

Dear business partners,

We are proud to present to you the latest edition of cylindersnews, informing you regularly of news and developments coming out of Cylinders Holding.

I took the lead of Vítkovice Cylinders company, the central firm of the Cylinders Holding group and number one on the world cylinders market, about a year and a half ago. The business of steel cylinders, high pressure vessels, and their applications is a dynamically evolving industry. For more than 15 years, most of which I have spent travelling the world as a sales director for various companies, I had opportunity to get to know all kinds of different global enterprises and their management methods. Vítkovice Cylinders is extraordinary in many respects - it innovates alongside its customers and is, at the same time, the designer of its own new developments, which are created based on strong visions. That is what makes it a company worth developing and which I have the honour of managing and representing.

We are a global company and we deliver to every continent and to more than 100 countries; even so, there have existed and still exist markets where we are not 'at home'. In many cases they are lucrative destinations like Australia or Korea. Thanks to great efforts we managed to slowly open these markets and we now supply numerous regular customers. This involved new challenging certifications, which we have tackled.

Thanks to support devoted to research and development and the approval of new investments, we are able to meet even the most demanding customer requests - both in terms of technical and quality requirements. In addition to new investments, we have also managed to successfully launch the technologies purchased in previous years.

Thanks to our strong technical development we are now a regular supplier to industries, which were completely unreachable for us just a year ago. This mainly includes supplies for our hydrogen programme (transport and storage) and manufacturing of applications (bundles, containers, trailers), which is in turn linked to the growth of delivery volume, because our portfolio of manufactured steel cylinders is now complemented with

the mentioned new products in which our customers are taking an extraordinary interest.

Generally it may be said that the companies of the Cylinders Holding group have stood and still stand for everything essential concerning the implementation of new cylinder-production technologies in markets, new types of cylinders and utility characteristics, gas storage, and transportation. We will continuously inform you, our customers, about steps forward in the area of technical developments, both in terms of production technology and products themselves. The combination of permanent technological and product expertise with regular maintenance of our machine pool and plants gives us a very strong and stable position in world markets. Similarly, active personnel management, in which we have a great advantage thanks to our own secondary school within the group, produces new generations of experts in fields necessary to our company as well as all of Czech industry.

Today we have all the professions we need for the flawless functioning of both our technologies and our tools manufacturing (which has up till now been ensured solely by outsourcing) embodied in our company structure. After upgrading our machinery, we are now able to manufacture the vast majority of tools necessary for the creation of cylinders, pressure vessels, and application production ourselves. Therefore we have everything under direct control.

If I compare the situation year and a half ago, when I stepped inside Vítkovice Cylinders, to now, definite progress can be seen in all directions of operation - from commercial successes through new technologies, products, and investments to increased flexibility throughout the company. Our firm has boldly moved closer to you, our customers in the markets across the world, and that is a direction we will move constantly. Continued closeness between ourselves and our customers is a trend that I advocate in all our times as general and a trend that I guarantee to you.

