

The Two Minute Solutionizer

Leaks in a compressed air system.

Leaks are a significant source of wasted energy in a compressed air system, often wasting as much as 30% of the compressors output. Compressed air leaks can also contribute to problems with system operations, which include:

- Fluctuating system pressure, which can cause air tools and other air-operated equipment to function less efficiently, possibly affecting production.
- Excessive compressor capacity, resulting in higher than necessary costs
- Decreased service life and increased maintenance of supply equipment (including the compressor package) due to unnecessary cycling and increased run time.

Although leaks can occur in any part of the system, the most common problem areas for leakage are; couplings, hoses, tubes, pipe joints, quick disconnects, FRL's (filter, regulators and lubricators), condensate traps, valves, flanges, packing, thread sealant, and point of use devices. The leakage rates are a function of the supply pressure in an uncontrolled system and increase with higher pressures. Leakage rates are also proportional to the square of the orifice diameter. (See table 1.)

Let us take for example a 0.125" hole, which will pass 26-cfm at 6.9 barg (100 psig). The same orifice will pass 21.4-cfm at 5.5 barg (80 psig), a difference of 17.7%.

Leak cost = # of leaks x leakage rate (cfm) x kW/cfm x # of hours x £/kWh

A 75kW compressor, operating 6000 hours per annum with an electrical cost of £0.045, the cost of this leak at 6.9 barg (100-psig) would be:

Cost = 1 x 26 x [75 x 1.1 / 0.94 = 88 kW/460 = 0.19 kW/cfm] x 6000 x 0.045
Cost = £1334

If the operating pressure was 5.5 barg (80-psig) then the cost of the leak would be:

Cost = 1 x 21.4 x [75 / 0.94 = 80 kW/460 = 0.17 kW/cfm*] x 6000 x 0.045
Cost = £982

Potential savings are £352 per annum. Just imagine if the plant had twenty 0.125" leaks across the plant. The potential savings are £7040! Is this ever achieved?

Identifying and fixing leaks is the most obvious means of reducing compressed air costs but it is also the least permanent reduction. In fact we classify leak repair in most systems as pointless frantic activity. Many plants identify and repair leaks throughout their systems only to see the air demand return in a few weeks. Most leak programs are short lived because of the temporary nature of the improvement and it is sometimes hard to quantify the value of the repairs. Long term effectiveness is the understanding on why the leak occurs in the first place.

Next – controlling leaks in a compressed air system.

Pressure		Diameter of orifice (")										
psi	bar	0.016	0.031	0.063	0.125	0.25	0.375	0.5	0.63	0.75	0.875	1
		Discharge in cfm										
1	0.07	0.028	0.112	0.45	1.8	7.18	16.2	28.7	45	64.7	88.1	115
2	0.14	0.04	0.158	0.633	2.53	10.1	22.8	40.5	63.3	91.2	124	162
3	0.21	0.048	0.194	0.775	3.1	12.4	27.8	49.5	77.5	111	152	198
4	0.28	0.056	0.223	0.892	3.56	14.3	32.1	57	89.2	128	175	228
5	0.34	0.062	0.248	0.993	3.97	15.9	35.7	63.5	99.3	143	195	254
6	0.41	0.068	0.272	1.09	4.34	17.4	39.1	69.5	109	156	213	278
7	0.48	0.073	0.293	1.17	4.68	18.7	42.2	75	117	168	230	300
9	0.62	0.083	0.331	1.32	5.3	21.2	47.7	84.7	132	191	260	339
12	0.83	0.095	0.379	1.52	6.07	24.3	54.6	97	152	218	297	388
15	1.03	0.105	0.42	1.68	6.72	26.9	60.5	108	168	242	329	430
20	1.38	0.123	0.491	1.96	7.86	31.4	70.7	126	196	283	385	503
25	1.72	0.14	0.562	2.25	8.98	35.9	80.9	144	225	323	440	575
30	2.1	0.158	0.633	2.53	10.1	40.5	91.1	162	253	365	496	648
35	2.4	0.176	0.703	2.81	11.3	45	101	180	281	405	551	720
40	2.8	0.194	0.774	3.1	12.4	49.6	112	198	310	446	607	793
45	3.1	0.211	0.845	3.38	13.5	54.1	122	216	338	487	662	865
50	3.4	0.229	0.916	3.66	14.7	58.6	132	235	366	528	718	938
60	4.1	0.264	1.06	4.23	16.7	67.6	152	271	423	609	828	1082
70	4.8	0.3	1.2	4.79	19.2	76.7	173	307	479	690	939	1227
80	5.5	0.335	1.34	5.36	21.4	85.7	193	343	536	771	1050	1371
90	6.2	0.37	1.48	5.92	23.7	94.8	213	379	592	853	1161	1516
100	6.9	0.406	1.62	6.49	26	104	234	415	649	934	1272	1661
110	7.6	0.441	1.76	7.05	28.2	113	254	452	705	1016	1383	1806
120	8.3	0.476	1.91	7.62	30.5	122	274	488	762	1097	1494	1951
125	8.6	0.494	1.98	7.9	31.6	126	284	506	790	1138	1549	2023
150	10.3	0.582	2.37	9.45	37.5	150	338	600	910	1315	1789	2338
200	13.8	0.761	3.1	12.35	49	196	441	784	1225	1764	2401	3136
250	17.2	0.935	3.8	15.18	60.3	241	542	964	1508	2169	2952	3856
300	20.7	0.995	4.88	18.08	71.8	287	646	1148	1795	2583	3515	4592
400	27.6	1.22	5.98	23.81	94.5	378	851	1512	2360	3402	4630	6048
500	34.5	1.519	7.41	29.55	117.3	469	1055	1876	2930	4221	5745	7504
750	51.7	2.24	10.98	43.85	174	696	1566	2784	4350	6264	8525	11136
1000	69.0	2.985	14.6	58.21	231	924	2079	3696	5790	8316	11318	14784

Table 1 - Leakage rates for different supply pressures and approximately equivalent orifice sizes. For well rounded orifices, multiple values by 0.97, and for sharp edges multiple by 0.61

*7% reduction in energy per 1-barg reduction in pressure.