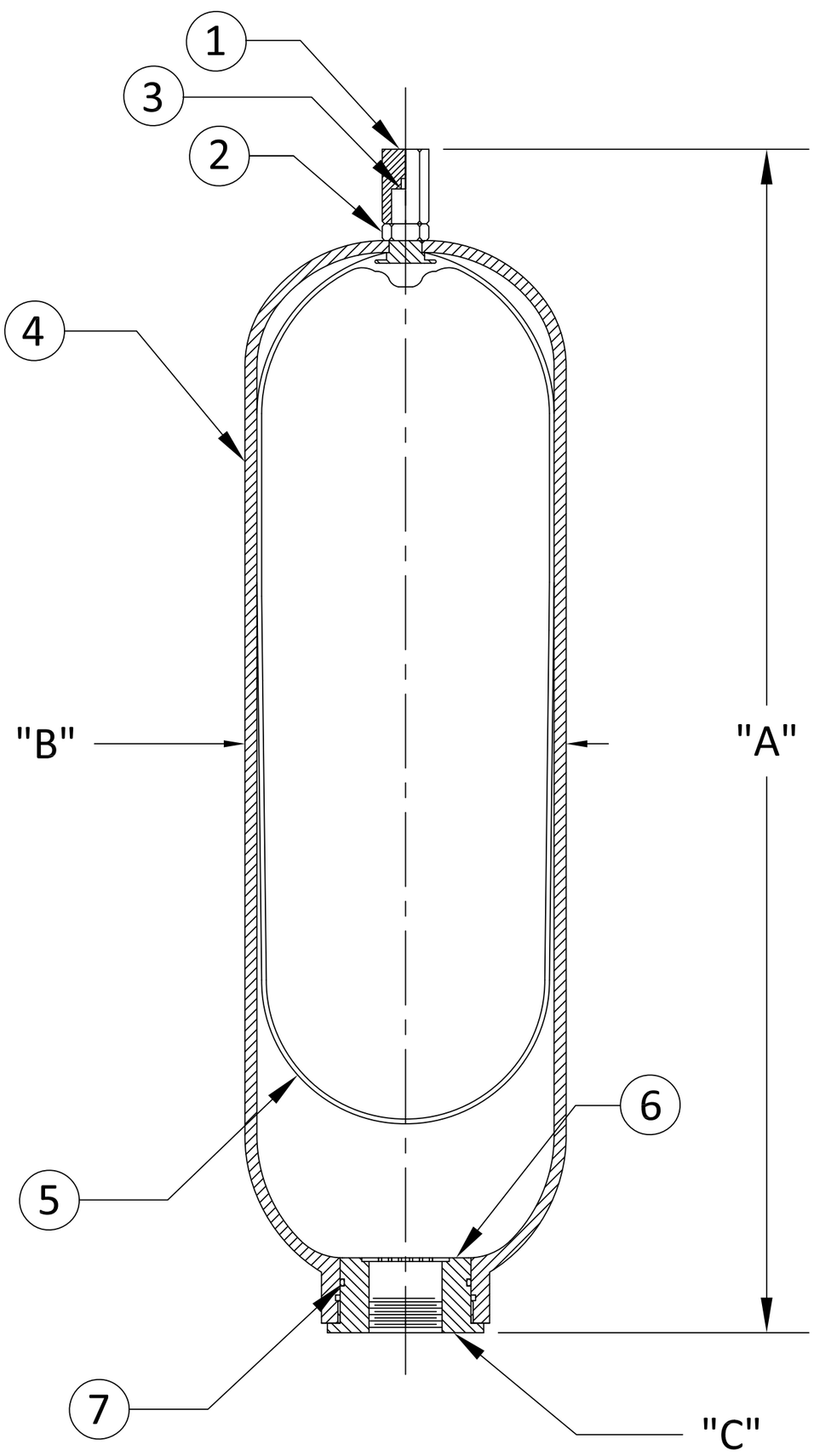
National Fire Equipment Ltd.

