Cylinders for high pressure gases
Tenaris S.A., constituted in Luxembourg, is quoted on the stock markets of New York, Milan, Mexico City and Buenos Aires.

Tenaris production units are, in addition to Dalmine (Italy), Siderca (Argentina), Tamsa (Mexico), NKKTubes (Japan), AlgomaTubes (Canada), Tavsa (Venezuela), all present in the seamless tube sector, and Confab (Brazil) and Siat (Argentina) in the welded tube sector.

Tenaris claims world leadership in its sector, with 14,000 employees and an annual production capacity of more than 3,000,000 tons of seamless tubes and 850,000 tons of welded tubes.

Thanks to its production and commercial worldwide network and to the use of the most sophisticated information technology, Tenaris has developed an organization strongly oriented to the customer, offering a vast range of services and a redesigned purchasing chain, with consequent risk minimization, cost control, increased flexibility and reduction in time to market.

The strong technological and managerial integration existing among the companies within the Group has gained worldwide quality system certification in compliance with ISO 9000 criteria and, for the automotive sector, QS 9000.
TenarisDalmine Gas Cylinders Division

- Cylinders for gas at high pressure and hydraulic accumulator shells, with working pressures of 300 bar and over.

- High capacity cylinder systems mounted directly onto trailers or housed in mobile container bodies, for transport and accumulation of gases.

- Fixed plants used to accumulate gas at high pressure.

TenarisDalmine Gas Cylinders Division is a leader in production of cylinders for compressed gas, and is one of the very few production units in the world that covers every phase of production vertically: from the steel, to production of seamless tubes, to the finished product.

In addition to the large range of standard products, TenarisDalmine is also able to manufacture special products designed and set-up with the customers, on the basis of their specific needs. A complete series of accessories can be supplied on request.

The quality assurance system, conforming to the ISO 9001:2000 standard, is recognized by the major producers and distributors of technical gases, for export to all European countries and the majority of the world. TenarisDalmine is also approved to sell vessels in the United States and Canada.
A broad production range for every type of gas

- Special products to customer specifications
- Accessories supplied and fitted on request

TenarisDalmine cylinders supplied with:
- Shot blasted internal surface
- External surface painted on a primer layer
- Stamping and inspection according to the requested standards

In addition to traditional vessels, TenarisDalmine produces cylinders for:
- Fire extinguishers;
- Medical applications;
- Alimentary uses.

### DIMENSIONAL RANGE

<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>Working pressure</th>
<th>Test pressure</th>
<th>External diameter</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>bar</td>
<td>psi</td>
<td>bar</td>
<td>psi</td>
</tr>
<tr>
<td>TECHNICAL GASES</td>
<td>200</td>
<td>2900</td>
<td>300</td>
<td>4350</td>
</tr>
<tr>
<td></td>
<td>200</td>
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<td></td>
<td>300</td>
<td>4350</td>
<td>450</td>
<td>6525</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>2900</td>
<td>300</td>
<td>4350</td>
</tr>
<tr>
<td>ACETYLENE</td>
<td>15-19</td>
<td>218-276</td>
<td>60</td>
<td>870</td>
</tr>
<tr>
<td></td>
<td>15-19</td>
<td>218-276</td>
<td>60</td>
<td>870</td>
</tr>
<tr>
<td></td>
<td>15-19</td>
<td>218-276</td>
<td>60</td>
<td>870</td>
</tr>
<tr>
<td>CNG (Compressed natural gas for vehicles)</td>
<td>200</td>
<td>2900</td>
<td>300</td>
<td>4350</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>2900</td>
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<td>4350</td>
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<td></td>
<td>200</td>
<td>2900</td>
<td>300</td>
<td>4350</td>
</tr>
</tbody>
</table>
The production cycle meets all the international standards, conforms to ISO 9001:2000 and has been approved by Lloyd’s Register of Shipping, which has given TenarisDalmine the first group certificate (R.001) certifying that all the production units conform to the requirements of ISO 9001:2000.

Furthermore, TenarisDalmine products respect the requirements of the main international standards.

STANDARDS AND TECHNICAL REGULATIONS

<table>
<thead>
<tr>
<th>EUROPEAN COMMUNITY DIRECTIVES</th>
<th>INTERNATIONAL or internationally recognized</th>
<th>NATIONAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cylinders for transport</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>99/36/EC (TPED)</td>
<td>EN 1964</td>
<td>DOT3AA</td>
</tr>
<tr>
<td>ISO 9809 - ISO 4705</td>
<td>BS 5045</td>
<td></td>
</tr>
<tr>
<td>84/525/EC</td>
<td>TRG 310</td>
<td></td>
</tr>
<tr>
<td>DOT3AA</td>
<td>DRIRE</td>
<td></td>
</tr>
<tr>
<td>BS 5045</td>
<td>GB5099</td>
<td>IRAM 2526</td>
</tr>
<tr>
<td><strong>Cylinders for portable extinguishers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>97/23/EC (PED)</td>
<td>EN 1964</td>
<td>DOT3AAX</td>
</tr>
<tr>
<td>84/525/EC</td>
<td>BS 5045</td>
<td>DOT3T</td>
</tr>
<tr>
<td><strong>Natural gas cylinders for vehicles</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>84/525/EC</td>
<td>ECE-ONU R.110</td>
<td>D.M. 12.09.25</td>
</tr>
<tr>
<td><strong>Tubes for transport</strong></td>
<td>EN ISO 11120</td>
<td>DOT3AAX</td>
</tr>
<tr>
<td>99/36/EC (TPED)</td>
<td>BS 5045</td>
<td>DOT3T</td>
</tr>
<tr>
<td><strong>Large capacity vessels for storage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>97/23/EC (PED)</td>
<td>BS 5045</td>
<td>AD-Merkblatt</td>
</tr>
<tr>
<td>ASME VIII DIV. 1</td>
<td>VSR</td>
<td></td>
</tr>
<tr>
<td><strong>Vessels for marine and offshore applications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>American Bureau of Shipping</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Shells for accumulators</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>97/23/EC (PED)</td>
<td>ASME VIII DIV. 1</td>
<td>AD-Merkblatt</td>
</tr>
<tr>
<td>BS 7201</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Production cycle

