BELL 212 GROUND RUN AND TEST FLIGHT PROCEDURES

INTRODUCTION

1. The purpose of this document is to provide the pilot with the necessary guidance to conduct ground run and test flights for the Bell 212. It is designed to be used with an aircraft that has just come out of maintenance and requires a complete test programme before it receives "technical dispatch". However, elements of this document can be used as necessary when conducting specific testing while in the field.

2. The procedures found in this document are based upon, and subordinate to, the Bell 212 Aircraft Flight Manual procedures as well as the applicable Maintenance Manual instructions. Procedures contained within can be modified as necessary in consultation with the Aircraft Maintenance Engineer (AME) to achieve the desired results.

CAUTION:

Many ground run and test flight procedures require the pilot to operate the aircraft close to, or at, maximum operating limits. Exceptional diligence is required to avoid unnecessarily exceeding a placarded limitation. It is strongly recommended to have the AME accompany the pilot on any test flights to provide for additional lookout for traffic while the pilot is monitoring instruments in the cockpit.

3. Conduct a thorough review of the Aircraft Journey Logbook and discuss with the AME the requirements and expectations of the ground run and/or test flight. Carry out a thorough pre-flight inspection of the aircraft. If the ground run / test flight is necessitated because of maintenance activity, inspect and discuss those specific areas with the AME to ascertain what was carried out prior to engine start.

GROUND RUN PROCEDURES

PRE-START CHECKS

4. Carry out all normal pre-start checklist procedures and in addition:

   (a) Select each BATT switch on independently. Note that the BATTERY caution segment is OFF. Select both BATT switches to ON. BATTERY segment should now be illuminated;

   (b) Visually check that all illuminated caution panel segments are indicating correctly. Incorrect segments may be a result of the wrong P/N caution panel being installed.

   (c) Select both fuel valve switches to ON. Check FIRE EXT is in the OFF position. Pull each FIRE PULL handle and note that the fuel valves close correctly. Reset the FIRE PULL handles and check that the fuel valves open again.

CAUTION:

Failure to properly ensure that the FIRE EXT switch is OFF will result in the applicable fire bottle discharging its contents.

(d) Cycle the BOOST PUMPS and FUEL VALVES and listen for proper motoring sounds and that the appropriate CAUTION segments function;

(e) Check that the PART SEP caution lights are illuminated. Position the PART SEP switches to OVRD ON and note that the doors close (motoring sound) and that the appropriate PART SEP light extinguishes in approximately 15 seconds. Select OVRD OFF and check that the lights illuminate again;

(f) Have the AME open the EXTERNAL POWER door. The caution segment should illuminate. Close the door and note the light extinguishes;

(g) Turn on the VENT BLOWER and listen for the motoring and check that you can feel air circulating at the windscreen;

(h) If possible, check all cockpit lights are functional;

(i) Trip the Idle Release switch and listen for the solenoid opening and closing approximately five seconds later; and

(j) Cycle the controls fully to check for unusual binding (do not apply excessive force on the cyclic grip to prevent fatigue cracks).

GROUND RUN

5. Start the aircraft normally in accordance with the Aircraft Flight Manual (AFM) noting any unusual indications or characteristics. An engineer must be present to conduct a leak check during the start sequence.

CAUTION:

Be vigilante during the first start sequence, especially if a fuel component (AFCU, MFCU, etc...) has been changed. Idle RPM will not have been properly set and N1 RPM may be high. Always be prepared to abort the start.

NOTE:

If dual controls are installed, a second abbreviated ground run should be planned for from the left seat to ensure the controls and collective / cyclic switches function as expected.

6. With the engines running at idle:

(a) note that all temperatures and pressures are indicating correctly;

(b) confirm that the RPM warning light is ON and that other warning and caution lights are OFF.

(c) check and adjust N1 idle speeds.

NOTE:

While the acceptable N1 idle speed range is 61 ±1% it is recommended that this be adjusted to a closer tolerance during the test procedure to contend with changes resulting from variations in temperature and altitude when the helicopter is on operations.

(d) Visually check the rotor track. If excessive vibration is evident, correct the track before proceeding.

(e) Fuel Control Units and High Rotor RPM Warning Light:

(1) At ground idle read and record as follows:

a. Hp pressure altitude (Altimeter set to 29.92" hg);.

b. OAT; and

c. ENG 1 and ENG 2 N1.

