

QTG FNPT II single engine turbine based on JAR STD 3H, May 1 st 2002	April 10th 2008	Doc v1.22	Operator, Country
	Simcopter GmbH, Switzerland		
Chapter 6			Page 25

Chapter 6

Validation Tests

Note, that the specified initial condition parameters for each applicable test are saved in a state file (.sta). The appropriate state file is loaded into the simulation before the respective test to get the simulated aircraft to the specified setting. Consequently, the 'Initial conditions' sections also reference the related state file with its name.

6.1 PERFORMANCE

6.1.1 Engine Assessment

6.1.1.1 Start Operations

6.1.1.1.1 Engine Start and acceleration (transient), Rotor Brake Used

Test objective	To demonstrate that the simulation of engine start and acceleration conforms to that class of helicopter.
Demonstration procedure:	Perform start up procedure according to checklist while monitoring engine instruments and measuring acceleration times from starter engagement to ground idle (at 68% NG) and from ground idle to flight idle.
References:	Ecureuil AS350 BA Flight Manual 'engine start procedure' and VFTR
Initial conditions:	state file qtgEcureuilAS350BA_OnGround_EngineOff.sta
QNH:	1013 mbar
Gross Weight:	1760 kg
Temperature (OAT):	12° C
Wind direction:	N/A
Wind speed:	Zero
Altitude:	On ground
IAS:	0 kts
Rotor Brake:	Used
A/P:	OFF
Position Freeze:	OFF
Altitude Freeze:	OFF
Fuel freeze:	OFF
CG:	Load 260kg / Fuel 230kg

QTG FNPT II single engine turbine based on JAR STD 3H, May 1 st 2002	April 10th 2008	Doc v1.22	Operator, Country
	Simcopter GmbH, Switzerland		
6.1.1.1 Start Operations			Page 26

Manual test procedure

PREPARE 'eng start / accel RBrk On' via QTG config page
 UNFREEZE simulation
 SET Rotor brake on
 PRESS start button for that test

After the second audio signal:

START engine according checklist

Evaluation criteria Time and temperatures within tolerance compared to the plotted curve from the original Ecureuil AS350 BA.

Parameter	Units	Recurrent test tolerance
Light Off Time:	sec	±10% or ±1 sec
Torque:	%	±5%
Rotor Speed:	rpm	±3%
Fuel Flow:	litres/hour	±10%
Pwr Turb. Speed:	NG	±5%
Turbine Gas Temp.:	° C	±30 ° C

Expected result(s)

- Acceleration times (NG & RRPM) to steady state ground idle at 68% NG and from there to flight idle (operating RPM)
- Peak Temperatures (T4)

SOC

The video footage is used as a general reference without rotor brake used. However the behaviour of the FNPT - when using the rotor brake, is what can be expected from that class of Helicopter. The engine still starts but with about 70 less RRPM. Results in the Reference data below are without rotor brake used.

Test result

See graphs on the following pages.

Source data

Flight Manual AS350 BA 4.1 page 4, '3. Starting' and VFTR doc v1.3, Engine Start and acceleration (transient), Rotor Brake Not Used

Comparison of results

	Reference data	Master Test result	Recurrent Test result
Time to Grd. idle [sec]	[REDACTED]	[REDACTED]	
Time to Flt. Idle [sec]	[REDACTED]	[REDACTED]	
T4 trend [° Celsius / sec]	[REDACTED]	[REDACTED]	
Torque [%]	[REDACTED]	[REDACTED]	
Fuel Flow [ltr/h.]	[REDACTED]	[REDACTED]	
NG trend [RPM/sec]	[REDACTED]	[REDACTED]	
RRPM trend [RPM/sec]	[REDACTED]	[REDACTED]	
Date of test	[REDACTED]	[REDACTED]	
Examiners Signature			

* during the first 5 seconds there is no Pilot input

QTG FNPT II single engine turbine based on JAR STD 3H, May 1 st 2002	April 10th 2008	Doc v1.22	Operator, Country
	Simcopter GmbH, Switzerland		
6.1.1.1 Start Operations			Page 27

