HELPFUL AIR COMPRESSOR INFORMATION
for Quincy Compressor Products

Manual No. 50046-101

Terminology

Compressors are machines designed form compressing air or gas from an initial intake pressure to a higher discharge pressure.

Booster Compressors are machines for compressing air or gas from an initial pressure, which is above atmospheric pressure, to still higher pressure.

Vacuum Pumps are machines for compressing air or gas from an initial pressure which is below atmospheric to a final pressure which is near atmospheric.

Reciprocating Compressors are those that use a reciprocating motion to compress air.

Single-Acting Compressors are those in which compression takes place on but one stroke per revolution in each compressing element.

Double-Acting Compressors are those in which compression takes place both strokes per revolution in each compressing element.

Single-Stage Compressors are those in which compression from initial to final pressure is complete in a single step or stage.

Multi-Stage Compressors or Compound Compressors are those in which compression from initial to final pressure is completed in two or more distinct steps or stages.

Two-Stage Compressors are those in which compression from initial to final pressure is completed in two distinct steps or stages.

Portable Compressors are those consisting of compressor and driver so mounted that they may be readily moved as a unit.

Intercoolers are devices for removing the heat of compression of the air or gas between consecutive stages of multi-stage compressors.

Aftercoolers are devices for removing the hat of compression of the air or gas after compression is completed. They are one of the most effective means of removing moisture from compressed air.

Moisture Separators are devices for collecting and removing moisture precipitated from the air and gas during the process of cooling.

Load Factor is the ratio of the average compressor output during period of actual use to the continuous rated output of the machine.

ASME Standard (UM Type) tank is made and tested in accordance with the American Society of Mechanical Engineers standards. ASME certificate of compliance is furnished with each tank.

Absolute Pressure is the gauge pressure plus atmospheric Pressure. At sea level the gauge pressure in pounds per square inch (psi) plus 14.7 gives the absolute pressure in pounds per square inch (psia).

Displacement of a Compressor Cylinder is the volume swept through by the piston. This is usually expressed in cubic feet per minute (cfm).

The Displacement of a Multi-Stage Compressor is that of the first stage only, since the same gas passes through all stages in series.

Free Air is air at normal atmospheric condition. Because the altitude, barometer and temperature vary at different localities and at different times, it follows that this term does not mean air under identical conditions.

Compressed Air is free air that has been pressed into a volume smaller than it normally occupies. As compressed air exerts pressure it performs work when released and allowed to expand to its normal free state.

Actual Capacity of an air or gas compressor is the quantity of air or gas compressed and delivered. It is usually expressed in cubic feet per minute (acfm) at compressor inlet conditions.

Volumetric Efficiency is the ratio of the actual capacity of the compressor to displacement and is expressed in percent.

Compressed Efficiency is the ratio for the theoretical horsepower to the actual indicated horsepower required to compress a definite amount of gas.

Mechanical Efficiency is the ratio of the indicated horsepower in the compressing cylinders to the indicated horsepower in the power cylinders, in the case of steam-driven or internal combustion engine-driven compressors, and to the brake horsepower delivered to the shaft in case of a power driven machine. It is expressed in percent.

Overall Efficiency is the product of the compression efficiency and the mechanical efficiency.

Compression Ratio is the ratio of the absolute discharge to the absolute intake pressure.

Low Pressure Orifice Test is a method of accurately measuring the air delivered by a compressor. It is the method recognized by ASME, ANSI and International Standards.

Useful Formulae

1. COMP. RPM = $\dfrac{\text{motor pulley dia. x motor rpm}}{\text{comp. pulley dia.}}$

2. MOTOR PULLEY p.d. = $\dfrac{\text{comp. pulley dia. x comp. rpm}}{\text{motor rpm}}$

3. COMP. PULLEY p.d. = $\dfrac{\text{motor pulley dia. x motor rpm}}{\text{comp rpm}}$

4. MOTOR RPM. = $\dfrac{\text{comp. pulley dia. x comp. rpm}}{\text{motor pulley p.d.}}$

5. FREE AIR = piston displacement x volumetric eff. (%)

6. REQUIRED PISTON DISPLACEMENT = $\dfrac{\text{free air}}{\text{vol. eff}}$

7. PISTON DISPLACEMENT IN CU FT. MIN* = $\dfrac{\text{Cyl. Bore in in. x cyl. Bore x stroke in in. x rpm}}{2200}$

8. CU. FT. COMPRESSED AIR = $\dfrac{\text{Cu. Ft. free air x 14.7}}{\text{(psig + 14.7)}}$

9. CU. FT. FREE AIR = $\dfrac{\text{Cu. Ft. compressed air x (psig + 14.7)}}{14.7}$

10. CU. FT. FREE AIR REQ'D. TO RAISE REC FROM O GAUGE TO FINAL PRESSURE = $\dfrac{\text{Vol. of rec. in cu. ft x psig}}{\text{(atmospheric pressure) psia}}$

11. CU. FT. FREE AIR REQ'D. TO RAISE REC FROM SOME PRESS GREATER THAN 0 GAUGE TO A FINAL HIGHER PRESSURE =

$$\begin{array}{c}\text{Vol. of rec.}\\ \text{in cu. ft.}\end{array} \; \dfrac{\text{(final psig – initial psig)}}{\text{(atmospheric pressure) psia}}$$

12. PISTON SPEED IN FT. PER MIN. = $\dfrac{\text{2 x stroke (in inches) x rpm}}{\text{(psig + 14.7)}}$

13. GALLONS = $\dfrac{\text{cu. ft.}}{.134}$

14. CU. FT. = gallons x .134

15. TOTAL FORCE IN LBS. OF AIR CYLINDER = $\dfrac{\text{Cu. Ft. free air x 14.7}}{\text{(psig + 14.7)}}$

16. CFM OF FREE AIR REQ'D TO OPERATE AIR CYLINDER (SINGLE ACTING) = $\dfrac{\text{Cu. Ft. free air x 14.7}}{\text{(psig + 14.7)}}$

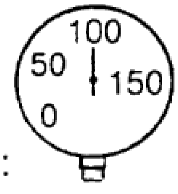
17. PUMP UP TIME (MIN) = $\dfrac{\text{V (tank size in gal) x (final tank press – initial tank press)}}{\text{7.48 x atmos. Press. (psia) x pump delivery (cfm)}}$

**Piston displacement for multi-stage compressors – only the low pressure cylinders are considered.*

WHAT IS COMPRESSED AIR?

Air at greater than atmospheric pressure —
usually 100 pounds over atmospheric pressure — or 100 PSIG.

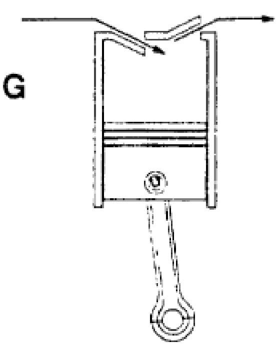
P.S.I.G. means Pounds Per Square Inch Gauge



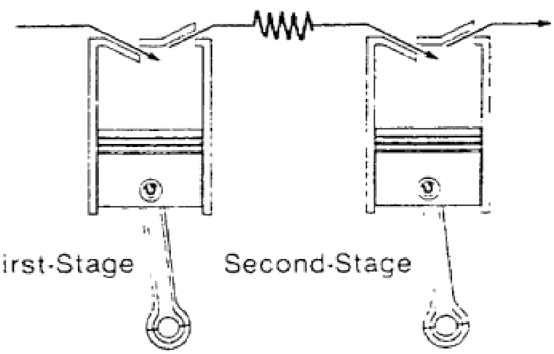
Atmospheric air can be compressed in several ways:

POSITIVE DISPLACEMENT COMPRESSORS — are machines in which successive volumes of air are confined within a closed space and elevated to a higher pressure.