(2) Select ENG 1 GOV switch to MAN. Check MASTER CAUTION and GOV MAN Caution Light illuminate. Once N1 stabilizes record the value.

NOTE:

Idle N1 may decrease substantially when the governor switch is selected to the manual mode. Throttle may need to be increased to prevent the engine idle from decreasing below 50% N1.

(3) Slowly advance ENG 1 throttle to achieve 97% N2/Nr. Raise the collective slightly, Nr should decrease. Maintain 97-98% Nr with small throttle movements until approximately 35% transmission torque is indicated. Move the throttle to IDLE and lower the collective.

NOTE:

The engine should respond positively to throttle movements. There should be no sign of instability (surging or hunting).

(4) Select ENG 1 GOV switch to AUTO. N1 should stabilize at original speed, and the caution light should go out.

NOTE:

An audible "pop" may be heard when the governor mode is changed.

(5) Repeat the procedure for ENG 2 and then with MAN GOV still selected, advance ENG 2 throttle and check that the High Rotor RPM Warning Light illuminates at 103 ±1% Nr.

CAUTION:

1. Do not permit N1 to decrease below 50% during this check. If necessary re-select the AUTO mode to arrest an excessive drop in N1 when MANUAL GOV is selected. In this circumstance an adjustment will be required.

2. On the ground all selections to the MANUAL GOV mode are to be made with both throttles in the IDLE position.

3. Do not exceed 104.5% Nr.

4. Do not exceed 100% N2 for more than 10 seconds.

(6) Ensure GOV switches are back in AUTO. Decrease beep to minimum for five seconds, then in sequence slowly and smoothly advance the throttles to full open. Be alert for unusual or abnormal characteristics and observe published engine and rotor limits. Check low RPM warning activates between 90-94% Nr.

ENGINE "BEEP" RANGE

7. Adjust the beep limits as follows:

(a) Both engines operating at full throttle 97 ± 0.5% Nr minimum, to 101.5 ± 0.5% N2 maximum.

(b) Single Engine - 95 ± 0.5% N2 to 99.5 ± 0.5% N2.

NOTE:

1. The beep range between LOW and HIGH should be 4.5 ± 0.5% N2.

2. Even with the individual engine beep limits correctly adjusted, there could be a difference of up to one per cent between the two. This difference can result in torque splits particularly under high power demand conditions, therefore an attempt should be made to closely match the beep limits of the individual engines.

3. When adjusting beep ranges ENG 2 should always be adjusted first since it will affect ENG 1 as well. Then ENG 1 should be adjusted thereafter.

FORCE TRIM - PEDAL CREEP CHECK

8. Establish 98 to 100% Nr. Select Force Trim ON and cyclic friction OFF. Centre the cyclic and pedals and ensure the collective is fully lowered:

(a) Displace the cyclic and pedals 1/2 to 1 inch from trim. A force gradient must be felt and the control must return to approximately the "trimmed" position when the pressure is released.

(b) Displace the controls approximately one inch. Momentarily depress the pilots trim release. A new trim should be established.

(c) Using the copilots trim release (if installed), repeat the check procedure.

(d) Select Force Trim OFF. Ease feet back from pedals. The pedals should not move, or tend to centre, unless disturbed (the cyclic control may tend to "fall" away if released but the force required to counter this tendency will be extremely light).

9. With force trim OFF, slowly cycle the flight controls two to three inches. Check that the rotor responds to the control movements.

HYDRAULIC SYSTEMS AND FRICTION CHECK

10. Increase the friction on the cyclic and collective to ensure they can restrain the controls properly. Reduce the frictions to minimum and check control movement with small control displacements. Controls should feel light with no indications of binding.

11. Conduct the hydraulic systems check in accordance with the AFM.

(a) use an “X” or “Y” pattern when moving the cyclic during the hydraulic check (this checks each cyclic servo in isolation). Check the hydraulic system “feel” and *visually check* the rotor response.

(b) flight controls need only be displaced two to four inches to check the hydraulic system and rotor response. Avoid large aggressive control movements during this check.

(c) cyclic and pedal forces with trim and friction off should be light and the force required to raise the collective should be 8-10 pounds, measured at the centre of the ENG 1 throttle. With the HYD SYS 1 OFF, the pedals will be stiff but movable.

