U.S. Department
of Transportation

**Research and
Special Programs
Administration**

400 Seventh Street, S.W.
Washington, D.C. 20590

APR 15 1998

Mr. Steven T. Gentry
Worthington Cylinder Corporation
P.O. Box 391
1085 Dearborn Drive
Columbus, Ohio 43085

Dear Mr. Gentry:

This is in response to your inquiry requesting clarification of the testing requirements for DOT 4E specification cylinders. Your questions are paraphrased below, followed by our answers.

Q1: Are weld tensile specimens tested per 49 CFR § 178.68-17(a) (now § 178.68(l)(1)) required to meet both apparent and actual breaking stress requirements?

A1: Yes. The specimen must meet both requirements to pass the test.

Q2: What are the minimum wall thickness requirements of 49 CFR 178.68-10 (now § 178.68(f))?

A2: The absolute minimum wall thickness is 0.140. In addition, the minimum wall thickness must be such that the calculated wall stress at twice the service pressure is less than 20,000 psi or 1/2 the minimum tensile strength, whichever is less. The minimum tensile strength is determined in accordance with § 178.68(j).

Q3: Where should the thickness of tensile coupons be measured?

A3: According to ASTM E8, paragraph 7.1.1: "For referee testing of specimens under 3/16 in. in their least dimension, measure the dimensions where the least cross-sectional area is found".

I hope this information is helpful. If we can be of further assistance, please contact us.

Sincerely,

for Hattie L. Mitchell
Chief, Regulatory Review and Reinvention
Office of Hazardous Materials Standards

Worthington Cylinder Corporation

Ind request

OFFICE OF CHIEF COUNSEL
DOT/RSPA
97 APR -8 AM 11:12

April 2, 1997

Office of Chief Council
RSPA
U.S. Department of Transportation
400 Seventh Street S.W.
Washington, D.C. 20590

Dear Sir or Madam:

Worthington Cylinder Corporation sent you a request for an interpretation of the 4E Specification October 24, 1996. This letter was sent to you via Registered Mail and was received at your location on November 1, 1997 (see attached copy of Registered Mail card). I have enclosed another copy of our request for your review.

As to date, we have had no response from the DOT on our request. I have tried on numerous occasions to contact a representative from DOT on this issue but, have received no telephone call back. This is an important issue to Worthington Cylinder Corporation and would appreciate a response to our inquiry as soon as possible.

Thank you for your cooperation in this matter.

Sincerely:

Steven T. Gentry
Project Engineer
Worthington Cylinder Corporation

attachments

P.O. Box 391, 1085 Dearborn Dr. • Columbus, Ohio 43085 • Tel. (614) 438-3013 • FAX (614) 438-3083
A SUBSIDIARY OF WORTHINGTON INDUSTRIES, INC.

Worthington Cylinder Corporation

October 24, 1996

Office of Chief Council
U.S. Department of Transportation
400 Seventh Street S.W.
Washington, D.C. 20590

Dear Sir or Madam:

Worthington Cylinder Corporation has some questions concerning 49 CFR 178.68 titled Specification 4E. We are asking the U.S. Department of Transportation for their official interpretation on these issues.

QUESTION #1

Paragraph 178.68-17(a) states that the weld tensile specimen must have an actual breaking stress of at least 30,000 psi and a minimum apparent breaking of stress of 2 times the minimum cylinder sidewall tensile strength as defined in the formula in Paragraph 178.68-10(b).

For an example, I will use 3 cylinders manufactured to Specification 4E. Each cylinder has a test pressure of 480 psi, inside diameter of 12 inches and a minimum sidewall thickness of .142 inches. This indicates a minimum wall stress of 17,662 psi and a minimum tensile strength requirement of 35,324 psi. We test the welds and determine the following information :

ACTUAL WELD TENSILE STRENGTH

CYLINDER NUMBER	ACTUAL SAMPLE THICKNESS	ACTUAL SAMPLE WIDTH	SAMPLE AREA IN^2	LOAD POUNDS	TENSILE STRENGTH PSI	≥ 30,000 PASS / FAIL
1	0.160	0.500	0.0800	2520	31,500	PASS
2	0.155	0.500	0.0775	2200	28,387	FAIL
3	0.158	0.500	0.0790	2400	30,380	PASS

APPARENT WELD TENSILE STRENGTH

CYLINDER NUMBER	APPARENT SAMPLE THICKNESS	ACTUAL SAMPLE WIDTH	SAMPLE AREA IN^2	LOAD POUNDS	TENSILE STRENGTH PSI	≥ 35,324 PASS / FAIL
1	0.142	0.500	0.0710	2520	35,493	PASS
2	0.142	0.500	0.0710	2200	30,986	FAIL
3	0.142	0.500	0.0710	2400	33,803	FAIL

P.O. Box 391, 1085 Dearborn Dr. • Columbus, Ohio 43085 • Tel. (614) 438-3013 • Fax (614) 438-3083
A SUBSIDIARY OF WORTHINGTON INDUSTRIES, INC.