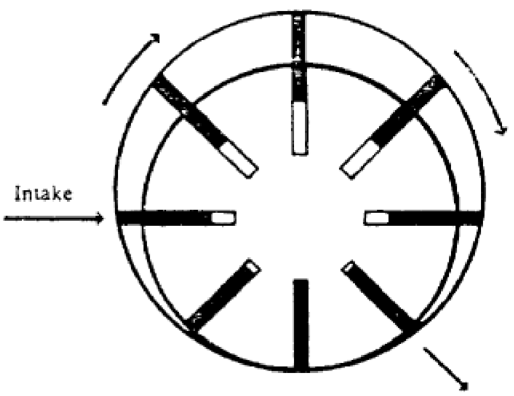
RECIPROCATING



SINGLE STAGE

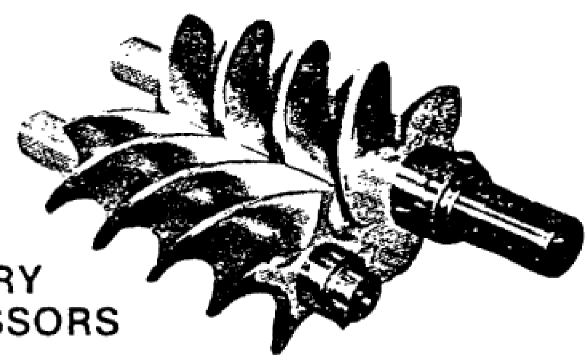


TWO STAGE



SLIDING VANE

ROTARY COMPRESSORS



HELICAL SCREW

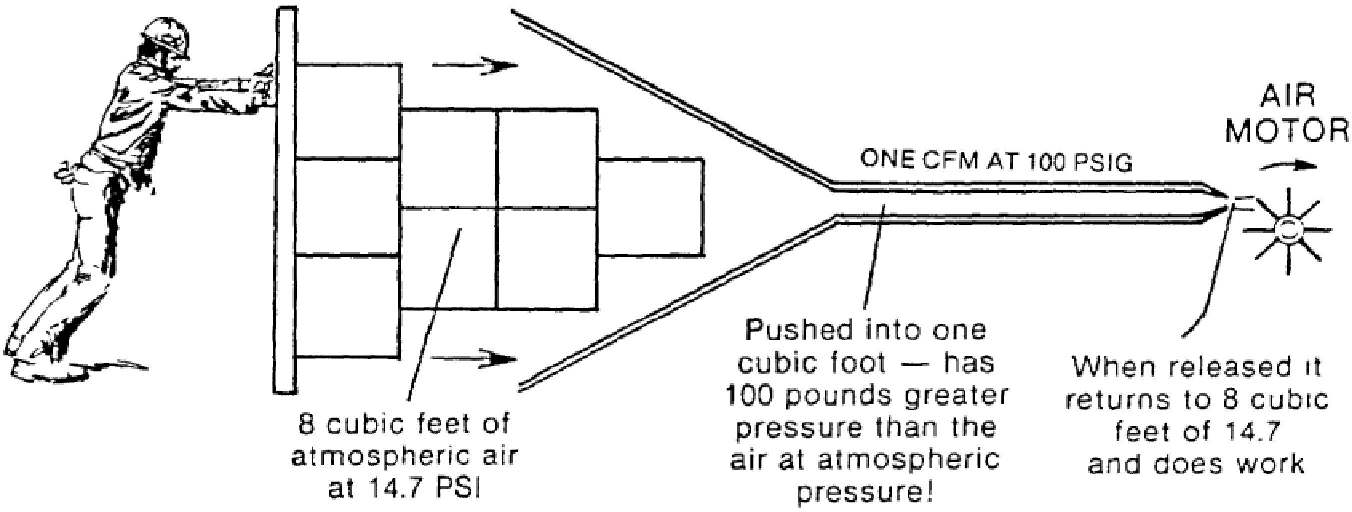
DYNAMIC COMPRESSORS — are machines in which air is compressed by the mechanical action of rotating impellers imparting velocity and pressure into the air.

CENTRIFUGAL COMPRESSOR (Operates like a fan)

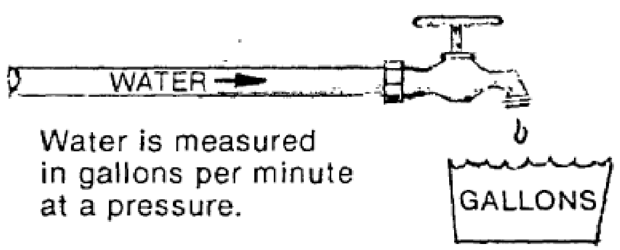
USES OF COMPRESSED AIR

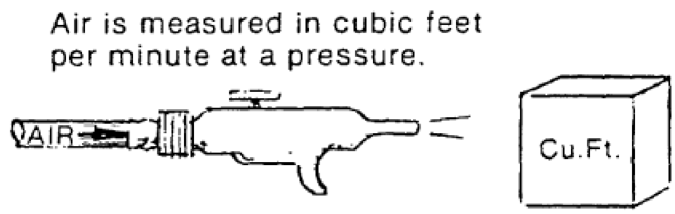
Air which has been compressed above atmospheric pressure will return to atmospheric pressure when released.
Therefore; compressed air is *STORED ENERGY!*
The amount of this stored energy, or the ability of the compressor to supply this energy is expressed in both CFM and PSIG.

CFM or Cubic Feet Per Minute is the volume of air measuring the compressors capabilities.



Remember PSI = *POUNDS PER SQUARE INCH* or the measure of air pressure or force delivered by the compressor.





The volume *(MEASURED IN CFM)* required — determines the size of air compressor needed to do the job.

Example: 5 HP COMPRESSOR will supply 20 CFM at 100 PSIG

200 HP COMPRESSOR will supply 1,000 CFM at 100 PSIG

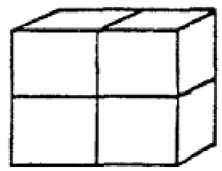
OTHER USES OF COMPRESSED AIR

ONE HP COMPRESSOR

could supply 200 PSIG or more!

— A Good Rule To Remember —

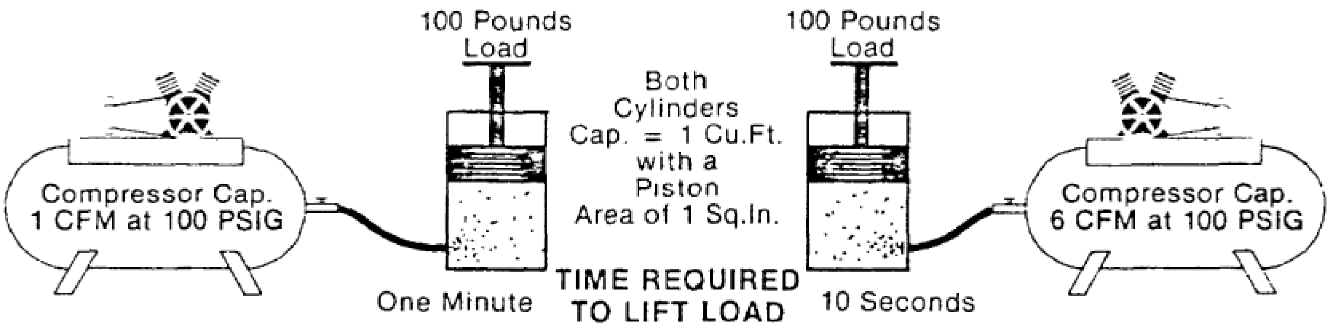
will provide about



4 Cubic Feet of Compressed Air at 100 PSIG

Larger — more efficient — two stage reciprocating type compressors will provide 5+ cubic feet per horsepower.