(d) the cyclic and collective control forces should not change significantly when either HYD SYS is selected OFF.

FUEL BOOST PUMP CHECK

12. In addition to the procedure in the AFM, select both BOOST PUMP switches off. No loss of power to either engine should be experienced.

NOTE:

1. Do not conduct this check if above 5000’ pressure altitude.

2. If a loss of power is experienced, immediately roll the affected engine’s throttle to IDLE CUTOFF. Do not select the BOOST PUMP switch to ON until ready for a restart.

PITOT HEATER CHECK

13. Select Pitot Heat ON. DC loadmeter should increase. Select Pitot Heat OFF.

CABIN HEATER CHECK

14. Select Cabin Heater ON. Set the thermostat to maximum. Confirm that the heater delivers warm air. Check the function of the defroster switch and the aft cabin outlet selector. With aft cabin outlets selected on, have a crew member check for flow of warm air.

GENERATOR VOLTAGE CHECK

15. Turn on cockpit, instrument and/or landing lights to increase the load sufficiently. At 98-100% Nr note the readings on GEN 1 and GEN 2. If necessary, have generator outputs balanced to equalize the readings.

DC ELECTRICAL SYSTEM CHECK

16. Check the DC electrical system as follows:

(a) Select GEN 1 OFF.
Check that ENG 1 DC GENERATOR, INVERTER #2 caution lights and the MASTER CAUTION light illuminate.
Select GEN 1 to RESET then ON.
Check that the ENG 1 DC GENERATOR caution light goes out.
Select No.3 INVERTER OFF and back to DC BUS #2.
INVERTER #2 caution segment should go out.

NOTE:

Generator output is to be adjusted using ground test equipment

(b) Repeat check with GEN 2 OFF.

(c) Select GEN 1 and GEN 2 ON.

INVERTER (AC SYSTEM) CHECK

17. Check the AC electrical system in accordance with the AFM.

TORQUEMETER CHECK

18. With the collective full down and Nr set to 100% the indicated transmission torque should be between 20% and 30%. The engine torque needles should not be split by more than four per cent.

NOTE:

1. Do not conduct any in-flight power checks if flat pitch torque indications are outside of nominal.

2. A low flat pitch torque will result in a high autorotation Nr and may limit the amount of collective available for the "cushioning" an engine-out landing. Conversely, a high flat pitch torque will result in low rotor RPM in an autorotation to the point where safe flight may not be possible.

2. Incorrect flat pitch torque readings will affect normal collective position in flight as well as affect torque limiting.

SINGLE ENGINE CHECKS

19. Roll ENG 2 to idle (61 ± 2%) and beep ENG 1 to 97% Nr. Ensure that ENG 1 throttle is fully open. Apply enough friction to each throttle to hold them in place.

20. Power Assurance and Single Engine Checks. Carry out power assurance check in accordance with normal procedures.

WARNING:

Under some conditions the helicopter may become very light on the skids or even fly at this power setting. Care must be taken, particularly if ground personnel or equipment are near the aircraft. Pilots should adjust the weight (ballast with personnel if necessary) to ensure the helicopter stays on the ground during this check.

NOTE:

During power assurance and engine power checks, turn respective generator OFF.

21. Set approximately 90% N1 and check:

(a) Engine Oil Pressure - Normal Operating Range.

(b) Transmission Oil Pressure - Normal Operating Range.

(c) CGB Oil Pressure - Normal Operating Range.

(d) Torque - Indication should be relatively steady.

NOTE:

Transmission oil pressure indication should be steady; engine oil pressure may fluctuate slightly (±5 psi). CGB oil pressure fluctuations within the normal operating range (60 - 85 psi) and intermittent, transient, fluctuations up to 10 psi outside this range are acceptable.

(e) Check that the ENG 2 N2 needle indicates lower than the ENG 1 N2 and Nr needles.

(f) Heater Air Shut-off Valve - With 90% N1 or more on ENG 1 select heater ON. ENG 1 ITT should rise and ENG 2 ITT should remain steady.

22. Repeat the procedures for ENG 2.

ENGINE ACCELERATION/DECELERATION CHECKS

23. Proceed as follows for an acceleration check:

(a) Set both throttles to idle.

(b) Apply friction to hold ENG 2 throttle in place.

(c) Fully open ENG 1 throttle abruptly and as N1 passes 90% immediately retard the throttle to idle.