6.1.1.1.2 Engine Start and acceleration (transient), Rotor Brake Not Used

Test objective	To demonstrate that the simulation of engine start and acceleration conforms to a helicopter.
Demonstration procedure	Perform start up procedure according to checklist while monitoring engine instruments and measuring acceleration times from starter engagement to ground idle (at 68% NG) and from ground idle to flight idle.
References	Ecureuil AS350 BA Flight Manual 'engine start procedure' and VFTR
Initial conditions	state file qtgEcureuilAS350BA_OnGround_EngineOff.sta
Gross Weight:	1760 kg
QNH:	1013 mbar
Temperature (OAT):	15° C
Wind direction:	N/A
Wind speed:	Zero
Altitude:	On ground
Rotor Brake:	Not used
IAS:	0
A/P:	OFF
Position Freeze:	OFF
Altitude Freeze:	OFF
Fuel freeze:	ON
CG:	Load 260kg / Fuel 230kg
Manual test procedure	
PREPARE	'eng start / accel RBrk Off' test via QTG config page
UNFREEZE	simulation
PRESS	start button for that test
<u>After the second audio signal:</u>	
START	engine according checklist

QTG FNPT II single engine turbine based on JAR STD 3H, May 1 st 2002	April 10th 2008	Doc v1.22	Operator, Country
	Simcopter GmbH, Switzerland		
6.1.1.1 Start Operations			Page 28

Evaluation criteria

Times and temperatures within tolerance compared to the plotted curve from the original Ecureuil AS350 BA.

Parameter	Units	Recurrent test tolerance
Light Off Time:	sec	±10% or ±1 sec
Torque:	%	±5%
Rotor Speed:	rpm	±3%
Fuel Flow:	liters/hour	±10% > N/A
Pwr Turb. Speed:	NG	±5%
Turbine Gas Temp.:	° C	±30 ° C

Expected result(s)

- Acceleration times (NG & RRPM) to steady state ground idle at 68% NG and from there to flight idle (operating RPM)
- Peak Temperatures (T4)

Test result

See graphs on the following pages.

Source data

Flight Manual AS350 BA 4.1 page 4, '3. Starting' and VFTR doc v1.3, Engine Start and acceleration (transient), Rotor Brake Not Used

Comparison of results

	Reference data	Master Test result	Recurrent Test result
Time to Grd. idle [sec]	[REDACTED]	[REDACTED]	
Time to Flt. Idle [sec]	[REDACTED]	[REDACTED]	
T4 trend [° Celsius / sec]	[REDACTED]	[REDACTED]	
Torque [%]	[REDACTED]	[REDACTED]	
Fuel Flow [ltr/h.]	[REDACTED]	[REDACTED]	
NG trend [RPM/sec]	[REDACTED]	[REDACTED]	
RRPM trend [RPM/sec]	[REDACTED]	[REDACTED]	
Date of test	[REDACTED]	[REDACTED]	
Examiners Signature			

QTG FNPT II single engine turbine based on JAR STD 3H, May 1 st 2002	April 10th 2008	Doc v1.22	Operator, Country
	Simcopter GmbH, Switzerland		
6.1.1.1 Start Operations			Page 29

6.1.1.1.3 INTENTIONALLY LEFT BLANK

QTG FNPT II single engine turbine based on JAR STD 3H, May 1 st 2002	April 10th 2008	Doc v1.22	Operator, Country
6.1.1.2 INTENTIONALLY LEFT BLANK	Simcopter GmbH, Switzerland		
6.1.1.2 INTENTIONALLY LEFT BLANK			Page 30

6.1.1.2 INTENTIONALLY LEFT BLANK

QTG FNPT II single engine turbine based on JAR STD 3H, May 1 st 2002	April 10th 2008	Doc v1.22	Operator, Country
	Simcopter GmbH, Switzerland		
6.1.1.3 Engine and Rotor Speed Governing			Page 31

