ASHCROFT®

Trust the shield®

HYDROGEN

/ COURAGE

Progress begins with courage. Courage to accept new challenges and to meet them with new approaches and technical developments: especially in times of dynamic change and with regard to securing our future energy supply.

The use of sustainable energy sources changes the requirements for materials and components. With pressure measurement technology specially developed for use with hydrogen, we are in a position to meet the specific requirements - now and in the future.

The irrepressible will to innovate and develop new technical solutions is our driving force and already a living reality - always inspired by the original pioneering spirit of our founder Edward Ashcroft.

MEASURE US BY IT!

THIS IS ASHCROFT

DEVELOPMENT FROM TRADITION

When Edward Ashcroft founded our company in 1852, his mission was to protect the steam-powered industry and its workers by using more sophisticated and reliable instruments. Times have changed, but not our attitude. With a history of more than 165 years, of which more than 40 years with our own production in Europe, we have experienced and learned a lot. Together with our customers, we have mastered three industrial revolutions, survived global and regional conflicts and crisis's. We look forward to accompanying our customers with our products in the fourth industrial revolution as well.

GLOBAL - REGIONAL - LOCAL

Globally positioned - regionally represented and locally available for you. With local contacts who speak your language and are ready to solve your challenges.

OUR GREATEST STRENGTH

All of Ashcroft's products and services are the result of our exceptional people. We are all passionate about our common goal, the best customer satisfaction. Ashcroft is inspired of a common commitment to our work and to each other. Combining the talents of our diverse workforce makes us more competitive, resilient and better able to respond to the ever-changing needs of our customers and markets.

OUR MOTIVATION

As a customer and partner, you are the focus of our attention. We are passionate about designing and producing the most innovative, high quality pressure and temperature measuring instruments on our planet.

OUR VALUES

Our five corporate values are not abstract, but are lived by us, and every Ashcroft employee bases his or her daily actions on them.

THINK CUSTOMER FIRST

Every measure, every plan and every project is aimed first and foremost at you, our customer. We see the world through your eyes.

NEVER SETTLE / CHALLENGE THE STATUS QUO

What was true yesterday is not necessarily true today. At Ashcroft, we challenge each other to never be indifferent, to keep improving ourselves and the company.

RESPECT EACH OTHER

We celebrate our diversity, share our ideas and intensify our collective thinking. We act and discuss in mutual respect and thus find better solutions.

THINK BEYOND BORDERS

Across geographical borders. Beyond the factory. Beyond your own area of responsibility. Beyond the personal comfort zone.

WIN AS A TEAM

The common goal is more important to us than our own.

DARE

COURAGE

/ ASHCROFT HYDROGEN

PIONEER WORK

DISCOVER

/ ASHCROFT PRESSURE MEASUREMENT TECHNOLOGY FOR HYDROGEN

HARDLY ANY OTHER TOPIC OCCUPIES THE TECHNICAL INDUSTRY, BUT ALSO CURRENT EVENTS, AS MUCH AS THE USE OF HYDROGEN.

Whether for powering vehicles, ships or even aircraft to transform transport or for use as a fuel for sustainable energy supply, hydrogen seems to offer an ideal solution.