(d) Record the time required for the engine to accelerate from idle to 90% N1.

NOTE:

The engine should not surge during this check and the time required for acceleration should not exceed approximately five seconds.

24. Proceed as follows for a deceleration check:

(a) Open ENG 1 throttle fully and set 90% N1, raising the collective as necessary.

(b) Abruptly close ENG 1 throttle and lower the collective.

(c) Record the time required for N1 to decelerate to 65%

NOTE:

The deceleration should be smooth and the time should not exceed five seconds.

25. Repeat the procedure for ENG 2.

COMPASS CHECKS

26. Confirm that the compass cards are valid and in place. If aircraft compasses are due to be swung, this can be done in conjunction with the test flight.

RADIO/NAVAID CHECKS

27. As much as practical, check the operation of the installed radios and navigation aids.

PRE-SHUTDOWN CHECKS

28. Proceed as follows:

(a) Open ENG 2 throttle fully. Set 97-99% N2;

(b) Turn Cabin Heater ON;

(c) Release ENG 1 Idle stop and close the throttle slowly reducing N1 to 50-52%;

(d) The RPM Warning Light, PART SEP #1 caution light and MASTER CAUTION light, should illuminate and the heater should cease to function at 52 ±2% N1;

(e) Open ENG 1 throttle fully. Retard ENG 2 throttle back to the idle stop, release the stop and repeat the preceding checks for ENG 2; and

(f) Select Cabin Heat OFF.

CAUTION:

Do not allow N1 to drop below 50% during this check. If N1 drops to between 48% and 50% re-open the throttle very cautiously. If ITT starts to rise or if N1 drops below 48%, close the throttle, shutting down the engine. Carry out the remainder of the check then restart the engine in accordance with the prescribed procedure and continue.

SHUTDOWN

29. Shut down the engines and note any discrepancies or unusual characteristics. In particular carry out the following:

(a) Check that the appropriate caution panel segments illuminate as Engine, CGB, and XMSN oil pressures fall below limits.

(b) Check the engine coast down time 20 seconds minimum from 61% to 5% N1.

POST-SHUTDOWN

30. Following shutdown thoroughly inspect the engines, transmissions, rotors and' hydraulic system for evidence of leaks, loose items and unusual conditions.

FLIGHT TEST PROCEDURES

1. Review the Aircraft Journey Logbook to ensure that there are no outstanding items precluding the aircraft from be flight tested. Carry out the preflight inspection in accordance with the AFM. If any deficiencies or unservicabilities were identified during the ground run portion they must be rectified before continuing with flight testing.

2. Before starting the aircraft record the following:

   (a) Hp - pressure altitude (altimeter set to 29.92" hg) - feet.

   (b) OAT - outside air temperature - degrees C.

   (c) Wind velocity - knots.

   (d) Indicated fuel quantity - pounds.

   (e) Hobbs Meter.

3. At idle, record the following:

   (a) N1 - gas generator speed - percent (61 ±2%).

   (b) ITT - interturbine temperature - degrees C.

4. Establish 100% Nr and check the following:

   (a) Low RPM warning light extinguished - percent (%);

   (b) Beep Range - percent (%);

   (c) Transmission torque - percent (%);

   (d) Torque Sharing - a maximum split of 4% engine torque is acceptable.

   NOTE:

   Torque splits in excess of this at idle may result in erratic load sharing at high power settings.

BEFORE TAKE-OFF

5. Complete the pre-run-up, run-up and pre-take-off checks. Note and record any deficiencies or unusual characteristics.

HOVER CHECKS

6. Carry out a hover check as follows:

   (a) Having set 100% Nr on the ground in flat pitch, slowly raise the collective to establish a steady 5 to 10 foot hover. Check that the steady-state Nr in the hover is 100 ±1.0%.

(b) With the helicopter headed into wind, the left directional control pedal will be up to one inch forward of the right directional control pedal, the cyclic control will be approximately centred laterally while its fore and aft position will depend on the CG of the helicopter and the wind speed. Check that the helicopter responds readily to all control movements and note any binding or unusual vibrations or control forces. Increases and decreases of the collective control should not induce excessive transient Nr changes. Rotor and engine limits should not be exceeded as a result of collective movements in the hover.

(c) Carry out left and right pedal turns. Check the helicopter response to directional control movements.

NOTE:

Some transient torque variations and torque splits may occur during power changes. These will be most pronounced in cold weather.

