User inputs data into orange cells. Results are calculated in tan cells. All pressures calculated in absolute units, i.e., equations contain 14.7 psi added to gauge pressures.

**Effective Volume**

| | | |
|---|---|---|
| [1]pre-charge pressure, P1 | | psi, gage |
| [2]cut-in pressure, P2 | | psi, gage |
| cut-out pressure, P3 | | psi, gage |
| Gross volume of hydro tank(s), Vt | | gallons |
| Effective draw-down volume, Ve | 0 | gallons |
| acceptance factor | #DIV/0! | |

**Horizontal Tank Volumes**

| | | |
|---|---|---|
| Inside Diameter | | inches |
| Inside Side Wall Length | | inches |
| End Caps | | select |
| Water level | | inches above bottom |
| Water Volume | #DIV/0! | gallons |

*[1] Pre-charge pressure cannot be greater than cut-in pressure for pump to start, and optimal setting is about 2-4 psi below cut-in pressure to maintain system pressure.*

*[2] Calculate Total Dynamic Head in distribution system to determine acceptable cut-in pressure. Note: Volume below amount needed to maintain minimum system pressure unavailable as storage.*

**Cycle Time**

$$\frac{V_e}{(I-O)} + \frac{V_e}{O}$$
= pump on + pump off

| | gpm | times in minutes | | | Cycles/hr |
|---|---|---|---|---|---|
| Pump into tank, I | | Pump ON | Pump OFF | Cycle Time | Nc |
| Demand, O | | Pump Off | no demand | no demand | no demand |
| net flow, gpm | pump=demand | | | * Maximum pump cycle = | #DIV/0! |
| | | Pump Off | = ł Minimum pump run | | |

** Maximum pump cycle occurs @ demand = half pump capacity.*

*ł Minimum pump run times: 1 min. < 5 hp ≥2 min., or manufacturer's recommendation.*

**Pump Selection**

| | Total head: | Low Pressure | | High Pressure | |
|---|---|---|---|---|---|
| | | psi | feet | psi | feet |
| Tank inlet above measuring point, ft | | 0.0 | 0.0 | 0.0 | 0.0 |
| Measuring point to static water level, ft | | | | | |
| Drawdown below static water level, ft | | | | | |
| Dynamic head, pump to tank, ft | | | | | |

***Use positive values. Approximate operating point for the pump. Find points between low and high head on pump curve and use median for pump capacity.***

## CAPACITY ANALYSIS WORKSHEET FOR HYDROPNUMATIC SYSTEMS

**Persons preparing a capacity analysis report should consider, and coordinate appropriate aspects of the report with, applicable local government comprehensive plans and applicable regional water supply plans prepared by water management districts.**

**Rule 62-555.320(6):**
The total capacity of all water source and treatment facilities connected to a water system shall at least equal the water system's design maximum-day water demand (including design fire flow demand if fire protection is bring provided).

Additionaly, 62-555.320(19) storage requirements apply.
For small hydro systems:
**Rule 62-555.320(19)(b)2…**
For water systems that are using hydropneumatic tanks and that were permitted before August 28, 2003, no finished-water storage capacity is required if the source, treatment, and finished-water pumping facilities themselves can meet peak-hour water demand for at least four consecutive hours. For systems that are using hydropneumatic tanks, the well pump and treatment facilities almost always are designed to meet at least the peak-hour demand (which generally is approximately four times the annual average daily demand). If the well pump and treatment facilities cannot meet the peak-hour demand, the required effective storage volume in the hydropneumatic tank is:

{(peak-hour demand, gpm) – (well pump capacity, gpm)} * (240 minutes)

For water systems that are using hydropneumatic tanks and that are permitted after August 28, 2003, no finished-water storage capacity is required if the source, treatment, and finished-water pumping facilities themselves can meet peak-hour water demand for at least four consecutive hours and can meet peak instantaneous demand for at least 20 minutes. For systems that are using hydropneumatic tanks, the well pump and treatment facilities almost always are designed to meet a least the peak-hour demand (which generally is approximately four times the annual average daily demand) and should be designed to meet the peak instantaneous demand (which generally is approximately 10 times the annual average daily demand and hence the recommendation in Section 7.2.2a of *Recommended Standards for Water Works*). If the well pump and treatment facilities can meet the peak-hour demand but cannot meet the peak instantaneous demand, the required effective storage volume in the hydropneumatic tank is:

