Dukes INC aerospace

PNEUMATIC TEST LABORATORY

CAPABILITIES REPORT

INTRODUCTION

Dukes, Inc. designs, manufactures, and tests hot air control valves for use in anti-ice and environmental control applications on type certificated aircraft. The valves manufactured by Dukes, Inc. are subjected to acceptance testing using hot, pressurized air. Additionally, prototype parts manufactured to new designs are subjected to qualification and certification testing per customer specifications.

Dukes' pneumatic test laboratory is located at 9060 Winnetka Avenue, in Northridge, California. This report provides a description of the test facility including test line size and quantities, pressure and temperature limits, and air flow capacity.

PNEUMATIC TEST LINES

Dukes' hot air lab consists of nine air flow lines. Each line may be operated independently by the test technicians. Pressure is supplied by remote sensing regulators and is controlled at each of the line operator's work stations.

The hot air lines are sized as follows:

- One three-inch diameter line (may be converted into a two-inch diameter line.)
- Six two-inch diameter lines.
- One one-and-a-half-inch diameter line (may be converted into a two-inch line.)
- One one-inch diameter line.

All of the air lines use a Daniels air flow measuring device in the upstream section of the lines.

All of the air lines are capable of independent air temperatures by means of hot/cold blending valves in the upstream section of the lines.

All of the air lines terminate in AS1895 flanges (PSI, low profile) at the test bed, and use spool adapters to connect with the test article's flanges.

TEST BED AIR PRESSURE

Air lines #1 and #2 are capable of 340 psig at the test bed. These lines are supplied by a rotary screw compressor, which delivers air into a 10,000 gallon volume tank, which is then supplied to the test line.

Air lines #3 and #4 are capable of 650 psig at the test bed. These lines are supplied by a boost compressor which delivers air into a 700 gallon volume tank.

Air lines #5, #6, #7, #8 and #9 are capable of 340 psig at the test bed. These lines are supplied by a rotary screw compressor, which delivers air into the 10,000 gallon volume tank.

To obtain compressed air, Dukes has the following compressors on site:

- 350 hp Sullair rotary screw compressor capable of 310 psig and 75 lb/min flow.
- 400 hp Sullair rotary screw compressor capable of 340 psig and 75 lb/min flow.
- 75 hp Joy piston compressor capable of 500 psig and 45 lb/min flow.
- 75 hp boost compressor capable of 650 psig and 35 lb/min flow.

Sullair Rotary Screw Compressor

750 psig Boost Compressor

Compressed Air Storage

TEST BED TEMPERATURE

Air lines #1 and #2 are capable of 650°F at the test bed. These lines are supplied by a natural gas fired heater rated for 2,500,000 BTU.

Air lines #3 and #4 are capable of 1000°F at the test bed. These lines are supplied by a three-stage electric heater.

Air lines #5, #6, #7, #8, and #9 are capable of 900° at the test bed. These lines are supplied by a natural gas fired heater rated for 2,000,000 BTU.

2-Million BTU Gas Heater

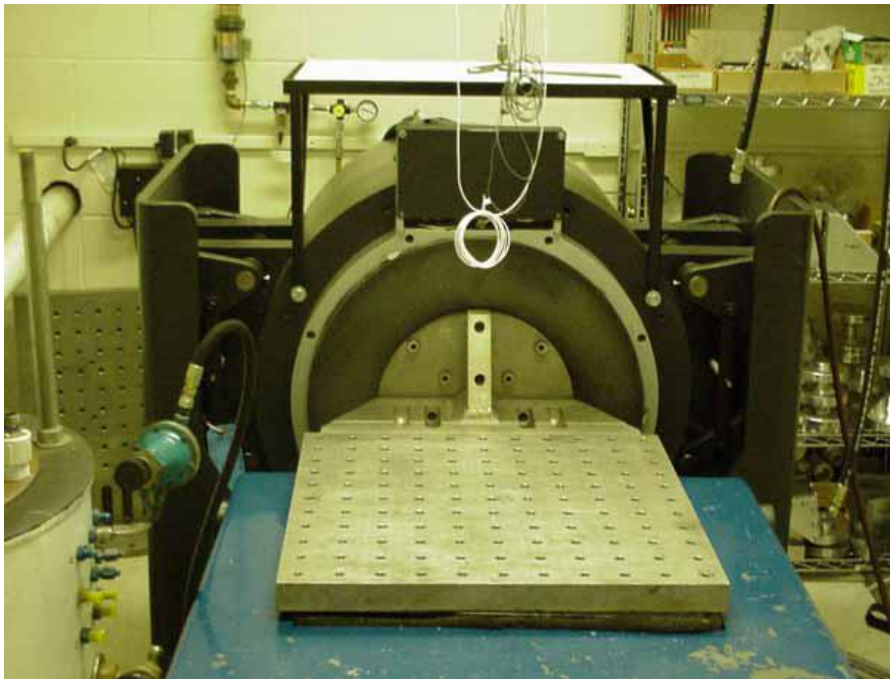
AIR FLOW CAPABILITY

With three compressors operating, Dukes can supply 185 lbs/min of air, compressed to 340 psig. The air may be distributed to the test lines as required to meet the test parameters, and each test line is capable of flowing the entire 185 lb/min supply, if necessary.

For high pressure requirements, Dukes' boost compressor can deliver air to the test bed at 650 psig and 35 lb/min.

VIBRATION TEST CAPABILITY

Dukes has one vibration table on site. The system is rated for 6,000 lbf, and is capable of sine, random, and sine-on-random (gunfire) vibration profiles. Hot air is ducted to the vibration table with flexible couplings, so the test unit can be exposed to hot pressurized air during vibration testing.



Vibration Table

PROOF & BURST PRESSURE TESTING

Proof and Burst pressure testing is performed at Dukes. The proof bench is supplied with gaseous nitrogen, and is capable of supplying gas to the test unit at up to 6,000 psig. The proof bench does not use a heater, and supplies nitrogen at room temperature, only.

When hot proof or burst pressure testing is required, Dukes uses a portable in-line heater that is fueled with a propane burner. This heater is capable of raising the air temperature to 1500°F at the test unit. Gaseous nitrogen is used for the air source, and pressures may be up to 6,000 psig. This heater is a low flow device, and is used when the airflow requirements are defined to be as required to maintain temperature during testing.

AMBIENT TEMPERATURE CONTROL

When required, ambient air temperature is controlled and maintained by surrounding the test article with an ambient box. These boxes are made of insulating material, and heating or cooling is provided with heaters or liquid nitrogen as the test requires. Temperature is maintained with a thermostatic controller which senses the ambient temperature through thermocouples, and commands the heat or cooling system to operate as required.

Dukes, Inc. Test Line Capability Matrix

Line No.	**Max Test Bed Pressure**	**Max Test Bed Temperature**	**Max Test Bed Airflow**
1	340 psig	650°F	185 lb/min
2	340	650	185
3	340	1000	185
3 supplied by boost	650	1000	35
4	340	1000	185
4 supplied by boost	650	1000	35
5	340	900	185
6	340	900	185
7	340	900	185
8	340	900	185
9	340	900	185