

How to avoid equipment degradation and instrumentation failures in urea plants?

Urea plants

The high temperatures and pressures, corrosion and crystallisation inherent in the urea manufacturing process can put a strain on even the most reliable pressure measurement equipment and quickly render it inoperative.

Fuji Electric France has developed a heavy-duty diaphragm seal to protect relative and absolute pressure transmitters and differential pressure transmitters from the harsh environments encountered in urea fertilizer production.

The third agricultural revolution will not be possible without the use of fertilisers.

Organic farming dreamed of chemical-free crops that would preserve our health and our environment. Today, the dream of the 1980s is coming up against the reality of the soil: without help, the land is depleted.



Keywords

- Agriculture
- Fertiliser plant
- Diaphragm seal
- Process condition
- Pressure measurement
- Urea production



Producing more is becoming essential, while agricultural land is shrinking.

The world's population is growing steadily and the demand for food is soaring, unchecked, year after year.

The Food and Agriculture Organisation of the United Nations (FAO) estimates that food production will have to increase by 70% to feed the additional 2.3 billion people on our planet by 2050. At the same time, the area of cultivated land is constantly decreasing.

Cultivated agricultural land accounted for 5 billion hectares worldwide. But every year, more than 3 million hectares are severely degraded. Today, nearly 5 million hectares of our arable land are lost every year.

Mineral fertilisers more necessary than ever

9.7 billion in 2030 and more than 11 billion people by the year 2100.

This demographic pressure has led the agricultural world in recent years to increase the yield of arable land. This is a more environmentally friendly method. Compared to the old agricultural practices, which are responsible for more than 80% of the world's deforestation.

Every year, 51,600 square kilometres of forest were lost: the equivalent of the size of Costa Rica. Add to this a demand for biofuels (albeit declining) and the global market for mineral fertilisers is expected to reach USD 143.34 billion by 2028.



Today, the need for mineral fertilisers is exploding on every continent!



Urea production becomes a critical issue!

Global urea production is around 200 million tonnes per year and demand has surged since the beginning of the year.

With the rise in agricultural commodity prices, countries such as Australia and Korea are on the brink of collapse.

- The COVID-19 pandemic is delaying factory maintenance and investment in new production capacity.
- China halts urea exports to secure supplies for its own agricultural sector and brings road freight in Australia to its knees: Australian AdBlue production remains dependent on Chinese urea.
- Geopolitical tensions are rising in Europe and gas prices are soaring. The whole urea industry is being consumed!

And it is unlikely that the global tension will subside before 2023.

A major challenge for urea production sites

Optimising output and increasing the efficiency and profitability of production units becomes a major challenge for the plant manager when faced with the inevitable trade-off of meeting increased urea demand:

Synthesise more product in an attempt to increase production at the risk of compromising plant efficiency and product quality, or maximise urea quality at the expense of volume and yield.

This is a real challenge for the maintenance manager, who must anticipate problematic, long and costly plant shutdowns, which are nevertheless essential to ensure the sustainability and safety of the installations, to keep all the equipment running at optimum efficiency and to limit maintenance periods.

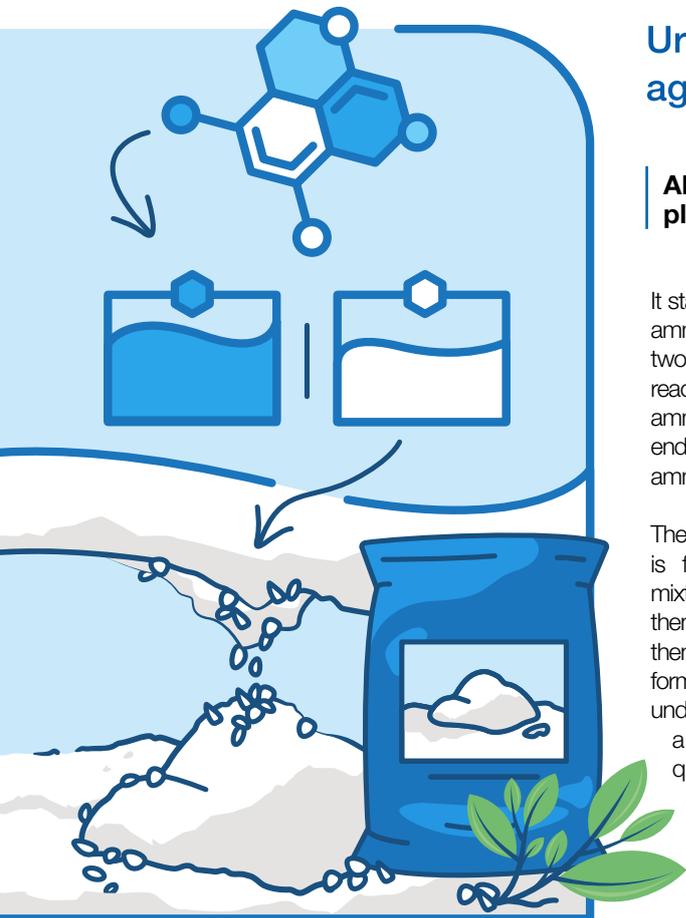
This is a constant challenge for the instrumentation manager who must adapt to the extreme conditions and dangers inherent in urea production.

