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ANALYZED

AIR CONDITIONING GROUND TEST PANEL

LOG/105/46

Sept/56

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AIR CONDITIONING GROUND TEST PANEL

LOG/105/46

September, 1956.

- The following is a list of the items information required and nature of the equipment used, to ensure correct operation of the Air Conditioning System.
- 1.1 Installation of resistance thermometers to read temperatures at the following points:-
 - 1.1.1 Air Flow downstream of cockpit temperature control valve.
 - 1.1.2 Air Flow downstream of "100%" temperature control valve.
 - 1.1.3 Air Flow downstream of expansion valve.
 - 1.2 Installation of pitot head to read "Static" of air flow in supply duct "in under" area.
 - 1.3 Pressure tap-off, upstream of heat exchanger, for direct reading on test panel pressure gauge.

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ENGINEERING DIVISION

AVRO AIRCRAFT LIMITED, MALTON, ONTARIO

AIR CONDITIONING GROUND TEST PANEL.

1. INTRODUCTION

- 1.1 A proposed test schedule has been laid down in the form of a Logistics Report No. LOG/105/40, dated July, 1956, describing the method and equipment required for checking out the C-105 Air Conditioning System, prior to flight of the aircraft. It is considered that in the case of a prototype aeroplane, testing would be necessary before the commencement of each flight, whereas in the case of an operational aircraft it would be limited to the 25 hour inspection period.

The tests would be conducted primarily with the engines running individually, and subsequently with them together. Instrument readings would be taken during all three conditions, and the engines would be run at a constant r.p.m., details of which will be given at a later date.

To ensure complete functional coverage of the system, various transmitting instruments, in the form of resistance thermometer bulbs, and pressure transmitters are mounted at different points in the Air Conditioning System, and suitably connected to a test panel, mounted in the nose undercarriage wheel well. To this panel can be made the required electrical and pressure connections from the ground test panel.

The following is a list of the tests information required, and nature of the equipment used, to ensure correct operation of the Air Conditioning System.

- 1.2 Installation of resistance thermometer bulbs to read temperatures at the following points:-
- 1.2.1 Air flow downstream of cockpit temperature control valve.
 - 1.2.2 Air flow downstream of radar temperature control valve.
 - 1.2.3. Air flow downstream of expansion turbine.
- 1.3 Installation of pitot head to read "Volume of air flow in supply duct to radar nose".
- 1.4 Pressure take-off, upstream of heat exchanger, for direct reading on test panel pressure gauge.

Resistance thermometer bulbs, pitot head and pressure take-off are wired and piped respectively to the test panel mounted at the front left hand corner of the nose wheel well, and terminate in the following connections:-

- (a) Resistance Thermometer Bulbs - C.Sc3102E-165-1P Electrical Connector.
- (b) Pressure Take-off - MS21903-D4 Pipe Union.
- (c) Pitot Head - Pitot and static line connections terminate in AN832-4D Pipe Union.

REQUIREMENTS

General

The test panel will consist of the following instruments and equipment, suitably mounted on a rigidly constructed instrument panel as suggested by schematic lay-out figure, 1.

- 2.1 A resistance thermometer indicator, capable of measuring the following temperatures:-
 - 2.1.1 Temperatures between 0°F and 150°F to work in conjunction with a resistance thermometer bulb, located in duct, downstream of cockpit temperature control valve.
 - 2.1.2 Temperatures between 40° and 100°F to work in conjunction with a resistance thermometer bulb, located in duct downstream of radar temperature control valve.
 - 2.1.3 Temperatures between -30 and 100°F to work in conjunction with a resistance thermometer bulb, located in duct downstream of expansion turbine.
- 2.2 An air pressure gauge to read from zero to 100 pounds per square inch and fitted with a pulsation damper.
- 2.3 Air speed indicator instrument with dial graduated in pounds of air per minute, and reading from zero to 80 pounds per minute.
- 2.4 A temperature indicator is required to read ambient air temperature from -65°F to 120°F and to work in conjunction with a flush fitting free air resistance type thermometer bulb, located in a suitable position on the exterior of the test panel.
- 2.5 Charts, relating temperature and pressure readings to local ambient air temperatures at time of running tests, also stowage for same.
- 2.6 Indicators to be clearly labelled as to their point of application in the Air Conditioning System.
- 2.7 The test panel to be supplied with a general service lead, consisting of two low pressure, and one high pressure hoses, and necessary electrical cable to operate temperature indicators. Free end of service line to be equipped with appropriate fittings etc, to agree with resident fittings on aircraft test panel.

General service lead to be a minimum of 50 feet long to ensure safe operation of test panel during running of aircraft engines. Stowage to be provided for general service lead, inside casing of test panel.

3. DESCRIPTION

3.1 Housing

The test panel shall be constructed in the form of a light, but rigid box approximately 24 inches, by 20 inches, by 20 inches deep.

