STATUTORY RULES AND ORDERS,
1931, No. 679.

PETROLEUM.
Compressed Gases.

THE GAS CYLINDERS (CONVEYANCE) REGULATIONS, 1931, DATED JULY 31, 1931, MADE BY THE SECRETARY OF STATE FOR THE HOME DEPARTMENT IN PURSUANCE OF SECTION 6 OF THE PETROLEUM (CONSOLIDATION) ACT, 1928 (18 & 19 GEO. 5. c. 32) AS APPLIED BY ORDER IN COUNCIL DATED THE 20TH JANUARY, 1930.(a)

In pursuance of Section 6 of the Petroleum (Consolidation) Act, 1928, as applied by Order in Council dated the 20th January, 1930, I hereby make the following Regulations for the conveyance by road of vessels containing any of the gases specified in the First Schedule hereto in a compressed state.

1. No cylinder shall be used for the conveyance by road of any of the said gases in a compressed state unless (1) it is constructed in accordance with the specifications contained, and has complied with the tests described, in the Second Schedule hereto; (2) the conditions contained in the following Regulations are complied with.

2. Cylinders shall be maintained in good condition and the valves shall be securely closed so as to prevent leakage.

3. Cylinders shall be so conveyed as not to project beyond the sides or ends of the vehicle. Adequate means shall be taken to prevent cylinders falling off the vehicle. This Regulation shall not apply to any cylinder containing any of the gases specified in the First Schedule in a compressed state carried exclusively for the purposes of, and attached to, the vehicle.

4. Cylinders shall be legibly marked or labelled with the name of the gas and the name and address of the person or firm by whom it was compressed.

5. The working or internal pressure in any cylinder shall not exceed 1,800 lbs. to the square inch.

6. The valves of cylinders containing carbon monoxide, coal gas, hydrogen or methane shall be protected against damage, either by the design of the cylinder or by the provision of a stout metal cap or metal cover, securely attached to the body of the cylinder. The metal cap or cover shall be so made that it is nowhere in actual contact with any part of the valve or valve body. Every valve cap or cover shall be provided with a vent of such size as to prevent any

(a) S.R. & O. 1930 (No. 34) p. 1396.

gas pressure inside the cap or cover. This Regulation shall not come into force until after a period of one year from the date of these Regulations.

7. The valves of cylinders containing carbon monoxide, coal gas, hydrogen or methane shall be provided with left handed screw threads for the pipe or other connections.*

8. Oil or similar lubricant shall not be used on any valves or other fittings of any cylinder.

9. Each cylinder shall, before being filled with gas, have been submitted by the gas compressing person or firm within the preceding two years to the hydraulic test specified in the Second Schedule. Prior to any hydraulic test the cylinder shall be thoroughly cleaned and examined externally and, so far as practicable, internally, for surface defects, corrosion and foreign matter. Where internal rust or foreign matter is observed the cylinder, prior to the hydraulic test, shall be heated to a temperature not exceeding 300° C. and again cleaned and examined. After each hydraulic test and before being taken into use the cylinder shall be thoroughly dried internally, and shall be stamped on the neck end with marks and figures indicating the person or firm and the date of test as specified in Clause 8 of the Second Schedule. Any cylinder which fails to pass the test shall not be conveyed by road when containing any compressed gas to which these Regulations apply.

10. Cylinders containing gases shall be painted with the following identification colours :—

Air	grey.
Argon	blue.
Carbon monoxide	red with yellow band.
Coal gas	red.
Hydrogen	red.
Methane	red.
Neon	medium brown with black band.
Nitrogen	dark grey with black band.
Oxygen	black.

The distinguishing colour band shall be painted round the neck of the cylinder close to the valve fitting.†

This Regulation shall not come into force until after a period of one year from the date of these Regulations.

11.—(*a*) The owner of a vehicle used for the conveyance of cylinders containing any compressed gas to which these Regulations apply, who employs any person in connection with such conveyance, shall take measures to ensure that any such person is acquainted with and carries out the provisions of Regulation 3.

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* Precautions should be taken to insure that the valves of emptied cylinders are securely shut before the cylinders are loaded for conveyance. These precautions apply more especially when the cylinders have contained inflammable gases and are conveyed in closed vehicles.

† The requirements of this Regulation will be met if the instructions contained in British Engineering Standards Association Specification No. 349/1931 are followed.

(*b*) No person shall deliver or cause to be delivered any cylinder containing any compressed gas to which these Regulations apply to any carrier for the purpose of conveyance by road :—

(i) unless he shall have brought to the notice of such carrier the provisions of Regulation 3 ;

(ii) unless he delivers any such cylinder or causes it to be delivered, as the case may be, to the carrier in such a state as to comply with the requirements of these Regulations.

