VÍTKOVICE

MACHINERY GROUP

CYLINDERS GROUP

VÍTKOVICE

VÍTKOVICE CYLINDERS a.s.

» VÍTKOVICE CYLINDERS private joint stock company is a producer of high pressure seamless steel cylinders with more than a century old tradition.

The history of Vítkovice Steelworks in the 20th century was linked to pressure vessel manufacture. The long-term experience in manufacturing and know-how of the company is fully demonstrated by over 10 million high pressure cylinders, which have been produced so far.

In the threshold of the 3rd millennium VÍTKOVICE CYLINDERS uses the most advanced fully automated robotic manufacturing equipment to produce pressure cylinders in accordance with international quality standards. The company has developed its own manufacturing technologies for the manufacture of high pressure cylinders, made here on three process lines. So far as the technical gases and fire extinguishers are concerned, VÍTKOVICE CYLINDERS has established itself as one of the key suppliers to the leading international companies in the gas and fire-fighting industries.

The company is deeply involved in the automotive industry with the supply of CNG cylinders and filling stations for CNG.

The slogan of VÍTKOVICE CYLINDERS a.s. ***"Let's go to the world together!"*** challenges all partners not only in the Czech republic but all over the world to join a correct, technically advanced and high quality cooperation within the global market.

» MISSION

VÍTKOVICE CYLINDERS' mission is to be one of the leading companies servicing the needs of the world's gas and automotive industry.

» VISION

Our vision is to be the leader in the field of high pressure cylinder manufacture, important supplier of filling stations for CNG, storage systems, trailers and CNG conversion kits.

The size of the world market for steel pressure cylinders is constantly growing. With new technologies, new procedures and the rapid development of emerging markets, there is a growing market requirement for steel cylinders throughout the world.

Modern technology

» ***Brand-new production line for manufacture of high-pressure seamless steel cylinder up to 406 mm in outside diameter***

» ***Production in 3 plants***

» plant No. 1
Steel cylinders in outside diameter from 140 mm to 229 mm

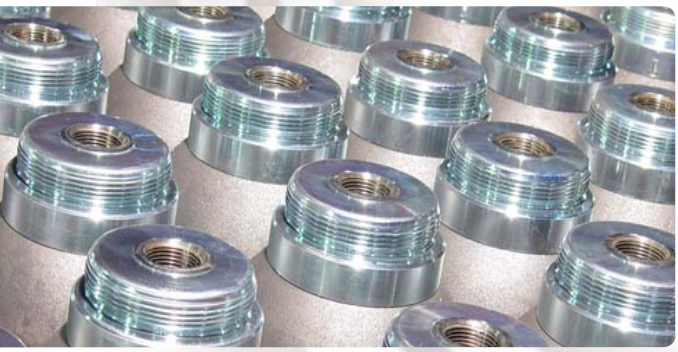
» plant No. 2
Steel cylinders in outside diameter from 83 mm to 140 mm

» plant No. 3
Steel cylinders in outside diameter from 229 mm to 406 mm

Green technolgy

» ***Company VÍTKOVICE CYLINDERS offers the following assortment:***

» high-pressure seamless steel cylinders for technical gases
» high-pressure seamless steel cylinders for CNG
» filling stations for CNG
» conversions to CNG drive
» delivery of CNG components
» bundles and trailers for CNG and other gases



Steel Cylinders for Industrial Gases

» are widely used in welding, flame / gas cutting, machinery engineering and for other purposes

Water capacity Cylinder`s family [L]	Outside Diameter [mm]	Pressure Working [bar]	Pressure Test [bar]	Bottom Shape	Drawing Number
0.8 - 1.8	83	200	300	convex	LA 4 - 0277a
2.0 - 3.0	100	200	300	concave	LA 4 - 0266
2.0 - 3.0	100	200	300	convex	LA 4 - 0267
2.0 - 4.0	100	200	300	concave	LA 4 - 0264H2
2.0 - 4.75	100	200	300	convex	LA 4 - 0358
2.0 - 6.3	115	200	300	convex	LA 4 - 0356
2.5 - 5.0	115	200	300	concave	LA 4 - 0320
4.0 - 15.0	140	200	300	concave	LA 4 - 0282/a
4.5 - 15.0	140	300	450	concave	LA 4 - 0473
5.0 - 15.0	140	200	300	concave	LA 4 - 0378
5.0 - 15.0	140	200	300	convex	LA 4 - 0379
5.0 - 15.0	140	200	250	concave	LA 4 - 0353
5.0 - 15.0	140	200	300	convex	LA 4 - 0449
5.0 - 15.0	140	200	300	convex	LA 4 - 0379
5.0 - 15.0	140	200	300	concave	LA 4 - 0333 H2
6.0 - 16.0	160	300	450	concave	LA 4 - 0512
8.0 - 23.0	171	200	300	concave	LA 4 - 0402
8.0 - 23.0	171	230	345	concave	LA 4 - 0543
8.0 - 30.0	178	200, 230	300, 345	concave	LA 4 - 0388
10.0 - 45.0	204	200	300	concave	LA 4 - 0405
10.0 - 45.0	204	200	300	convex	LA 4 - 0434
13.4 - 40.0	204	200	300	concave	LA 4 - 0114
15.0 - 30.0	204	200	300	concave	LA 4 - 0157
15.0 - 30.0	204	300	450	concave	LA 4 - 0204
15.0 - 45.0	204	200	300	concave	LA 4 - 0344
15.0 - 55.0	229	200	300	concave	LA 4 - 0313
15.0 - 55.0	229	200	300	concave	LA 4 - 0460
15.0 - 55.0	229	200	300	concave	LA 4 - 0478
15.0 - 55.0	229	300	450	concave	LA 4 - 0205
15.0 - 55.0	229	350	525	concave	LA 4 - 0517
15.0 - 56.0	229	200	300	convex	LA 4 - 0406 H2
25.0 - 50.0	229	230	345	concave	LA 4 - 0083
80.0	267	200	300	concave	LA 4 - 0587
80.0	267	300	450	concave	LA 4 - 0588
80.0 - 140.0	360	300	450	concave	LA 4 - 0585
80.0 - 140.0	360	200	300	concave	LA4 - 0584
70.0 - 140.0	360	200	300	convex	LA4 - 0592
83.0	390	200	300	convex	LA4-0594
81.0	390	250	375	convex	LA4-0607
89.0	406	200	300	convex	LA4-0672

