FLEXCON INDUSTRIES®

A Swan Group Company

# Diaphragm Tank Sizing Guide

## HTX and SXHT Series
## Hydronic Expansion Tanks

## PH and WHV Series
## Thermal Expansion Tanks

## Wellrite, Challenger, Flexlite Series
## Water Well Storage Tanks

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# Boyle's Law

All diaphragm tank sizing begins with a basic law of physics known as Boyle's Law. When applied to Hydronic and Thermal expansion tanks it will determine the *acceptance* factor of the tank. When applied to Water well storage tanks it will determine the *drawdown* factor. Boyle's Law is expressed as an equation where;

($P_a$ divided by $P_f$) - ($P_a$ divided by $P_o$) = Acceptance or drawdown factor

## Boyle's Law as applied to hydronic and thermal expansion tanks;

when: $P_a$ = pressure in tank before system is filled (plus 14.7 PSI atmospheric pressure)

$P_f$ = minimum operating or fill pressure (plus 14.7 PSI atmospheric pressure)

$P_o$ = maximum operating pressure (plus 14.7 PSI atmospheric pressure)

For pre-pressurized diaphragm type expansion tanks, $P_a$ is equal to $P_f$ so the formula becomes;

1 minus ($P_f$ divided by $P_o$) = *Acceptance* Factor

## Boyle's Law as applied to water well storage tanks;

What is called the *acceptance* factor in hygronic applications, is called the *drawdown* factor in water well applications.

when: $P_a$ = pressure in tank before system is filled (plus 14.7 PSI atmospheric pressure)

$P_f$ = pump cut-in pressure (plus 14.7 PSI atmospheric pressure)

$P_o$ = pump cut-out pressure (plus 14.7 PSI atmospheric pressure)

With all the pre-pressurized diaphragm tanks, Pa is equal to Pf, so the formula is;

1 minus ($P_f$ divided by $P_o$) = *Drawdown* Factor

# HTX & SXHT Sizing

**for**

## Hydronic Heating Systems

### Use these tanks when installing a closed loop heating system

**Information required:**

1. Total system water content _____ gallons
2. Initial fill water temperature _____ F
3. Maximum water temperature _____ F
4. System fill pressure _____ psig
5. Maximum pressure (10% below relief valve) _____ psig

**Tank Selection:**

6. Enter total system water content (form line 1) _____ gallons
7. Enter expansion factor from Table 1 _____
8. Expanded water volume (line 6 X line 7) _____ gallons
9. Acceptance factor from Table 2 _____
10. Total tank volume required
    (divide line 8 by line 9)

    Line 8 _____ gallons acceptance volume

    Line 10 _____ gallons total tank volume

Select Flexcon tank below which satisfies both line 8 and line 10. For larger systems,multiple tanks may be manifolded together to meet system requirements. For systems containing propylene glycol please contact customer service.


HTX
SERIES


SXHT
SERIES

| HTX and SXHT Series | | | | | |
|---|---|---|---|---|---|
| Model | Total Volume (gallons) | Maximum Acceptance (gallons) | Dimensions | | |
| | | | Diameter (inches) | Length (inches) | Weight (lbs) |
| HTX 15 | 2.1 | 1.0 | 8 | 12.5 | 5.5 |
| HTX 30 | 4.5 | 2.5 | 11 | 14.0 | 10.0 |
| HTX 60 | 6 | 3.0 | 11.4 | 17.2 | 11.5 |
| HTX 90 | 15 | 6 | 16 | 20.8 | 28.0 |
| SXHT 30 | 15 | 6 | 16 | 21.7 | 32.0 |
| SXHT 40 | 20 | 8 | 16 | 28.8 | 39.0 |
| SXHT 60 | 33 | 13.4 | 16 | 42.8 | 57.0 |
| SXHT 90 | 44 | 17.7 | 21 | 36.2 | 72.0 |
| SXHT 110 | 62 | 25 | 21 | 47.9 | 112.0 |
| SXHT 160 | 81 | 32.6 | 21 | 62.0 | 123.0 |

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# PH & WHV Sizing

**for**

**Domestic Water Heating Systems**

## Use these tanks with water heaters or radiant heating systems (with non barrier tubing)


PH
SERIES

**Information required:**

1. Total system water content or water heater x 1.1 _____ gallons
2. Initial fill water temperature _____ F
3. Maximum water temperature _____ F
4. System fill pressure _____ psig
5. Maximum pressure (10% below relief valve) _____ psig

**Tank Selection:**

6. Enter total system water content (form line 1) _____ gallons
7. Enter expansion factor from Table 1 _____
8. Expanded water volume (line 6 X line 7) _____ gallons
9. Acceptance factor from Table 2 _____
10. Total tank volume required (divide line 8 by line 9)

    Line 8 _____ gallons acceptance volume

    Line 10 _____ gallons total tank volume


WHV
SERIES

Select Flexcon tank below which satisfies both line 8 and line 10. For larger systems,multiple tanks may be manifolded together to meet system requirements. For systems containing propylene glycol please contact customer service.

