



U.S. Department
of Transportation

**Pipeline and Hazardous
Materials Safety
Administration**

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

MAY 07 2012

Mr. Charles E. Tudor, CP-P/MH
12419 Entiat River Road
Entiat, WA 98822

Reference No.: 12-0038

Dear Mr. Tudor:

This responds to your January 23, 2012 letter requesting clarification of the Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180) applicable to the packaging of nitrous oxide in non-specification cylinders. In your incoming letter, you describe a scenario in which your client intends to ship 7.5 grams of nitrous oxide in a 10-ml non-specification cylinder via air and vessel internationally. These nitrous oxide non-specification cylinders are to be used in medical devices. Based on this scenario, your questions are paraphrased and answered as follows:

- Q1. Is nitrous oxide permitted to be transported in 10-ml non-specification cylinders for domestic and international air transport?
- A1. The answer is no. The Column 7 entry in the Hazardous Materials Table (HMT; § 172.101) for “UN 1070, Nitrous Oxide” lists Special Provision A14. Special Provision A14 states that nitrous oxide is not authorized to be transported as a limited quantity in accordance with § 173.306 when transported by aircraft. Therefore, nitrous oxide, when transported by air, must comply with the requirements specified in either §§ 173.304, 173.314, or 173.315. Specifically, § 173.304(f) provides the authorized specification cylinders permitted, filling requirements, and outer packaging requirements for the air transport of oxidizers, including nitrous oxide. Nitrous oxide would only be permitted to be shipped by aircraft in a non-specification cylinder if the shipment utilized a special permit. It should be noted that nitrous oxide transported by highway, rail or vessel meeting the limited quantities for compressed gas requirements specified in § 173.306 may be transported in non-specification cylinders.
- Q2. If nitrous oxide is permitted to be transported in 10-ml non-specification cylinders for domestic and international air transport, what filling limits should be used?
- A2. As noted above, nitrous oxide is not permitted to be shipped in 10-ml non-specification cylinders by air unless a special permit is issued providing relief from the requirements of the HMR. Furthermore, as specified in the table in § 173.304a(a)(2), nitrous oxide has a maximum filling density of 68% when transported in accordance with the HMR. Shipments transported under the

International Civil Aviation Organization's Technical Instructions (ICAO TI) must comply with the filling limits listed in packing instruction (PI) 200.

- Q3. Does USG 18 and § 173.304(f) apply to air shipments of nitrous oxide?
- A3. The answer is yes. For air shipments of nitrous oxide transported in the United States, both USG 18 and § 173.304(f) would apply.
- Q4. Does PHMSA require fire-resistant outer packaging on vessel shipments of oxidizers, specifically nitrous oxide?
- A4. The answer is no. The requirements in § 173.304(f)(3) requiring a rigid fire-resistant outer packaging are specific to air shipments of oxidizing gases. There is no analogous requirement for vessel transport.
- Q5. Should 10-ml nitrous oxide non-specification cylinders be treated as "articles" and be packaged in accordance with PI 003 as indicated by the International Maritime Dangerous Goods (IMDG) code?
- A5. In accordance with § 173.22 and Chapter 2 of the IMDG code, it is the shipper's responsibility to properly class and describe a hazardous material. This Office does not perform that function. However, it is the opinion of this Office that, the scenario you describe, "UN 1070, Nitrous Oxide" is the most appropriate proper shipping description. Furthermore, under the IMDG code "UN 1070, Nitrous Oxide" should be packaged in accordance with PI 200.
- Q6. If the 10-ml nitrous oxide non-specification cylinders are to be treated as "articles" are they required to be packaged in combination packagings that have been UN performance tested?
- A6. As stated in A5, it is the opinion of this Office that in the scenario you describe "UN 1070, Nitrous Oxide" is the most appropriate proper shipping description. Therefore, for vessel transport under the HMR, the nitrous oxide could be packaged in accordance with §§ 173.304, 173.306, 173.314, or 173.315. Under the IMDG code, nitrous oxide should be packaged in accordance with PI 200.
- Q7. Is there an existing special permit covering the nitrous oxide cartridges described above?

A7. PHMSA's Approvals and Permits Division has issued special permits authorizing the use of non-specification cylinders for the air transport of nitrous oxide under specific transport conditions and after a technical review of the non-specification cylinder. Based on the schematic drawing you provided in your incoming letter, it does not appear as if your non-specification cylinder has been issued a special permit. Under § 107.105, you may apply for your own special permit that authorizes air shipment of nitrous oxide in non-specification cylinders. You may contact our Approvals and Permits Division at (202) 366-4535 for more information.

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

Sincerely,

A handwritten signature in cursive script that reads "T. Glenn Foster". The signature is written in black ink and is positioned to the left of the typed name.

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

Benedict
§ 173.304
§ 173.306
Cylinders
12-0038

Office of Hazardous Materials Standards, PHMSA
Attn: PHH-10
US Department of Transportation, East Building
1200 New Jersey Avenue, SE.
Washington DC 20590-0001

Attn: Charles Betts, Division Director

Greetings:

My specific questions relate to the shipment of nitrous oxide in cartridges, in particular cartridges that are small non-spec cylinders--the same as commonly used for CO2 for a myriad of consumer applications.