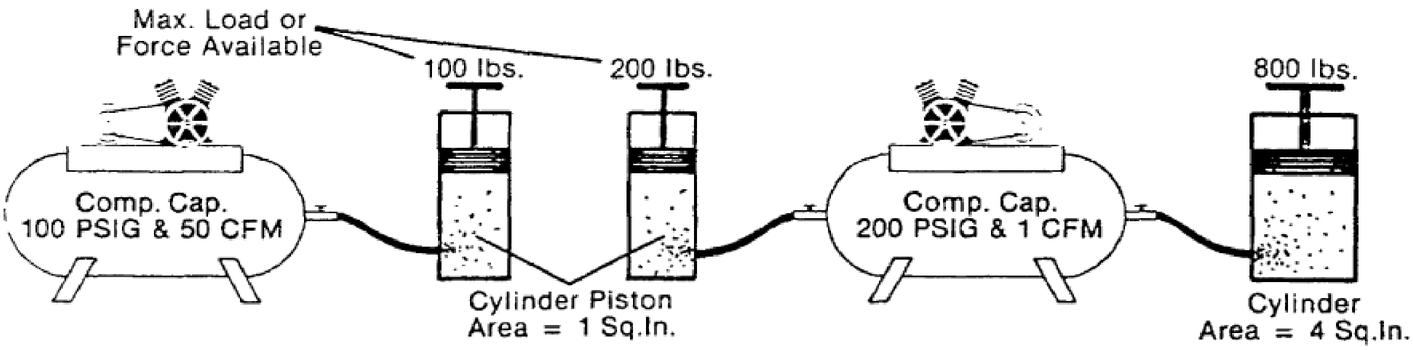
— What does air volume do?



Volume Does The Job Faster!

Some tools, motors, hammers will not operate without sufficient volume.

— What does pressure do?



Greater Pressure Increases The Force Or Torque!

TYPICAL USES OF COMPRESSED AIR

TOOLS	CFM REQUIRED AT 100 PSIG
Drill 1/4"	25
Screwdriver #6	24
Nutsetter 1/2"	30
Impact Wrench 3/4"	35
Die Grinder	24
Horizontal Grinder	60
Vert. Grinder 5" Pad	35
Burring Tool	24
Rammers — Medium	34
Air Motor 1-HP	25
Air Motor 2-HP	50
Air Hoist 1000 lbs.	One Cubic Foot Per Foot Of Lift
Paint Spray Gun	20
Chipping Hammer	30
Circular Saw 8"	45

Compressed air is the 4th utility to industry!

It is as important as water, electricity, and fuel (gas, oil, etc.).

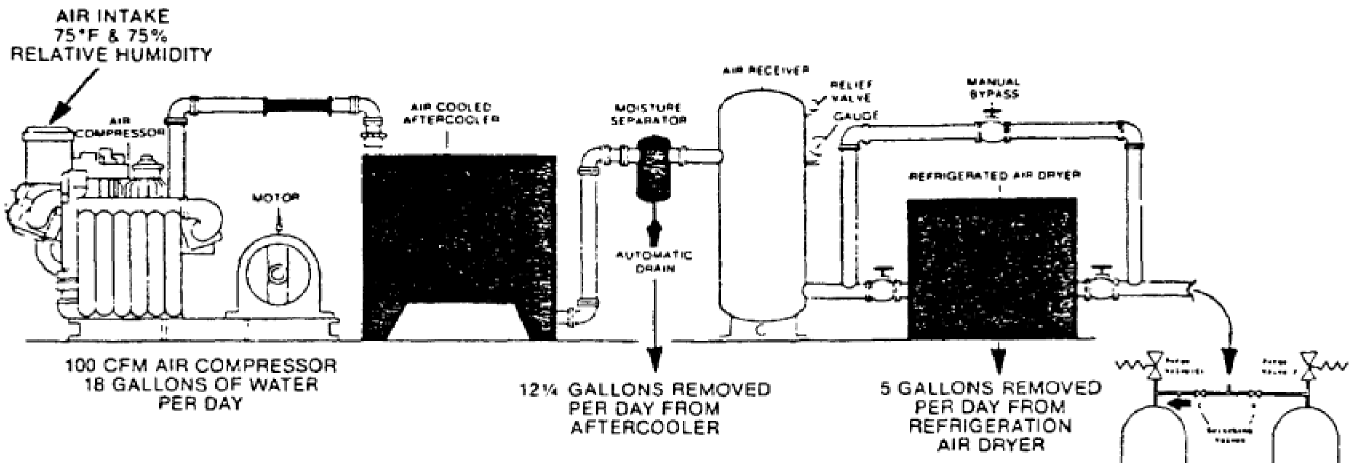
The great advantage of compressed air is the high ratio of power to weight or power to volume. In comparing electric motors, compressed air produces smooth translation with much more uniform force. Compressed air equipment can be more economical, and more durable.

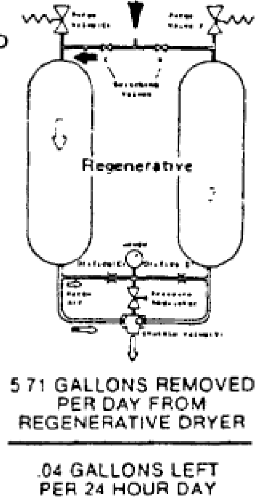
Compressed air tools can be operated without the shock hazard of electricity or the explosion hazard of oil.

Industrial Uses of Compressed Air:

Production Line Tools — Automation & Assembly Stations — Plant Maintenance — Chemical Manufacturing — Aircraft Mfg. — Automobiles — Beverages — Agriculture — Cement — Foundries — Plastics — Construction — Hospitals — Monuments — Power Plants — Sewage Plants — Painting & Ski Areas.

