

Inspection of Compressed Air Cylinders

External Inspection

Before inspection the cylinder must be clean and free of loose coatings, corrosion products and other materials which may obscure the surface. Foreign materials may be removed by brushing, controlled shot-blasting, water-jet cleaning chemical cleaning or other non-destructive methods. The method used must not remove a significant amount of cylinder material, and steel cylinders may not be heated above 300°C. Aluminium cylinders are even more restricted in the temperatures permitted, which are specified by the manufacturer.

The cylinder is inspected for dents, cracks, gouges, cuts, bulges, laminations and excessive wear, heat damage, torch or electric arc burns, and corrosion damage. The cylinder is also checked for illegible, incorrect or unauthorised permanent stamp markings, and unauthorised additions or modifications. If the cylinder exceeds the rejection criteria for these items it is unsuitable for further service and will be made permanently unserviceable.

Typical rejection criteria include:

Bulges	Burns	Cracks	Cuts	Dents	Defaced stamp markings
Gouges	Corrosion	General corrosion	Line corrosion	Pit corrosion	

Internal visual inspection

Unless the cylinder walls are examined by ultrasonic methods, the interior must be visually inspected using sufficient illumination to identify any damage and defects, particularly corrosion. If the inner surface is not clearly visible it should be cleaned by approved method which does not remove a significant amount of wall material. Methods allowed include shot-blasting, water jet cleaning, flailing, steam or hot water jet, rumbling and chemical cleaning . The cylinder must be internally inspected after cleaning.

Cracks	Corrosion	General corrosion	Line corrosion	Pit corrosion
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Damage to neck threads

Supplementary tests

When there is uncertainty whether a defect found during visual inspection meets the rejection criteria, additional tests may be applied, such as ultrasonic measurement of pitting wall thickness, or weight checks to establish total weight lost to corrosion. Hardness tests on aluminium cylinders are done on the cylindrical body and must avoid making deep impressions.

Cylinder neck inspection

While the valve is off, the threads of cylinder and valve must be checked to identify the thread type and condition. The threads of cylinder and valve must be of matching thread specification, clean and full form, undamaged and free of cracks, burrs and other imperfections. Tap marks are acceptable and should not be confused with cracks. Other neck surfaces will also be examined to be sure they are free from cracks. In some cases threads may be re-tapped, but if the threads are altered they must be checked with the appropriate thread gauges.

The aluminium alloys used for diving cylinders are 6061 and 6351. 6351 alloy is subject to sustained load cracking and cylinders manufactured of this alloy should be periodically eddy current tested according to national legislation and manufacturer's recommendations. 6351 alloy has been superseded for new manufacture, but many old cylinders are still in service, and are still legal and considered safe if they pass the periodic hydrostatic, visual and eddy current tests required by regulation and as specified by the manufacturer. The number of cylinders that have failed catastrophically is in the order of 50 out of some 50 million manufactured. A larger number have failed the eddy current test and visual inspection of neck threads, or have leaked and been removed from service without harm to anyone.

Pressure test or ultrasonic examination

Ultrasonic inspection may be substituted for the pressure test, which is usually a hydrostatic test and may be either a proof test or a volumetric expansion test, depending on the cylinder design specification. Test pressure is specified in the stamp markings of the cylinder. The results of a correctly performed pressure test are final.

Inspection of valve

Valves that are to be reused must be inspected and maintained to ensure they remain fit for service.

The recommended practice for valve inspection and maintenance includes inspection, and where applicable correction of threads, cleaning of components, replacement of excessively worn and damaged parts, packing and safety devices, lubrication as applicable with approved lubricants for the gas service, checks for correct operation and sealing at intended operating pressure. Checks may be done with the valve fitted to the cylinder after inspection and testing, or before the valve is fitted.

Gauging of threads may be mandatory to ensure the integrity of parallel threads. If the gauge exceeds the maximum gauge limit for taper threads, re-tapping may be considered at the discretion of the competent person.

Final operations

Diagram of a cylinder shoulder with stamp marking: TC3ALM 207 DOT-3AL 3000 P1576 LUXFER 01(testing authority stamp)93 S80 and date stamps for 3 hydrostatic tests

Stamp markings on an American manufacture aluminum 80 cu ft 3000 psi cylinder

Diagram of a cylinder shoulder with stamp marking: M25x2 ISO BS5045/3/B/S CP 23200kPa 11/92 SER NO P2699M LUXUK 2451 3V03 TP 34800kPa CAPACITY 12.2L TARE 16.3 kg, and three hydrostatic test dates

Stamp markings on a British manufacture aluminium 12.2 litre 232 bar cylinder

The interior of the cylinder must be thoroughly dried immediately after cleaning or hydrostatic testing, and the interior inspected to ensure that there is no trace of free water or other contaminants.

If the cylinder is repainted or plastic coated, the temperature must not exceed 300°C for steel cylinders, or the temperature specified by the manufacturer for aluminium cylinders.

Before fitting the valve the thread type must be checked to ensure that a valve with matching thread specification is fitted.[41] Fitting of valves should follow the procedures specified in ISO 13341 Transportable gas cylinders - Fitting of valves to gas cylinders.

After the tests have been satisfactorily completed, a cylinder passing the test will be marked accordingly. Stamp marking will include the registered mark of the inspection facility and the date of testing (month and year).

Records of a periodic inspection and test are made by the test station and kept available for inspection. These include:

Identification of the cylinder:

.name of current owner;

cylinder serial number;

mass of cylinder;

name of the cylinder manufacturer;

manufacturer's serial number;

cylinder design specification;

cylinder water capacity or size;

date of test during manufacture.

Records of the tests and inspections:

Type of inspections and tests done;

test pressure;

date of the test;

whether the cylinder passed or failed the inspections and tests (giving reasons for failure);

identification stamp mark of the test station;

identification of tester;

details of any repairs made.

Rejection and rendering cylinder unserviceable

If a cylinder fails inspection or testing and cannot be recovered, the owner must be notified before making the empty cylinder unserviceable by crushing, burning a hole in the shoulder, irregular cutting of the neck or cylinder or bursting using a safe method. If the owner does not give permission they become legally responsible for any consequences.

Pre-fill visual inspection

Before filling a cylinder the filling operator may be required by regulations, code of practice, or operations manual, to inspect the cylinder and valve for any obvious external defects or damage, and to reject for filling any cylinder that does not comply with the standards. They may also be required to record cylinder details in the filling log.