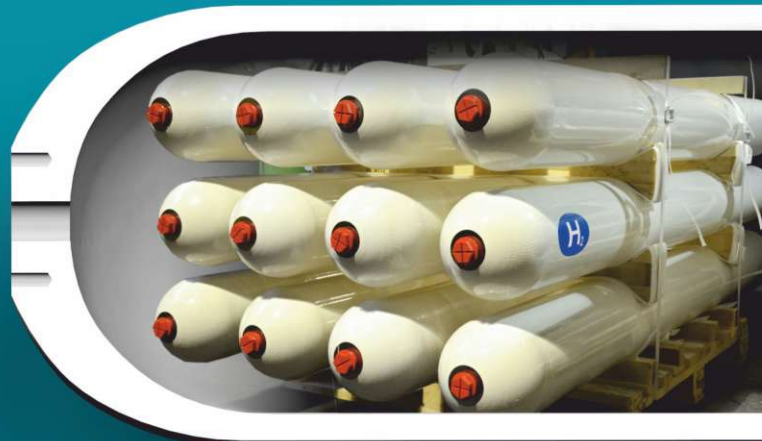




# Cylinders Holding



[www.cylinders.cz](http://www.cylinders.cz)



## ABOUT THE COMPANY

Cylinders Holding is a Czech company that has been continuously producing pressure cylinders for more than 110 years. After massive investment, it is a global producer with the largest share in the European steel cylinder market. The company's export targets all the continents. In selected territories, the holding builds not only a market position but also new production facilities.

The company has undergone significant developments thanks to its current owners. Nowadays it operates four lines for the production of extruded cylinders in Ostrava, Czech Republic, and in Sosnowiec, Poland. In Ostrava, there are also two lines for the production of tubular cylinders. It also has special technology for the production of pressure tanks for hydrogen and technical gases as well as atypical pressure systems for hydraulic applications. Cylinders Holding builds on development - whether new technologies in automotive, such as CNG and hydrogen pressure systems, or new patented technology in tool making and original technology for moulding processes for rotary hollow products.

The stormy development dates back to the 1990s, when the company devoted itself to the transition from the 150 bar system to the 200 bar cylinder system. At the beginning of the third millennium, it was a key global player to switch the gas distribution system to 300 bar. It has maintained this position to this day. In 2008, the company developed and built a

new technology for production of cylinders up to 406 mm in diameter by backward extrusion. It is a unique technology, even on a global scale. Not only have complex shaping processes been developed, but also latest technologies have been used. An important step was the acquisition of two German production lines - the best technology for the production of steel tube cylinders at the time. Due to a combination with our own unique equipment, an absolutely unique tube cylinder production has emerged, unparalleled in the world.

Technology for the production of cylinder bundles for the automotive industry and various CNG applications was built in Sosnowiec, Poland, in 2017. This technology uses a new APS Extreme coating system, while also treating internal surfaces, and includes a robotic helium test.

Cylinders Holding is currently committed to the Cylinders 4.0 strategy because it is aware that new technologies, new value-added products, original special services and robotization of processes will be key parameters for development of new supply systems in the future.

Cylinders Holding builds its future on the principles of the circular economy. Mobile and virtual gas pipeline systems developed by Cylinders Holding confirm that there are comfortable, environmentally friendly and economical top-quality solutions that reduce the burden on our planet.



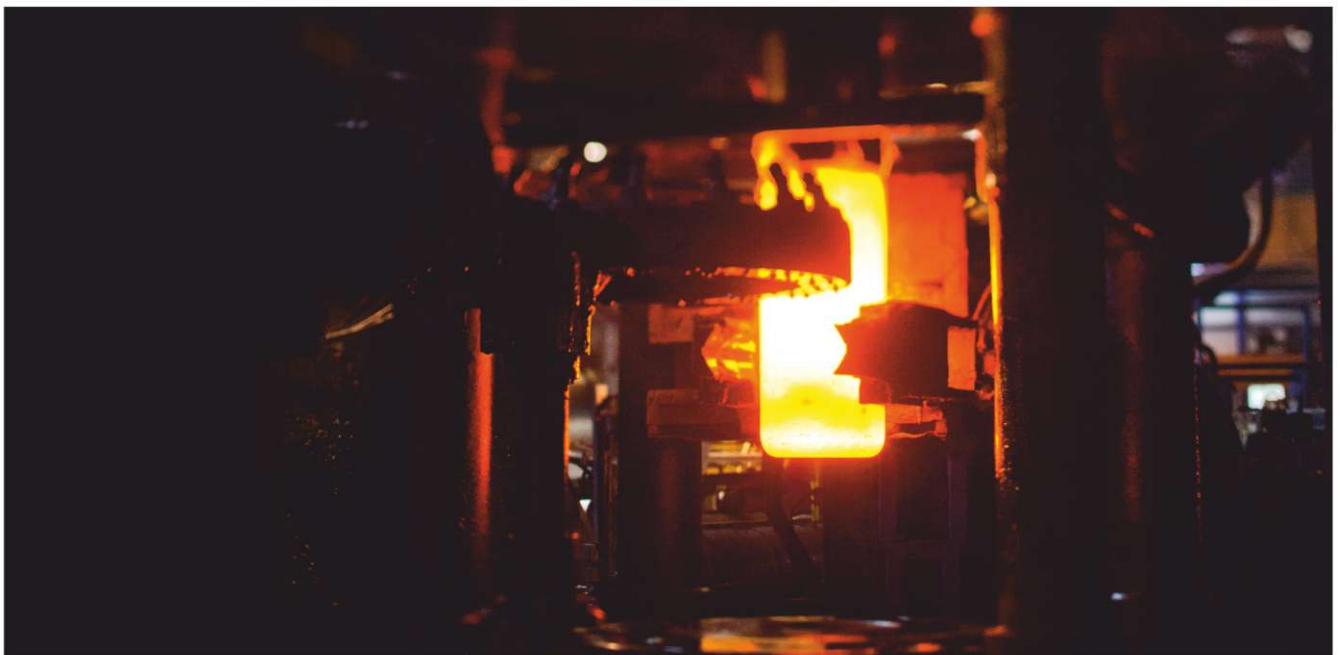
Ing. Jan Světlík  
CEO of CYLINDERS HOLDING a.s.

