

April 20, 2023

Mark Fazio
Chief Engineer
Kidde Aerospace and Defense
4200 Airport Dr.
Wilson, NC 27896

Reference No. 22-0067

Dear Mr. Fazio:

This letter is in response to your June 22, 2022, email requesting clarification of the Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180) applicable to service and test pressure requirements for DOT-4D, DOT-4DA, and DOT-4DS pressure vessel specifications. Specifically, you provide a scenario of a DOT-4D pressure vessel made from 4130 steel with a service pressure of 500 psi.

Based on the scenario provided we have paraphrased and answered your questions as follows:

- Q1. You ask whether the HMR allows for the actual test pressure to exceed two times the service pressure, as prescribed for a DOT-4D (see § 178.53(e)), DOT-4DA (see § 178.58(f)), and DOT-4DS (see § 178.47(f)), respectively.
- A1. The answer is yes. However, the actual test pressure must not exceed 110% of the minimum test pressure, with an allowance of +1%, per CGA C-1 Pamphlet (2016), Section 5.2.1. During the hydrostatic test, each specification requires a minimum test pressure of at least two (2) times the service pressure. It is discouraged to have the actual test pressure exceed the guidance provided in the CGA C-1 Pamphlet as it may cause an unsafe condition.
- Q2. You ask whether the HMR allows for the wall stress calculation to be based on two times the service pressure, including in cases where the test pressure exceeds two times service pressure.
- A2. The answer is yes. Wall stress calculations must be based on the minimum test pressure—which is defined as two (2) times the service pressure. This applies for DOT-4D, DOT-4DA, and DOT-4DS specifications.
- Q3. You ask whether the wall stress calculated at a test pressure which is greater than two times the service pressure may exceed the stress threshold, per §§ 178.47(f), 178.53(e), or 178.58(f), provided that the calculated stress at two times service pressure does not exceed the stated limits.
- A3. Wall stress must be calculated using a test pressure of two (2) times the service pressure for the DOT-4D, DOT-4DA, and DOT-4DS specifications.

CONCUR:
ROUTING PHH-11
INITIALS ECR
DATE 7/21/22
ROUTING PHH-11
INITIALS DDK
DATE 07/22/22
ROUTING PHH-22
INITIALS KWAC
DATE 2/2/23
ROUTING PHH-22
INITIALS CWF
DATE 2/3/23
ROUTING PHH-10
INITIALS MBN w/ edits
DATE 2/10/23
ROUTING PHH-40
INITIALS KM
DATE 2/28/23
ROUTING PHC-10
INITIALS AG BSB w/edits
DATE 3/27/202 3 3/30/23

Q4. Prior to performing the hydrostatic test, you ask whether the test can be performed at 90% of actual test pressure, including cases where the test pressure exceeds two times the service pressure.

A4. The answer is yes. For both the DOT-4DA and DOT-4DS specifications, the test can be performed at 90% of the minimum test pressure which is defined as two (2) times the service pressure.

For the DOT-4D specification, the test can be performed at 90% of the minimum test pressure which is two (2) times the service pressure (see § 178.53(h)(3)(ii)). For the lot test in § 178.53(h)(1)(iii), the test can be performed at 90% of the test pressure equal to three (3) times the service pressure (which exceeds two (2) times service pressure). However, if opting to use the latter performance standard, the remainder of the lot must be tested using a proof pressure method. Section 5.7 of the CGA C-1 Pamphlet provides further guidance on performing the 90% system check.

Q5. You ask whether the test pressure may be marked in addition to the markings required in § 178.35.

A5. The answer is yes. As specified in § 178.35(f)(6), other markings are authorized, provided they are made in low stress areas, other than the side wall, and are not of a size and depth that will create harmful stress concentrations. Such marks may not conflict with any DOT required markings. However, a test pressure marking that reflects a pressure higher than the minimum test pressure of two (2) times service pressure is discouraged as it may create confusion and an unsafe condition—especially when the cylinder is due for requalification in accordance with § 180.209.

I hope this information is helpful. Please contact us if we can be of further assistance.

Sincerely,

Dirk Der Kinderen
Chief, Standards Development Branch
Standards and Rulemaking Division



U.S. Department
of Transportation

**Pipeline and Hazardous
Materials Safety
Administration**

1200 New Jersey Avenue, SE
Washington, DC 20590

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- A1. The answer is yes. However, the actual test pressure must not exceed 110% of the minimum test pressure, with an allowance of +1%, per CGA C-1 Pamphlet (2016), Section 5.2.1. During the hydrostatic test, each specification requires a minimum test pressure of at least two (2) times the service pressure. It is discouraged to have the actual test pressure exceed the guidance provided in the CGA C-1 Pamphlet as it may cause an unsafe condition.
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- Q3. You ask whether the wall stress calculated at a test pressure which is greater than two times the service pressure may exceed the stress threshold, per §§ 178.47(f), 178.53(e), or

178.58(f), provided that the calculated stress at two times service pressure does not exceed the stated limits.