3.1 Cont'd.....

The box shall have a hinged lid complete with quick release fasteners, and supporting chains for use in the open position. The lid shall incorporate the conversion charts in such a way for them to be readily discernably by an operator using the test panel. Connections from the electrical and pressure reading instruments shall be grouped on the inside dividing panel, separating the instruments, etc., from the stowage compartment. The service lead shall be permanently attached to these connections and shall be stowed in a neat coil in the open portion of the box when the test panel is not in use.

The instrument panel shall be readily detachable and have sufficient length of hose and electrical cable, from the instruments, to allow removal for internal adjustments, etc. The box shall be fitted with lifting handles, placed one at either end, to facilitate lifting on or off a trolley etc. during transportation.

3.2 Pressure Gauge.

A panel type pressure gauge, capable of reading pressures over a range of zero pounds/square inches to 100 pounds/square inches, will be required, to indicate pressure in duct upstream of heat exchanger.

Suggested Gauge: United States Gauge Company, New York,
Pressure Gauge, Figure 645 - U.S. Gauge Company
Catalogue 41 (Avro ref. U-14-9-9C)
3 1/2 inch dial - Range zero pounds/square inches
to 100 pounds/ square inches in 2 pound increments.
Black Finish.

3.3 Air Flow Indicator.

An instrument in the form of an airspeed indicator will be required to measure the flow of air in the delivery duct to the radar nose. It will require a modified scale and be capable of covering a range of zero - 80 pounds of air per minute.

Suggested Gauge: Kollsman A.S.I. Indicator, Type 586CK-1-09
3 inch dial - Range 40 miles per hour - 300 miles
per hour in one revolution of pointer.
Note: (Kollsman to be approached concerning fitment
of new dial)

3.4 Ambient Air Indicator.

Readings obtained during running tests are dependent on ambient air temperature at that instant, thus the test panel will require a thermometer for this purpose to read from -65°F to 120°F.

Suggested Instrument:
Weston Resistance Thermometer, Model 727, type 102,
with modified fahrenheit scale.

3.5 Temperature Indicator.

A temperature indicator is required to work in conjunction with three Weston type 19/1 resistance thermometer bulbs, located in the aircraft air conditioning system. It is required to read temperatures downstream

3.
3.5 Cont'd.....

of: the cockpit temperature control valve, the radar temperature control valve, and the expansion turbine, and must have a range large enough to successively cover from zero °F to 150°F, zero to 80°F and -30 to 100°F. A rotary three position wafer switch will be placed in circuit with the temperature indicator, to enable the reading from each thermometer bulb to be taken separately.

Suggested Instrument:-

Weston Resistance Thermometer, Model 727,
Model 102, with modified fahrenheit scale.

3.6 Master Switch.

A master "on-off" switch shall be located in the wiring circuit and shall be so arranged as to supply power to the ambient air temperature indicator when the switch is in the "on" position. Thus, a continual ambient air temperature reading is available throughout the tests.

Suggested switch - AN3021/10

3.7 Rotary Selector Switch.

A two wafer rotary switch shall be used with an "off" position and three "on" positions, thus one temperature indicator may be used to select, in turn, the various readings from the resistance thermometer bulbs located in the aircraft.

Suggested switch - Cutler Hammer, No. 8918D058

3.8 Free Air Temperature Bulb.

A free air, flush type thermometer bulb shall be located on the outside casing of the test panel, and suitably connected to the temperature indicator described in paragraph 3.4.

Suggested Instrument:

Weston Flush Type Free Air Resistance Bulb, Type 21

3.9 Piping.

Piping from pressure and static connections on air flow indicator, and pressure connection on air pressure gauge, shall be flexible hoses, with flared ends, as per AN specification, and used in conjunction with standard fittings.

3.10 Electrical Wiring.

Electrical connection from the temperature indicators will be 20 AWG copper wire and will terminate in a AN3102M-165-1P receptacle, wires to be suitably clipped between indicators and receptacle. See figure 2 for circuit diagram.

3.11 A suitable electrical supply of either 12 volt or 24 volt D.C. current is necessary to operate the resistance thermometer indicators in the test panel. A current draw of approximately .32 amperes will be required in the case of a 24 volt supply and approximately .16 amperes for the 12 volt supply.

A two pin receptacle will be required for connection to the electrical supply, preferably mounted on a recessed panel located on the outside casing of the test panel, to prevent damage to the plug during transportation.

A suitable dust cover for the receptacle shall be attached to the panel by a short length of chain.

3.12 Instruction Plate.

A suitably etched, metal or plastic plate to be firmly attached in a conspicuous position on the face of the test panel, giving clear and concise instructions as to the panel's operation.

3.13 Identification Labels.

Labels to be attached adjacent to all instruments and clearly etched, stating at which point in the aircraft system the reading is measured.

3.14 Service Lead.

The service lead will consist of the following items, suitably sheathed to prevent scuffing due to abrasive floors, etc. It will be 50 feet in length and the pipes and electrical connector will require to be identified to exclude any possibility of mal-connection at the aircraft.