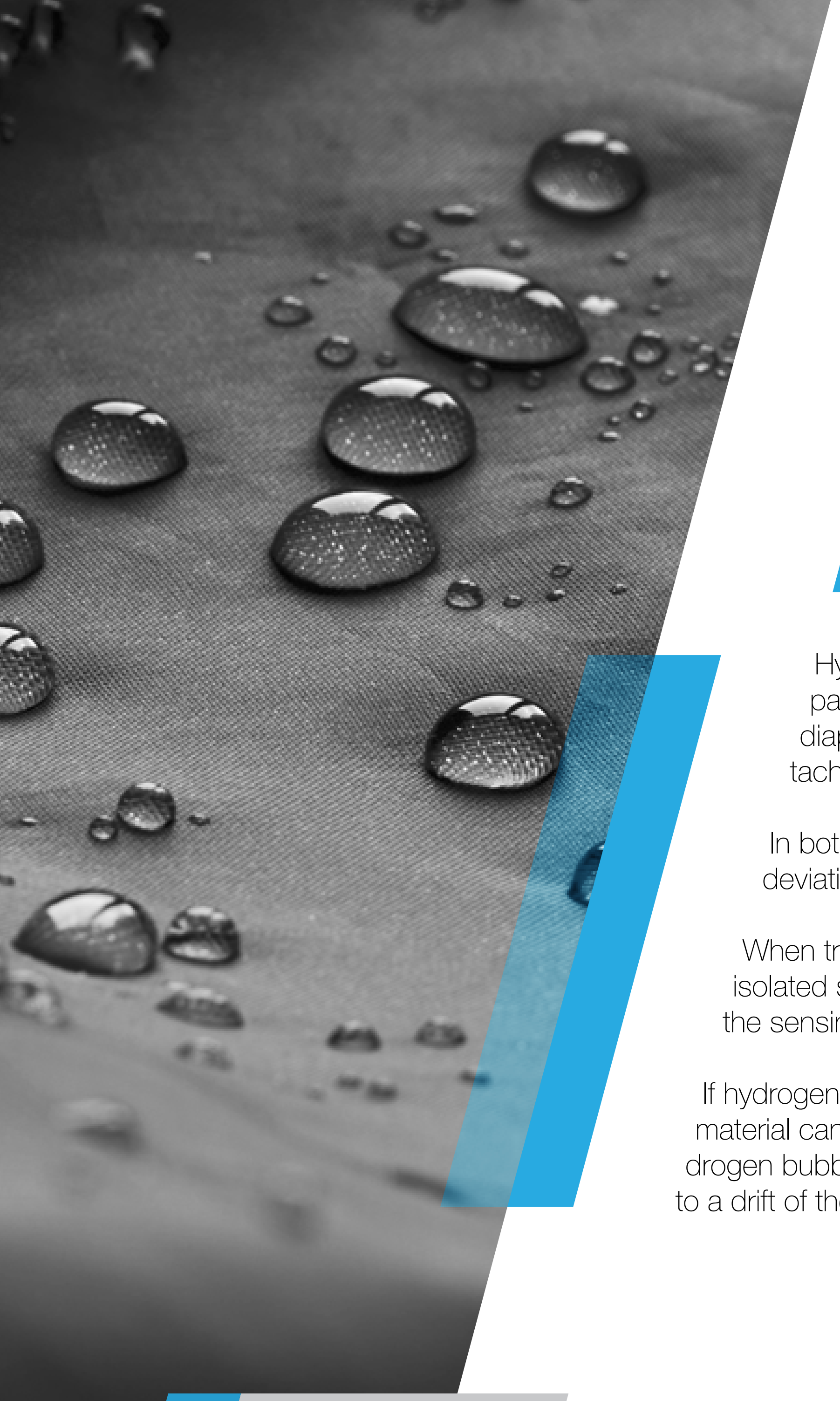
Since many applications of hydrogen technology are new or in some cases still in the development or testing phase, knowledge about suitable instrumentation is important in order to measure the highly explosive element safely and reliably in the long term in order to control the processes and applications.

Hydrogen places very individual and challenging demands on the materials of the measuring instruments.

It is not a question of whether a measuring device is suitable for hydrogen, but whether it has been specially developed for hydrogen.

This is exactly what we have done at Ashcroft. A portfolio of mechanical and electrical pressure measurement technology developed for hydrogen applications.

Just as we pioneered the then burgeoning steam industry in 1852, we are living that role again, with unique product solutions specifically and only for the hydrogen industry.



IN MANY HYDROGEN APPLICATIONS, THERE ARE PROCESSES THAT CAN LEAD TO PENETRATION OF HYDROGEN IONS.

This can lead to hydrogen permeation and embrittlement, which can cause premature failure of your pressure transmitter.