BET-01 BLADDER EXPANSION TANK

Nominal Size (Gallons)	Model Number	"A" OAH (in)	"B" Dia. (in)	"C" Fluid Connector	Est. Dry Weight (Lbs)	Design Pressure (PSI)
2.5	2.5BET-17	19	8.625	1" NPT FEMALE	47	175
5.0	5.0BET-17	30	8.625	1" NPT FEMALE	67	175
10	10BET-17	51	8.625	1" NPT FEMALE	108	175

- FOR USE IN EXPANSION CHAMBER APPLICATION
- 175 PSI DESIGN PRESSURE WITH A 4X SAFETY FACTOR.
- BLADDER MATERIAL IS AROMATIC RESISTANT BUNA-N
- ASME CODED, SECTION VIII, DIV. 1.
- UL LISTED FOR FIRE PROTECTION



PARTS LIST:

ITEM	QTY	DECRIPTION
1	1	VALVE GUARD
2	1	LOCKNUT
3*	1	DYNA SEAL
4	1	SHELL
5*	1	BLADDER ASSEMBLY
6	1	FLUID PLUG
7*	1	O-RING

*RECOMMENDED REPLACEMENT PARTS

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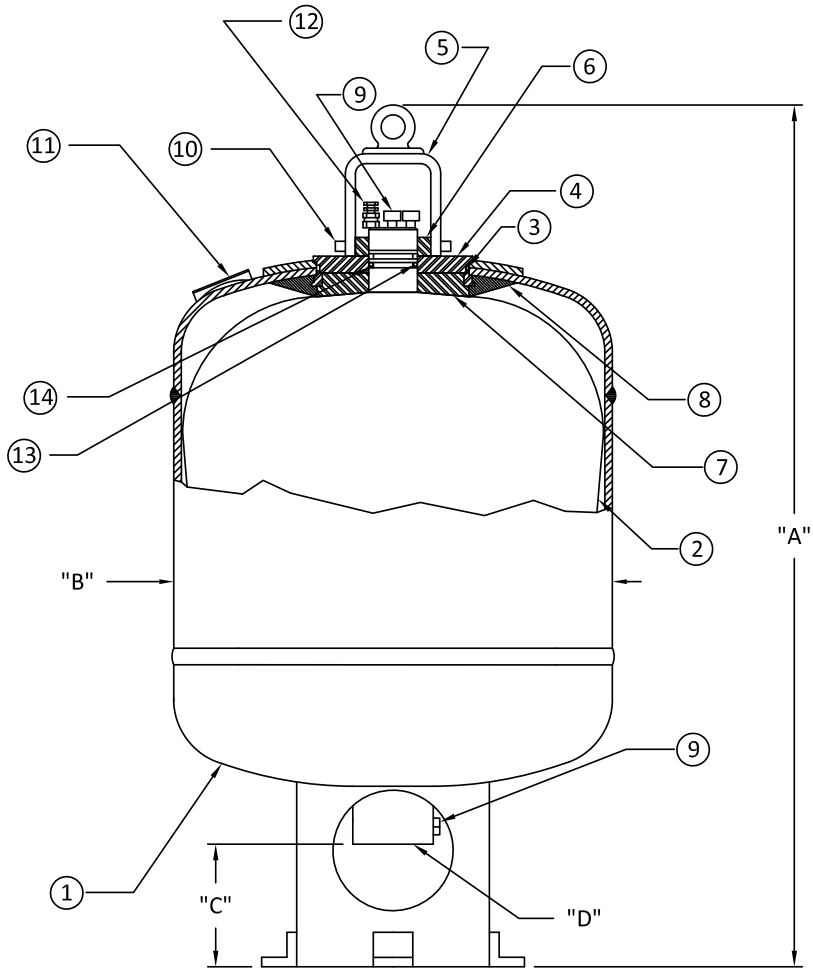
National Fire Equipment Ltd.