HYDRAULIC SYSTEMS

7. In a steady 10-foot hover, with the force trim and control friction OFF, select HYD SYS 1 ON. Vary hover height with collective, effect turns left and right with the pedals, and move the cyclic, along diagonal paths (4-6 inches). No binding or unusual forces or vibrations should be encountered and the helicopter should react positively to control movements. Select HYD SYS 2 ON and repeat the procedure.

NOTE:

1. Aggressive and/or excessive control movements are not required to properly complete this check.

2. Moving the cyclic along diagonal paths individually checks the operation of the cyclic boost cylinders.

3. With HYD SYS 2 selected ON, the pedals will be stiff, but it is possible to achieve directional control and the pedals should not tend to creep.

FLIGHT INSTRUMENT (GYRO) CHECKS

8. During the hover manoeuvres check for proper response of the aircraft flight instruments to aircraft attitude changes.

SINGLE ENGINE HOVER CHECK

9. Land the helicopter, roll ENG 2 throttle to ground idle, beep to maximum. Increase collective slowly and lift helicopter into a 5-foot steady hover. Note torque required to hover. Land and repeat the procedure for ENG 2. Do not exceed engine limitations.

NOTE:

Single engine torque should indicate approximately the same for both engines.

MANUAL THROTTLE CHECK

CAUTION:

Care must be exercised during this check to avoid exceeding the rotor and/or engine speed limits.

10. Land the helicopter. Roll both engines to ground IDLE. Select ENG I GOV to MANUAL. Open ENG 2 throttle to FULL OPEN. Adjust Nr to 98%. Gradually open ENG 1 throttle to approximately match ENG 2 conditions (torque, N1, ITT). Increase collective pitch, lifting the helicopter into a hover maintaining approximately matched engine conditions by manually controlling ENG 1. ENG 1 should respond readily to throttle movement and there should be no evidence of surge, or of other engine instabilities. Land and reduce both throttles to ground IDLE. Reselect ENG 1 GOV to AUTO. Select ENG 2 GOV to MANUAL and repeat the procedure to check ENG 2.

LOW ROTOR SPEED CONTROLLABILITY CHECK

11. Establish a hover. Beep the Nr to minimum. Carry out hovering turns, side and rearward flight. There should be no increase in flight control forces nor should the flight control limits be reached. If there is a significant change in vibration level as Nr is reduced, particularly if a lateral vibration is felt, this should be recorded.

VIBRATION CHECK

12. At 100% Nr check the vibration level for low, medium and high-speed vibrations and if possible note whether these occur in the vertical or lateral plane. There should be no vibrations felt by the pilot in the flight control system. Use a Strobex unit to determine vibration levels and to assess blade tracking. Only the main rotor track may be checked in flight. If a high speed vibration is evident it may be necessary to track the tail rotor.

ROTOR TRACKING

13. In general the rotor should be tracked as part of a maintenance flight test procedure: this is to be conducted in accordance with Maintenance Instructions, under the direction of a qualified technician. If, during the conduct of the flight assessment, it becomes apparent that the blades are out of adjustment and the aircraft is being subjected to excessive vibrations, it may be necessary to terminate the flight and adjust the blades before proceeding further.

NOTE:

As a general rule eliminate lateral vibrations (balance) before addressing the vertical vibrations (track).

FORWARD FLIGHT CHECKS

14. From a steady hover gradually apply power, accelerate and establish a 60-70 knot climb. Be alert for unusual characteristics, control positions and/or responses during the initial acceleration and climb. If vibration levels are excessive, record the Strobex readings and return to adjust the rotor. If vibration is acceptable, continue to climb checking the flight controls by turning left and right using 20-30 degrees of bank. At a safe altitude establish level flight at approximately 90 KIAS. Check the track and vibration levels. If vibrations are acceptable, maintain level flight and increase power to establish an airspeed of approximately 100 KIAS. Continue in level flight for two to three minutes and note the following:

    (a) Check engine, transmission, CGB oil pressures and temperatures for operation in the normal range. Note any unusual oil pressure fluctuations.

    (b) Check all engine and flight instruments for normal indications and response to control movements. Compare pilots and co-pilots flight instruments as well as the ENG 1 and 2 instruments for similar readings. Significant differences between the two should be recorded and investigated after the flight.