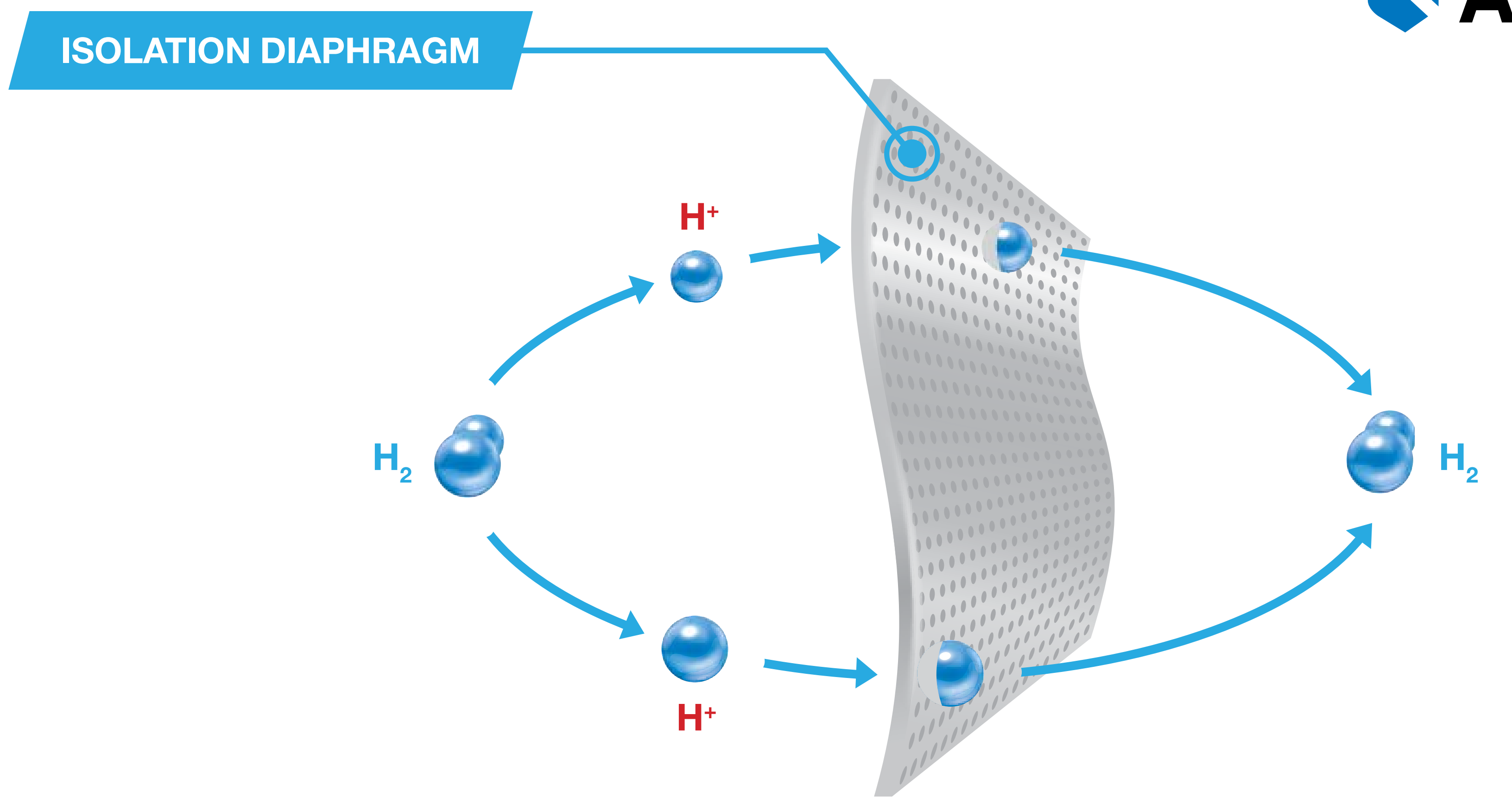
HYDROGEN PERMEATION

Hydrogen permeation is the penetration of hydrogen ions through the lattice structure of a particular material. This can cause problems with pressure transmitters that rely on a thin metal diaphragm to transmit pressure either directly on a strain gauge or via a liquid-isolated sensor attached to a strain gauge.

In both cases, the diaphragm is the weak link in the system. Over time, permeation will cause signal deviation or complete failure if the correct material is not selected for the application.

When transmitters contain liquid-isolated sensors, hydrogen permeation can be a problem. Liquid-isolated sensors rely on a thin metal diaphragm to prevent the medium from coming into contact with the sensing element.

