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FUNCTION TEST PROCEDURE

UTILITY HYDRAULIC SYSTEM

A. V. ROE CANADA LIMITED

MALTON · ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT: ARROW I

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UTILITY HYDRAULIC SYSTEM

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AVRO AIRCRAFT LIMITED
MALTON · ONTARIO
TECHNICAL DEPARTMENT

REPORT No.
SHEET No.

AIRCRAFT:		PREPARED BY	DATE
ARROW I	FUNCTIONAL TEST PROCEDURE UTILITY HYDRAULIC SYSTEM	CHECKED BY	DATE

This report defines the Hydraulic Utility System testing that is required during the manufacture of the Arrow I aircraft.

C O N T E N T S

1. Condition of Aircraft
2. Test Equipment Required
3. Functional Test Procedure

FORM 1318A

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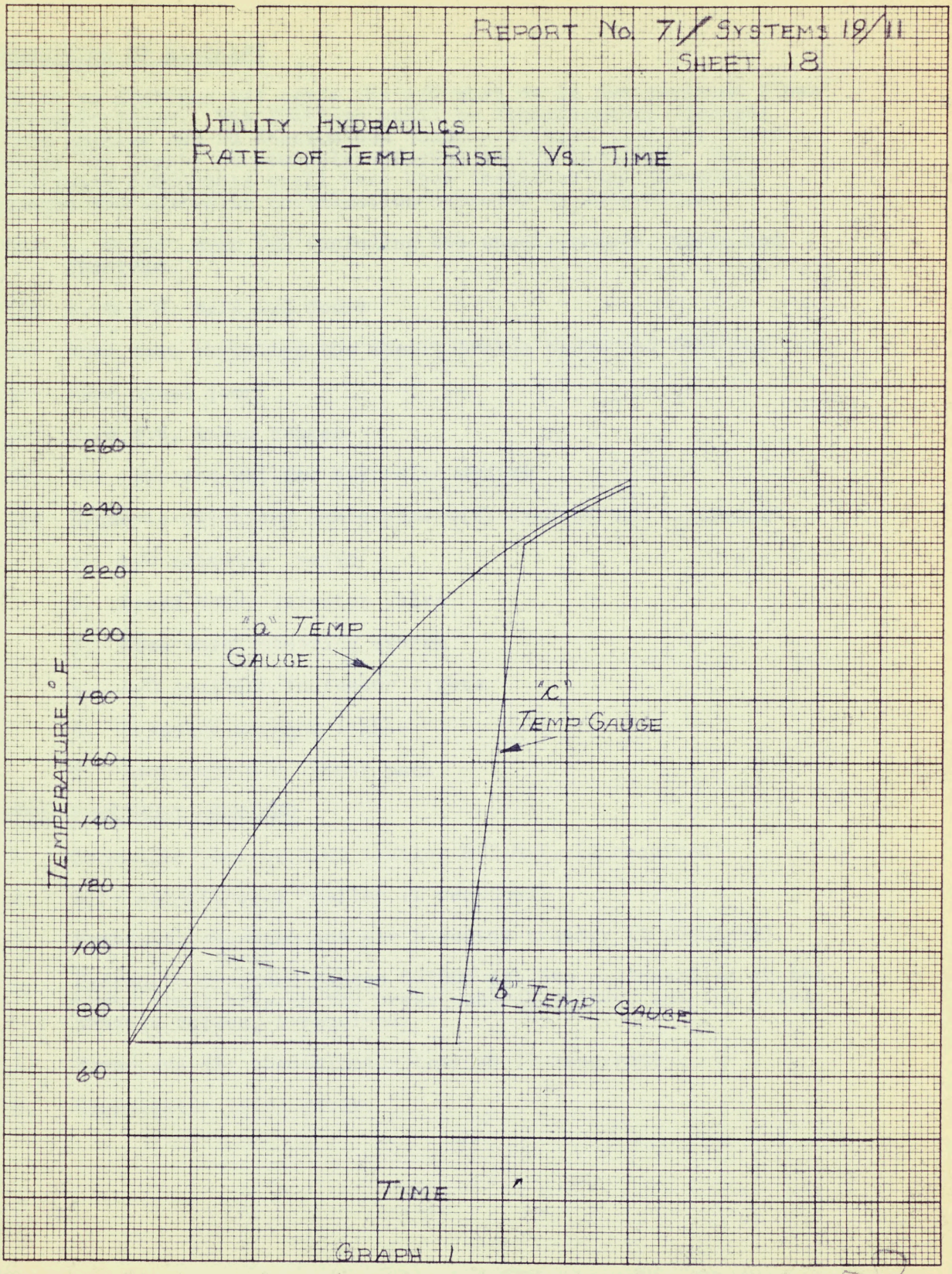
UTILITY HYDRAULICS
RATE OF TEMP RISE VS TIME



