



U.S. Department  
of Transportation

1200 New Jersey Avenue SE  
Washington, DC 20590

**Pipeline and Hazardous  
Materials Safety  
Administration**

JUN 13 2011

Mr. Steve Gentry  
Worthington Cylinders  
1085 Dearborn Drive  
Columbia, Ohio 43085

Reference No.: 11-0117

Dear Mr. Gentry:

This responds to your May 12, 2011 letter requesting clarification of the Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180) applicable to the internal capacity limits and pressure relief devices (PRD) required for Specification Department of Transportation (DOT) 39 cylinders intended to contain a Division 2.1 liquefied compressed gas.

Specifically, in your letter, you state that you plan to ship a Division 2.1 liquefied compressed gas, HFO-1234yf, that you have classified as "UN3161, Liquefied gas, flammable, n.o.s. (2,3,3,3-Tetrafluoroprop-1-ene)" in a specification DOT 39 cylinder. We have paraphrased your questions and answered them below.

Q1: Can HFO-1234yf be packaged in specification DOT 39 cylinders of any volume capacity as long as the service pressure and test pressure of the cylinder are in accordance with the applicable specifications?

A1: HFO-1234yf may be packaged in specification DOT 39 cylinders; however, there are limits on the volume capacity of these cylinders. As previously stated in a letter of interpretation, Ref. No. 11-0052 (see attached letter), the filling requirements for liquefied compressed gases in DOT specification cylinders are based on the type of gas contained in the cylinder and are found in § 173.304a of the HMR. In addition, § 173.304a(a)(2) provides a table listing various types of liquefied gases and their corresponding maximum permitted filling densities. Based on your incoming letter, the material you wish to ship is not specifically listed in the table in this section. For gases not specifically listed in the table in § 173.304a(a)(2), the filling density can be determined using the formula provided in "Note 1" to that Table. Therefore, the filling density for any cylinder containing your material, including a specification DOT 39 cylinder, can be determined by calculating the percent ratio of the weight of the gas in the packaging to the weight of the water the container will hold at 16 °C (60 °F).

Please note that, in accordance with § 178.65, cylinders built to meet a DOT 39 specification may not have a maximum water capacity that exceeds 55 pounds (1,526 cubic inches) for cylinders with service pressure of 500 p.s.i.g. or less, and 10 pounds (277 cubic inches) for cylinders with service pressure in excess of 500 p.s.i.g.

Q2: If HFO-1234yf can be packaged in specification DOT 39 cylinders, what PRD should be used?

A2: As stated in A1, HFO-1234yf may be packaged in specification DOT 39 cylinders provided certain filling requirements are met. In addition, in accordance with § 173.301(f)(4), a PRD is required on a specification DOT 39 cylinder regardless of cylinder size or filled pressure. A specification DOT 39 cylinder used for liquefied Division 2.1 materials must be equipped with a metal PRD. Fusible PRDs are not authorized on specification DOT 39 cylinders containing liquefied gas. Furthermore, in accordance with § 173.301(f)(1), a specification DOT 39 cylinder filled with HFO-1234yf would need to comply with the requirements specified in CGA Publication S-1.1. As you stated in your incoming letter, CGA Publication S-1.1 does not specifically identify your commodity. CGA Publication S-1.1 does, however, mandate a CG-7 PRD for other similar liquefied compressed gases and it is the opinion of this Office that cylinders containing HFO-1234yf must be fitted with a CG-7 PRD.

I hope this satisfies your inquiry. Please contact us if we can be of further assistance.

Sincerely,

A handwritten signature in black ink, appearing to read "T. Glenn Foster", with a long, sweeping underline.

T. Glenn Foster  
Chief, Regulatory Review and Reinvention Branch  
Standards and Rulemaking Division

Benedict  
§ 173.304a  
§ 178.65  
Cylinders  
11-0117



**WORTHINGTON**  
CYLINDERS

A Worthington Industries Company

May 12, 2011

Office of Hazardous Materials Standards  
Pipeline and Hazardous Materials Safety Administration  
PHH-10  
U.S. Department of Transportation  
East Building  
1200 New Jersey Avenue, SE  
Washington, DC 20590-0001

Dear Madam or Sir:

In accordance with 49 CFR 105.20, Worthington Cylinder Corporation is requesting an interpretation of the requirements for packaging and shipping HFO-1234yf (a liquefied flammable material, red diamond, 2.1 material) in Specification 39 (49 CFR 178.65) cylinders as defined in 49 CFR 173.304a (see **Attachment 1** for MSDS). I have reviewed the interpretations on the PHMSA website and could not locate anything that directly answers my questions.

|                   |  |
|-------------------|--|
| <b>Name:</b>      | Steven T. Gentry   |
| <b>Position:</b>  | Regulatory Affairs Manager   |
| <b>Company:</b>   | Worthington Cylinder Corporation   |
| <b>Address:</b>   | 1085 Dearborn Drive<br>Columbus, Ohio 43085  |
| <b>Telephone:</b> | 614-438-3057   |
| <b>Fax:</b>       | 614-840-4830   |
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**Question #1:** Can HFO-1234yf be packaged in Specification 39 cylinders of any volume capacity as long as the service pressure and test pressure of the cylinder are in accordance with the applicable Specifications?

**Worthington Interpretation:** In 2001 DOT started the consolidation and rewriting of 49 CFR. This was when 173.304 was renumbered to 173.304 and 173.304a. A Note was removed from the Table of 173.304 that stated the following . . . **Note 9. When used for the shipment of flammable gases, the internal volume of a Specification 39 cylinder must not exceed 75 cubic inches** (see **Attachments 2 and 3** of 49 CFR from 2001 and 2002).

49 CFR 173.304a is titled "Charging of cylinders with liquefied compressed gas". Therefore, removal of Note 9 from the Table and no further prohibitions in 173.304a would permit HFO-1234yf to be packaged and transported in Specification 39 cylinders of any capacity.

**Does DOT confirm the interpretation of Worthington?**

**Question #2:** If DOT confirms that HFO-1234yf can be packaged in Specification 39 cylinders as defined in Question #1, what pressure relief device should be used?

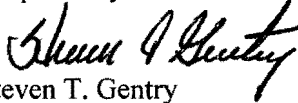
**Worthington Interpretation:** The general cylinder requirements noted in 49 CFR 178.35 defaults to 49 CFR 173.301(f) for the requirements of the pressure relief device. Basically, 173.301(f) tells the user to follow CGA Publication S-1.1 and that the pressure relief device shall be capable of preventing rupture of the normally filled cylinder when subjected to a fire test conducted in accordance with CGA Publication C-14. Therefore, the device selection and set pressure of the pressure relief device on a Specification 39 cylinder charged with HFO-1234yf would need to comply with the requirements of CGA Publication S-1.1.

Table 3 of CGA Publication S-1.1 doesn't not specifically identify the commodity HFO-1234yf. Since CGA Publication S-1.1 mandates a CG-7 for other liquefied flammable gases (i.e. butane, propane, propylene), Worthington would conclude that the CG-7 device would be the device selected by DOT for the commodity HFO-1234yf.

**Does DOT confirm the interpretation of Worthington?**

Thank you for your assistance in this matter. If I can be of any further assistance, please contact me at 614-438-3057 or e-mail at [steve.gentry@worthingtonindustries.com](mailto:steve.gentry@worthingtonindustries.com).

Respectfully Submitted:



Steven T. Gentry  
Regulatory Affairs Manager  
Worthington Cylinder Corporation

Attachments