If hydrogen permeation occurs with this type of sensor, the hydrogen ions that penetrate the membrane material can convert to hydrogen molecules in the insulating liquid. The molecules collect and form a hydrogen bubble. These bubbles cause a shift of the zero point in the output of the transducer and can lead to a drift of the output value or permanent damage to the sensor cell over time.



One way to reduce hydrogen permeation is to use a material with a dense lattice structure such as 316L stainless steel or variants of 316 stainless steel with a large membrane thickness. Another solution is to provide the membrane with a very thin gold layer. The gold layer has a very dense lattice structure that increases the membrane's resistance to hydrogen penetration.

Besides the lattice structure of a material, hydrogen permeation is also influenced by the pressure of an application. The higher the pressure of the application, the greater the concentration gradient of hydrogen ions acting on the membrane.

This force stretches the lattice structure of the material, allowing more hydrogen ions to penetrate the material. Therefore, a material should be used that not only has a dense lattice structure, but is also well suited for the pressure range of the application.

HYDROGEN EMBRITTLEMENT

EMBRITTLEMENT IS A PHENOMENON THAT LEADS TO THE LOSS OF DUCTILITY AND THUS TO THE BRITTLENESS OF A MATERIAL.

Materials that are particularly susceptible include high-strength steels, titanium and aluminium alloys, and electrolytically tough pitch copper.

Hydrogen embrittlement is also known as hydrogen-induced cracking or hydrogen attack. The mechanisms can be aqueous or gaseous and involve the penetration of hydrogen into the metal, reducing its ductility and load-bearing capacity.

BUT HOW DOES EMBRITTLEMENT OCCUR?

Because hydrogen is such a small atom, it can penetrate the metal through microcracks in the surface. Inside the metal, the hydrogen atoms recombine with others to form hydrogen molecules (H2).

These molecules collect with other H2 molecules, resulting in a larger mass of hydrogen that exerts outward pressure in the crack. Stresses below the yield stress of the susceptible material then lead to cracks and catastrophic brittle fractures.

When hydrogen molecules decay, they form hydrogen ions, which are among the smallest ions in the world. They can penetrate the lattice structure of many metals and enter the metal, where they then reform as hydrogen molecules.

The absorbed hydrogen molecules create pressure and tension inside the material. This can affect the deformability and strength of the material and eventually lead to cracks in the material.

- Hydrogen embrittlement - A process that results in a decrease in the fracture toughness or ductility of a metal due to the presence of atomic hydrogen.
- Hydrogen Environmental Embrittlement (HEE) - The degradation of certain mechanical properties that occurs when a material is intentionally exposed to a gaseous hydrogen environment under the influence of an applied stress.
- Internal Hydrogen Embrittlement (IHE) - The deterioration of certain mechanical properties resulting from the accidental ingress of hydrogen into susceptible metals during forming or finishing.
- Hydrogen reaction embrittlement (HRE) - The deterioration of certain mechanical properties that occurs when hydrogen reacts with the metal matrix itself to form metal compounds such as metal hydride at relatively low temperatures. This form of hydrogen damage can occur in materials such as titanium, zirconium and even some types of iron or steel alloys.

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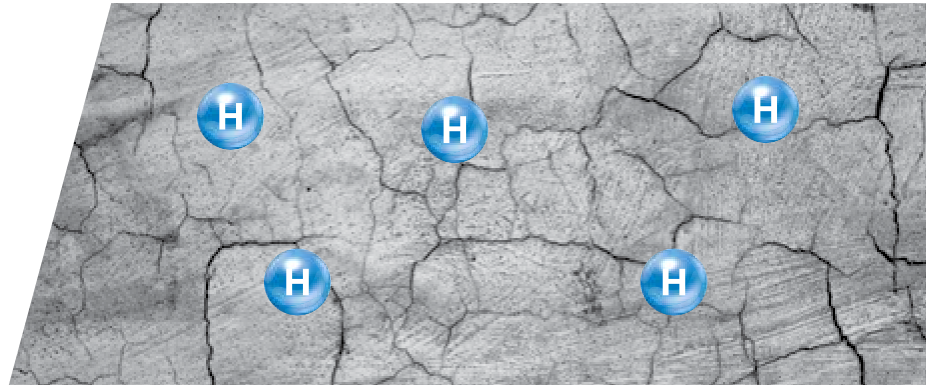

