CHECK FLIGHT CERTIFICATE

Sikorsky S76A+ / A++ **CFS 249 Issue 1**
Turbomeca Arriel 1S or 1S1 Engines

Date:	Crew:	Observer:	Registration:

Performance	Climb #1	Climb #2	
Average Weight			
Average Altitude			ft
Average Temp.			°C
Speed			KIAS
Achieved Rate			fpm
Scheduled Rate			fpm
Margin			fpm
Permitted Margin	-20	-20	fpm

Airfield:
Start Weight Kg/Lbs*:
Takeoff cg:

Performance:

SATIS/UNSATIS/NOT APPLICABLE*

*(delete as applicable)**

Defects

No.	Defect	-/R/FT	Action?

(use a continuation sheet as necessary)

Conclusions/Comments

I CERTIFY that I have tested the above aircraft and have detailed the deficiencies and unsatisfactory features above. Those items annotated R or FT must be dealt with as shown in the notes on the reverse side.

Name:	Signed:	Date:	Licence No.:
For CAA Use only	Report Logged by:	Date:	Report No.:

NOTES

General

Only CAA personnel or pilots specifically briefed to carry out CAA check flights may conduct the test.

General notes on test conduct can be found in the CAA Check Flight Handbook.

This sheet replaces any check flight certificate given in the schedule.

Registration: If the aircraft is not on the UK register, add the manufacturers serial number and expected UK registration (if known).

Crew: Captain, co-pilot, Flight engineer (where applicable).

Airfield: Departure airfield.

Start Weight: Actual all up weight at first engine start. Also delete Kg or Lbs as appropriate.

Takeoff cg: Actual cg at lift-off, preferably as a % of the Mean Aerodynamic Chord.

Performance

A full description of climb analysis is given in the CAA Check Flight Handbook.

Climb#1/Climb#2: Enter in these columns data from the first and second climbs.

Average Weight: The aircraft all up weight at the midpoint of the measured climb.

Average Altitude: The altitude at which the line drawn to average the measured points passes through at the mid time.

Average Temp: The temperature at which the line drawn to average the measured points passes through at the mid time.

Speed: The target climb speed (Indicated Airspeed.)

Achieved Rate: The climb rate as given by the slope of the line drawn to average the measured altitude points in feet per minute.

Scheduled Rate: The expected gross rate of climb read from the appropriate graph in the Flight Manual with any adjustments for configuration differences. For large aircraft, the basic gross data are normally to be found in a separate supplement labelled 'Additional Flight Test Data'.

Margin: The difference between the Scheduled and Achieved rates of climb (negative if achieved is lower than scheduled).

Defects

Enter all defects from the flight. All defects must also be entered in the Technical Log. Procedural items entered in the Technical Log (such as re-stowing oxygen masks) need not be entered here. Items affecting flight safety which were known before the flight, whether or not they were deferred should be entered. In the latter case, the defect should be annotated accordingly after the details.

No.: The first column is to allow the items to be numbered.

Defect: Enter details of the defect.

-/R/FT: Classify each defect according to its impact on safety, regardless of whether it can be deferred according to the MEL. Any deferrals should be dealt with in the normal way in the Technical Log. Items requiring rectification (or deferral under the MEL) before further flight for hire or reward or before the issue of the CofA should be marked 'R'. Additionally, items that require re-checking in-flight following rectification (such as inadequate climb performance) should be marked 'FT'. Items requiring both should be marked 'R/FT'.

Action?: This column should be left blank unless further information is required from the engineers or the item is considered to be of sufficient import that CAA action is considered necessary, then the person/department/agency from whom further action is required should be noted in this column. Annotate accordingly if an MOR or similar report is to be raised.

Conclusions/Comments

Any conclusions, notes or comments useful for tracking defects may be entered.

Name: Only the pilot who carried out the test may sign this sheet.

CAA Check Flight Schedule

All CAA Check Flight Schedules (CFSs) are prepared based on a design standard which, before September 2003, was the UK Type Certificate. Following the creation of EASA there may be different design standards in service within the European Union (EU) - this may include modifications approved in any EU country.

It is the responsibility of the flight crew to ensure that the exercises and limitations in the CFS are correct for the aircraft under test.

The prime source of information will be the aircraft flight manual and in the event of conflict the flight manual should be taken as overriding.

CAA policy is that pilots who conduct check flights on the behalf of the Authority must be acceptable to the Authority, must have been briefed on techniques and safety considerations before carrying out the tests in these schedules and must have carried out a check flight within the last 4 years.

The CAA does not accept responsibility for the use of a CAA CFS on a test flight not directly under their control.

CHECK FLIGHT SCHEDULE

Sikorsky S76A+ / A++ **CFS 249 Issue 1**
Turbomeca Arriel 1S or 1S1 Engines

Registration	
Flight Date	

1. INTRODUCTION

This schedule is applicable only to the Sikorsky S76A+ or A++ (Except S/N 760364 which must use AFTS No. 310) with Turbomeca Arriel 1S or 1S1 engines and 9500 gearbox. It is based on the assumption that the every day operation of the helicopter serves as a continuous check on the functioning of all normal services.

The Check Flight must be carried out by an experienced pilot acceptable to the CAA in accordance with this schedule and the general guidance given in the CAA Check Flight Handbook. The crew are expected generally to monitor the behaviour of all equipment and report any unserviceable items. In addition to completing all the tests in this schedule any characteristics which are considered to be unsafe or undesirable must be recorded.

The minimum crew for this flight is to be increased by a flight observer.

WARNING

1. It is illegal to carry passengers on a check flight made under "A" or "B" conditions except passengers performing duties in the aircraft in connection with the flight. Although it may be legal to carry passengers on a test flight with a Certification of Airworthiness in force it is strongly recommended, for Check Flights and other tests entailing greater risk than normal flight, that:

1) It is preferable to use ballast, and

2) Before accepting any passengers on a check flight the pilot in command should inform them that the risk is greater than on an ordinary flight.

2. Under no circumstances are the limitations contained in the CAA approved Flight Manual to be exceeded.

3. If a clipboard or kneeboard is used to record the results there is a possibility of fouling the controls especially the duals, if fitted. To reduce this possibility, the pilot must have briefed the observer on the need to ensure that the clipboard is well clear of the controls especially during manoeuvres requiring large control deflections such as low speed envelope and autorotation. The pilot should monitor the position of the clipboard during the flight to ensure that it is not in a potentially hazardous position. Whenever possible, flexible, rather than rigid, clipboards should be used.

Should there be any query about the Check Flight or its results, the local CAA Surveyor or the Helicopter Flight Test Section at Airworthiness Division, Flight Department, Aviation House, Gatwick must be consulted.

It is permissible for this Schedule to be completed on separate flights and dates provided the loading for each flight is clearly stated. All defects from all flights must be recorded on the Check Flight Certificate even if rectification work has been carried out between flights.

It is recommended that the tests are made in the sequence given. The results are to be written in ink in the spaces provided.

Operator/Maintenance Organisation		Registration	
Aerodrome		Flight Dates	
		Pilot	
		Co-pilot	
		Observer	

Weather	

Aerodrome pressure altitude			QFE/QNH	
Wind velocity/direction			Ground Temp	
Take-off time(s)			Landing Time(s)	

2. LOADING

The aircraft is to be loaded to a weight limit of 10,800 lbs or to the highest AUW as is practicable. A lower weight to comply with the Operator's company policy is also permitted. The CG should be approximately in the neutral position.

NOTE: The autorotation RPM check has to be carried out at a low weight (approximately 8500 lbs) in order to stay within the power off limits. To facilitate this it is permissible to carry out paragraph 18 on a separate flight/date and without an observer if desired.

Take-off weight (actual)	
Fuel contents	
C.G. position	

3. PRE-FLIGHT INFORMATION

Aircraft Serial No.	
Total airframe hours	
EAPS fitted?	

