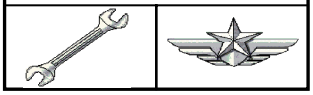
Information Notice

SUBJECT: ROTOR FLIGHT CONTROLS

Use of twist grip

Jim,
See Page 6/12

For the attention of



AIRCRAFT CONCERNED	Version(s)	
	Civil	Military
AS350	B3	
AS550		C3

EUROCOPTER has recently been informed of an event that occurred during the starting phase of an AS350 B3 helicopter equipped with an Arriel 2B engine. After analysis, it appears that the event is an indirect consequence of the customer's starting procedure which does not comply with the aircraft documentation. The customer, who has a mixed fleet of AS350 B3 helicopters equipped with Arriel 2B and Arriel 2B1 engines (MOD 073254), used a similar personal procedure for the two types of aircraft.

We must remind you that only the procedures written down in the Flight Manual are to be complied with.
Any other procedure can lead to a red GOV failure when the FADEC self-test is carried out, the inability to start or an NR overspeed when the twist grip is rotated (if the stop is not in the normal FLIGHT detent).

With this Information Notice EUROCOPTER would like to remind you that:

1. The procedures described in the Flight Manual state that:
   - the twist grip must be in the "FLIGHT" detent before carrying out the starting procedure for the AS350 B3 helicopter equipped with an Arriel 2B engine (section 4.1),
   - the twist grip must be in the "IDLE" detent before carrying out the starting procedure for the AS350 B3 helicopter equipped with an Arriel 2B1 engine (section 4.3).

2. LS 1702-71-05 (refer to appendix) summarizes the various types of twist grip and their use during training or on an actual failure for the AS350 B3 helicopters equipped with Arriel 2B or Arriel 2B1 engines.

3. For helicopters which embody modification 073084 (twist grip with FLIGHT detent stop at stick base) ALERT SERVICE BULLETIN No. 67.00.33 introducing modification 073222 (improvement to twist grip operation) had to be complied with within 18 months from the date of issue of the ASB (July 7, 2008), i.e. before January 7, 2010.

EUROCOPTER would also like to inform you that:

1. For helicopters which do not embody modification 073084, modifications 073084 and 073222 will soon be proposed via a TIP (Technical Improvement Proposal). These modifications respectively introduce:
   - an automatic stop which frees the range beyond the FLIGHT position when the red GOV light is activated.
   - an electromagnet which is more reliable when it is heated and has increased unlocking efficiency.

   EUROCOPTER recommends that you adopt these modifications which make the operation of the twist grip more reliable and standardize the AS350 B3 helicopters with Arriel 2B engine with regard to the Ecureuil fleet.

2. Modification 073357 will soon be proposed via a Service Bulletin in order to improve the reliability of the "IDLE/FLIGHT" electrical function of the twist grip on the AS350 B3 helicopter with Arriel 2B engine. This modification uses the FLIGHT position signal from the engine control unit (HMU). If there is inconsistency between the signal from the engine control unit and the signal from the twist grip, the system will give priority to the FLIGHT rating command to restore full engine power.
   With this modification the forced idle switch will no longer have to be replaced every 500h as is currently defined in the PRE (Maintenance Program).

3. EUROCOPTER will shortly propose to customers the possibility of replacing the Arriel 2B engine equipping AS350 B3 helicopters with ARRIEL 2B1 engines via a TIP (Technical Improvement Proposal).
   Reminder:
   - the B3 helicopter version with Arriel 2B engines has a single-channel engine governor and FADEC back-up MANUALLY controlled using the mechanical system of the twist grip.
   - the B3 helicopter version with Arriel 2B1 engines has a dual-channel engine governor, a simplified twist grip and an automatic back-up control ("EBCAU").

   This modification means, in particular, that total governor failure training (red GOV) is not required.
   It will be particularly attractive for customers with a mixed fleet of AS350 B3 helicopters (Arriel 2B and 2B1 engine) and/or EC130 B4 helicopters (Arriel 2B1 engines), and who wish to standardize their fleet.

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Lettre-Service
No. 1702-71-05

Marignane, ~~15.06.2005~~
12.04.2006

SUBJECT:

350	~~B~~	~~B~~	~~B1~~	~~B2~~	B3	~~BA~~	~~BB~~	~~L1~~
550	~~B2~~	~~B2~~	C3	~~A2~~				
355	~~E~~	~~F~~	~~F1~~	~~F2~~	~~N~~			
555	~~MN~~	~~GN~~	~~GN~~	~~GP~~	~~AP~~	~~AN~~		
EC130	~~B4~~							

A l'attention de

POWER PLANT: Ecureuil AS350 B3 and AS550 C3 helicopters
Different versions of twist grip and FADEC controls

Purpose of Revision 1: To modify the Note on page 2, by replacing the incorrect information: "Manu" with "Auto"

Dear Customers

The purpose of this Service Letter is to provide technical information to improve understanding of the operation of the engine governor and controls as well as to recall the training and flight control procedures, particularly in engine governor back-up mode.

