

Appendix D

AOE Air Supply System Operating Procedure

This appendix contains the instructions and procedures required to operate the high capacity compressed air supply system located in the basement of the Aerospace and Ocean Engineering side of Randolph Hall. This system is a ‘blow-down’ type composed of a 4-cylinder Ingersol-Rand air compressor capable of 765 psig and a pair of storage tanks with a combined capacity of 800 cubic feet. The compressor is run to charge the storage tanks to a desired pressure, then shut down, and air is consumed from storage. Using an initial full charge to 300psi and a flow rate of 35 scfm, an experiment can be run continuously for at least two hours. Leaks in the system will cause a full charge to drain on its own over a period of eight hours, so it is important to charge the system as a last step before an experimental run.

Prior to starting the compressor, check that the control panel in the supersonic lab is **turned on** and that the **load switch is set to unload**, as shown in Figure D-1. Next, walk to the compressor room and go to the large blue control panel, shown in Figure D-2. Check that the E-stop button is **off** by rotating the button to the right until it pops out. Also, check that the black switch is in the **off** position and then **push the green ‘start’ button**. Several auxiliary pumps will turn on, which supply oil and cooling water to the compressor. Move to the oiler and check that there is a drop of oil hanging from each oiler, as shown in Figure D-3. Also, check that the oiler has at least the level of oil indicated in Figure D-4. Look up and to the right to check in the cooling pipe sight window, shown in Figure D-5, to see that the cooling water is flowing. The spinner clicking against the sight window will now be audible. If the cooling water is not flowing, the compressor will start, but then promptly shut down automatically.

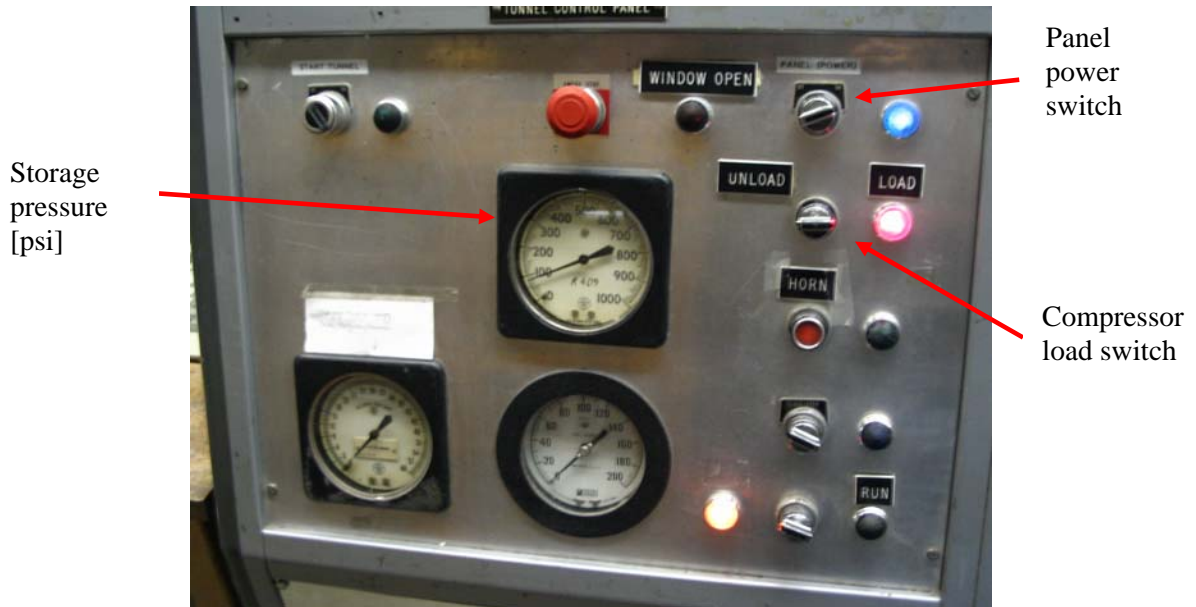


Figure D-1. Supersonic tunnel control panel, showing compressor load control.