GRAPH 1

G9-12
10 X 10 TO THE ½ INCH
MADE IN CANADA

1. CONDITION OF AIRCRAFT

Prior to starting the tests the A/C must be in the advanced final assembly stage. The fuselage shall be significantly complete from station 120 to station 600 (approximately) with the inner wings (at least) permanently attached to the fuselage. The following components shall have been installed and correctly jigged and hydraulic installation approved by inspection.

(a) L. & R.H. main L/G including the wheels, brakes, tires and fairings.

(b) L. & R.H. main L/G doors

(c) Nose gear including the wheels brakes tires and fairings

(d) Nose wheel door

(e) L. & R.H. speed brakes

(f) The complete utility hydraulic system

(g) Electric circuitry associated with each of the following:

1. L/G selector valve
2. Speed brake selector valve
3. Nose wheel steering system
4. L/G position indicator lights
5. Pressure warning lights
6. Emergency A.C. power pack

2. TEST EQUIPMENT REQUIRED

1. Hydraulic test machine trailer H.T.M.T. (1 required)
2. H.P. Air/nitrogen trailer (1 required)
3. Hydraulic charging and air bleeding trailer (1 required)
4. Hydraulic pressure gauges 0-3000 psi (to be installed in the brake lines between the brake control valves, and the brake shuttle valves, 4 required.
5. Power and air conditioning trailer (1 required)
6. Compensator level gauge.

3. FUNCTIONAL TEST PROCEDURE

3.1 The utility hydraulic system must be properly filled and bleed of all air. The accumulators and H.P. nitrogen bottle must be correctly charged and checked for leakage.

3.1.1 Accumulator Nitrogen Charging

3.1.1.1 Nitrogen for this operation will be obtained from the H.P. Compressed Air/Nitrogen trailer.

3.1.1.2 Before nitrogen charging of the accumulators, ensure that all hydraulic pressure has been relieved from the system. To discharge hydraulic pressure, open the manual dump valve situated on the forward face of former 485 and operate the brakes until all pressure is relieved.

3.1.1.3 Remove the hydraulic access panel and connect the line from the nitrogen trailer to the charging connection on the accumulator gauge, situated at Station 572 immediately above the hydraulic access panel. Charge to the pressure shown on the placard corresponding to ambient temperature. Recheck the pressure after 1 hour and adjust if necessary.

3.1.1.4 Connect hoses 1 and 2 of the test machine to the aircraft utility external supply couplings. Select "MODE 2" ([redacted]) and start up the auxiliary pump. Shut off the test machine when 4000 psi shows on the accumulator gauge. Disconnect the hoses. Allow the hydraulic pressure to remain in the system for 15 minutes and then relieve it as described in Para. 3.1.1.2. The nitrogen pressure now indicated on the gauge should be correct to the original setting.

3.1.1.5 If there is any leakage, check all joints with soap solution. External leaks will be indicated by bubbles. If no external leakage is found, slacken off a connection in the line from the accumulator to the gauge. An internal leak in the accumulator will be indicated by traces of hydraulic fluid in the nitrogen which escapes from the connection. This will necessitate replacement of the accumulator. All traces of soap solution must be removed after completion of the external leakage check.

3.1.1.6 After tightening the joints, or other rectification as necessary, the procedure given in Paras 3.1.1.3 and 3.1.1.4 must be repeated.