	No.1	No.2
Engine Serial No.		
Hours run since new		
Hours run since overhaul		

4. PRE-FLIGHT CHECKS

4.1	Carry out the normal external inspection (check pitot and static heat, see 4.3 below)	
	Doors and transparencies: Condition and Operation	
	Seats and harnesses	
	Placarding: Legibility and accuracy	
	Instruments: Legibility and accuracy of colour bands and markings. General condition.	
	Check altimeters within ±50 ft for the same pressure setting.	
	Adjust pedals to full aft position. Alternatively press pedals rapidly to determine if adjusters slip on either side.	
	CWP and warning lights: all bulbs working, markings clearly visible.	

4.2 <u>External Power/DC Primary Busses</u>

a)	With battery switch(es)-ON, external DC power connected and - OFF, check that the BUS TIE OPEN caution light is - ON. For aircraft fitted with the optional dual inverter system (except Sperry Helipilot installations) it should be possible to switch an inverter ON. Switch inverter(s) off.	
b)	Place the EXT POWER switch-ON. The BUS TIE OPEN caution light should go off and the BATT OFF (and AUX BATT OFF on dual battery installations) caution light(s) should go on.	

4.3 Pitot heat:-

a) With the battery switch ON and external DC power on, pull the PLT PITOT HTR PWR and CPLT PITOT HTR PWR circuit breakers.

Turn the pilot and co-pilot heat switches ON. PLT PITOT HTR and CPLT PITOT HTR caution lights should be ON.

b) Reset the circuit breakers. PLT and CPLT PITOT HTR caution lights should go out. Check the pitot tubes. They should be warm. Also check heated static vents on Sperry DAFCS and Sperry Helipilot equipped aircraft. WARNING: The pitot tubes may get very hot.

c) Turn pilot and co-pilot pitot heat OFF.

4.4 Engine Failure Warning System

a) #1 and #2 ENG OUT warning lights - ON.

PILOT

#1/#2	#2/#1

b) Engine out ground test switch (side of console) - hold at TEST. Alternating tone will be heard. To reset tone, press #1 then #2 ENG OUT light on pilot's side.

Warning lights remain on. (If capsules have been previously pressed, no tone will be heard). If tone resets when only one capsule has been pressed this indicates a fault.

c) Cycle battery and external power off and on to reset engine failure warning system.

d) Repeat check using #2 then #1 ENG OUT light on pilot's side to reset tone.

CO-PILOT

#1/#2	#2/#1

e) Repeat on co-pilot's side.

4.5 Fire Extinguisher System

a) EXT-FIRE switch - OPEN. Red WARN light - ON.

b) Pull both T-handles back 1 inch.

c) FIRE EXT switch - MAIN, then RESERVE. Check that green TEST light goes - ON in each position. Release switch.

d) EXT-FIRE switch - SHORT. Red WARN light and green TEST light - ON.

e) FIRE EXT switch - MAIN, then RESERVE. Check that green TEST light stays - ON in each position.

f) Both T-handles - Full Forward.

g) EXT-FIRE switch - NORM

h) Check red WARN light and green TEST light - OFF

4.6 Fire Detector System

EXT power ON

4.6.1 Aircraft fitted with single FIRE warning capsules:

a) Fire detector test switch - FWD. FIRE warning lights and T-handle lights should light and continuous tone should be heard.

b) Press FIRE warning light capsule to reset tone.

c) Repeat a) and b) with fire detector switch - AFT/BAG.

d) Repeat on co-pilot's side.

i) FWD

ii) AFT/BAG

4.6.2 Aircraft fitted with dual FIRE warning capsules:

a) Fire detector test switch - FWD. FIRE warning lights and T-handle lights should light and continuous tone should be heard.

b) Press #1 then #2 FIRE warning light capsules to reset tone. If tone resets when only one capsule has been pressed this indicates a fault.

#1/#2

c) Repeat a) to b) with fire detector test switch - AFT/BAG, resetting as required. Press capsules in order shown.

#2/#1

d) Repeat on co-pilot's side.

i) FWD

#1/#2

ii) AFT/BAG

#2/#1

4.7 Flotation System Test

Perform if not carried out on a regular basis operationally.

Before carrying out the Flight Manual check the serviceability of the test switch must be determined as follows:

a) With external power connected, pull out all 6 float circuit breakers, 2 float control and 4 float power, put test switch to 'TEST' position. No lights should indicate.

b) Reset and pull each POWER CB in turn, as each one is reset, the float test red light should illuminate. If any float POWER CB fails to illuminate the red light, discontinue the testing and investigate.

c) If each float POWER CB correctly lights the red test light in turn, when reset, with the others pulled, then the test switch is serviceable.

d) Reset CB's except DC Essential FLOAT CONT CB. (Leave switch in 'TEST' position)
Carry out Flight Manual checks (Part 1 Section II).

Reset 'TEST' switch to NORM.

4.8 Fuel Levers:

a) Move No.1 and No.2 fuel levers to OFF, DIR, PRIME, and XFEED. Check for binding, detents, and alignment with markings.

4.9 Engine Levers/T-Handles

a) With trigger pulled, move the No.1 and then the No.2 engine levers through their entire range, including travel forward of position marked FLY. With triggers functioning, check for positive stops at Idle and Fly. There should be no evidence of binding.

b) EXT-FIRE switch - OPEN
Place the engine levers in the FLY position and fuel levers in CROSSFEED. Pull each fire T-handle fully back. There should be no evidence of binding and all levers must reach their OFF position. Reset the T-handles.
EXT-FIRE switch - NORM, lights OFF

4.10 Rotor Brake - Electric

a) To check the rotor brake interlocks, set the following initial conditions:
EXTERNAL power switch - OFF
BATTERY switch - ON
Rotor Brake switch - OFF
No.1 and No.2 Engine Levers - FLY position
No.1 and No.2 Engine Out Lights - ON
Rotor Brake Caution Light - OFF

b) Place the Rotor Brake Switch - ON, the Rotor Brake Caution Light should remain OFF.

c) Place the No.1 Engine Lever to IDLE. The Rotor Brake Caution Light should remain OFF.

d) Place the No.1 Engine Lever in FLY position. Bring the No.2 Engine lever to IDLE. The Rotor Brake Caution Light should remain OFF.

e) Bring the No.1 Engine lever to IDLE. The Rotor Brake Caution Light should go ON.

f) Place the Rotor Brake Switch in the OFF position. The Rotor Brake Caution Light should go OFF.

g) Reset the rotor brake to ON and check caution light ON. Then place the Battery switch off and the Rotor Brake switch in RELEASE, then OFF. Wait several seconds and then place the Battery switch ON, checking that the Rotor Brake caution light is out (does not even flash).

h) To check the hard rotor brake, set the following conditions:

No.1 and No.2 Engine Levers - SHUTOFF
Rotor Brake Switch - OFF
Rotor Brake Caution Light - OFF
Battery and/or External Power - OFF

i) Place the rotor brake switch - ON - for at least 5 seconds. Then place the rotor brake switch in the OFF position without going to RELEASE.

j) Place the battery switch - ON, check for the Rotor Brake Caution Light ON, momentarily, then OFF.

4.11 Engine Starters/Igniters

a) Set the following initial conditions:

No.1 and No.2 Engine Levers - OFF
No.1 and No.2 Fuel Levers - OFF
Rotor Brake - ON
Master Start - OFF

b) Depress the No.1 Engine Starter button and move the engine lever slowly forward. Ignition should be heard when one-half inch beyond SHUTOFF. The No.1 engine starter should not engage. Repeat the check for the No.2 engine

c) Turn the MASTER START switch ON. Move the No.1 and No.2 engine levers one inch forward. Depress and release the No.1 engine starter button. The starter should not engage. Repeat with the No.2 engine

d) Move both engine levers to the SHUTOFF position. Depress and release the starter buttons. The starters should engage.

NOTE: It may be necesssary to open the DV window to hear the igniters.

Re-configure engine and fuel levers.

Satisfactory completion of pre-start checks.