Seamless Steel Cylinders for Fighting Fire Equipment

» are used for fire extinguishers and stationary fire fighting systems

Water capacity	Outside	Pressure		Bottom	Drawing Number
Cylinder`s family [L]	Diameter [mm]	Working [bar]	Test [bar]	Shape	
2.0 - 4.0	102	200	250	convex	LA 4 - 0251
2.0 - 4.75	102	200	320	convex	LA 4 - 0382
2.0 - 4.75	102	200	320	concave	LA 4 - 0352
2.0 - 6.3	115	200	300	convex/concave	LA 4 - 0356
2.5 - 5.0	115	200	300	concave	LA 4 - 0320
5.4 - 8.0	140	200	250	convex	LA 4 - 0252
5.0 - 15.0	140	200	250	concave	LA 4 - 0353
5.0 - 15.0	140	200	320	convex	LA 4 - 0379
5.0 - 15.0	140	200	320	concave	LA 4 - 0378
5.0 - 15.0	140	200	320	concave	LA 4 - 0379
5.0 - 15.0	140	200	320	convex	LA 4 - 0449
10.0 - 21.0	204	200	250	concave	LA 4 - 0210
15.0 - 45.0	204	200	300	concave	LA 4 - 0344
15.0 - 55.0	229	300	450	concave	LA 4 - 0205
80.0	267	250	375	concave	LA 4 - 0605
80.0 - 140.0	360	250	375	concave	LA 4 - 0606
83.0	390	200	300	convex	LA4-0594
81.0	390	250	375	convex	LA4-0607
89.0	406	200	300	convex	LA4-0672

Seamless Steel Cylinders for Respiration, Sanitary and Diving Equipment

» are used in scuba diving, medical care and respiration equipment

Water capacity	Outside	Pressure		Bottom	Drawing Number
Cylinder`s family [L]	Diameter [mm]	Working [bar]	Test [bar]	Shape	
2.0 - 4.75	102	200	320	convex	LA 4 - 0382
2.0 - 4.75	100	200	300	convex	LA 4 - 0358
2.5 - 5.0	115	200	300	concave	LA 4 - 0320
4.0 - 10.0	140	200	300	convex	LA 4 - 0148
4.5 - 8.0	140	300	450	convex	LA 4 - 0465
4.5 - 15.0	140	300	450	concave	LA 4 - 0473
6.0 - 16.0	160	300	450	concave	LA 4 - 0512
8.0 - 15.0	160	230	345	concave	LA 4 - 0343
8.0 - 23.0	171	200	300	concave	LA 4 - 0402
8.0 - 35.0	178	230	345	concave	LA 4 - 0480
10.0 - 18.0	204	200, 230	300, 345	convex	LA 4 - 0345

Steel Cylinders for Beverage and Drinking Devices

» are widely used in the food industry. In the drinking industry, they are used namely for tapping of various beverages, predominantly beer

Water capacity	Outside	Pressure		Bottom	Drawing Number
Cylinder`s family [L]	Diameter [mm]	Working [bar]	Test [bar]	Shape	
2.0 - 4.0	100	200	300	concave	LA 4 - 0264
2.0 - 4.75	100	200	300	convex	LA 4 - 0358
4.0 - 15.0	140	200	300	concave	LA 4 - 0282/a
4.0 - 15.0	140	230	345	concave	LA 4 - 0513
5.0 - 15.0	140	200	250	concave	LA 4 - 0353
5.0 - 15.0	140	200	300	convex	LA 4 - 0379
6.0 - 16.0	160	300	450	concave	LA 4 - 0512
8.0 - 15.0	160	230	345	concave	LA 4 - 0343
8.0 - 23.0	171	200	300	concave	LA 4 - 0402
8.0 - 30.0	178	200	300	concave	LA 4 - 0388
8.0 - 35.0	178	230	345	concave	LA 4 - 0480
10.0 - 21.0	204	200	300	concave	LA 4 - 0210
10.0 - 21.0	204	200	300	concave	LA 4 - 0521
10.0 - 32.0	204	230	345	concave	LA 4 - 0342
15.0 - 55.0	229	300	450	concave	LA 4 - 0313
15.0 - 55.0	229	300	450	concave	LA 4 - 0205

Acetylene Cylinders

» in combination with high-pressure steel cylinders are widely used in areas such as welding, flame or plasma cutting and chemical industry

» acetylene cylinders are filled with ecological asbestos-free porous mass UL 1 (acetone solvent) or UL 2 (DMF solvent), both BAM approved. Massing is arranged in LINDE VITKOVICE plant