3.1.2 Emergency Nitrogen Bottle Charging

NOTE: Before charging, ensure that the undercarriage selector is in the normal "DOWN" position. If an emergency "DOWN" Selection has been made, the hydraulic system will have to be bled as described in Chapter 3.1.3.

3.1.2.1 The bottle will be charged from the H.P. Compressed Air/Nitrogen Trailer.

3.1.2.2 Connect the charging line to the charging gauge connection in the nose wheel well, and charge to 5000 p.s.i. Re-check after one hour, when the nitrogen charge will be at ambient temperature. Re-charge as necessary.

3.1.2.3 If any leakage is detected, indicated by a persistent loss of pressure, check all points in the system with a soap solution. Points of leakage will be indicated by bubbles.

3.1.2.4 After tightening any leaking joints, repeat the proecdure in Para. 3.1.2.2

3.1.3 Topping Up the Utility Hydraulic System

3.1.3.1 Topping Up (Accumulators to be Discharged)

3.1.3.1.1 Remove the hydraulic access panel.

3.1.3.1.2 Pull down on the bleed valve cable, which is situated at the side of the compensator and watch the flow of fluid past the bleed sight drain gauge. Bleed until a continuous flow of bubble-free fluid is seen at the gauge.

3.1.3.1.3 Operate the manual dump valve and the brakes until all hydraulic pressure is relieved from both accumulators. Check the accumulator nitrogen pressure (Ref. Para. 3.1.1.3).

3.1.3.1.4 Insert the level gauge through the hole in the bottom of the compensator until it contacts the piston. Slide the window up on the level gauge until it contacts the bottom of the compensator. Check the reading on the RED scale opposite the FULL marking at the bottom of the window. Note the temperature reading on the fluid temperature thermometer on the return line above the compensator.

3.1.3.1.4 The two readings should agree.

3.1.3.1.5 If the level is low enough to require filling, the figure corresponding to that on the temperature gauge will be level with, or above the "REFILL" marking on the window. Connect the hydraulic charging and bleed trailer to the return side external supply coupling, and charge to the correct level.

3.1.3.1.6 If the level is too high, it will be necessary to repressurize the system by means of the ground test trailer in order to force the surplus fluid out through the manual bleed valve.

3.1.3.1.7 After topping up, the system must be left pressurized in order to have pressure available for brake operation. Check the pressure on the emergency accumulator pressure gauge. (4000 psi.)

3.1.3.2 Topping Up (Accumulators Charged)

3.1.3.2.1 Remove the hydraulic access panel.

3.1.3.2.2 Insert the level gauge into the compensator and check the level as in Para. 3.1.3.1.4 except that the reading is taken on the WHITE scale.

3.1.3.2.3 If the level is low, carry out the charging procedure as in Para. 3.1.3.1.5.

3.1.3.2.4 If the level is too high, bleed off surplus fluid through the manual bleed valve as in Para. 3.1.3.1.6.

3.1.3.2.5 Check that there is a minimum of 2500 psi pressure on the emergency accumulator gauge. If the pressure is below this figure, repressurize the system.

3.1.4 Initial Filling and Air Bleeding Procedure

The following procedure is to be carried out for filling and bleeding the complete utility hydraulic system. This procedure is to be followed when initially filling the system or when refilling after the system has been completely flushed and drained.

3.1.4.1 Pre-Filling Instructions

3.1.4.1.1 Check that the Hydraulic Test Machine Trailer is NOT connected to the aircraft.

3.1.4.1.2 Check that the undercarriage is in the "DOWN AND LOCKED" position and that the undercarriage selector is in the "DOWN" position.

3.1.4.1.3 Check both accumulator nitrogen charges and re-charge if necessary. (Ref. Chapter [illegible]).

3.1.4.1.4 Set the aircraft on rigging jacks so that the wheels are off the ground.

3.1.4.1.5 Set the speed brake selector in the "HOLD" position.

3.1.4.1.6 The emergency undercarriage nitrogen bottle must be charged to 5000 psi.

3.1.4.1.7 Fill the aircraft pump cases with hydraulic fluid at the pump filling plug.

3.1.4.1.8 Fill the hydraulically driven emergency power pack motor case with oil at the motor filling plug.

3.1.4.1.9 Wire-lock the nose wheel micro-switch in the ground position.

3.1.4.2 Priming the System

3.1.4.2.1 With the mode selector "OFF", connect Nos. 1 and 2 hoses of the Hydraulic Test Machine Trailer to the aircraft utility system external supply couplings.

