U.S. Department
of Transportation

**Pipeline and Hazardous
Materials Safety
Administration**

1200 New Jersey Avenue, SE
Washington, DC 20590

JUN 15 2018

Mr. John Freiler
Engineering Manager
Truck Trailer Manufacturing Association
7001 Heritage Village Plaza, Suite 220
Gainesville, VA 20155

Reference No. 17-0065

Dear Mr. Freiler:

This letter is in response to your July 6, 2017, letter requesting clarification of the Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180) applicable to the installation of U.S. Department of Transportation (DOT) 400-series cargo tank vents on Motor Carrier (MC) 300-series cargo tank motor vehicles (CTMV). Specifically, you include in your letter two scenarios and enclose guidance documents and a technical bulletin from your organization; one driver/vehicle examination report; and a clarification letter on this topic issued by the Research and Special Programs Administration, the predecessor agency of the Pipeline and Hazardous Materials Safety Administration (PHMSA).

We have paraphrased and answered your questions as follows:

Scenario 1:

An MC 307 CTMV fitted with a 30-pounds per square inch gauge (psig) pressure relief device (PRD) has a set discharge pressure of 30 psig (or maximum allowable working pressure (MAWP)) to 33 psig (110% of MAWP); see superseded §§ 178.342-4(c) and 180.407(j)(1)(ii)(A). However, per the requirements in § 180.407(j)(1)(ii)(B), a vent upgraded to conform to DOT 407 specifications on a 30 psig MAWP CTMV would be required to open between 36 psig (120% of MAWP) to 39.6 psig (132% of MAWP); see §§ 178.347-4(c) and 178.345-10(d)(1).

Q1. Based on Scenario 1, when upgrading an MC 307 CTMV PRD to a DOT 407 CTMV PRD, is the correct set-to-open pressure 120–132% of MAWP?

A1. An MC 307 PRD modified to conform to DOT 407 specifications on a 30 psig MAWP CTMV would be required to open between 36 psig (120% of MAWP) and 39.6 psig (132% of MAWP), as prescribed in §§ 180.407(j)(1)(ii)(B), 178-347-4(c), and 178.345-10(d)(1).

Scenario 2:

An MC 307 CTMV with a 30 psig MAWP originally had a PRD flow rated at 130% or 39 psig. The original MC 307 design specification limited the flow to 130% per superseded § 178.342-4(b). In this case, the upgraded PRD would flow at 150% per the test pressure requirements prescribed in § 178.347-5; it would negate the requirement in paragraph (b) of superseded § 178.342-4 and conform to the PRD requirements stated in § 178.345-10.

Q2. Based on Scenario 2, when upgrading an MC 307 CTMV PRD to a DOT 407 CTMV PRD, is the correct **flow pressure** equal to the CTMV's test pressure?

A2. As prescribed in § 178.345-10(e), a DOT 400-series CTMV's flow rating is determined at a pressure **not exceeding** the CTMV's test pressure. Per § 178.347-5(b), the test pressure of a DOT 407 CTMV must be the greater of 40 psig or 1.5 times (150%) its MAWP. Thus, the flow pressure for Scenario 2 must be no more than 45 psig, provided the minimum venting capacity is met.

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

Sincerely,

T. Glenn Foster

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

Stevens
§180.405(c)(2)(iv)
Cargo Tanks
17-0065

TTMA
TRUCK TRAILER Manufacturers Association
TTMAnet.org Since 1941

Tank Conference

Jeffrey M. Sims • President
7001 Heritage Village Plaza • Suite 220 • Gainesville, VA 20155 • 703-549-3010

July 6, 2017

U.S.DOT
PHMSA-Office of Hazardous Materials Standards
Attn: PHH-10
East Building
1200 New Jersey Ave, SE
Washington, DC 20590

Phmsa.hm-infocenter@dot.gov

Subject: Request for Interpretation – Venting Upgrades

Dear Sirs,

We are requesting formal interpretation of the provisions to upgrade venting as provided for under sections 180.405(c)(2)(iv) and 173.33(d)(3) of title 49 CFR especially in light of a recent citation issued to Harnett Trucking (copy attached).

In that case, a specification MC-307 cargo tank with upgraded vents meeting the DOT 407 requirements was cited for not meeting 178.343-4 and 180.405(c). The violation claims that the tank failed the inspection due to the inclusion of a DOT 407 vent on an MC-307 cargo tank. This specific tank was manufactured with MC-307 specification required reclosing and fusible vents, and was upgraded post construction. However, many tanks built during the early '90s were constructed as MC-307 or 312 cargo tanks with vents upgraded to DOT 407 or 412 vents similar to this tank as provided for in the HMR:

> 180.405(c)(2) A cargo tank of a specification listed in paragraph (c)(1) of this section may have its pressure relief devices and outlets modified as follows:
>
> ...
>
> (iv) A Specification MC 307 cargo tank, to conform with a Specification DOT 407 cargo tank (See §§178.347-4 and 178.345-11 of this subchapter).

And

> 173.33(d)(3) A cargo tank motor vehicle made to a specification listed in column 1 may have pressure relief devices or outlets conforming to the applicable specification to which the tank was constructed, or the pressure relief devices or outlets may be modified to meet the applicable requirement for the specification listed in column 2 without changing the markings on the tank specification plate. The venting capacity requirements of the original DOT cargo tank specification must be met whenever a pressure relief valve is modified.

Column 1	Column 2
MC 307	DOT 407.

It has been standard industry practice to apply upgraded venting when the opportunity presents, as the new venting was seen to be safer as it banned non-reclosing devices such as fusible caps or rupture discs except when under a reclosing pressure relief device, and provided for greater product retention in an overturn due to the higher set pressures. When the caution in 173.33(d)(3), "*The venting capacity requirements of the original DOT cargo tank specification must be met whenever a pressure relief valve is modified*" is brought up, stakeholders relied on the 1996 letter of interpretation signed by Hattie Mitchell stating that the caution is not intended to prevent upgrades that are flow rated according to the DOT 400 specification, i.e., vents that achieve their flow rate only at the tank test pressure rather than the 130% of MAWP. The caution is there to require that flow rates be checked carefully against the requirements anytime the pressure relief devices are modified.

That letter referenced 180.405(h)(3) which says:

> As provided in paragraph (c)(2) of this section, the owner of a cargo tank may elect to modify reclosing pressure relief devices to more recent cargo tank specifications. However, replacement devices constructed to the requirements of §178.345-10 of this subchapter must provide the minimum venting capacity required by the original specification to which the cargo tank was designed and constructed.

Given the similarity in language between the caveat here and the language in 173.33(d)(3) stakeholders have understood that the flow rates of vents that have been upgraded is to be determined as required for the new specification: i.e. at tank test pressure per 178.345-10.