| PH & WHV Series | | | | | |
|---|---|---|---|---|---|
| Model | Total Volume (gallons) | Maximum Acceptance (gallons) | Dimensions | | |
| | | | Diameter (inches) | Length (inches) | Weight (lbs) |
| PH 5 | 2.1 | 1.0 | 8.5 | 11.5 | 7.0 |
| PH 12 | 4.5 | 2.0 | 10.0 | 15.0 | 10.0 |
| PH 25 | 6.0 | 3.8 | 12.5 | 19.2 | 11.5 |
| WHV 50 | 15.0 | 6.3 | 16.0 | 21.7 | 32 |
| WHV 75 | 20.0 | 9.0 | 16.0 | 28.8 | 39 |
| WHV 120 | 33.0 | 14.4 | 16.0 | 27.8 | 60 |
| WHV 165 | 44.0 | 19.8 | 21.0 | 36.2 | 72 |
| WHV 320 | 85.0 | 38.3 | 21.0 | 44.4 | 140 |

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# Well Tank Sizing

## Use these tanks with domestic water well systems

Information required:

1. Pump capacity in gallons per minute (GPM)
_____ gallons
or storage volume required
2. Pump cut-in pressure
_____ psig
3. Pump cut-out pressure
_____ psig


Tank Selection:

5. Enter drawdown factor from table 3
_____
6. Divide storage volume (line1) by the drawdown factor (line5)
_____ gallons

Select the well tank that satisfies the total volume determined in Line 6.
Or, use the simple table below.

| Flexcon Models | | | Tank Volume (gallons) | Drawdown | | | Dimensions | | | Shipping Weight (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| WR (steel) | PC (steel) | FL (composite) | | @ 20/40 psig (gallons) | @30/50 psig (gallons) | @40/60 psig (gallons) | Diameter (inches) | Height (inches) | System Connection | |
| WR45 | PC44 | | 14 | 5.6 | 4.6 | 4.1 | 16 | 22.0 | 1” | 28.0 |
| | | FL 5 | 15 | 6.0 | 5.1 | 4.4 | 16.5 | 25.6 | 1” | 19.0 |
| WR60 | PC66 | | 20 | 8.1 | 6.8 | 5.9 | 16 | 29.0 | 1” | 36.0 |
| | | FL 7 | 22 | 8.8 | 7.5 | 6.5 | 16.5 | 34.1 | 1” | 24.0 |
| WR80 | PC88 | | 26 | 10.5 | 8.9 | 7.7 | 16 | 34.5 | 1” | 41.0 |
| WR100 | PC111 | | 32 | 12.9 | 10.9 | 9.4 | 21 | 27.8 | 1 1/4” | 54.0 |
| WR120 | PC122 | | 34 | 13.3 | 11.3 | 9.7 | 16 | 42.8 | 1” | 49.0 |
| | | FL12 | 35 | 14.1 | 11.9 | 10.3 | 16.5 | 48.9 | 1” | 33.5 |
| WR140 | PC144 | | 44 | 17.7 | 15.0 | 13.0 | 21 | 36.3 | 1 1/4” | 67.0 |
| | | FL17 | 50 | 20.1 | 17.0 | 14.7 | 21.4 | 43.3 | 1 1/4” | 47.0 |
| WR200 | PC211 | | 62 | 25.0 | 21.1 | 18.3 | 21 | 48.0 | 1 1/4” | 82.0 |
| | | FL22 | 65 | 26.1 | 22.1 | 19.1 | 21.4 | 51.3 | 1 1/4” | 58.0 |
| | | FL28 | 82 | 32.6 | 27.6 | 23.9 | 21.4 | 64.7 | 1 1/4” | 69.5 |
| WR240 | PC244 | | 82 | 32.6 | 27.6 | 23.9 | 21 | 62.0 | 1 1/4” | 99.0 |
| WR260 | PC266 | | 85 | 34.3 | 29.0 | 25.1 | 26 | 44.5 | 1 1/4” | 121.0 |
| | | FL30 | 90 | 36.2 | 30.6 | 26.5 | 24.2 | 57.0 | 1 1/4” | 77.0 |
| | | FL40 | 119 | 48.0 | 40.6 | 35.1 | 24.2 | 72.1 | 1 1/4” | 99.5 |
| WR360 | PC366 | | 119 | 48.0 | 40.6 | 35.1 | 26 | 59.75 | 1 1/4” | 153.0 |

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# Acceptance and Expansion Factors

**Table 1**
Expansion Factors

| Final Temp, F | Initial Temperature F | | |
|---|---|---|---|
| | 40 | 50 | 60 |
| 100 | .00575 | .00569 | .00520 |
| 110 | .00771 | .00765 | .00716 |
| 120 | .01004 | .00998 | .00949 |
| 130 | .01236 | .01230 | .01181 |
| 140 | .01501 | .01495 | .01446 |
| 150 | .01787 | .01779 | .01730 |
| 160 | .02092 | .02086 | .02037 |
| 170 | .02418 | .02412 | .02363 |
| 180 | .02763 | .02757 | .02708 |
| 190 | .03127 | .03121 | .03072 |
| 200 | .03510 | .03504 | .03455 |
| 210 | .03911 | .03905 | .03856 |