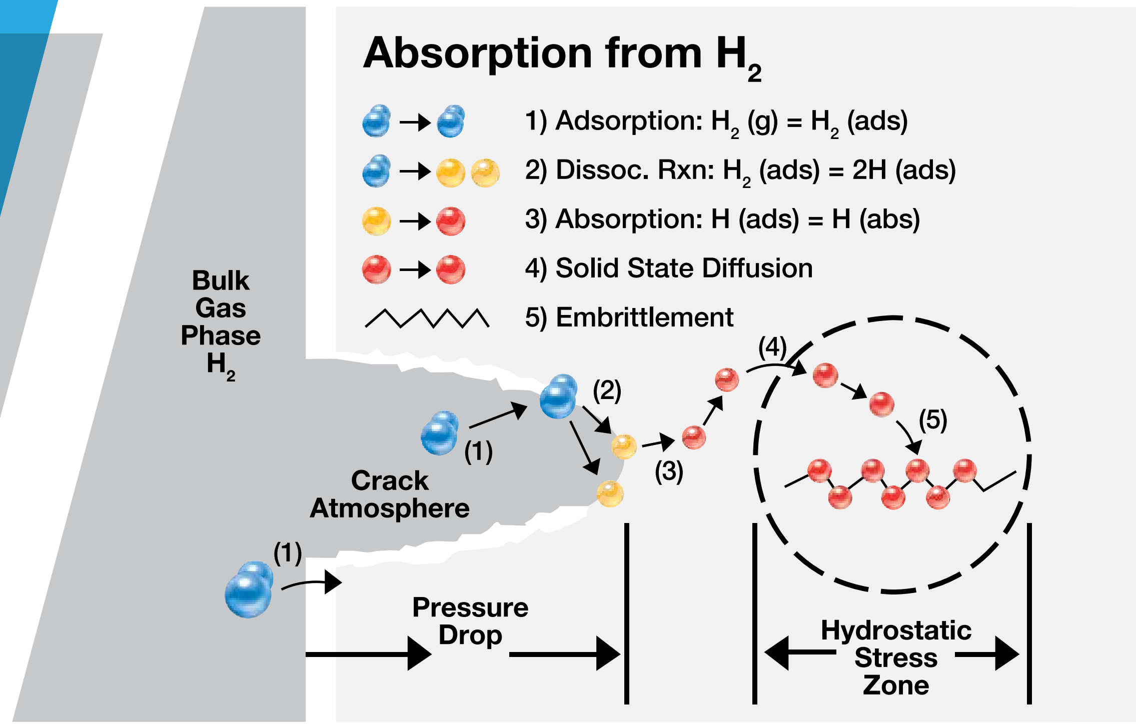

ASHCROFT ELECTRONIC PRESSURE MEASUREMENT TECHNOLOGY FOR HYDROGEN

NOT ONLY SUITABLE, BUT SPECIALLY DEVELOPED FOR ALL HYDROGEN APPLICATIONS.

A286 is an iron-based superalloy that finds its application in aerospace engineering due to its combination of high strength and good corrosion resistance at medium temperatures. The high nickel content of A286 makes it resistant to strain-induced phase transformations. Although A286 is also referred to as stainless steel, it differs significantly from the 300 series alloys and has the highest resistance especially to hydrogen embrittlement.

Conventional pressure transmitters use the material 17-4PH for the thin-film sensor cell. While this material is very well suited for conventional applications in industrial and process technology, the application with hydrogen usually leads to embrittlement of the material and hydrogen diffusion into the sensor structure. The associated long-term drift leads to an additional measurement deviation, which, depending on temperature and pressure, can amount to 3% or more. In addition to the loss of accuracy, high system pressures can lead to a technically induced total failure.

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ASHCROFT SOLUTION FOR SYSTEM PRESSURES FROM 0...350 BAR

For applications with hydrogen, Ashcroft uses a thin-film sensor cell made of 316L stainless steel. Up to a system pressure of 350 bar, this material, in conjunction with the material thickness used for the pressure sensor, is insensitive to embrittlement and therefore very stable over the long term.

