

# Venting Guide for Retrofitting API 12F Tanks

## Disclaimer

This document is intended to be guidance to assist storage tank owners to understand venting requirements for aboveground storage tanks. It is not intended to replace any regulatory requirements or accepted venting standards. If there is a conflict in information found in this document and those found in the referenced documents of the Standata for upgrading existing API 12F tanks, the latter shall prevail.

## Background

Tanks (including those used by the oil service industry) which contain flammable or combustible liquids are regulated by the *Alberta Fire Code*. Consult MSDS flash point information to determine which products those include. A flash point below 93.3 Centigrade would qualify as flammable or combustible. Despite API 12F tanks not being a listed specification for storage tanks acceptable to the Fire Code, a good many of these tanks are in use in the oil service industry. The Alberta Government recently issued a province-wide variance permitting tanks built to the API 12F specification to be used if certain technical provisions were present. The major deficiency with this type of storage tank is related to venting. Under the 12F specification a tank can be designed to not include emergency venting if the tank is used in a remote location. Unfortunately, tanks without emergency venting are situated close to built-up areas. A good illustration of the consequences of inadequate ventilation on a tank exposed to fire can be viewed at:

<http://www.youtube.com/watch?v=6qcrwNM74sg>

## Satisfying the Variance

Tank owners may continue to use non-ULC listed tanks if they are upgraded as stated in the Variance. The owner must establish who the authority having jurisdiction is. You may access the PTMAA website (Jurisdiction) to see if the tanks are located in a PTMAA municipality. If the municipality is not listed, application must be made to the local fire department.



An engineered drawing which includes notes identifying what tanks must be upgraded must be sent to the authority having jurisdiction. For tanks located in PTMAA jurisdiction a permit application must be completed and submitted along with the drawings. The authority having jurisdiction will review the drawings to ensure all aspects of the Fire Code and Variance are being complied with. The final part of the process is to register the tanks with the PTMAA if they are not already registered. To qualify for registration you will require evidence from the authority having jurisdiction that the application has been approved by a Safety Codes Officer. All upgrading must be completed by December 31, 2011.

## Secondary Containment

To qualify for the Variance the tank farm must have secondary containment that meets Subsection 4.3.7. of the Fire Code. If the containment is earthen the engineer must certify that the dike provides a permeability of not more than  $10^{-6}$  cm/sec to the flammable or combustible liquids contained in the storage tanks. If a membrane provides the secondary containment it shall conform to ULC/ORD-C58.9.

## Venting Requirements

Emergency relief vent devices shall be vapour-tight and permitted to be either of the following:

- (1) Designed and sized according to API 2000, NFPA 30 or ULC-S630, or
- (2) Designed by a PEng and tested in accordance with maximum internal pressures, as specified in API 12 F

Emergency venting may be accomplished by the use of the following:

- (a) larger or additional relief devices
- (b) a gauge hatch that permits the cover to lift under abnormal internal pressure, or
- (c) a manhole cover that lifts when exposed to abnormal internal pressure.

All manufactured devices shall be stamped with the following information:

- (1) Start-to-open pressure
- (2) Pressure at which the valve reaches the full open position.
- (3) Flow capacity at full open position. Flow capacity shall be expressed in cubic feet per hour of air or cubic meters per hour of air at 60° F (15.6° C) and an absolute pressure of 14.7 psi (101 kPa).

## Choosing the Right Vent(s)

When choosing vents that are appropriate for a particular tank, several factors must be considered:

1. The amount of vapour that must pass through the vent under normal operating and emergency conditions.
2. The design pressure and vacuum of the tank. Pressure relief valves must open before the pressure limits of the structure are met. Emergency vents are typically rated at a particular flow capacity at 2.5 psi. This pressure is much greater than the maximum design pressure of a 12F tank. The vent vendor must be able to offer a solution that will recognize the required vent capacity based on tank diameter and height and the design pressure of the tank. To illustrate the attention that must be paid to this difference, compare the product offered by one vendor that has an 8" pressure/vacuum vent that will provide the same vent flow capacity as another who would recommend a 16" vent for a 400 bbl tank. The latter

company is taking into account the design pressure of the specific tank and not using the standard 2.5 psi rating for the vent.

3. The flow capability of the vent where shape, screens, flame arrestors, etc., must be taken into account when determining what vent to install.
4. Embedding an appropriately sized vent in a roof hatch is a relatively simple solution but if selecting a vent to replace a cover in its entirety, it is important that the holes on the vent cover match the holes available on the roof.
5. Existing vents should be considered when determining what additional venting capacity is required. For example, for a tank that has an 8” thief hatch for pressure/vacuum conditions during product movement and thermal heating, the addition of a second 8” thief hatch may provide sufficient emergency venting.