Additionally, PHMSA recently added 180.407(j), *Pressure Vent Bench Test*, to make the opening pressures for vents clearer. For an MC-307 tank with vents upgraded to DOT 407 the code requires that the vents be set "according to the pressures set forth for a DOT 407 cargo tank in §178.347-4 of this subchapter." See 180.407(j)(1)(ii)(B). §178.347-4 requires that pressure vents be set in accordance with §178.345-10(d), which states:

> (d) *Settings of pressure relief system.* The set pressure of the pressure relief system is the pressure at which it starts to open, allowing discharge.
>
> (1) *Primary pressure relief system.* The set pressure of each primary relief valve must be no less than 120 percent of the MAWP, and no more than 132 percent of the MAWP. The valve must reclose at not less than 108 percent of the MAWP and remain closed at lower pressures.

It's clear that when a MC-307 cargo tank has its pressure relief devices upgraded, the HMR requires that they will conform in all ways to the upgraded specification. That is, it is set and flow rated according to the DOT 407 specifications at the cargo tanks test pressure and the original specification is consulted only to determine the required flow rate for the cargo tanks surface area at to be in compliance.

- We believe that this citation, if allowed to stand, will create a safety risk for these tanks with upgraded venting. The upgraded vents are better performing and the prohibition against non-reclosing vents and higher set pressures means that retention of the hazardous commodity being transported is maximized. The consequences of allowing this citation to stand is to essentially outlaw upgrades: carriers will change back to MC-307 vents and fusible caps and lose the safety gains with the newer DOT 407 venting. Additionally, MC-307 cargo tanks with vent upgraded to DOT 407 specifications venting has been the industry norm for about 25 years without a reported incident caused by the use of these upgraded vents; a change now would be a tremendous waste of resources, causing confusion and the possibility of worker injury or mistaken vents being placed during the unnecessary and unwarranted change.

Background on the addition of the provision in 173.33(d)(3) requiring "The venting capacity requirements of the original DOT cargo tank specification must be met whenever a pressure relief valve is modified":

This provision was added to the code in response to comments made at public meetings that I attended. At those meetings, there was much concern expressed by vent makers in regard to the so-called "Smart Vent" or "Dual Function" requirements {the reduced leakage during surge requirements laid out in §178.345-10 (b)(3) }. Betts Industries, a leading Manufacturer of vents for MC-306 cargo tanks had developed a style of vent for the DOT 406 requirements that would leak less than one gallon during surge (the proposed requirement at that time), but those vents had a reduced capacity *at the set and flow rate pressures for a DOT 406 cargo tank* when compared to the vents currently in service on MC-306 tanks. It was felt that a potential safety hazard existed wherein a MC-306 cargo tank operator could replace his existing vents one for one with the new smart vents, not realizing that their capacity *as measured at the DOT 406 pressures* would be lower in terms of SCFH than that cargo tank originally required. This lead to the following entry in the Federal Register Vol. 59, No. 212, Thursday, November 3, 1994, pg. 55163 & 55169:

Page: 55163:
Section 173.33

Consistent with the changes made in § 180.405(h) in this final rule, a new sentence is added to paragraph (d) stating that the venting requirements of the original DOT cargo tank specification must be met whenever a pressure relief valve is modified to a more recent specification. See preamble discussion for § 180.405(h).

Page: 55169:
Section 180.405

...

Paragraph (h) specifies that replacement for any pressure replacement for any reclosing pressure relief valve must be capable of re-seating to a leak-tight condition after a pressure surge. Section 180.405(c) authorizes modifying the reclosing pressure relief valves of an MC 306 cargo tank by installing the dual function pressure relief valves which are required for DOT406 cargo tank motor vehicles. Commentators pointed out that this replacement could result in an MC 306 cargo tank having lower emergency venting capacity than its specification requires: because it is difficult to produce a valve that achieves the comparatively high flow rates of the MC 306 units, withstands the pressure surges specified in the DOT 406 specification, and recloses with minimal loss of lading. A reduced flow capacity is less likely to be encountered in fitting and MC 307 with a DOT 407 valve replacement, and in fitting an MC 312 with a DOT 412 valve replacement, because of the larger pressure differentials which are commonly used in these cargo tanks. Regardless of the equipment installed, the venting requirements specified in the particular cargo tank specification must be met whenever a pressure relief valve is replaced. ...

Q1. When upgrading an MC-307 cargo tank's pressure relief device to a DOT 407 pressure relief device, is the correct set to open pressure 120% to 132% of MAWP?

For example, an MC-307 30psig pressure relief device has an allowable set to discharge pressure of 30psig (or MAWP) to 33psig (110% of MAWP); see §178.342-4 (c) and §180.407(j)(1)(ii)(A). However, per the requirements in §180.407(j)(1)(ii)(B), a vent upgraded to conform with DOT 407 specs on a 30psi MAWP cargo tank would be required to open between 36psig (120% of MAWP) to 39.6psig (132% of MAWP); see §§178.347-4(c) & 178.345-10(d)(1).

Q2. When upgrading an MC-307 cargo tank's pressure relief device to a DOT 407 pressure relief device, is the correct FLOW PRESSURE equal to the tank's test pressure?

For example, an MC-307 tank with a 30psig MAWP normally has a pressure relief device flow rated at 130% or 39psig. The original design regulation specification limited the flow to 130% per §178.342-4 (b). So, in this case, the upgraded pressure relief vent would flow at 150% per the test pressure requirements stated in §178.347-5. It would negate the requirement in section (b) of §178.342-4 and conform to pressure relief requirements stated in §178.345-10.

We understand that PHMSA and the industry share the position that safety is enhanced with upgraded vents. We hope we can continue this cohesiveness and further hope that an expeditious clarification will prevent needless wasted efforts and the degradation to safety and risks to workers with needless vent replacements.

If you have any questions at all, please feel free to contact me.

Sincerely,

John Freiler

John Freiler
Engineering Manager

cc Glenn Foster, Chief, Regulatory Review and Reinvention
Stan Staniszewski

Encl. Background on 173.33(d)(3)
1996 Hattie Mitchell Letter
Harnett Trucking citation and supporting photos.
TTMA Position paper on Venting Upgrades
TB 126 Bench Testing Pressure Relief Devices

interp

INTERPRETATION

U.S. Department of Transportation
Research and Special Programs Administration

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

Ref. No. 96-1094

JUN 10 1996

Mr. John Freiler
Senior Project Engineer
Girard Equipment, Inc.
P O Box 302-B
Rahway, NJ 07065

Dear Mr. Freiler:

This is in response to your letter requesting clarification of the pressure relief requirements specified in 49 CFR 173.33(d). Specifically, you asked if § 173.33(d)(3) prohibits upgrading vents on MC 307 and MC 312 cargo tanks to DOT 407 and DOT 412 vents that are flow rated in accordance with § 178.345-10. I apologize for the delay in responding and regret any inconvenience it may have caused.