MOISTURE IN COMPRESSED AIR



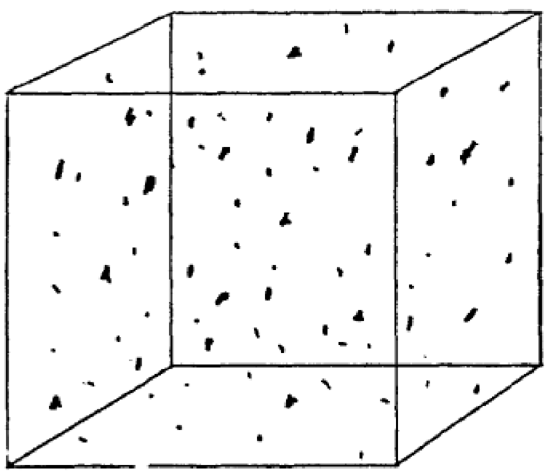


BASIC LAW OF PHYSICS:

Hot Air Holds More Water Vapor

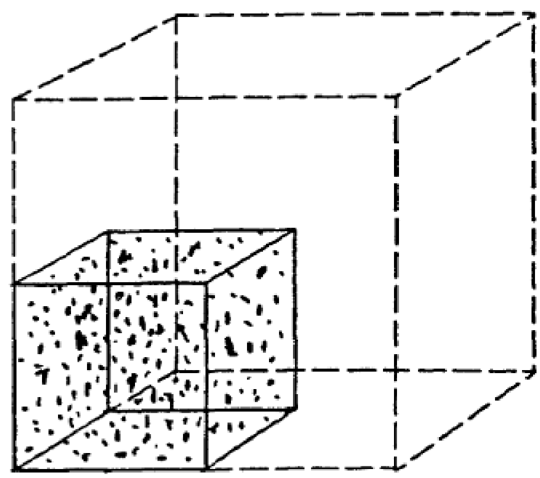
Problems caused by water in compressed air:

1. Washing of required lubrication.
2. Maintenance and wear increases.
3. Air equipment sluggish.
4. Rust
5. Instrument problems.
6. Paint spotting.
7. Air line freeze.
8. Shortens air tool life.



One Cubic Foot Air
Contains:
1. Water Vapor
2. Dust & Dirt
3. Odors & Vapors

When compressed to 100 PSIG it becomes 1/8 its previous size



The volume of air has changed, but the amount of water vapor, dust, dirt & odors has not changed. Just more concentrated.

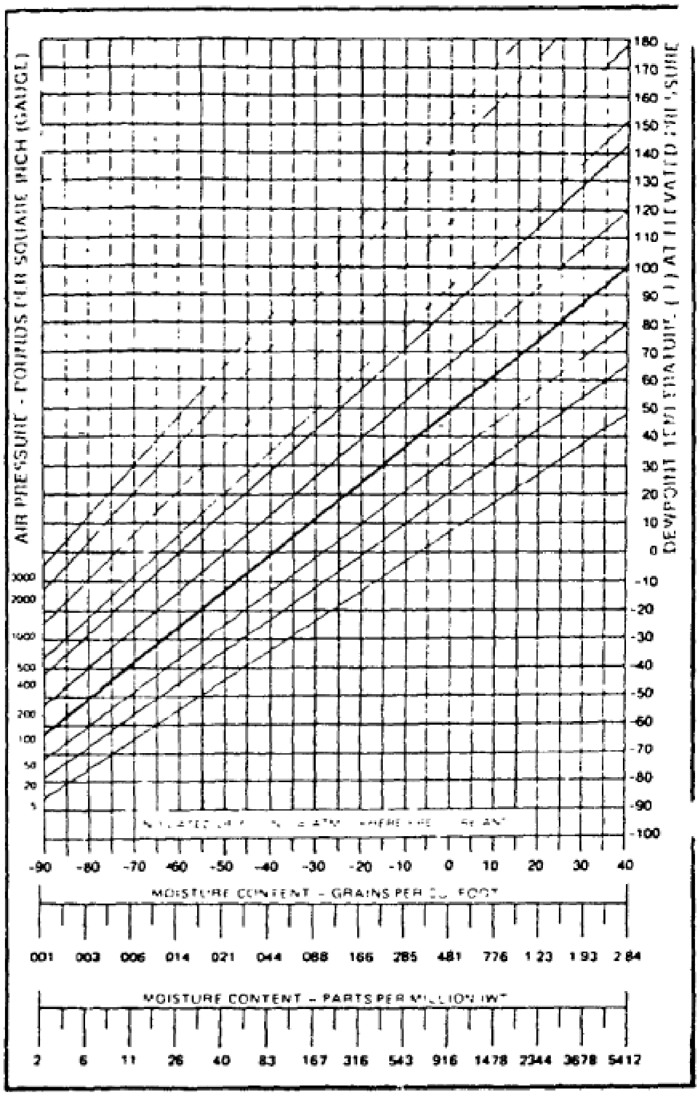
DEW POINT CONVERSION CHART

AIR MOISTURE CONTENT

Grains of water in one cubic foot of air at various temperatures and percentages of saturation.

TEMPERATURE		PERCENTAGE OF SATURATION			
°F	°C	30	50	70	100
-20	-28.90	0.050	0.083	0.116	0.166
-15	-26.10	0.065	0.109	0.153	0.218
-10	-23.30	0.086	0.142	0.200	0.285
-5	-20.50	0.111	0.185	0.259	0.370
0	-17.80	0.144	0.240	0.337	0.481
5	-15.00	0.183	0.305	0.427	0.610
10	-12.20	0.233	0.388	0.543	0.776
15	-9.44	0.296	0.493	0.690	0.986
20	-6.67	0.370	0.618	0.864	1.235
25	-3.89	0.465	0.776	1.086	1.551
30	-1.11	0.580	0 968	1.354	1.935
35	1.67	0.710	1.183	1.656	2.368
40	4.44	0.855	1.424	1.994	2.849
45	7.22	1.024	1.707	2.390	3.414
50	10.00	1.222	2.038	2.853	4.076
55	12.80	1.455	2.424	3.394	4.849
60	15.60	1.724	2.872	4.022	5.745
65	18.30	2.035	3.391	4.747	6.782
70	21.10	2.394	3.990	5.586	7.980
75	23.90	2.807	4.678	6.549	9.356
80	26.70	3.280	5 467	7.654	10.934
85	29.40	3.821	6.368	8.915	12.736
90	32.20	4 437	7.395	10.353	14.790
95	35.00	5.137	8.562	11.987	17.124
100	37.80	5.930	9.883	13.836	19.766
105	40.50	6.825	11.375	15.925	22.750
110	43.00	7.834	13.056	18 278	25.112

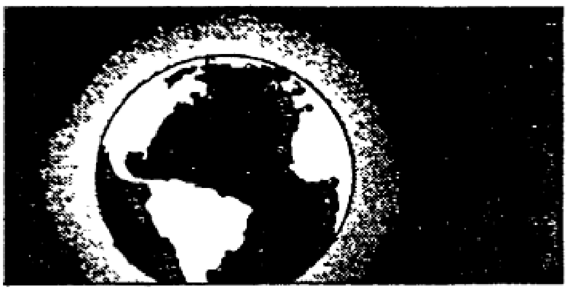
DEWPOINT CONVERSION CHART



RULE OF THUMB:

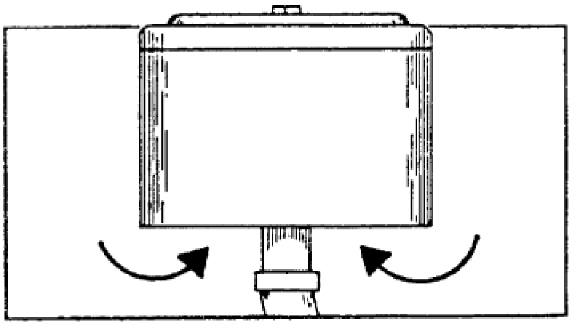
FOR EVERY 20°F TEMPERATURE DROP — WE LOOSE ONE HALF THE WATER!

HOW TO EXTEND THE LIFE OF YOUR .....