5. ENGINE START/ROTOR ENGAGEMENT

	Eng. 1	Eng.2
Carry out rotor brake on starts for both engines		
Satisfactory control of T5 during start		

ROTOR ENGAGEMENT

	No.1	No.2
Hydraulic power (approx. 3000 psi) available before 10% N_R.		

NOTE: Depending on the modification state of the undercarriage, No.2 system may not produce 3000 psi until 65% N_R.

	No.1	No.2
Overspeed system advisory lights out by 25% N_2 and 45% N_1		

Fuel totaliser set (if fitted)	

6. POST START CHECKS

6.1 Servo Interlock Check

At 60% to 70% N_R place pilot's SERVO switch to No.1 OFF, co-pilot's NO.2 OFF. #1 SERVO SYSTEM caution light should remain ON, no transfer should occur. Recenter co-pilot's switch, and place pilot's in NO.2 OFF. #2 SERVO SYSTEM caution light should go ON. Place co-pilot's SERVO switch to NO.1 OFF. No transfer should occur. Recenter co-pilot's switch.	
Repeat check with co-pilot's switch leading.	

6.2 N_2 Beep Range:

a) At flat pitch with one engine in FLY and the other in IDLE, check the following N_2 values on each engine:

	MIN	MAX
No.1		
No.2		

S-76A+ Min 98 ± 1% Max 107 ± 1%
S-76A++ Min 102-103% Max 108-109%

Acceleration time to maximum beep should be no more than 8 seconds.

b) With both engines in FLY, check the following N_2 values:

S-76A+ Min Less than or equal to 99% Max 108 ± 1%
S76A++ Min 103 ± 1% Max 109 ± 1%

c) Check that the beepers:

are smooth both up and down from either pilot's or co-pilot's side,

have approximately equal beep rates for both engines, and

are wired so that the pilot has over-ride capability over the co-pilot.

6.3 N_1 Tachometers:

Carry out test in accordance with Flight Manual Pre-Take-off check. Note indicated digital N_1 and placard value.

No.1	No.2

Placard N_1

6.4 Engine Acceleration/Surge Check

During the engine stall (surge) check, check for smooth acceleration and deceleration and no loud popping noises indicative of a compressor stall.

With No.1 N2 beeper at MAX beep and No.2 N2 beeper at MIN beep:

a) Retard No.1 engine lever to slightly split the N_2/N_R needles, then re-advance until the needles are just re-joined. Note that No.1 engine N1 must be at least 70% before proceeding to b).

b) Rapidly advance No.1 engine lever to FLY. Acceleration time to maximum torque should be no more than 4.5 seconds.

NOTE The limit is valid for altitudes below 3000 ft, at higher altitude this check should not be carried out.

c) Repeat the above check with the No. 2 engine.

CAUTION

T_5, N_1 and torque must be closely monitored during this check to avoid exceedance of limits.

Note During the engine stall check, note any lateral oscillations which might be attributed to a faulty damper. There should be no excessive (4 "beats") inplane lateral oscillations.

c) Place both engine levers in the FLY position and match torques.

Satisfactory completion of pre-taxy checks.

7. TAXIING CHECKS

Taxy time

7.1 Satisfactory operation of parking brake.

7.2 During taxi, depress both pilots' brakes and insure that the aircraft comes to a smooth controlled stop with no indication of binding or swerving.

Repeat this check using the co-pilots' brakes.

Turns :

Perform a ground taxi turn to the right by depressing the right pedal. Increase to a tight turn. There should be no indications of binding in the the brakes during this check).

Repeat the check in a ground taxi turn to the left.

7A. POWER ASSURANCE CHECK *(S-76A++ Only)*

Carry out power assurance checks IAW Flight Manual, Part 1, Section II.

ENG	PRESS ALT	OAT	TARGET TORQUE	TARGET N_1	N1 OBS	N_R	Fuel Flow	T5	N1 Margin
1									
2									

EAPS	ON	OFF
ANTI-ICE	ON	OFF

8. HOVER CHECKS

8.1 Match torques at 30% torque at 101% N_R **(S-76A+)** 107% **(S-76A++)** and establish a low hover. Record the following:-

Take-off time.

ENG	*TORQUE*	*N_1*	*N_R*	*PRESS ALT*	*OAT*
1					
2					

Maximum difference in torque between engines 5%.
Rotor speed **(S-76A+)** 100 ± 1.5%.

8.2 **<u>Beep Range: S-76A+ Only</u>**

a) In a ten foot hover, beep both engines to 100% Nr.

b) Simultaneously beep both engines to maximum beep. The No.1 and No.2 N_2 beep rates should be approximately the same and it should be possible to match torques at any N_R from 100% to 107%.

Reset normal N_R.

8.3 While in a stable hover, turn off collective trim. Add left pedal, collective should not drop. Add right pedal, collective should not climb.

Reset collective trim ON.

9. LOW SPEED ENVELOPE

9.1 AFCS engaged. See Appendix 1 for test method. Assess the vibration level, control response and position (adequate control margin) during the following manoeuvres. The tests should be flown at the Flight Manual sideways/rearwards airspeed limits (35 knots up to 6900 ft) unless this would result in a groundspeed in excess of 20 kts.

Do not exceed 20 kt estimated groundspeed.

a) Turns on the spot.

b) Sideways flight left and right

c) Rearwards flight

9.2 Disengage AFCS and carry out gentle hover manoeuvres (it is not necesary to fly sideways/rearwards up to speeds flown in b) and c) above).

Re-engage AFCS, note smooth re-engagement.

9.3 Hover Augmentation Mode (if equipped)

Check collective trim is ON.

Check correct operation of hover augmentation mode and radio altimeter hold.

Manoeuvre the helicopter using the 4-way cyclic switch.

10. SINGLE ENGINE CLIMB PERFORMANCE

Carry out a climb on each engine in turn for 4 minutes on a straight course. Climbs should be carried out in stable, non turbulent conditions away from cloud. Do not start to record until established in the climb on condition.

Associated Conditions

Altimeter - set to 1013 mb

Landing gear - retracted. All air bleeds - off

Speed - V_{BROC} (74 KIAS - 1 knot per 1000 ft PA) EAPS - off

	S-76A+	S-76A++
Off line engine	Retard to idle (50 ± 2%).	Zero torque, positive N_2 split, N_1 at or slightly above 70% in order to keep on-line engine N_1 gauge in AEO mode.
Torque	100%	***100% must be set***
N_1	99% (N_1 gauge in OEI mode)	100% (N_1 gauge in AEO mode)
T_5	845°C	845°C
N_R	96%	100%
NOTE 1	Torque/engine parameters not to exceed values shown above during climb.	Torque/engine parameters not to exceed values shown above during climb.
NOTE 2	The climb performance must be analysed and compared with the scheduled performance, see Section 21.1 of this Schedule.	The climb performance must be analysed and compared with the scheduled performance, see Section 21.1 of this Schedule. Note that 65 fpm must be added to value obtained from Appendix 6.
NOTE 3	Depending on Altitude/OAT the aircraft may not climb unless the weight is less than approximately 10,500 lbs.	The climb must be carried out on the torque limit of 100% **without exceeding the engine parameters shown above.** This may necessitate a climb at low altitude. If the torque limit cannot be reached before an engine limit, the test must be delayed until ambient conditions are suitable. *It may not be possible to carry out this test in hot climates unless revised scheduled data is obtained (App 6).*
NOTE 4	This climb is carried out at 99% N_1 in order to respect the 100% N_1 (absolute) limit for normal use. The Flight Manual limits for OEI operations (N_1, Tq and T_5) apply for actual emergency use.	This climb is carried out at 100% Tq in order to respect the limit for normal use. The Flight Manual limits for OEI operations (N_1, Tq and T_5) apply for actual emergency use.

