FIGURE 1(A) ALKALINITY VS PH

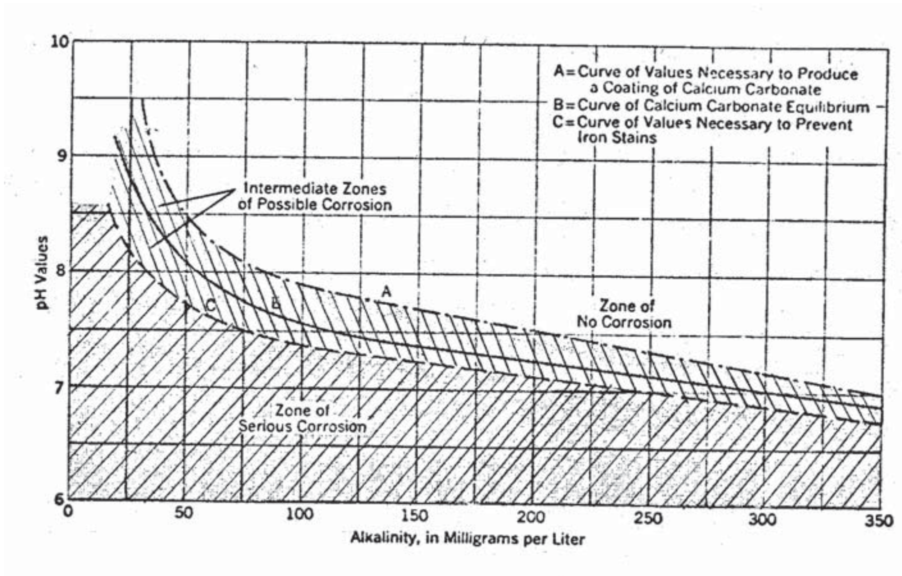
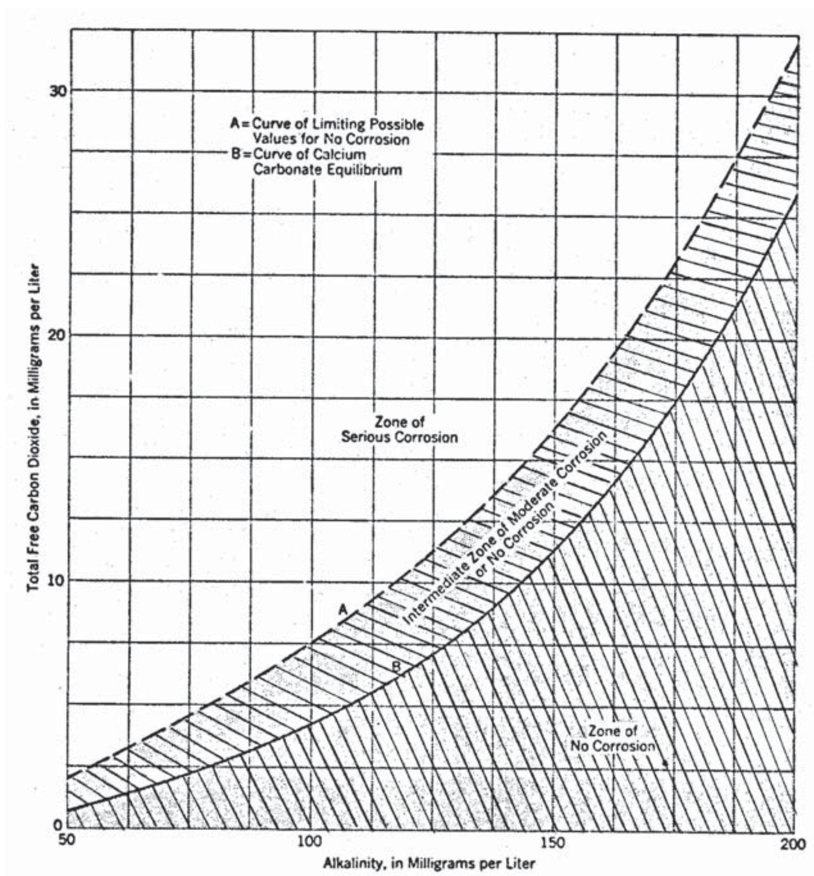


FIGURE 1(B) ALKALINITY VS TOTAL FREE CARBON DIOXIDE



Source of Figures 1(a) and 1(b):
Water Supply and Waste Disposal. Hardenberg, W.A., and Rodie, E.S., International Textbook Co., Scranton, PA 1961.

