

Revision 1
27 April 2007

Approval of modifications covering aircraft ferry fuel systems and overweight operation

General

Civil Aviation Authority Advisory Circulars (AC) contain information about standards, practices, and procedures that the Director has found to be acceptable for compliance with an associated rule.

Consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices, or procedures are found to be acceptable they will be added to the appropriate Advisory Circular.

In addressing a subject the use of the imperative *shall* and *must*, terms not normally welcome in an AC, is because they are associated with mandatory provisions of the Rule itself.

Each reference to a number in this AC, such as 21.505, is a reference to a specific rule within Part 21.

Purpose

This AC provides methods acceptable to the Authority for showing compliance with Civil Aviation Rule *Part 21 Certification of Products and Parts* in respect of the approval of aircraft ferry fuel systems and overweight operation modifications.

Related Rules

This Advisory Circular relates specifically to *Part 21 Certification of Products and Parts, Subpart C – Design Changes*, the approval of aircraft modifications, and also to *Part 91 General Operation and Flight Rules*.

Published by
Civil Aviation Authority
PO Box 31441
Lower Hutt

Authorised by
Manager Rules Development

Change Notice

Revision 1 re-numbers this advisory circular from AC 21-05 to AC 21-5 as part of a project to standardise the numbering of all ACs.

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Introduction

Aircraft are sometimes required to conduct a ferry flight (usually a “one-off”) that is outside the normal maximum range of the aircraft. In such cases, the use of a temporary ferry fuel system is often involved, and sometimes operation at a weight greater than the maximum weight permitted by the aircraft’s flight manual is required.

This AC details the process and requirements to be met for the approval of such ferry fuel system and overweight operation modifications.

The installation of a ferry fuel system, however temporary, is a change to the aircraft’s type design that must be approved as a modification.

The operation of an aircraft at a weight greater than that permitted by the aircraft’s flight manual is a change to the aircraft’s type design and must also be approved as a modification.

Modifications are approved in accordance with New Zealand Civil Aviation Rule Part 21, Subparts 21C and 21N. A modification may be approved if it can be demonstrated that the modified configuration complies with the design requirements that the aircraft was originally type certificated against.

CAA recognises that it is often not possible nor practicable for the operator to demonstrate compliance with all applicable design requirements in the case of ferry fuel systems and overweight operations. The operator should be able to demonstrate that:

- a) An aircraft embodying a ferry fuel system or an overweight operation for a one-off ferry flight is of a satisfactory safety standard; and
- b) Appropriate procedures, limitations and conditions, have been established to ensure the safety of the aircraft and third parties.

This AC provides guidance on the requirements to be met for the approval of a modification that installs a ferry fuel system and/or overweight operation. It includes associated limitations and conditions to maintain an acceptable level of safety, and details the approval process and other related activities.

NOTE: This AC applies to small un-pressurised fixed-wing aircraft type certificated against FAR Part 23 or an equivalent set of design requirements.

If operators propose a similar modification for a helicopter or a larger aircraft, or a pressurised fixed-wing aircraft, then they should contact the CAA Aircraft Certification Unit for further advice. The basic requirements of this AC will be applicable but there may be additional requirements.

Ferry fuel systems

A temporary ferry fuel system typically involves the installation of an additional fuel tank or tanks, in either the passenger or cargo compartments. Agricultural operators with agricultural aircraft equipped with a hopper may want to convert the hopper to a fuel tank.

The two basic concepts of ferry fuel system are—

- a) The **Top-up** system. A system where fuel from the ferry tank is fed into the main fuel tank/s as fuel from the main tank/s is expended and the basic operation of the original fuel system is unchanged.
- b) The **alternative** system. A system where a fuel selector valve selects fuel from either the original fuel system or the ferry fuel system. This system is typically used for agricultural aircraft utilising the hopper as a fuel tank.

Ferry fuel systems are intended for use only during the cruise portion of flight and not during take-off, climb or landing. Nevertheless, the operator should ensure that the ferry fuel system has the capacity to supply fuel to maintain correct engine operation in all normal cruising flight manoeuvres.

In the case of a **top-up** system, the basic fuel system is largely unchanged and it is only necessary for the operator to ensure the fuel flow to the main tanks is at least as great as the fuel consumption at maximum continuous power.

In the case of **alternative** systems, the operator should be able to demonstrate the minimum fuel flow required by the applicable airworthiness requirements.

The satisfactory operation of the ferry fuel system should be demonstrated. The supply of a ferry fuel schematic diagram may suffice for a simple **top-up** system. Otherwise, a test-flight may be required to confirm the basic operation of the ferry fuel system. For such a test flight, the operator will be required to apply for a Special-Experimental Airworthiness Certificate for the purposes of research and development.