NFPA 30 – 2.2.5.1.2 states, normal vents shall be sized to be at least as large as the filling or withdrawal connection, whichever is larger, but in no case less than 1-1/4 in. (32 mm) nominal inside diameter. Each storage tank must have emergency venting capacity in accordance with Table 1. Note that venting requirements in Table 2 apply to standard dimension tanks. Non-standard dimension tanks must have venting that is specifically designed for the surface area of the tank. All calculations shall assume no drainage systems are provided and no suppression systems are provided in the dike area. A drainage system would take spilled liquid away from the tank.

The wetted surface area (WA) for a vertical, cylindrical tank is calculated as the area of the shell to an elevation of not more than 30 feet above the bottom.

$$WA = (\pi) (d) (L)$$

A 400 barrel tank, for example, has a standard dimension of d = 12’ and L = 20’

$(3.14) (12) \times (20) = 754 \text{ ft.}^2$  By interpolation, 754 ft.<sup>2</sup> of tank area would require 446,360 standard cubic feet per hour of venting capacity.

**Table 1**

Wetted Area (Square Feet)	Venting Requirement (SCFH)
350	288,000
400	312,000
500	354,000
600	392,000
700	428,000
800	462,000
900	493,000
1,000	524,000
1,200	557,000
1,400	587,000
1,600	614,000

SCFH is Standard Cubic Feet per Hour

**Table 2**

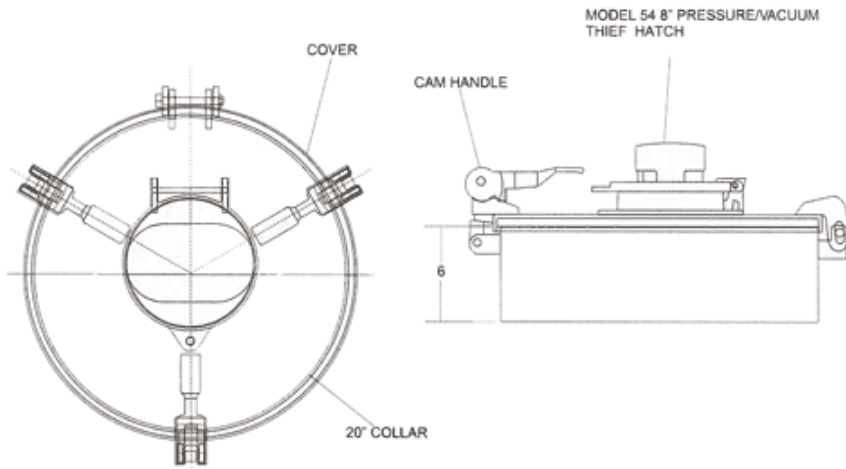
**Venting Requirements**

Tank Capacity		Standard Diameter (feet)	Standard Height (feet)	Emergency Venting Discharge Required		Design Pressure Oz/sq. in	Maximum Pressure During Emergency Venting Oz/sq. in
(barrels)	(kiloliters)			M <sup>3</sup> /hr	Ft <sup>3</sup> /hr		
100	16	9.5	8	6601	233110	16	48
150	24	9.5	12	8272	292121	16	48
200	32	12	10	8527	301127	16	24
210	33.6	10	15	9688	342127	16	48
250	40	11	15	10277	362927	16	24
300	48	12	15	10728	378854	16	24
400	64	12	20	12640	446360	16	24
500	80	12	25	14363	507222	16	24
500	80	15.5	16	12890	455200	8	12
750	120	15.5	24	15393	543600	8	12

**Choosing the Right Vent(s)**

When selecting a vent which will accommodate the required flow rate it is very important that the vent is set to open at a pressure that is lower than the design pressure of the tank. Most API 12F tanks have an internal design pressure maximum of 16 oz. (The popular 750 bbl tank has a design pressure of only 8 oz.) API 2000 states that internal design pressure is not to be exceeded by more than 20% when selecting vents. Therefore, the vent(s) for a 16 oz tank must be wide open at no greater internal pressure than 19.2 oz. For a tank with an internal design pressure of 16 oz the normal set to open pressure is 8 oz.

