

AVRO AIRCRAFT LIMITED

Inter-Departmental Memorandum

Ref 7655/09/J
 Date March 28, 1958
 To S. E. Harper
 From J. D. Hodge
 Subject ARROW 1 - WHEEL BRAKE TESTS

Herewith R.F.T. No. 5035 covering the testing required on the Arrow 1 Wheel Brakes during the Phase 1 Engineering Program on Aircraft 25201.

In order to complete this testing the following measurements will be required in addition to those listed in Report No. FAR/C105/1, Issue 7.


- | | | |
|---|--------------|----------|
| 1. Pressure in Emergency Brake Supply Line | 0 - 2000 psi | ± 40 psi |
| 2. Pressure at outlet of brake line
shuttle valve at the bottom of each
main gear leg | 0 - 3000 psi | ± 60 psi |
| 3. Continuous brake pad temperatures for
2 main wheels (one Port, one Stbd) | 0 - 2000°F | ± 40°F |

Items 1 and 3 have already been installed for ground testing but have not previously been specified for flight test.

This memorandum is issued as an addendum to FAR/C105/1 Issue 7, and the above measurements will be included in the next issue of this report.

AA*bb


 J. D. Hodge
 Technical Flight
 Test Co-ordinator


 Project Approval

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AVRO AIRCRAFT LIMITED

MALTON, ONTARIO

REQUISITION FOR FLIGHT TEST

R.F.T. NO. 5035

SHEET NO. 1 OF

DATE: March 24, 1958

AIRCRAFT 25201	ASSIGNMENT NO. X73-384	WORK ORDER NO.
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ARROW 1 WHEEL BRAKE TESTS1. OBJECT

To prove the Arrow 1 wheel brake system on a complete aircraft.

2. EQUIPMENT REQUIRED

Arrow 1, Aircraft 25201.

3. INSTRUMENTATION REQUIRED3.1 Pressures

Continuous pressure readings at the following points.

- 3.1.1 Emergency brake supply line.*
- 3.1.2 At outlet of the brake line shuttle valve at the bottom of each main gear leg. *
- 3.1.3 Utility Hydraulics Pump Inlet.
- 3.1.4 Pressure regulator "return" port.
- 3.1.5 Pressure regulator "system" port.

3.2 Temperatures

- 3.2.1 Utility Hydraulic pump inlet temperature (one pump).
- 3.2.2 Brake cylinder return temperature.
- 3.2.3 Continuous brake pad temperature for 2 main wheels (one port, one stbd)*.

3.3 Accelerations

- 3.3.1 Aircraft longitudinal acceleration (\ddot{X}).
- 3.3.2 U/C leg acceleration fore and aft. (port undercarriage).
- 3.3.3 U/C leg acceleration fore and aft (stbd undercarriage).

R.F.T. PREPARED BY: <i>Ed Anderson</i>	APPROVED BY: <i>D. Deaton</i>	AUTHORIZED BY: <i>[Signature]</i>
DATE FOR COMPLETION	PRIORITY	ESTIMATED COMPLETION DATE:



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REQUISITION FOR FLIGHT TEST

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3.4 Miscellaneous

- 3.4.1 Record of the aircraft heading during landing and taxiing.
- 3.4.2 Ground wind speed and direction.
- 3.4.3 Ambient air temperature and barometric air pressure.
- 3.4.4 Runway conditions.

3.5 Painted Colour Bar Indicators

The brake wheel walls of all four wheels should be painted radially at 90° spacing from the hub outwards to the bead seating. Tire side walls and beading should be painted similarly. Temperature range of the strips cover the range 250°F to 800°F.

3.6 Using cameras and surveying equipment as necessary obtain a plot of A/C position along the runway vs. time. The following points should be clearly indicated when applicable.

- 3.6.1 Touchdown point.
- 3.6.2 Point at which the throttles were reduced to idling.
- 3.6.3 Point of first brake application.
- 3.6.4 Point when the brake parachute release actuation was made.
- 3.6.5 Point where the brake parachute was fully streamed.
- 3.6.6 Point where N/W touched down.
- 3.6.7 It must be possible to correlate brake pad temperature to the above points.

4. PROCEDURE

4.1 In order to determine the ability of the brakes to hold the A/C during engine run up the following procedure should be adopted.