FIGURE 2:
NORTH CAROLINA GUIDELINES CROSS CONNECTION CONTROL IN WATER DISTRIBUTION SYSTEMS

These guidelines are supplemental to Section .0406(b). These guidelines are intended as a minimum requirement. Public water suppliers may adopt more stringent requirements. Each supplier of water shall conform to the minimum requirements established in these guidelines.

I. Degree of Hazard:

A. Severe: Actual or potential threat of contamination that presents an imminent danger to the public health with consequence of serious illness or death.

B. Moderate: One that presents foreseeable and significant potential for pollution, nuisance, aesthetically objectionable or other undesirable alterations of the drinking water supply.

II. Backflow Prevention Assembly Requirements:

Degree of hazard	RPZ*	DCVA**	Air Gap
Severe	X	-------	X
Moderate	-------	X	-------

* Reduced pressure zone
** Double check valve assembly
*** This is not intended to be an exhaustive list

III. Facilities that Require Installation of a Backflow Preventer***:

A. Moderate hazard - DCVA:

1. Fire sprinkler systems without booster pump facilities or chemical additives.
2. Connection to tanks, lines and vessels that handle non-toxic substances.
3. Lawn sprinkler systems without chemical injection or booster pumps.
4. Most commercial establishments.
5. Automatic service stations, bakeries and beauty shops with no health hazard and bottling plants with no back pressure.
6. etc.

B. Severe hazard - RPZ or air gap:

1. Lawn sprinkler systems with chemical injection or booster pump
2. Wastewater treatment plants
3. Connection to an unapproved water system or unapproved auxiliary water supply
4. Connection to tanks, pumps, lines, steam boilers or vessels that handle sewage, lethal substances, toxic or radioactive substances
5. Fire sprinkler systems with booster pump facilities or chemical additives
6. Buildings with five or more stories above ground level
7. Hospitals and other medical facilities
8. Morgues, mortuaries and autopsy facilities
9. Metal plating facilities
10. Bottling plants (subject to back pressure)
11. Canneries
12. Battery manufacturers
13. Exterminators and lawn care companies
14. Chemical processing plants

15. Dairies
16. Film laboratories
17. Car wash facilities
18. Dye works
19. Laundries
20. Swimming pools
21. Water front facilities
22. etc.

IV. Approved Backflow Prevention Assemblies:

Meets American Society of Sanitary Engineering (ASSE) standard and carries ASSE seal or is on the University of Southern California approval list.

V. Backflow Prevention Assembly Installation:

Backflow prevention assemblies must be located in a place where it is readily accessible for regular testing, maintenance and inspection. Bypass lines parallel to a backflow prevention assembly shall have an approved backflow prevention assembly installed that is equal to that on the main line.

A. RPZ:

1. Above ground installation preferred.
2. Below ground vault shall have positive drainage with adequate gravity drainage to atmosphere.
3. 12 inches minimum clearance from vault walls and floor.
4. Installation in accordance with manufacturer's recommendations.

B. DCVA:

1. Vertical or horizontal installation acceptable.
2. Adequate drainage shall be provided if installed below ground.

FIGURE 3(A): DEMAND WEIGHT OF FIXTURES IN FIXTURE UNIT

Fixture type	Weight in fixture units
Bathtub	4
Bedpan washer	10
Bedit	4
Demtal unit or cuspidor	1
Dental laboratory	2
Drinking fountain	2
Kitchen sink	4
Lavoratory	2
Laundry tray (1 or 2 compartments)	4
Shower, each head	4
Sink: service	4
Urinal, pedastal	10
Urinal (wall lip)	5
Urinal stall	5
Urinal with flush tank	3
Urinal trough (for every 2 foot section)	2
Wash sink, circular or multiple (each set of faucets)	2
Water closet: F.V.	10
Water closet: tank	5

FIGURE 3(B): EXAMPLE – FIXTURE UNITS AND ESTIMATED DEMANDS

Kind of Fixtures	Building Supply		
	No. of Fixtures	Fixture Units	Demand (gallons per minute)
Water closets	130	1,300	
Urinals	30	150	
Shower heads	12	48	
Lavoratories	130	260	
Service sinks	27	81	
TOTAL		1,839	310