NOTE: Part of the installation procedure for ferry fuel modifications involves a post-installation check flight. This check is simply to verify that the modification has been installed correctly and does not require the issue of a Special-Experimental Category airworthiness certificate. This check flight is quite different from the test flight mentioned above, the purpose of which is to determine if the basic design of the proposed ferry fuel system operates as intended.

This AC also contains guidelines for any ferry oil system. A ferry oil system would normally be required only for an older engine installation – typically a radial engine with a separate oil tank and comparatively high oil consumption.

This AC is based on Federal Aviation Requirements (FAR) **PART 23 –AIRWORTHINESS STANDARDS: NORMAL, UTILITY, ACROBATIC, AND COMMUTER CATEGORY AIRPLANES** at amendment 53 dated April 1998. It may be used for any proposed ferry fuel installation. Any applicant for a modification approval may elect to show compliance with a later certification basis than that originally used to certificate the aircraft.

Appendix I gives a detailed checklist that covers the applicable requirements of FAR 23 for typical ferry fuel installations. It includes details of those paragraphs of FAR 23 for which compliance need not be demonstrated and the reason/s why.

Overweight operations

The maximum permitted weight of an aircraft is specified as a limitation in the flight manual. The only way this can be changed is by issue of a flight manual supplement that specifies a greater maximum weight. The only way a flight manual supplement can be issued is as part of a modification approval.

The should demonstrate that:

- a) The greater weight is necessary for the route being flown.

- b) The weight increase has been kept to a minimum (e.g. no cargo or unnecessary persons.)
- c) The centre of gravity limits (extrapolated as necessary) are met and can be maintained.
- d) The minimum performance requirements are met in the overweight condition.

To meet the intent of paragraph (b) above, the weight increase over the existing maximum must comprise fuel. It is therefore almost inevitable that an overweight operation will also involve a ferry fuel system installation and so the overweight operation would be approved as part of the ferry fuel system modification.

The general principle of permitting overweight operations is that the inherent strength to allow for manoeuvres and atmospheric turbulence are utilised.

Limitations are placed on unnecessary manoeuvres and the avoidance of atmospheric conditions likely to promote turbulence.

As a general guideline a 10% increase in MCTOW is permitted without any additional engineering substantiation. Any greater increase requires engineering substantiation usually with the support of the manufacturer.

However, if the applicant can demonstrate that the manufacturer or the Airworthiness Authority of the State of Design has previously permitted a weight increase greater than 10%, then this will normally be accepted and will be subject to the same limitations. For example, the FAA has now adopted a practice for new type certificates of specifying any maximum permitted ferry weight increase on the type certificate data sheet. (See type certificate 3A13 covering the Cessna 182R model as an example.)

There are two performance requirements that need to be considered for an overweight operation:

- a) FAR 23.65 – Minimum rate or gradient of climb; and
- b) FAR 23.1041 – Engine cooling.

Flight-testing may be required to demonstrate compliance with those requirements for overweight installations in an aircraft type with no previous overweight history, or for a weight greater than previously approved. Modification approval will not be granted until a flight test has been satisfactorily completed. The applicant would be issued a Special-Experimental Airworthiness Certificate for the flight-test to be conducted.

Approval process

Any design change to an aircraft must be installed in accordance with acceptable technical data, as listed in Appendix D of Part 21. In accordance with Part 21, subparts C and N the Director of Civil Aviation may approve a locally developed modification. Either the CAA Aircraft Certification Unit or a Part 146 Certificated Design Organisation holding the appropriate delegation can grant this approval. .

These modifications are frequently “one-off” approvals that rely on on-site inspection of the installation to determine compliance with the applicable airworthiness requirements.

A Part 146 Design Organisation is often in a better position to perform this work.

A Part 146 Organisation may approve a modification that meets the guidelines given in this AC without further referral to the CAA. (Refer to the CAA web site www.caa.govt.nz for a list of Part 146 Certificated Design Organisations.)

However, the aircraft owner may have to contact the CAA to have the aircraft's airworthiness certificate re-categorised. See later section headed "Airworthiness Certificate".

All of the conditions and limitations associated with the operation of aircraft with a ferry fuel system installed are contained in the flight manual supplement and are approved as part of the technical data for the modification. Appendix III gives an example of such a supplement. This should be carefully customised to suit the particular installation.