## MANUFACTURING TECHNOLOGY

Cylinders Holding uses 8 production lines which cover the wide production portfolio of cylinders, tanks, pressure vessels, H<sub>2</sub> storage vessels and accumulator shells, as shown in the table below.

Line	Production technology	Diameter [mm]	Water volume [liter]	Working pressure [bar]	Location
1	Extrusion	229 - 406	50 - 260	200 - 450	CZ
2	Extrusion	204 - 320	27 - 100	150 - 300	PL
3	Extrusion	171 - 244	5 - 60	16 - 300	CZ
4	Extrusion	100 - 204	2 - 20	150 - 300	PL
5	from Pipes	140 - 229	5 - 20	150 - 300	CZ
6	from Pipes	83 - 140	0,8 - 10	150 - 300	CZ
7	Accumulator shells	95 - 406	0,5 - 200	330 - 690	CZ, PL
8	Combined	204 - 450	204 - 450	80 - 1380	CZ, PL

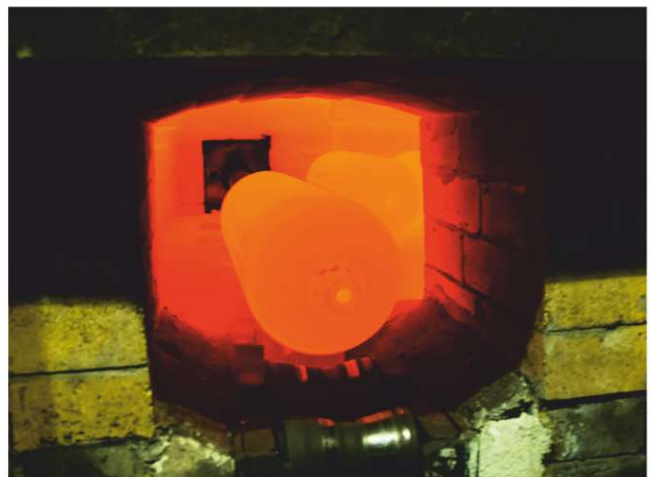
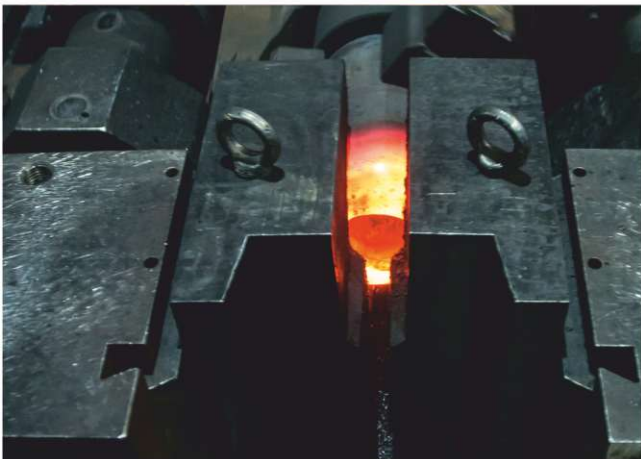
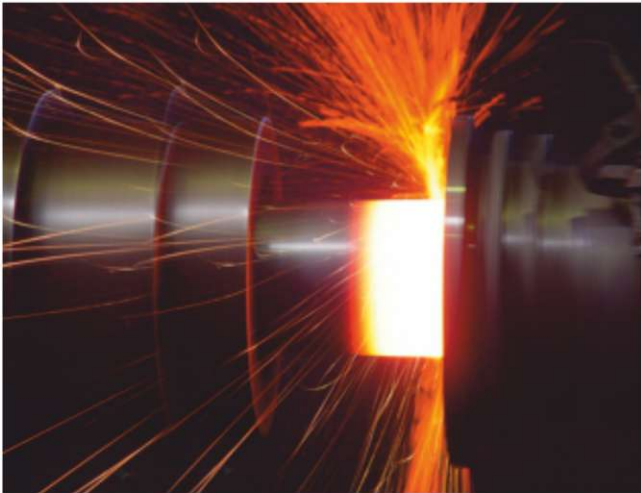
Manufacturing companies of the Cylinders Holding Group have a number of unique technologies, primarily of special production methods of seamless high-pressure steel cylinders, tanks, accumulator shells and pressure vessels made from billet by the reversed extrusion method.



