U.S. Department
of Transportation

Pipeline and Hazardous Materials Safety Administration

1200 New Jersey Avenue, SE
Washington, D.C. 20590

SEP 2 4 2013

Mr. Tim McLoughlin
M & M Metrology, Inc.
272 South Military Trail
Deerfield Beach, FL 33442

Ref. No.: 13-0131

Dear Mr. McLoughlin:

This is in response to your June 19, 2013 email requesting clarification of the Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180) applicable to the calibration and certification of gauges used for pressure testing cylinders. You request clarification of the accuracy of the pressure indicating device as required under HMR § 180.205. Specifically, you ask if you are correct in calibrating an 1100 psig pressure gauge to ±5.5 psig (±0.5%) of its full range.

You are correct. In accordance with § 180.205(g)(3)(i) the pressure indicating device itself (the pressure gauge) must be certified as having and accuracy of ±0.5%, or better, of its full range.

Section 180.205(g)(3)(i) also provides that the pressure indicating device as part of the retest apparatus must be accurate to within ±1.0% of the prescribed test pressure of any cylinder being tested. Since the described gauge is calibrated to ±5.5 psig, the gauge would not be authorized for testing cylinders having a prescribed test pressure below 550 psig.

These requirements are consistent with the Compressed Gas Association Standard CGA C-1-2009 paragraph 5.3.2.2 which provides that the pressure indicating device shall be manufactured and certified to an accuracy grade of ±0.5% or better, and the pressure indicating device shall permit reading of pressures to within 1% of the test pressure of each cylinder tested.

I trust this information is helpful. If you have further questions, please do not hesitate to contact this office.

Sincerely,

Delmer Billings
Senior Regulatory Advisor
Standards and Rulemaking Division

Babich
§180.205
Cylinders
13-0131

Drakeford, Carolyn (PHMSA)

From: Betts, Charles (PHMSA)
Sent: Wednesday, June 19, 2013 12:32 PM
To: Drakeford, Carolyn (PHMSA)
Cc: Cassidy, Duane (PHMSA); Leary, Kevin (PHMSA)
Subject: RE: Interpretation of CFR 49

Carolyn –

Please log and assign to specialist for handling.

Thanks,
Charles

From: Cassidy, Duane (PHMSA)
Sent: Wednesday, June 19, 2013 12:30 PM
To: Betts, Charles (PHMSA); Leary, Kevin (PHMSA)
Subject: Fw: Interpretation of CFR 49
Importance: High

Please the interpretation request below regarding calibration of hydro equipment and, more specifically, the accuracy of the gauges.

From: M & M Metrology, Inc. [mailto:contactus@mmmetrology.com]
Sent: Wednesday, June 19, 2013 09:12 AM Eastern Standard Time
To: Cassidy, Duane (PHMSA)
Subject: FW: Interpretation of CFR 49

From: M & M Metrology, Inc. [mailto:contactus@mmmetrology.com]
Sent: Wednesday, June 19, 2013 8:59 AM
To: 'Duane.Cassidy@dot.com'
Subject: Interpretation of CFR 49
Importance: High

Good Morning,

My name is Tim McLoughlin and I am the Quality Assurance for M & M Metrology, Inc. We are a calibration lab in south Florida and calibrate several Hydro-Test pressure gauges for companies that service fire extinguishers . One on my customers is having an issue with an auditor from Arrowhead Industrial mostly the interpretation of49 CFR ch.1, 180.250 sect 3(i) and CGA C-12009 para .5.3.2.2. The CFR state that "The pressure indicating device itself, must be certified as having an accuracy of .5% or better, of its full range" The CGA specification say "Shall be accurate to ±1 percent of test pressure" and is requiring the pressure indicating device itself to 1% of reading. We are talking of a 1100 psig pressure gauge @ .5% is ±5.5 psig at any point of the gauge and Arrowhead is requiring 1% of reading. I understand that (ii) of the CFR references the 1% but that is of the entire test setup. Please clarify what the accuracy of the test indicating device itself would be. We have continued to calibrate the gauges to ±5.5 psig. If possible please respond as my customer are due to be audited by Arrowhead in early July. I have also attached a picture of the gauge and the mfr specs are listed below. I also included a copy of the certification that we provided. Additional calibration point have been added to accommodate the 3rd bullet from the CGA 5.3.2.2