3.1.4.2.2 Connect the electrical ground power supply to the aircraft.

3.1.4.2.3 Turn the mode selector to "MODE I", and start up the auxiliary pump. Check that the needles on the vacuum gauge are within the safety range, as indicated by the green arc on the dial face.

3.1.4.2.4 Operate all the utility services (undercarriage, speed brakes, wheel brakes, nose wheel steering, and armament pack when fitted) by means of the cockpit selectors. function each system in turn until bubble-free fluid is seen in the Hydraulic Test

3.1.4.3.10 U/C Door Up-Lock Jacks:- 7 places
U/C Leg Up-Lock Jacks:- 3 places
U/C Leg down-locks:- 3 places
Accumulator connections:- 2 places
Pressure switch connections 2 places
Flying control and utility
Compensators (1500 psi pressure
inlet):- 3 places.

3.1.4.3.11 Operate the wheel brakes and drain off one quart of oil at each brake unit bleed point.

3.1.4.3.12 Operate the speed brakes for 3 complete cycles.

3.1.4.3.13 Operate the nose wheel steering mechanism for 3 complete cycles.

3.1.4.3.14 Carry out three complete retraction cycles on the undercarriage. Note that at 500 psi pressure the gear will retract only partially.

3.1.4.3.15 Repeat all items 3.1.4.3.14 inclusive until the oil returning from the aircraft is seen to be free of air bubbles in the HTMT sight gauges when the bleed buttons are pressed.

3.1.4.3.16 Repeat all items 3.1.4.3.11 to 3.1.4.3.14 inclusive at 4000 psi pressure and 40 GPM total delivery.

NOTE: At this time all the sub-systems (i.e. U/C, speed brakes, and nose wheel steering) should operate smoothly and with quick response to selections. The action should not be spongy nor should there be any hammering in the pipes.

3.1.4.3.17 Re-set the HTMT to 4500 psi and 20G.P.M. total flow rate. Run the machine with no aircraft services operating, in order to bleed the lines through the heat exchangers and by-pass valves. Press the bleed buttons periodically until no air bubbles are seen in the sight gauges.

3.1.4.3.18 Shut down the HTMT main pumps.

3.1.4.3.19 Check the level of the aircraft utility compensator as per Para. 3.1.3.2.2. If the level is low, adjust the test machine low pressure adjustment until the correct level is attained. This is brought about by the

3.1.4.2.4 Machine Trailer No. 1 sight glass. This procedure utilizes the large capacity of the hydraulic test machine trailer reservoir to displace the majority of the air from the system.

3.1.4.2.5 Stop the auxiliary pump.

3.1.4.2.6 Turn the mode selector "OFF".

3.1.4.2.7 Refill the Hydraulic Test Machine Trailer reservoir to the correct level on the gauge.

3.1.4.3.1 Operating the System

3.1.4.3.1 With the mode selector off, connect Nos. 1 and 2 hoses to the aircraft.

3.1.4.3.2 Connect the electrical ground supply to the aircraft.

3.1.4.3.3 Turn the mode selector to "MODE 3", and start up the pump. Check that the needles on the vacuum gauge are within the safety range, as indicated by the green arc on the dial face.

3.1.4.3.4 Check the Hydraulic Test Machine Trailer compensator fluid levels.

3.1.4.3.5 Press the bleed buttons and check that there are no bubbles in the sight glasses.

3.1.4.3.6 Adjust the low pressure adjustment valves until the low pressure gauges read 50 p.s.i.

3.1.4.3.7 Bleed the aircraft utility system as in Para. 3.1.3.1.2.

3.1.4.3.8 Pre-set the test machine main pumps for 500 psi pressure and 1.5 G.P.M. flow each, by means of the volume and pressure controls.