FORCE TRIM CHECK

15. Check that the force trim operates properly and that a new trim position for the controls can be established by holding the controls and momentarily depressing the trim button. With force trim OFF some light control pressure will be required to hold a steady cyclic position.

PEDAL CREEP CHECK

16. Select force trim OFF at 100 KIAS in level flight and move feet one-half inch off the directional control pedals. Gently manoeuvre the helicopter with the cyclic control only. Check that the directional control pedals remain in their set position. Select force trim ON. Select HYD SYS 2 ON and recheck for pedal creep.

DIRECTIONAL CONTROL POSITION CHECK

17. When established in straight and level flight at 100 KIAS, check the pedal position. The right pedal should be beside or up to one inch forward of the left pedal when the ball is centred (measured at the centre of the foot rest).

    NOTE:

    1. If the lateral CG is significantly displaced from the centreline this check will not be valid.

    2. The pedal position will vary dependent upon aircraft loading and atmospheric conditions. Manufacturing tolerances will also contribute to slight differences in pedal position between aircraft. If the pedals are

positioned outside the stated range or if rigging is suspected it will be necessary to check (on ground after shutdown) that full pedal movement results in full tail rotor pitch change.

STABILIZER BAR DAMPING CHECK

18. Rapidly roll into and establish a 30 degree bank coordinated turn then maintain a constant cyclic position. The helicopter should start to roll in the direction of the established bank angle within five seconds. Check this in both left and right hand turns.

TORQUE LIMITER AND LOAD SHARING

19. Proceed as follows:

(a) Reduce power and allow airspeed to decrease to 40-60 KIAS. Adjust Nr to 100%.

(b) Increase power to the maximum allowable observing all engine/transmission limits, allowing the helicopter to accelerate to and then climb at approximately 100 KIAS;

(c) At a transmission torque of between 102-104 per cent the torque limiter should prevent further power from being delivered. A further increase in collective pitch should result in decreased rotor RPM at constant torque.

CAUTION:

1. Do not exceed 104% torque.

2. Do not droop rotor below 97% Nr.

NOTE:

1. Overtorque of transmission up to 104% for five seconds or less is permissible while performing sharing check as part of functional check flight.

2. A decrease of up to one percent rotor RPM as 100% torque is approached is acceptable. If this droop exceeds one percent, the droop compensator should be adjusted.

3. Torque rise should be smooth and steady. As the maximum power is approached the engine torques should be within 8% of each other under steady conditions and no abrupt transient splits or torque hunting should be experienced.

4. Excessive transient torque splits, particularly associated with power change, may be rectified by priming the torque sharing unit. Transients of up to 25% torque can be expected when power is changed rapidly.

(d) It should be possible to trim the cyclic in the high speed, maximum power climb. The cyclic cushion should not be encountered in the steady flight regime.

AUTOROTATION

20. Enter an autorotation over a safe area. From an altitude that is consistent with safety, and the test requirements, stabilize the helicopter in straight autorotative flight at approximately 70 KIAS. Observe rotor RPM limits. Record the following:

(a) Hp - pressure altitude (altimeter set at 29.92" hg) – feet;

(b) OAT - Outside air temperature at the test altitude - degrees C.

(c) Fuel remaining - pounds.

(d) Rotor RPM – allow to stabilize for 300-500 feet of descent before recording.

NOTE:

1. Using the preceding information obtained and the computed density altitude, determine the required rotor RPM from the autorotation RPM check chart (Annex A).

2. Observed RPM must be in accordance with the chart found in the appropriate Maintenance Manual.

21. In autorotative flight, manoeuvre the helicopter and record any unusual control characteristics or control positions.

ENGINE POWER AVAILABLE CHECK

22. This check is performed to determine the power available from the installed engines when operating within the specified limits. A suggested procedure is as follows:

NOTE:

Perform these checks with heater OFF and DC NON ESS BUS set to MANUAL.

(a) Set power to maintain level flight between 60-80 KIAS.

(b) Select GEN 1 OFF.

(c) Roll ENG 2 throttle to IDLE (increase throttle friction to ensure throttle stays at IDLE);

(d) Beep ENG 1 to maximum (approximately 99% N2).