Calibrated Pressure Gauge

Can be used in many different applications where a high quality calibrated gauge is required
Features:

- 0-1100psi range x 2 psi increments
- Manufactured to Class 2A specifications (0.5% accuracy full range)
- 1/4" Male NPT bottom connection
- 6" diameter
- Mirrored dial face
- Calibrated to 0.5% at the following increments: 200,350,400,500,600,700,800,900,1000psi
- Additional calibration points can be added (please fill in above)
- Can be used to US DOT and Transport Canada cylinder testing specifications in a range of 111 - 1000psi
- Internal "True Zero" adjustment knob
- Includes calibration certificate

Thanks in advance for your time
Tim
954 426-0111

0
100
200
300
400
500
600
700
800
900
1000
1100
psi
HYDRO-TEST
PRODUCTS INC
2 psi min

M & M Metrology

M & M Metrology, Inc

272 South Military Trail
Deerfield Beach, FL 33442
Ph (954) 426-0111 Fax (954) 426-0522
ContactUs@mmmetrology.com

Certificate of Calibration

Certificate No.: 100564

Gage ID:	120398-1	P/O Number:	Verbal Jim	Temperature:	72° F
Manufacturer:	Hydro-Test Products	Calibration Date:	06/11/2013	Humidity:	50 %
Serial Number:	120398-1	Next Due Date:	06/30/2014	Customer Info:	
Model Number:	140-018	Cal. Freq.:	12 EOM	A.A.C. United Fire & Safety Equipment 305 S.W. 15th Ave. Pompano Beach, FL 33069	
Description:	0-1,100 psig Pressure Gauge	Calibrated By:	J.S.		
		On-Site:	No		
		As Found Cond.:	In Tolerance		
		As Left Cond.:	In Tolerance		
		Pass.:	Yes		

Comments:

Calibration Statement:

It is hereby certified that the above described gauge has been calibrated in compliance with ISO/IEC 17025:2005, ANSI/NCSL Z540-1:1994, ISO 10012-2003, ISO 9001:2000, ISO9001-2008, ISO/TS 16949:2002, AS9100 Rev C Section 1, AS9100 Rev. C Clause 7.6, ISO9001/9002:1994, AS9100 Rev, C section 2, Clause 4.11, Mil-Std-45662A, ISO/TS 16949 Rev 2 Clause 7.6, 21CFR820.72 and 21CFR58.63 FDA Quality System, United Technologies PW-QA 6077J and the M & M Metrology Quality Program. All standards used are traceable to the National Institute of Standards & Technology. All calibration records are on file for review at M & M Metrology, Inc. upon your request . The Collective uncertainty of the measurement standards shall not exceed 25% of the acceptable tolerance for each characteristic of the MT&E being calibrated or verified unless otherwise stated (TUR4:1). The above listed instrument passed all calibration points listed below unless otherwise specified. The results listed on this certificate or report are relevant only to the instrument described above. This certificate or report shall not be reproduced except in full, without the written approval of M & M Metrology, Inc.

Calibration Standards Used:

Gage ID:	Manufacturer	Model Number	Description	Due Date:
MMPM38861	Heise	HQS-2	0-2,000 psig Pressure Module	12/31/2014
MMPR2527	Heise	PTE-1 2H	Dual Display Digital Pressure Indicator	04/30/2014

Procedures Referenced:

Procedure Name - Rev No.