Emergency vent imbedded in a clean-out hatch:



## **Getting the Work Done**

For engineers and tank owners correcting vent deficiencies on tanks will likely involve the manufacturer of the tank. The PTMAA has compiled a list of companies who manufacture or distribute API tanks in Alberta. There may be some not included on the list that appears below but in most cases the manufacturer of the tank will be stated on the tank itself. It is not mandatory that the original equipment manufacturer is involved but the person doing the physical changes to the tank must be very familiar with vent specifications, set-to-open pressures, etc. Manufacturers likely will be able to source vents that will provide the necessary venting but it's important the engineer working with the tank owner is involved to ensure the right vent is installed.

## **Safety**

It is absolutely imperative that occupational health and safety regulations are followed when any work on tanks is performed. For example, Section 169, Part 10, of the *Occupational Health and Safety Code*, Fire and Explosion Hazards, requires the employer to ensure that hot work is not begun until:

- A hot work permit is issued,
- The work location is clearly or suitably isolated from combustible materials,
- Procedures have been implemented to ensure continuous safe performance of the hot work, and
- Testing shows that the atmosphere does not contain a flammable substance in a mixture with air, in an amount exceeding 20% of that substance's lower explosive limit for gas or vapours.

Other relevant sections of that regulation must be complied with including 162, 163, 164 and 165 when doing hot work. The employer must have procedures and precautionary measures to ensure that flammable substances that are stored, handled, processed or present at a work site will not ignite unintentionally.

## **Vent Manufacturers**

Amongst the brands of vents popular on API aboveground storage tanks are:

Enardo  
OPW  
EBW  
Morrison Brothers  
Clay & Bailey  
Franklin  
Protectoseal

Tank manufacturers may provide additional vent supplier names.

## API Tank Manufacturers

AGI Envirotank  
PO Box 879  
Biggar, SK  
S0K 0M0  
1-800-746-6646  
[www.envirotank.com](http://www.envirotank.com)

Emerald Metal  
Site 7, Box 18, RR2  
Tofield, AB  
T0B 4J0  
1-780-662-9350  
[www.emeraldmetal.com](http://www.emeraldmetal.com)

Peaceland Fabricating  
PO Box 331  
Hythe, AB  
T0H 2C0  
1-780-356-2200  
[www.peaceland.ca](http://www.peaceland.ca)

AGR Tanks  
PO Box 9049 Station Main  
Sylvan Lake, AB  
T4S 1S6  
1-403-887-2927

GLM  
1508 8<sup>th</sup> St.  
Nisku, AB  
T9E 7S6  
1-780-955-2233  
[www.glmprocess.com](http://www.glmprocess.com)

Prism Production Products  
PO Box 728  
Forestburg, AB  
T0B 1N0  
1-877-264-1050

Argo Sales Ltd.  
#1300, 717 7<sup>th</sup> Ave. SW  
Calgary, AB  
T2P 0Z3  
1-403-265-6633  
[www.argosales.com](http://www.argosales.com)

Hot Pass Welding  
4424 50<sup>th</sup> Ave.  
Calmar, AB  
T0C 0V0  
1-780-985-3838

Remo Manufacturing  
PO Box 728  
Redcliff, AB  
T0J 2P0  
1-403-548-0078

Altus (formerly Nusco)  
1604 8<sup>th</sup> St.  
Nisku, AB  
T9E 7S6  
1-780-955-2051  
[www.altusenergy.com](http://www.altusenergy.com)

Huge L Steel  
PO Box 466  
Regina, SK  
S4N 3A2  
1-306-591-1401  
[www.hugelsteel.com](http://www.hugelsteel.com)

Scorpion Welding  
Bay 102, 25 Chisholm Ave.  
St. Albert, AB  
T8N 5A5  
1-780-460-9954  
[www.scorpionwelding.ca](http://www.scorpionwelding.ca)

Clemmer Steelcraft  
4006 60<sup>th</sup> Ave.  
Innisfail, AB  
T4G 1S7  
1-800-661-2851  
[clemmersteelcraft.com](http://clemmersteelcraft.com)

Industrial Steelcraft  
4734 45A St.  
Lacombe, AB  
T4L 2C7  
1-403-782-7144

Tanksafe Inc.  
#208, 3112 11<sup>th</sup> St. NE  
Calgary, AB  
T2E 7J1  
1-403-291-3937  
[www.tanksafe.com](http://www.tanksafe.com)

DE-In Industries Ltd.  
PO Box 559  
Debolt, AB  
T0H 1B0  
1-780-957-2521  
[www.de-in.com](http://www.de-in.com)

Northern Steel  
Box 1718  
Tisdale, SK  
S0E 1T0  
1-888-674-8265  
[www.northern-steel.com](http://www.northern-steel.com)