(e) Slowly increase collective in straight and level flight until either an engine limit is reached (810^0 IIT or 100% N1) or the rotor RPM droops to 97% Nr. If an engine limit is reached before the rotor droops to 97%, reduce power slightly, beep to 97% Nr and re-establish maximum allowable power. Allow conditions to stabilize (30 seconds) and record:

(1) Hp - pressure altitude (altitude set to 29.92" hg) – feet;

(2) OAT - outside air temperature – degree C;

(3) N1 - gas generator speed - percent (%);

(4) ITT - Interturbine temperature - degree C.

(5) Torque - engine and transmission (these values should be approximately equal) - percent (%).

(6) Nr - rotor RPM - percent (%).

(g) Reduce power. Beep ENG 1 to 98%. Advance ENG 2 to full open and select GEN 1 ON. Repeat the procedures for ENG 2.

N1 LIMITER CHECK

23. The following applies:

(a) If, during the POWER AVAILABLE CHECK (para 22), maximum N1 was not obtained or if N1 was not the limiting parameter, it will be necessary to climb to a higher altitude to ensure that:

(1) 100% N1 can be obtained.

(2) the N1 limiter is set correctly (100 to 100.5%).

(b) At this higher altitude record the readings as detailed in paragraph 22.

24. If the engine meets the power available requirements but due to conditions it is not possible to check or set the N1 limiter the aircraft should be considered serviceable but an entry should be made in the aircraft journey log to the effect that the N1 limiter has not been checked.

NOTE:

1. The N1 limiter can be adjusted on the ground if the OAT is above 4^{0}C by setting the Part Power Trim Stop. Use of the Power Trim Stop will physically reduce the N1 limit by 4.5% and extreme care must be employed to prevent exceeding engine limits as the engine responds as it would if the governor was selected to MANUAL. This procedure must be carried out with the aircraft sufficiently loaded to keep it on the ground during the check,

2. If the rotor droops before any limit is reached, the engine may be fuel flow limited or the N1 limiter may be set too low. Expect the engine to be fuel flow limited in the lower levels on very cold days. In this case climbing to a higher altitude should permit assessment of the N1 limiter or power available.

3. If climbing to a higher altitude does not affect the maximum N1 attainable, it can be expected that the limiter has been encountered.

This opinion can be verified using the manual topping procedure. If necessary have the N1 limiter adjusted and re-check.

4. Improperly set ITT bias can make an acceptable engine appear to be power restricted. It is important that this value be correctly identified and that the bias is properly adjusted before flight.

CAUTION:

In attempting to determine the N1 limiter setting, the following shall be adhered to:

1. Do not exceed l01.5% N1;

2. Do not exceed 100% N1 for more than 10 seconds.

MANUAL TOPPING

NOTE:

This procedure should only be used if there is any doubt as to the validity of an N1 Limiter Check and is not a routine test flight procedure.

25. Manual topping will only be required if there is doubt as to the setting of the N1 limiter or the engine is behaving in an unusual fashion during the N1 limiter check.

CAUTION:

This procedure must be conducted very carefully to avoid exceeding rotor and engine limits as the N1 and N2 governors are bypassed. The attention of the pilot conducting the test will be concentrated in the cockpit and a second pilot or qualified observer should be in the co-pilots seat maintain a "look-out".

26. Conduct Manual Power Available Check (if required) as follows:

(a) Increase throttle friction so that throttles are stiff but movable. Establish straight and level f1ight between 60-80 KIAS.

(b) Roll ENG 1 to Idle.

(c) Check and if necessary adjust rotor RPM to 97 to 98% Nr.

(d) Ensure, positively that ENG 1 N1 is at Idle.

(e) Identify ENG 1 Governor Control Switch.

(f) Select ENG 1 Governor Control Switch to MANUAL cross-check caution panel and Master Caution Light. Cancel Master Caution Light.

(g) Gently manipulate the throttles until ENG 1 has assumed all the load and ENG 2 is at flight idle as follows:

(1) Slowly advance ENG 1 until rotor RPM increases to 99.5 to 100% Nr.

(2) Slowly retard ENG 2 until rotor RPM decreases to 97% Nr.

(3) Again advance ENG 1 until rotor RPM increases to 100%.

(4) Again reduce ENG 2 until rotor RPM decreases to 97%;

(5) Continue this procedure until ENG 2 is at Idle and ENG 1 has taken the load (DO NOT open ENG 1 throttle completely).