FIGURE 3(C): ESTIMATE CURVES FOR DEMAND LOAD

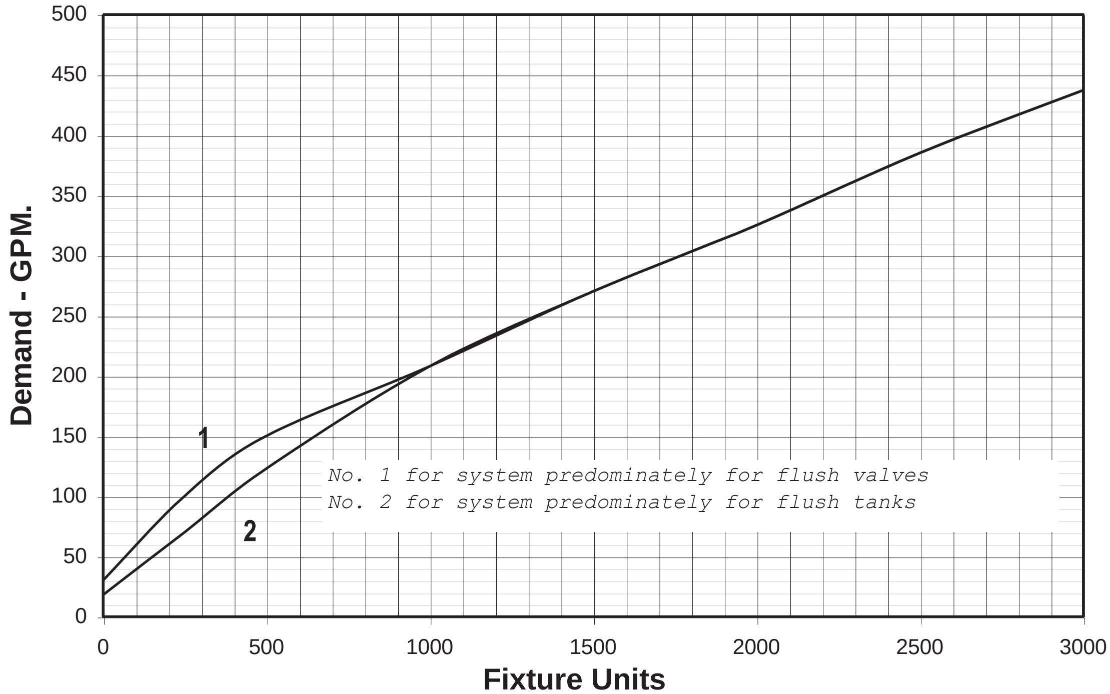


FIGURE 3(D): ENLARGED SCALE DEMAND LOAD

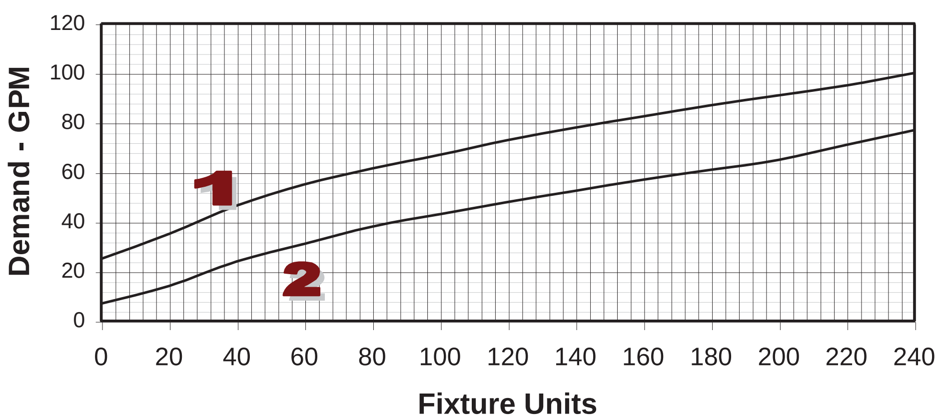
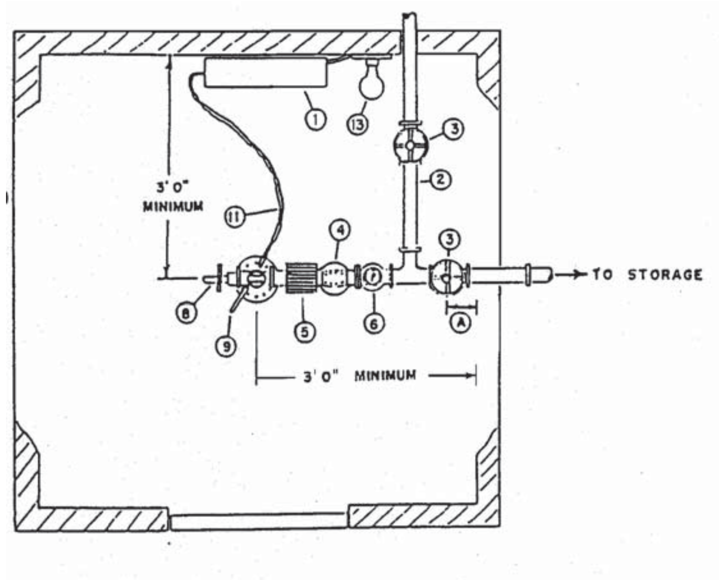