Water capacity	Outside	Pressure		Bottom	Drawing Number
Cylinder`s family [L]	Diameter [mm]	Working [bar]	Test [bar]	Shape	
2.0 - 4.0	100	18	60	concave	LA 4 - 0264
2.5 - 5.0	115	18	60	concave	LA 4 - 0320
2.0 - 6.3	115	18	60	convex	LA 4 - 0356
5.0 - 15.0	140	18	60	concave	LA 4 - 0353
8.0 - 23.0	171	18	60	concave	LA 4 - 0402
8.0 - 30.0	178	18	60	concave	LA 4 - 0388
15.0 - 30.0	204	18	60	concave	LA 4 - 0131
15.0 - 50.0	229	18	60	concave	LA 4 - 0482
15.0 - 55.0	229	18	60	concave	LA 4 - 0481

Steel Cylinders for CNG

» are used as storage tanks in automotive industry or as bundles for CNG filling stations or trailers

Water capacity	Outside	Pressure		Bottom	Gas	Drawing
Cylinder`s family [L]	Diameter [mm]	Working [bar]	Test [bar]	Shape	Capacity [m³]	Number
4.0 - 10.0	140	200	300	convex	0.8 - 2.0	LA 4 - 0518
15.0 - 55.0	229	200	300	concave	3.0 - 11.0	LA 4 - 0313
15.0 - 55.0	229	300	450	concave	4.5 - 16.5	LA 4 - 0205
15.0 - 55.0	229	350	525	concave	5.25 - 19.25	LA 4 - 0517
25.0 - 39.0	235	200	300	convex	5.0 - 7.8	LA 4 - 0297
34.0 - 64.0	267	200	300	convex	6.8 - 12.8	LA 4 - 0595
35.0 - 80.0	273	200	300	convex	7.0 - 16.0	W - 2578
48.0 - 100.0	316	200	300	convex	9.6 - 20.0	W - 2618
50.0. - 95.0	324	200	300	convex	10.0 - 19.0	LA 4 - 0593
70. - 140.0	360	200	300	convex	14.0 - 28.0	LA 4 - 0592
80.0 - 140.0	360	200	300	concave	16.0 - 28.0	LA 4 - 0584
80.0-140.0	360	300	450	concave	24.0 - 42.0	LA 4 - 0585
83.0	390	200	300	convex	16.60	LA 4 - 0594
81.0	390	250	375	convex	20.25	LA 4 - 0607
89.0	406	200	300	convex	17.80	LA 4 - 0672

Certificate


CERTIFICATE OF TYPE APPROVAL

Number of approval: 473 – 08

Reg. No.: 605/08/07/02/0 – 00.211.222

According to the international standard ISO11439:2000 issued to the producer:

VÍTKOVICE CYLINDERS a.s.
Ruská 24/83
CZ - 706 00 Ostrava – Vítkovice
Ident.-No.: 258 49 026

for pressure appliance:

Title: Gas cylinder – high pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles

Type of cylinders: Type CNG1

Drawing: LA 4 - 0592 Rev. 2

Standard: ISO 9809-1
Test pressure: 300 bar
Working pressure: 200 bar
Water capacity: 77 litres

Place of manufacture: VÍTKOVICE CYLINDERS a.s., Ostrava – Vítkovice

Hereby we approve that above stated type of pressure equipment – Gas cylinder – high pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles - Tuffs to requirements of

the International standards ISO 11439:2000

Details about evaluation and list of important parts of technical documentation are stated in the evaluation report, Reg. No. 2222/TOSKAVIZA, which is an integral part of this certificate.

All information may be obtained from the inspection and approval authority:

TÜV SÜD Czech s.r.o., Novodvorská 994, 142 21 Praha 4

Conditions and rules of a use of this certificate are in the rear page of the certificate

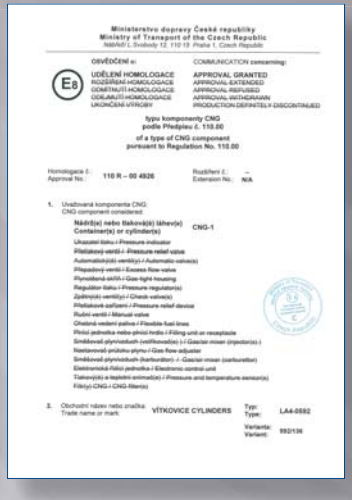
Prague, 09.10.2008

Ing. Ivo Dvořák
Head of the Certification Body

Product Certification Body

TÜV SÜD Czech s.r.o., Novodvorská 994, 142 21 Praha 4 – CR, IČ 60867101

ZERTIFIKAT ◆ CERTIFICATE ◆ CERTIFICADO ◆ CERTIFICAT


Ministerstvo dopravy České republiky
Ministry of Transport of the Czech Republic
Nábřeží I. Svobody 12, 110 15 Praha 1, Czech Republic

OSVĚDČENÍ o: / COMMUNICATION concerning:

Ea

UDĚLENÍ HOMOLOGACE / APPROVAL GRANTED
ROZŠÍŘENÍ HOMOLOGACE / APPROVAL EXTENDED
ODMÍTNUTÍ HOMOLOGACE / APPROVAL REFUSED
ODEJMUTÍ HOMOLOGACE / APPROVAL WITHDRAWN
UKONČENÍ VÝROBY / PRODUCTION DEFINITELY DISCONTINUED

typu komponenty CNG
podle Předpisu č. 110.00
of a type of CNG component
pursuant to Regulation No. 110.00

Homologace č. / Approval No.: 110 R – 00 4926
Rozšíření č. / Extension No.: – / N/A