10.1 SINGLE ENGINE CLIMB PERFORMANCE ***ENGINE No 1***

Conditions

	S-76A+	S-76A++
Off line engine	Retard to idle (50 ± 2%).	Zero torque, positive N_2 split, N_1 at or slightly above 70% in order to keep on-line engine N_1 gauge in AEO mode.
Torque	100%	***100%***
N_1	99% (N_1 gauge in OEI mode)	100% (N_1 gauge in AEO mode)
T_5	845°C	845°C
N_R	96%	100%

Time	Alt	OAT	IAS	Torque	N_1	T_5	N_R	Engine Oil Temp	Engine Oil Press	Fuel Flow	Fuel
0											
0.30											
1.00											
1.30											
2.00											
2.30											
3.00											
3.30											
4.00											

After the climb, obtain an accurate OAT by flying at approximately mid-climb altitude at Vbroc in level flight for 1 min. to allow OAT to stabilise

Alt	
OAT	

10.2 SINGLE ENGINE CLIMB PERFORMANCE ***ENGINE No 2***

Conditions

	S-76A+	S-76A++
Off line engine	Retard to idle (50 ± 2%).	Zero torque, positive N_2 split, N_1 at or slightly above 70% in order to keep on-line engine N_1 gauge in AEO mode.
Torque	100%	***100%***
N_1	99% (N_1 gauge in OEI mode)	100% (N_1 gauge in AEO mode)
T_5	845°C	845°C
N_R	96%	100%

Time	Alt	OAT	IAS	Torque	N_1	T_5	N_R	Engine Oil Temp	Engine Oil Press	Fuel Flow	Fuel
0											
0.30											
1.00											
1.30											
2.00											
2.30											
3.00											
3.30											
4.00											

After the climb, obtain an accurate OAT by flying at approximately mid-climb altitude at Vbroc in level flight for 1 min. to allow OAT to stabilise

Alt	
OAT	

11. AUTOROTATION HANDLING

See Paragraph 18 for measurement of rotor rpm in autorotation.

Carry out a gentle entry to autorotation at 75 kts.

Check handling/vibration levels in turns left and right to 30° AOB in autorotation.	

12. POWER ASSURANCE CHECK (100% N_1) *(S-76A+ Only)*

Carry out 100% N_1 power assurance check on each engine in turn in accordance with the Flight Manual procedure (Section II).

IAS	135 ± 10 kts
N_R	100%
N_1	100% (climb if necessary to avoid exceeding 104% torque)
Torque	104% maximum
Air bleeds	Off
Anti-ice	Off unless operationally necessary
DC generator	Off on engine being tested

Note the following:

ENG	PRESS ALT	OAT	ASI	ANTI-ICE	N_1	TORQUE	N_R	T_5	FUEL FLOW
1									
2									

	No.1	No.2
Scheduled torque %		
Margin %		
Scheduled T5°C		
Margin °C		

13. ENGINE MAXIMUM CONTINGENCY N_1 CHECK & ENGINE OUT AUDIO TONE

At 60 to 74 KIAS, landing gear down, N_R 105 to 107% **(A+),** 107% **(A++)** check that maximum contingency N_1 (101.7%) can be achieved on each engine in turn. Altitude/OAT envelope "B" in Figure 1.
(Note that this is for an Arriel 1S and a higher altitude will be required for a 1S1).

Ensure operating conditions (weight, altitude and OAT) will permit flight on one engine without exceeding limits shown below.

Select heater ON. Slowly retard the engine lever on No.2 engine. Audio engine out tone should be heard at 65% N1.

Continue retarding No.2 engine to idle (approx. 50% N1), increase collective to give approx 100% N1 on No.1 engine, check auto shut down of heater occurs.

Check decimal point on N_1 gauge of on-line engine is flashing at N_1 greater than 94%

No.1	No.2

Select heater OFF if auto shutdown had not occurred (record failure in box above).

Increase pitch above 100% N1 until either a limiting engine/torque parameter is reached or the rotor droops to 100%. Note it is **not** required to exceed 101.7% N1 for this test, i.e. N1 topping value is not needed.

Associated conditions : **Do not exceed engine/torque limitations**

IAS 60 to 74 KIAS
Torque 115%
N_1 101.7% **NOTE 101.7% N1 must be obtained without exceeding torque or T5 limits - if necessary climb to higher altitude.**
T_5 885°C
Airbleeds Off Anti-ice Off unless operationally required
Re-advance No.2 engine and repeat with No.1 engine retarded.
Select heater ON. Engine out tone at 65% N_1. Auto heater shutdown.

NOTE Time above intercontingency power (**S-76A+,** 100% N_1, 111% Tq, 845°C T_5) (**S-76A++** 101.2% N_1, 111% Tq, 868°C T_5) exceeding 10 seconds must be recorded in the engine log book. If all the parameters cannot be recorded in this time give priority to N_1, torque, N_R and reduce collective before 10 seconds is exceeded.

Note the following (Give priority to recording the data in the double lined box):

ENG	PRESS ALT	OAT	N1	TORQUE	NR	T5	FUEL FLOW	TIME ABOVE INTERCON
1								
2								

14. HANDLING CHECKS

14.1 Cruise

Ensure Landing Gear Up.

14.1.1 At normal cruise power note the following in stabilised conditions:

	PRESS ALT	*IAS*	*OAT*	*ENGINE*	*N1*	*T5*	*TORQUE*
PILOT				1			
CO-PILOT				2			
STANDBY							

FUEL [ ] WEIGHT [ ] VIBRATION LEVEL [ ]

If the aircraft is fitted with the optional alternate static system, check that the altimeter error at 120 KIAS is in accordance with the FM Supplement (window closed). [ ]

If vibration level is high, note frequency and axis. [ ]

Altimeters. Check for proper operation and agreement e.g. no excessive lag, smooth operation.. [ ]

ASI's should agree to within ±5 knots. [ ]

Check VSI's for correct operation. [ ]

14.1.2 At normal cruise power carry out turns left and right (30° AOB). Note control response and vibration level. [ ]

14.2 Maximum Speed *Ensure Landing Gear Up.*

Determine Vne from placard before next test.

Without exceeding placarded VNE apply max.continuous power and stabilise at maximum obtainable speed in level flight.

Vibration level.

If vibration level is high, note frequency and axis.

At Vne carry out gentle turns (up to 20° AOB) left and right.

Note:-

Vibration level.

Control response.

14.3 Rapid Engine Acceleration

Match torques at 80% and note approximate collective position. With engine levers in FLY position in a stabilised descent at approximately 75 KIAS with approximately 5% torque set (do **not** re-match), increase collective to give about 80% torque in 2 to 3 seconds.
Check there is no tendency for surge and satisfactory engine response.

Note 1
Care must be taken not to increase collective too quickly; carry out practice collective pulls at a slow rate first and progressively increase rate. Increase collective to the approximate position noted at 80% matched torques.

Note 2 : Do not reduce below N_R limit (82%).

Engine response/surge

Transient NR droop %

15. AFCS CHECKS

If Phase III or Sperry Helipilot or DAFCS (SPZ-7000) is fitted use appendix 2, 3 or 4 after completing 15.1 to 15.4.

15.1 Trim out at approximately 135 kts. Record any bias in any one trim axis that makes it difficult to fly hands off and normal trim response rates in pitch and roll.

15.2 At approximately 120 KIAS with both channels engaged check the aircraft returns to its original attitude, with a maximum of one slight overshoot, after the following disturbances:-

Note: Phase III equipped aircraft automatically engage airspeed hold when the cyclic is moved against longitudinal trim force, this can result in a significant overshoot of attitude datum as the autopilot regains original airspeed. To avoid this, select cyclic trim from AUTO to ON.

i) Pitch

a) Without re-trimming alter pitch attitude by 5° nose up in less than 2 seconds then release cyclic. (Note this is a 5° change of attitude not 5° nose up absolute).

b) Repeat nose down.

ii) Roll

a) Alter roll attitude by 10° left in less than 2 seconds then release cyclic.

b) Repeat 10° right.

iii) Yaw

Note satisfactory yaw channel functioning during i) and ii).