It must be remembered that the training and flight control procedures in back-up mode on the AS350 B3 and AS550 C3 equipped with FADEC-governed engines, are very different to previous versions of the Ecureuil AS350 and AS550 equipped with hydro-mechanically governed engines. A thorough acquaintance with the procedures is therefore necessary to safely pilot the new aircraft equipped with electronically-governed engines ("FADEC" Full Authority Digital Engine Control). Specific training according to the aircraft version and with an experienced instructor is necessary; the necessity of this training is detailed in the following paragraphs.

Sheets 1, 2 and 3 at the end of this Service Letter summarize the main information to be known.

A FADEC-type engine governor comprises:

- a digital computer often called the DECU (Digital Engine Control Unit) or sometimes the FADEC,
- a pump/metering unit assembly often called the HMU (Hydro-Mechanical Unit),
- electrical (and, possibly, mechanical) links between the helicopter, the DECU and the HMU.

The Ecureuil AS350 B3 and AS550 C3 helicopters, with a FADEC-governed Arriel 2 engine, comprise two families:

- pre MOD No. 073254, with the Arriel 2B engine equipped with a **single-channel governor** and a **manual back-up system,**
- post MOD No. 073254, with the Arriel 2B1 engine equipped with a **two-channel governor** and an **automatic back-up system.**

1 - Pre MOD No. 073254

1.1 Technical characteristics

Engine:
Arriel 2B.

Automatic engine governor:
FADEC single-channel type.

FADEC-governor back-up system:
Manual, with mechanical control.

Consequence of a total governor failure (red GOV light):
The fuel flow is frozen at its value at the moment of the failure.

Fuel flow control after failure:
Manually controlled by the pilot using the twist grip, which mechanically actuates the fuel metering unit of the HMU.

Total governor failure flight control training:
NECESSARY, and carried out by simulating a total governor failure by actuating the Auto/Manu switch.

Twist grip (**pre** MOD No. 073084):
All the positions are stable.
The grip has two ranges, one to reduce the fuel flow and one to increase the fuel flow, separated by a disengageable mechanical stop.

The grip has three operating modes:

- Normal "Flight" mode:
  - the grip is in the "Flight" position against the disengageable stop.
- "Mixed" mode with DECU active:
  - in the reduced position (reduced by more than approximately 30°, for a maximum of 45°), the grip activates an electrical switch which sets the engine to idle NG (zero power) via the DECU,
  - during reduction, between the "Flight" position and the "fully reduced" position, the grip controls the metering unit of the HMU but the fuel flow is still governed by the DECU,
  - the (amber) "TWIST GRIP" and amber "GOV" lights are illuminated.
- "Manual Back-up" mode (with DECU inactive):
  - DECU inactive (actual total governor failure or failure simulated by the Auto/Manu switch set to Manual) with the red "GOV" light illuminated,
  - the grip controls the HMU metering unit and directly adjusts the fuel flow in the increase range or reduction range,
  - the (amber) "TWIST GRIP" light is illuminated.

Warning: with the manually disengageable stop, **the pilot must make sure that the stop is re-engaged after each flight control training session in manual back-up control mode**. If this is overlooked, there is a risk of excess engine fuel flow, and therefore rotor overspeed, after auto-rotation training, when trying to return the grip to the "Flight" position. If the stop is not re-engaged, the grip may exceed the "Flight" position.

Twist grip (**post** MOD No. 073084):

The disengageable mechanical stop is replaced with an **automatic stop** which frees the grip beyond the Flight position (to increase the fuel flow rate) when the red "GOV" light is illuminated. This red light is illuminated for an actual total governor failure or in flight control training in "Manual" mode with the Auto/Manu switch set to "Manual".

Note: this modification automatically re-engages the disengageable stop after governor failure training, as soon as the grip is returned to below the "Flight" position and the Auto/Manu switch is returned to "Auto".

1.2 Training procedures

The following paragraphs give explanations regarding the behavior of the equipment during the training procedures described in the Flight Manual.