The answer is no. Section 173.33(d)(3) provides that pressure relief devices or outlets on a specification cargo tank motor vehicle listed in column 1 may be modified to meet the applicable requirements for the specification listed in column 2. However, replacement devices constructed to the requirements of § 178.345-10 must provide the minimum venting capacity required by the original specification to which the cargo tank was designed and constructed. See § 180.405(h)(3).

I trust this satisfies your inquiry.

Sincerely,

Hattie L. Mitchell

Hattie L. Mitchell, Chief
Exemptions and Regulations Termination
Office of Hazardous Materials Standards

173.33(d)

961094

DRIVER/VEHICLE EXAMINATION REPORT

Aspen 3.0.0.17

Federal Motor Carrier Safety Administration
Illinois Division
3250 Executive Park Drive
Springfield, IL 62703
Fax 217-492-4986

Report Number: US1459000551
Inspection Date: 05/16/2017
Start: 02:24 PM CT **End:** 3:26:14 PM CT
Inspection Level: I - Full
HM Inspection Type: Bulk

L T HARNETT TRUCKING INC
7431 STATE ROUTE 7
KINSMAN, OH 44428
USDOT#: 00239562 **Phone#:** (330)876-2701
MC/MX#: 170992 **Fax#:**
State#:

Driver: STILTNER, JIMMY R
License#: RU636599 **State:** OH
Date of Birth: 03/27/1944
CoDriver:
License#: **State:**
Date of Birth:

Location: MARSHALL SCALES **MilePost:** 151 **Shipper:** OPC POLYMERS
Highway: I70 WB **Origin:** COLUMBUS, OH **Bill of Lading:** 66877
County: CLARK, IL **Destination:** IMPERIAL, MO **Cargo:** LIQUIDS/GASES IN TANKS

VEHICLE IDENTIFICATION

Unit	Type	Make	Year	State	Plate #	Equipment ID	VIN	GVWR	CVSA #	CVSA Issued #	OOS Sticker
1	TT	INTL	2006	OH	PVR7200	4	2HSCNAPR66C301602	52,000			
2	ST	POLA	1994	OH	TPL9175	2865	1PMS34227R1012865	58,000			

BRAKE ADJUSTMENTS

Axle #	1	2	3	4	5
Right	1 1/8	1 1/8	3/4	5/8	1
Left	1	3/8	3/4	1 1/4	1 1/4
Chamber	L-20*	L-30	L-30	C-30	C-30

VIOLATIONS

Vio Code	Section	Unit	OOS	Citation #	Verify	Crash	Violations Discovered
393.45PC	**393.45**	**2**	**Y**		**U**	**N**	**Brake Tubing and Hose Adequacy - Connections to Power Unit: Axle 2 Left Emergency hose cut core exposed**
393.45B2PC	393.45(b)(2)	2	N		N	N	Brake Hose or Tubing Chafing and/or Kinking - Connection to Power Unit: Service side chafing rubbing against cat walk
178.342-4	180.405(c)	2	N		N	N	MC307 venting: MC307 (30psig MAWP) equipped with MC407 vent with a set pressure of 36psig (MAWP).

HazMat: 3 Flammable **Placard:** Yes **Cargo Tank:** 407

Special Checks: No Data for Special Checks.

Pursuant to authority contained in Title 49, Code of Federal Regulations, Section 396.9(c), I hereby declare vehicles with defects followed by an "Y" in the "Out of Service" column in the violations discovered section of this report OUT OF SERVICE. No person shall remove the out of service stickers applied to these vehicles, or operate such vehicles until the out of service defects have been repaired and the vehicles have been restored to safe operating condition.

Signature Of Repairer X: Facility: EWS Date: 5-16-17

Signature Of Motor Carrier X: Tom Lytle Title: Manager Date: 6-7-17

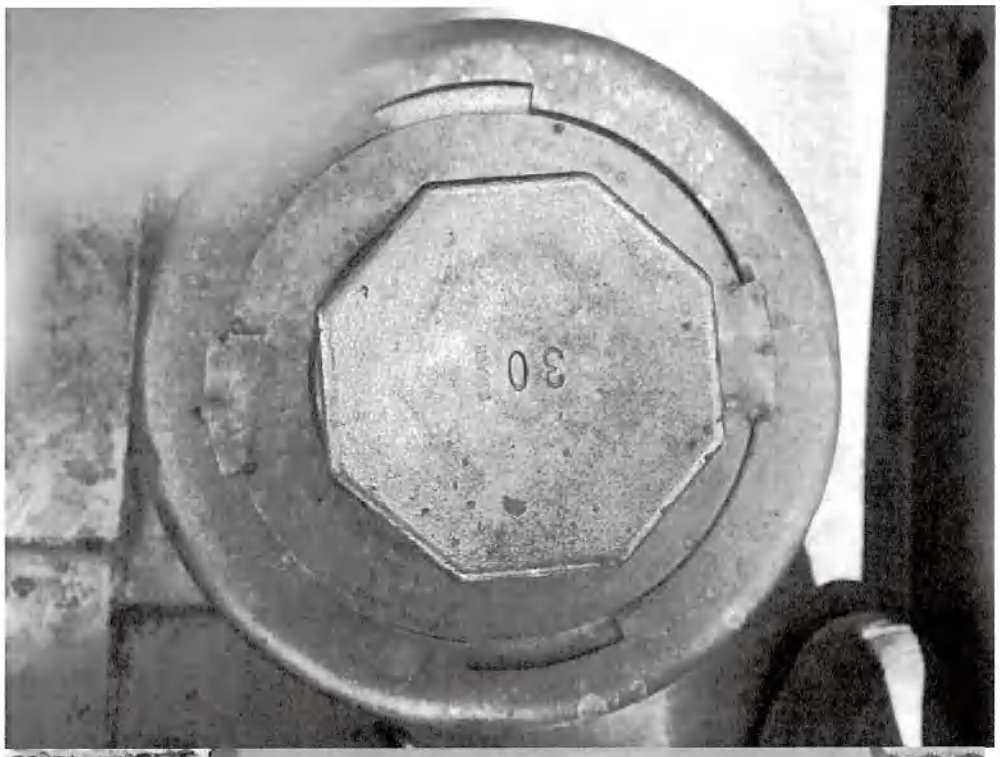
Report Prepared By: JAMES D. BROMM Badge #: US1459
X James D. Bromm