**Table 2**
Acceptance Factors
Hydronic and Thermal Tanks

| $P_o$ Maximum Operating Pressure (PSIG) | $P_f$ - Minimum Operating Pressure at tank (PSIG) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 12 | 20 | 25 | 40 | 50 | 60 | 70 | 80 | 90 |
| 27 | .360 | .168 | | | | | | | |
| 30 | .403 | .224 | .112 | | | | | | |
| 50 | .587 | .464 | .386 | .155 | | | | | |
| 70 | .685 | .590 | .531 | .354 | .236 | .118 | | | |
| 90 | .745 | .669 | .621 | .478 | .382 | .287 | .191 | .096 | |
| 110 | .786 | .723 | .682 | .561 | .481 | .401 | .321 | .241 | .160 |
| 130 | .815 | .760 | .726 | .622 | .553 | .484 | .415 | .346 | .277 |
| 150 | .838 | .789 | .759 | .668 | .608 | .547 | .486 | .429 | .365 |

| Plain Steel Tank Volumes | | |
|---|---|---|
| Gallons | Diameter | Length |
| 15 | 14” | 26” |
| 30 | 14” | 49” |
| 40 | 14” | 65” |
| 60 | 16” | 74” |
| 80 | 20” | 64” |
| 100 | 20” | 79” |
| 120 | 24” | 67” |
| 135 | 24” | 75” |

**Table 3**
Drawdown Factors
Water Well Storage Tanks

| Cut-out or Final Tank Pressure (PSIG) | Cut-in or Initial Tank Pressure (PSIG) | | | |
|---|---|---|---|---|
| | 20 | 30 | 40 | 50 |
| 40 | .366 | .183 | | |
| 50 | .464 | .309 | .155 | |
| 60 | .535 | .402 | .268 | .134 |
| 70 | .590 | .472 | .354 | .236 |
| 80 | .634 | .528 | .422 | .317 |

| Volume of water in gallons per Lineal Foot | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Type | 1/2” | 3/4” | 1” | 1 1/4” | 1 1/2” | 2” | 2 1/2” | 3” | 4' | 5 | 6 |
| Steel Pipe | .016 | .028 | .045 | .078 | .105 | .172 | .250 | .385 | .667 | 1.00 | 1.50 |
| Copper Pipe | .012 | .025 | .043 | .065 | .092 | .161 | .250 | .357 | .625 | 1.00 | 1.40 |

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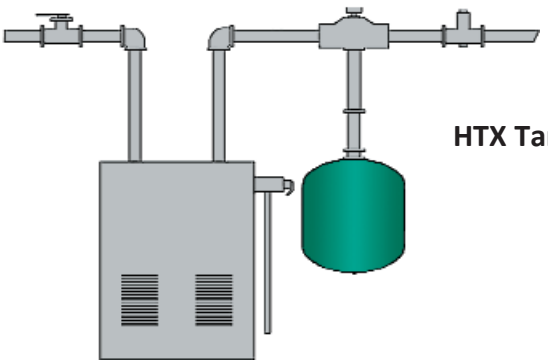
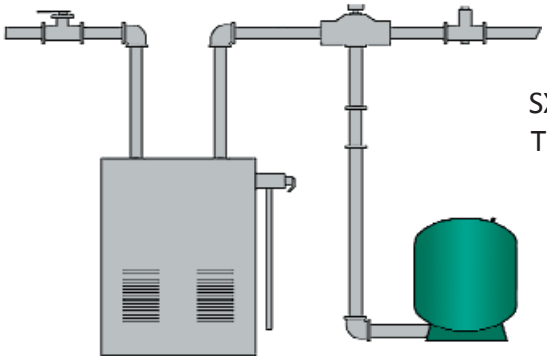
# Typical Installations

Hydronic Systems

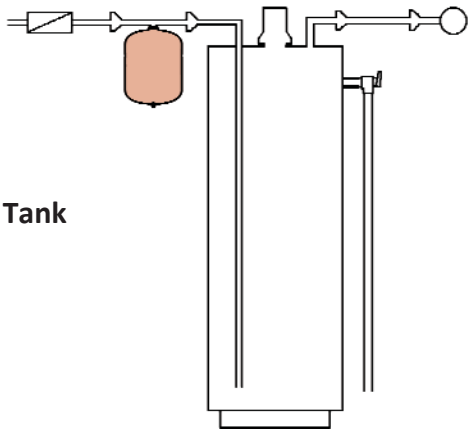


**HTX Tank**



SXHT Tank

Water Heater Systems



**PH Tank**

Water Well Storage Systems