BET-02 BLADDER EXPANSION TANK

Nominal Size (Gallons)	Model Number	"A" OAH (in)	"B" Dia. (in)	"C" Connection to Ground (in)	"D" Fluid Connection	Est. Dry Weight (Lbs)	Design Pressure (PSI)
25	25BET-17	46	22	10	3" FEMALE NPT	300	175
40	40BET-17	53	22	10	3" FEMALE NPT	361	175
80	80BET-17	66	22	10	3" FEMALE NPT	534	175
100	100BET-17	87	22	10	3" FEMALE NPT	697	175
120	120BET-17	103	22	10	3" FEMALE NPT	841	175
150	150BET-17	103	24	10	3" FEMALE NPT	921	175

- FOR USE IN EXPANSION CHAMBER APPLICATION.
- 175 PSI DESIGN PRESSURE WITH A 4X SAFETY FACTOR.
- BLADDER MATERIAL IS AROMATIC RESISTANT BUNA-N.
- ASME CODED, SECTION VIII, DIV. 1.
- UL LISTED FOR FIRE PROTECTION



Parts List:

Item	Qty	Description
1	1	Shell Assembly
2*	1	Bladder Assembly
3*	1	O-Ring
4	1	Gas End Plate
5	1	Valve Guard Assembly
6	1	Locknut
7	1	Gas Plug
8	1	Anti-Extrusion Ring
9	3	Pipe Plug
10	4	Socket Head Cap Screw
11	1	ASME Nameplate
12	1	Gas Valve
13*	1	O-Ring
14*	1	Back-Up Ring

*Recommended replacement parts.

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VELM.EX5181
Expansion Chambers

Expansion Chambers

See General Information for Expansion Chambers

YOUNG ENGINEERING & MFG INC EX5181
560 W TERRACE DR
SAN DIMAS, CA 91773-2914 USA

Model	Capacity Gallons	Max Rated Pressure
1.0-BET-17	1	175
2.5-BET-17	2-1/2	175
5.0-BET-17	5	175
10-BET-17	10	175
25-BET-17	25	175
40-BET-17	40	175
80-BET-17	80	175
100-BET-17	100	175
120-BET-17	120	175
150-BET-17	150	175

The expansion chambers are for use in antifreeze systems incorporating glycerine or propylene glycol types of antifreeze. The minimum use temperature of these devices is -20°F.

Last Updated on 2005-06-14

Operation

The gas in the bladder compresses as the pressure builds, allowing the liquid to enter the chamber. As the fluid pressure increases as a result of expansion, the excess fluid discharges within the bladder or diaphragm. The more fluid that the chamber accepts, the greater the pressure becomes.

The compression of this gas follows Boyle's Law of Gases:

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

where

P_1 = precharge pressure (psia)
V_1 = volume of the expansion tank (gal)
T_1 = precharge temperature (ºR)
P_2 = compress pressure (psia)
V_2 = compress volume (gal)
T_2 = compress temperature (ºR)

Without the compression of this gas bladder, the piping system would develop extremely high pressures because the system is locked up hydraulically. The expanding fluid trapped by the back pressure valve has nowhere to go, thereby increasing pressure.

The expansion chamber, to be effective, should be installed downstream of the backflow preventer in a location where thermal effects are minimal. This would be at the base of the piping where temperature changes are kept to a minimum. Excessive heat will prevent the expansion chamber from absorbing its maximum capacity.

The total volume of the fluid, V, in gallons is:

$$V = \frac{\Delta V_S \left[\frac{P_2}{P_1} \right]}{1 - \left[\frac{P_2}{P_3} \right]}$$

where

P_3 = Maximum Operating Pressure

and the volumetric expansion of the liquid within the piping system (V_S) can be expressed as:

$$\Delta V_S = \Delta T * V_S * \gamma$$

where

ΔT = maximum temperature differential
V_S = total volume of the fluid (gal)
γ = coefficient of thermal expansion of the trapped fluid

Example

Piping system – 6" Ø pipe, 200 ft long
Minimum temperature -10ºF
Maximum temperature 110ºF
Propylene Glycol is working fluid
@ 50% concentration
P_{max}: 150 psig (165psia)
P2: 70 psig (85psia)
P1: 65 psig (80psia)

$\Delta T = 110-(-10) = 120ºF$

$$V_S = \left[\frac{\pi}{4}\right]\left[\frac{6}{12}\right]^2 (200)\left[\frac{7.481 gal}{1 ft^3}\right] = 294 \text{ gallons total system volume}$$

$$\Delta V_S = 120\ (294)\ 3.210 \times 10^{-4} = 11.3 \text{ gallons total volumetric expansion}$$

$$V = 11.3 \left[\frac{\left[\frac{85}{80}\right]}{\left[1 - \frac{85}{165}\right]} \right] = 24.76 \text{ gallons expansion chamber volume required}$$