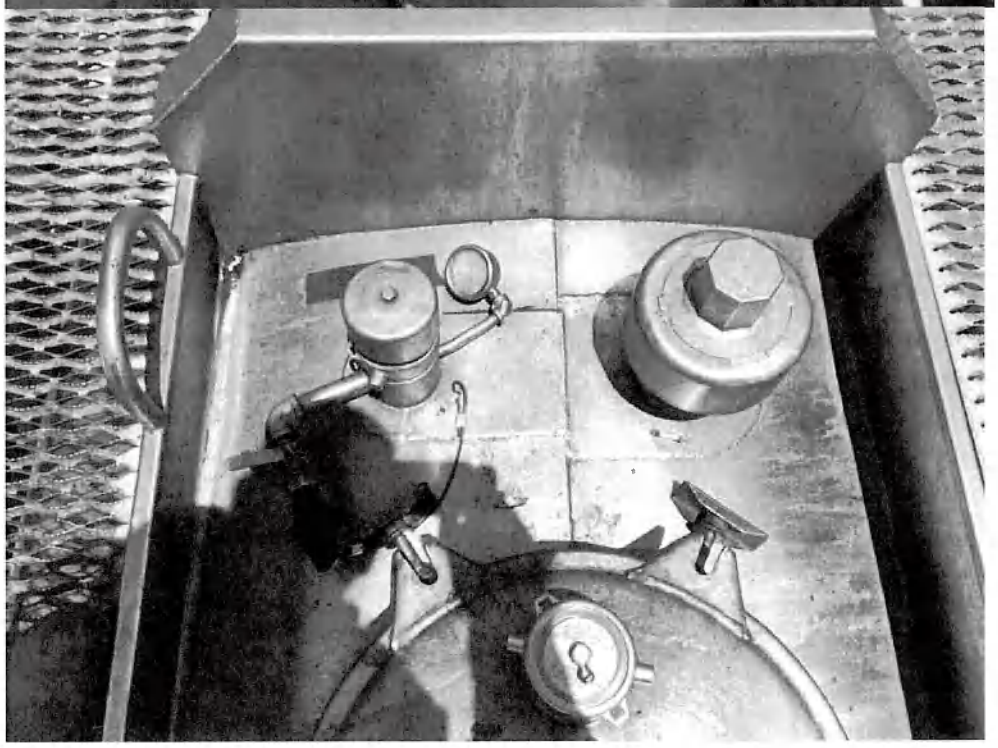
Copy Received By: JIMMY STILTNER
X Jimmy R. Stiltner

00239562 IL US1459000551

Harnett Trucking

DOT407 violation of MC307 upgrade





MFG. BY: POLAR TANK TRAILER INC.
MONTH AND YEAR IN WHICH FINAL
STAGE MFG. IS COMPLETED:
GROSS VEHICLE WEIGHT RATING: LBS
GROSS AXLE WEIGHT RATING:
AXLE NO. GROSS WEIGHT RATING
(FROM FRT. OF VEHICLE) LBS
WITH TIRES
RIMS AT PSI COLD
(FROM FRT. OF VEHICLE) LBS
WITH TIRES
RIMS AT PSI COLD
(FROM FRT. OF VEHICLE) LBS
WITH TIRES
RIMS AT
THIS VEHICLE CONFORMS TO ALL
MOTOR VEHICLE SAFETY STANDARDS
DATE OF MANUFACTURE SHOWN
VEHICLE IDENTIFICATION NO.
CLASSIFICATION OF VEHICLE

MANUFACTURED BY POLAR TANK TRAILER

MFG. SERIAL R1-12865 MFG. DATE 7/98

D.O.T. SPEC. MC 307

ORIGINAL TEST 7/98 CERTIFICATION DATE 7/98

DESIGN PRESSURE 30 P.S.I.G.

TEST PRESSURE 45 P.S.I.G.

HEAD MAT'L 112MNT316 SHELL MAT'L 12MNT316

WELD MAT'L T316 LINING MAT'L NONE

NOMINAL COMP'T CAP (FRONT TO REAR)

7000 U.S. GALS.

MAX. PROD. WT. 58000 LBS./GAL.

MAX. PROD. LOAD LBS. MAX. TEMP 225 °F

LOADING LIMIT OPEN MH 80

UNLOADING LIMIT NONE

#2865 Cal file

TREMCAR
TREMCAR U.S.A. INC.
TANK TRAILER SPECIALISTS
436 12th Street NE • Strasburg, Ohio 44680
Phone: 330-878-7708 • Fax: 330-878-5074 • Toll Free: 888-TREMCAR

DOT NUMBER: CT-10556

EXTERNAL VISUAL INSPECTON REPORT

In accordance with 49 CFR pat 180 Para. 180.470 (d))

R Stamp Repair Required ____Yes ____No

R -6563

Customer L.T. HARNETT
Date 3-14-17
MC/DOT No. 307
Manufacturer POLAR
Unit No. 2865
Year of MFR. 1993
Serial No. 1PM534227R101286
MAWP/Design Pressure 30
Original shell thickness N/A
Original head thickness N/A
Min. Shell Thickness .121
Min. Head Thickness .112
Cap. Comp. 1. 7000 2.____ 3.____ 4.____ 5.____ 6.____
Cargo Tank is Jacketed X Yes ____No
Internal Visual Inspection Made X Yes ____NO
Insulated X Yes ____No
Material 316 SS
Last Service Product N/A Last Service Date 2-16 Last Service Miles ____
Special Service ____
*Cargo tank used to haul product corrosive to tank X Yes ____No
Upper Coupler Assembly Removed X Yes ____No
(Required every two years for tank in corrosive service)

INSPECTION STEPS	Acceptable	Non-Acceptable	See Corrective Action
1.Shell and heads: condition of welds-dents-Gouges-corrosion or abrasion.....	X		
2.Upper coupler assembly: condition of plate-	X		
3.Bolted attachments: piping brackets and supports Valve installations-valve operator installation-Dust cap retainers-all tank-to-frame and/or Undercarriage attachments	X		
4. All major appurtenances and structural attachments On the cargo tank, including suspension system Attachments, connecting structures, frame(s), cross-Members, outriggers and bolsters.....	X		
5. Piping and all valves and adapters: attachments-Leakage-handles and levers-cables or air lines-Shear sections-dust caps-all gaskets or o-rings-Lubrication points.....	X		
6. Internal valve operation: three means or closure (Normal, remote, and thermal)- function check-			

TREMCAR
TREMCAR U.S.A. INC.
TANK TRAILER SPECIALISTS
436 12th Street NE • Strasburg, Ohio 44680
Phone 330-878-7708 • Fax: 330-878 5074 • Toll Free 888-TREMCAR