(h) Observing all engine limits, slowly increase the collective pitch maintaining rotor RPM between 97 and 100% Nr with the throttle. When a limit is reached (ITT or N1) establish 97% Nr and record as follows:

(1) Hp - pressure altitude (altimeter set to 29.92" hg) - feet.

(2) OAT - outside air temperature - degrees C.

(3) N1 - gas generator speed - percent – (%);

(4) ITT - interturbine temperature - degrees C.

(5) Torque - percent (%).

(6) Nr - rotor RPM - percent (%).

NOTE:

1. The power available should be equal to or greater than that obtained in the automatic mode.

2. If 100% N1 can be obtained in the MANUAL but not in the AUTO mode under the same altitude/OAT conditions, an adjustment to the N1 limiter will be required.

(i) After the readings have been recorded, slowly reduce throttle and collective pitch settings to those required for level flight between 60-80 KIAS.

(j) Using the ENG 1 Throttle set rotor RPM to 97%.

(k) Slowly increase ENG 2 until rotor RPM reaches 100%.

(s) Repeat this procedure until the ENG 2 takes the load and ENG 1 is at Idle.

(t) Select ENG 1 Governor to AUTO. Check that the caution light goes out.

(u) Open ENG 1 Throttle fully.

(v) Repeat the procedure, if necessary, for ENG 2.

AVIONICS EQUIPMENT

27. Communications - The following equipment checks apply:

    (a) Intercom - Check all intercom stations and switches including the "hot mike" feature for satisfactory operation.

    (b) Two-way Radios - Check all installed two-way radios for adequate communication and volume control. Check the functioning of receiver test facilities. It must be possible to establish adequate communications 30 NM from the ground station (helicopter must be 1200 feet or higher above the ground station for this check to be valid). An effective range of 22 NM can be expected when flying 500 feet higher than the ground station.

28. Navigation Equipment - The following refers:

    (a) Transponder – In conjunction with a co-operative ground station check as many features as possible including the IDENT feature.

    (b) ELT - Check operation. Select radio receivers to 121.5 mHz or appropriate frequency for the ELT. At the appropriate time (first five minutes of every hour) select ELT ON. A tone should be heard. Select ELT OFF.

POST-FLIGHT AND SHUTDOWN CHECKS

29. Carry out the following post-flight and shutdown checks on the ground in conjunction with the shutdown procedures:

    (a) Re-check the beep range and the N1 idle speed.

    (b) Shut down the engines in sequence.

    (c) Inspect the main cabin, rotor head, engine, transmission, and tail rotor for evidence of leaks and loose equipment.

    (d) Note the Hobbs Meter and confirm it represents true flight time. Record the flight time and the result of the test.

    (e) Complete the aircraft journey log, noting all deficiencies.

COMPASS SWINGING

30. Those performing the compass swing should remove any magnetic or ferrous items from their person and use only non- magnetic tools when adjusting the compass. If there is any equipment aboard the aircraft that has any magnetic effect on the compass, ensure it is secured in the position it would be in during normal flight (remember your wristwatch can affect the compass as you attempt to adjust the compensators). Check the maintenance manual to ensure the aircraft is configured properly before beginning the compass swing.

31. With engines running and aircraft in proper configuration, align the helicopters skid tube with the 000 degree (north) heading line of the compass rose. If the aircraft compass is not in alignment with magnetic north, adjust the north-south compensator screw with a non-metallic screwdriver until the compass reads 000 degrees.

32. Align the aircraft to the 90-degree (east) heading line of the compass rose. If the aircraft compass does not indicate 90 degrees, adjust the east-west compensator screw until it reads 090 degrees.

33. Align the aircraft to the 180-degree (south) heading. Note the indicated heading on the aircraft compass. If it is not 180, adjust the north-south compensator screw to remove half the difference of the reading and actual heading. For example if the compass reads 184 while the aircraft is positioned at 180 degrees, adjust the north-south compensator until the compass indicates 182 degrees.

34. Align the aircraft to the 270-degree (west) heading. If the compass does not indicate 270, adjust the east-west compensator to split the difference as in the above step.

35. Swing the aircraft around the headings and record the compass indications. Starting with the current heading (270) mark down the actual reading on the compass. Turn the aircraft around the compass rose at each 30-degree heading and record the compass readings.

36. If the aircraft is equipped with a gyro compass slaved to MAGNETIC NORTH, check the heading indications as well, as you go around the compass rose.