**Recommended 25.0 gallon unit

COEFFICIENTS OF THERMAL EXPANSION

($x10^{-4}$ / ºF)

VOLUME PERCENT MIXED WITH WATER	GLYCERINE	PROPYLENE GLYCOL
10%	---	2.55
20%	---	2.75
30%	---	2.94
40%	---	3.11
50%	2.72	3.21
60%	2.70	3.38
70%	2.72	3.61
80%	2.82	---
90%	---	---
100%	2.90	---

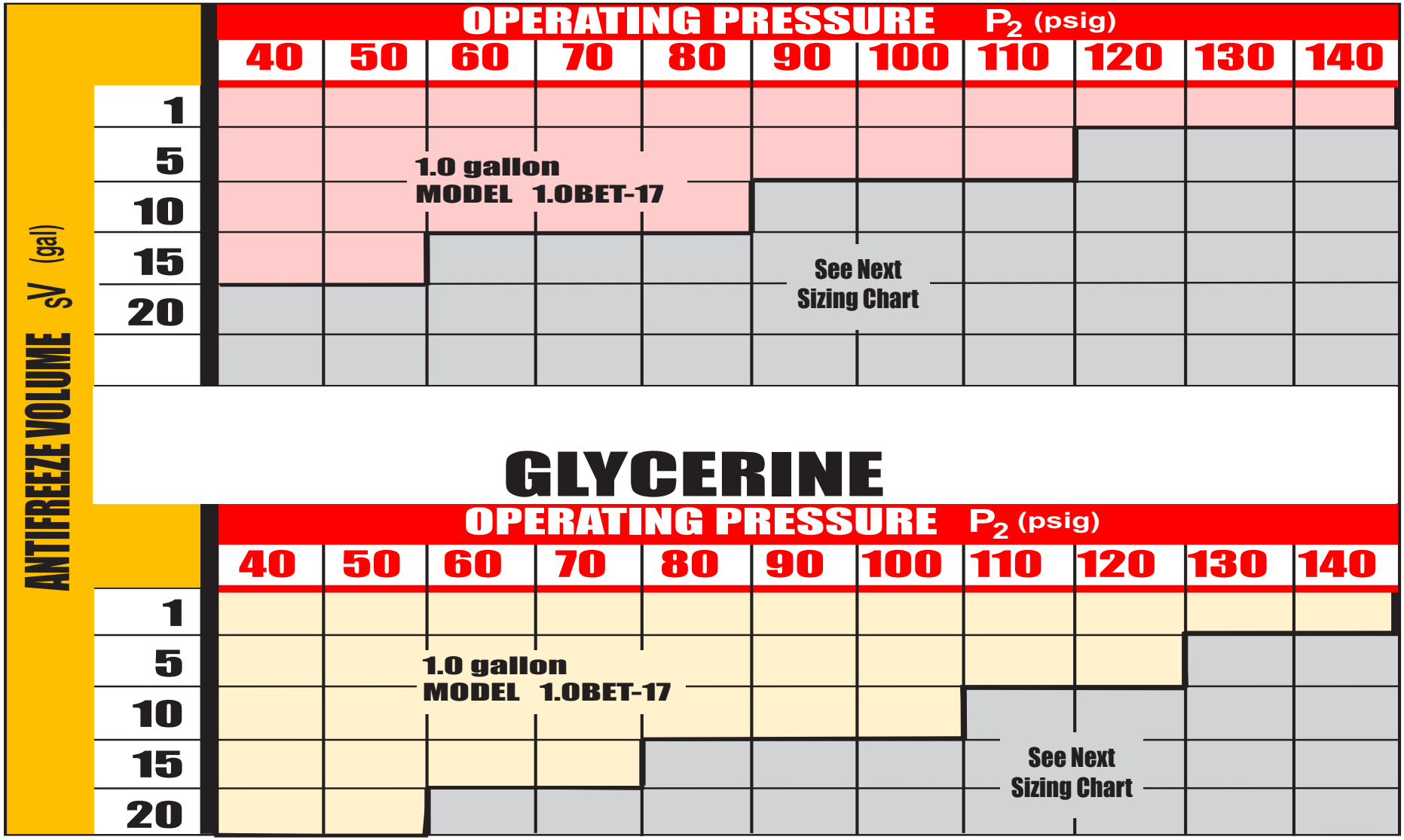
Coefficient of thermal expansion for Propylene Glycol & Glycerine were derived from the following references:

Reference: Dowfrost and Dowfrost HD., Engineering and Operations Guide, The Dow Chemical Company, April 1996.