1. Uvažovaná komponenta CNG: / CNG component considered:
Nádrž(e) nebo tlaková(é) láhev(e) / Container(s) or cylinder(s): CNG-1
Ukazatel tlaku / Pressure indicator
Pojistný ventil / Pressure relief valve
Automatický(é) ventil(y) / Automatic valve(s)
Případový ventil / Excess flow valve
Rynková skříň / Gas-tight housing
Regulátor tlaku / Pressure regulator(s)
Zpětný(é) ventil(y) / Check valve(s)
Přetlakové zařízení / Pressure relief device
Ruční ventil / Manual valve
Ohebné vedení paliva / Flexible fuel lines
Plnicí jednotka nebo plnicí hrdlo / Filling unit or receptacle
Směšovač plynu/vzduch (vstřikovače) / Gas/air mixer (injector(s))
Nastavovač průtoku plynu / Gas flow adjuster
Směšovač plyn/vzduch (karburátor) / Gas/air mixer (carburettor)
Elektronická řídicí jednotka / Electronic control unit
Tlakový(é) a teplotní snímač(e) / Pressure and temperature sensor(s)
Filtr(y) CNG / CNG filter(s)

2. Obchodní název nebo značka / Trade name or mark: VÍTKOVICE CYLINDERS
Typ / Type: LA4-0592
Varianta / Variant: 592/13K

Bundles:

Storage systems:

» stationary or transportable storage systems (PED or TPED)
» working pressures 200, 250, 300, 330 bar or higher
» medium CNG (technical gases as an option)
» unlimited water capacity
» container´s solution as an option

Use in the segments of:

a) Private households
b) Industrial areas
c) CNG filling stations

Trailers:

Transportable storage system:

1. Working / testing pressure - 200 / 300 bar
   » consisting of 140 litre cylinders (outside diameter 360 mm)
   » total water capacity 21 000 litres
   » storage system divided into 5 sections

2. Working / testing pressure - 300 / 450 bar
   » consisting of 140 litre cylinders (outside diameter 360 mm)
   » total water capacity
   » litres
   » storage system divided into 5 sections

Filling stations for CNG

» HOME & COMPANY CNG FILLING STATIONS

Technical specification:

- » Flow rate 5 Nm^3 / h at 15 °C, 200 bar
- » Maximum outlet pressure 235 bar
- » Minimum inlet pressure 0,02 bar
- » Maximum inlet pressure 0,2 bar
- » Ambient temperature range -15 to + 50 °C
- » 3 - stage oil compressor
- » Electrical supply 3 x 400 V, three phase, 50 Hz
- » Circuit breaker for connection 10 A
- » Electric motor 2 kW, 1410 rpm / min.
- » Integrated gas meter
- » Dimensions W x H x L 600 x 1050 x 780 mm
- » Weight 120 kg
- » Noise level 49 dB at 5 m
- » Certification – CE, ATEX, and others

Advantages:

- » Automatic refuelling process
- » Modular solution allows expand the flow rate up to 60 Nm^3 / h
- » Integrated gas dryer for 1 000 hours of operation
- » Fast filling as an option (possibility to attach storage systems, fast serving systems, NGV I., NGV II. pistols)
- » Ideal solution for households and company fleets (company cars, taxi, cars, driving schools, bakeries, public administration, forklifts,…)

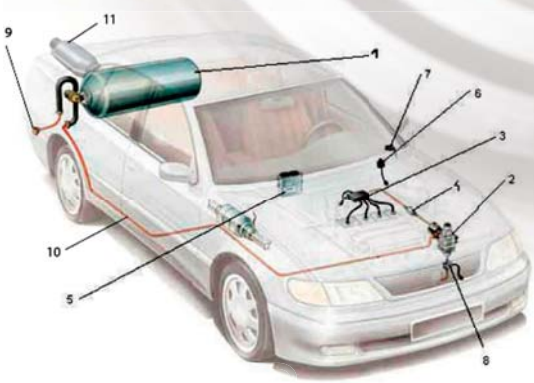
EFFICIENT, RELIABLE, MODERN WITH SHORT TERM INVESTMENT RETURN!

» PUBLIC FILLING STATIONS

- » for public filling
- » flow rate ranging from 100 Nm^3 / h up to several thousands Nm^3 / h
- » output pressure from 200 up to 300 bar
- » modular solution of compressor units and storage systems - possibility to attach another compressor unit and CNG storage system.
- » efficient drying of natural gas
- » calibrated serving stands with NGV I., NGV II. pistols, card terminal, tele-monitoring
- » fully automatic operation of CNG technology
- » complete turn-key construction of CNG filling stations
- » nonstop service
- » funding securing - leasing - grants - ensured by the third contracting party (investor)

Conversion for CNG cars:

