largest producers of metals known as the platinum group. These metals are of vital importance for many industrial applications. They are also very coveted as jewellery. But, before such applications can be realized, the raw material has to undergo a very long process.

The Bushveld Complex in South Africa was formed about 2 billion years ago when liquid magma from the mantle penetrated the continental crust. It covers nearly 100,000 square kilometers with a thickness of up to 8 km. The area is located approximately 100 km north-west of Johannesburg, in the border area of the four provinces Northwest, Gauteng, Mpumalanga and Limpopo, and has tremendous geopolitical importance for the country. Along with China, Brazil, Australia and India, South Africa is one of the 10 major iron ore producing countries in the world.

Where primeval forces rule

In iron ore extraction, the raw material is first reduced to small chunks in several steps in crushers and then finely ground in ball mills. These are slowly rotating cylinders, inside which are steel balls that pulverize the ore through a cascading

effect. Due to their heavy weight, the cylinders are mounted in bearings lubricated by a thin film of water. VEGABAR 52 measures the pressure in the water feed system, thus ensuring the function of the bearings and continuous operation of the mill.

The resulting fine material is then suspended in water to form a suspension. Hydrocyclones then separate the usable iron ore from rock debris. A specific concentration of the suspension is required to operate the hydrocyclone. Fluctuations can lead to a complete blockage. It is therefore important to measure the concentration of the suspension, as well as monitor the pressure at the inlet and the vacuum at the outlet of the cyclone. These parameters are a measure of cyclone function at the correct operating point.

Almost as hard as diamond

Because of the abrasive ingredients; iron ore, sand, coal, clay and other minerals, all internal components of the cyclone are subject to extreme wear and are therefore lined with hard rubber.
All non-flush internal fixtures also run the risk of getting clogged up. That's why the critical measuring points at the inlet and outlet are fitted with VEGABAR 52 ceramic pressure transmitters.

Info

Lonmin Plc is a British-South African mining company and the third largest platinum producer in the world. Platinum metals in catalytic converters not only keep the environment clean but also give jewellery that certain special something.
South Africa alone holds about 80 % of the world's known platinum deposits. The largest South African deposits of this precious metal are located in the Bushveld Complex, north of Johannesburg. 92 % of Lonmin's annual platinum production comes from there.
In the past fiscal year more than 11.7 million tons of raw ore were extracted.

Rock residues are separated from the usable iron ore by centrifugal force in the hydrocyclone.

Sapphire-ceramic, which has a Mohs hardness of 9, is one of the hardest materials in the world and is second only to diamond. With this material, the instruments are permanently resistant to abrasion. The special design of the measuring cell allows flush mounting in the cyclone separator. This prevents fouling and reduces the need for cleaning.

The concentration of the suspension is measured radiometrically. The radiation source VEGASOURCE and detector MINITRAC 31 are mounted externally on the uptake tube in the hydrocyclone and measure the suspension, right through the pipe and medium, without interfering with the process. High availability and reliability are thus ensured.

Everything under control

The high accuracy and long-term stability of the instrument enables accurate and reliable process control. The plant operator or control system compensates all measured deviations by regulating the pump output or fine-tuning the suspension.

With the help of VEGA measurement technology Lomnin has everything under control: the operational reliability, availability and efficiency of the plant.

Under difficult conditions

Waterways are an important factor for any industrial location. To maintain these waterways and keep them navigable, suction excavators, or dredgers, are regularly deployed. On a dredger belonging to the company EDT Offshore, robust measurement technology from VEGA ensures high availability and maximum efficiency of the loading operations.

Dredgers loosen the sediment from the channel bottom and suck it up on board through a suction line. The entrained water is separated from the dredged material and pumped back into the sea. Sand extracted from the seabed is used, e.g. to protect coastal zones, create harbors or reclaim land. One of the most well-known projects is Palm Islands of Dubai.

Reliability is paramount

The job of the measurement technology on board is to determine the flow rate and the solid content of the sucked up sediment. This is important because the relationship between solid content and flow rate is critical for the productivity of the dredger. Depending on the application and size of the ship, the suction hoses or pipelines can reach a diameter of up to 1.3 m.

Special applications require special solutions. A pressure transmitter monitors the line pressure in the intake pipe, a radiometric sensor the density and flow rate of the sludge.

Large ships can suck up sand and mud from a depth of up to 30 meters. The suction process is closely monitored to ensure maximum loading efficiency. The monitored parameters are line pressure, density and flow.

Line pressure is an especially important parameter: too low a pressure impairs suction, too high a pressure is inefficient and results in greater equipment wear.

The density of the mud provides information on the ratio of water to sand in the pipeline. The trick is to transport as much sand as possible without clogging the pipe. If that were to happen, a complete overhaul of the suction mechanism would be necessary – that could mean a system shutdown lasting several days.

The operating team has to rely 100 % on the on-board instrumentation to keep the process under control and running optimally at all times. And that's a real challenge. The dredged material places very high demands on the robustness of the equipment, because sand acts like sandpaper and subjects the piping and the instrumentation to tremendous wear.

A tailor-made solution

Exactly this occurred on one of the EDT Offshore dredgers. Because of extreme wear, a complete overhaul of the deployed measurement technology was necessary.

Up until then, the company had used pressure transmitters with a metallic measuring diaphragm. These had to be replaced at regular intervals because the diaphragm was quickly destroyed by pressure shocks and abrasion. It didn't take long for VEGA to find the ideal solution: a robust VEGABAR 52 process pressure transmitter with ceramic-capacitive CERTEC® measuring cell. The combination of front-flush mounting and sapphire-ceramic measuring cell guarantees a long service life for the measurement.