Anthony Armin Newman., Glycerol, C.R.C Press, 1968

BLADDER EXPANSION TANK SIZING CALCULATIONS

PROPYLENE GLYCOL



GLYCERINE

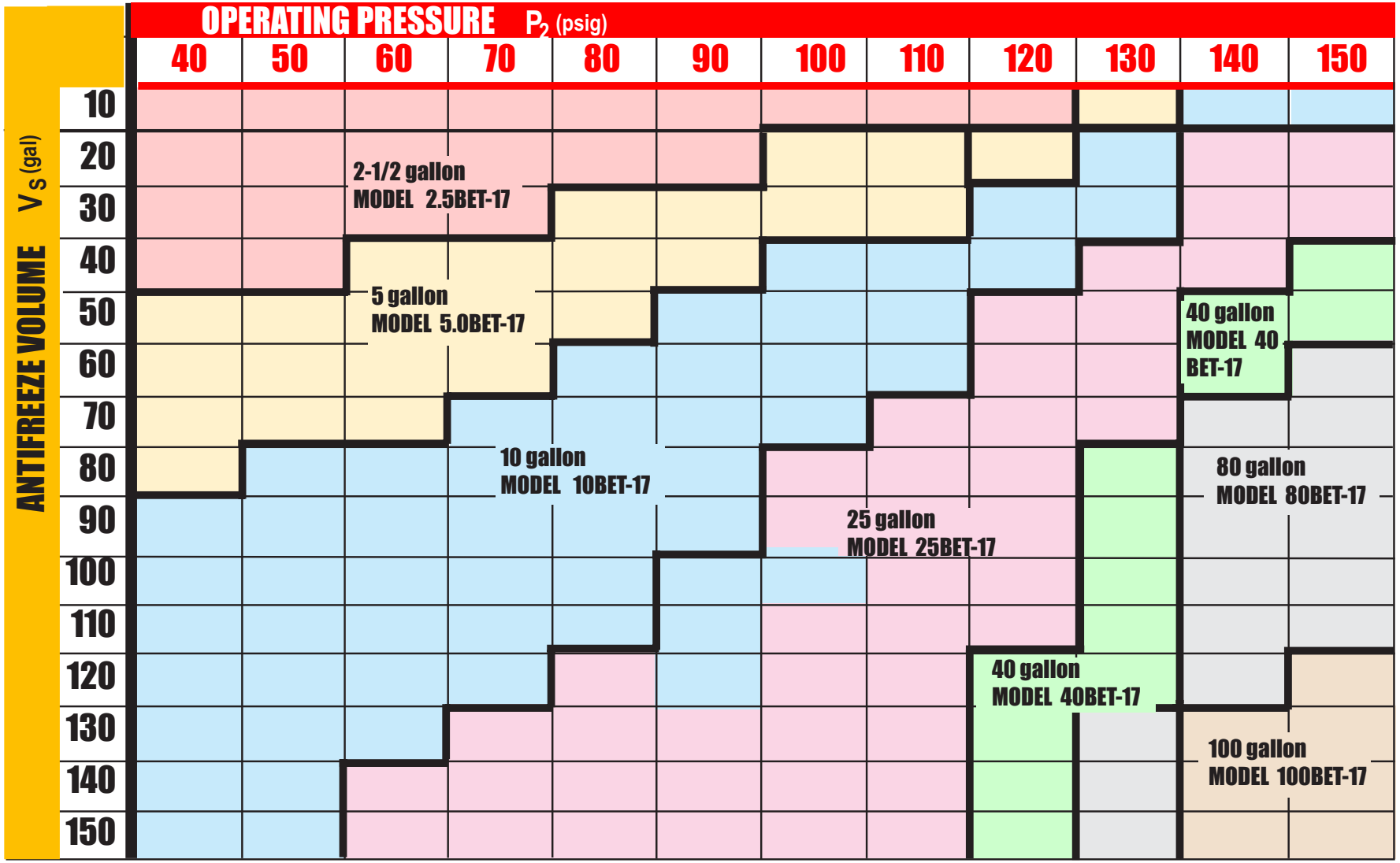
Assumptions: 70% Anti - Freeze

P_{MAX} = 150 psig

ΔT=100°F

BLADDER EXPANSION TANK SIZING CALCULATIONS

PROPYLENE GLYCOL

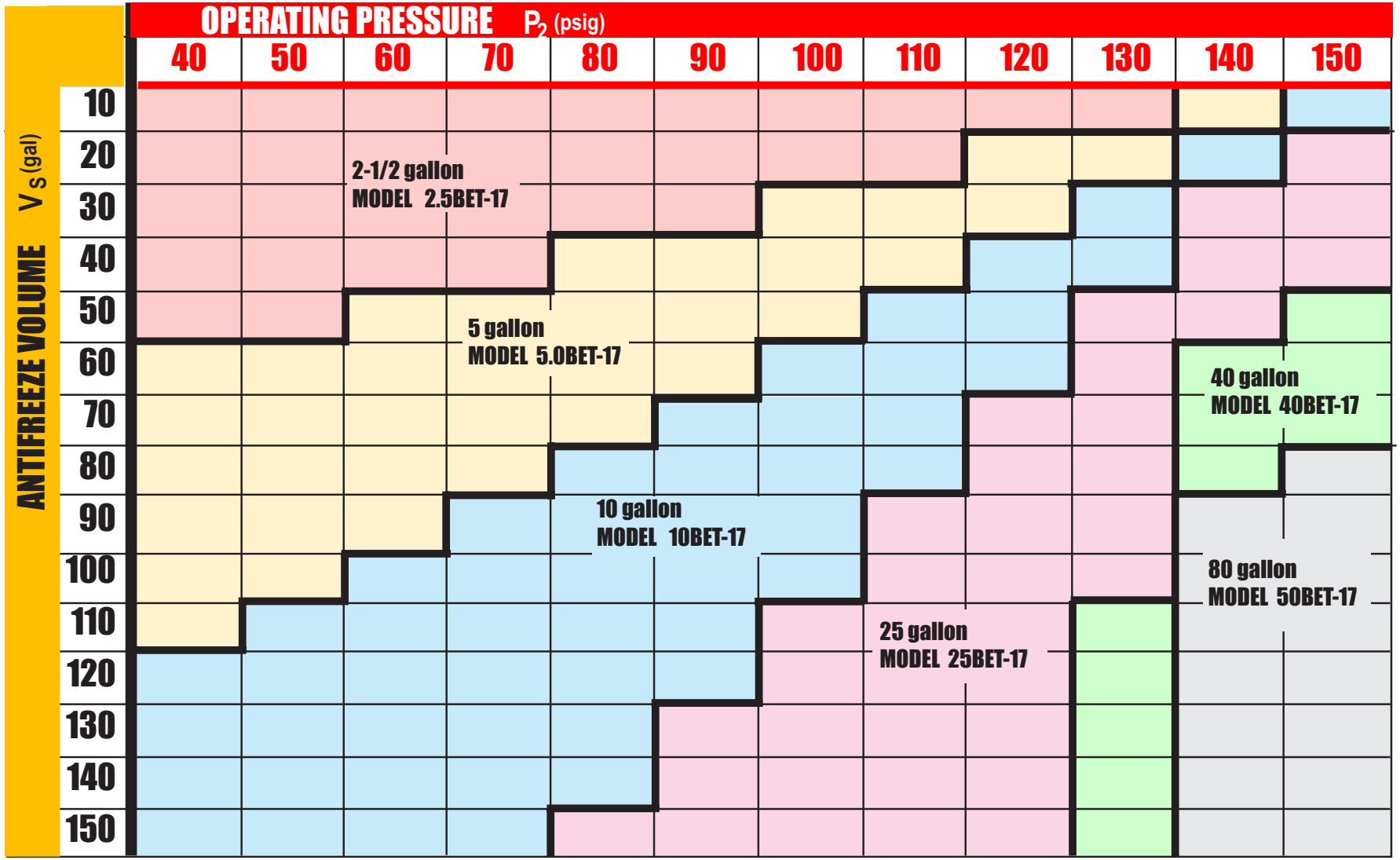


Assumptions: 70% Propylene Glycol

P_{MAX} = 150 psig

ΔT=100°F

BLADDER EXPANSION TANK SIZING CALCULATIONS GLYCERINE



Assumptions: 70% Glycerine

P_{MAX} = 150 psig

ΔT=100°F

Bladder Expansion Tanks
Frequently Asked Questions

1. **Why do I need a Bladder Expansion Tank (BET) in my antifreeze sprinkler system?** As the temperature changes in an antifreeze sprinkler system, the fluid expands. With a backflow preventor installed, the pressure within the sprinkler system increases because the fluid is trapped. This overflow of fluid enters the BET, relieving the pressure, which builds as a result of the expansion.

2. **How do I determine the size of the Bladder Expansion Tank?** Young Engineering has produced a sizing chart, which indicates the unit required based on operating pressure and system volume. There is one chart for Propylene Glycol and one for Glycerine.

3. **Does the BET come precharged with nitrogen gas?** The unit is precharged from the factory at 20 psig. This is done to prevent damage as the result of handling during shipping. Before the unit is exposed to fluid pressure, it should be precharged to 90% of the operating pressure. Air or nitrogen gas can be used, with nitrogen gas preferred because it is ozone free.