3.1.4.3.9 Start up the main pumps.

3.1.4.3.10 Crack open and re-tighten the piping joints at the following components to allow entrapped air to escape:

3.1.4.3.19 increased pressure overcoming the aircraft pressure and forcing the aircraft compensator piston down to its correct position.

If the level is too high, stop the auxiliary pump and press the low pressure pump button until the level is correct.

3.1.4.3.20 If not already done, stop the auxiliary pump.

3.1.4.3.21 Press the high pressure dump botton.

3.1.4.3.22 Turn off the mode selector.

3.1.4.3.23 Disconnect the hoses.

3.2 Personnel Safety Precautions

3..1 Due to the high power output of the hydraulic system, operating rates of landing gear and speed brakes without air loads are liable to be much more rapid than experienced in the past. With this in mind, particular attention must be paid to ensure the safety of personnel working near these areas.

3.3 Test Procedure - Power Circuit

3.3.1 Connect the H.T.M.T. to the Aircraft.

3.3.2 Select Mode 2 and start up the auxiliary pump. Adjust the low pressure adjustment valves until the low pressure gauges on the H.T.M.T. read 50 psi.

3.3.3 With hydraulic pressure removed from all accumulators, record the compensator fluid level and fluid temperature.

3.3.4 Start up the H.T.M.T. main pumps and slowly pressurize the system and note the following (with the main pump flow set at 5 GPM per pump).

3.3.4.1 The gradual build up of pressure as indicated by the accumulator pressure gauges and the reduced pressure gauge. The reduced pressure should be between 1450 and 1850 psi. maximum.

3.3.4.2 The operation of the cockpit warning lights. The utility hydraulics warning light should go out at 300 + 600 psi. - 200
The emergency brake warning light should go out at 2100 ± 75 psi. These pressures can be read from the pressure gauge on the rig. or the accumulator gauges. (In either case the gauge tolerances must be taken into account.)

3.3.4.3 The pressure regulator cut-out pressure.

3.3.4.4 The change in compensator fluid level and fluid temperature.

3.3.4.5 The return system pressure as read at the L.P. gauge on the H.T.M.T.

3.3.5 Shut off the H.T.M.T. main pumps.

3.3.5.1 Operate the wheel brakes. Check that the utility hydraulics warning light comes on at 100 ± 400 psi.

3.3.5.2 Continue operating the wheel brakes. Check that the "Emergency Brake" light comes on at 2100 ± 75 psi.

3.3.6 Repeat sections 3.3.4, and 3.3.5 inclusive five (5) times to check consistency of results.

3.3.7 To test the heat exchangers and associated valves circuit.

3.3.7.1 To carry out this test strap on thermocouples of temperature gauges in the following locations.

(a) At the "Pressure Regulator" port of the by-pass control valve (7-1956-353).

(b) At the "Compensator" port of 7-1956-353.

(c) At the wire locked "Fuel H/E" port of the thermal by-pass valve 7-1956-383.

They should be mounted about 12" from the ports specified. They should read over the range of 50 to 250°F in at least 10° increments. The three temperatures must be the same before the test is started.

3.3.7.2 Connect the H.T.M.T. to the Aircraft. Select Mode 2, start up the auxiliary pump and adjust the low pressure to 50 psi.

3.3.7.3 Shut off the coolant flow to the H.T.M.T. heat exchangers.

3.3.7.4 Start up the main pumps and adjust to 40 gpm. capacity. Raise the pressure until the aircraft pressure regulator valve is operating.

3.3.7.4 Read and tabulate the temperatures on all three gauges simultaneously (i.e. in 10 sec.) at one minute intervals. Graph 1 shows the temperature Vs approximate time relationship for a normally operating system.

The reading on gauge 'a' will increase gradually as the test progresses. The reading on gauge 'b' will increase together with 'a' up to about 100°F. at which time 'b' values will start to drop. The reading on gauge 'c' will stay sensibly constant at the ambient temperature until temperature 'a' reads 213°F at which time 'c' reading will increase rapidly and 'a' and 'c' should be the same by the time 'a' reaches 230°F.

