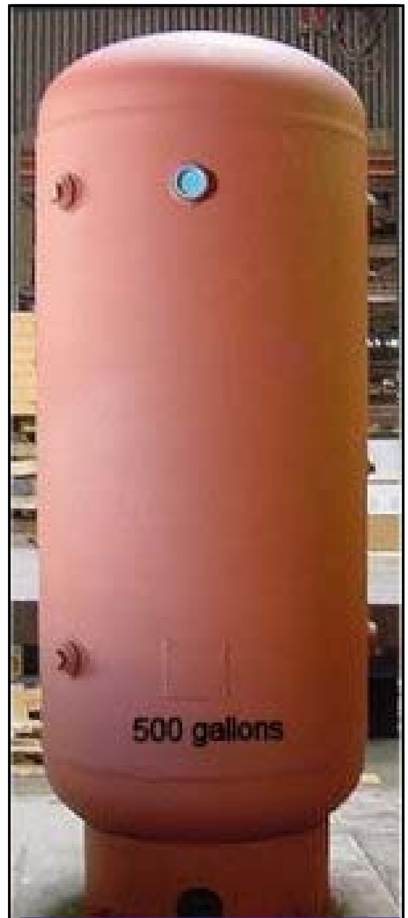
Sizing the Air Receiver



UFAS (Useful Free Air Storage)
$\frac{V(Ft^3) \times \Delta P}{14.7}$

The air receiver must in general be sized according to:

- the **variation in the consumption** demand
- the compressor size and the **modulation strategy**

In general it is possible to calculate the maximum consumption in the system by summarizing the demand of each consumer. The summarized consumption must be multiplied with a **usage factor** ranging 0.1 to 1 - depending on the system. In practice it is common that the manufacturer use standardized receivers for specific compressor models based on their know-how.

For calculating the receiver, note that it is necessary with a **pressure band** for the receiver to be effective. If the consumption process requires 100 psig and the compressor is set to 100 psig, there is no storage and no buffer. Any increased demand makes a pressure drop below 100 psig until the compressor controls respond by increasing the volume compressed.

If the compressors operates at 110 psig the difference between 110 and 100 psig accounts for the air stored in the receiver. If the demand increase, the pressure can drop 10 psig before the minimum requirement is met. Note that in a compressed air system the pipe work also makes the purpose of a buffered volume.

The receiver volume may be calculated using the formula

$t = V (p_1 - p_2) / q_s p_a \quad (1)$

where
V = volume of the receiver tank (cu ft)
t = time for the receiver to go from upper to lower pressure limits (min)
q_s = free air flow (scfm)
p_a= atmospheric pressure (14.7 psia)
p_1 = maximum tank pressure (psia)
p_2 = minimum tank pressure (psia)

The table below indicates normal receiver volumes at given consumptions. The table is based on a design pressure of 140 psig (9.5 bar). 1 cubic foot = 7.48 gallons

Air Flow Capacity (FAD[1])		Recommended Receiver Volume		Gallons
(cfm)	(m^3/h)	(m^3)	(cu ft)	
100	170	0.3	11	83
200	340	0.5	18	135
350	595	1	35	265
600	1020	1.5	53	400
700	1190	2	71	540
1500	2550	3	106	800
2000	3400	4	141	1060
2600	4420	5	177	1350
3000	5100	6	212	1590
4000	6800	8	282	2150
5000	8500	10	353	2650
6000	10200	12	424	3200
7000	11900	14	494	3700
8000	13600	16	565	4250
9000	15300	18	636	4775
10000	17000	20	706	5300

Secondary Air Receiver Tank

A secondary air receiver tank has a slightly different purpose than the primary air tank. It is installed near a piece of equipment that operates intermittently.
The advantage of installing secondary tanks at locations where higher flow rates are required on an intermittent basis is that if an intermittent process can be averaged out (which an air tank will do), the instantaneous requirement of the compressed air system is reduced.

Air Receiver Code Requirements

Many regions have a code requirement for the construction of air receiver tanks. The American Society of Mechanical Engineers (ASME) has established a code for air receiver tanks and many companies rate their tanks to that code.

Safety Relief Valves

All tanks that contain compressed air should have a safety relief valve.
A rule of thumb is to set the relief valve to 10% than the highest system pressure requirement. But the relief valve should never be set higher than the pressure rating of the tank it is connected to.

Condensate Drains

All tanks should have a condensate drain to remove liquid from the tank.
If the manual drain cannot be opened on a regular basis, an automatic-timer drain should be used.

Pressure Gauge

The tank should have a large pressure gauge mounted to it. By using a pressure gauge rated to double the operating pressure, the normal needle location will be pointing straight up. A gauge snubber should also be used to protect the gauge from pressure spikes.