Additional conditions of approval may be required and should be included on the form CAA 337 (available from the CAA Certification Unit) or on a Part 146 equivalent approval certificate. Examples of typical conditions of approval include:

- a) Approved for a single installation in serial number xxxxx.
- b) The re-classification of the aircraft's airworthiness certificate to a Restricted Category when this modification is embodied in the aircraft.

Ferry fuel modifications need not always be "one-off" approvals. A modification approval for multiple installations may be granted provided the following criteria are met:

- a) The modification is fully defined by drawings etc to a standard that is readily reproducible by the installer.
- b) All required tests are specified. (E.g. Pressure tests of tanks, post-installation functional flight tests, removal instructions, etc.)

An approval for multiple installations only applies to installations embodied by the originator of the modification when approved under a form CAA 337.

Technical data

A ferry fuel system installation would normally be classified as a major modification and requires a conformity certificate. *Part 43 Subpart E* –prescribes the requirement for the issue of a conformity certificate by the holder of an Inspection Authorisation, or by a person authorised for that purpose under a Part 145 Certificated Maintenance Organisation.

The modification must be fully defined to enable such a conformity inspection.

For a one-off installation the technical data defining the modification may consist of marked-up photographs, sketches, etc.

Complete engineering drawings, a parts listing and installation instructions will be required for the approval of multiple installations.

A schematic diagram of the modified fuel system is required in all cases.

The applicant should also supply instructions for the removal of the ferry fuel system especially if any blanking plates or plumbing is required unless it is very simple and obvious.

Airworthiness certificate

The provisions of Annex 8 to the ICAO Convention on Civil Aviation are no longer met when an aircraft has a ferry fuel or overweight operation modification approved that does not fully comply with the applicable airworthiness requirements. In such cases the aircraft's airworthiness certificate

must be classified in the Restricted Category and a statement made on the certificate that ICAO Annex 8 is no longer complied with.

The requirement for the aircraft to be re-classified in the Restricted Category must be a condition of approval of the modification.

The operator will need to apply to the CAA for the re-issue of an airworthiness certificate for the aircraft. The CAA may issue a Dual Category Certificate; Restricted Category for the ferry flight, and Standard Category for when the aircraft is returned to its original configuration.

The Airworthiness Certificate will also contain the following wording:

This aircraft does not comply with the International Airworthiness Standards of Annex 8 to the Convention on International Civil Aviation when operated in this configuration. For this reason, written permission to operate must be obtained from each country over whose territory the aircraft is to be flown.

The equivalent wording will also be included in the flight manual supplement that is an integral part of the ferry fuel modification.

APPENDIX I

Ferry fuel system modification approval checklist

The following is an approval checklist applicable to a typical ferry fuel system or overweight operation modification based on applicable FAR 23 requirements. It is considered complete and includes details (shaded) of those requirements that need not be considered for approval. This is based on the assumption that a satisfactory level of safety can be obtained without compliance with these particular requirements, and that compliance would not increase safety to the extent that would justify the burden of showing compliance. This list is based on FAR 23 at amendment 53 dated April 1998.

1. Identification of non-compliances with the certification basis

FAR 23 Requirement check	Y / N	Details
Is the aircraft to operate at a weight above its certificated Maximum Take-off Weight (MCTOW) or Maximum Zero Fuel Weight (MZFW)?		
Does any part of the ferry fuel system not meet the applicable design requirements?		
If the answer to either of the above questions is Yes , then the aircraft's airworthiness certificate must be re-classified in the Restricted Category and the wording specified earlier in this AC included on both the Airworthiness Certificate and the Flight Manual Supplement.		

2. Overweight operation

FAR reference	Check	Y / NA	Details
	Has the applicant demonstrated that the overweight applied for is necessary for the route to be flown?		
	Has every reasonable effort been made to keep weight to a minimum? I.e. No passengers or unnecessary equipment or cargo		
23.25 & 23.29	Have weight and balance calculations been submitted to demonstrate weight and c.g. limits can be complied with?		
23.49	Has a new V_{S1} been calculated? $V_{S1}(\text{new}) = V_{S1} \sqrt{(W2/W1)}$		

23.65 & 23.67	<p>If the weight increase is > 10% are the minimum performance requirements met?</p> <p><u>NOTES</u></p> <ol style="list-style-type: none"> 1. For multi-engine aircraft the minimum performance is a gradient of climb of at least 1.5% with landing gear and flaps retracted at a speed not less than 1.2 V_s with one engine inoperative and using maximum continuous power on the other engine(s). 2. For a single-engine aircraft the minimum performance is a steady angle of climb of 1:12. 3. Performance calculations must be corrected to ISA conditions at sea level. 		
23.305	<p>If the weight increase is > 10% has suitable substantiation been submitted; or</p> <p>Does the manufacturer or the airworthiness authority of the State of Design support the increase?</p>		
23.335	<p>Have revised V_{NE} and V_A speeds been calculated?</p> $V_A \text{ (new)} = V_A \sqrt{W1/W2}$ $V_{NE} \text{ (new)} = V_{NE} \sqrt{W1/W2}$		
23.1041	<p>If the weight increase is > 10% has adequate engine cooling been demonstrated at overweight operations?</p>		

3. Ferry fuel tank installation

Note. Shaded areas indicate requirements that need not be complied with.