Another unique methods for the production of these mentioned products are unique "tailor made" technologies:

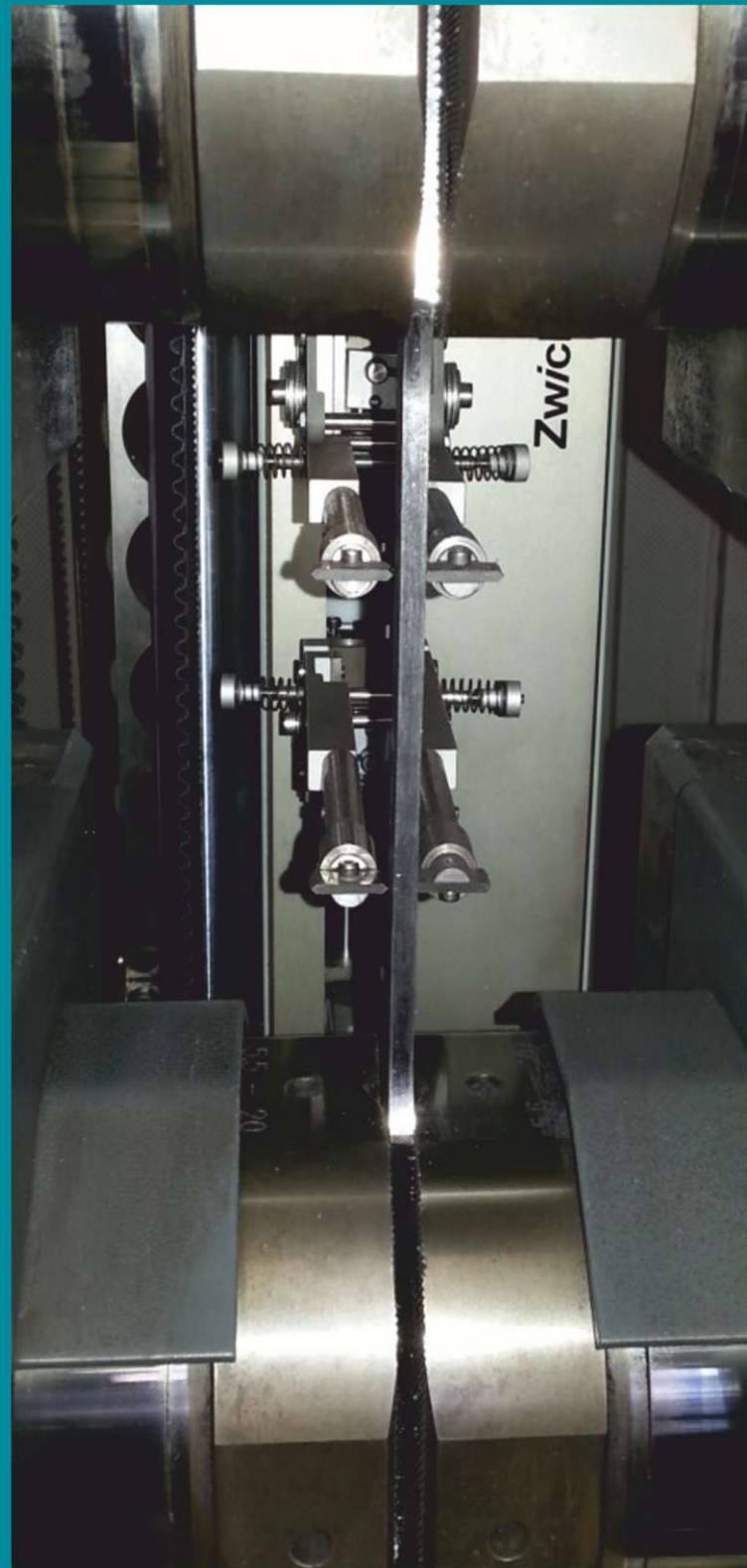
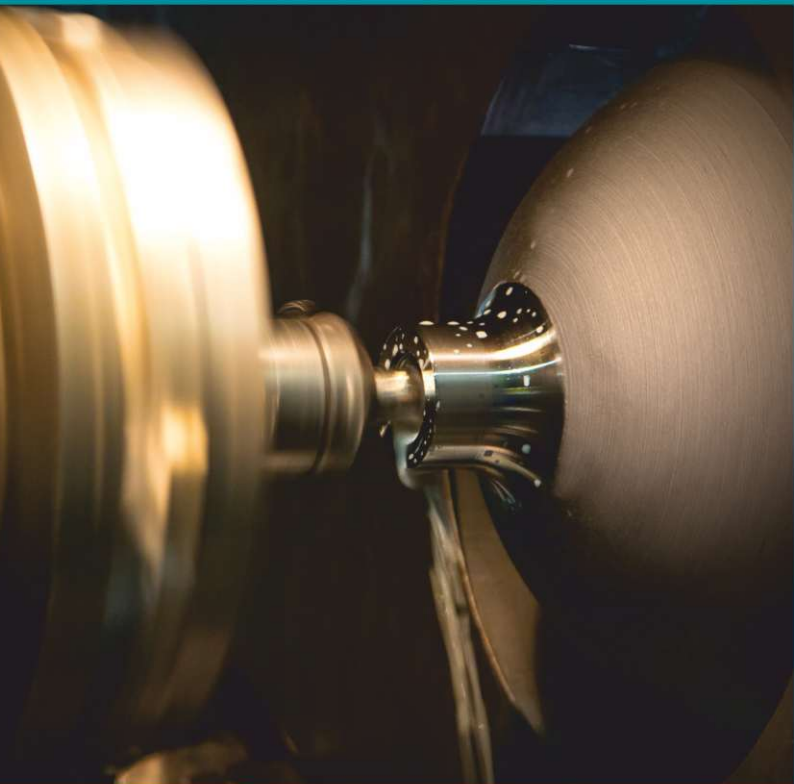
- **Rotary die forming**
- **Rotary forging**
- **Spinning forming**