1.2.1 Auto-rotation training

An engine failure is simulated by the intentional reduction of the engine power. From the "Flight" position, the pilot moves the twist grip in the reduced fuel flow direction. If the pilot slowly turns the grip, the engine first maintains its nominal power. In fact, the pilot uses the "Mixed" mode and the DECU, which is active, compensates for the reduction in fuel flow requested by the grip. If the pilot quickly but partially turns the grip, there will a momentary reduction in power corresponding to the time taken for the automatic control to compensate for grip operation.
When the grip has been rotated approximately 30°, the engine idle electrical switch is activated. The DECU governs the idle rating of the engine, the NG of which is reduced to zero power. The pilot then reduces the pitch to change to auto-rotation.

Note: the idle switch controlled by the twist grip produces the same result as when the "Off/Idle/Flight" switch is set to "Idle"; the grip sets the engine to idle without releasing the collective pitch lever.

Auto-rotation flight control procedure: refer to the Flight Manual.

Inversely, from the "fully reduced" position of the grip (45°), if the pilot turns the grip to increase the fuel flow, from the start to approximately 30°, the engine remains at zero power. At approximately 30°, the grip releases the electrical switch to "Flight" which allows the automatic governor to operate normally. The behavior of the engine will then depend on the rotor speed (NR) at this time:

- If the NR is greater than the nominal governing speed*, the engine remains at zero power, with only a slight variation in NG (small increase to approximately 71% NG).
- If the NR is less than the nominal governing speed*, the engine is re-synchronized by its free wheel and then increases its power to re-accelerate the rotors to the nominal NR governing speed*. The engine acceleration is programmed in the FADEC and lasts approximately 9s between zero power and maximum continuous power (MCP).

* Normal NR governing range: 390 to 394 rpm.

Comment:
As soon as the Idle electrical switch has been released (grip reduced by less than 30°), there is no need to rapidly return the grip to the Flight position. The pilot can take his time to check his angle of descent and flight path and then calmly return the twist grip to the Flight position.
This comment may be very useful for a twist grip pre MOD No. 073084 to avoid an excess fuel flow and rotor overspeed if the disengageable stop remains disengaged by inadvertence.

Reminder:
If there is the beginning of an excess fuel flow and rotor overspeed, do not reduce the collective pitch (which aggravates the phenomenon and increases the vibrations), but counter the NR by increasing the collective pitch and reduce the twist grip.

1.2.2 Total governor failure training (red "GOV" light)

Reminder:
In the event of a total FADEC-governor failure detected by the DECU, **the engine fuel flow is frozen at its value at the moment of the failure.** The engine power is therefore maintained. In stabilized flight, there is no urgency to modify the flight parameters and to adjust the twist grip. On the contrary, rapidly reducing collective pitch, without a synchronized reduction of the twist grip, will create rotor overspeed. Flight control must then be smooth, avoiding abrupt actions.

Training for total governor failure must be carried out with an experienced instructor.

The training starts by simulating a total engine governor failure by setting the "Auto/Manu" selector to "Manu".

During training, regardless of the maneuvers carried out, it is always possible to de-activate the failure simulation by resetting the selector to "Auto". **The automatic governor becomes immediately active provided that the twist grip has not been reduced beyond 30° ("Idle" switch activated).**

The change to "Manu" mode freezes the fuel flow, lights up the red "GOV" light and activates the GONG (as for an actual total governor failure).

"Manu" mode shall be engaged only in stabilized flight conditions.

In "Manu" mode, the fuel flow is adjusted by the pilot using the twist grip. The pilot (on the RH side) must disengage the "Flight" stop of the grip. Relative to the frozen fuel flow, the pilot can then increase power by turning the grip in the increase range or reduce power by turning the grip in the reduction range.

The pilot must become accustomed to continuously coordinating movements with the collective pitch control lever and twist grip, hence the need to train regularly.
He must be accustomed to correctly coordinating actions in flight before carrying out a complete landing.
If the pilot does not feel sure of himself, he must not hesitate to return to "Auto" mode and then back to "Manu" mode from stabilized flight to perfect his pitch/grip coordination.
Flight control in "Manu" mode must be fully mastered before carrying out a complete landing.

For the landing, it is preferable to carry out a long direct final approach, to set power at rather less than that of level flight at Vy while monitoring the rotor speed (NR) and then slowly increase the grip as the speed drops until reaching hover flight. Allow the NR to decrease for the touch-down.
Once landed, the engine fuel flow must be reduced readily using the grip before reducing collective pitch.

At the end of the training session, the pilot returns the "Auto/Manu" selector to "Auto", he can then calmly return the grip to "Flight", without making any abrupt movements, ensuring that the disengageable stop is in the normal flight position.