DOT NUMBER: CT-10556

LEAK TEST REPORT

___ Hydrostatic or X Pneumatic, EPA Method 27- when applied
(In accordance with 49 CFR Part 180 Para. 180.407 (h))

Test Liquid MR over H20 Stamp Required __Yes __No
#R-6563

Customer LJ. HARNETT
MC/DOT No. 307
Unit No. 2865
Serial No. 1PMS34227R1012865
Original shell thickness N/A
Min. Shell Thickness .121
Material 316 SS

Date 3-14-17
Manufacturer POLAR
Year of MFR. 1993
MAWP/Design Pressure 30
Original head thickness N/A
Min. Head Thickness .112
Insulated ___Yes ___No

	Capacity	Test pressure	Start Time	End Time
Comp 1	2000	24.0	7:56	7:41
Comp. 2				
Comp. 3				
Comp. 4				
Comp. 5				

Vents Removed & Tested N

Comp.	1	2	3	4	5
Set To Discharge	36.0				
Open Pressure	36.0				
Reseal Pressure	33.0				
Vent Type	GIRARD 30# 407				

Disposition _____ Removed _____ Replaced X Reinstalled

Remarks

The following must be completed for each compartment. Red flag all vents removed or rendered inoperative. Reinstall vents after completing bench test requirements including normal vents if ok.

		Acceptable	Nonacceptable (See Remarks)
1	Install test fitting into manhole assembly Cleanout or any other top opening. Close Manhole, open internal valve (if appropriate) And gradually pressurize to 80% of MAWP.		

TTMA TRUCK TRAILER Manufacturers Association
TTMAnet.org Since 1941

Tank Conference

Jeffrey M. Sims • President
7001 Heritage Village Plaza • Suite 220 • Gainesville, VA 20155 • 703-549-3010

TTMA Position on MC 307 to DOT 407 Venting Upgrades

Updated December 17, 2015.

ABSTRACT

TTMA summarizes the history and rationale behind the venting changes made when DOT authorized new 400 series cargo tanks. The HMR allowed owners of older cargo tanks to upgrade their venting systems to the new code, and the industry embraced this. However, a small minority of users have some confusion, both about what the HMR requirements actually specify and what is best practice. This paper describes the requirements as laid out in the HMR and in official code interpretations from DOT.

BACKGROUND

The Truck Trailer Manufacturers Association (TTMA) is an international trade association formed in 1941 representing approximately 90% of the trailers manufactured in the United States. TTMA works closely with both regulators and end users.

In September of 1990, Docket HM-183 was advanced and the Code of Federal Regulations was modified for construction of cargo tanks. Prior to 1990, DOT had spent a number of years investigating the design, construction and safety of cargo tanks hauling hazardous materials. The old Motor Carrier (MC 306, 307, 312) codes would not be used for cargo tank construction after September 1, 1995. All cargo tanks would be constructed to the new DOT 407 code, three notable differences were:

- Removal of fusible and/or frangible disc from the pressure relief system.
- Set to discharge changed from (MAWP to +10%) to (120% to 132% of MAWP).
- Flow rate calculation threshold shifted from 130% of MAWP to 150% of MAWP.

In reviewing actual performance of cargo tanks, DOT concluded the safety record of tanks could be improved. For venting, the MC codes were designed primarily around preventing catastrophic failure of the tank. However many accidents didn't involve catastrophic scenarios, but were less severe (more common) sorts of events; for example, a tank rolling-over on a highway exit ramp. In these events, the design of the MC code venting allowed release of product - when it could possibly have been prevented. Changes were put forward to continue to provide catastrophic levels of protection, while also increasing cargo retention in less severe incidents.

Fusible and frangible devices as stand-alone pressure relief devices were removed from cargo tanks (about) 25 years ago. This was done to provide improved containment of the hazardous materials. Industry embraced this change, and it has been a great improvement to the cargo tank design.

The set-to-discharge pressure range was increased a slight amount from MC 307 to DOT 407. This increase in pressure range does not have any negative affect on the structural integrity of the cargo tank, since both designs are subject to test pressures of at least 150% of MAWP. The higher set-to-

discharge pressure allows for variations and hysteresis within acceptable limits of use. This change allows the pressure relief device to reseat and seal before dropping below the MAWP.

Both of these changes serve to contain the product in the cargo tank in the event of a rollover far better than the earlier designs. In a rollover, a fusible or frangible device that had opened could allow the entire cargo to escape the tank. The increased set-to-discharge pressure served to protect the tank from discharging when the weight of the cargo (head) was added to any internal pressure (when the tank was inverted).

CHALLENGE

The HMR allow for pressure relief devices to upgraded to the newest specification in §§180.405(c)(2) and 173.33(d)(3). Thousands of MC 307 cargo tanks were produced between 1990 and 1995 with DOT 407 compliant vents. Moreover, many owners of older cargo tanks from the MC 307 years desired an upgrade to newer pressure vents. WHY? Industry didn't want to maintain the older style of cargo tanks with fusible devices that needed to be constantly replaced. They wanted to be environment friendly with robust re-closing pressure relief devices. It made sense then and still does today. They wanted higher flow rates from the DOT 407 pressure relief devices.

On the other hand, some groups have misconstrued or misunderstood the wording and intent of the changes to the Code of Federal Regulations. Their misguided interpretations would allow fusible devices back on MC 307 cargo tanks with DOT 407 compliant venting, along with greatly reduced pressure relief devices. Seemingly, they don't understand the applicable engineering principles.

Will the design of the MC 307 cargo tank be compromised in any form or fashion if the set to discharge pressure is increased by 10%? Should the flow rates be calculated at 130% or 150%? Both of these questions are technical in nature and are answered best by design certifying engineers familiar with cargo tank design and construction.

UNDERSTANDING THE DESIGN

Fusible and/or frangible device background:

Fusible vents have been used on cargo tanks since the 1950's. Typically, a fusible device consists of a threaded connection holding a fusible element and a disc. The fusible device is designed to yield at an approximate temperature of 250^{0}F. The fusible device communicates with the vapor space of the tank. In a fire emergency, the fusible element would melt and provide an outlet for vapor pressure to escape from the tank vessel. In a catastrophic fire, the boiling liquid could cause a rupture resulting in damage, possible injury and release of the lading. The fusible device creates an inexpensive form of venting the cargo tank's pressure, potentially suppressing the rupture.

During the 40 year period from 1950 to 1990 many improvements were made to manufacturing fusible vents. With all of the improvements, the fact remains that this type of relief device is non-reclosing. Once opened, it will stay open until manually replaced. Tank trucks are subject to high shock and vibration loads on a regular basis. Fusible vents are not able to withstand the high vibration load over an extended period of time. When subject to these vibration loads, the fusible vent may open at an

inopportune time. The surrounding environment would then unnecessarily be exposed to toxic, harmful vapors. Heat systems are used on some tank trucks that transport thick viscosity ladings. These heating systems sometimes operate very near to the temperature range that a fusible device is required to yield. The high heat eventually degrades the fusible vent and causes it to open. Another form of adverse heat to the fusible vent is steam from tank cleaning operations.