15.3 Repeat 15.2 with only one channel engaged.

i) Pitch Channel 1

a) 5° nose up.

b) 5° nose down

ii) Roll Channel 1

a) 10° left

b) 10° right

iii) Yaw Channel 1

Note satisfactory functioning.

i) Pitch Channel 2

a) 5° nose up.

b) 5° nose down

ii) Roll Channel 2

a) 10° left

b) 10° right

iii) Yaw Channel 2

Note. Satisfactory functioning.

Re-engage Channel 1.

15.4 During the flight test check that when making 30° bank turns without using the trim release or cyclic trimmer, the fly through capability is retained (control forces do not continue to increase during the manoeuvre).

15.5 **<u>AFCS OUT</u>**

At 120 KIAS disengage the AFCS. Carry out turns, climbs and descents. Check smooth disengagement/re-engagement.

16. PITCH BIAS ACTUATOR (IF FITTED)

a) Place the AFCS indicator selector knob in the PBA position. Establish level flight at 120 KIAS. Note that both indicator needles are in the same positions and approximately centred.

b) Smoothly lower the collective. Note that the command (CH 2) needle moves aft (right) followed by the actuator (CH 1) needle. Aircraft pitch attitude should remain almost constant.

c) Raise the collective and note forward (left) movement of the command and actuator needles. Pitch attitude should remain almost constant.

Note: If pitch attitude is seen to vary significantly during this check pull BIAS ACTR circuit breaker and repeat tests, similar collective lever movements should then produce a more marked attitude change indicating that the PBA was controlling pitch attitude.

17. FUNCTIONING

17.1 Heating and Ventilation

Check that the heating can be satisfactorily controlled and that the ventilation is adequate.

17.2 Landing Gear

With gear up, check operation of the landing gear up tone and warning light at 40 KIAS or 65 ± 7 KIAS (depending on the airspeed switch installed) and by using the Rad Alt decision height bug if this system is Installed.

At 130 KIAS record

Extension time

Retraction time

Maximum time 15 seconds

18. AUTOROTATION RPM

18.1 After reducing weight to approximately 8500 lbs carry out a steady autorotative descent at 85 kts with the collective lever fully down and gear down. Record the following when stabilised.

NOTE : Do not exceed power off rpm limits (115).

PRESS ALT	*OAT*	*N_R*	*FUEL*		*WEIGHT*

Satisfactory needle split. (It may be necessary to slightly retard the engine levers to achieve this).

19. LANDING

Time

19.1 Confirm no tendency to resonance during a smooth landing with a gentle collective lowering.

NOTE Should any divergent oscillations be noted, lift off immediately and carry out a normal landing, consider repositioning the helicopter.

Fuel quantity

Totaliser reading

The totaliser reading should agree to within 5% of the actual amount consumed.

19.2 <u>Cabin Address System (if fitted)</u>

Operate cabin address system and ensure it functions adequately for use in directing an emergency evacuation.

19.3 <u>Emergency Load Shed</u>

If the helicopter is equipped with HUMS, the card must be downloaded and removed prior to this test to avoid loosing data. AC generator on line.

Switch off both DC generators and check that both DC GEN and BUS TIE lights illuminate. Switch from NORMAL to SHED and check essential services maintained by battery. Restore electrical power.

19.4 Retard each engine in turn to idle stop.

	ENG.1	ENG.2
N1 at ground idle 50% ± 2%		
T5 at ground idle		

19.5 **<u>Internal and External Lighting</u>**

<u>Internal</u>

Flight Instrument Lights	
Secondary lights (glareshield)	
Lower console lights	
Standby compass and OAT lights	
Cockpit floodlight	
Wander light and cabin dome lights	

<u>External</u>

Anti-collision lights	
Position lights	
Search light	
Landing light	
Strobe lights (if fitted)	

19.6 Emergency Radio/Intercom Systems

Note that individual aircraft may have different systems fitted, if some of the following tests do not apply, a test must be devised to at least ensure the functioning of the pilot's emergency radio transmit/receive. Note that it may also be necessary to pull CB PS SIGN PLT ICS.

Check the function of the auxiliary ICS system as follows (cannot be carried out on internal battery):-

a) Pull CB ICS Co-pilot on DC Ess Bus.

Check Co-pilot station box is inoperative. [ ]

Check pilot station box continues to operate. [ ]

Select AUX TALK on Co-pilot station box, ensure proper operation is restored. [ ]

Reset CB ICS Co-pilot on DC Ess Bus, select NORM TALK on Co-pilot station box.

b) Pull CB ICS Pilot on DC Ess Bus.

Check Pilot station box remains operative. [ ]

Pull CB PS SIGN PLT ICS

Check Pilot station box is inoperative. [ ]

Check Co-pilot station box continues to operate. [ ]

Select AUX TALK on Pilot station box, ensure proper operation is restored. [ ]

Reset CB ICS Pilot on DC Ess Bus, select NORM TALK on Pilot station box.

c) Select AUX LISTEN on Pilot station box, check:-

- Radio receivers can be heard one at a time as selected with priority left to right if more than one is selected. [ ]
- Volume control from receiver only. [ ]
- Pilot intercom tels (headset earpiece) are inoperative. [ ]
- Transmit function operates. [ ]

Select Pilot station box to NORM LISTEN.

d) Repeat with AUX LISTEN on Co-pilots station box (note that co-pilot intercom tels are then inoperative). [ ]

20. SHUTDOWN

20.1 T-handle Checks

Complete Pre Shutdown Checks

a) Check both DC generators ON, the Fire Extinguisher Test Switch OPEN, and both engine levers at IDLE. MASTER START ON **Autopilot OFF**

b) **CAUTION**

If an internal engine fire occurs as indicated by a rapid increase in T_5, immediately pull engine lever fully OFF and engage starter to minimise high T_5 and put out fire.

If a bay or baggage fire is indicated, the Extinguisher Test switch must be re-selected to NORM.

Pull the No.1 T-handle back one inch, observe the No.1 DC GEN Caution Light goes ON, continue pulling the No.1 T-handle back fully to shutdown the No.1 engine. Shutdown should be immediate when T-handle is fully aft.

c) Apply rotor brake at 45% N_R. The rotor should stop in 10 to 15 seconds (Electric rotor brake)
CAUTION Engine Operation with rotor stopped limited to blades 45° to long axis.

d) Repeat check (b) for the No.2 T-handle.

Reset T-handles forward after shutdown.
Reset extinguisher test switch to NORM

e) With both engines shutdown have ground personnel inspect for leaks or other discrepancies.

21. POST FLIGHT ACTION

21.1 Performance Climb

Plot out the data on the analysis sheet (Appendix 5) and determine the achieved rate of climb for each engine. The scheduled performance must be obtained from Appendix 6 and compared with the achieved performance. For the **S-76A++** the OAT/Pressure altitude lines **must** be ignored and only the Main Transmission Torque Limit (dotted) line used irrespective of altitude/OAT. This is because the OAT/Pressure altitude lines are only valid for the Arriel 1S engines. For the **S-76A++** 65 fpm must be added to the value obtained from Appendix 6 to allow for additional rate of climb due to 100% Nr being used.

No.1 Engine. Achieved - Scheduled rate of climb =	
No.2 Engine. Achieved - Scheduled rate of climb =	

Tolerance = – 20 fpm.

21.2 Autorotation RPM

Determine the scheduled rotor speed in autorotation and compare with the achieved value.

Actual NR - Scheduled NR =	

21.3 Engine Power Assurance

Determine power margin from Flight Manual.