- A3. Wall stress must be calculated using a test pressure of two (2) times the service pressure for the DOT-4D, DOT-4DA, and DOT-4DS specifications.
- Q4. Prior to performing the hydrostatic test, you ask whether the test can be performed at 90% of actual test pressure, including cases where the test pressure exceeds two times the service pressure.
- A4. The answer is yes. For both the DOT-4DA and DOT-4DS specifications, the test can be performed at 90% of the minimum test pressure which is defined as two (2) times the service pressure.

For the DOT-4D specification, the test can be performed at 90% of the minimum test pressure which is two (2) times the service pressure (see § 178.53(h)(3)(ii)). For the lot test in § 178.53(h)(1)(iii), the test can be performed at 90% of the test pressure equal to three (3) times the service pressure (which exceeds two (2) times service pressure). However, if opting to use the latter performance standard, the remainder of the lot must be tested using a proof pressure method. Section 5.7 of the CGA C-1 Pamphlet provides further guidance on performing the 90% system check.

- Q5. You ask whether the test pressure may be marked in addition to the markings required in § 178.35.
- A5. The answer is yes. As specified in § 178.35(f)(6), other markings are authorized, provided they are made in low stress areas, other than the side wall, and are not of a size and depth that will create harmful stress concentrations. Such marks may not conflict with any DOT required markings. However, a test pressure marking that reflects a pressure higher than the minimum test pressure of two (2) times service pressure is discouraged as it may create confusion and an unsafe condition—especially when the cylinder is due for requalification in accordance with § 180.209.

I hope this information is helpful. Please contact us if we can be of further assistance.

Sincerely,

Camonn Patrick acting for

Dirk Der Kinderen
Chief, Standards Development Branch
Standards and Rulemaking Division

From: [INFOCNTR \(PHMSA\)](#)
To: [Dodd, Alice \(PHMSA\)](#); [Hazmat Interps](#)
Subject: FW: Interpretation of 49 CFR 178.47, 178.53 and 178.58
Date: Thursday, June 30, 2022 2:14:18 PM
Attachments: [178-4D-4DS-4DA service-test pressure.pdf](#)

Dear Alice,
Please see the forwarded message regarding an LOI request. Thank you.
Best,
Rachel Mangum (HMIC)

From: Fazio, Mark P Collins <Mark.Fazio@collins.com>
Sent: Wednesday, June 22, 2022 11:45 PM
To: INFOCNTR (PHMSA) <INFOCNTR.INFOCNTR@dot.gov>
Subject: Interpretation of 49 CFR 178.47, 178.53 and 178.58

CAUTION: This email originated from outside of the Department of Transportation (DOT). Do not click on links or open attachments unless you recognize the sender and know the content is safe.

To whom it may concern,
Please see the attached interpretation request.

Thank you,

**Mark Fazio | Chief Engineer, Kidde Fire Suppression
Sensors & Fire Protection Systems | Avionics
COLLINS AEROSPACE**
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June 22, 2022

Pipeline and Hazardous Materials Safety Administration
U.S. Department of Transportation, East Building
1200 New Jersey Avenue, SE
Washington, D.C. 20590-0001

Attention: Interpretations

Subject: 4D, 4DS and 4DA service and test pressures

Dear Sir/Madam:

Kidde Technologies, KDBA Kidde Aerospace & Defense (KAD), a long time manufacturer of pressure vessels used for aircraft and military vehicle fire extinguishing, is requesting interpretation of 49 CFR 178.35(F), 178.47(F, I, J), 178.53(E, H), and 178.58(F, I). Specifically, Kidde seeks confirmation of the following:

- 1) Test pressure may exceed 2x service pressure.
- 2) Wall thickness stress calculation is based on 2x service pressure, including in cases where the test pressure exceeds 2x service pressure.
- 3) The wall stress calculated at a test pressure greater than 2x service pressure may exceed the stress threshold per 178.47(F), 178.53(E) or 178.58(F), provided the calculated stress at 2x service pressure does not exceed the stated limits.
- 4) Processing prior to hydrotesting may be performed at up to 90% of actual test pressure, including in cases where the test pressure exceeds 2x service pressure.
- 5) The actual test pressure may be marked on a low stress attachment as "TP xxxx" including in cases where the test pressure exceeds 2x service pressure.

As an example, please consider a 4D pressure vessel made from 4130 steel with a service pressure of 500 psi. Per the above interpretation it is then acceptable to perform the wall stress calculation at 1000 psi. A test pressure of 1500 psi can be used in the manufacture with a pressure process prior to hydrostatic test not to exceed 1350 psi (1500 x .9). The wall stress at 1500 psi may exceed 37,000 psi as long as the wall stress at 1000 psi (2x 500 psi service pressure) does not exceed 37,000 psi. Finally, the test pressure may be marked in addition to the markings per 49 CFR 178.35.

Please advise if the above interpretation and example are correct.

Thank you,

Mark Fazzio