My client wishes to ship 8 ml cartridges internationally as a consumable that is used in a medical device they are developing. The filling limit is 0.75 as per the table in ICAO/IATA (higher than the 0.68 permitted in the CFR at 173.304 table of filling limits). Cartridges of nitrous oxide are in common consumer use as blowing agents for home dispensers of whipped cream, possibly of foreign origin. My client needs the ability to ship the cartridges world wide by air and vessel. They desire to package them in relatively small quantities for distribution to doctors.

Question 1. Can these cartridges containing nitrous oxide be offered for domestic/international air transport? If so, can they be filled based on the filling limits table in ICAO and IMDG? Or are they limited to low pressures of aerosols? (See discussion)

Question 2. If they can ship by air does USG 18 apply (173.304(f)) to these cartridges?

Question 3. Has PHMSA imposed fire resistant outer packaging on vessel shipment of oxidizers? Or more specifically, for cylinders of nitrous oxide?

Question 4. Are these cartridges to be treated as "articles" as is indicated by the IMDG Code use of PI 003 instead of P200?

Question 5. If they are articles in combination packaging, are they required to be UN performance tested? Note that the IMDG Code PI 003 does not require UN performance testing. This could result in a miss match for import/export if this were to be used.

Question 6. Is there an existing special permit covering these N2O cartridges?

The IMDG Code entry references PI P003. Column 17 of the Table suggests that this entry is for mixtures of propane and butane used in camping stoves. This type of cartridge is low pressure and not what we have here. P003 treats cartridges as “articles”, whereas the CFR and ICAO/IATA is rather silent on this.

None of the modal regulations define “Receptacles, small containing gas (gas cartridges)”. The common everyday CO2 cartridge has been around for nearly a hundred years. Its use for other gases is common (I know they are used for helium in addition to nitrous oxide.) It is interesting that the regulations do not specifically recognize these cartridges as a standard package form.

Further investigation turned up an interesting special permit SP-7951 that has been in existence for a long time. A specific aerosol can with this permit mark is Land-O-Lakes brand 16 oz., whipped heavy cream by Land-O-Lakes, Inc., distributed by WhiteWave Foods, Broomfield, CO. and purchased at a Costco. The can lists nitrous oxide as the propellant. The permit (issued to ConAgra, Inc.) doesn’t mention nitrous oxide and lists authorized shipping names as Compressed gas n.o.s. and Consumer Commodity. The permit also authorizes shipment by cargo and passenger air without mention of DOT 31FP outer packaging which would seem inconsistent with provisions of the regulations not covered by the permit. This permit has nothing to do with cartridges per se. I have not found a permit that does apply to nitrous oxide cartridges.

I have been reading these regulations for 40 years but never had to deal with these critters. So, have I missed something or are the regulations a bit vague on this subject?

I look forward to your prompt response.

Sincerely,



Charles E. Tudor, CP-P/MH
HM Packaging Compliance Consultant
12419 Entiat River Road
Entiat, WA 98822

Ph.: 509 784 0264

Email: cetudor4143@gmail.com

Attachment (2)

DISCUSSION:

As I read the regulations for Nitrous oxide, UN 1070 a 2.2 gas with a sub risk of 5.1:

“Excepted Quantity” provisions do not apply to air or vessel transport due to sub-risk.

Limited Quantity provisions for UN 1070 in the CFR apply only to surface transport. (See Special Provision A14 in the Table.) For domestic surface transport it appears that 173.306(a)(1) would permit shipment as Limited Quantity, but the water is muddied by 173.306(j) which limits pressure in small receptacles to 970 kPa (141psi) and “containing no HM other than a Division 2.2 gas”. Does the sub-risk 5.1 represent “another HM”?? Nitrous oxide is shipped at much higher pressure requiring 1800 psi rated cylinders.

173.304(f) specifically addresses nitrous oxide in air shipment and requires spec cylinders with relief devices and a UN performance tested (PG I, II) fire/heat resistant overpack (DOT 31FP). Non-spec cartridges or articles are not discussed.

There is no Limited Quantity provision for UN 1070 in ICAO/IATA. PI 200 specifically requires cylinders other than UN marked cylinders to meet the requirements of the national authority of the State where they are approved and filled. (How does one know if there are no marks on them?) PI 200 also requires cylinders of nitrous oxide to have relief devices so if these cartridges are “cylinders” by definition (this is not clear) then they cannot be shipped under this regulation (unless approved by you—the competent authority). If they can be considered cylinders then USG 18 requiring the fire resistant overpack would apparently apply. The only discussion of cartridges specifically in PI 200 is imposing the hot water bath in Section 6.4.4.1. Apparently pressure is not an issue.

There is no Limited Quantity provision in the IMDG Code for UN 1070. P200(1) again specifically requires pressure relief devices and does not discuss non-refillable cartridges.

Looking further—

Considering the PSN “Receptacles, small, containing gas or Gas cartridges (*oxidizing without a release device, not refillable and not exceeding 1L capacity*), UN2037:

This description very much describes the shipment. But....

