

ISO Standards Summary as compared to US DOT 49 CFR

Recommendations for UN Model Regulation

ISO Standard 10461

Seamless aluminum-alloy gas cylinders- periodic inspection and testing

	ISO 10461	49 CFR 173.34 & CGA C-1 pamphlet
Intervals between inspection and tests	Usually specified by national authorities. Should no regulations apply, <i>recommended intervals proposed</i> in Annex A: 5 or 10 years depending on gas	5 year interval unless used as fire extinguishers then 12 years
External visual inspection	<p>Inspect surface for dents, cuts, gouges, bulges, cracks or laminations; heat damage, torch or electric arc burns; corrosion; other defects; integrity of permanent attachments. <i>Typical rejection limits given for guidance</i> in Annex C:</p> <p><u>Isolated pits</u> 5mm or greater diameter must be less than 15% original wall thickness.</p> <p>Isolated pits 5mm or less in diameter - assess to ensure remaining wall thickness is adequate for cylinder duty.</p> <p><u>Area corrosion</u> - reject if greater than 10% of the original wall thickness or if the original metal surface is not recognizable.</p> <p>If area corrosion is borderline, hydrostatic test may be used and permanent expansion must be less than 2% of total. The residual wall thickness shall be determined by any suitable method (e.g. UT). Wall thickness must be at least min. design wall thickness.</p> <p><u>Channel corrosion</u> - reject if total length of corrosion in any direction exceeds circumference of the cylinder and is greater than 10% of original wall thickness.</p> <p><u>Cracks</u> - all cylinders displaying a crack shall be rejected. Particular examination shall be made for neck and shoulder cracks (guidance given).</p>	Per CGA C-6.1

Internal visual inspection	Inspect using appropriate device (e.g. lamp) to identify same defects as above for external inspection. Remove lining or coating that may obstruct thorough inspection. If cylinder has more than minor surface corrosion, must be cleaned, then inspected again. <i>Typical rejection limits given for guidance in Annex C (same limits as for external visual inspection above).</i>	
Verification of cylinder mass or tare	A loss of mass of more than 3% shall be subjected to an additional examination. A loss of mass greater than 5% of the original mass shall be rejected. If a mass/tare is not marked on the cylinder, must obtain from the manufacturer.	
Hydrostatic test	Each cylinder must be subjected to a hydraulic pressure test, either a proof pressure test, or a volumetric expansion test.	
Proof pressure test	Hold at marked test pressure for a sufficiently long period to ascertain that pressure will not decrease and that tightness is guaranteed. <i>Typical test method given in Annex E:</i> The pressure shall not exceed the test pressure by 3% or 10 bar, whichever is lower. Hold at test pressure for a min. of 30 seconds. Pressure gauges shall be tested against a master gauge at least once per month. The master gauge shall be tested annually.	Any internal pressure applied to the cylinder, prior to test pressure, shall not exceed 90% of min. test pressure. If test pressure cannot be achieved or maintained due to error, the test may be repeated at a pressure 10% or 100 psi higher, whichever is lower. Cumulative increase shall be no more than 10% of min. test pressure. Test system accuracy verification: At the beginning of each day, total test system must be proven accurate to within +/- 1.0% throughout the range of pressures to be used.
Volumetric expansion test	Cylinder must be rejected if Permanent expansion exceeds 10% of the total expansion. <i>Typical test method proposed in Annex F:</i> Authorizes the water jacket and non water jacket methods.	173.34 only authorizes the water jacket method for DOT 3AL cylinders.
Inspection of the valve	Each valve shall be inspected and maintained according to ISO 10297	Check C-6.1
Marking	May mark the next test date. Cylinder shall be stamped <i>according to national requirements or with</i> - symbol of inspection body or test station; -date of the test (may be indicated by the month and year or by the year followed by a number within a circle to denote the quarter of the year) Markings <i>should preferably</i> be not less than 6mm, but in any case shall not be less than 3mm.	

<p>Records</p>	<p>Test record shall be retained for not less than the period between tests. <i>Where national regulations require certain information to be recorded, this shall be complied with.</i> <i>The test record may include:</i> owner, serial number, date of previous test, manufacturer, manufacturing specifications, water capacity, cylinder mass/tare if applicable, test pressure, inspection/test date, results of the inspection/test, the inspection performed.</p>	<p>Records must be maintained until either the expiration of the retest period or until the cylinder is again reinspected or retested, whichever occurs first. Records must include: For each test to demonstrate calibration, the date, serial number of the calibrated cylinder, calibration test press., total, elastic and permanent expansions, and retest operator. For each cylinder, the date, serial number, specification or exemption number, service pressure, actual dimensions or a symbol, manufacturer's name or symbol if present, owner's name or symbol if present, result of visual insp., actual test pressure, total, elastic, and permanent expansion, percent perm. expansion, disposition with reason for any repeated retest, rejection or condemnation, test operator.</p>
<p>Other criteria</p>		
<p>Recommendations (i.e. accept as is, accept conditionally, reject)</p>	<p>Accept (possibly refer to UN annex for test intervals?)</p>	