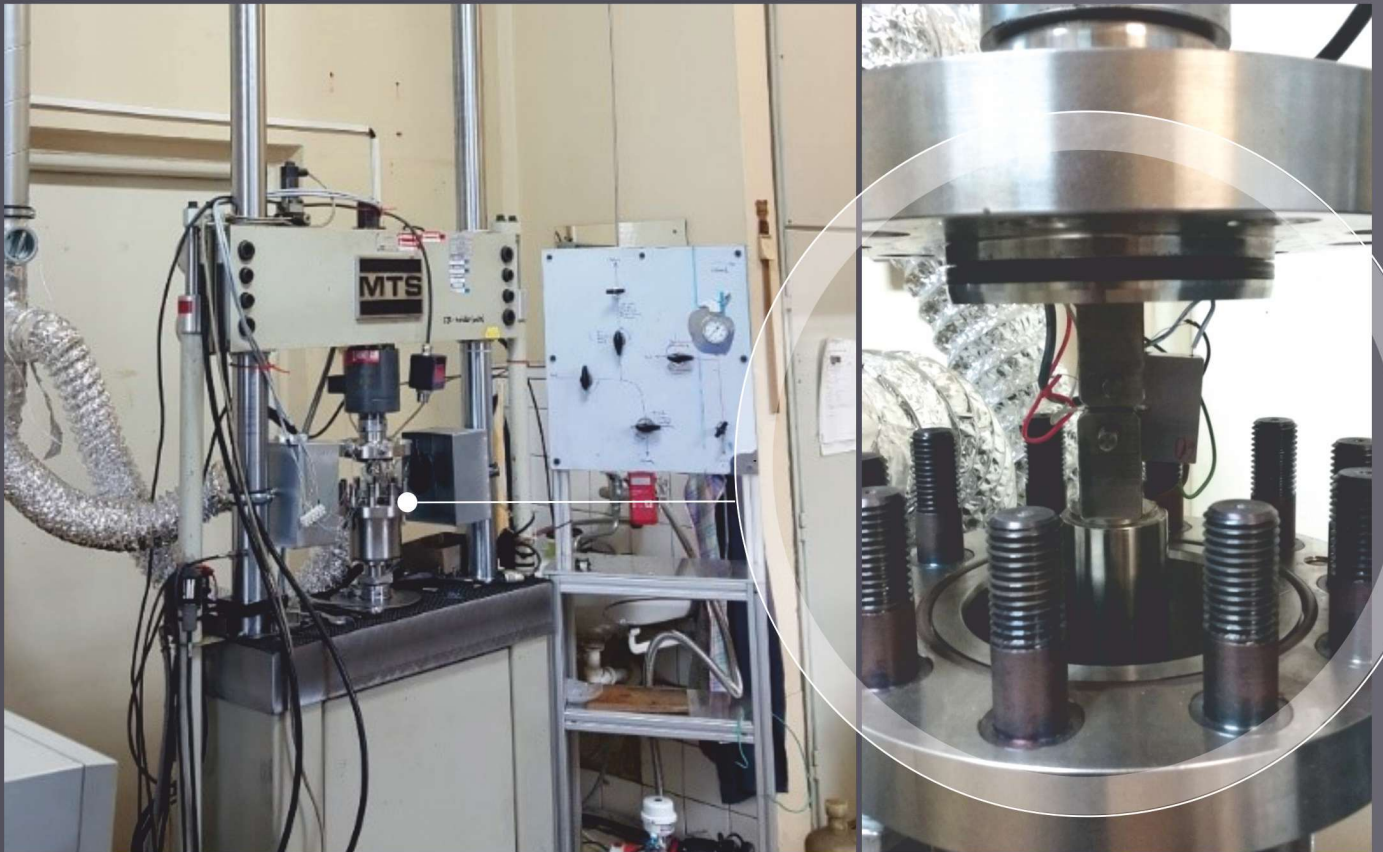
Jiří Brož

CEO of VÍTKOVICE CYLINDERS a.s.

THE DEVELOPMENT OF LIGHTWEIGHT CYLINDERS FOR HYDROGEN STORAGE AND TRANSPORT HAS ADVANCED

The Cylinders Holding group is successfully continuing the trend of decreasing the weights of hydrogen cylinders. Another great success in this respect has been achieved by certifying the first reverse extruded cylinder (50 L/300 bar) with a yield stress of 1099 MPa for the storage and transport of hydrogen.

The testing was carried out according to the ISO 11114-4 standard using the test device seen in Figure 1, and the test was extremely demanding from the material properties point of view. Finally, the material proved its very good resistance to hydrogen embrittlement. These excellent results are based on the defined chemical composition of steel and the fine-grained microstructure in the specially developed version of 34CrMo4 steel, which was described in a previous edition of cylindersnews. Thanks to these breakthroughs, these types of cylinders will be 15 kg lighter while maintaining their high safety levels.