The procedure for an actual total governor failure is identical to that for training.
Note: there is no point in setting the "Auto/Manu" selector to "Manu" and this is not specified in the Flight Manual.

1.2.3 Comments regarding the twist grip post MOD No. 073084

The procedures described previously are applicable.

The only differences post MOD No. 073084 are:

- The pilot and copilot grips are identical.
- The Flight stop is automatically released on the pilot and copilot grips when the red "GOV" light illuminates.
- The stop returns to its normal position when the red "GOV" light is extinguished (at the end of training when the "Auto/Manu" switch is set to "Auto") **and** as soon as the grip has been returned below the Flight range.

With MOD No. 073084, after training for a total governor failure, there is no longer a risk of leaving the stop in the disengaged position and risking an excess fuel flow when moving the grip from "fully reduced" to Flight.

2- Post MOD No. 073254

The *differences* with regard to the pre MOD version are indicated in *italics*.

2.1 Technical characteristics

Engine:
Arriel 2B1 (identical to that of the EC130 B4).

Automatic engine governor:
FADEC *two-channel* type.

FADEC-governor back-up system :
Electronic with automatic control (third channel).

Consequence of a total governor failure (red GOV light):
The fuel flow is automatically governed by the third channel.

Fuel flow control after failure:
Controlled automatically by the third channel which operates a standby metering unit via an electrical actuator.

Total governor failure flight control training:
NOT NECESSARY (refer to paragraph 2.2.2).

Twist grip:
It has two stable positions: "Idle" with the grip in the reduced position and "Flight" in the normal position.
Between these two positions, the grip is unstable and automatically returns to the "Flight" position.
Note: there is no useful range beyond the "Flight" position.
Note: the grip does not control any mechanical linkage, only an "Idle/Flight" electrical control switch.

The grip has *two* operating modes:

- Normal "Flight" mode:
  - the grip is in the "Flight" position,
  - the FADEC governor operates normally and governs the rotor speed.
- "Idle" mode:
  - in the fully reduced position, the grip activates an electrical switch which sets the engine to idle NG (zero power) via the DECU,
  - during reduction, governing is automatic, exactly as in the "Flight" position,
  - the (red) "TWIST GRIP" light illuminates and the GONG sounds.

2.2 Training procedure

The behavior of the equipment during the auto-rotation training procedure described in the Flight Manual is explained below.
There is no longer any training for the engine governor failure.

2.2.1 Auto-rotation training

The engine power must be reduced to simulate an engine failure. From the "Flight" position, the pilot reduces the twist grip. *The "TWIST GRIP" light illuminates and the GONG sounds but engine operation is not modified. On reaching the "Idle" position (rotation of about 45°),* the engine idle electrical switch is activated. The DECU sets the engine rating to idle, the NG of which is reduced to zero power. The pilot then reduces the pitch to change to auto-rotation.

Auto-rotation flight control procedure: refer to the Flight Manual.

Inversely, from the "fully reduced" position of the grip (45°), if the pilot turns the grip to the "Flight" position, the grip releases the electrical switch (at about 40°) to "Flight", which allows the automatic governor to operate normally. *When the grip reaches the "Flight" position, the "TWIST GRIP" light is extinguished.* The behavior of the engine will then depend on the rotor speed (NR) at this time:

- If the NR is greater than the nominal governing speed*, the engine remains at zero power, with only a slight variation in the NG rating (small increase to approximately 71% NG).
- If the NR is less than the nominal governing speed*, the engine is re-synchronized by its free wheel and then increases its power to re-accelerate the rotors to the nominal NR governing speed*. The engine acceleration is programmed in the FADEC and lasts approximately 9s between zero power and maximum continuous power (MCP).

* Normal NR governing range: 390 to 394 rpm.

Comment:
As soon as the electrical "Idle" switch has been released (rotation of grip less than 40°), *the FADEC automatic governor operates nominally and the pilot can* ***accompany*** *the twist grip to the "Flight" position. Moreover, the twist grip automatically returns to "Flight" if it is released.*

2.2.2 Total governor failure (red "GOV" light)

Training for a FADEC governor failure (red GOV light) is not necessary as an automatic back-up (third channel) then governs the rotor speed.
Flight control in this mode resembles the normal behavior of the aircraft.

There is a "TEST" selector to regularly check the correct operation of the back-up (third channel) ***on the ground. In flight, this selector must not be activated.***
It is located on the overhead panel, near the engine starting selector.