3.14.1 Pressure Hose.

Medium pressure cotton braided flexible hose, 50 feet in length, with flared end type fittings, as per MS28741-4

3.14.2 Pressure And Static Hoses From Air Flow Meter.

Low pressure rubber covered flexible hose 50 feet in length, with flared end type fittings, as per AN6270-4

Note: Free ends of all hoses to be clearly identified as to their connections on the aircraft test panel.

3.14.3 Resistance Thermometer Bulb Leads.

20 AWG copper wires, 50 feet in length, and terminating at each end in AN3102M-165-1" electrical plugs.

Note: Temperature indicators will require calibrating in conjunction with resistance thermometers and thermometer leads.



AVRO AIRCRAFT LIMITED
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TECHNICAL DEPARTMENT

REPORT NO. _____

SHEET NO. _____

AIRCRAFT: C-105
A/C Comp. System
Temp. Table

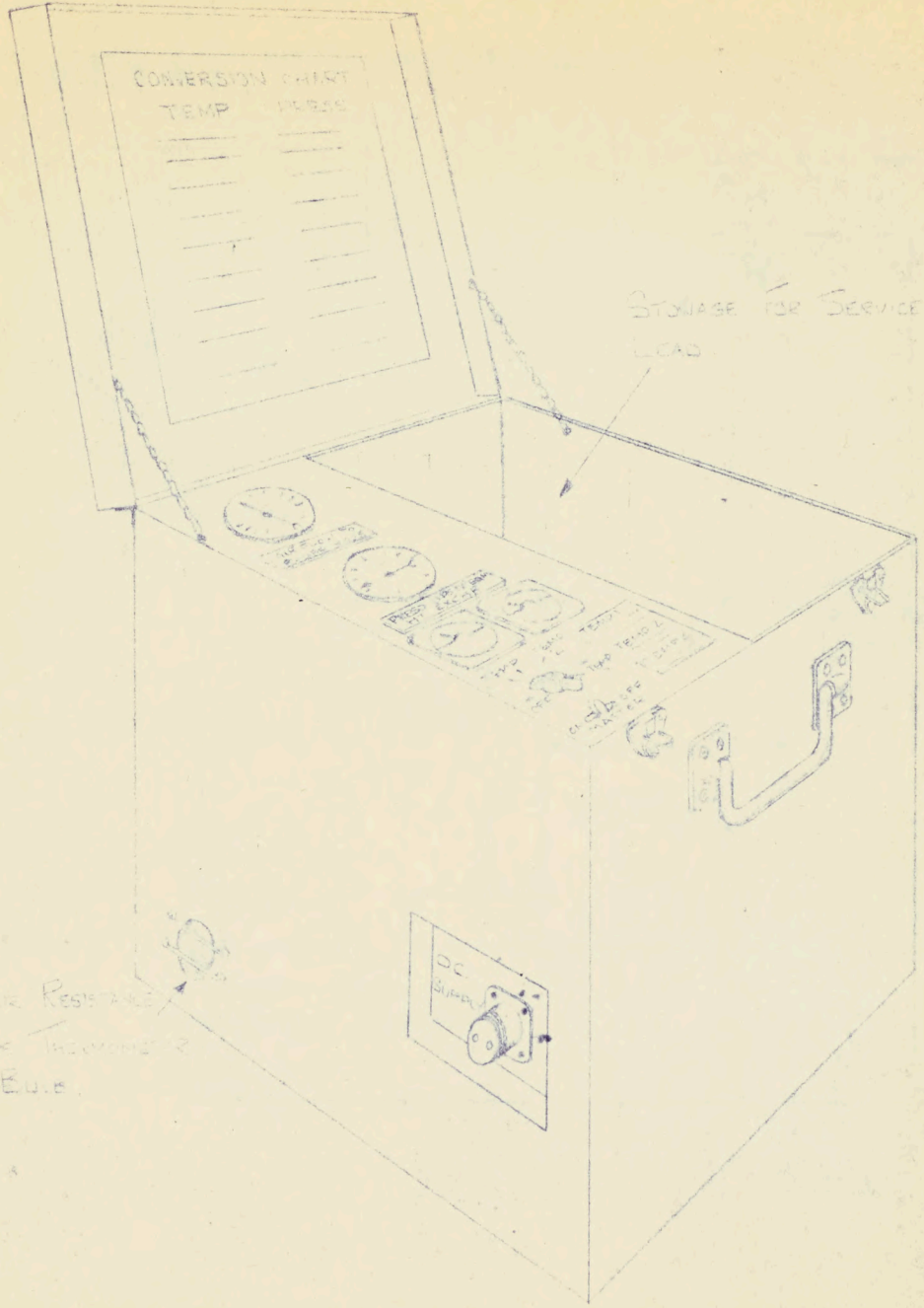
Fig. 1.

PREPARED BY _____

DATE _____

CHECKED BY _____

DATE _____



STORAGE FOR SERVICE
LOAD

See Air Resistance
See Instrument
Etc.



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AIRCRAFT:

Circuit Diagram.

Fig. 2.