Such innovative cylinders will bring our customers significant savings thanks to the lower weight of transported cylinders but identical water volume, meaning more cylinders can be transported at once. This also means we will achieve more environmental savings thanks to the lower demands for steel consumption and the corresponding lower energy demands for material heating prior to the forming processes, heat treatment, etc. during the manufacturing process. Thanks to this successful step, we are continuing in towards our goals in materials development. By the end of 2019 we are also planning to obtain a certificate for 50 L/200 bar cylinders, and certification for hydrogen cylinders up to 150 L of water volume will follow soon after.

BILLET - OR TUBE - MADE SOLUTIONS FOR HYDROGEN STORAGE OVER 400 BAR WP?

Due to the consolidation of the complete production cycle including raw materials, we are able to produce billet-type vessels completely in-house, meaning the differences in price and delivery time compared to tube-type vessels, where the tubes have to be supplied from different manufacturer, are significant.

The production time of billet-made solutions is approximately half that of tube-made solutions, where the most time-consuming element is waiting for the delivery of the tubes.

These pressure vessels, mainly the billet-made type, are then assembled into storage systems (bundles and containers) with complete piping either as standardised solutions or custom-made solutions based on customer requests.

The main advantages of billet-made solutions:

1. Improved mechanical properties
2. Significantly higher resistance to hydrogen embrittlement initiation thanks to the extremely low levels of sulphur and phosphorus
3. Higher resistance to fatigue initiation
4. Same amount of stored gas
5. Vessel has only one connection, therefore there is no need to use another plug or flange to blind the second opening
6. For complete PED storage banks, welded piping connections are used
7. Delivery time twice as fast - market advantage of flexibility
8. Price
9. We are the only manufacturer in the world capable of producing these unique 500 bar and 1000 bar solutions



VITKOVICE MILMET

IS A LEADER IN SUPPLYING CNG-1 CYLINDERS

FOR THE CONVERSION OF TRUCKS ON THE POLISH MARKET

Given the exemption from road tolls in Germany for vehicles powered by compressed and liquefied natural gas (CNG and LNG) from 1 January 2019 to 31 December 2020, interest in Cylinders Holding-made CNG cylinders for trucks has increased significantly. The main customers are transport and forwarding companies. Together with Polish companies, manufacturers and suppliers of modern gas equipment, we have met these new customers' requirements. Conversion of popular diesel engines to DUAL FUEL systems (diesel + CNG) is mainly carried out using CNG-1 cylinders in diameters from 273 mm to 320 mm and capacities from 41 L to 90 L. Assemblies with one or four cylinders are the most common configurations.



03

PRESSURE
VESSELS,
CONTAINERS,
AND BUNDLES

SAFE TRANSPORTATION OF HYDROGEN ALL OVER THE WORLD IN 20FT CONTAINERS

MEGC IMDG TPED 250 BAR

The Multi-Element Gas Container (MEGC) is designed as a mobile or stationary device used for the transport, storage, and distribution of hydrogen (H₂). It is certified for domestic and international road transport (ADR), rail (RID), and maritime (IMDG) shipping without having to transfer the medium to another vessel.

MEGCs comprise a self-supporting framework and actual bundle of cylinders. The frame is designed to allow up to 8 containers to be stacked. The upper part is adapted to make the opening of the roof panels simple, enabling quick inspection of the overall piping system. The built-in bundle consists of seamless steel cylinders for a total water volume of 15.2 m³. Individual cylinders can be equipped with manually or electrically operated cylinder valves divided into 6 independent sections. Filling and emptying of the container is done through threaded inlet/outlets, the dimensions and type of which can be changed according to the customer's requirements and the specific connection of the high-pressure hose.