Both engines should be idled with the wheel brakes in the parked position and no chocks in front of the wheels. Then alternately run up each engine to maximum thrust, including A/B, or until the aircraft begins to creep forward, whichever occurs first.

4.2 The above procedure should then be repeated, running up both engines simultaneously maintaining the engines at equal thrust until the aircraft begins to creep.

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4.3 This test should be conducted as in item 4.1 applying the brakes in the normal manner, not the parking brakes.

4.4 Repeat the procedure of item 4.2 applying the brakes in the normal manner, not the parking brakes.

NOTE:- In the preceding four tests, three different aircraft weights should be tested, 50,000 lbs. 57,000 lbs and 64,000 lbs and on various conditions of the runaway i.e. wet, dry, icy etc. These tests should be done prior to a flight while brakes are cool and again immediately after a landing while the brakes are hot.

4.5 To show the ability of the parking brakes to hold for a 24 hour period the following test should be completed. Using either the engines or the ground test rig charge all (utility and flying control) accumulators to 4,000 psi. Shut off the engines or the ground test rig, set the parking brake, actuate the speed brake until the main utility system accumulator is flat. During this 24 hour period there must be no maintenance or actuation of the hydraulic system. Record data as requested in section 5.2.

4.6 In order to determine the number of wheel brake applications available from the emergency brake accumulators, with the engines off and only the emergency accumulators fully charged to 4,000 psi, apply full brakes for approximately 2 seconds then release then. Repeat this cycle at 4 seconds intervals until the accumulators are flat. This test should be done before and immediately after a typical flight.

4.7 To determine the emergency wheel braking capability the following procedure should be followed.

4.7.1 Taxi the aircraft to 100 knots, ^{reduce RPM to idle} reduce RPM to idle, then apply wheel brakes.

4.7.2 The above test (4.7.1) should then be repeated at increasing speeds (120 knots, 140 knots etc) until a maximum speed to allow a safe stop is reached without using the braking parachute.

4.7.3 The aircraft should weigh 57,000 lbs (approx) at the start of this test and the speed brakes should be extended in all cases. These runs should be completed on either wet or dry runways (at least one run should be done on each).

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4.7.4 For this test only install a 4,000 psi solenoid operated stop valve in the normal brake supply line wired through the battery to a switch in the pilots cockpit. Wheel braking with this valve closed will be by emergency hydraulic supply. Stop valve is to be located so that the normal brakes only are made inoperative.

4.7.4.1 Nose wheel steering is presumed to be inoperative after failure of the normal hydraulic supply. For this reason the pilot is to be instructed not to use nose wheel steering unless necessary to control the aircraft.

4.7.4.2 The pilot is also to be instructed to make his braking and control his ground run similarly to that of a service pilot making an emergency stop where it is known that the normal brake supply has failed. There would be therefore a limited and unknown amount of hydraulic fluid in the emergency brake accumulator.

5. DATA REQUIRED

- 5.1 For the procedure in sections 4.1, 4.2, 4.3, and 4.4, it is necessary to record the L.P and H.P compressor R.P.M.'s (both engines) and whether the aircraft crept or held. If creeping did occur the R.P.M.'s at which this happened must be recorded. The condition of the tarmac must be observed (wet, dry, etc.). Pressures and temperatures should be recorded as per instrumentation sections 3.1 and 3.2.
- 5.2 The recordings required under section 4.5 of the procedure are as follows. Emergency brake accumulator pressures after parking the brakes and after 1, 2, 4, 8, 12, 16 and 24 hours. Record the emergency brake accumulator N₂ precharge pressures before and after the test. Record ambient temperature where the A/C is stored, and hydraulic fluid temperature prior to the test.
- 5.3 The recordings required under section 4.6 of procedure, are the accumulator pressures and the brake pot pressures at the end of each fifth brake application cycle. Also record the emergency brake accumulator N₂ precharge temperatures and pressures before and after the flight. It would be preferable if the flight considered was the first flight for that day, and the recordings before flight should be made before the engines are started.

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REQUISITION FOR FLIGHT TEST

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5.4 All instrumentation as under section 3 should be recorded for procedure under item 4.7. The condition of the runway should also be observed together with the exact A/C weight and the distance required to stop.

NOTE:- These tests should be done wherever convenient within the normal flight activities. Weight specifications throughout this R.F.T. are only approximate.

* These are additional instrumentation items to the list in FAR/C105/1.

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