CP36E Revision 01/01/2002 - R.1

Calibration Measurements:

Calibration Point: / Comments:	Minimum: / Type:	Nominal: / Units:	Maximum: / Limited:	Before: / After:	Deviation: / Deviation:	Fail Before: / Fail After:
01 200	194.5	200.0	205.5	201.5	1.5	No
	V	psig	No	201.5	1.5	No
02 300	294.5	300.0	305.5	301.4	1.4	No
	V	psig	No	301.4	1.4	No
03 400	394.5	400.0	405.5	401.3	1.3	No
	V	psig	No	401.3	1.3	No
04 500	494.5	500.0	505.5	501.1	1.1	No
	V	psig	No	501.1	1.1	No
05 600	594.5	600.0	605.5	600.2	0.2	No
	V	psig	No	600.2	0.2	No
06 800	794.5	800.0	805.5	798.6	-1.4	No
	V	psig	No	798.6	-1.4	No
07 1000	994.5	1000.0	1005.5	995.2	-4.8	No
	V	psig	No	995.2	-4.8	No

Approved By: _____ Date _____
Authorized Quality Representative

* - Unless otherwise stated in the "Comments."

5.3.2.2 Pressure indicating device

The pressure indicating device (PID) shall be a pressure gauge or other suitable device such as a pressure transducer and digital readout that:

- shall be manufactured and certified to an accuracy grade of ±0.5% or better;
- shall permit reading of pressures to within 1% of the test pressure of each cylinder tested. For analog PIDs, interpolation to one half of the marked increment is permitted;
- shall permit readings of pressures from 90% to 110% of the test pressure of any cylinder tested;
- shall be accurate to ±1% of test pressures; and
- shall be recalibrated periodically in accordance with Appendix B.

For example, using a 10 000 psi pressure gauge with an accuracy grade of ±0.5%, the reading is accurate to ±50 psi (0.5% x 10 000 psi) at any point on the pressure gauge. For a test pressure range of 3000 psi to 5000 psi, at 3000 psi the gauge accuracy may deviate by only ±30 psi (1% of 3000 psi) while for 5000 psi the gauge may deviate by as much as ±50 psi.

NOTE—The gauge in this example satisfies the accuracy grade requirement but could not be used for test pressures less than 5000 psi since the gauge is only accurate to ±50 psi. An accuracy of ±30 psi is required for the minimum test pressure at 3000 psi. A gauge with a smaller range (e.g., 5000 psi) or a better accuracy (e.g., ±0.25%) is needed.

5.3.2.3 Pressure recording device

The use of a pressure recording device is not required. However, if used, the device should be compatible with the maximum system pressure capability. The pressure recording device shall be adjustable so that correlation with the PID can be achieved.

5.3.2.4 Associated plumbing

All pressure valves, fittings, and connecting tubing shall be of a size and material appropriate for the pressures and the stresses of the test and be adequately sized and installed in a manner to prevent leakage, air entrapment, or exposure to external damage. Additional pressure supply system components such as surge chambers, reservoirs, pulsation dampeners, accumulators, etc., shall be selected with consideration to pressure cycling capabilities and maximum test pressures. All pressure supply system components shall be properly selected, installed, and maintained to ensure leak-free performance.

CAUTION: *In the design and construction of the pressure system, consideration shall be given to the potential hazards associated with the containment of liquids under high pressure. The use of additional safety equipment such as relief devices, blast shields, test cages, etc., is advisable to prevent possible injury to testing personnel and equipment.*

5.3.3 Timing device

During testing, a timing device that is capable of accurately measuring the minimum test duration shall be used.

5.4 Calibrated cylinder

A calibrated cylinder is required when performing the verification procedure for test methods where volumetric expansion determinations are required. The calibrated cylinder is a derived secondary standard used to demonstrate test apparatus integrity and to confirm PID and EID accuracy.

A calibrated cylinder is a cylinder that has been specially prepared so that it no longer experiences permanent expansion at the pressures for which it has been calibrated. The expansion readings of the cylinder shall be repeatable and linear. A certification for the cylinder noting the actual pressure and expansion values for each pressure calibration level shall be available. The original signed certification of calibration should be maintained in a safe place and a copy shall be posted on or near the hydrostatic test console.

(ii) Condemned in accordance with paragraph (i) of this section.