3.3.8 System Proof Pressure Test

3.3.8.1 Connect the H.T.M.T. to the aircraft at the armament pack quick disconnects or some suitable location downstream of the pressure regulator.

3.3.8.2 Select Mode 2, start up the auxiliary pump and adjust the low pressure to 50 psi.

3.3.8.3 Start up the H.T.M.T. main pumps and adjust their flow to 20 gpm each.

3.3.8.4 Raise the pressure until the relief valves are fully open.

3.3.8.5 Check the power circuit for leakage by visually checking all pipe joints. (The power circuit being the pressure lines from the pressure regulator up to the subsystem control valves and return lines.)

3.3.8.6 Reduce the pressure to 4000psi and check that relief valves have closed. This can be done approximately by reducing the pump flow to 5 gpm each. If the pressure is maintained at 4000psi then the relief valves are closed.

3.3.8.7 Since the landing gear is down for this test this subsystem can be checked immediately. Increase the pump flows to 20 gpm each the the pressure as in 3.3.8.4.

3.3.8.7.1 Check the landing gear down lines for leakage, i.e. the lines to the door and gear uplocks, the transfer valves and the door actuators.

3.3.8.8 Select speed brakes open, check lines for leakage.

3.3.8.9 Select speed brakes closed, check lines for leakage.

3.3.8.10 Reduce the pressure to 400 psi. Select landing 'up' and increase the pressure as in 3.3.8.4.

3.3.8.10.1 Check as many up lines as possible.

3.3.8.10.2 Reduce the pressure to 400 psi. and extend the landing gear. Inspect the lines in the wheel wells to determine if any oil may have leaked out under higher pressure.

3.3.8.11 Operate the emergency A.C. alternator. Check lines for leakage under pressure as given in 3.3.8.4.

3.3.8.12 Check the reduced pressure lines from the pressure control valve to the compensators and brake valves for leakage.

3.4 Test Procedure - Sub Systems

3.4.1 Landing Gears

3.4.1.1 Connect the H.T.M.T. to the Aircraft.

3.4.1.2 Support the Aircraft on rigging jacks so that the landing gear wheels are clear of the ground.

3.4.1.3 Select Mode 2 on the H.T.M.T. and start up the auxiliary pump. Adjust the low pressure adjustment valves until the low pressure gauges on the H.T.M.T. read 50 psi.

3.4.1.4 Check that Landing gear cockpit selector is in the "down" position and start up the H.T.M.T. main pumps.

3.4.1.5 With the main pumps supplying 5 gpm each select L/G up and down 5 times. The pressure setting of the H.T.M.T. should be above the cut out pressure of the aircraft pressure regulator (i.e. above 4300 psi). This will check the L/G operation under pressure regulator control.

3.4.1.5.1 Check for correct operation of the L/G position cockpit indicators at the end of each L/G operation and that the L/G position corresponds to the L/G selector position.

3.4.1.5.2 With gear up and locked check that the door and leg fairing rigging requirements are met.

3.4.1.6 Increase the main pump flow until the total flow is 40 gpm or until the nose gear operating time

3.4.1.6 is 2 secs. (This is 2 secs. for the nose gear only not the nose door as well. In the air the nose gear is subjected to drag loads which tend to increase the nose gear operating time. The maximum terminal piston velocity of the nose gear may be reached on the ground at a flow less than 40 gpm.) If the flow is less than 40 gpm record the value.

3.4.1.7 With the setting obtained in 3.4.1.6 operate the L/G 20 times.

3.4.1.7.1 Check visually that the L/G and L/G door speeds at the end of each travel are indicative of correct functioning of the jack dampers and restrictors.

3.4.1.7.2 Record the total landing gear operating times, from cockpit selection until the last door locks up for retraction and last leg locks down for extension. This need only be done for three of the 20 selections providing the results are consistent.

3.4.1.7.3 At the end of the 20 cycles, check the door jack piston rods for scoring by the internal downlock mechanisms.

3.4.1.7.4 At the end of the 20 cycles, check the structural integrity of the uplocks and mechanically operated sequence valves.