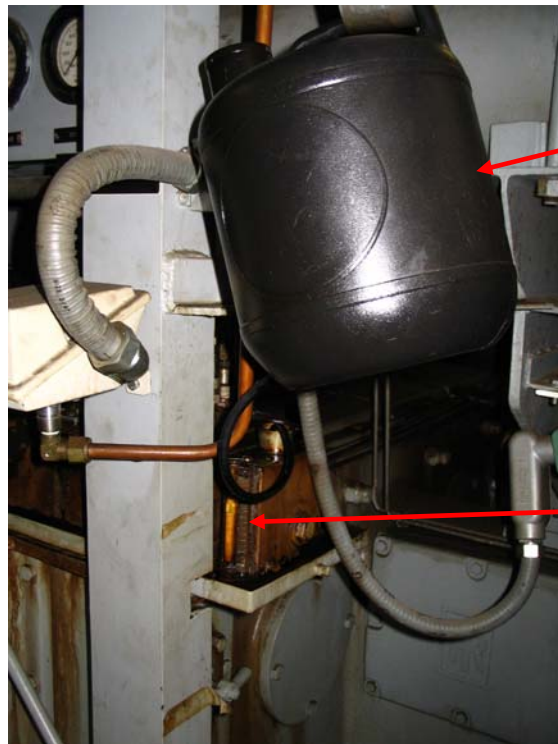
Figure D-2. Large blue air compressor control panel in the rear left corner of the compressor room.

Look for oil drop hanging here

Push plunger if no oil drop



Figure D-3. Check compressor oiler for correct operation by observing an oil droplet in each of the nine oilers.



Oil fill jug

Oil level should be at least half full

Figure D-4. Check oil level in oiler and fill as necessary using black jug.

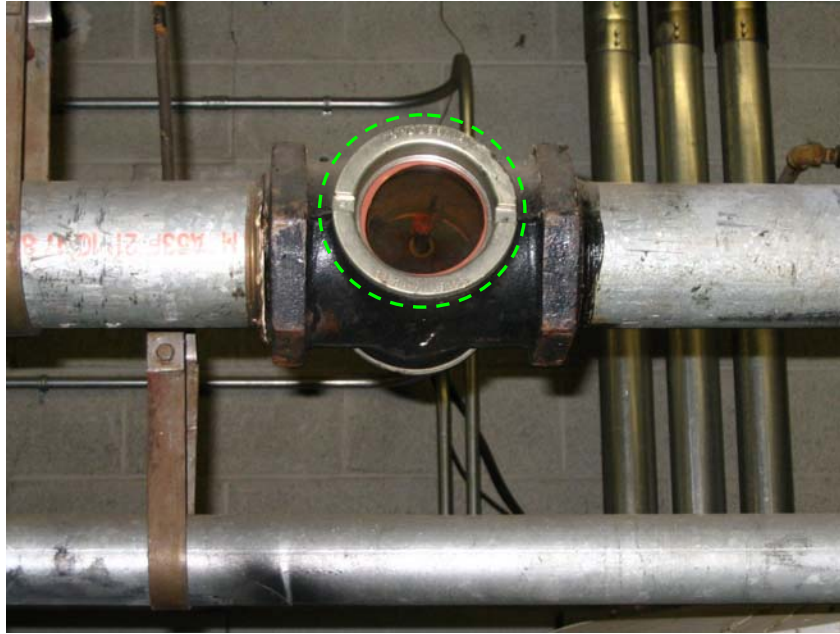


Figure D-5. Check for cooling water flow in sight window and listen for clicker.

With the oil and water running, go back to the control panel; turn the **black switch to on** and then **push the green start button** again. A loud clunk will be heard, followed by the compressor starting. At this point, all gauges on the control panel will come alive. The readings of the gauges should approximately correspond between runs, and should be near those shown in Figure D-6. Locate the compressor log, shown in Figure D-7, and fill out a line for the run. At this point, all columns can be filled out, except for the intercooler drain and temperature checks, which will be completed just before shutdown.



Figure D-6. After starting the compressor, check the gauges for proper indications, as discussed.