From the point of view of heat treatment, Cylinders Holding Group operates a number of furnaces in which can be processed a wide range of all products and material grades.



During our production processes, we also use a number of special CNC turning and milling centers made especially for processing all the range of products of Cylinders Holding.

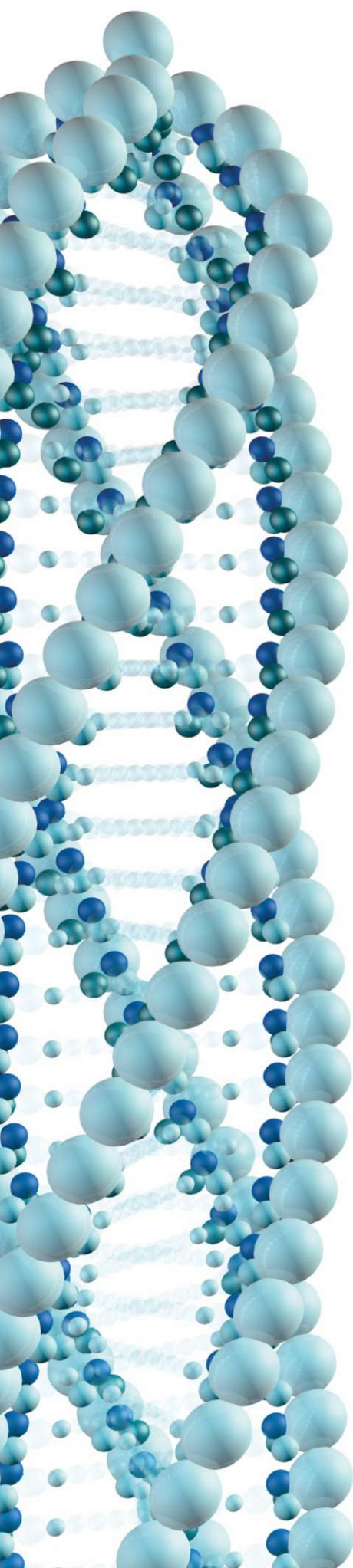
An integral part of the production capacities are also unusual special devices for destructive and non-destructive testing of all manufactured products.



These devices include pressure testing chambers up to 1600 bar, destruction testing rooms up to 2000 bar and the largest test facility in the world for volumetric expansion testing (Water Jacket) with a test pressure up to 720 bar.

We are also outstanding in the field of the most advanced technologies for the application of anticorrosive surface protection and cleaning of the inner surface of cylinders and tanks fulfilling the most demanding requirements of the automotive and gas industry.