12. In proceedings for a breach of Regulation 1 in respect of the material and manufacture of cylinders it shall be a good defence to produce a certificate from the makers stating that the cylinders were manufactured in accordance with the requirements of the Second Schedule.

13. These Regulations shall not apply to the conveyance of :—

(i) Any cylinder the capacity of which does not exceed 12 lbs. of water.

(ii) Any air receiver to be used in connexion with the starting of an internal combustion engine.

(iii) Any air receiver which forms part of a compressing plant.

14. If the Secretary of State is satisfied that in respect of any class of cylinders or any mode of conveyance any of the requirements of these Regulations may be safely suspended or modified, he may by Order authorise such suspension or modification for such period or under such conditions as he may think fit. Any such Order may be revoked by the Secretary of State at any time.

15. These Regulations shall come into force on the 1st day of September, 1931, and may be cited as the Gas Cylinders (Conveyance) Regulations, 1931.

J. R. Clynes,
One of His Majesty's Principal Secretaries of State.

Whitehall.
31st July, 1931.

FIRST SCHEDULE.

Air, argon, carbon monoxide, coal gas, hydrogen, methane, neon, nitrogen and oxygen.

SECOND SCHEDULE.

1. Cylinders shall be made of :—

Steel, of seamless construction to specifications A or B. Provided that cylinders manufactured prior to the date of coming into force of these Regulations may be made of :—

(*a*) Wrought iron, lap welded, or

(*b*) Steel to specification C, lap welded or of seamless construction, or

(*c*) Steel to Admiralty Specification if made by British manufacturers prior to the year 1921.

2. *Specification A.**

(*a*) The steel shall be made by the acid or by the basic open hearth process and shall have the following chemical composition:—

Carbon	0.43 to 0.48 per cent.
Manganese	0.5 to 0.9 per cent.
Silicon	Not to exceed 0.3 per cent.
Sulphur	Not to exceed .045 per cent.
Phosphorus	Not to exceed .045 per cent.
Iron	The remainder.

(*b*) Before the necking or closing in operations, each cylinder shall be examined for maximum and minimum thickness and for external and internal surface defects.

(*c*) Cylinders after manufacture shall be raised to a temperature not less than 820° C. and not exceeding 850° C. in a furnace, remaining within the furnace only for a time sufficient to ensure that all parts of the cylinder are at the same temperature. Before the temperature falls appreciably, they shall be removed and allowed to cool in still air in such a position that they are not subjected to draughts.

(*d*) Tensile tests shall be made on the material of one finished cylinder in every batch or, where the number of cylinders in any batch exceeds one hundred, from one finished cylinder in every hundred. The tensile tests shall be made on a bar cut longitudinally from the finished cylinder, of the form and dimensions shown in Fig. 1. In cases where a test piece of this size cannot be obtained from the cylinder, a test piece geometrically similar shall be prepared. The yield stress and the ultimate stress shall be not less than 20 tons per square inch and 40 tons per square inch respectively. The elongation shall be not less than 14 per cent. on a 6-inch gauge length, or on a corresponding length in cases where a test piece geometrically similar to the standard test piece has to be used.

(*e*) Impact tests shall be made in the case of cylinders of not less than 6 inches diameter. Six test pieces shall be cut, three in a longitudinal and three in a transverse direction, from the same cylinder from which the test pieces were taken in accordance with paragraph (*d*), and machined to the dimensions shown in Fig. 1. The mean energy required for fracture shall be not less than 3 foot-pounds for the transverse test pieces and 5 foot-pounds for the longitudinal test pieces.

(*f*) Another finished cylinder in every batch, or, where the number of cylinders in any batch exceeds one hundred, one cylinder in every hundred shall be subjected to and prove satisfactory under a flattening test as follows:—

The middle part of the cylinder shall be placed between two compression blocks having flat faces 2¾ inches wide with corners rounded to ¼-inch radius, and pressure shall be applied until cracks appear at the folded surface between the compression blocks. The test shall be deemed to be unsatisfactory if the distance between the faces of the blocks in contact with the cylinder, when cracks appear, is more than eight times the wall thickness of the cylinder. If the cylinders are of such length that from the cylinders used for the tests in paragraphs (*d*) and (*e*) above there can be obtained a parallel portion four diameters long, this parallel portion may be used for the flattening test.