The CFR again references 173.304 / .306 and SP A14—back to square one—are cartridges limited to 970 kPa or can they be filled to 0.68/0.75 density per the table??

ICAO/IATA references PI 203 and SP A167 (which invokes the 6.4.4 hot water bath). PI 203 addresses aerosols and gas cartridges but appears to limit the max pressure at 55°C to 1500 kPa (217 psi). This doesn’t fit for nitrous oxide.

Component Specification

Document Number: 10072

Nitrous Oxide Cylinder, 8 gram

Revision: D

7.5 GRAMS N2O / 10 ml
FOOD GRADE - CRIMPED CLOSURE

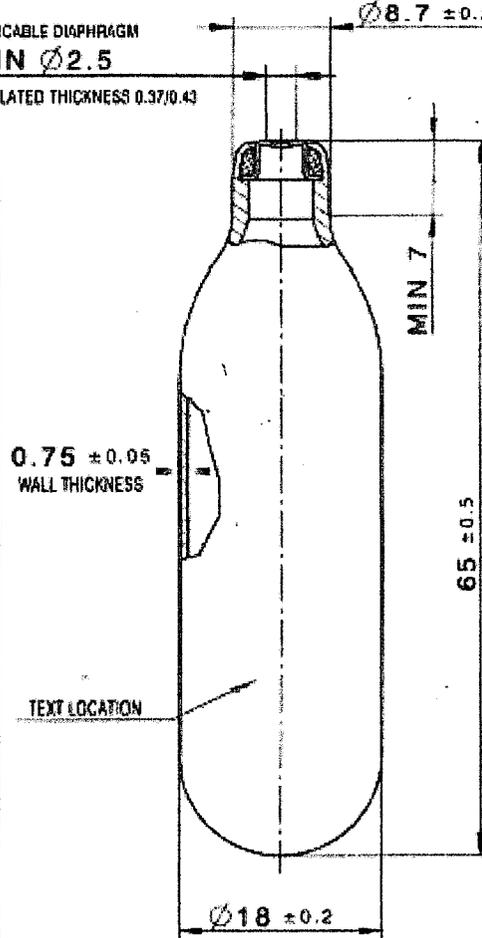
ARTICLE No. 0173

PIERCABLE DIAPHRAGM
MIN $\varnothing 2.5$
UNPLATED THICKNESS 0.37/0.43

$\varnothing 8.7 \pm 0.2$

10ml = 0.618 in³

MASS OF GAS GASMASSE MASSE DE REMPLISSAGE	7.5 ± 0.25g N2O
WATER CAPACITY VOLUMEN VOLUME	10.3ml MIN
FILLING DENSITY FÜLLDICHTE DENSITE DE REMPLISSAGE	0.75kg/l MAX
TEST PRESSURE = PRESSURE OF CONTENTS AT PRÜFDRUCK = INNENDRUCK BEI PRESSION DE CONTROLE = PRESSION INTERNE A	65 ± 5°C
BURST PRESSURE OF CYLINDER BERSTDRUCK DES ZYLINDERS PRESSION D'ECLATEMENT DE LA BOUTEILLE	50MPa MIN
CAP PIERCING FORCE (ISI SPEC VIA.P.001.X) KAPPENANSTECKKRAFT FORCE DE PERCUSSION	450N MAX
CAP PIERCING WORK (ISI SPEC VIA.P.001.X) ARBEIT BEIM DURCHSTECHEM DER KAPPE TRAVAIL POUR LA PERFORATION DU CAPUCHON	0.75Nm MAX
SURFACE TREATMENT OBERFLÄCHENBEHANDLUNG TRAITEMENT DE SURFACE	IN ACCORDANCE WITH pink laquered
PARTS LIST	
CYLINDER MATERIAL	W-No.1.0338 EN 10139 DC04
UNFILLED CYLINDER	0144
CAP MATERIAL	W-No.1.0338 EN 10139 DC03
CAP	0291
WASHER	0269
N2O-(ISI SPEC 0193, E942)-99,0% PURITY N2O V/V	
NOTES	
1. INTERNAL SURFACE SHALL BE CLEAN, DRY AND FREE OF RUST AND/OR LOOSE PARTICLES	
2. STORAGE TEMPERATURE LIMIT: MAX +50°C	



				GmbH AN IS- GROUP COMPANY	SUPPLIER SCHNEIDERSTRASSE 4 A-1210 VIENNA AUSTRIA	ALL DRAWING DIMENSIONS IN mm	SCALE
						DRAWING STD. ISO 2768 mK	2:1
				TITLE 8 g N2O / 10 ml CRIMPED CLOSURE 8 g N2O / 10 ml ZYLINDER MIT BÖRDELKAPPE BOUTEILLE DE 8 g N2O / 10 ml A CAPUCHON SERTI			
01	02-07-10	n. Drg.	KPR	Whoas products are the subject of patent protection in AUSTRIA, EUROPE and principal countries of the world. This drawing and all information or descriptive matter set out therein are confidential and copyright and must not be disclosed, loaned, copied or used for manufacturing, tendering or other purposes without the prior and written consent of the owners.			
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