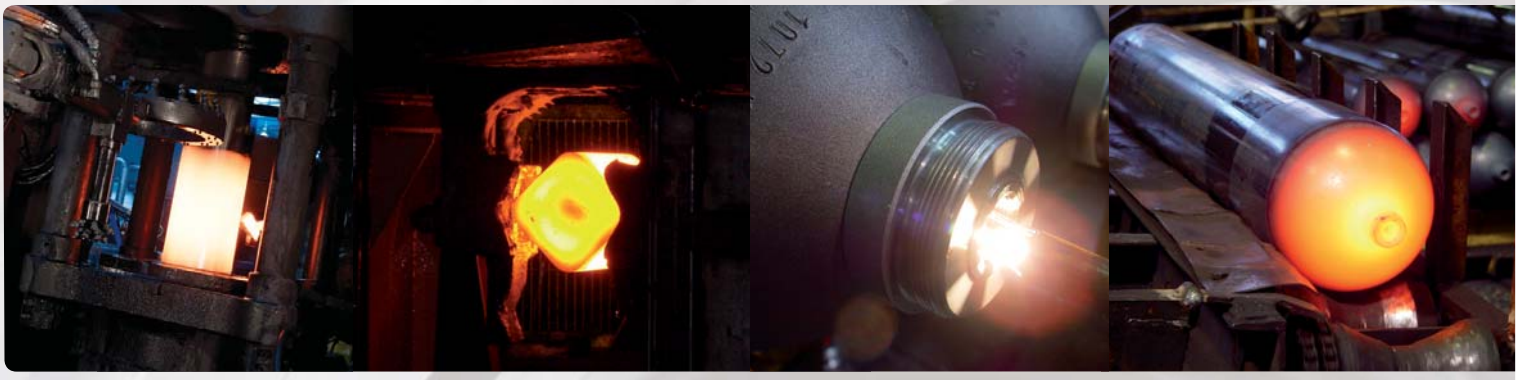
- » kits vitgas for conversion of CNG cars with sequential gas injection system of 5th generation
- » delivery of the whole kit (including cylinder) necessary for the CNG conversion
- » all components certified according to European norm ECE – R110



Scheme of the vehicle converted to CNG drive

1. Pressure tank
2. Pressure regulator
3. Sequential injection
4. Natural gas filter
5. Natural gas control unit (cooperates ith gasoline control unit)
6. Water temperature sensor
7. Switching box (natural gas - gasoline)
8. Natural gas pressure sensor
9. Multifunction valve
10. High-pressure pipe
11. Catalytic converter