The challenge is complicated by the constantly changing technologies and

materials that must be chosen to avoid the risk of breakdowns and forced plant shutdowns.

Improving the reliability of manufacturing processes, avoiding production stoppages and guaranteeing the safety of installations is particularly difficult in these conditions. And those responsible for increasing overall efficiency and keeping plants running are under great pressure due to the complexity of the urea manufacturing process, which is very aggressive on equipment.





Urea production: a complex and highly aggressive process for your facilities.

Although the approaches to urea processing differ from plant to plant, the production process is common to all.

It starts with the high-pressure synthesis of ammonia and carbon dioxide. There are two main reactions: first, an exothermic reaction produces the highly corrosive ammonium carbamate, and second, an endothermic reaction breaks down the ammonium carbamate into urea and water.

The residual ammonium carbamate is first separated from the urea-water mixture in a high-pressure extractor and then in a recirculation stage. The water is then expelled in the evaporation stage to form urea melt. Finally, the molten urea undergoes a granulation process to obtain a final solid urea product of the desired quality.

Each urea production process presents unique safety, reliability and efficiency challenges that compel

plant managers to improve the performance of their facilities for a safer, more reliable and more environmentally friendly fertiliser industry.

This can only be achieved with innovative, high-performance equipment and measuring instruments, specially designed and manufactured with materials that can withstand corrosive environments and ensure a long service life.

Material selection is therefore vital at the design stage of equipment and measuring instruments. Poor material selection can lead to catastrophic failures, plant shutdowns, and even loss of life.

Why use the Fuji Electric urea pressure transmitter with 1.4466 steel diaphragm seal?

The materials used for pressure transmitters, as well as the choice of sensor technology, play a very important role in the fertiliser industry, and particularly in the urea industry.

Just like strippers, scrubbers and the reactor of your plant, urea measuring instruments are subject to chemical attack by ammonium carbamate, which causes accelerated degradation of the components in contact with this highly corrosive agent.

Conventional materials for the thin diaphragm of a pressure transmitter's measuring cell do not protect against erosion, corrosion and the mechanical stresses inherent in the urea manufacturing process.

By using urea grade 1.4466 stainless steel, existing urea processes can then achieve a higher level of performance, resulting in energy savings and an increased level of safety due to (for example) a reduced need for passivation. Finally, the measuring cell and electronic components used to manufacture pressure transmitters cannot withstand the high temperatures of the process fluid.

This is why it is essential to use diaphragm seals. The diaphragm seal flushes with the process medium, which no longer has a direct impact on the temperature of the transmitter cell. The transmitter cell can then be mounted at a distance from the measuring point, making it possible to measure extreme temperatures.

The austenitic stainless steel 1.4466 urea grade remote seal pressure transmitters offered by Fuji Electric are, in most cases, the best choice for use under normal urea production process conditions for pressures up to 26 bar (377 psi) and temperatures up to 180°C.

Above these conditions, the use of zirconium or tantalum diaphragm separators may be required for more critical measurement points.