4. **How do I precharge the BET?** Each unit has a gas valve similar to that of a car tire. A gas Schraedar valve charging adapter or our standard CG-3000B Charging and gauging Assembly can be used to pressurize the unit.

5. **Where do I install the BET on the antifreeze system?** The unit should be installed anywhere down stream of the backflow preventor. It is preferred to be at the low point to minimize the effects of temperature.

6. **At what orientation should the BET be installed?** The recommended installation is vertical with the gas valve pointing straight up. If this is not possible, than a horizontal installation is acceptable.

7. **How long will the precharge last in the bladder?** The gas precharge will slowly permeate through the rubber bladder and eventually will need to be recharged. We recommend that the charge pressure be inspected annually to assure proper performance.

8. **Can the BET be repaired?** The Young Engineering BET (with the exception of the 1 gal. non-repairable) is a repairable design with very few parts, which can fail.

9. **What can go wrong and how can you tell the product is not functioning?** The rubber bladder losing its precharge is the most likely cause of unit failure. This can be identified by the increase in system pressure as a result of a temperature rise. If the bladder has lost its precharge pressure or failed, the pressure as a result of a temperature rise will exceed the design pressure. If this occurs the precharge should be inspected and the unit recharged. Operation and maintenance manuals on all BET's are available from the factory.