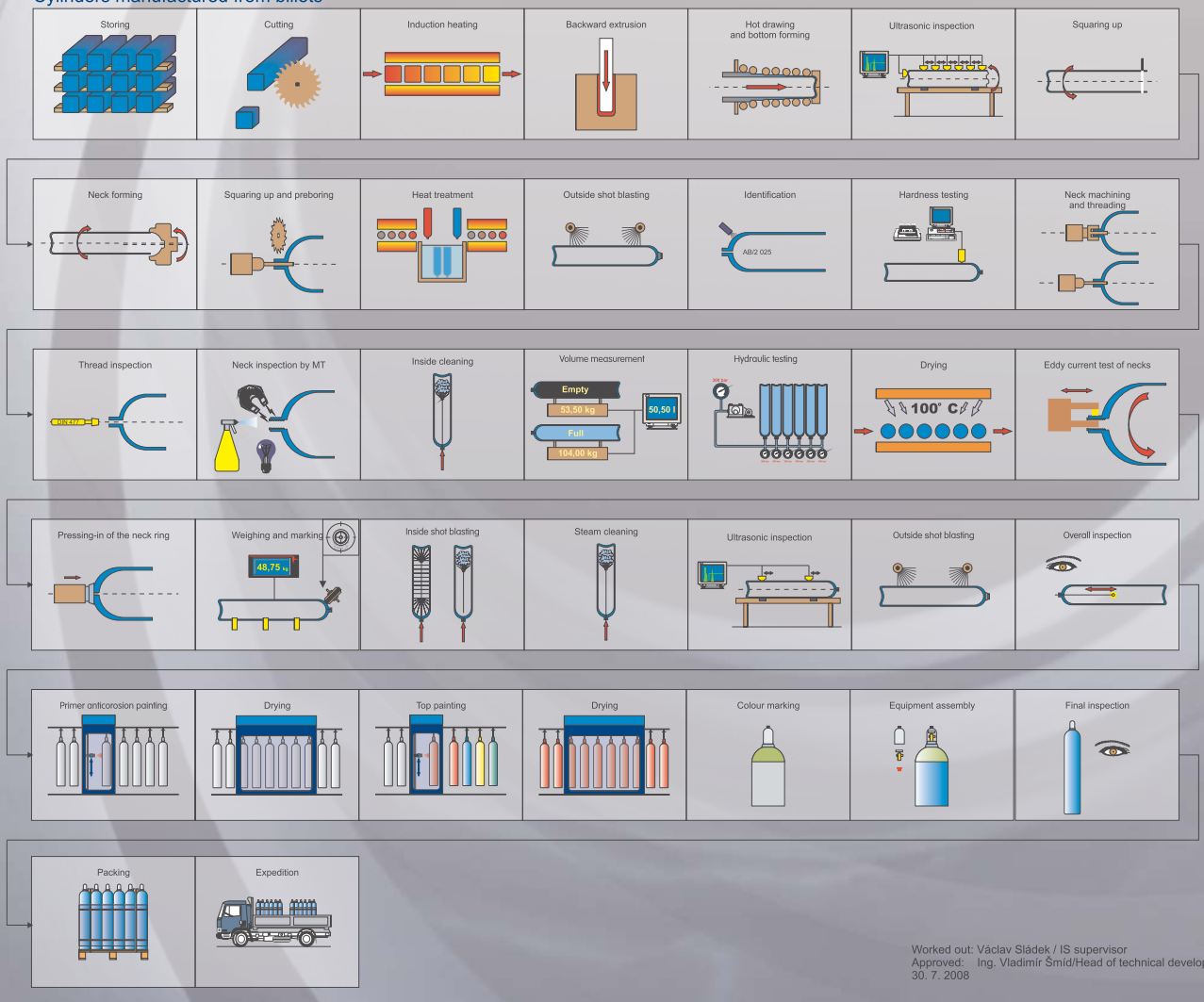
vitkovice.com



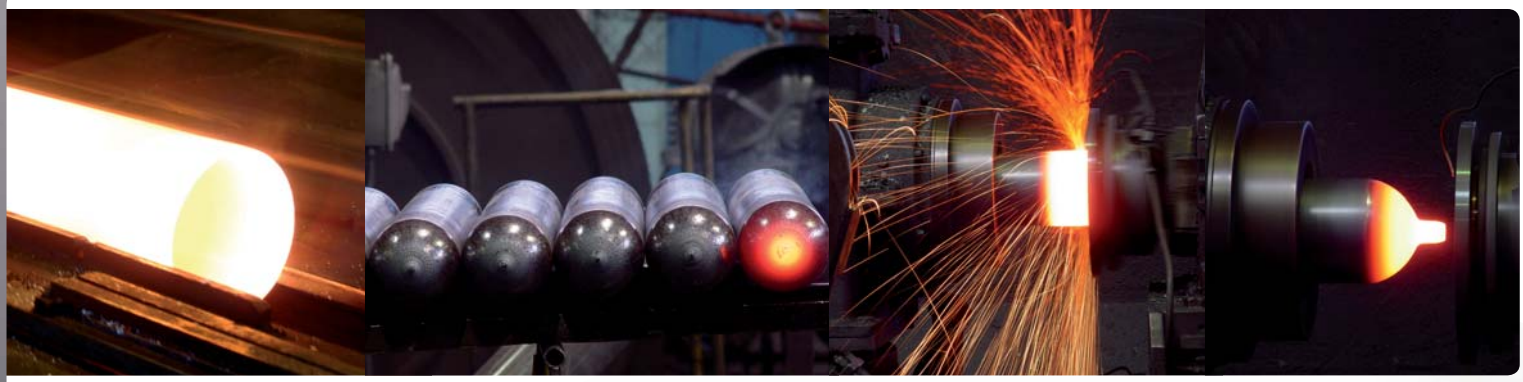
Steel cylinders are produced by applying reverse extruding and broaching, where a hot billet is used as a raw material.
This manufacturing method represents top production technology providing output of excellent quality light-weight high pressure steel cylinders.
Unique rotary forming technology is being used for closing the semi-product and form the neck, developed by enginneers from the company VÍTKOVICE a.s.
Hot forming and heat treatment processes are followed by machining operations and various types of testing procedures according required cylinders standards.

Technological route of cylinder production - Plant 1

Cylinders manufactured from billets



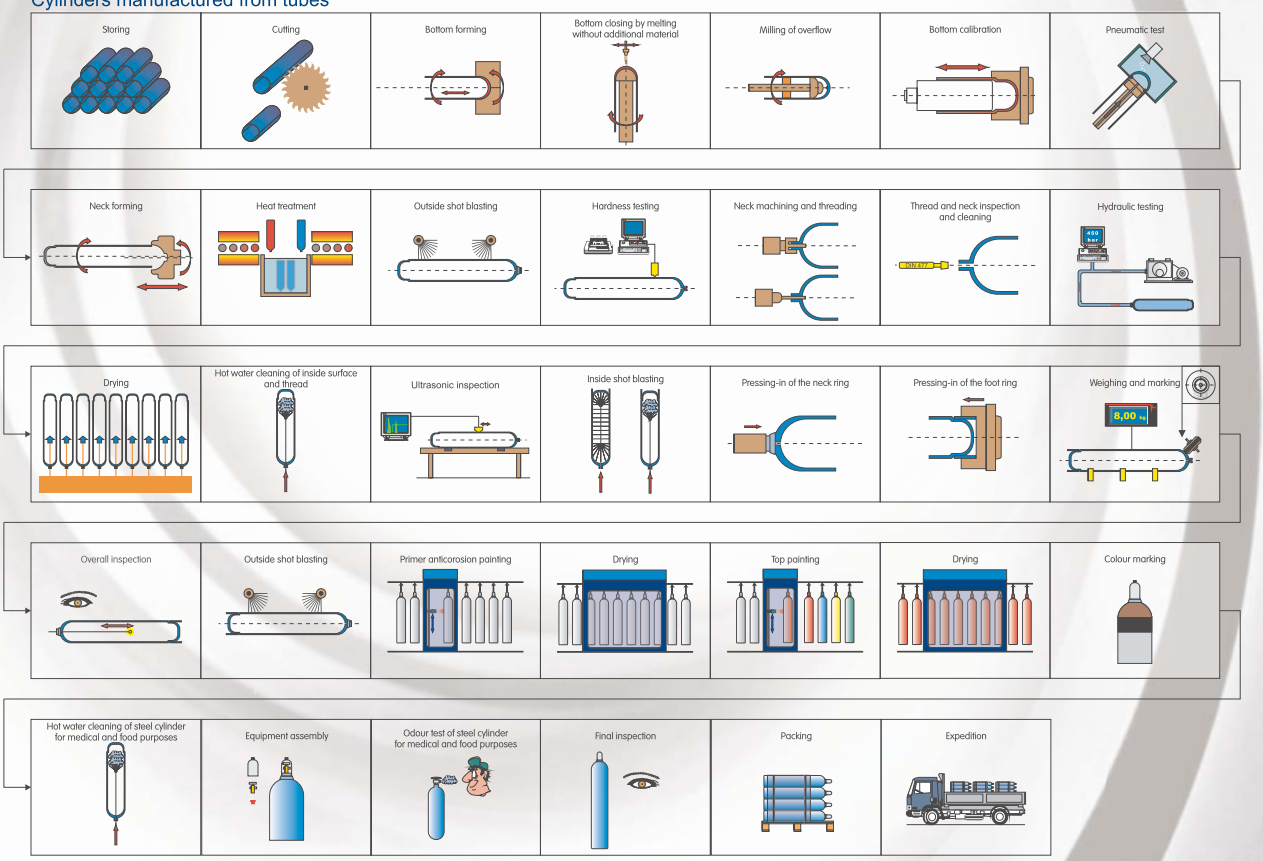
Worked out: Václav Sládek / IS supervisor
Approved: Ing. Vladimír Šmíd/Head of technical development
30. 7. 2008