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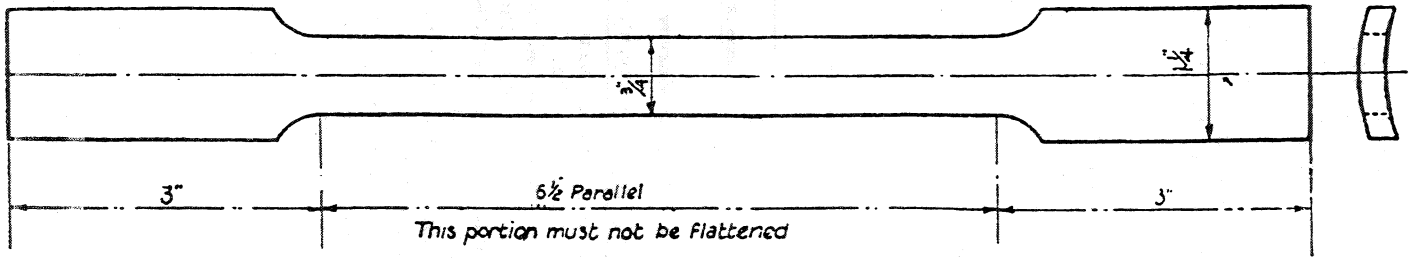
* *Note.*—Cylinders manufactured in accordance with the British Engineering Standards Association Specification No. 399/1930 (High Carbon Steel Cylinders) will conform with Specification "A" above.

Fig. 1.

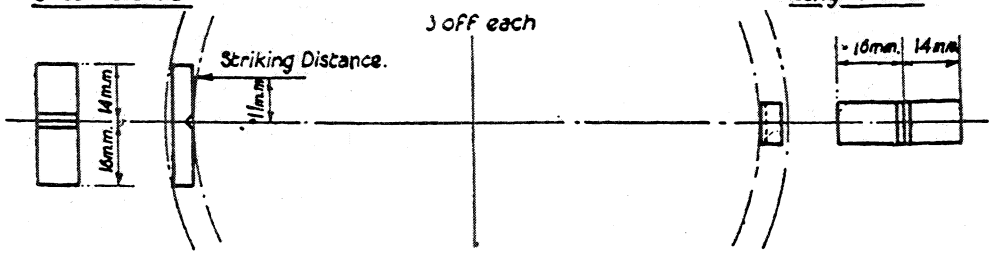
Longitudinal Tensile Test Piece

Ends may be flattened for grips.



Cantilever Type Impact Test Pieces

10mm x 5mm x 30m.m. Notch 1½mm deep Angle 45° Root Radius 0.25 m.m



Tensile and Impact Test Pieces.

3. *Specification B.**

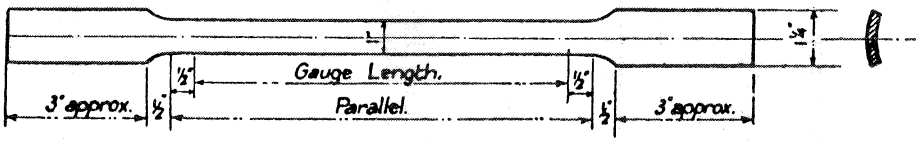
(*a*) The steel shall be made by the acid or basic open hearth process and shall have the following composition:—

Carbon	0.20 to 0.25 per cent.
Manganese	0.45 to 0.75 per cent.
Silicon	Not to exceed 0.2 per cent.
Sulphur	Not to exceed 0.045 per cent.
Phosphorus	Not to exceed 0.045 per cent.
Iron	The remainder.

(*b*) Before the necking or closing in operations, each cylinder shall be examined for maximum and minimum thickness and for external and internal surface defects.

(*c*) Cylinders after manufacture shall be raised to a temperature not less than 860° C. and not exceeding 890° C. remaining within the furnace only for a time sufficient to ensure that all parts of the cylinder are at the same temperature. Before the temperature falls appreciably, they shall be removed and allowed to cool in still air in such a position that they are not subjected to draughts.

(*d*) Tensile tests shall be made on the material of one finished cylinder in every batch or, where the number of cylinders in any batch exceeds one hundred, from one finished cylinder in every hundred. The tensile tests shall be made on a bar cut longitudinally from the finished cylinder, of the form and dimensions shown in Figure 2.



Ends only may be Flattened for gripping in Testing Machine.

Fig. 2. Tensile test piece cut from gas cylinders.

The yield stress shall be not less than 15 tons per square inch.

Provided that, if the yield stress is less than 17 tons per square inch, the hydraulic stretch test to be applied to the completed cylinders of that batch, in accordance with the provisions of Clause 6, shall be carried out by the manufacturers of the cylinders by the "water jacket" method.†

The ultimate stress shall be not less than 28 tons per square inch nor more than 33 tons per square inch.