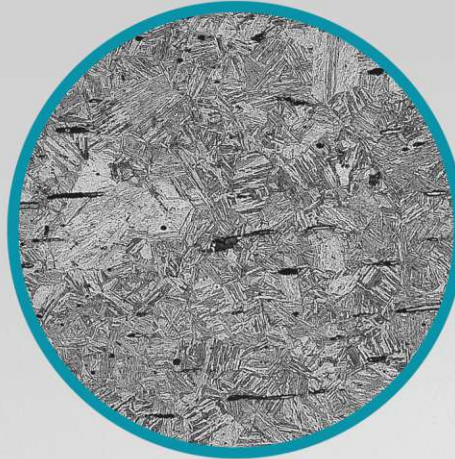
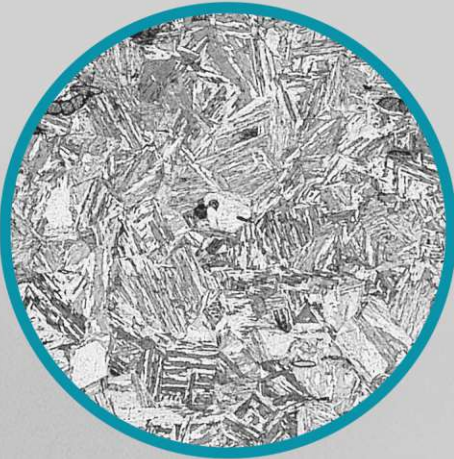
## INNOVATION AND PRODUCT DEVELOPMENT

Products innovation and the development of new products have always been the basic philosophy of Cylinders Holding. Thanks to this, we have been at the top of worldwide cylinder production for many years.

**Innovations take place primarily in the following areas:**

- **Weight reduction of existing cylinders**  
Our products are being continuously weight reduced thanks to the innovation and are the lightest in the world today thanks to the uniquely developed CrMo steel with increased strength and toughness.
- **New types of cylinders with extruded inner neck**  
We have developed and patented the extrusion of cylinders with the inner neck, which gives our customers the opportunity to reduce significantly the weight of stationary and mobile applications, where there are required two connecting points (in the neck and bottom).
- **Pressure vessels for extreme pressures**  
In the area of new products we designed and manufactured pressure vessels with a working pressure of 1380 bar.
- **Stainless steel cylinders**  
We have developed a unique patented technology of the reverse extruded stainless steel cylinders that is certified for diving, special gases, calibration gases, automotive and other fields of use.
- **Development of surface treatment of tools**  
We have a unique type of surface protection for tool steels for hot work, which is protected by the European utility model.





1  
protlačovaná  
nerezová láhev  
18. června 2015

VITKOVICE  
CYLINDERS a.s.



Extruded  
stainless steel  
grinder

18. June 2015

VITKOVICE  
CYLINDERS a.s.



#### ■ **Extruded tanks for hydrogen storage**

As the only one in the world, we produce reverse extruded pressure vessels for hydrogen storage at up to 1000 bar, which gives our customers a higher fatigue life compared to tanks made from tubes.

#### ■ **Special NDT methods**

We have developed a mobile device for non-destructive testing by acoustic emission method. This gives our customers a unique opportunity to have checked cylinders, tanks, bundles, trailers and other applications within periodic inspection much more simply and quickly and anywhere in the world.

#### ■ **Product applications**

We produce a comprehensive solution for storage of gases, primarily hydrogen, in unique storage modular units according to exact customer specifications or in units designed according to limit parameters (space, volume, location, etc.). For these applications, we have special pipe welding technology for extreme pressures.

Thanks to our own material and its processing into the final form of tanks, including their installation into units, we are the only global manufacturer in the field of complex pressure applications that is able to offer to the customer a whole made "under one roof". All components are recyclable, thanks to that we maximize our contribution to reduce secondary waste.



## HIGH PRESSURE CYLINDERS AND THEIR USE

Under the Cylinders Holding brand we produce high pressure steel cylinders, tanks, pressure vessels and their applications in the range from 0.5 to 22.000 liters, with a diameter from 83 mm to 450 mm, with a working pressure of up to 1380 bar. Our pressure cylinders and vessels find use in all market segments.



## PRESSURE CYLINDERS AND MOST COMMON TYPES

- **Industrial and technical gases**  
from 2 to 240 litres, working pressure 450 bar  
most common types: 20/40/50 l, 300/450 bar
- **CNG for automotive industry**  
from 17 to 160 litres, working pressure up to 300 bar  
most common types: diameter 320 mm, 47 litres, 200/300 bar
- **CNG for filling stations and other CNG applications**  
from 50 to 190 litres, working pressure 450 bar  
most common types: 80/120/150/180 l, 250/300/450 bar
- **Hydrogen and hydrogen mixtures**  
from 2 to 150 litres, working pressure 1100 bar  
most common types: 50 l, 300/450 bar and 50 l, 1000 bar
- **Food industry**  
from 2 to 50 litres, working pressure 300 bar  
most common types: 13.4/20/30 l, test p. 200/250/300 bar
- **Fire fighting systems and fire extinguishers**  
from 2.7 to 180 litres, working pressure 330 bar  
most common types: 120/140 l, 300/450 bar; 6.7 l, 250 bar
- **Breathing apparatus**  
from 1 to 50 litres, working pressure 450 bar  
most common types: 6 l, 300/450 bar
- **Sport and professional diving**  
from 1 to 50 litres, working pressure 450 bar  
most common types: diameter 204 mm, 12/15/18 l, 230/345 bar
- **Land, naval and aircraft safety systems**  
from 2 to 240 litres, working pressure 450 bar  
most common types: 20/35/50 l, 300/450 bar
- **Aircraft and army equipment**  
from 2 to 240 litres, working pressure 450 bar  
most common types: 5/6/ l, 300/450 bar, convex bottom
- **Laboratory equipment**  
from 0.8 to 50 litres, working pressure 450 bar  
most common types: 5/6/10 l, 300/450 bar
- **Medical equipment**  
from 2 to 50 litres, working pressure 300 bar  
most common types: 2/3 l, 200/300 bar
- **Hobby, airsoft, fishkeeping, paintball equipment**  
from 2 to 15 litres, working pressure 450 bar  
most common types: 12/15/20 l, 230/345 bar
- **Acetylene, including porous mass**  
from 2 to 50 litres, test pressure 60 bar  
most common types: 50 l, 19/60 bar
- **High-capacity tanks and vessels**  
from 200 to 580 litres, working pressure 420 bar  
most common types: 500 l, 420 bar