(3) For DOT specification cylinders, the marked service pressure may be changed upon approval of the Associate Administrator and in accordance with written procedures specified in the approval.

(4) For a specification 3, 3A, 3AA, 3AL, 3AX, 3AXX, 3B, 3BN, or 3T cylinder filled with gases in other than Division 2.2, from the first requalification due on or after December 31, 2003, the burst pressure of a CG–1, CG–4, or CG–5 pressure relief device must be at test pressure with a tolerance of plus zero to minus 10%. An additional 5% tolerance is allowed when a combined rupture disc is placed inside a holder. This requirement does not apply if a CG–2, CG–3 or CG–9 thermally activated relief device or a CG–7 reclosing pressure valve is used on the cylinder.

(d) *Conditions requiring test and inspection of cylinders.* Without regard to any other periodic requalification requirements, a cylinder must be tested and inspected in accordance with this section prior to further use if—

(1) The cylinder shows evidence of dents, corrosion, cracked or abraded areas, leakage, thermal damage, or any other condition that might render it unsafe for use in transportation;

(2) The cylinder has been in an accident and has been damaged to an extent that may adversely affect its lading retention capability;

(3) The cylinder shows evidence of or is known to have been over-heated; or

(4) The Associate Administrator determines that the cylinder may be in an unsafe condition.

(e) *Cylinders containing Class 8 (corrosive) liquids.* A cylinder previously containing a Class 8 (corrosive) liquid may not be used to transport a Class 2 material in commerce unless the cylinder is—

(1) Visually inspected, internally and externally, in accordance with paragraph (f) of this section and the inspection is recorded as prescribed in § 180.215;

(2) Requalified in accordance with this section, regardless of the date of the previous requalification;

(3) Marked in accordance with § 180.213; and

(4) Decontaminated to remove all significant residue or impregnation of the Class 8 material.

(f) *Visual inspection.* Except as otherwise provided in this subpart, each time a cylinder is pressure tested, it must be given an internal and external visual inspection.

(1) The visual inspection must be performed in accordance with the following CGA Pamphlets: C–6 for steel and nickel cylinders (IBR, see § 171.7 of this subchapter): C–6.1 for seamless aluminum cylinders (IBR, see § 171.7 of this subchapter); C–6.2 for fiber reinforced composite special permit cylinders (IBR, see § 171.7 of this subchapter); C–6.3 for low pressure aluminum cylinders (IBR, see § 171.7 of this subchapter); C–8 for DOT 3HT cylinders (IBR, see § 171.7 of this subchapter); and C–13 for DOT 8 series cylinders (IBR, see § 171.7 of this subchapter).

(2) For each cylinder with a coating or attachments that would inhibit inspection of the cylinder, the coating or attachments must be removed before performing the visual inspection.

(3) Each cylinder subject to visual inspection must be approved, rejected, or condemned according to the criteria in the applicable CGA pamphlet.

(4) In addition to other requirements prescribed in this paragraph (f), each specification cylinder manufactured of aluminum alloy 6351-T6 and used in self-contained underwater breathing apparatus (SCUBA), self-contained breathing apparatus (SCBA), or oxygen service must be inspected for sustained load cracking in accordance with Appendix C of this part at the first scheduled 5-year requalification period after January 1, 2007, and every five years thereafter.

(g) *Pressure test.* (1) Unless otherwise provided, each cylinder required to be retested under this subpart must be retested by means suitable for measuring the expansion of the cylinder under pressure. Bands and other removable attachments must be loosened or removed before testing so that the cylinder is free to expand in all directions.

(2) The pressure indicating device of the testing apparatus must permit reading of pressures to within 1% of the minimum prescribed test pressure of each cylinder tested, except that for an analog device, interpolation to ½ of the marked gauge divisions is acceptable. The expansion-indicating device of the testing apparatus must also permit incremental reading of the cylinder expansion to 1% of the total expansion of each cylinder tested or 0.1 cc, whichever is larger. Midpoint visual interpolation is permitted.