The sand dredger EDT SIMI, built in 1999, measures 70.75 meters in length and can hold 5,000 tons of cargo. It sails under the flag of Cyprus, dredging sand from a depth of 10 to 30 m in bodies of water all over the world. 1,600 m³ of sediment can be conveyed in less than 2 hours via its suction hose. In the same period, 1,200 m³ of cargo can be discharged on land.

Non-contact radiometric (radiation-based) measurement lends itself well for the density measurement. The instrument, which is mounted on the outside of the suction pipe, measures right through the pipe and the medium. This ensures maximum availability and reliability of the measurement. MINITRAC 31 calculates the density of the medium from the intensity of the gamma radiation coming from the radioactive source.
The sensor can also read in and process additional measurement data, such as the flow velocity of the medium. The advantage for customers: they need only one data line to the control room and can call up all readings together.

The package offered by VEGA won over the customer completely. During the installation of the measuring system, the intuitive DTM adjustment, which fully brought its advantages to bear, was a great help. The transmitters were integrated into the control system in a few simple steps and put into operation within a very short time.

Info

EDT Offshore is a family-run company based in Cyprus. With a fleet of 20 specialized, high-tech vessels, EDT is a world leader in dredging and other offshore operations.

To ensure that a measuring point operates reliably, even at dizzying heights, the right sensor has to be there right from the start.

Decision criterion #1: the application

In recent years, the trend has been to use measuring instruments that can do "everything." But does it always have to be a high- spec. version with an almost infinite number of features? What does it really come down to when buying a sensor?

In the process industry today, almost everything involves highly specialized instrumentation. The physical operating conditions are the basic factor for the selection of a measuring instrument. Typical of these are the extreme pressures and temperatures, as well as corrosive and toxic media. Level measurement technology is subject to particularly high standards. For example, perhaps it has to be Ex compatible, fulfill specific industrial standards or needs meet legal requirements, like local water resources law.

A sensor must be able to fulfill the measuring task and have the proper technical specification for the particular application. Period. Users of course look for a sensor that best meets their technical requirements. It must have the basic functions and a long service life, work reliably, be accurate, adaptable and robust. Simple adjustment and commissioning are also increasingly important. It also practically goes ithout saying that the instrument has to be technologically up to date.

Questions that have to be asked

Ideally, the purchaser or engineer says right at the start that he knows he needs five level measuring points based on guided wave radar and that these should satisfy certain specifications.

But this isn't always the case, and the overall application needs to be considered. For example; if the level of a fluid in a container under certain operating conditions, such as high pressure and/or temperature, is measured via specific product properties (density, dielectric) one must consider which measurement method is possible, without being influenced by these conditions.

If non-contact measurement is needed, then certainly through air radar is a first choice. The next thing is to decide which physical conditions the instrument must meet and research manufacturers who offer instruments suitable for the job. Other aspects that influence the selection of an instrument are, for example, dimensions, installation size, available mounting space and reliability under difficult conditions. Requirements on materials, durability and maintenance increase the demands on the sensor still further.

A real key area for many customers is the quality of the services offered. In case of any questions or advice, the supplier should provide fast and competent technical support, of course this service should cost as little as possible, too. And one more thing: the instrument supplied needs to be be reasonably priced.

Hard and soft factors

Basically, every company tries to manage and optimize its procurement activities as best it can, the 'hard facts' are: save costs and procure instruments at reasonable prices and on attractive terms.

These terms may include, fast availability, a long warranty period and high reliability. Standardization, in the sense of simplifying and optimizing procurement channels, also plays an important role. The goal: the lowest possible Total Cost of Ownership (TCO).

In all of this, there are the 'soft facts', such as the 'human factor', that should not be underestimated. A good relationship between the manufacturer and the user often increases the acceptance of a particular brand palpably. A customer with good experience from an instrument and supplier will gladly buy again.

Conversely, users want reliable suppliers who maintain an open dialogue with their customers and inform them immediately, e.g. if procurement problems, technical flaws or supply bottlenecks occur. The supplier who makes the client feel important and cared for will always earn plus points. Good contact can indeed tip the scales in a purchasing decision.

Simple adjustment and setup is particularly important for users of level measurement technology.

Fast delivery times are a real sticking point for many buyers of level measurement technology.

VEGA grows in Asia

The founding of a subsidiary in India takes VEGA's expansion in Asia one step further.

No matter where measurement technology from VEGA is used in the world: you'll find subsidiaries and sales partners right next door. Asian customers in China, Singapore and Thailand benefit greatly from the one-on-one consulting provided by VEGA's subsidiaries. In nine other Asian countries, customers are cared for by sales agencies.

For many years VEGA was represented in India by a trade partner. But in order to better look after customers in that country and provide them with the product and service quality they expect from VEGA, a subsidiary was established there. On 1 January 2012, VEGA India Level and Pressure Measurement Pvt. Ltd. commenced operations. A highly-qualified, 16-member sales and service team looks after customers in the industrial centers scattered throughout the country.

The location of the sales and service company is in Pune, in the state of Maharashtra.

"Customers in India are now also supported by VEGA's own competent staff and provided with the most optimal solutions in measurement technology."

Sudarsan Srinivasan,
Managing director, VEGA India Pvt. Ltd.

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