6.1.1.3 Engine and Rotor Speed Governing

6.1.1.3.1 Engine and Rotor Speed Governing, Climb

Test objective	To demonstrate, that in climb the Engine and Rotor Speed Governing of the FNPT II conforms to a Single Engine Turbine helicopter.
Demonstration procedure	Climb with different torque settings at 55 KIAS. Alter the torque setting by collective step inputs. Record and compare appropriate parameters.
References	Flight Manual AS350 BA [3], section 2.1, page 4 and VFTR
Initial conditions	state file qtgEcureuilAS350BA_CruiseAtClimbSpeed_Medium.sta
Gross Weight:	1760 kg
Torque:	40 %
NG:	88 % rpm
Altitude:	1490 ft MSL
IAS:	55 kts
QNH:	1013 mbar
Temperature (OAT):	12° C
A/P:	OFF
Position Freeze:	OFF
Altitude Freeze:	OFF
Fuel freeze:	ON
CG:	Load 260kg / Fuel 230kg
Manual test procedure	
PREPARE	'Eng / Rotor Gov, Climb' test via QTG config page
UNFREEZE	simulation
STABILIZE	55 KIAS in level flight
PRESS	start button for that test
<u>After the second audio signal:</u>	
SET	50 % torque and maintain 55 KIAS
<u>After 25 sec elapsed time:</u>	
SET	60 % torque and maintain 55 KIAS
<u>After 45 sec elapsed time:</u>	
SET	70 % torque and maintain 55 KIAS
<u>After 65 sec elapsed time:</u>	
SET	80 % torque and maintain 55 KIAS

QTG FNPT II single engine turbine based on JAR STD 3H, May 1 st 2002	April 10th 2008	Doc v1.22	Operator, Country
	Simcopter GmbH, Switzerland		
6.1.1.3 Engine and Rotor Speed Governing			Page 32

Evaluation criteria

Parameter	Units	Recurrent test tolerance
Collective Control Position:	index in QTG instrument	
Torque:	%	±5%
Rotor speed (RRPM):	rpm	±1.5%
Indicated Air Speed (IAS):	kts	

Expected result

Rotor speed shall stay between 385 rpm and 394 rpm in all stabilized climb conditions.

If collective control is not moved, torque shall stay between 48% and 52% for a torque setting of 50%
between 57% and 63% for a torque setting of 60%
between 67% and 73% for a torque setting of 70%

Test result

See graphs on the following pages.

QTG FNPT II single engine turbine based on JAR STD 3H, May 1 st 2002	April 10th 2008	Doc v1.22	Operator, Country
	Simcopter GmbH, Switzerland		
6.1.1.3 Engine and Rotor Speed Governing			Page 33

Source data (Flight Manual AS350 BA [3], section 2.1, page 4) and VFTR doc v1.3, Engine and Rotor Speed Governing, Climb

8 MAIN ROTOR SPEED

8.1 Power On

- . On the ground at low pitch - - - - - 380 ± 5 rpm
- . In stabilized flight - - - - - 390 + 4 rpm
- 5

8.2 Power Off

- . Maximum - - - - - 430 rpm
- . Minimum - - - - - 320 rpm

NOTE : The horn sounds when the rotor speed drops below 360 rpm.

9 ROTOR BRAKE LIMITATION

- Maximum rotor speed for rotor brake application : 170 rpm
- Minimum time between two consecutive brakings : 5 minutes

10 TORQUE LIMITATIONS

- Maximum torque : IAS 40 kt-74Km/H - 46 MPH or higher 83 %
- IAS below 40Kt-74Km/H - 46 MPH 88 %

11 ENGINE LIMITATIONS

The aircraft is equipped with a TURBOMECA "ARRIEL 1B" engine. Operating limitations are determined by the gas generator rotation speed (Ng), by the exhaust gas temperature (t4) or by the free turbine rotation speed (Nf) depending on the operating conditions.

11.1 Gas Generator Speed

- Maximum transient rating (5 sec. max.) 105 %
- Maximum takeoff rating (5 minutes) 100 %
- Maximum continuous rating 98 %

When O.A.T. is higher than I.S.A. + 15°C, reduce the max. takeoff and max. continuous ratings by 0.05 % per degree C ; these corrections are marked on a plate fitted in the cockpit and shown in Section 2.2.

When the heating and demisting systems are being used and the outside air temperature is + 10°C or more, subtract 1 % Ng from the above limits.

- Minimum stabilized rating 67 %

NOTE : 100 % Ng corresponds to 51800 rpm

QTG FNPT II single engine turbine based on JAR STD 3H, May 1 st 2002	April 10th 2008	Doc v1.22	Operator, Country
	Simcopter GmbH, Switzerland		
6.1.1.3 Engine and Rotor Speed Governing			Page 34

Comparison of results

	Reference data	Master Test result	Recurrent Test result
Torque 50%	██████████	██████████	
Torque 50%	██████████	██████████	
Torque 60%	██████████	██████████	
Torque 60%	██████████	██████████	
Torque 70%	██████████	██████████	
Torque 70%	██████████	██████████	
Torque 80%	██████████	██████████	
Torque 80%	██████████	██████████	
Date of test	██████████	██████████	
Examiners Signature			