## PRODUCT APPLICATIONS

Virtual pipeline is a new term symbolizing group of products and equipment designed to replace function of conventional gas pipeline in locations which are not directly connected to a gas pipeline network. These application solutions also serve to deliver of gases to the locations that allow or require road, rail and / or ship traffic. These applications meet wide range of international requirements and regulations.

### ■ High-pressure transportable bundles

High-volume bundles for transport of compressed gases such as hydrogen, helium, natural gas, etc., are used, for example, in virtual gas pipelines.

### ■ High pressure stationary bundles:

Large-capacity gas storage bundles with wide range of applications according to customer specifications and variable working pressures from 200 to 700 bar. Bundles are used (for example and not only) as a gas containers for filling stations or high-pressure containerized solutions.

### ■ MEGC Container (20', AB-Roll)

Multiple Element Gas Containers are used to transport large volumes of technical gases, CNG and hydrogen. The construction and connection of cylinders in containers conform to ADR / RID / IMDG. These solutions are unified according to the dimensional standards of shipping container or AB-Roll shipping containers.

### ■ Trailers (battery vehicles)

Trailer storage or battery vehicles for gas transport conform to production according to ADR regulations.



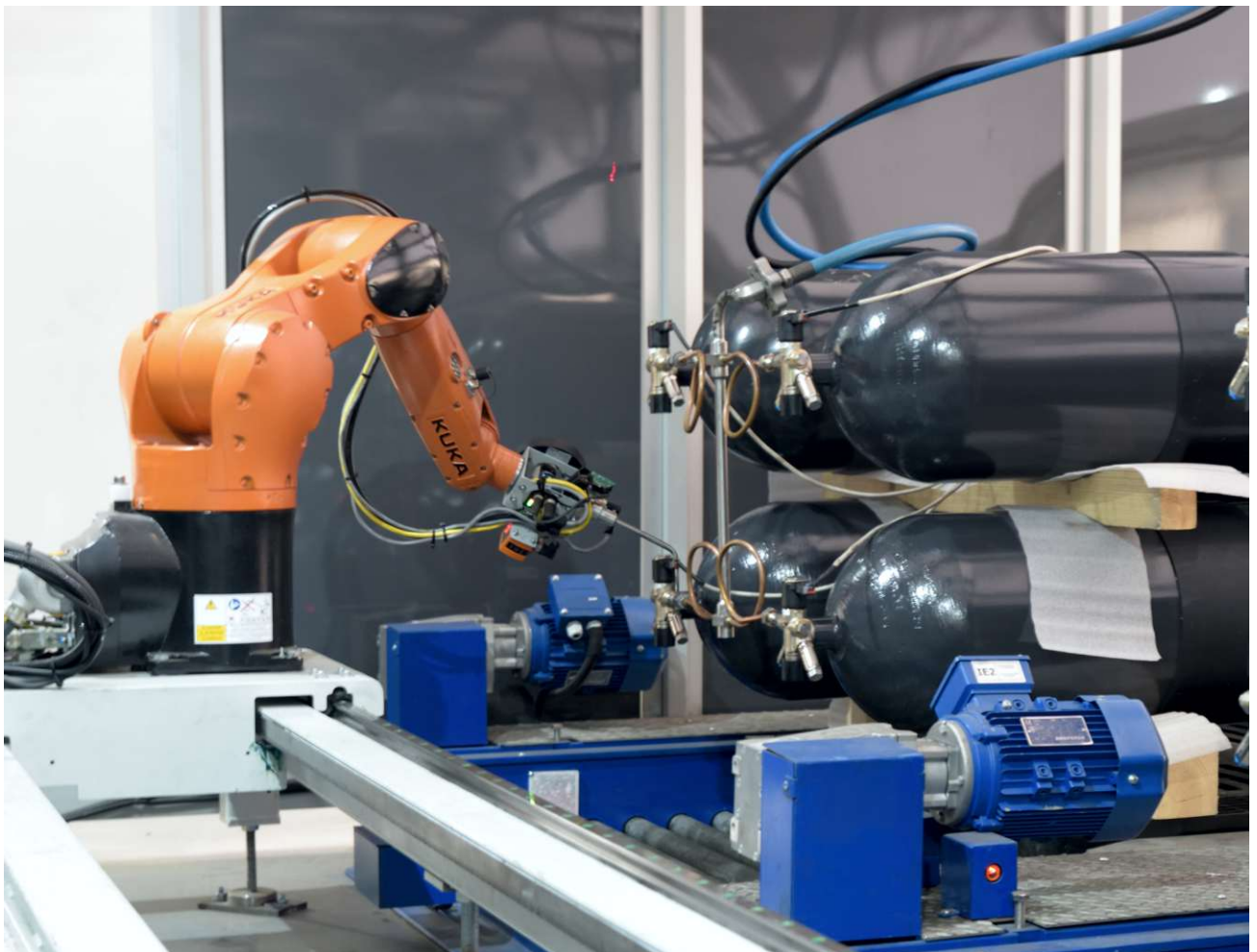
## PRODUCT SUPPORT

### APS Extreme

In 2017, at Sosnowiec, Poland, the innovative production technology of cylinders and cylinders applications was introduced. It meets the highest requirements of the automotive industry. This technology includes innovative anticorrosion protection technology, using APS Extreme system, cleaning preparation, washing, and preserving the inner surface of the cylinder, then automotive applications assembly line, fully automated equipment for testing of leakage from cylinders and applications, helium method for leak detecting up to  $10^{-7}$  mbar·litr·sek<sup>-1</sup>.

### PERIODIC TESTING AND TESTING OF CYLINDERS

As an added value we offer to our customers comprehensive revisions of pressure vessels, including hydrostatic and ultrasonic testing. We also carry out regular inspections of high pressure and low pressure vessels and other applications.





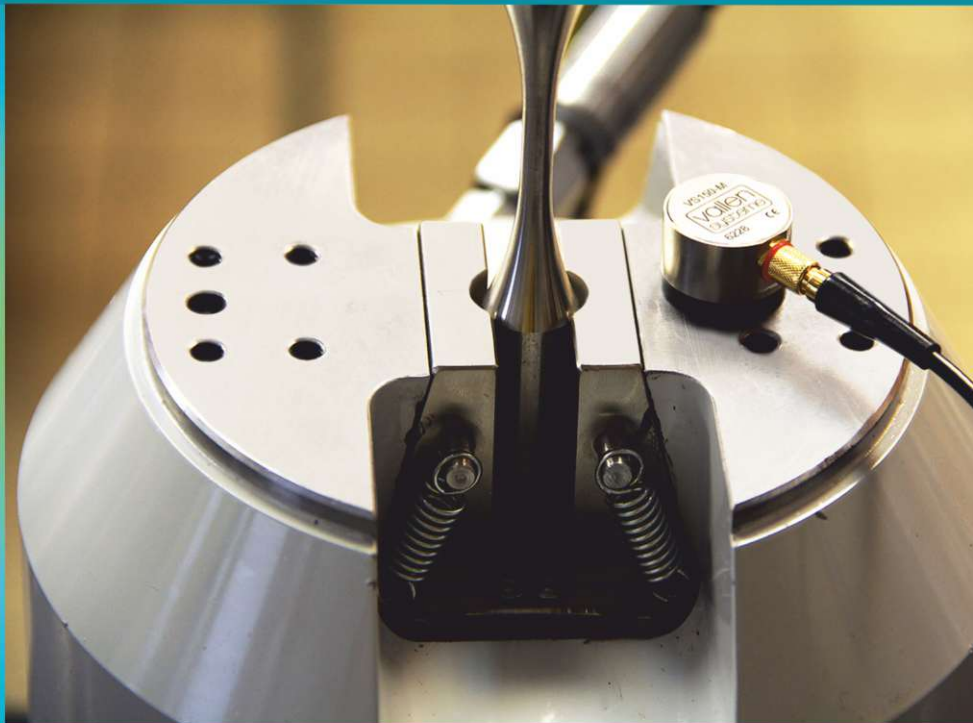
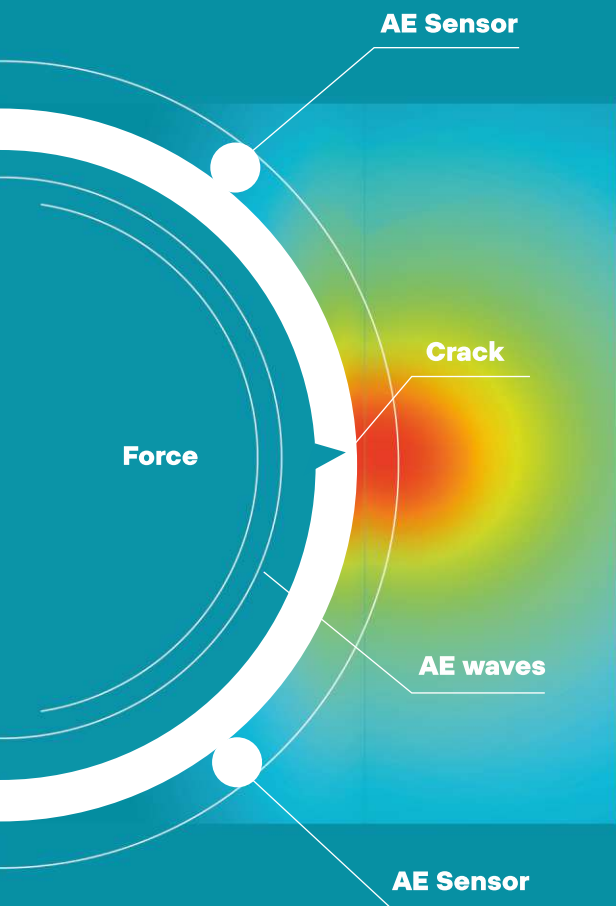
## MANAGEMENT SYSTEMS