Visual check ➔ Cutting tube into lengths ➔ Weighing

Hardness check ➔ First external shot blasting ➔ Tempering ➔ Oil Tempering

Ultrasonic test of the cylinder body for defects and wall thickness ➔ Neck drilling ➔ Neck butting ➔ Neck threading

Shipping ➔ Packaging ➔ Fitting accessories ➔ Primer coating and packing
High pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles

Today natural gas is regarded as the only ecological fuel that is immediately available and usable, so much that European community programs foresee that in the near future natural gas powered transport could reach 10% of all vehicles in circulation.

TenarisDalmine, who makes attention to the environment as one of its key mission points, produces cylinders for the on-board storage of natural gas according to ISO 11439 and ECE-ONU R 110 standards. These norms provide for adoption of automatic safety devices that, in case of an accident, allow a controlled discharge of the gas and pass the most severe tests, among which are, for example, ‘bonfire test’ and ‘bullet penetration test’. The ‘bonfire test’ simulates a fire on board the vehicle by using a large flame to cause a cylinder under pressure to heat and verifies the integrity of the vessel up to the point when the safety device opens to allow the gas to evacuate completely.

The ‘bullet penetration test’ checks, by means of the impact of a bullet fired from a gun, that the complete penetration of the cylinder wall under pressure by a foreign body does not cause anything other than a hole of minimum size.

This allows TenarisDalmine to supply the main car companies and international markets.
TenarisDalmine produces special vessels such as hydraulic accumulator shells and two-neck vessels to be installed in plants for production and gas storage.

**HYDRAULIC ACCUMULATOR SHELLS**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working pressure</td>
<td>from 250 to 360 bar - from 3.626 to 5.220 psi</td>
</tr>
<tr>
<td>Internal diameter</td>
<td>from 200 to 353 mm</td>
</tr>
<tr>
<td>Capacity</td>
<td>from 20 to 200 l - from 44 to 440 lb</td>
</tr>
<tr>
<td>Length</td>
<td>from 710 to 2,000 mm</td>
</tr>
</tbody>
</table>
Tenaris Dalmine is one of the few manufacturers in the world to have an Expander Rolling Mill for large diameter seamless tube production. This makes possible to produce high quality vessels with close tolerances for every type of industrial use, for the gas storage and transportation.

**Large diameter vessels**

Tenaris Dalmine is one of the few manufacturers in the world to have an Expander Rolling Mill for large diameter seamless tube production. This makes possible to produce high quality vessels with close tolerances for every type of industrial use, for the gas storage and transportation.

### LARGE DIAMETER VESSELS

**VESELS FOR TRANSPORT AND STORAGE OF GAS**

<table>
<thead>
<tr>
<th>Category</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working pressure</td>
<td>up to 400 bar - 5800 psi</td>
</tr>
<tr>
<td>Internal diameter</td>
<td>from 273 to 622 mm - from 10 3/4 to 24 1/2 inch</td>
</tr>
<tr>
<td>Capacity</td>
<td>from 100 to 2,500 l - from 220 to 5512 lb</td>
</tr>
<tr>
<td>Length</td>
<td>from 1.700 to 12.192 mm - from 5.58 to 40 feet</td>
</tr>
</tbody>
</table>

Special vessels with larger dimensions and capacity can be designed and manufactured on request.
TenarisDalmine can satisfy the most diversified equipment needs for transport and storage of fluids compressed at high pressure, and makes available to the customer its own technical resources and experience, from the initial development phases of every equipment type.

The application field features road transport equipment for compressed gases, systems for storage of pressurized fluids in fixed industrial installations, on-ship or off-shore equipment, extinguishing fluid accumulator systems for fire-fighting facilities. There is considerable commitment to leading-edge environmental projects like accumulator systems at filling stations for CNG-powered vehicles, large tanks for biogas storage (methane-rich gas obtained exclusively from biomass fermentation) for industrial vehicle fleets and urban public transport bus refilling stations, as well as compressed gas storage to regulate pneumatically turbine blade trim in wind-driven power stations.

In all these applications TenarisDalmine continuously cooperates with the most prestigious research centers (such as the Materials Development Center) in order to develop ever more efficient and advanced technical solutions.
A century of history

- The Company was established in Milan on June 27, 1906. In 1909, a year after the first stone was laid down, the first tube was rolled at Dalmine. In 1910 the first cylinder was produced from seamless tube.

- In 1956 the Sabbio Bergamasco plant was built for gas cylinders production.

- On February 27, 1996 Dalmine became part of the Techint Group.

- On May 21, 2002 the Gas Cylinder Division produced the 10,000,000th cylinder.

- In 2002 Tenaris S.A. was constituted, which Dalmine belongs to.
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