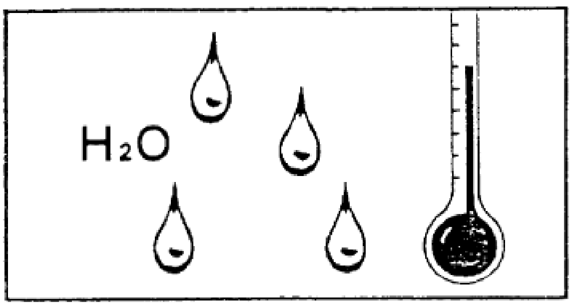
AMBIENT

The ambient or surrounding atmosphere should be kept clean. This area must also be well ventilated for proper cooling. Inadequate cooling results in overheating, which strains your compressor system.



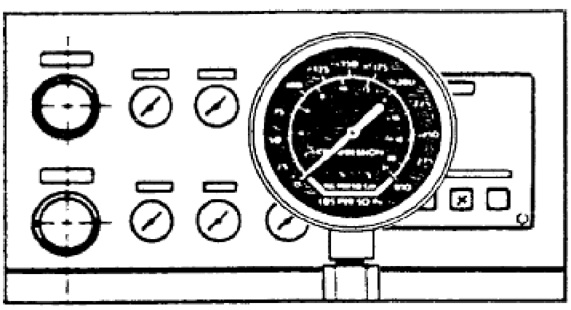
INLET FILTER

The inlet filter which also functions as a silencer, needs regular inspection. A dirty filter increases wear on components and lessens operating efficiency. Intake leaks cause system contamination!



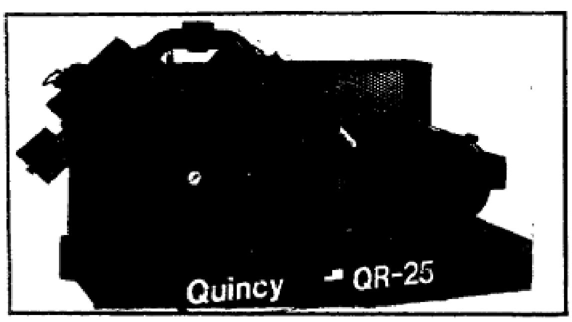
COOLING WATER

A adequate supply of uncontaminated cooling water with regulated temperature & pressure control provides an ideal condition for the operation of water cooled equipment.



GAUGES AND CONTROLS

All instrumentations for gauging speed, pressure, temperature, etc., must be kept fully operational and accurately calibrated. Moisture and other contaminates will effect gauge readings.

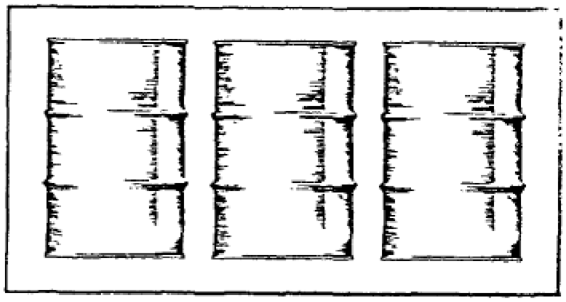


MOTOR AND COMPRESSOR

The motor and compressor are the most important components of your system. Their smooth performance is essential! Locate unusual noises or vibrations. Rough service, improper alignment, are warnings of system breakdowns; don't ignore them!

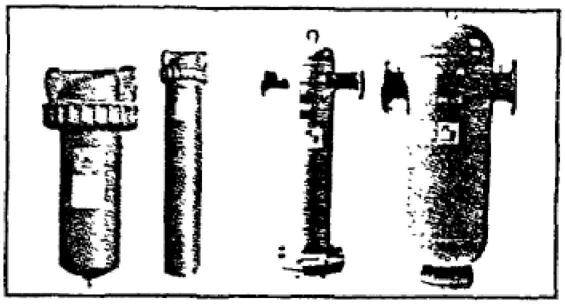
LUBRICATION

Always use the proper weight and grade of oil specified by the manufacturer. Keep the oil reservoir and component parts clean by changing oil when needed, this reduces sludge and varnish build-up. When oil breaks down it thins out, lessening lubrication, thus increasing wear.



MAINTENANCE

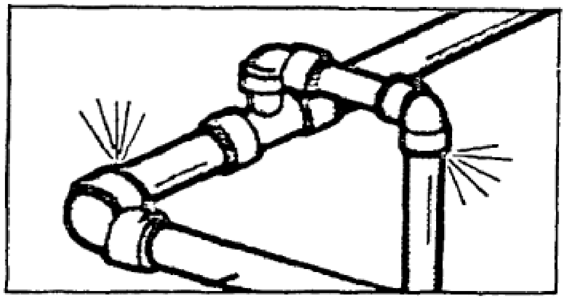
Develop routine inspection of all items on this page. Replace, repair or clean them whenever necessary. The performance and life of your equipment depends directly upon the maintenance provided.



LOSSES

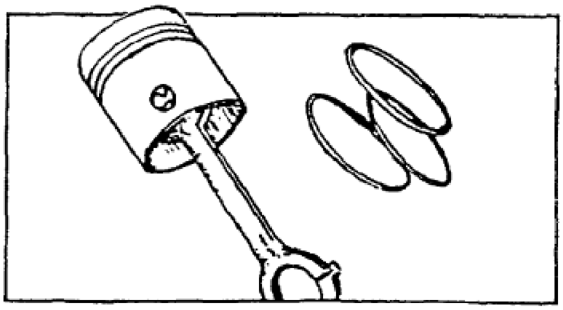
With compressor motor off and the air tank at pressure. Check all connections, valves, and lines to point of use. Leaks make the unit work harder.

—Pressure lost cannot be regained.—



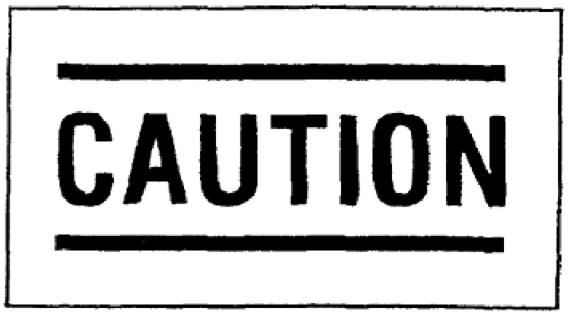
WORN PARTS

Worn parts cause imbalance, vibrations and noises, but sometimes friction and loose components are inaudible. That is why periodical micrometer and seal tests need to be done to determine the life that remains in your compressor parts.

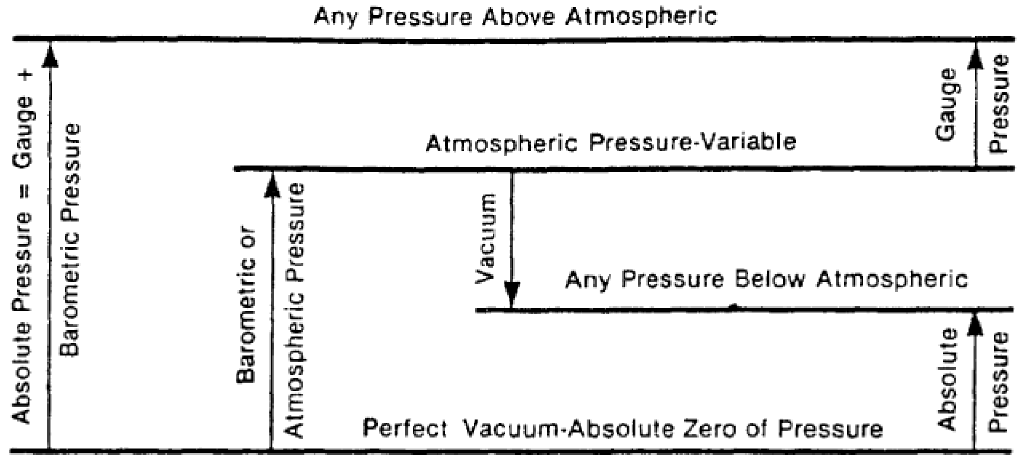


SAFETY FIRST

Compressed air and electricity are dangerous. When performing maintenance or service work, make absolutely sure that the electrical supply has been disconnected and locked out, and the internal compressor system has been completely relieved of all pressure.



