SEPC

QUALITY, ACCURACY, IN TIME, EVERYTIME!

Pressure Vessels for Gases / Air Receivers

SEPC Manufactures Air Receivers for Industrial applications

SEPC

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Why do we require Air Receivers along with Air Compressors?

Air receivers are metallic or non metallic tanks used for dry or wet compressed air storage and are used in nearly all compressed air systems where buffer air stock is required. Due to the inherent risk of explosion in pressurized chambers, it is highly recommended that Air rreceivers be designed and fabricated to standards. The American Society of Mechanical Engineers (ASME) has mandated a code ASME Code Section VIII Division 1. Air receivers shall always meet or better ASME code over and above any other National, International, Local Government, Technical committee with jurisdiction powers , or Insurance codes that apply to a particular installation where this .

Air Receiver requires valves for pressure relief, drain and instruments for measuring temperature pressure etc. which are also covered by codes of design and construction either as mandatory or standard practices which need to be adhered to while accessorizing the equipment. Safety valve is set at a pressure lower than the MAWP (Maximum Allowable Working Pressure) for which the air receiver was stamped and 10% higher than the operating pressure. Drain valve to remove accumulated moisture. Instruments such as Pressure gauges, Thermal gauges, manholes / handholes and Saddle supports or Skirts for mounting air receiver. Standard receivers are designed for horizontal as well as for vertical Mounting.

Purpose of Air Receiver in a Compressed Air system:

Reduces wear and tear on the compressor, capacity control system and motor due to reduced compressor tripping and re-start.

Well designed Receiver stops pulsations in discharge pipeline leading to cost benefits in longer break down free runs and less vibrations.

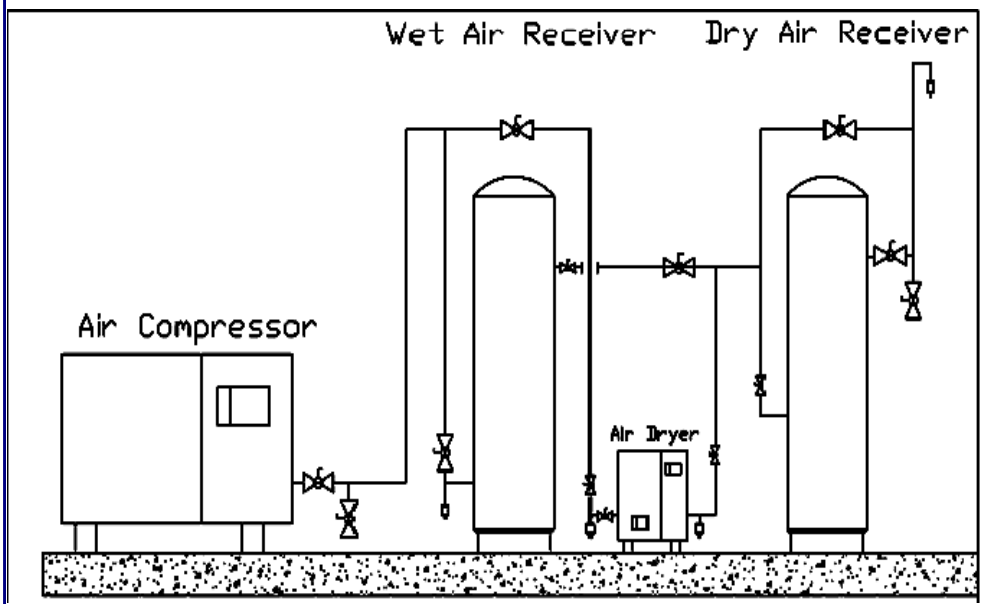
Separates some of the moisture, oil and solid particles that are present in the air when it inducts air from the compressor end or air that may have come over from the after-cooler circuit..

Reduces dew point and temperature peaks after regeneration cycle.

Provides additional storage capacity to compensate for sudden demand surge in compressed air usage.

Contributes to reduce energy demand by optimiizing electric demand charges associated with excessive cycling of the compressor motor.

Even though these benefits do exist the additional storage alone justifies the cost allocated for this component in any Compressed Air System.



Air Receiver:

Depending upon the location of the Air receiver it is classified into two categories

- wet air receivers (supply)
- dry air receivers (demand)

Wet Receivers: Wet receivers provide additional storage capacity and reduce moisture. The large surface area of the air receiver acts as a free cooler, causing condensation which removes moisture content. As the moisture content is removed at this point in the system, filters and dryers can be downsized proportionately. The "wet receiver" means a pressure vessel or tank located immediately next to or right after the compressor. It partially removes contaminants, allows for pressure to be stabilized and also helps in pulsation reduction.

Wet receivers are located downstream of the moisture separator and upstream of the air dryer and filtering equipment.

Dry Receivers: wet air Receivers feed pressurized air to filters and Air dryers. This ‘clean air is stored in the ‘Dry Receiver’ which is just similar to a ‘Wet Receiver’ sans the corrosion protection coating to combat moisture attack or other corrosive elements prior to filtering. So when a demand peak is thrust upon the system, the Dry Receiver buffers the filter and the dryer from the fluctuations and keeps them working within the design parameters of temperature, pressure and flow rate.