ASHCROFT SOLUTION FOR SYSTEM PRESSURES FROM 350...1400 BAR

For high pressure applications with hydrogen, A286 thin film sensing elements are used in Ashcroft pressure transmitters. The material properties of the A286 thin film sensor ensure permanent resistance to embrittlement and permeation, ensuring maximum reliable accuracy with negligible long-term drift even in high pressure hydrogen applications up to 1400 bar.

/ E2G

PRESSURE TRANSDUCER

FEATURES

- Ranges from 100 mbar to 1400 bar
- Ingress rating IP66 / 67
- Highly configurable
- Field calibratable
- Wide range of process and electrical connections
- Customisable
- External magnetic adjustment for zero and span

CE RoHS COMPLIANT

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/ TECHNICAL DATA

GAUGE AND VACUUM RANGES	/ -1…1400 bar	**ABSOLUTE PRESSURE RANGES**	/ 0…1 to 0…20 bar (abs)
ACCURACY	/ ±0.25%, ±0.5% or ±1.0% of span, Terminal Point Method (includes hysteresis, linearity, repeatability, offset and span)	**LONG-TERM STABILITY**	/ ≤0,25% the measuring span / year at reference conditions
REFERENCE TEMPERATURE	/ 21°C ±2°C	**RESPONSE TIME**	/ 4 ms
PROOF PRESSURE	/ 1,2x to 2x	**BURST PRESSURE**	/ 3x to 8x
TEMPERATURE LIMITS	/ Storage: -50°C to 125°C / Operating: -40°C to 125°C / Media: -40°C to 125°C	**SHOCK**	/ 80 g, 6 ms, Haversine
VIBRATION	/ 10 g effective in all directions with 20-2000 Hz	**MATERIAL**	/ Sensor element material: Stainless steel 17-4 PH / Stainless steel 316L (1.4404) / Stainless steel 316L (1.4404) isolated / A286 / Process connection: Stainless steel 316L (1.4404) / Housing: Stainless steel 316L (1.4404)
INGRESS RATING	/ Standard IP66 ; IP67 and IP69K optional	**SUPPLY CURRENT**	/ max. 8 mA (VDC-output signal)
OUTPUT SIGNAL	/ 4-20 mA (2-wire) / 20-4 mA (2-wire) / 1-5/6 VDC (3-wire) / 0-5/10 VDC (3-wire) / 1-11 VDC (3-wire) / 0,1-5/10 VDC (3-wire) / 0,5-4,5 VDC (3-wire)	**HUMIDITY**	/ 0-100% R.H. (non-condensing)

ASHCROFT®
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/ TECHNICAL DATA

GAUGE AND VACUUM RANGES	/ -1…1400 bar	**ABSOLUTE PRESSURE RANGES**	/ 0…1 to 0…20 bar (abs)
ACCURACY	/ ±0.25%, ±0.5% or ±1.0% of span, Terminal Point Method (includes hysteresis, linearity, repeatability, offset and span)	**LONG-TERM STABILITY**	/ ≤0,25% the measuring span / year at reference conditions
REFERENCE TEMPERATURE	/ 21°C ±2°C	**RESPONSE TIME**	/ 4 ms
PROOF PRESSURE	/ 1,2x to 2x	**BURST PRESSURE**	/ 3x to 8x
TEMPERATURE LIMITS	/ Storage: -50°C to 125°C / Operating: -40°C to 80°C / Media: -40°C to 80°C	**SHOCK**	/ 80 g, 6 ms, Haversine
VIBRATION	/ 10 g effective in all directions with 20-2000 Hz	**MATERIAL**	/ Sensor element material: Stainless steel 17-4 PH / Stainless steel 316L (1.4404) / Stainless steel 316L (1.4404) insulated / A286 / Process connection: Stainless steel 316L (1.4404) / Housing: Stainless steel 316L (1.4404)
INGRESS RATING	/ Standard IP66 ; IP67 and IP69K optional	**SUPPLY CURRENT**	/ max. 8 mA (VDC-output signal)
OUTPUT SIGNAL	/ 4-20 mA (2-wire) / 20-4 mA (2-wire) / 1-5/6 VDC (3-wire) / 0-5/10 VDC (3-wire) / 1-11 VDC (3-wire) / 0,1-5/10 VDC (3-wire) / 0,5-4,5 VDC (3-wire)	**HUMIDITY**	/ 0-100% R.H. (non-condensing)