- It is our interpretation that the only cylinder that passed the requirements of Paragraph 178.68-17(a) is Cylinder #1. This cylinder met both requirements of the 30,000 psi minimum actual weld tensile strength and 35,324 psi apparent weld tensile strength.

  Cylinder #2 failed because the actual and apparent weld tensile strengths were below the 30,000 psi and 35,240 psi requirements. Cylinder #3 failed because the apparent weld tensile strength was below the 35,240 psi requirement.

  We are asking that you confirm our interpretation.

QUESTION #2

Paragraph 178.68-10 discusses the minimum wall thickness that is required for a Specification 4E cylinder. Part (a) of this paragraph states that in any case, the cylinder wall thickness shall never be less than 0.140 inches. Additionally, the stress calculation shall not exceed 20,000 psi and the wall thickness used in the stress calculation shall be the determining factor for the minimum sidewall tensile strength. Part (c) goes further to state, that the minimum thickness of the heads and bottoms shall not be less than the minimum required sidewall thickness.

I have enclosed **Attachment A** for your review. This drawing illustrates 3 cylinders manufactured to Specification 4E. The purpose of this drawing is to illustrate the defined minimum wall thickness of the cylinder in accordance with Paragraph 178.68-10. We will assume that the wall stress calculation has indicated the minimum sidewall thickness as 0.142 inches. We will assume that the cylinder sidewall has the tensile strength required of the stress calculation times a factor of two (in this case 35,324 psi).

- It is our interpretation of Paragraph 178.68-10 that all 3 cylinders comply with the requirement. We also interpret Paragraph 178.68-10 to state that in all 3 cylinders illustrated, the minimum wall thickness used for the stress calculation would be 0.142 inches.

  We are asking that you confirm our interpretations.

Therefore, based upon affirmative answers by the Department of Transportation to Questions #1 and #2, it can be concluded that Cylinder #1 passed the tensile requirements of Specification 4E. This is due to the actual weld tensile strength exceeding 30,000 psi, the apparent weld tensile strength exceeding 35,324 psi and the cylinder sidewall tensile strength exceeded 35,324 psi.

Cylinder #2, passing the cylinder sidewall tensile strength requirements, failed the Specification 4E requirements because the actual and apparent tensile weld strengths did not meet the minimum strength requirements. Cylinder #3, passing the cylinder sidewall tensile strength and the actual weld tensile strength requirement, failed the Specification 4E requirements because the apparent weld tensile strength did not meet the minimum weld tensile strength requirement.

QUESTION #3

Proper measuring the thickness of tensile coupons has been a question that has been around for a number of years. This is extremely important when testing weld tensile coupons for aluminum cylinders manufactured to Specification 4E for determination of actual tensile strength. I have enclosed **Attachment B** for your review. In reviewing the drawing, I have illustrated a typical tensile coupon for

an aluminum weld. It should be noted that Worthington's experience in testing these welds will indicated that the fracture will occur in the heat affected zone of the weld not in the minimum "thickness" in the reduced area of the tensile coupon.

- It is the interpretation of Worthington, that the minimum thickness noted in the reduced section of the coupon in this illustration would be 0.157 inches. This would then be used as the thickness multiplier in determination of the square inch area of the coupon.. Depending on tensile testing equipment and technique of determining tensile strength, the area would then be used in the equation to determine the actual weld tensile strength as described in Paragraph 178.68-17(a).