3.4.1.7.5 During the last cycle, record the pressure regulator cut-in and cut-out pressures.

3.4.1.8 After establishing satisfactory performance of the L/G on normal selection, set the L/G in the "up" position.

3.4.1.9 Shut off the H.T.M.T. and disconnect from the aircraft. Discharge the power circuit accumulator by operating the speed brakes or the manual dump valve at station 485.

3.4.1.10 Check that the nitrogen storage bottle pressure is 5000 $\pm$ 250 psi.

3.4.1.11 Select Emergency L/G down.

3.4.1.11.1 Check that the L/G extends completely and that the L/G cockpit indicators show correct L/G position.

3.4.1.11.3 After 3 minutes check the residual pressure in the bottle, leave for 10 minutes and re-check. There should be no drop in pressure.

3.4.1.11.4 Check all the piping containing H.P. nitrogen from the bottle to the L/G door jacks, uplocks, transfer valves etc. for leakage at pipe fittings, using a soap solution. (Note - this may be started during 3.4.1.11.3).

3.4.1.11.5 Check that there has been no damage to the L/G doors during emergency extension.

3.4.1.12 Select normal L/G down. Check that the nitrogen pressure in the L/G units is vented to atmosphere. Record the quantity of oil that is vented over-board with the nitrogen during this operation.

3.4.1.13 Bleed and prime the utility hydraulic system.

3.4.2 Speed Brakes

3.4.2.1 Connect H.T.M.T. to aircraft, select Mode 2, start up the auxiliary pump and set the low pressure gauges to 50 psi.

3.4.2.2 Start up the H.T.M.T. main pumps and adjust their flow to 5 gpm each.

3.4.2.3 Operate the speed brakes for 5 cycles. One complete cycle to consist of successively selecting the speed brakes to the following positions.

(a) Speed brakes "retract".

(b) Two intermediate hold positions.

(c) Speed brakes "extend".

(d) Two intermediate hold positions.

(e) Speed brakes "retract".

3.4.2.3.1 Check at least once that the requirements laid down in the rigging instructions are met for brakes extended and retracted.

3.4.2.3.2 Check during one cycle that the selector position agrees with the brake position for 'retract','estend' and 'hold'.

3.4.2.3.3 Record the times for full brake extension and retraction. (Once only is required).

3.4.2.3.4 Check for smooth operation and synchronization of the speed brakes.

3.4.2.3.5 Place the brakes in the 'hold' selection at approximately half way open. Record the amount of brake 'creep' for each brake over a five minute period.

3.4.2.4 Reset the H.T. M.T. pumps to 20 gpm flow rate each.

3.4.2.5 Operate the speed brakes for 20 cycles, a cycle consisting of retract, extend, retract.

3.4.2.5.1 Record the extension and retraction times during one cycle.

3.4.2.5.2 Record the pressure regulator cut-in and cut-out pressures during one cycle.

3.4.3 Wheel Brakes

Install the 3000 psi gauges on branch lines from the L.H. and R.H. normal brake lines L.H. and R.H. emergency brake lines between the brake control valves and the shuttle valves at the bottom of the main L/G legs.

3.4.3.1 Normal Brake System Test

Connect the H.T.M.T. to the aircraft, select Mode 2, start up the auxiliary pump and adjust low pressure to 50 psi. Start up the main pumps and set them to deliver 10 gpm each.

3.4.3.1.1 Apply brakes as hand as possible (both L.H. and R.H.)

3.4.3.1.1.1 Record brake pressures in L.H. and R.H. normal brake lines.

3.4.3.1.1.2 Pressure in L.H. and R.H. emergency brake lines should be about 100 psi.

3.4.3.1.1.3 Check that all wheels are locked by attempting to rotate them by hand.

3.4.3.1.2 Release brakes and check that all wheels are free to rotate and that pressure on all 4 gauges is about 100 psi.