Guidance from DOT:

In the 1980's, when DOT was contemplating re-writing cargo tank regulations, they held several public meetings that TTMA members attended. Officials from DOT clearly and succinctly stated their thoughts and intentions regarding fusible devices in the passage, below.

In the Federal Register (Volume 50, No.180, p.37776, Tuesday September 17, 1985) DOT stated:

> ***5. We believe that the risk from hazardous material transportation is substantially reduced when packaging is designed to retain the lading in non-catastrophic accidents and to minimize the quantity of lading released when release is inevitable. However in a cargo tank accident, particularly an overturn followed by a fire, the functioning of a frangible disc or a fusible element would result in the release of a substantial quantity of lading. A reclosing pressure relief device on the other hand would minimize the quantity of lading released. Further we believe that a frangible disc and fusible elements particularly in low pressure applications are much more likely to fail as a result of impact and liquid surge than reclosing pressure relief devices. Accordingly, for all cargo tanks constructed after the effective date of the final rule, we are proposing that all pressure relief devices be re-closing except a frangible disc may be used in series with a reclosing pressure relief device.***

TTMA believes that DOT had a thorough understanding of fusible/frangible devices and focused a great deal of their attention to eliminating the use of non-reclosing devices. This greatly enhances tank safety and protects public interest. How, one might ask? First, when a rollover occurs with an opened fusible device, lading is almost always released; conversely, reclosing pressure relief devices release lading only when there is pressure on the tank. Secondly, the release of non-accident vapors to the atmosphere is prevalent when using fusible devices that have failed due to impact and/or liquid surge. This inadvertent release of vapors is greatly reduced or eliminated with the use of reclosing pressure relief devices.

MC 307 Venting systems:

49 CFR 178.342-4, *(a)* through *(d)* specifies safety relief vents on MC 307 Cargo Tanks. The device will consist of pressure-actuated spring loaded device, otherwise known as a reclosing safety relief device. When necessary to meet the venting capacity of Table III, one or two fusible and/or frangible devices would be added to the total venting system. The spring loaded safety relief device in this system makes up a subpart of the total capacity of the pressure relief system. The fusible or frangible device(s) are used to augment this system.

DOT 407 venting systems:

49 CFR 178.345-10 *(a)* through *(h)* specifies the requirements for DOT 406, 407 and 412 series pressure relief system. Specifically, 178.345-10 *(b)* (1) requires that each primary pressure relief system consist of one or more reclosing pressure relief valves. Furthermore, non-reclosing (e.g., fusible disc) pressure relief devices are not authorized in any cargo tank. The venting capacities from Table I will require one or more reclosing pressure relief devices.

Note: reclosing pressure relief manufacturers were able to meet the higher flow requirements of 178.345-10 by changing the design pressure of the relief device, increasing the flow rates by up to 10 times.

The clear intent by the DOT was to remove any fusible and/or frangible disc from trailers hauling hazardous cargo, due to safety concerns for the general population.

Upgrading MC 307 to DOT 407:

There are three different sections of code that address upgrading MC 307 cargo tanks to DOT 407 cargo tanks. §173.33*(d)* (3) specifies that the pressure relief devices may be modified from MC 307 to DOT 407. Again, §180.405 (*c*) (2) states that an MC 307 cargo tank may have its pressure relief devices modified to conform to the DOT 407 specification. Lastly, §180.405*(h)* (3) says the owner of a cargo tank may elect to modify reclosing pressure relief devices to more recent cargo tank specifications, however it must provide minimum venting capacity required by the original specification. The Federal Government clearly wanted cargo tank owners to willfully consider upgrading MC 307 pressure venting systems to DOT 407 code. None of the three cited codes suggests leaving fusible vents in place, nor does it mention having to update the set to discharge pressure from 120% of MAWP to MAWP, or calculating the flow rates at 130% of MAWP. Instead, they clearly state how to upgrade the pressure system to the new code requirements.

While some have misinterpreted the caution to ensure that upgraded vents have sufficient capacity to prevent cargo tank rupture as meaning that the pressure vents must be rated at the original pressures, this was settled when the DOT issued an interpretation dated June 10, 1996 and signed by Hattie L Mitchell which said:

...Specifically, you asked if §173.33(d)(3) prohibits upgrading vents on MC 307 and MC 312 cargo tanks to DOT 407 and DOT 412 vents that are flow rated in accordance with §178.345-10.

...

The answer is no. ...

HOW TO MEET THE REQUIREMENTS

Fusible devices shall not be employed on cargo tanks with DOT 400 series compliant venting, including MC 307 units. The results are evident! There is a much lower non-accident release record. Lading is not being poured out needlessly when trucks are involved in rollover accidents without explosions. Toxic vapors are not being released to our atmosphere.

Set-to-discharge requirements of the DOT 400 series venting regulations are easily met. The increased tolerance range of 120% to 132% MAWP is easier to qualify during bench testing, the possibility of set-

to-discharge going under the MAWP has been eliminated, and reseat (or reseal) of the pressure relief device occurs before reaching MAWP. The change in set-to-discharge pressure does not have adverse effects on the structure or integrity of the shell design for the cargo tank.

As a general physics statement, mass flow proportionally increases with pressure. During a catastrophic event, a rapid temperature rise will consequently increase flow rates. The older, outdated pressure requirement of 130% to MAWP for the mass flow calculation has been abandoned. All transportation industries embrace the updated flow pressure requirement of 150%. This calculation is applied to trains, ships, and other forms of transporting hazardous materials. TTMA fully embraces this shift and sees no reason to apply an outdated standard to cargo tanks.

TTMA has noted an untarnished safety record for upgraded MC 307 cargo tanks using the modified DOT 407 pressure relief systems over the past 25 years. This track record stands by itself. Thousands of cargo tanks have been built and continue to be in service using this system, working safely, as intended.

ABOUT THE USERS WHO HAVE MISINTERPRETED THE UPGRADE REQUIREMENTS

TTMA is aware of some people advancing the idea that pressure relief devices, especially those on MC 307 cargo tanks cannot be upgraded to DOT 407 vents set and flow rated according to the DOT 407 requirements. This small group of users continues to operate cargo tanks with the misunderstanding and misinterpretation that requires a fusible device and flow rate calculations at 130% of MAWP. They feel it is the only way to be in complete compliance with the code. However, by applying pressure relief devices that are set and flow rated according to the original specification, <u>they have simply forgone upgrading</u>. They are operating their cargo tanks with pressure relief meeting the requirements when the cargo tank was built as provided for in 173.33(h)(2). They do not necessarily gain the benefits of having better lading retention and fully reclosing devices of the DOT-400 series requirements.