/ E2S

INTRINSICALLY SAFE PRESSURE TRANSDUCER

FEATURES

- Ranges from 100 mbar to 1400 bar
- Robust 316 stainless steel housing
- FM, ATEX and IECEx intrinsically safe approvals
- FM non-incendive approved
- 4-20 mA or numerous voltage outputs available
- External magnetic adjustment for zero and span
- Wide range of electrical and process connections

/ E2X - E2F

EXPLOSION PROOF PRESSURE TRANSDUCER

FEATURES

- Ranges from 100 mbar to 1400 bar
- Robust 316 stainless steel housing
- E2X - FM, ATEX and IECEx double approval flame proof/intrinsically safe
- E2F - FM, ATEX and IECEx approval explosion proof enclosure
- FM non-incendive approved
- 4-20 mA or numerous voltage outputs available
- External magnetic adjustment for zero and span
- Wide range of electrical and process connections

HYDROGEN

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/ TECHNICAL DATA

GAUGE AND VACUUM RANGES	/ -1…1400 bar	**ABSOLUTE PRESSURE RANGES**	/ 0…1 to 0…20 bar (abs)
ACCURACY	/ ±0.25%, ±0.5% or ±1.0% of span, Terminal Point Method (includes hysteresis,linearity, repeatability, offset and span)	**LONG-TERM STABILITY**	/ ≤0,25% the measuring span / year at reference conditions
REFERENCE TEMPERATURE	/ 21°C ±2°C	**RESPONSE TIME**	/ 4 ms
PROOF PRESSURE	/ 1,2x to 2x	**BURST PRESSURE**	/ 3x to 8x
TEMPERATURE LIMITS	/ Storage: -50°C to 125°C / Operating: -40°C to 80°C / Media: -40°C to 80°C	**SHOCK**	/ 80 g, 6 ms, Haversine
VIBRATION	/ 10 g effective in all directions with 20-2000 Hz	**MATERIAL**	/ Sensor element material: Stainless steel 17-4 PH / Stainless steel 316L (1.4404) / Stainless steel 316L (1.4404) insulated / A286 / Process connection: Stainless steel 316L (1.4404) / Housing: Stainless steel 316L (1.4404)
INGRESS RATING	/ Standard IP66 ; IP67 and IP69K optional	**SUPPLY CURRENT**	/ max. 8 mA (VDC-output signal)
OUTPUT SIGNAL	/ 4-20 mA (2-wire) / 20-4 mA (2-wire) / 1-5/6 VDC (3-wire) / 0-5/10 VDC (3-wire) / 1-11 VDC (3-wire) / 0,1-5/10 VDC (3-wire) / 0,5-4,5 VDC (3-wire)	**HUMIDITY**	/ 0-100% R.H. (non-condensing)

HYDROGEN

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/ TECHNICAL DATA

GAUGE AND VACUUM RANGES	/ -1…1200 bar	**ABSOLUTE PRESSURE RANGES**	/ 0…1 to 0…20 bar (abs)
ACCURACY	/ ±0.25% or ±0.5% of span, Terminal Point Method (includes hysteresis, linearity, repeatability, offset and span)	**LONG-TERM STABILITY**	/ ≤0,25% of span / year at reference conditions
REFERENCE TEMPERATURE	/ 23°C ±2°C	**RESPONSE TIME**	/ 30 ms
OVERPRESSURE	/ up to 200% of the pressure range	**TEMPERATURE**	/ Storage: -20°C to 70°C / Ambient: -10°C to 60°C / Media: -10°C to 60°C
MATERIAL	/ Sensor element material: Stainless steel 17-4 PH / Stainless steel 316L (1.4404) / Stainless steel 316L (1.4404) insulated / A286 / Process connection: Stainless steel 316L (1.4404) / Housing: Aluminium	**INGRESS PROTECTION**	/ Standard IP66 / NEMA 4
SUPPLY CURRENT	/ max. 20,8 mA	**OUTPUT SIGNAL**	/ 4-20 mA (2-wire)
SUPPLY VOLTAGE	/ 24 VDC	**DISPLAY**	/ 6-digit LCD with LED backlight
HUMIDITY	/ 35-85% R.H. (non condensing)	**FUNCTIONS**	/ Min./max. holding function / Scaling for display and output signal / Simulation 4-20 mA output signal