	MARGIN
ENGINE	***Torque or N1***
1	
2	

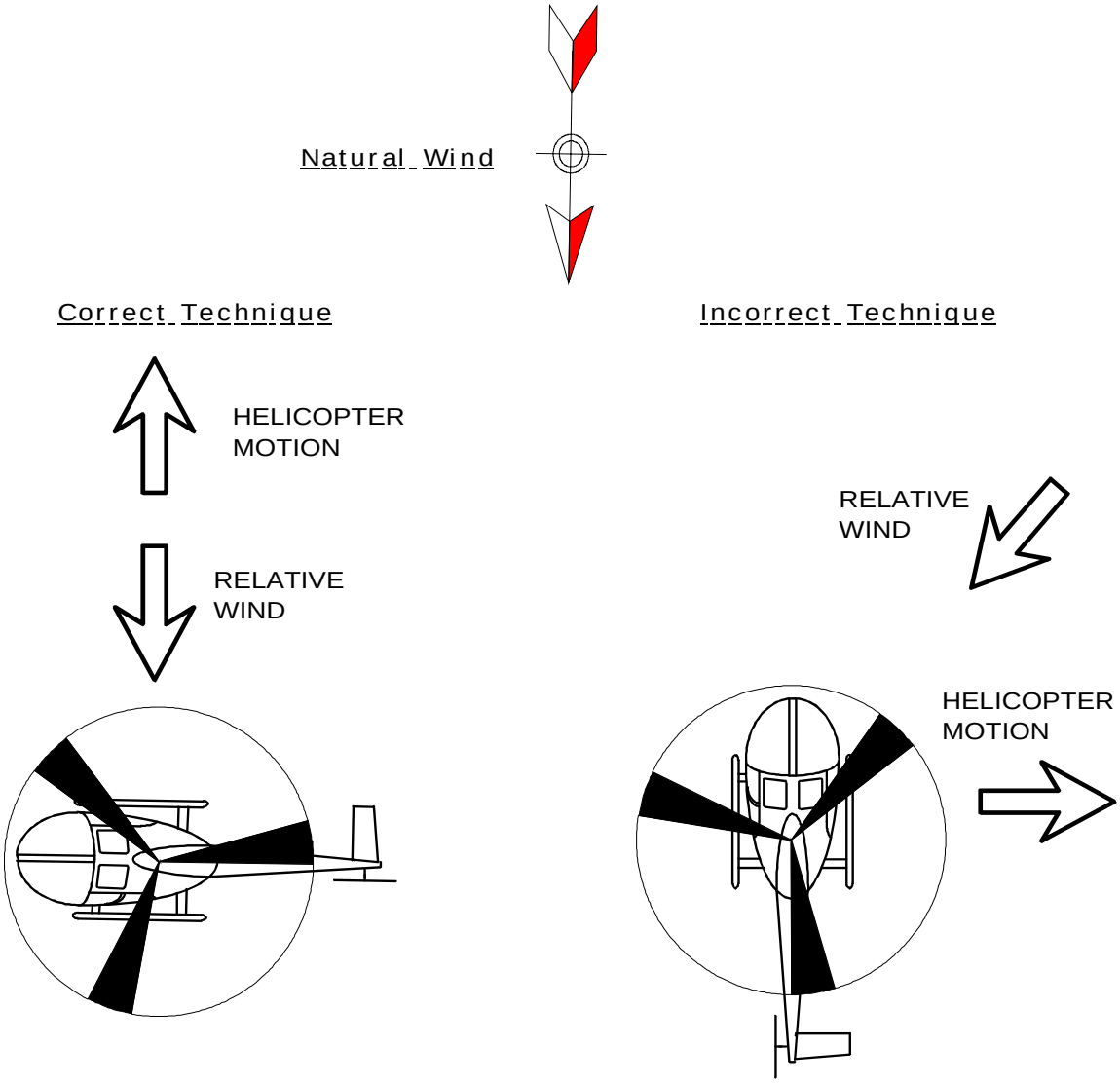
S-76A+ only. Determine T_5 margin from Part 2, Section VI of the Flight Manual.

	MARGIN
ENGINE	***T5***
1	
2	

SIDEWAYS AND REARWARDS FLIGHT

For the sideways flight tests the helicopter should be rotated so that the natural wind is on the side of the aircraft and then gently accelerated into the wind and stabilised. The mean natural wind speed should be added to the estimated ground speed to give the required relative air speed.

For rearwards flight the helicopter should be lined up tail into wind and gently accelerated rearwards to achieve the required relative air speed.



ADDITIONAL CHECKS FOR HAMILTON STANDARD PHASE III AP

1. AIRSPEED HOLD

i) a) From trimmed level flight at 120 KIAS with fixed collective and heading hold, move cyclic aft against trim and establish approximately 100 KIAS. Release cyclic and check that the aircraft smoothly returns to the trimmed condition ±5 kts.

b) Repeat with forward cyclic to 140 KIAS (do not exceed V_{NE}).

ii) Check A/S light extinguishes below 45 KIAS (use cyclic beeper trim).

2. HEADING HOLD

i) Check correct operation of heading hold during flight at normal cruise speed.

ii) At 120 KIAS in level flight with feet off the pedals slowly increase and decrease collective to give ±20% torque change, check heading maintained.

3. TURN CO-ORDINATION

i) At 120 KIAS level flight, feet lightly on pedals carry out turns left and right at 30° angle of bank. The slip ball may go as much as ½ ball width out but should be centred when established in the turn.

ii) Check turn co-ordination inoperative below 60 KIAS.

4. AUTO SHUTDOWN

Check that switching off a pitch channel when manoeuvring in pitch results in an AUTO SHUTDOWN light.

Repeat in roll.

ADDITIONAL CHECKS FOR SPERRY HELIPILOT

1. ALTITUDE HOLD

i) At a normal cruise speed check altitude is held ±50 ft.

ii) With heading hold also engaged gently reduce torque by about 20%. Check altitude is held within 100 ft of datum and then returning to datum ± 50 ft.

iii) a) Engage VS mode and select a rate of climb of 500 fpm at 120 KIAS. When rate of climb has stabilised engage ALT mode and check altitude returns to level at engagement after maximum of 100 ft overswing.

b) Repeat with a 500 fpm rate of descent.

2. AIRSPEED HOLD

i) a) From trimmed level flight at 120 KIAS with fixed collective and heading hold, move cyclic aft against trim and establish approximately 110 KIAS. Release cyclic and check that the aircraft smoothly returns to the trimmed condition ± 5 kts.

b) Repeat with forward cyclic to 130 KIAS (do not exceed V_{NE}).

3. HEADING HOLD

i) Check correct operation of heading hold during flight at normal cruise speed.

ii) At 120 KIAS in level flight with feet off the pedals slowly increase and decrease collective to give a ±10% torque change, check heading maintained.

4. SAS MODE

At a typical cruise speed check operation in SAS mode during straight flight and turns.

5. ILS (Optional)

Carry out a coupled ILS at 120 KIAS. Check correct operation of auto level and go-around mode.

6. GA Mode

a) Align the heading bug with present heading.

b) Set up 130 KIAS, 500 fpm descent (IAS mode).

c) Engage HDG mode.

d) Rotate heading bug left or right 90° to establish 20° to 25° bank angle.

e) Engage GA mode when bank angle is 20° to 25°.

f) Check GA commands wings level (and then constant heading) and 750 fpm climb.

g) Rotate heading bug left or right 30° and check new heading is acquired.

ADDITIONAL CHECKS FOR SPERRY SPZ 7000 DAFCS

1.1 ALTITUDE HOLD (2 CUE MODE)

i) At a normal cruise speed check altitude is held ±50 ft.

ii) With heading hold also engaged gently reduce torque by about 20%. Check altitude is held within 100 ft of datum and then returning to datum ±50 ft

iii) a) From level flight at 120 KIAS, engage VS mode and select a rate of climb of 500 fpm. When rate of climb has stablilised engage ALT mode and check altitude returns to level at engagement after maximum of 100 ft overswing.

b) Repeat with a 500 fpm rate of descent.

1.2 AIRSPEED HOLD (2 CUE)

i) a) Disengage ALT and engage IAS. From trimmed level flight at 120 KIAS with fixed collective and heading hold, move cyclic aft against trim and establish approximately 100 KIAS. Release cyclic and check that the aircraft smoothly returns to the trimmed condition ± 5 kts.

b) Repeat with forward cyclic to 140 KIAS (do not exceed V_{NE}).