**Cylinders
Holding**

CYLINDERS HOLDING IS EXPANDING

In autumn of this year, our companion production plant in Belarus – the company Cylinders Bel – will come into operation. Its headquarters is located in the industrial city of Orsha in north-eastern Belarus. The focus of this company will be the production of high pressure seamless steel cylinders, which it is provided by our own top expertise and time-honoured, highly productive production technology.

This new Belarusian production line was designed directly by our experts, who prepared all the technology, checked out the line's technological parameters, and optimised its production processes. The entire project is being brought to life by Vladimír Kufa, who is the director of the new company. An important Belarusian metallurgical firm is a strategic partner and a minority shareholder in Cylinders Bel. This company, Byelorussian Steel Works (BSW), created production the background and infrastructure for us in Belarus and participates in the supply of input material for pressure cylinders.

The new Cylinders Bel production plant will send top products all over the world alongside its sister companies Vítkovice Cylinders and Vítkovice Milmet. Now we are already working to expand this project to include follow-up services.

We are entering into the Eurasian Economic Union markets with modern, lighter cylinders. Working pressures will be 200 bar for the majority of cylinders. Our beginning production capacity will amount to 50,000 cylinders per year and we will gradually increase it to a target of around 100,000 units per year.



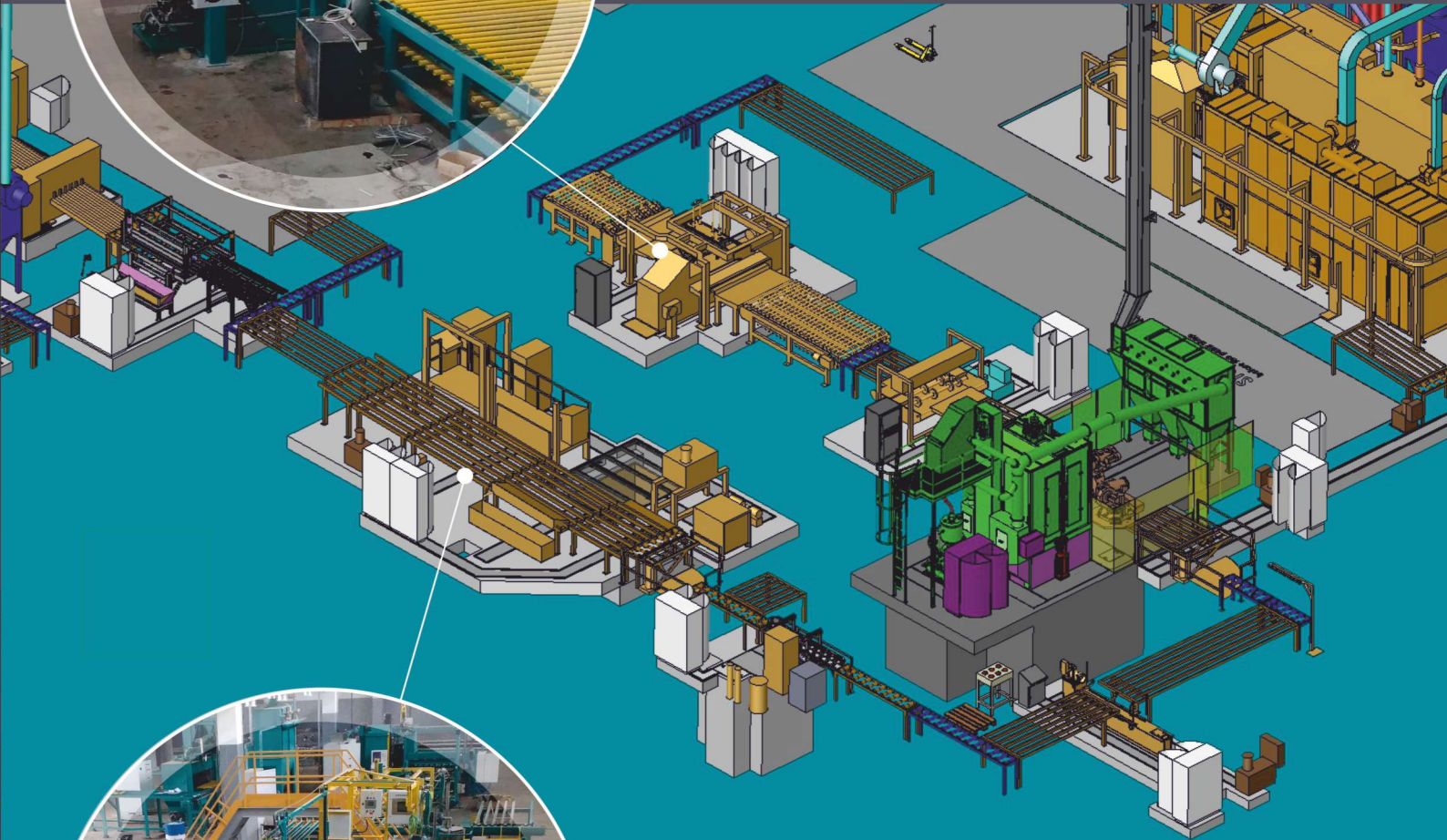
04

SPECIAL
TECHNOLOGY,
INNOVATIONS,
INVESTMENTS

Цилиндры Бел

The first cylinders for our customers will leave the production line in October 2019.