/ GC51

PRESSURE TRANSMITTER

/ KJ91

INTRINSICALLY SAFE PRESSURE TRANSMITTER

FEATURES

- Ranges from 400 mbar to 1400 bar
- Compact and robust construction
- Min./Max. Hold function
- Scaling for display and output signal
- Simple operation by means of internal keys
- Simulation for 4-20 mA output signal and user-defined scaling
- Keypad lock with password to protect settings

ADDITIONAL FEATURES KJ91

- ATEX and IECEx intrinsically safe approvals

HYDROGEN

/ 8008S

STAINLESS STEEL PRESSURE GAUGE

FEATURES

- Meets EN 837-1 and ASME B40.100 specifications
- Dry pressure gauges can be filled on site
- FlutterGuard™ damping as standard for unfilled gauges
- Extensive range of process connections and measuring ranges
- Cost-effective solution for stainless steel pressure gauges
- Mass spectrometer helium leak test of 1 x 10^{-6} scc/c

- Optional safety pattern design (S2) or solid front design (S3)

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/ TECHNICAL DATA

PRESSURE RANGES	/ Vacuum, compound, 0 to 1400 bar	**ACCURACY**	/ 63 mm: ±1,6% % of span according to EN 837-1 / ±1,0% Optional / 100 mm: 1,0% of span according to EN 837-1
DIAL SIZE	/ 63 mm, 100 mm	**OVERPRESSURE**	/ ≤100 bar / 125% of the measuring range / >100 to ≤600 bar / 115% of the measuring range / >600 bar / 110% of the measuring range
MATERIAL	/ Bourdon tube: Stainless steel 316L (1.4404) / Process connection: Stainless steel 316L (1.4404) / Housing: Stainless steel 304 (1.4301); optionally 316L / Movement: Stainless steel 316L (1.4404)	**WINDOW**	/ Polycarbonate, instrument glass, safety glass
DIAL	/ Aluminium	**POINTER**	/ Aluminium
INGRESS PROTECTION	/ IP66 / NEMA 4X	**PROCESS CONNECTION LOCATION**	/ Lower, center back or lower back
DAMPENING	/ Flutterguard™, Glycerine filling, Silicone filling	**PROCESS CONNECTION**	/ All common sizes

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/ TECHNICAL DATA

PRESSURE RANGES	/ Vacuum, compound, 0 to 1400 bar	**ACCURACY**	/ 1,0% of span according to EN 837-1, optionally 0,5%
DIAL SIZE	/ 100 mm, 160 mm	**WORKING PRESSURE**	/ Suitable for maximum resting pressure load equal to the maximum scale value
MATERIAL	/ Bourdon tube: Stainless steel 316L (1.4404) / Process connection: Stainless steel 316L (1.4404) / Housing: Stainless steel 304 (1.4301); optionally 316L / Movement: Stainless steel 316L (1.4404) / Bayonet ring: Stainless steel 304 (1.4301); optional 316L / Restrictor: Stainless steel 316L (1.4404)	**WINDOW**	/ Polycarbonate, instrument glass, safety glass
DIAL	/ Aluminium	**POINTER**	/ Aluminium
INGRESS PROTECTION	/ IP66 / IP67 / NEMA 4X	**PROCESS CONNECTION LOCATION**	/ Lower, lower back
DAMPENING	/ Glycerine filling, silicone filling, white oil filling, halocarbon filling or optional I *PLUS!*™ version	**PROCESS CONNECTION**	/ All common sizes

/ T5500

STAINLESS STEEL PRESSURE GAUGE

FEATURES

- Robust, fully welded stainless steel construction
- 100 mm and 160 mm dial size
- Ingress protection class IP66 / IP67 / NEMA 4X
- ATEX approval
- Optional arctic ambient temperature down to -70°C
- Over pressure 130%
- Dry, liquid-filled or ***PLUS!***™ damped movement

- Optional safety pattern gauge with baffle wall S3 (T6500)

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www.ashcroft.eu

ASHCROFT INSTRUMENTS GMBH • Max-Planck-Str. 1 • 52499 Baesweiler • GERMANY