METHODS OF EXPRESSING PRESSURE



NOTE: SCFM is technically defined as free air at
14.7 PSIA, 60 F. and 36% relative humidity.

COST OF COMPRESSED AIR:

I. **15%** Fixed Charges: Compressor, Installation, Depreciation, Insurance, Repair.

II. **15%** Operating Charges: Attendance, Lubrication, Cooling-Water, Filters.

III. **70%** Power: Electric Motor Driven (both energy & demand) at 6¢/kw hr.

— FACTS —

A. 20¢ per 1000 CF @ 100 PSIG: 200 HP = 1000 CFM X 60 min. × 24 hr. = $288.00 per day.

B. Rule of Thumb: Cost $1.00 per HP per 24 hrs. at 6¢ per kw hour.

C. Cost of Air Leakage ¼" leak = 2,920,000 cu. ft. per month = $684.00.

TABLE I Electric Operating Cost

Motor	Full Load KVa	Operating Cost Per Year (8760 hours) at Stated Cost per kWh ($)						
Size HP	@ 1800 RPM	.03	.04	.05	.06	.07	.08	.09
10	10.14	$ 2,665	$ 3,553	$ 4,441	$ 5,330	$ 6,218	$ 7,106	$ 7,994
15	15.67	4,118	5,491	6,865	8,236	9,609	10,982	12,354
20	20.06	5,271	7,029	8,786	10,544	12,301	14,058	15,815
25	24.93	6,551	8,735	10,919	13,103	15,287	17,471	19,655
30	28.58	7,511	10,014	12,518	15,022	17,525	20,029	22,532
40	38.32	10,070	13,427	16,784	20,141	23,498	26,855	30,211
50	47.10	12,378	16,504	20,630	24,756	28,882	33,008	37,134
60	57.21	15,035	20,046	25,058	30,070	35,081	40,093	45,104
75	71.10	18,685	24,913	31,142	37,370	43,599	49,827	56,055
100	91.11	23,944	31,925	39,906	47,887	55,869	63,850	71,831
125	118.47	31,134	41,512	51,890	62,268	72,646	83,024	93,402
150	140.57	36,942	49,256	61,570	73,884	86,198	98,511	110,825
200	188.65	49,577	66,103	82,629	99,154	115,680	132,206	148,732

Useful Data

DISCHARGE, CUBIC FEET, FREE AIR PER MINUTE

Gauge Pressure before Orifice PSIG	DIAMETER OF ORIFICE in inches										
	1/64	1/32	1/16	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1
5	.062	248	.993	3.97	15.9	35.7	63.5	99.3	143	195	254
15	.105	420	1.68	6.72	26.9	60 5	108	168	242	329	430
20	123	491	1.96	7.86	31 4	70.7	126	196	283	385	503
25	.140	562	2.25	8.98	35.9	80 9	144	225	323	440	575
30	.158	.633	2.53	10 1	40.5	91.1	162	253	365	496	648
35	.176	703	2.81	11 3	45.0	101	180	281	405	551	720
40	.194	.774	3 10	12.4	49 6	112	198	310	446	607	793
45	.211	.845	3.38	13 5	54.1	122	216	338	487	662	865
50	.229	.916	3.66	14.7	58 6	132	235	366	528	718	938
60	264	1.06	4 23	16 9	67 6	152	271	423	609	828	1082
70	.300	1.20	4.79	19 2	76.7	173	307	479	690	939	1227
80	.335	1 34	5 36	21.4	85.7	193	343	536	771	1050	1371
90	.370	1.48	5.92	23.7	94 8	213	379	592	853	1161	1516
100	406	1.62	6.49	26.0	104	234	415	649	934	1272	1661
110	441	1.76	7.05	28 2	113	254	452	705	1016	1383	1806
120	.476	1.91	7.62	30 5	122	274	488	762	1097	1494	1951
125	.494	1 98	7.90	31 6	126	284	506	790	1138	1549	2023

FRICTION OF AIR IN HOSE

Size of hose, coupled each end (in)	Gage pressure at line (Lb.)	Cu ft. free air per min passing through 50-ft lengths of hose											
		20	30	40	50	60	70	80	90	100	110	120	130
		Loss of pressure (psi) in 50-ft lengths of hose											
1 2	50	1 8	5 0	10 1	18 1								
	60	1 3	4 0	8 4	14 8	23 4							
	70	1 0	3 4	7 0	12 4	20 0	28 4						
	80	0 9	2 8	6 0	10 8	17 4	25 2	34 6					
	90	0 8	2 4	5 4	9 5	14 8	22 0	30 5	41 0				
	100	0 7	2 3	4 8	8 4	13 3	19 3	27 2	36 6				
	110	0 6	2 0	4 3	7 6	12 0	17 6	24 6	33 3	44 5			
3 4	50	0 4	0 8	1 5	2 4	3 5	4 4	6 5	8 5	11 4	14 2		
	60	0 3	0 6	1 2	1 9	2 8	3 8	5 2	6 8	8 6	11 2		
	70	0 2	0 5	0 9	1 5	2 3	3 2	4 2	5 5	7 0	8 8	11 0	
	80	0 2	0 5	0 8	1 3	1 9	2 8	3 6	4 7	5 8	7 2	8 8	10 6
	90	0 2	0 4	0 7	1 1	1 6	2 3	3 1	4 0	5 0	6 2	7 5	9 0
	100	0 2	0 4	0 6	1 0	1 4	2 0	2 7	3 5	4 4	5 4	6 6	7 9
	110	0 1	0 3	0 5	0 9	1 3	1 8	2 4	3 1	3 9	4 9	5 9	7 1
1	50	0 1	0 2	0 3	0 5	0 8	1 1	1 5	2 0	2 6	3 5	4 8	7 0
	60	1 1	0 2	0 3	0 4	0 6	0 8	1 2	1 5	2 0	2 6	3 3	4 2
	70	.	0 1	0 2	0 4	0 5	0 7	1.0	1 3	1 6	2 0	2 5	3 1
	80	.	0 1	0 2	0 3	0 5	0 7	0 8	1 1	1 4	1 7	2 0	2 4
	90		1 1	0 2	0 3	0 4	0 6	0 7	0 9	1 2	1 4	1 7	2 0
	100	.	1 1	0 2	0 2	0 4	0 5	0 6	0 8	1 0	1 2	1 5	1 8
	110	.	0 1	0 2	0 2	0 3	0 4	0 6	0 7	0 9	1 1	1 3	1 5

PIPE SIZE RECOMMENDED FOR TRANSMISSION OF COMPRESSED AIR TO 80-125 P.S.I.