1.3 HEADING HOLD (2 CUE)

i) Check correct operation of heading hold during flight at normal cruise speed.

ii) At 120 KIAS in level flight with feet off the pedals slowly increase and decrease collective to give a ±20% torque change, check heading maintained.

1.4 3 CUE MODE

At 130 KIAS engage IAS/VS/HDG modes and set a rate of descent of 500 ft/min. When stabilised engage ALT mode (IAS/ALT/HDG), check altitude overshoot within 100 ft of datum and then returns to datum ±50 ft.

Using the HSI bug alter heading by 90°. (IAS/ALT/HDG mode), check normal operation.

1.5 ALTITUDE PRESELECT (3 CUE)

i) At 120 KIAS select an altitude approximately 1200 ft higher or lower than current altitude and ARM. Initiate the change of altitude using VS mode set to 1000 ft/min (provided torque/engine limits are not exceeded). Note operation of ALT PRE mode recording any overswing.

Altitude alert light illuminates (if installed) 1000 ft before selected altitude.

ii) a) After stabilising at selected altitude increase collective to increase altitude. Alert light should illuminate at 250 ft deviation (if fitted). Tone should also be heard.

b) Repeat a) with 250 ft reduction in altitude.

1.6 4-WAY CYCLIC SWITCH

i) Deselect any flight director modes. At 120 KIAS check correct operation of fore/aft movement of cyclic switch in attitude mode (approximately 2°/second).

ii) Repeat with lateral movement:

a) Release switch below a roll angle of 6° from level - check aircraft returns to wings level.

b) Check that above 6° the roll attitude is maintained.

1.7 4-WAY COLLECTIVE SWITCH

Engage IAS/ALT/HDG, feet off pedals.

i) At cruise speed check ball centres with lateral movement.

1.8 SAS MODE

At a typical cruise speed check operation in SAS mode during straight flight and turns.

1.9 AFCS OUT

At 120 KIAS disengage the AFCS. Carry out turns, climbs and descents. Check smooth disengagement/ re-engagement.

1.10 ILS (Optional Test)

Carry out a coupled ILS (3 cue) at 120 KIAS. Check correct operation of auto level and go-around mode.

1.11 GO-AROUND MODE

a) Align the heading bug with present heading.

b) Set up 120 KIAS, 700 fpm descent (IAS/VS mode).

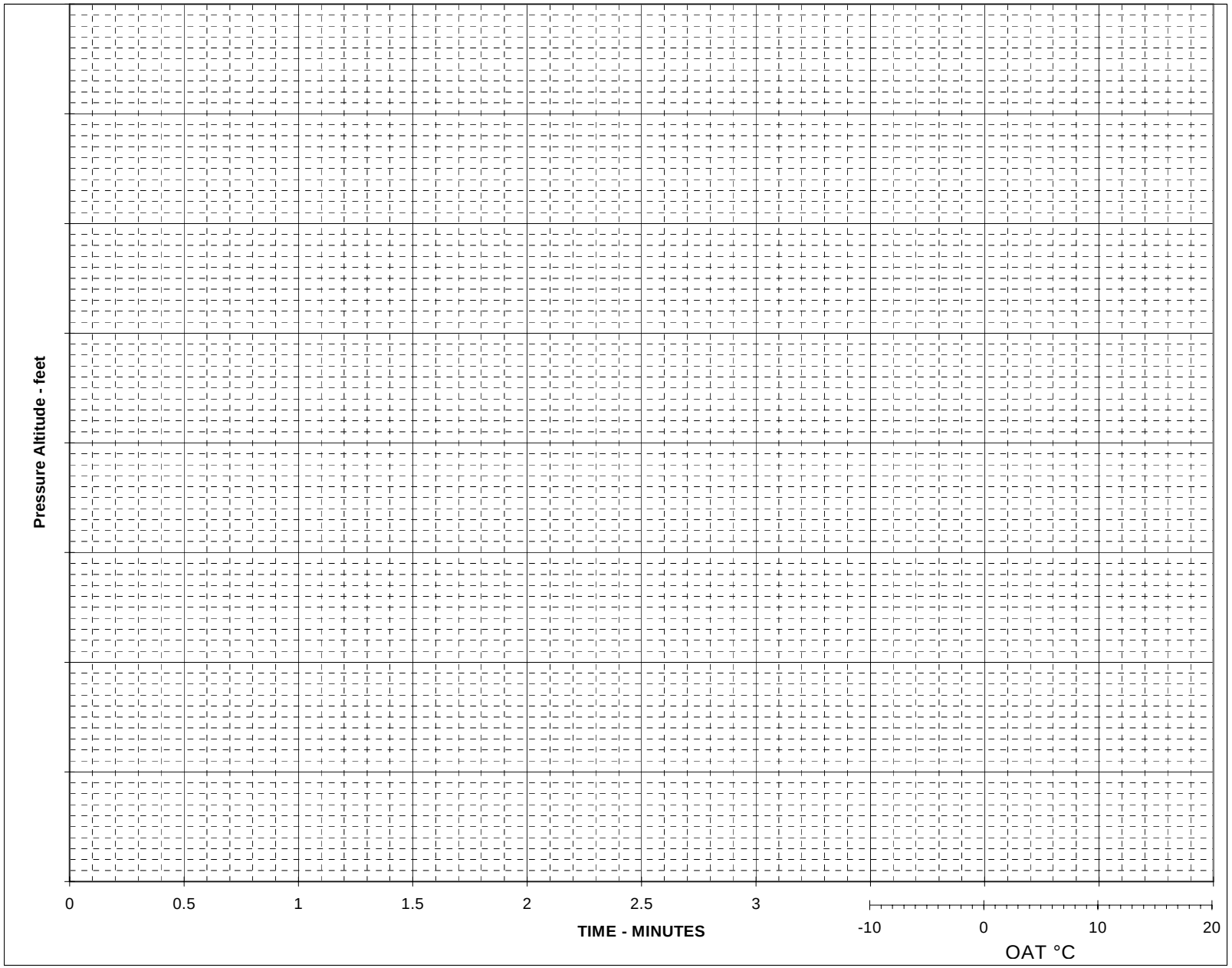
c) Engage HDG mode.

d) Rotate heading bug left or right 90° to establish 20° to 25° bank angle.

e) Engage GA mode when bank angle is 20° to 25°.

f) Check GA disengages HDG, commands wings level (and then constant heading) at 75 KIAS or more at 700 to 750 fpm climb.

g) Re-engage HDG, rotate heading bug left or right 30° and check new heading is acquired.