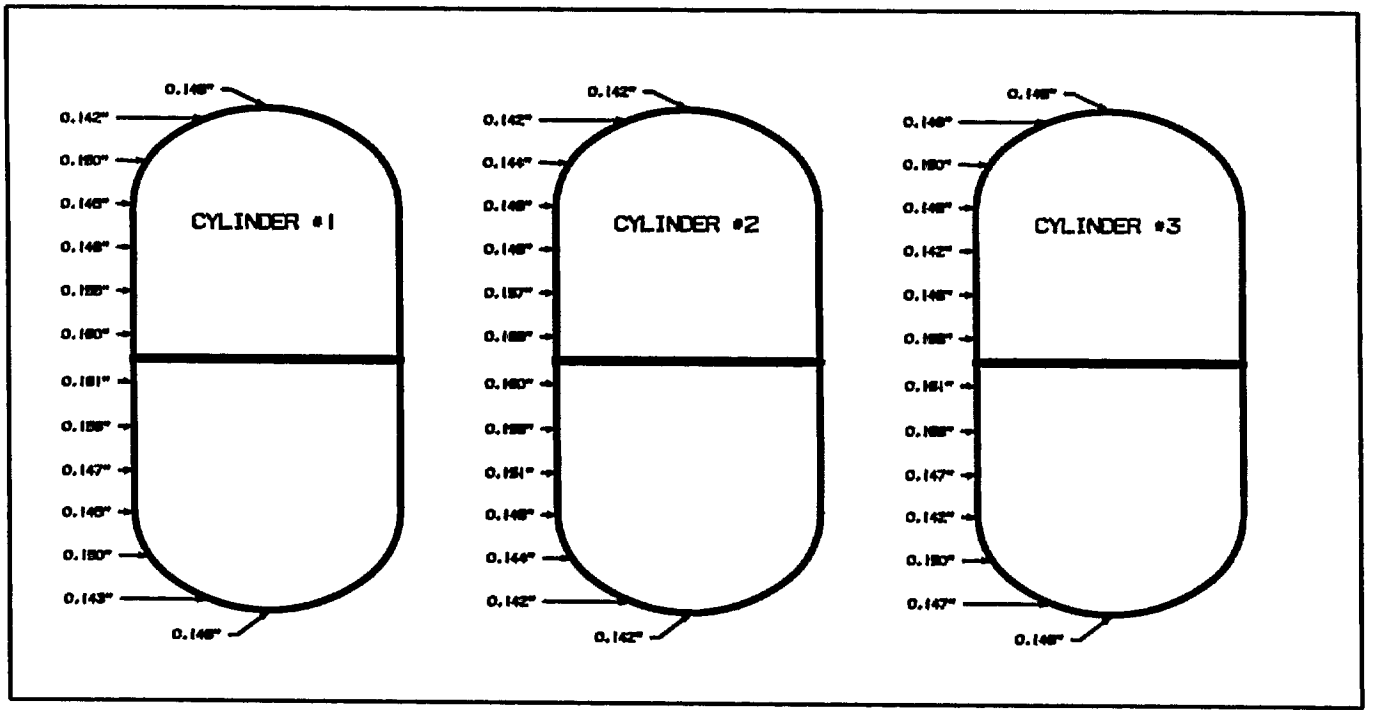
  We are asking that you confirm our interpretation.

Thank you for your timely response to these questions. The answers to these questions are extremely important to new rule makings at the Department of Transportation and in turn, our reply to the new rule makings. If I can be of any further assistance in this matter, please contact me at 614-438-3057.

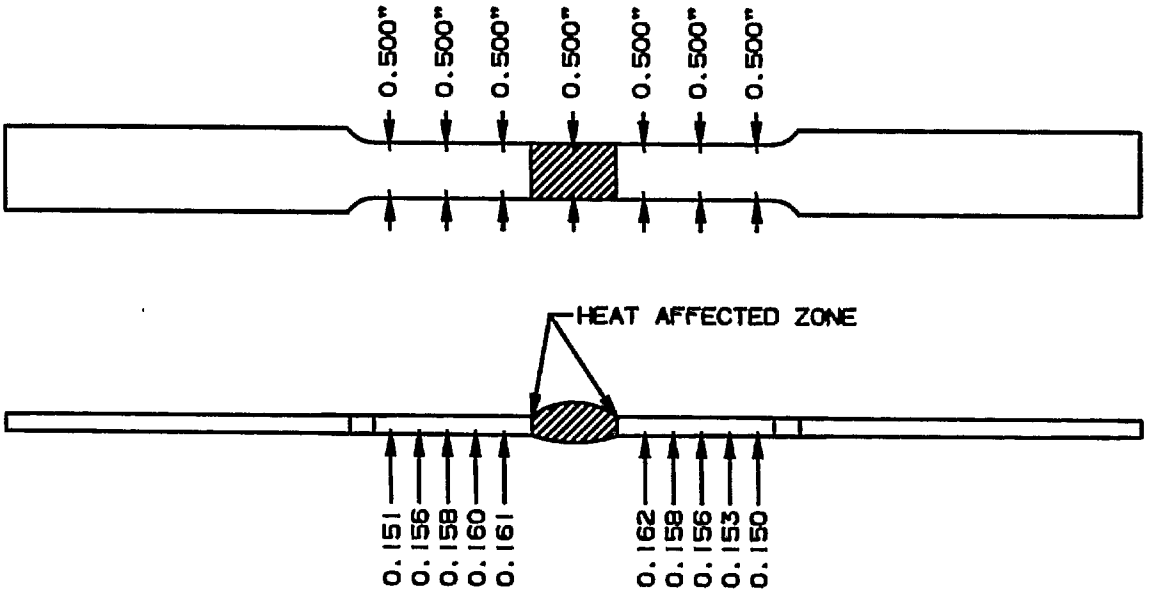
Sincerely:

Steven T. Gentry
Project Engineer
Worthington Cylinder Corporation

attachments



ATTACHMENT A



ATTACHMENT B

THE COLEMAN COMPANY, INC.
P.O. Box 2931 Wichita, Kansas 67201-2931

WICHITA KANSAS SEP 27'95 0.32 PB METER

Mr. Etward Mazzullo
U.S. Dept. of Transportation
Office of Hazardous Material
400 7th St. S.W.
Washington, DC 20590-0001