Our company operates a sophisticated technology of cylinder production from seamless tubes.
Traditional method of rotary forging with additional induction heating during closing is applied for closing the tube end = cylinder bottom.
Special technology of rotary forging is used to close the other tube end = cylinder neck, developed by engineers from the company VÍTKOVICE, a.s.
During the production of steel cylinders on the small cylinders line (where cylinders up to diameter of 140 mm are produced), the tube end is closed in a modern, fully automated workplace.
All our cylinders made on both production lines are internally treated for oxygen cleanness.
Our plant is equipped with valving machines, we are ready to serve to our customers with assembling the cylinders with required accessories.

Technological route of small cylinder production - Plant 2

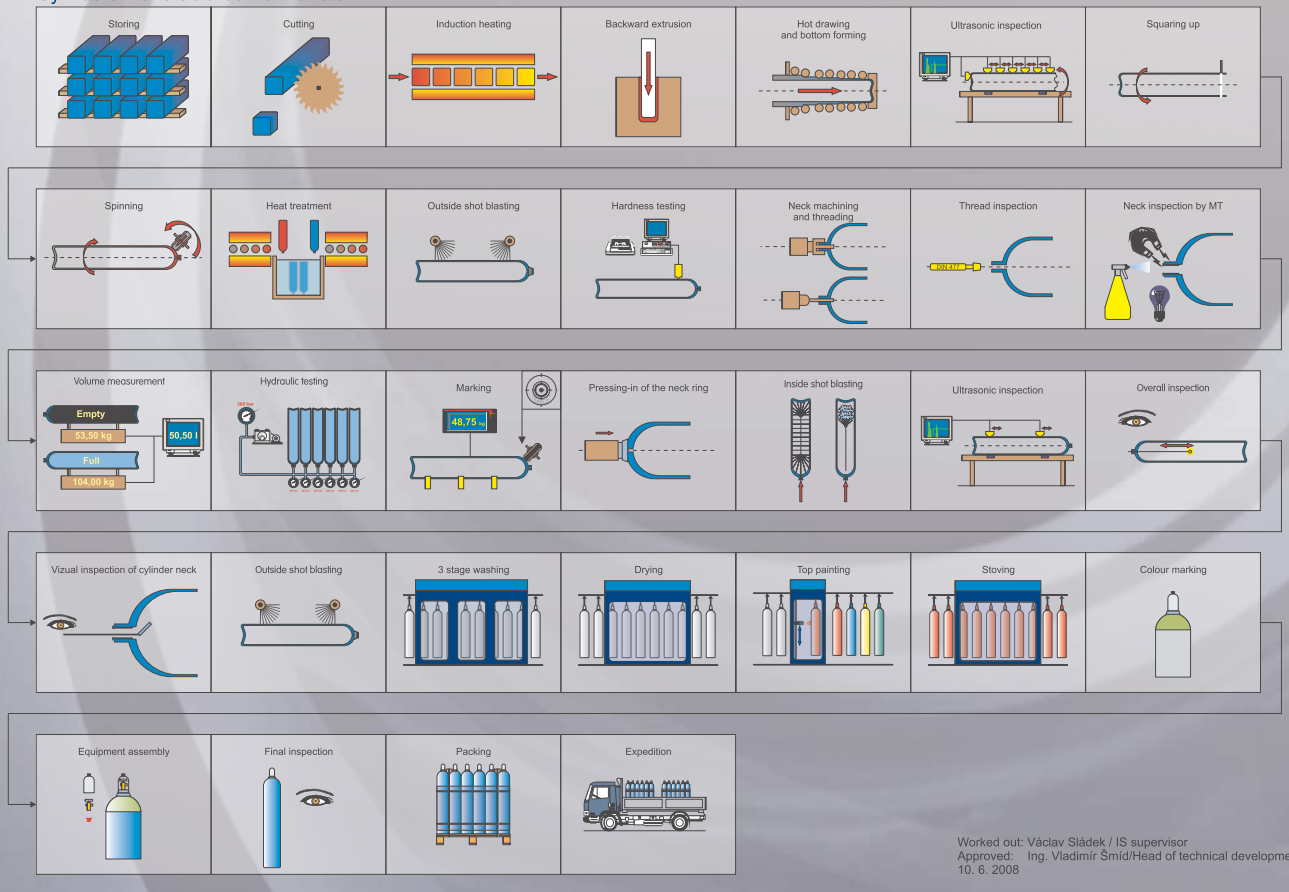
Cylinders manufactured from tubes



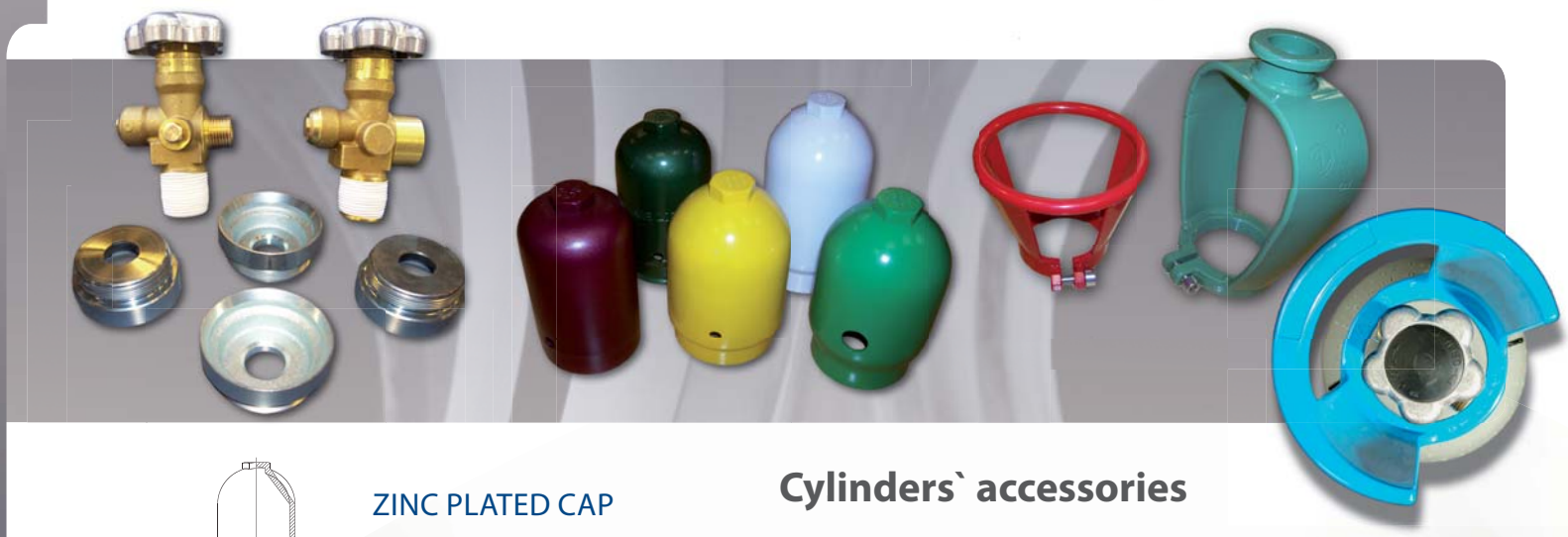
Worked out: Václav Sládek / IS supervisor

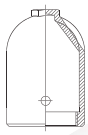
Technological route of cylinder production - plant 3

Cylinders manufactured from billets



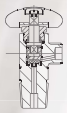
Worked out: Václav Sládek / IS supervisor
Approved: Ing. Vladimír Šmíd/Head of technical development
10. 6. 2008





ZINC PLATED CAP

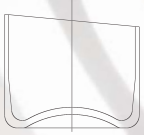
ABS PLASTIC TULIP GUARD



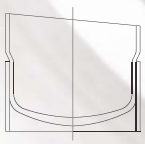
CYLINDER VALVE

NECK RING

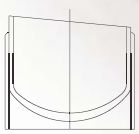
NECK + THREAD



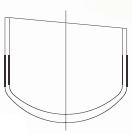
CONCAVE BOTTOM



CONVEX BOTTOM WITH FOOT RING



CONVEX BOTTOM WITH FOOT RING



CONVEX BOTOOM

Cylinders` accessories

Standard ***CAPS*** have been certified by BAM according to EN 962 Standards. They can be engraved with marks, logo, etc. They are supplied:

- raw
- zinc plated
- zinc plated and painted (powder)

ABS GUARDS for compressed gas cylinders

- for cylinders up to 20 l
- for cylinders up to 50 kg
- different colours
- customisation (raised logo and/or pad printing)
- EN 962 Standards

STEEL GUARDS have been certified by BAM according to EN 962 Standards.