FIGURE 4: TYPICAL WELL HEAD DETAILS

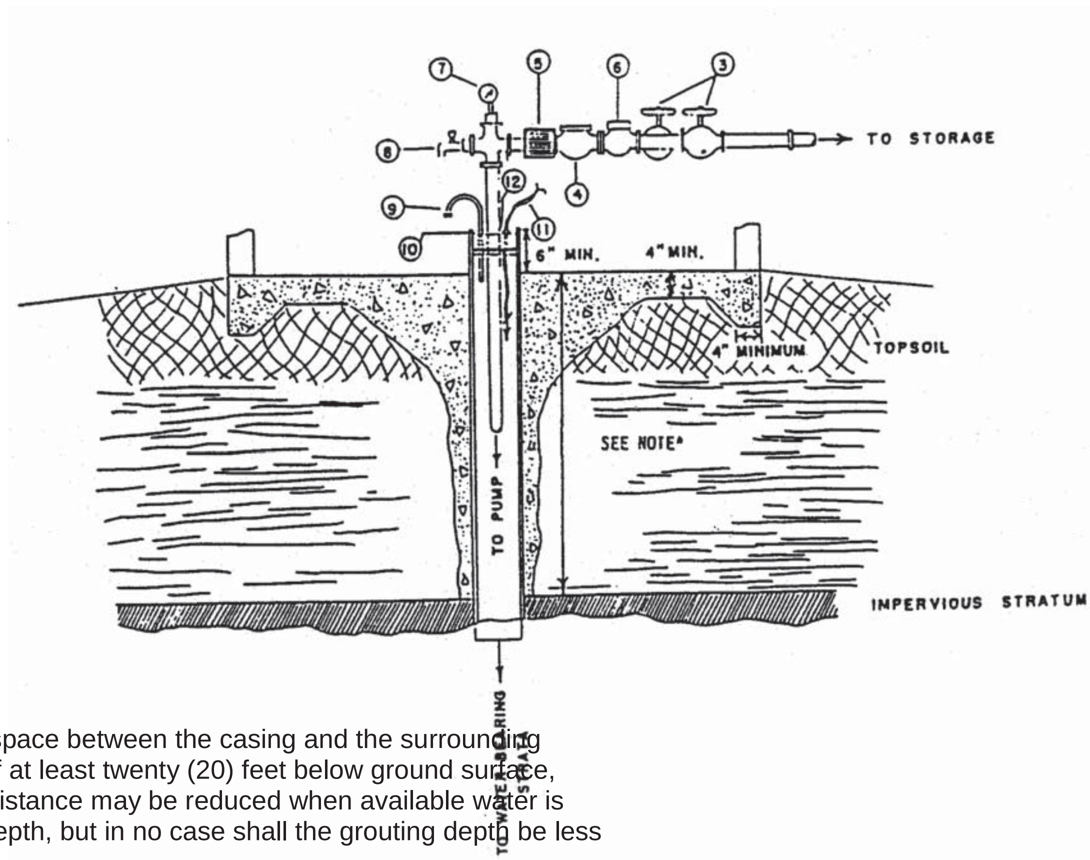
LEGEND

1. Control box
2. Blow off line
3. Gate valve
4. Check valve
5. dresser coupling (or union)
6. Meter
7. Pressure gauge (w/needle valve)
8. Sample faucet (non-threaded)
9. Screened vent
10. Sanitary well seal
11. Electrical conduit
12. Electrical cable seal
13. Electrical lighting