(3) Each day before retesting, the retester shall confirm, by using a calibrated cylinder or other method authorized in writing by the Associate Administrator, that:

(i) The pressure-indicating device, as part of the retest apparatus, is accurate within ±1.0% of the prescribed test pressure of any cylinder tested that day. The pressure indicating device, itself, must be certified as having an accuracy of ±0.5%, or better, of its full range, and must permit readings of pressure from 90%-110% of the minimum prescribed test pressure of the cylinder to be tested. The accuracy of the pressure indicating device within the test system can be demonstrated at any point within 500 psig of the actual test pressure for test pressures at or above 3000 psig, or 10% of the actual test pressure for test pressures below 3000 psig.

(ii) The expansion-indicating device, as part of the retest apparatus, gives a stable reading of expansion and is accurate to ±1.0% of the total expansion of any cylinder tested or 0.1 cc, whichever is larger. The expansion-indicating device itself must have an accuracy of ±0.5%, or better, of its full scale.

(4) The test equipment must be verified to be accurate within ±1.0% of the calibrated cylinder's pressure and corresponding expansion values. This may be accomplished by bringing the pressure to a value shown on the calibration certificate for the calibrated cylinder used and verifying that the resulting total expansion is within ±1.0% of the total expansion shown on the calibration certificate. Alternatively, calibration may be demonstrated by bringing the total expansion to a known value on the calibration certificate for the calibrated cylinder used and verifying that the resulting pressure is within ±1.0% of the pressure shown on the calibration certificate. The calibrated cylinder must show no permanent expansion. The retester must demonstrate calibration in conformance with this paragraph (g) to an authorized inspector on any day that it retests cylinders. A retester must maintain calibrated cylinder certificates in conformance with § 180.215(b)(4).

(5) Minimum test pressure must be maintained for at least 30 seconds, and as long as necessary for complete expansion of the cylinder. A system check may be performed at or below 90% of test pressure prior to the retest. In the case of a malfunction of the test equipment, the test may be repeated at a pressure increased by 10% or 100 psig, whichever is less. This paragraph (g) does not authorize retest of a cylinder otherwise required to be condemned under paragraph (i) of this section.

(6) Training materials may be used for training persons who requalify cylinders using the volumetric expansion test method.

(h) *Cylinder rejection.* A cylinder must ject ed when, after a visual inspection, it is condition for rejection under the visual i tion requirements of paragraph (f) of th tion.

(1) Except as provided in paragraphs and (h)(4) of this section, a cylinder that is ed may not be marked as meeting the re ments of this section.

(2) The requalifier must notify the cyl owner, in writing, that the cylinder has be jected.

(3) Unless the cylinder is requalified in formance with requirements in § 180.211, it not be filled with a hazardous material an fered for transportation in commerce when of a specification packaging is required.

(4) A rejected cylinder with a service pres of less than 900 psig may be requalified marked if the cylinder is repaired or rebuilt subsequently inspected and tested in con mance with—

(i) The visual inspection requirement paragraph (f) of this section;

(ii) Part 178 of this subchapter and this p

(iii) Any special permit covering the manu ture, requalification, and/or use of that cylin and

(iv) Any approval required under § 180.21

(i) *Cylinder condemnation.* (1) A cylin must be condemned when—

(i) The cylinder meets a condition for condemnation under the visual inspection requirements of paragraph (f) of this section.

(ii) The cylinder leaks through its wall.

(iii) Evidence of cracking exists to the extent that the cylinder is likely to be weakened appreciably.

(iv) For a DOT specification cylinder, other than a DOT 4E aluminum cylinder or a special permit cylinder, permanent expansion exceeds 10 percent of total expansion.

(v) For a DOT 3HT cylinder—

(A) The pressure test yields an elastic expansion exceeding the marked rejection elastic expansion (REE) value.

(B) The cylinder shows evidence of denting or bulging.

(C) The cylinder bears a manufacture or original test date older than twenty-four years or after 4380 pressurizations, whichever occurs first. If a cylinder is refilled, on average, more than once every other day, an accurate record of the number of rechargings must be maintained by the cylinder owner or the owner's agent.