TTMA does not recommend mixing devices: A DOT-407 venting system is not designed to be operated in conjunction with non-reclosing vents alongside it. DOT's intent was to eliminate non-reclosing devices to maximize retention of hazardous materials, and allowing fusibles to continue to operate on otherwise upgraded systems would be contrary to that mission. Further, this is most often done due to operator error: There is no need to provide a fusible vent alongside DOT 400 series reclosing device as these are adequately sized to provide sufficient flow to protect the cargo tank from rupture.

CONCLUSIONS

The clear intent by DOT is to have all fusible devices removed. Neither the integrity of the MC 307 cargo tank, nor the pressure relief system will be degraded - if the set to discharge pressure is increased from MAWP to 120%. It is a correct interpretation of the CFR - and also safe - to install DOT 407 pressure relief devices on MC 307 cargo tanks. Lastly, a calculated flow rate of 150% of MAWP is a standard used throughout transportation industries around the world.

TTMA TECHNICAL BULLETIN

TRUCK TRAILER MANUFACTURERS ASSOCIATION
8506 WELLINGTON RD. / SUITE 101
MANASSAS, VA 20109
(703)549-3010 www.ttmanet.org

TB No. 126 **November 15, 2012**

Title: Bench Testing Reclosing Pressure Relief Devices

Previous Editions: Originally issued November 2012.

1.0 Preface:

1.1 No part of this document may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage or retrieval system without written permission from the Truck Trailer Manufacturers Association.

1.2 Recommended Practices and Technical Bulletins are furnished by the TTMA as a guide to general practices in the manufacture, use, and repair of truck trailers. However, the scope of the TTMA's Recommended Practices and Technical Bulletins is not exhaustive of all general practices in the manufacture, use, and repair of truck trailers and there may exist such general practices which do not appear in either the Recommended Practices or Technical Bulletins.

1.3 Recommended Practices and Technical Bulletins represent the state-of-the-art that existed at the time of its preparation. Users of Recommended Practices and Technical Bulletins should familiarize themselves with advancements in practices that have occurred subsequent to the Recommended Practice's or Technical Bulletin's publication date.

1.4 The TTMA has not undertaken any evaluation of all the conceivable ways in which Recommended Practices or Technical Bulletins may be used by manufacturers, users, or repairers of truck trailers nor the consequences of such uses. Everyone who uses Recommended Practices or Technical Bulletins must first satisfy himself or herself that his or her safety, the safety of others, or the safety of the truck trailer and any other equipment will not be jeopardized by their use of information contained within the Recommended Practices or Technical Bulletins.

1.5 The Recommended Practices and Technical Bulletins may contain terms or words with specialized meanings. Definitions for such terms or words may be found in TTMA RP No. 36 - Tank Trailer and Tank Container Nomenclature or TTMA RP No. 66 - Trailer Nomenclature.

1.6 Within the Recommended Practices and Technical Bulletins, "shall" is used wherever conformance with the TTMA publication requires that there be no deviation from the specific recommendation. "Should" is used wherever deviation from the specific recommendation is permissible in complying with the TTMA publication.

1.7 Conformity with TTMA publications by manufacturers, users and repairers of truck trailers is voluntary and any non-conformity with such publications is not indicative of the non-conforming practice being deficient.

1.8 Any inclusion of Recommended Practices or Technical Bulletins within any contract, document or standard is voluntary, and any such inclusion shall not imply any endorsement or approval by the TTMA due to the multitude of ways in which the Recommended Practices or Technical Bulletins may conceivably be used.

2.0 Purpose:

This Technical Bulletin provides guidelines for bench testing reclosing pressure relief valves on DOT specification cargo tanks. The equipment described may be modified to test vacuum relief, but doing so is beyond the scope of this technical bulletin.

3.0 Definitions:

Bench Testing: A test to determine function that is performed at a convenient location off the cargo tank that the reclosing pressure relief valve is normally attached to.

Reclosing Pressure Relief Valves: A valve designed to open at a given pressure, relieving that pressure from a tank and reclosing once the pressure drops sufficiently. Also known as Vents, Pressure actuated fills (PAF), Emergency vents.

Pressure Relief Devices: Any device designed to automatically relieve pressure from a tank at a predetermined set of conditions. They include reclosing pressure relief valves and non-reclosing devices such as fusible caps, fusible plugs, and rupture discs.

MAWP: Maximum Allowable Working Pressure of the cargo tank. Stamped on the tank's specification plate. Also known as Design Pressure on 300 series tanks.

4.0 Background:

4.1 Properly functioning pressure relief valves are important to the safe operation of a cargo tank. Single-use pressure relief devices (e.g. fusible caps or rupture discs) cannot be tested for function and are not subject to this Technical Bulletin. Reclosing pressure relief valves (e.g. spring loaded vent or pressure actuated fill, etc.) shall be removed from the cargo tank periodically to verify that the valve is still performing as required.

4.2 During External Visual Inspection and Testing, §180.407(d)(3) states:

(3) All reclosing pressure relief valves must be externally inspected for any corrosion or damage which might prevent safe operation. All reclosing pressure relief valves on cargo tanks carrying lading corrosive to the valve must be removed from the cargo tank for inspection and testing. Each reclosing pressure relief valve required to be removed and tested must open at no less than the required set pressure and no more than 110 percent of the required set pressure, and must reseat to a leak-tight condition at no less than 90 percent of the start-to-discharge pressure or the pressure prescribed for the applicable cargo tank specification.

4.3 During a Pressure Test, §180.407(g)(1)(ii) states:

(ii) All self-closing pressure relief valves, including emergency relief vents and normal vents, must be removed from the cargo tank for inspection and testing.

(A) Each self-closing pressure relief valve that is an emergency relief vent must open at no less than the required set pressure and no more than 110 percent of the required set pressure, and must reseat to a leak-tight condition at no less than 90 percent of the start-to-discharge pressure or the pressure prescribed for the applicable cargo tank specification.

(B) Normal vents (1 psig vents) must be tested according to the testing criteria established by the valve manufacturer.

(C) Self-closing pressure relief devices not tested or failing the tests in this paragraph (g)(1)(ii) must be repaired or replaced.

5.0 Suitable bench testing equipment.

5.1 A bench testing set-up shall consist of (A) Test Chamber: a small volume or tank to hold air pressure, (B) Mount: means to securely attach the pressure relief valve to the test chamber, and (C) Air Control: means to controllably introduce, measure and exhaust pressurized air into and out of the test chamber.