Date	Unload Pressure Setting	Operation Time Record:		Intercooler's Draining Record:				Lubricator Oil Pumps:	Stage Temperature Reading:				Cooling Water Temperature:	Crankcase Oil Temperature:	Number of Tunnel Runs:	Tunnel/Compressor Operator:	Comments:	
		On	Off	1st	2nd	3rd	4th		1st	2nd	3rd	4th						
2/10	300	09:45	10:10	✓	✓	✓	✓	123456789	76	99	70	73	56	90	90	1	ADAM	RFL 1-5862
3/13	300	2:30	3:00	✓	✓	✓	✓	123456789	78	94	71	71	64	84	84	1	ADAM	RFL 1-5862
3/14	300	2:30	2:45	✓	✓	✓	✓	123456789	64	80	56	70	45	117	115	0	ADAM	RFL 1-5862
3/16	300	10:50	10:55	✓	✓	✓	✓	123456789	52	77	58	80	48	78	80	1	ADAM	RFL 1-5862
3/16	300	15:00	17:00	✓	✓	✓	✓	123456789	68	84	58	66	48	120	128	0	ADAM	RFL 1-5862
3/19	300	18:00	19:20	✓	✓	✓	✓	123456789	68	85	56	65	47	120	121	10	ADAM	RFL 1-5862
3/19	300	14:30	14:51	✓	✓	✓	✓	123456789	100	110	80	80	55	90	81	6	ADAM	RFL 1-5862
3/20	300	11:15	11:35	✓	✓	✓	✓	123456789	59	83	53	57	44	78	80	1	ADAM	RFL 1-5862
3/20	300	11:55	11:55	✓	✓	✓	✓	123456789	57	81	53	56	44	76	78	2	ADAM	RFL 1-5862
3/20	300	14:50	14:50	✓	✓	✓	✓	123456789	50	100	50	65	45	100	90	0	ADAM	RFL 1-5862
3/21	300	15:30	17:00	✓	✓	✓	✓	123456789	55	80	60	60	40	110	108	6	ADAM	RFL 1-5862
3/22	300	16:00	19:00	✓	✓	✓	✓	123456789	60	100	55	57	40	100	95	18	ADAM	RFL 1-5862
3/26	300	24:30	24:00	✓	✓	✓	✓	123456789	65	100	60	55	40	110	110	20	ADAM	RFL 1-5862
3/29	300	1:00	4:15	✓	✓	✓	✓	123456789	90	120	60	80	55	100	120	22	ADAM	RFL 1-5862
3/30	300	08:15	19:00	✓	✓	✓	✓	123456789	85	115	95	104	65	120	120	0	ADAM	RFL 1-5862
3/31	140	10:20	13:45	✓	✓	✓	✓	123456789	87	108	70	80	58	107	133	4	ADAM	RFL 1-5862
4/1	190	2:30	4:50	✓	✓	✓	✓	123456789	85	112	72	80	58	131	137	4	ADAM	RFL 1-5862
4/4	300	3:15	3:15	✓	✓	✓	✓	123456789	115	114	74	101	—	—	—	6	ADAM	RFL 1-5862
4/10	105	3:25	5:50	✓	✓	✓	✓	123456789	12	114	64	81	58	104	115	4	ADAM	RFL 1-5862
4/10	100	4:00	4:05	✓	✓	✓	✓	123456789	62	62	60	88	60	58	64	14	ADAM	RFL 1-5862
4/8	120	10:20	1:00	✓	✓	✓	✓	123456789	76	106	67	74	55	120	125	4	ADAM	RFL 1-5862
4/8	150	2:00	4:40	✓	✓	✓	✓	123456789	65	105	74	74	53	126	133	4	ADAM	RFL 1-5862
4/9	300	2:00	2:00	✓	✓	✓	✓	123456789	—	—	—	—	—	—	—	1	ADAM	RFL 1-5862

Figure D-7. Fill out a new line in the compressor log for the run.

After beginning the entry in the log, go back to the supersonic lab and turn the load switch to **load**. This will begin charging the tanks, the pressure of which can be read from the pressure gauge next to the load switch, see Figure D-1. It is a good idea to bring something to do while monitoring the storage tank pressure. Charging from empty to full (300 psi) takes approximately 30 minutes. When the gauge reads 300 psi, turn the load switch to **unload** and the panel power switch **off**. Go back to the compressor room, and read and note in the log all of the required temperatures: oil temperature in and out, water temperature, and stage temperatures. These temperatures will vary greatly from run to run depending on the outside air temperature and humidity. Figure D-8 shows all of the required thermometers.