- Quality System according to ISO 9001 since 1994
- Quality Management System according to ISO TS 16949 (now IATF 16949) since 2011
- Environmental Management System Certificate according to ISO 14001 since 2003
- Occupational Safety and Health Management System according to OHSAS 18001 since 2009
- Certification of QMS by TÜV SÜD
- Certification of EMS and HSMS by DNV GL
- Approved products by certification companies them TÜV SÜD, TÜV Rheinland, Bureau Veritas, DNV-GL, LR, Arrowhead, HSB, SII, RMR, SVTI, DOT, TC, etc.

## NORMS AND STANDARDS

- European Standards (EN ISO 9809-1,2, EN 1964-3, PED, TPED)
- International Standards (ISO 9809-1,2, ISO 11120, ISO 11439, UN ISO 9809-1)
- American Standards (DOT 3AA, ASME CODE section VIII, div. 1)
- Canadian Standards (TC - 3AAM)
- British Standards (BS 5045)
- Regulations (AD 2000, ADR/RID, IMDG, ECE R 110)
- Eurasian Economic Union - acc. TP TC 032/2013, TP TS 018/2011
- India - acc. Gas Cylinder Rules 2016 and Gas Cylinder Rules 2004
- Australia - acc. Occupational Health and Safety Regulation





### **SPECIAL NON-DESTRUCTIVE TESTING**

The Cylinders Holding group has a unique non-destructive testing technology (so-called acoustic emission), which can be used not only for testing Cylinders Holding's products and its applications, but also for other pressure systems (pressure pipeline, pressure fittings, boilers, etc.). This method is unique due to the range of tested pressure levels and mobility, which guarantees the possibility of testing anywhere in the world in a short period of time.

### **CONTROL PROCEDURE**

Our manufacturing process undergoes strict quality control from the beginning to the end. The control procedure of production process is based on various kinds of non-destructive testing procedures that are carried out within different stages of the production flow. The achievement of required mechanical properties is tested on 100 % products by hardness testing and finally by an independent laboratory. After successful final inspection the appropriate certificates are issued for each product and order. The quality of products and order documentation are verified by an independent notified body.

### **SERVICES**

The experienced team of experts in the Cylinders Holding group is able to implement various types of pressure components testing in terms of non-destructive tests, pressure tests up to the pressure of 2000 bar and fatigue tests.

## EMPLOYEE TRAINING AND EDUCATION

Since 2007, Cylinders Holding has been actively involved in education and training of both its existing and future employees. The company follows the tradition of employee education which dates back to the latter half of the 19th century, when it started to train apprentices through various types of secondary schools supported by former Vítkovické železářny.

Cylinders Holding is a founding member and also a proud partner of the Lower Vítkovice area, which currently serves as a unique educational, cultural and social centre with an international coverage. In addition, it is in close proximity of Cylinders Holding facilities.

We are trying to awaken children's interest in technical disciplines, starting at pre-school age. That is why cooperation with Lower Vítkovice is an important part of the whole process of education of our future colleagues. In addition, we offer children at primary

schools excursions to the Cylinders Holding production plants in the Czech Republic and Poland.

Cylinders Holding also works closely with the largest private industrial school in the Czech Republic. Students of Vítkovice Secondary Industrial School are educated in a wide portfolio of specialisations offered by the school. During their studies, they prepare for future employment in our companies. Here they prepare for technological development and innovative approaches while we support their faster adaptation to the work process.

We actively cooperate with technical universities in the Czech Republic and Poland. It involves both cooperation on the training of technical experts and cooperation on development and innovation. In particular, they are the VŠB - Technical University of Ostrava, Brno University of Technology and Silesian Polytechnics in Gliwice.





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