The production possibilities of the new Cylinders Bel company fits into the concept of the whole holding company and is intended to fill specific market requirements.



The table below shows the range of cylinders in production:

Parameter	Unit	Minimum	Maximum
Water capacity	litre	5,0	100,0
Working pressure	bar	5,0	320,0
Diameter	mm	140	320
Length	mm	500	1 550
Wall thickness	mm	2,5	10,0
Weight	kg	5,0	150,0



**Cylinders
Holding**

Stay tuned...

Our presence on social media networks is growing

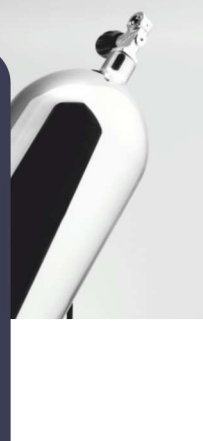
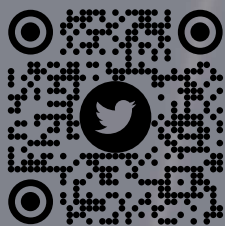
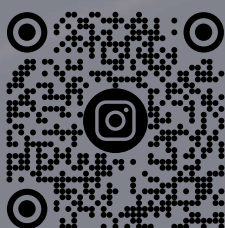
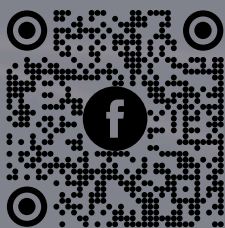
Cylinders Holding has over 30,000 fans on Facebook worldwide! And we are still growing. The newest trends in cylinders, hydrogen, CNG, and other technologies are being watched by fans from more than 35 countries including the US, India, and Australia.

Giving our companies a modern look

The unification of the sister companies' looks within Cylinders Holding is continuing on. Their looks are determined by the new Cylinders Holding web site, which is already prepared for the newest trends in online marketing and presentation of firms in the 21st century, including direct access to social networks. Similar designs have been applied to the web sites of Vítkovice Cylinders and Vitkovice Milmet, and the other subsidiaries within the frame of the holding will gradually adopt this modern look as well.

Cylinders Holding now on VKONTAKTE

Within the scope of strengthening the position of Cylinders Holding in the Russian market and opening a new production plant in Belarus, Cylinders Holding launched a page on VKONTAKTE, the most popular social network in the Commonwealth of Independent States, which is actively used by 100 million users.



05

SOCIAL NETWORKS



Cylinders Holding