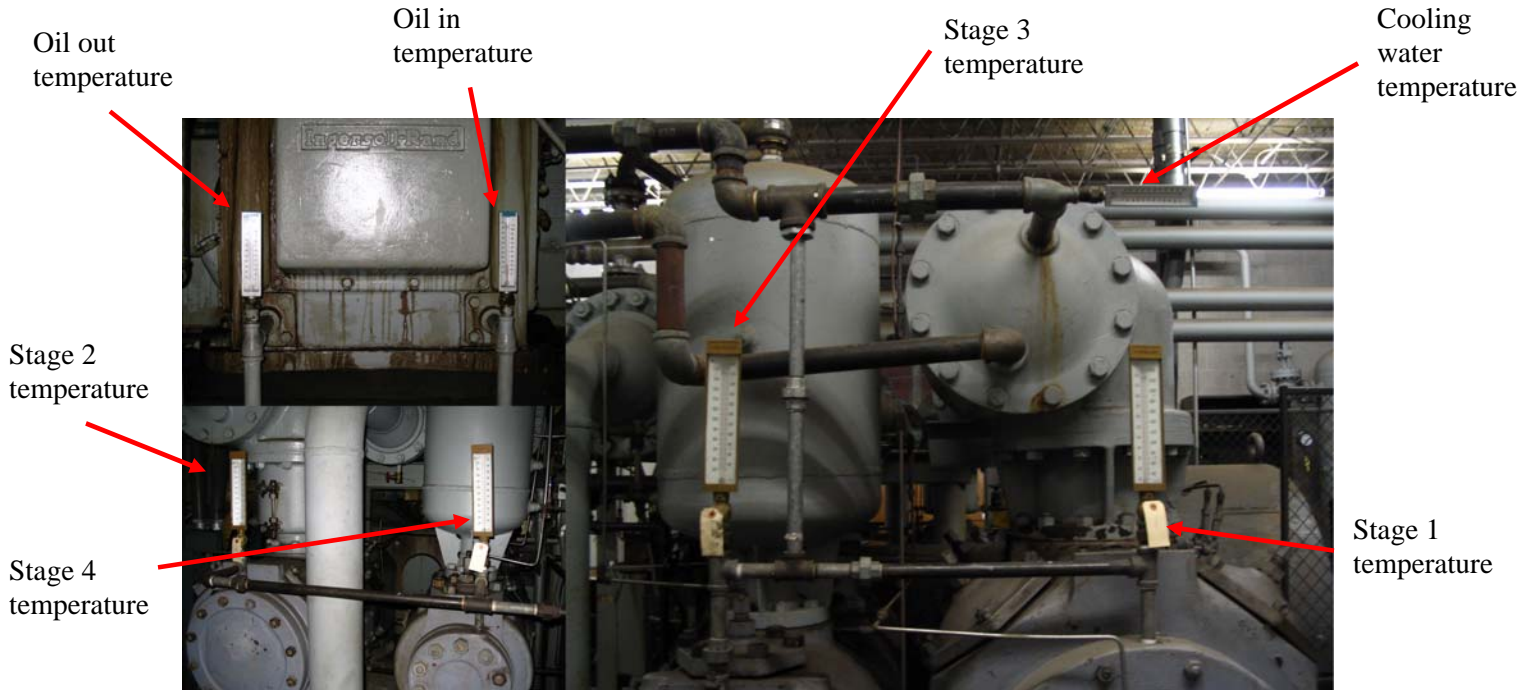


Figure D-8. Thermometer locations for cooling water and oil temperature readings.

After recording the temperatures, go back to the control panel, **turn the black switch off** and **push in the E-stop button**. When the black switch is turned off, a clunk will be heard and the compressor will wind down. As the compressor slows, begin draining the four condensate tanks. To drain the tanks, slowly open the valves indicated in Figure D-9 and allow most of the liquid to drain into the catch buckets. Close each

valve after draining except for the drain on stage 2, which has a sign indicating that it should be left slightly open. If any of the catch buckets fill up, they should be emptied into the drum shown in Figure D-10.