The elongation shall be not less than 15 per cent., the gauge length for specimens of different thickness being as follows:—

Thickness of Test Piece. Inch.	Gauge Length. Inches.
Over 0·40	8
0·20 to 0·40	6
Less than 0·20	4

* *Note.*—Cylinders manufactured in accordance with British Engineering Standards Association Specification No. 400/1931 (Low Carbon Steel Cylinders) will conform with Specification "B" above.

† Details of the "water jacket" method will be found in the Fourth Report of the Gas Cylinders Research Committee, to be obtained direct from H.M Stationery Office or through any Bookseller.

(*e*) Another finished cylinder in every batch, or, where the number of cylinders in any batch exceeds one hundred, one cylinder in every hundred shall be subjected to and prove satisfactory under a flattening test as follows:—

The middle part of the cylinder shall be placed between two compression blocks having flat faces 2¼ inches wide with corners rounded to ¼-inch radius, and pressure shall be applied until cracks appear at the folded surface between the compression blocks. The test shall be deemed to be unsatisfactory if the distance between the faces of the blocks in contact with the cylinder, when cracks appear, is more than four times the wall thickness of the cylinder. If the cylinders are of such length that from the cylinders used for the tests in paragraph (*d*) above there can be obtained a parallel portion four diameters long, this parallel portion may be used for the flattening test.

4. *Specification C.*

(*a*) The steel shall contain not more than 0.25 per cent. of carbon and not less than 99 per cent. of total iron.

(*b*) The ultimate stress of the steel shall be not less than 26 tons per square inch and not more than 33 tons per square inch. The ultimate elongation shall be not less than 1.2 inches on a test piece of 8-inch gauge length. The test piece shall be cut from a finished cylinder.

5. The thickness of the cylinder wall of cylinders made to specifications A and B shall not be less than the value of t (in inches) as given by the following formula:—

$$t = \frac{pD}{2f + p}$$

Where p=maximum working pressure (1,800 lbs. per square inch).

D=external diameter in inches.

f=22,400 pounds per square inch for cylinders made to specification A and for cylinders made to Admiralty specification, and 17,920 pounds per square inch for cylinders made to specification B.

(*Note*).—The formula in use for wrought iron, lap welded cylinders and for steel cylinders, lap welded or of seamless construction made to Specification C, was

$$t = \frac{pD}{2(f + p)}$$

Where f=14,560 pounds per square inch for wrought iron cylinders.

=16,800 pounds per square inch for lap welded steel cylinders to Specification C.

=17,920 pounds per square inch for seamless steel cylinders to Specification C.

6. Each completed cylinder when ready to be put into service shall be subjected to a hydraulic stretch test. The proof pressure applied in this test shall be 3,000 lbs. per square inch.

No pressure greater than the working pressure shall have been applied to any cylinder before the test.

The permanent stretch shown by the test shall not exceed 10 per cent. of the total stretch under the test pressure. Should the permanent stretch exceed 10 per cent. of the total stretch under the proof pressure, the cylinder may be re-heat treated and if it then passes the test it may be retained in service.

The re-heat treatment applied shall be, in the case of cylinders made to Specification A and to Admiralty specification that given in paragraph (*c*) of Specification A and in the case of cylinders made to Specification B and C that given in paragraph (*c*) of Specification B.

7. Cylinders made by British manufacturers prior to the year 1921 to Admiralty specification shall be of steel having from 0.43 to 0.53 per cent. of carbon and may be conveyed by road provided:—

(i) In the case of complete cylinders that they have been re-heat treated and tested by the manufacturers with satisfactory results.

(ii) In the case of cylinders made by cutting the original cylinder into lengths, that the new cylinders as constructed withstand the foregoing mechanical and hydraulic tests for finished cylinders, except that the flattening test may be limited to a flattening to 10 thicknesses of the cylinder walls without fracture occurring.

8. Each cylinder shall be permanently and visibly marked with:—

(*a*) Manufacturer's and owner's identification marks and rotation number.

(*b*) Date of last hydraulic test. This may be indicated by the month and year or by the year with a symbol to denote the quarter of the year.

(*c*) For cylinders manufactured after the date of these Regulations—a mark denoting the specification to which the cylinder has been manufactured. This mark may be that of the British Engineering Standards Association Specification No. 399/1930 (B.S.S. No. 399/1930) for cylinders to Specification "A" or Specification No. 400/1931 (B.S.S. No. 400/1931) for cylinders to Specification "B."

The marks shall be stamped on the neck end of the cylinder with the exception of the manufacturer's mark, which may be on the base.

9. If, for any reason, the re-heat treatment of any cylinder becomes necessary, that specified in Clause 6 above shall be applied. After any such re-heat treatment the cylinder shall be thoroughly examined and subjected to the hydraulic stretch test.

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