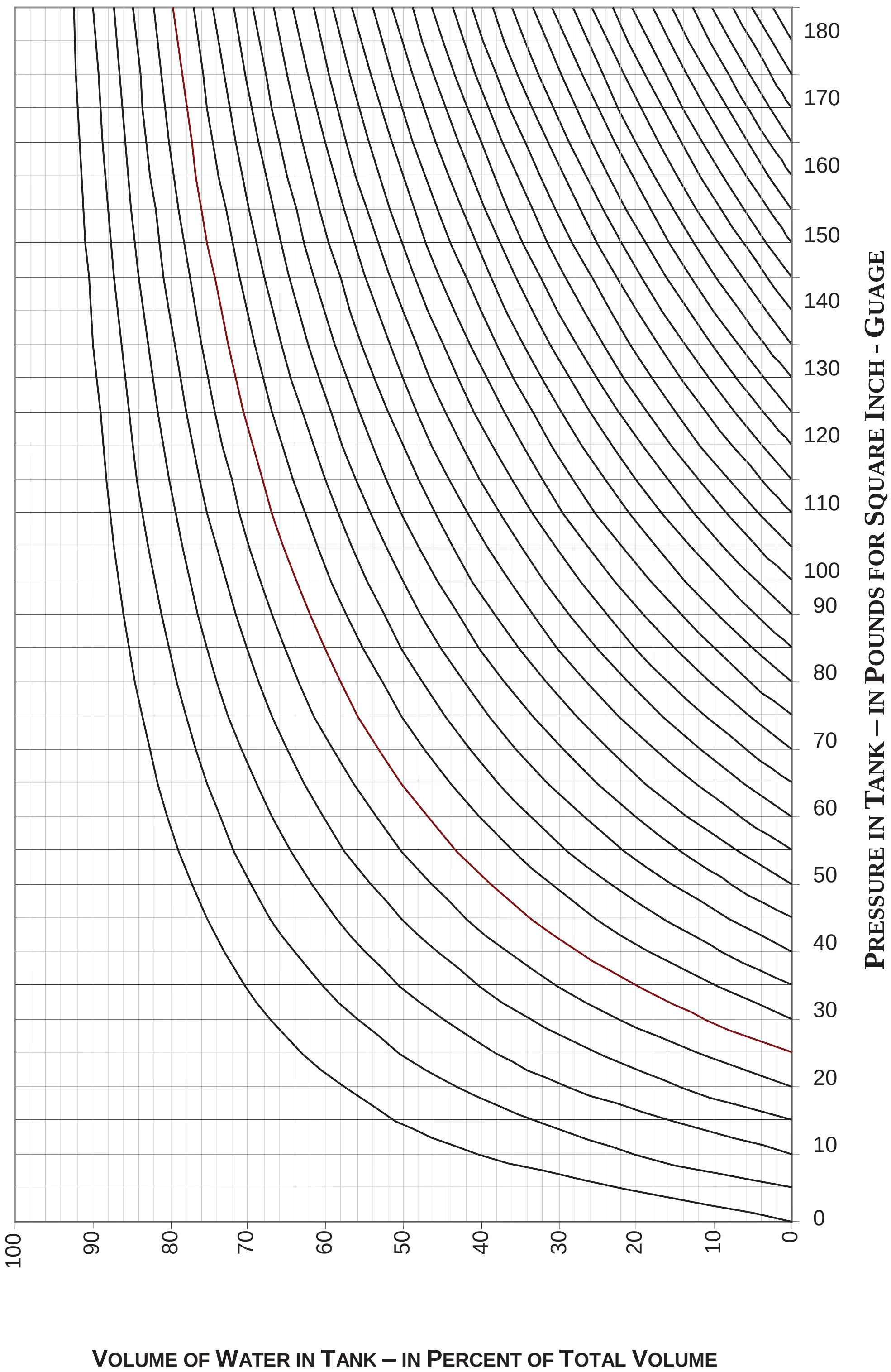
NOTES

A. Leave clearance between wall and valve for turning valve
B. Slope ground surface away from slab
C. Grout around casing to impervious stratum (20' min. depth)
D. Slope floor to drain
E. Provide hatch in roof above well casing.