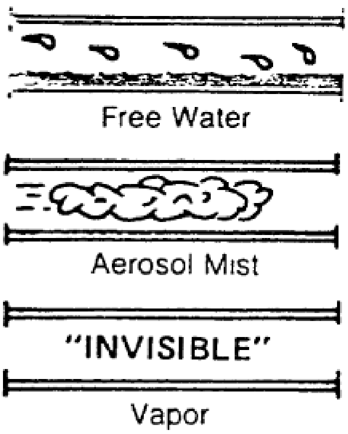
Volume Of Air Transmitted	Length of Run (Ft)				
	50-200	200-500	500-1000	1000-2500	2500-3000
(CFM)	Nominal Pipe Diameter (In)				
30-60	1	1	1-1/4	1-1/2	1-1/2
60-100	1	1-1/4	2-1/4		
100-200	1-1/4	1-1/2	2	2-1/2	2-1/2
200-500	2	2-1/2	3	3-1/2	3-1/2
500-1000	2-1/2	3	3-1/2	4	4-1/2
1000-2000	2-1/2	4	4-1/2	5	5
2000-4000	3-1/2	5	6	8	8
4000-8000	6	8	8	10	10

SAND BLASTING NOZZLES

Nozzle Diameter	Gage Pressure			
	60	70	80	100
1/16	CFM 4	5	5 5	6.5
3/32	9	11	12	15
1/8	17	19	21	26
3/16	38	43	47	58
1/4	67	76	85	103
5/16	105	119	133	161
3/8	151	171	191	232
1/2	268	304	340	412

COMPRESSED AIR CONTAMINANTS

MOISTURE



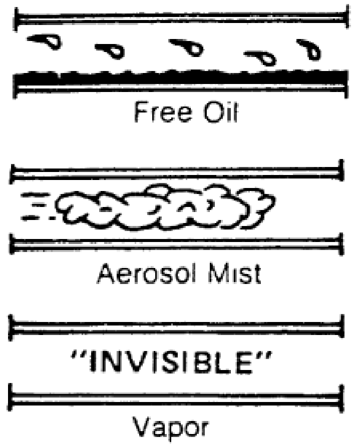
Removed By:

Free Water: Separators, Mechanical Filters, Coalescing Filters, Air Dryers

Aerosol Mist: Coalescing Filters, Air Dryers

"Invisible" Vapor: Air Dryers

OIL

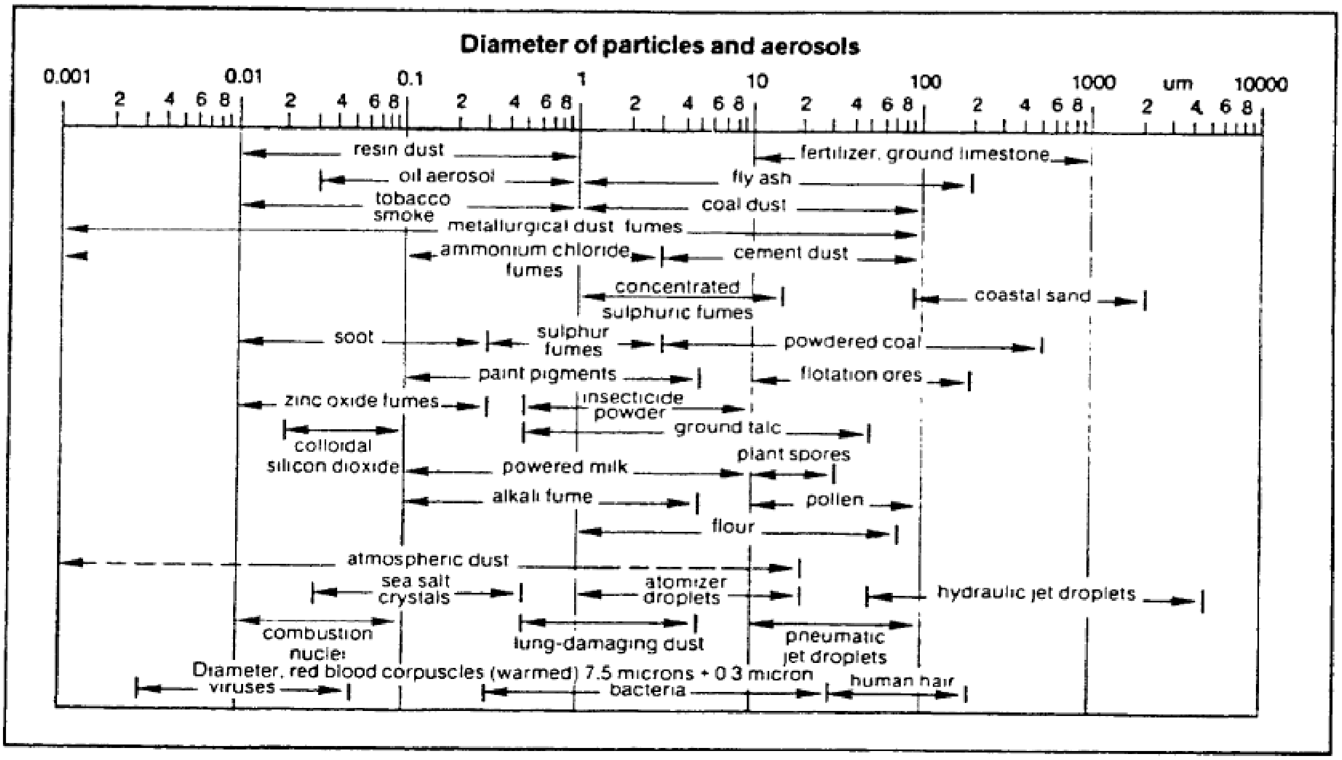


Removed By:

Free Oil: Separators, Mechanical Filters, Coalescing Filters

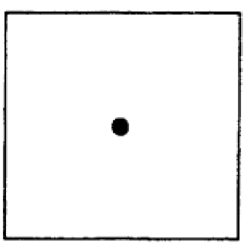
Aerosol Mist: Coalescing Filters

"Invisible" Vapor: Adsorbents

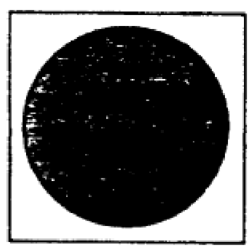


HOW LARGE IS A MICRON?

IF .01 MICRON IS THIS BIG →



THEN .1 MICRON IS THIS BIG →



AND 1 MICRON COULD NOT FIT ON THIS PAGE!

DID YOU KNOW???