5.2 Test Chamber: This may be a small air receiver tank, a pipe nipple with one end sealed, a manhole ring welded to blanked plate, or similar volume. The volume enclosed by the tank should be as small as practical in order to reduce the total energy contained in the compressed air for the test as well as to speed testing.

The test chamber should be strong enough to withstand, without deformation or cracking, at least 150% of the highest set-pressure relief valve possibly tested. The vessel shall be protected from seeing pressures in excess of this level by a pop-safety valve or regulating the air inlet, such that if a valve under test fails to open at all and the air inlet is kept open the test chamber will safely contain the pressure.

5.3 Mount: Usually a means of duplicating the mount used to attach the reclosing pressure relief valve to the tank. A threaded nipple or a weld collar & clamp ring are typical examples. The mount shall secure the valve to be tested to the test chamber in such a way that it can withstand the highest possible forces from pressure for which the test chamber is designed. The mount shall also include a means of forming a pressure-tight seal between the test chamber and valve, usually a rubber gasket or the like. The mount should hold the valve to be tested in the same attitude as when it's installed on the tank.

5.4 Air Control:

5.4.1 Location: air control valves, exhaust valves, pop-safety valves and pressure gauges shall be located in such a way as to protect the operator performing the test from dangerous expulsions of air and debris from exhausted air, sudden opening of the tested valve, etc.

5.4.2 Size & Strength: Air control fittings should be as small as practical to provide reasonable air flow into and out of the test chamber. ¼" NPT is typical. All fittings shall be pressure rated at least as much as the test chamber.

5.4.3 Inlet: Shall consist of a valve for controlling compressed air into the test chamber. Air coming in should be regulated to a maximum of the pressure the test chamber was designed for.

5.4.4 Exhaust: Shall consist of a valve that can exhaust the test chamber to atmosphere.

5.4.5 Pressure Gauge: Shall be connected to the test chamber to read the pressure within. Full scale on the gauge should be no more than the pressure the test chamber was designed for. Full scale should also be less than five times the lowest pressure being measured: see 6.4 below. The pressure gauge should be calibrated to verify it is reading true any time it is suspected of reading wrong or at least annually. Example: A test chamber designed to test up to 40 psig valves and thus at least strong enough to withstand 60 psig should have a gauge with a

top reading of no more than 60 psig. That 0-60 psig gauge should not be used to measure opening or reseating less than 12 psig.

6.0 Pre-Test Checks.

6.1 Determine the cargo tank specification (DOT 407, MC 307, etc.) and Maximum Allowable Working Pressure (MAWP) of the cargo tank to which the reclosing pressure relief valve is mounted. Determine the manufacturer and model number for the valve, the stamped set pressure and the specification for which the valve was made.

6.2 The reclosing pressure relief valve shall be removed from the tank and inspected for damage, corrosion or clogging. If the valve is not clean, it shall be cleaned to remove any chemical residue or build-up. Only valves appearing in good order shall be tested. Consult with the valve manufacturer to determine out-of-service conditions for a given valve design.

6.3 The connection between the valve and the tank shall be fully open to the tank with no obstructions or reductions in diameter unless approved in writing by the valve manufacturer.

6.4 Consult the following table to determine allowable opening and reseating pressures.

Tank Specification***	Valve Specification**	Minimum Opening Pressure	Maximum Opening Pressure	Minimum Reseating Pressure
MC 306*	MC 306*	3 psig	4.4 psig	2.7 psig
MC 306*	DOT 406*	3.63 psig	4.55 psig	3.3 psig
MC 307	MC 307	MAWP	110% of MAWP	90% of MAWP
MC 307	DOT 407	120% of MAWP	132% of MAWP	108% of MAWP
MC 312	MC 312	MAWP	110% of MAWP	90% of MAWP
MC 312	DOT 412	120% of MAWP	132% of MAWP	108% of MAWP
DOT 406*	DOT 406*	3.63 psig	4.55 psig	3.3 psig
DOT 407	DOT 407	120% of MAWP	132% of MAWP	108% of MAWP
DOT 412	DOT 412	120% of MAWP	132% of MAWP	108% of MAWP

* Values provided are for a DOT 406 cargo tank with a MAWP of 3.3 psig or a MC306 cargo tank with a MAWP of 3 psig. If the MAWP of the cargo tank being tested does not match these values, consult with the valve or tank manufacturer or a design certifying engineer.

** The code allows in 49CFR§180.405(c)(2) for pressure relief devices and outlet to be modified to newer equivalent specification. Pressure relief valves so modified shall be tested to conform to the new specification.

*** For a tank specs older than these listed (e.g. MC 300, MC 304, etc.): if the outlets have been upgraded as per the note above, test the valve according to the valve's specification. Otherwise consult the valve or tank manufacturer or a design certifying engineer for the appropriate pressures.

7.0 Testing method.

7.1 Mount the reclosing pressure relief valve. Use appropriate gaskets to ensure that there is no leak between the valve and the test chamber.

7.2 Gradually increase the pressure. Open the inlet valve such that the pressure in the test chamber is going up on the pressure gauge at about 20% of full scale every 10 seconds, or approximately as fast as the second hand on a watch. Look and listen for any leaks around the mounting of the valve: if detected, close the inlet valve, open the exhaust valve and adjust the valve's mount as required.

7.3 Detect and note the actual opening pressure. Consult with the valve manufacturer on the level of detection required: some manufacturers use a "start-to-leak" pressure for their vents and will use a leak detection fluid to reveal opening pressure, while most others use a pressure of "continuous flow" as determined by seeing, feeling or hearing. Use the recommended method to detect the actual opening pressure and note it. If the pressure is outside the range allowed as determined in 6.4 above, it must either be repaired or replaced.

7.4 Close the inlet and observe for reseating pressure. Once new air is not being introduced to the test chamber, the valve will continue to allow some air to escape and the pressure to fall. Wait until the gauge is longer falling: this is the reseating pressure. If the reseating pressure is below the minimum reseating pressure as determined in 6.4 above, it must be either repaired or replaced.

7.5 Open the exhaust valve and allow the test chamber pressure to fall to completely. Remove the pressure relief valve.

8.0 Results.

8.1 To report on the test, the following shall be noted: pressure relief valve manufacturer and model number, stamped set pressure, tested opening pressure and tested reseating pressure. Finally note the disposition of the valve: if it failed any of the tests, note that it's either repaired or replaced. Otherwise, note it as OK to remount.

8.2 If the valve needs repair: the valve manufacturer should be contacted for directions on how to repair the valve. Once repaired, the valve should be tested as if it was just removed from the tank to prove the effectiveness of the repair. If the valve cannot be repaired, it shall be replaced.

8.3 If the valve is OK to remount, or a replacement is selected, mount the pressure relief valve on the tank using the appropriate gaskets/seals.