Ground test procedure:
On the ground, with the twist grip in the "Flight" position and the collective pitch control lever at the lowest pitch, the rotor speed is approximately 380 rpm. When the TEST selector is activated, the red "GOV" light illuminates and the GONG sounds. The rotor speed (NR) then increases to approximately 391 rpm and is stabilized in the back-up system governing range which has been automatically activated. When the TEST selector is switched off, the red "GOV" light is extinguished and the NR decreases to approximately 380 rpm.

Actual FADEC governor failure:
The failure is indicated by the illumination of the red "GOV" warning and the activation of the GONG.
The back-up (third channel) automatically comes into operation and is immediately active.
In this back-up mode, the pilot must avoid rapid movements of the collective pitch control lever.
During the approach, the pilot must prevent the engine speed NG from dropping to below 80%; otherwise, with a lower NG, the power recovery time is appreciably increased.
Once landed, the pilot must not reduce collective pitch rapidly.

Note: if an actual governor failure occurs with low engine power, the engine is a little slow to accelerate following the power demand before reaching an NG of 80% and can give the impression that the back-up is not active.

Summary

The three following sheets show photographs of the twist grip and engine control panel in accordance with the three versions studied. They also summarize the main information.

EUROCOPTER hopes that this Service Letter will help in understanding the FADEC engine governor system as well as the controls equipping the Ecureuil with the Arriel 2 engine.

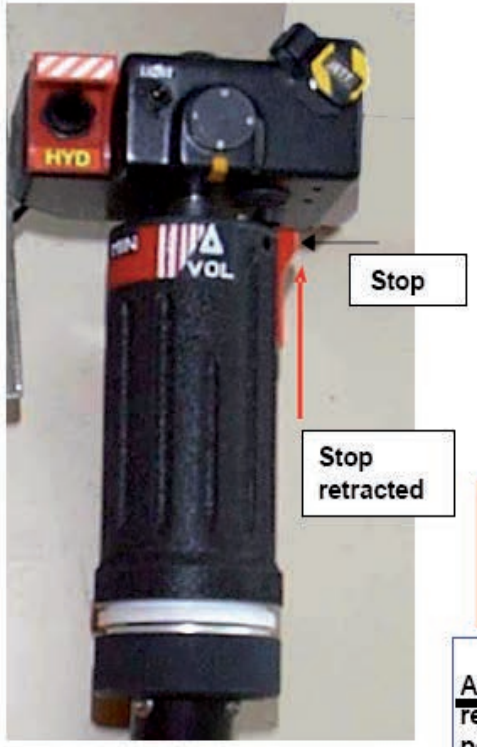
Kind regards.

M. SOULHIARD

Technical Support
Operations Director

Pre MOD 073084 and 073254

When the grip is not in the Flight position — Twist grip



Caution: there is no indication as to whether the Flight stop is engaged or not. This must be disengaged only during governor failure training or in the event of an actual governor failure and the pilot must make sure that the stop is re-engaged after each governor failure training session.

Total governor failure training: it is **NECESSARY** and must be carried out **with an experienced instructor**

Auto-rotation training: as soon as the Idle electrical switch has been released (grip reduced by less than 30°), there is no need to rapidly return the grip to the Flight position. The pilot can take his time and check his rate of descent and flight path and calmly return the grip to the Flight position.

Sheet No. 1

Post MOD 073084

When the grip is not in the Flight position **Twist grip**

The "Flight" stop is automatically released on the pilot and copilot grips when the red "GOV" light comes on.
The stop returns to its normal position when the red "GOV" light is extinguished (at the end of the governor failure training by returning the Auto/Manu switch to "Auto") **and** as soon as the grip is returned to below "Flight".

Total governor failure training: it is **NECESSARY** and must be carried out **with an experienced instructor**

Auto-rotation training: as soon as the Idle electrical switch has been released (grip reduced by less than 30°), there is no need to rapidly return the grip to the Flight position. The pilot can take his time and check his rate of descent and flight path and calmly return the grip to the Flight position.

Sheet No. 2

Post MOD 073254

When the grip is not in the Flight position Twist grip

The **twist grip** has two stable positions: "Idle" and "Flight". Between these two positions the grip is unstable and automatically returns to the "Flight" position.
There is no range beyond the "Flight" position.

FADEC governor failure training (red "GOV" light): it is not necessary because an automatic back-up (third channel) then governs the rotor speed.

Auto-rotation training: as soon as the Idle electrical switch has been released (grip reduced by less than 30°), there is no need to rapidly return the grip to the Flight position. The pilot can take his time and check his rate of descent and flight path and calmly return the grip to the Flight position.

Sheet No. 3