1. Your Compressor may operate more efficient with outside - Inlet Air.
2. Your Compressor operates more efficient with a clean Inlet Filter.
3. The power used to Compress Air is returned.
   (less losses enroute) or (input − losses = output)
4. "FREE AIR" is your most expensive utility!!!!
5. **LOSSES TO ELIMINATE:**

   A. Piping restrictions from design or obstacles.

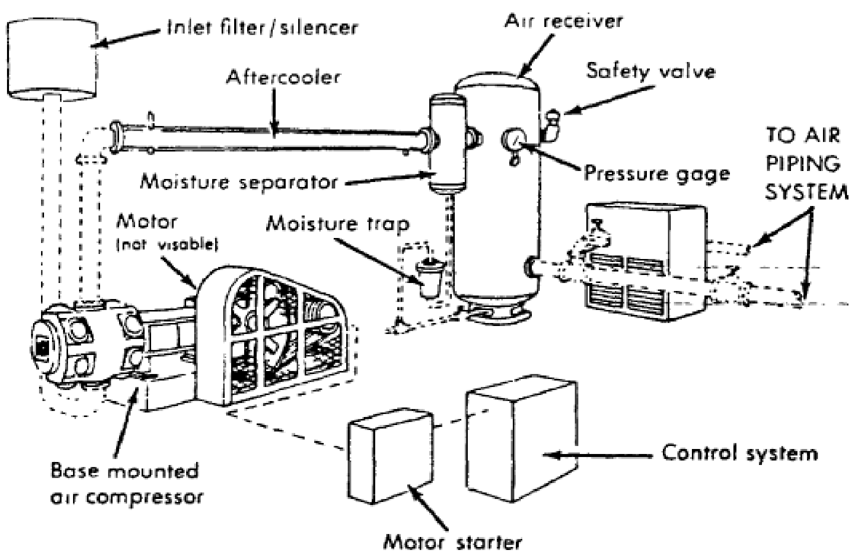
   NOTE: 8 CFM Free Air compressed to 100 PSIG:
   In 1/4" pipe will occupy 1,384 ft. of pipe.
   In 1/2" pipe will occupy 474 ft. of pipe.

   B. High Air Velocity = High Pressure Drop.
   C. Leaks 1/16" = 180,000 cubic ft. loss in 30 days. ($36.00)
   D. Worn Compressor Rings = Blow-by = Loss Efficiency.
   E. Fouled After Cooler = Increased Velocity = Pressure Loss.
   F. Loss from water in Compressed Air.

   NOTE: 100 CFM in 24 hours, at 90°F Ambient
   & 70% Humidity = 26.7 gallons of water.

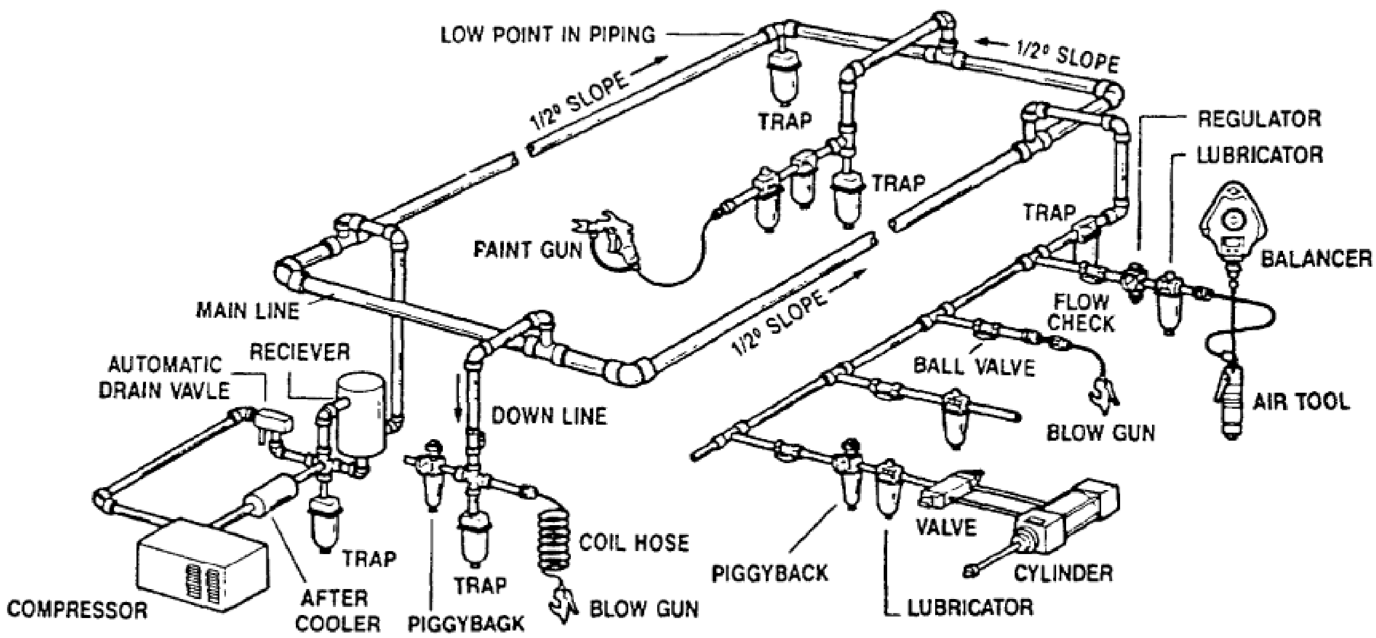
Compressed Air System Includes:

- Inlet Filter & Silencer
- Air Compressor
- Base
- Motor
- Motor Starter & Controls
- Belt-Guards
- After Cooler
- Moisture Separator
- Condensate Trap
- Air Receiver
- Relief Valves
- Safety Shut Down Switches
- Guages Pressure & Temp.
- Air Dryer
- All Properly Piped



GENERAL RULES FOR COMPRESSED AIR DISTRIBUTION SYSTEM

1. Pressure drop between the compressor and point of use are irrecoverable.
2. Pipe size should be large enough that pressure drop does not exceed 10% between receiver and point of use.
3. Arrange piping to avoid the following types of strains:
   A. Strains due to dead weight of the pipe itself.
   B. Strains due to expansion or contraction of the piping with temperature change.
   C. Strains due to internal pressure within the piping.
4. Design inlet and discharge piping for smooth flow with uniform translateral velocity over the entire area of the piping.
5. Install safety valve between compressor and stop valve (5 to 10 PSI above compressor operating pressure.)
6. Plan ahead for future emergencies and establish an area of loop to install temporary compressor.
7. Consider bypass lines on all items that may require future maintenance.
8. Use loop piping system if possible, both around the plant and within each shop.
9. Consider second air receiver at end of line or loop if you have peak demands for air of short durations.
10. Locate outlets from the main header as close as possible to point of application. This limits large pressure drops through hose.
11. Outlets must always be taken from the top of pipe line to prevent carryover of condensed moisture to tools.
12. All piping should be sloped so that it drains toward a drop leg or moisture trap — away from the compressor.



SELECTING A COMPRESSOR

A. Type based on PSI needs —

0 to 80 PSI	You may need a single stage.
80 to 250 PSI	You need a two stage unit.

B. Air Consumption — List all equipment and tool requirements — both continuous and intermittent air.

C. Compressor Horsepower — Determine total CFM.
Add approximately 20% for system variables.
Add ______% for future growth.
If above total = less than 100 CFM divide this total by four to find HP.
If total is over 100 CFM divide by five.

Example: System requires 310 CFM at 100 PSIG

$310 \div 5 = 62$ HP — 60 HP Compressor or 75 HP Compressor

D. Tank Size — As a general rule, the more receiver — the better the system, or size at least one minutes capacity of your compressor.
Use a large tank for installations where large flows of short duration is needed.
— Cu. ft. free air required to raise receiver from 0 gauge to final pressure —

$$\frac{\text{Vol. of Rec. in Cu.Ft.} \times \text{PSIG}}{\text{Atmospheric Pressure}}$$

E. Type Control — Use stop-start (pressure switch) control for small systems — up to 15 HP — Motor stops when the compressor unloads and starts again when the pressure in the receiver drops.
Continuous Run — With constant pressure control, loading and unloading as the supply of compressed air in the receiver drops or reaches a maximum.

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Reciprocating / Systems: 217.222.7700
Air Master 217.277.0270
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