3.4.3.1.3 Repeat 3.4.3.1.1 and 3.4.3.1.2 five times.

3.4.3.1.4 Depress R.H. rudder pedal as far as possible.

3.4.3.1.4.1 Record pressure in R.H. normal brake line.

3.4.3.1.4.2 Pressure in the other 3 lines should be about 100 psi.

3.4.3.1.4.3 Check that R.H. Wheels are locked and L.H. are free to rotate.

3.4.3.1.5 Repeat 3.4.3.1.4 except using L.H. brakes.

3.4.3.1.6 Repeat 3.4.3.1.3 and 3.4.3.1.5 five (5) times.

3.4.3.1.7 Record pressure regulator cut-in and cut-out pressures during one application of both brakes.

3.4.3.2 Emergency Brake System

3.4.3.2.1 To check the operation of the automatic change-over valve. Charge the accumulators to 4000 psi, shut down the H.T.M.T.

3.4.3.2.1.1 Apply L.H. brakes. Brake pressure should show on L.H. normal brake line gauge.

3.4.3.2.1.2 Operate the speed brakes from the accumulator. This will cause the accumulator pressure to decrease and when it reaches about 2500 psi the brake pressure will follow the accumulator pressure.

3.4.3.2.1.3 When this pressure has dropped to 900 $\pm$ 25 psi the change over valve will operate. This is indicated by an increase in emergency brake pressure from about 100 to 1500 psi and the normal brake pressure will drop to 100 psi.

3.4.3.2.1.4 Start up the H.T.M.T. and slowly increase the system pressure. The change over valve will shuttle back at a pressure of 600 $\pm$ 50 psi above the change over pressure of 900 psi $\pm$ 25 psi. This is indicated by an increase in normal brake pressure to about 1500 psi and a drop in emergency pressure to about 100 psi.

3.4.3.2.1.5 Repeat sections 3.4.3.2.1.1 and 3.4.3.2.1.4 on the R.H. brake valve.

3.4.3.2.2 Charge the accumulators to 4000 psi with the H.T.M.T. Operate the speed brakes to flatten the power circuit accumulator.

3.4.3.2.1 Apply L.H. and R.H. brakes as hard as possible, record pressures in emergency brake lines. Pressure in the normal brake lines should be about 100 psi. Check that wheels are locked.

3.4.3.2.2 Release brakes and check that all gauges read about 100 psi and wheels are free to rotate.

3.4.3.2.3 Repeat 3.4.3.2.1 and 3.4.3.2.2 three times.

3.4.3.2.3 Charge the accumulators to 4000 psi with the H.T.M.T. Operate the speed brakes to flatten the power circuit accumulator.

3.4.3.2.4 Depress both rudder pedals and set the parking brake. Record the pressure at the emergency brake line gauges. Check that the wheels are locked.

3.4.3.2.4.1 Release parking brake. Check that the wheels are free to rotate and that the gauges read about 100 psi.

3.4.3.2.4.2 Repeat 3.4.3.2.4 and 3.4.3.2.4.1 three times.

3.4.3.2.5 Repeat 3.4.3.2.3.

3.4.3.2.6 Record the number of brake applications that can be obtained before the emergency brake accumulator is flattened. Repeat 3 times.

3.4.3.3 Remove the brake line gauges and re-bleed the brake sub-system.

3.4.4 Nose Wheel Steering

3.4.4.1 Attach the H.T.M.T. to the aircraft, select Mode 2 start up the auxiliary pump, adjust the low pressure to 50 psi.

3.4.4.2 De-actuate the nose gear scossors switch.

3.4.4.3 Start up the H.T.M.T. main pumps and adjust their flow to 10 gpm each.

3.4.4.4 Operate the nose wheel steering switch on the control column and rotate the nose wheels to the maximum position in one direction.

3.4.4.5 Release the steering button. Record the time required for the wheels to centralize.

3.4.4.6 Repeat in opposite direction.

3.4.4.7 Repeat 3.4.4.4, 6.4.4.5, and 6.4.4.6 three times.

3.4.4.8 Re-actuate the nose gear scissors microswitch.

NOTE: If at any time during the tests it becomes necessary to adjust or replace any Hydraulic Equipment then test work must be repeated (including the proof pressure test) on the Power Circuit and Sub-Systems affected.