10. **Are there mounting accessories for the BET?** Yes, all sizes of the BET have mounting accessories. The most popular sizes: 1, 2-1/2, 5 and 10 gallon, have a mount bracket for a wall mount (see CLP-01 data sheet). The larger sizes: 25, 40, 80, 100, 120, 150 gallons have support stands for mounting the product (see CLP-02 data sheet).

Bladder Expansion Tanks
Frequently Asked Questions

11. **Why does the BET need to be Underwriters Laboratory approved?** Underwriters Laboratory (UL) test all listed products extensively to assure the quality of the products meet fire protection standards. The shell is designed to a 5:1 safety factory and tested to 2X the design pressure. The rubber bladders are tested to meet the chemical and physical requirements to assure compatibility with antifreeze solutions. The BET is designed, manufactured, and listed to UL standards for fire protection equipment and also is ASME code stamped. All of our BET units can be tested with the system up to 260 psig.

12. **Can the BET product line be used for surge control applications?** No, the BET is designed for thermal expansion of fluids, which normally occur very slowly. System temperatures may take hours to heat to their maximum. The flow rate into this product is very low usually gallons per hour. The fluid connection is designed for this type of fluid transfer. In a surge control application, the flow rates are normally higher with flow at rates of gallon per minute. In order for the surge suppressor to absorb the energy of these rapid flow changes, the unit must accept and discharge high flow rates. The BET is not designed to handle these high flow rates.

13. **How do I purchase a Young Engineering BET?** There are regional stocking distributors throughout the U.S. Please call the factory for the distributor serving your area.