316 stainless steel diaphragm seal eaten away by ammonium carbamate



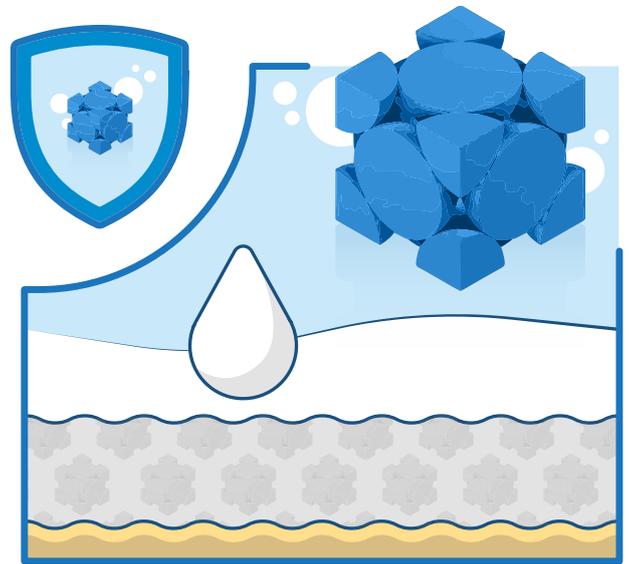
Stainless steel diaphragm seal austenitic urea grade 1.4466



Advantages of measuring instruments with 1.4466 urea quality seal

The use of a 1.4466 austenitic urea grade steel increases the corrosion resistance of the fertilizer plant pressure transmitter, resulting in:

- Longer life of the urea pressure transmitter
- Longer maintenance intervals
- Reduced maintenance and repair costs
- Less need for passivation



The urea diaphragm mounting solution offers several advantages:

Multiple applications:

Flow measurement of liquid, gas, steam, level measurement of a fluid in a tank, density measurement of a fluid or pressure measurement

Sufficient diaphragm diameter in contact with the fluid

To allow accurate measurement of even low pressures

Easy disassembly

For cleaning or calibration operations

Measurement value can be read directly at the point of measurement or from a distance

Allows measurement of extreme fluid temperatures

Easy installation of the transmitter

Even when the measuring point is in an unfavourable position for reading

Can be mounted on any type of pressure measuring instrument

Differential, relative or absolute pressure transmitters



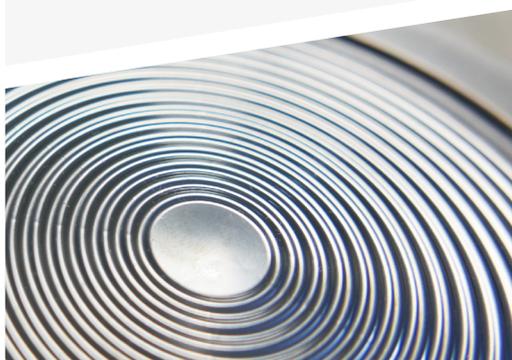
WARRANTY
USEFUL LIFE



SAFETY
MAXIMUM



DESIGN
RELIABLE
AND ROBUST



Fuji Electric diaphragm seal pressure transmitter

Made of urea grade stainless steel alloy 1.4466

Low failure rate

CSFF 92.3 % according to IEC61508 guaranteeing a very good MTBF (Mean Time Between Failure) and a useful life of 50 years

Maximum safety

With advanced safety features SIL2 certified to IEC 61508

Reliable and robust design

Fully welded without threaded connections
100% helium tested to control leakage

The 1.4466 - 25.22.2 - 310MoLN - S31050 - 2RE69 urea grade steel used to manufacture the separators and diaphragms of Fuji Electric's urea pressure transmitters is a fully austenitic stainless steel with very low carbon and impurities.

Practical experience has confirmed its excellent resistance to urea (ammonium carbamate) corrosion at high pressures and temperatures. It is also highly resistant to inorganic acids.

This steel grade is characterised by

- Excellent corrosion resistance to ammonium carbamate and nitric acid (used in the manufacture of ammonium nitrate).
- Excellent resistance to intergranular corrosion
- Excellent resistance to pitting and crevice corrosion

Fuji Electric Urea Diaphragm Seals are supplied with the following certifications:

3.1 inspection certificate

According to EN 10 204

Huey Intergranular Corrosion Test (IGC) certificate

According to ASTM A262 Practice C



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