Dry receivers are installed after purification equipment. All air receivers should be on concrete foundation..

Draining has to be allowed sufficient free space and pipe-line has to be easily approachable.

Air receivers located outdoors should be provided with a top shed cover as atmospheric condensation (moisture) may freeze and interfere with the operation of drain valves, Pressure gauges and safety valves when located in frigid zones.. Never install any valve between the air receiver and the safety valve. The safety valves should face away from area frequented by humans. Valve threads and fittings shall be such that the thrust of the air relieved, will tighten threaded pipe fittings if it lifts and blows, rather than unthreading them.

Pressure gauges should be of good quality and large enough dial size to read while standing on the ground. An isolation valve between the pressure gauge and the tank helps so that the gauge can be removed and replaced or recalibrated every six months without depressurizing the tank. Air receivers shall have an automatic valve trap / drainage system. The receiver shall be bolted or clamped to the floor or base on which it is mounted by use of foundation bolts in case of a pipe line fracture.

Maintenance & upkeep: Moisture shall be drained from the receiver periodically, especially in cold zones to avoid freezing over which causes ice formation inside or outside the vessel causing volumetric expansion and leads to cracking or brittle fracture. Any additional work shall be carried out with prior permission of Inspection engineer authorized to inspect such repairs.

Sizing an Air Receiver

The Air Receiver must be chosen according to

- **Variable consumption** at various locations.
- Compressor size & **modules designed.**

Calculate the maximum consumption in the system by adding up total demand from each node. The total must be multiplied with a **usage factor** varying between *0.1 - 1*

depending on the type of set up required or system design and specifications. Use standard size air receivers for specific compressor models designed for different applications.

The Air receiver needed is selected to be at least 10% higher in volumetric capacity than the total calculated air required (Air demand).

Extra capacity acts a s buffer and preserves the pressure in lines ensuring smooth transfer of pressurised air without frequent tripping. As the demand increases, the pressure can drop *10 %* before the minimum requirement is met. Pressure controllers and flow controllers can be used after the receiver for stabilizing downstream pressure in lines to *100 %,* which flattens demand peaks & trough just like a DC rectifier works in an electrical circuit. A compressed air system has piping which also stores air and requires work causing losses but also act as a buffer volume.

Air receiver volume shall be calculated using:

$t = V (p_1 - p_2) / C p_a$ (1)

where

V = volume of the receiver tank (cu ft)

t = time for the receiver to go from upper to lower pressure limits (min)

C = free air needed (scfm)

p_a= *atmosphere pressure (14.7 psia)*

p_1 = *maximum tank pressure (psia)*

p_2 = *minimum tank pressure (psia)*

Usually receivers are sized according to gallons or litre volumetric capacity as:

For 1 gallon for each ACFM (Actual Cubic Feet per Minute), or

4 gallons per compressor hp (horse power)

Airflow Capacity		Recommended Receiver Volume		
hp	kW	cu. ft.	gal	cu. m.
100	170	13	100	0.4
200	340	27	200	0.8
300	510	40	300	1.1
400	680	54	400	1.5
500	850	67	500	1.9
750	1275	101	750	2.9
1000	1700	134	1000	3.8
1500	2550	201	1500	5.7
2000	3400	268	2000	7.6
3000	5100	402	3000	11.4
4000	6800	536	4000	15.2
5000	8500	670	5000	19.0
7500	12750	1005	7500	28.5
10000	17000	1340	10000	38.0

Air Receiver Capacities (cubic feet)					
Tank Size	Tank Size	Gauge Pressure on Tank *(psig)*			
(metre)	*(gallons)*	0	100	150	200
0.30 x 0.60	10	1.3	11	15	19
0.35 x 0.90	20	2.7	21	30	39
0.40 x 0.92	30	4.0	31	45	59
0.50 x 1.25	60	8.0	62	90	117
0.50 x 1.60	80	11	83	120	156
0.60 x 1.75	120	16	125	180	234
0.75 x 2.15	240	32	250	360	467

Compressor Power		Recommended Receiver Volume		
cfm	cu.m /hr.	Cu. ft.	gal	cu. m.
5	3.7	3	20	0.1
7.5	5.6	4	30	0.1
10	7.5	5	40	0.2
15	11.2	8	60	0.2
20	14.9	11	80	0.3
25	18.7	13	100	0.4
30	22.4	16	120	0.5
40	29.8	21	160	0.6
50	37.3	27	200	0.8
60	44.8	32	240	0.9
75	56.0	40	300	1.1
100	74.6	54	400	1.5
125	93.3	67	500	1.9
200	149.2	107	800	3.0
350	261.1	188	1400	5.3
450	335.7	241	1800	6.8
500	373.0	268	2000	7.6

Air Receivers Capacities

- *1 ft^3 = 0.02832 m^3*
- *1 psig = 6.9 kPa = 0.069 bar*
- *1 Gallon (U.S.) = 3.785x10^{-3} m^3 = 3.785 dm^3 (liter) = 231 in^3*

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