AIRCRAFT TYPE
REGISTRATION
DATE OF TEST

Mean Weight
No 1 _____ Kg
No 2 _____ Kg

Mean Altitude
No 1 _____ feet
No 2 _____ feet

Mean OAT
No 1 _____ °C
No 2 _____ °C

ACHIEVED ROC
No 1 _____ ft/min
No 2 _____ ft/min

SCHEDULED ROC
No 1 _____ ft/min
No 2 _____ ft/min

DELTA ROC
No 1 _____ ft/min
No 2 _____ ft/min

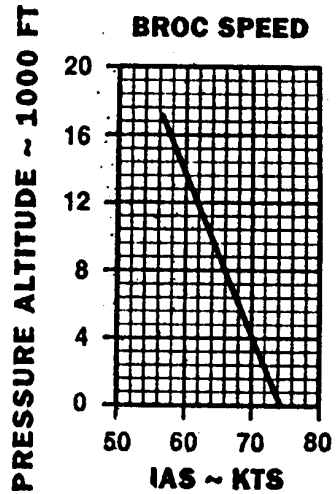
FORWARD CLIMB PERFORMANCE

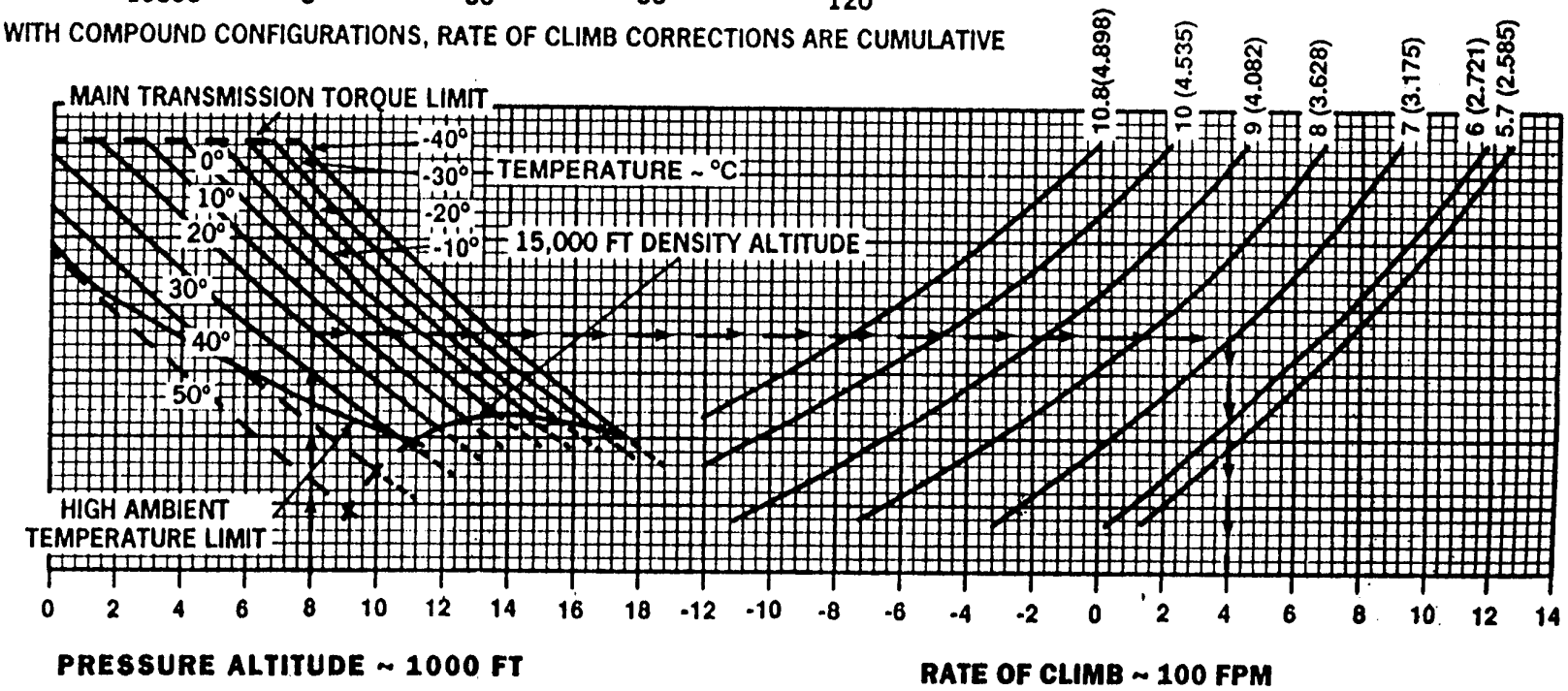
SINGLE ENGINE MAXIMUM CONTINUOUS POWER
BEST RATE OF CLIMB SPEED 96% NR (S-76A++ 100%)
EAPS NOT INSTALLED OR INSTALLED - ON OR OFF
ANTI-ICE OFF BLEED-AIR OFF GEAR RETRACTED

REDUCE RATE OF CLIMB DETERMINED FROM CHART BY AMOUNT SHOWN IN TABLE:

GROSS WEIGHT - LBS	ROC REDUCTION ANTI-ICE ON	ROC REDUCTION EAPS INST ANTI-ICE ON	ROC REDUCTION UTILTY HOIST INST	ROC REDUCTION SLIDING DOOR(S) OPEN
5700	10	40	40	195
6000	10	40	40	190
7000	10	40	40	175
8000	10	35	35	160
9000	10	35	30	145
10000	10	35	30	130
10800	5	30	30	120

WITH COMPOUND CONFIGURATIONS, RATE OF CLIMB CORRECTIONS ARE CUMULATIVE

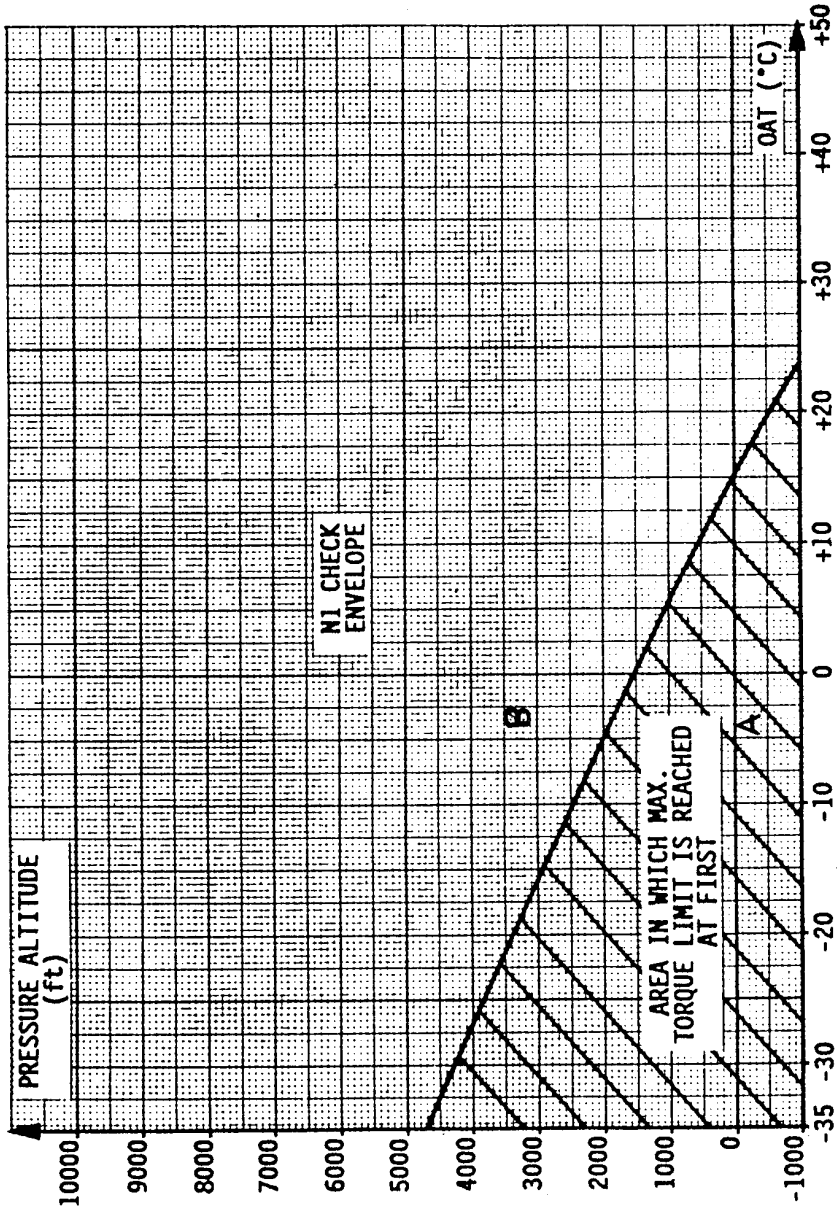




DASHED LINES ARE FOR INTERPOLATION ONLY

S-76 / ARRIEL

FLIGHT CHECK PROCEDURES MANUAL



N1 CHECK ENVELOPE FOR ROTORCRAFT
WITH MAX. TORQUE LIMIT 115 %
Figure 1A

APRIL 10, 1989 3-100A/(100B BLK)

NOTE

This Figure is based on the Arriel 1S engine. For the 1S1 engine a higher altitude/OAT will be required to reach the N_1 limit.