They can be engraved with marks, logo, etc.
They are supplied:

- raw
- zinc plated
- zinc plated and painted (powder)

VALVES for high pressure gas cylinders

- gas cylinder valves are intended to transportable gas cylinders for compressed and liquefied gases and gases dissolved under pressure
- they are subject to domestic and international regulations and standards
- all gas cylinder valves have been approved in accordance with pressure cylinder design regulation

The high-quality ***NECK RINGS*** are manufactured according to the drawing and/or sample of various customers, following to their requirements. There are mainly two types:

- hot forged from steel billet
- cold forged from steel plate

Both types of neck rings can be marked embossed and/or engraved.
The neck rings can be supplied raw or zinc plated.

Certificate

Quality management

Since the year 1994 we have been holder of the Quality System Certificate according ISO 9001. In 2003 we succesfully passed certification process for Enviromental Management System according ISO 14001. Certificates were awarded by TÜV.

Our cylinders fulfil requirements of TPED, PED, ADR/RID Agreement, DOT-3AA, TC-3AAM etc. They are designed and produced in accordance with many standards, mainly ISO 9809-1, ISO 9809-2, EN 1964-1, EN 1964-2, ISO 11439, ECE R110, further in accordance with special requirements of our customers. The production competence was approved by many Notify Bodies, among others TÜV, BV, DNV, LRS, Arrowhead, HSB, RMR etc..

The manufactoring process undergoes strict quality control from begining to its end. This control includes input material control, semi-finished product inspection and output finished product inspections. Control mechanism of production process is based on varios kinds of non destructive testing procedures, which are carried out within different stages of production flow. Achievement of required mechanical properties is tested by independent accredited testing laboratory. Quality certificates are issued for all produced cylinders after completion output inspection.

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