Universal Industries  
5014 65 St.  
Lloydminster, AB  
T9V 2K2  
1-780-875-6161  
[www.uic.ca](http://www.uic.ca)

NWP Industries Inc.  
PO Box 6280  
Innisfail, AB  
T4G 1S9  
1-403-213-3425  
[www.nwp.ca](http://www.nwp.ca)

**Note:** Some of these companies may not be in business any longer.

## Selecting an Engineer

Application to the Authority Having Jurisdiction must be done by submitting engineered drawings which clearly identify tanks to be modified in compliance with the Variance. Site drawings and the plan to come into full compliance with the Fire Code must be prepared by an engineer licensed to practice in Alberta. A tank owner can retain the services of any professional engineer licensed in Alberta but it would be advised that a firm with experience in petroleum facility design is used. The PTMAA has briefed engineers on the upgrading program and the tank owner may benefit by using a firm that is familiar with the requirements and solutions to this regulatory issue. Engineers wanting to participate in these projects include:

<b>FIRM</b>	<b>CITY</b>	<b>PHONE</b>	<b>CONTACT</b>
Yo-Star Enterprises	Edmonton	(780) 473-7162	Albert Ratsoy
TWD Technologies	Sherwood Park	(780) 410-0542	Mona Alkhatib
Five Star Engineering	Sherwood Park	(780) 499-9007	Albert Biel
Emerson Engineering	DeWinton	(403) 938-3079	Dale Emerson
Lexon Projects	Edmonton	(780) 435-7476	Harold Steinbrenner
Tiamet Consultants	Calgary	(403) 640-9009	Leon Mah
Hasegawa & Assoc.	Calgary	(403) 250-5261	Bill Hasegawa
CTM Design	Calgary	(403) 640-0990	Don Jonasson
Roosdahl Engineering	Saskatoon	(306) 382-2356	Larry Roosdahl
Cold Creek Enterprises	Calgary	(403) 225-5770	Dick Vathje
Petroleum Enviro Services	Edmonton	(780) 461-4799	Greg Van Loenen
Hasegawa Engineering	Lethbridge	(403) 328-2686	Mark Hasegawa
Williams Engineering	Red Deer	(403) 755-4063	Henk Brenkman
Conestoga-Rovers	Calgary	(403) 271-2000	Stephen Ball

## Engineered Drawings and Specifications

To get approval for tanks constructed to API 12F, drawings bearing a professional engineer's stamp and seal must be submitted to the Authority Having Jurisdiction. In most cases the PTMAA is the AHJ but this can be verified on the PTMAA website. For drawings and specifications submitted to the PTMAA, each 12F tank must be covered under a general statement to the effect, "normal and emergency venting has been designed in accordance with API 2000, NFPA 30 or ULC S-630". The Variance from the Fire Code allowing existing 12F tanks requires that all other aspects of the Code must be complied with. Engineers must prepare drawings as if the facility was not yet constructed. Other information that should be on the drawings or specifications include:

- Construction standard of all tanks on the facility (ULC/API)
- Requirement for fire extinguishers
- Location of loading/unloading nozzles (inside or outside dike and how spills might be collected)

- Tank capacities
- Distance to buildings and property lines
- Tank contents
- Spacing between tanks
- Detail on secondary containment (wall construction, liner, earthen, capacity, etc.)
- Distance from tank wall to secondary containment wall
- Evidence of bonding and grounding of tanks
- Fencing

## **API 650 Tanks**

The Alberta Fire Code permits use of tanks constructed to API 650 specification. Some of the features of tanks constructed to that standard is dependent on the requirements of the purchaser. The type of venting used on 650 tanks may be insufficient because the purchaser was not aware of the requirement for emergency venting. The PTMAA is currently investigating this issue with Alberta Municipal Affairs and directives may follow. If you have API 650 tanks at your facility and you plan on reviewing venting for 12F tanks it is recommended that you include any API tanks in your review and plan for upgrading.

## **Questions**

A considerable amount of time has been provided to comply with the Fire Code but please be aware that services and equipment may not be available if your project is left too late. If you have questions about the Variance and the procedure to meet it, please do not hesitate to contact the PTMAA.

Petroleum Tank Management  
 Association of Alberta  
 Suite 980, 10303 Jasper Ave.  
 Edmonton, AB  
 T5J 3N6  
 Phone (780) 425-8265 Toll Free: 1-866-222-8265 Fax: (780) 425-4722  
[www.ptmaa.ab.ca](http://www.ptmaa.ab.ca)