{(peak instantaneous demand, gpm) – (well pump capacity, gpm )} * (20 minutes)

Projections of maximum-day or peak-hour water demand usually are made by multiplying projections of annual average daily water demand by an appropriate peaking factor. Peaking factors vary depending upon PWS size, the extent of commercialization and industrialization, etc. Therefore, maximum-day to average-day peaking factors should be determined specifically for each PWS by looking at past water production da ta for the PWS. (According to *Water Distribution Systems Handbook*, which is incorporated as an engineering reference into Rule 62-555.330, F.A.C., maximum-day water demand typically ranges from 1.5 to 3.5 times average daily water demand.) Peak-hour to average-day peaking factors should be determined specifically for each PWS based upon flow measurement data if possible; but oftentimes, peak-hour to average-day peaking factors will have to be estimated. (According to *Water Distribution Systems Handbook*, peak-hour water demand typically ranges from 2.0 to 7.0 times average daily water demand.)
Finished-water storage need is the finished-water storage capacity needed for operational equalization to meet peak water demand and comply with subsection 62-555.320(19), F.A.C., plus finished-water storage capacity needed to meet any fire-flow requirements.
Finished-water storage needed to meet fire-flow requirements can be calculated using the equation…

FS = (NFFR + MDD – TPC) (NFFD)

where FS = fire storage, NFFR = needed fire-flow rate, MDD = maximum-day demand, TPC = treatment plant capacity (i.e., total maximum-day or peak capacity of a PWS's treatment plants), and NFFD = needed fire-flow duration.

Refer to the DEP "Capacity Analysis Report Guideline (2004) for additional information.

User inputs data into orange cells. Calculation results in tan cells.

| | input gpd | Peak Factor | Peak Factor Range | |
|---|---|---|---|---|
| Average Day Demand (ADD) | | | | |
| Maximum Day Demand (MDD) | 0 | 2 | 1.5-3.5 (or *DMDD)* | |
| Peak Hourly Demand (PHD) | 0 | 4 | 2.0-7.0 | |
| Peak Instantaneous Demand (PID) | 0 | 10 | [1]10 | |
| Pump flow to tank | 0 | | | |
| [2]Storage needed for peak-hour demand | **none** | gallons | | |
| [2]Storage for peak-instantaneous demand | **none** | gallons | **pump=demand** | gpm, net flow from Hydro page |

conversions:

| gpm*1440=gpd | | gpd/1440=gpm | |
|---|---|---|---|
| | gpm | | gpd |
| **0** | gpd | **0.0** | gpm |
| | gpm, needed fire flow rate | | |
| | minutes, needed fire flow duration | | |
| **0** | gallons, fire storage | | |

[1] *Depending on deisgn criteria, PID may also be determined using USACE "Design of Small Water Systems", Figure 4-1.*
[2] *Refer to F.A.C. 62-555.320(19)(b)2 above for applicable storage requirements.*

**CHLORINE FEED RATE**

Chlorine demand.  If no data, assume a value in the 5-10 ppm range.
Feed pump output:
Feed rate = well pump output rate (gpm) * dosage (ppm) * 1440 (min/day)  / [solution strength, % * (10,000 ppm/1% str.)]
Where:

Feed Rate = feed pump output rate (gpd)
Well Output = average well pump output (gpm) (assumed constant)
D = required dosage (demand + desired residual in distribution system, ppm)
% Cl sol'n = percentage of NaOCl in solution (off-the-shelf bleach is typically about 5%)
SS = solution strength (1 %/10,000 ppm)

User inputs data into orange cells.

Feed Rate Calcluations:

| | | |
|---|---|---|
| *Well Output | 0 | gpm |
| D | | ppm |
| % Cl sol'n | | percent NaOCl |
| SS | 0 | ppm |
| Feed Rate | 0.0 | gpd |
| *from Hydro Page* | | |

Chlorine Reservior Calculations:

| | | | | |
|---|---|---|---|---|
| Reservoir capacity: | | gallons (input tank size) | | |
| | Demand, gallons | pump on, min | pump amt gallons | refill time, days |
| *Max. Day | 0 | #DIV/0! | #DIV/0! | need dose |
| *Avg. Day | 0 | #DIV/0! | #DIV/0! | need dose |
| **From Storage page* | | | | |