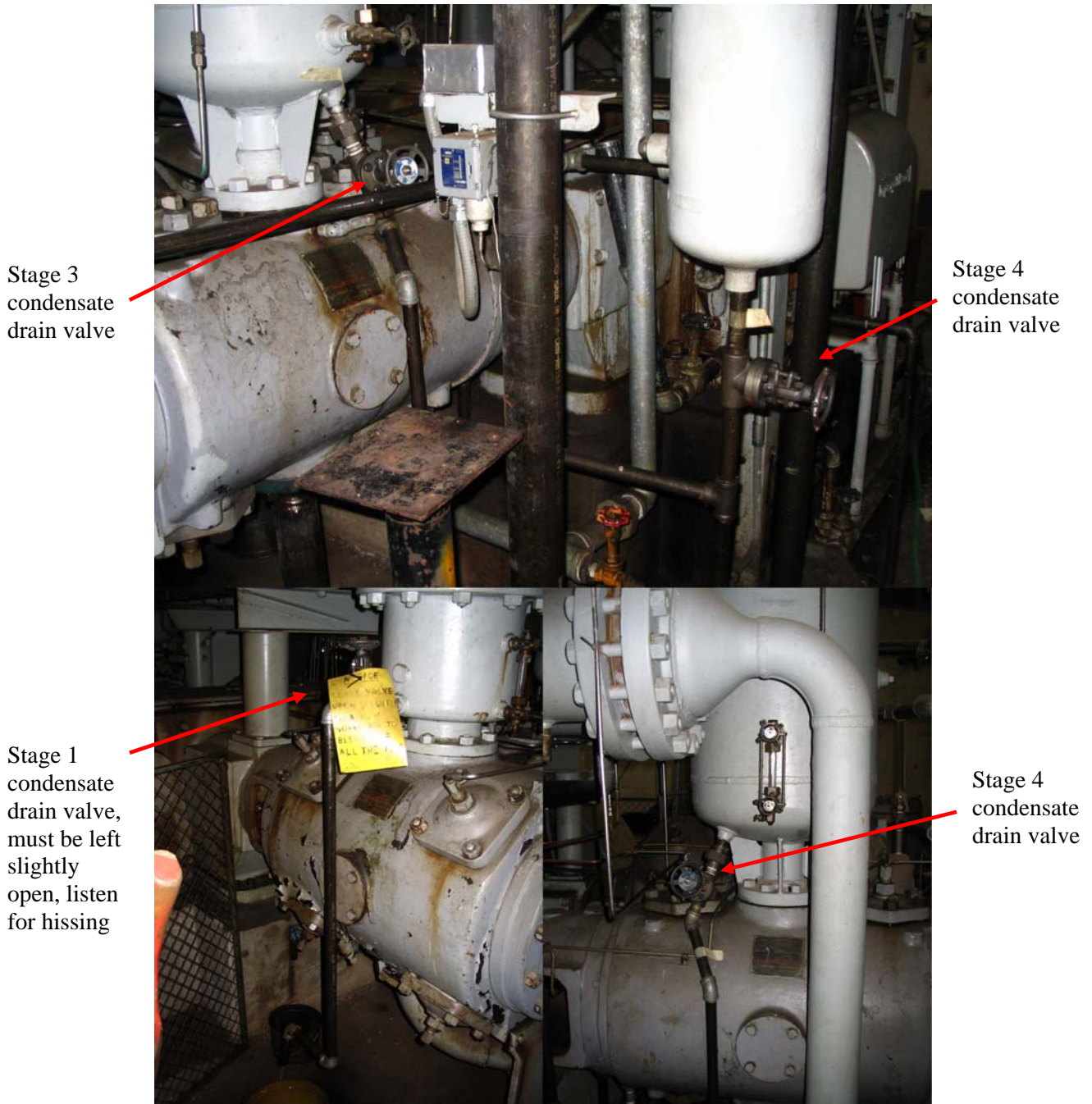


Figure D-9. Condensate drain valve locations for each compressor stage.



Figure D-10. Drum containing waste condensate oil/water mixture, located on rear wall of compressor room.

For safety reasons, be sure to close the outdoor valve behind Randolph Hall, as shown in Figure D-11, after all runs are complete each day. It is best to open the outdoor valve before running the compressor, to maximize air storage capacity. This valve controls air flow to the Mechanical Engineering (ME) side of Randolph Hall. If any abnormal instrument readings or equipment malfunctions are discovered, consult Steve Edwards in his office next to the supersonic tunnel lab as soon as possible.



Figure D-11. Outdoor valve controlling air delivery to the ME Department side of Randolph Hall.