NOTE*
Grout the annular space between the casing and the surrounding soil to a distance of at least twenty (20) feet below ground surface, provided that this distance may be reduced when available water is found at a lesser depth, but in no case shall the grouting depth be less than ten (10) feet.

FIGURE 5:
PRESSURE & VOLUME DIFFERENTIALS FOR HYDROPNEUMATIC TANKS



<u>FIGURE 6:</u> VOLUME OF HYDROPNEUMATIC TANKS

The following examples are offered in further explanation of the requirements for proper sizing of hydropneumatic tanks. As previously indicated, it is required to supply the indicated peak demand for a period of twenty minutes, and it is assumed that a combination of hydropneumatic storage and pumping will be utilized. The Effective Volume of the tank is considered to be the volume of water discharged between the high and low pressure setting.

Required Effective Volume = (Peak Demand – Pumping Capacity) x 20 minutes

For example, a mobile home system to serve 50 spaces and having a pumping capacity of 30 gpm would require an effective volume of:

Req'd. Effective Volume = (Peak Demand – Pumping Capacity) x 20 minutes = (60-30) x 20 = 600 gallons
(*For peak demands, see Rule .0802)*

The actual tank size required to furnish the 600 gallons effective volume depends upon the pressure settings, air-water volume controls, etc. A system without controls would require the largest tank, whereas a system with air charging device and automatic air-water volume controls would require a much smaller tank.

The curves indicating air-water volume relationships shown in Figure 5 may be utilized to determine required tank sizes.

Continuing the above example, assume further that it is necessary to operate the tank on a 60-40 psi pressure cycle, and assume that the tank has no air-water volume controls and was not precharged. These conditions are indicated by the top curve in Figure 5 since this curve passes through the 0% water – 100% air point.

At 60 psi, water volume: 80%
At 40 psi, water volume: 73%

Therefore, the percent water volume discharges during the 60-40 psi cycle is 80-73%=7% of the total tank volume. The total volume of a tank necessary to produce the required effective volume of 600 gallons:

$$\text{Total Volume} = \frac{600}{0.07} = 8570 \text{ gallons}$$

The tank size can also be determined by direct calculation rather than by using Figure 5. By using the principle of Boyle's Law and assuming the effects of temperature to be negligible, the tank is sized accordingly.

Continuing the above example and converting the pressure to Absolute (gauge + 14.7 psi), the volume is calculated as follows:

If there is no water (100% air) in the tank originally and it is filled with water until a pressure of 60 psi gauge is reached, the volume of air at that point is:

$$P_1V_1 = P_2V_2$$

$$\text{Vol.}_2 \quad \frac{P_1V_1}{P_2} = \frac{(0 + 14.7 \text{ psi}) \times (100)}{(60 + 14.7 \text{ psi})} = 19.7\% \text{ (air)}$$

On a 60-40 psi cycle, the tank would discharge to a pressure of 40 psi, and the air volume would be:

$$\underline{P_2V_2} \qquad \underline{(60 + 14.7 \text{ psi}) \times (19.7\%)}$$

$$\text{Vol.}_3 = \frac{}{P_3 \quad (40 + 14.7 \text{ psi})} = 26.9\% \text{ (air)}$$

The percent volume of water discharged during the 60-40 cycle is:

Percent volume: 26.9 – 19.7 = 7.2%

The total tank volume necessary to produce the required effective volume of 600 gallons is:

$$\text{Total Volume} = \frac{600 \text{ gal.}}{0.072} = 8330 \text{ gallons}$$

By utilizing an air charging system with automatic air-water volume controls, it is possible to discharge up to 25% of the tank volume during a 60-40 psi pressure cycle. The total tank volume necessary to furnish the required effective volume in this case would be:

$$\text{Total Tank Volume} = \frac{\text{Required Effective Volume (gallons)}}{0.25}$$