FAR Reference	Check	Y / N / NA	Details
23.603(a)(2)	Materials meeting approved specifications must be used.	–	Commercial materials may be used for the ferry fuel tank if shown to be suitable.

23.853(e)	Crew or passenger compartments may not have fuel lines or tanks installed unless adequately shielded or protected.	–	Ferry fuel tanks and lines may be installed in the crew or passenger compartments provided all the guidelines of this AC are met and the aircraft is classified in the Restricted Category.
23.863	Flammable fluid fire protection.	–	This section need not be specifically addressed provided all the other applicable guidelines of this AC are met, and the aircraft is classified in the Restricted Category.
23.867(b)(1)	Is the ferry tank(s) bonded to the airframe?		
23.951(a)	Does the ferry fuel system provide the required fuel flow? NOTE: For an <i>alternative</i> ferry system a fuel flow of 150% of fuel consumption at Maximum Continuous Power (MCP) is required for gravity systems, and 125% for pump fed systems. For a <i>top-up</i> system 100% of the fuel consumption at MCP is required.		
23.951(b)(1)	Are all fuel valves marked to indicate the tanks affected and the method of operation, to ensure that fuel is not drawn from both the main and ferry tanks at the same time?		
23.951(b)(1)	If more than one ferry tank is installed, is a means provided to feed from each tank separately? (I.e. Cannot draw from more than one tank at a time.)		
23.951(b)(2)	Does each ferry tank accessible to the pilot have accessible shut-off valves? NOTE: When the ferry fuel is exhausted there must be a means to prevent the introduction of air into the main fuel system.		

23.951(c) & (d)	Turbine engine requirements for fuel icing and venting.	–	This section need not be specifically addressed provided all the other applicable guidelines of this AC are met, and the aircraft is classified in the Restricted Category.
23.953	For a multi-engine aircraft: Has the ferry fuel system been arranged to allow for an independent fuel supply for each engine?		
23.954	Fuel system lightning protection	–	This section need not be specifically addressed provided all the other applicable guidelines of this AC are met, and the aircraft is classified in the Restricted Category.
23.955	Fuel flow requirements	–	Provided a fuel flow test has been carried out to ensure fuel flow meets the requirements of 23.951(a) above, this section need not be specifically addressed.
23.957	For a <i>top-up</i> system: Has the system or operating procedures been arranged to ensure existing fuel tanks cannot be overfilled and cause an overflow out of the vents? NOTE: For <i>alternative</i> ferry fuel systems on aircraft with fuel-injected engines, if the engine has a return line to the aircraft fuel tanks, the effect of this needs to be considered.		
23.959	Has the unusable fuel supply in the ferry system been determined and added to the Flight Manual Supplement? NOTE: Unusable fuel quantity in the ferry tank may be estimated from the physical characteristics of the tank in the cruise position, by minimum fuel flow tests, or by flight test.		

23.961	Fuel system hot weather operation	–	This section need not be specifically addressed provided all the other applicable guidelines of this AC are met, and the aircraft is classified in the Restricted Category.
23.963	Fuel tanks general	–	This section need not be specifically addressed provided all the other applicable guidelines of this AC are met, and the aircraft is classified in the Restricted Category.
23.965(a)(1)	<p>Has the ferry fuel tank been pressure tested to the maximum of:</p> <ul style="list-style-type: none"> a) 3.5 psi? b) Or the maximum pressure developed during emergency landing conditions? <p>NOTES: All tanks must be pressure tested. However, the pressure test may be a leak test to 2.0 psi only under the following circumstances:</p> <ul style="list-style-type: none"> a) The tank has been manufactured in accordance with Part 21 Subpart K to a suitable engineering drawing, and the first example of a tank to that drawing was pressure tested to the pressure specified above; or b) The tank has previously been used in an approved ferry system that involved a pressure test to the full 23.965(a)(1) pressure; or c) The configuration and construction of the tank is such that it can be structurally substantiated using conventional conservative analysis. 		

23.965(b), (c), (d)	Vibration testing of tanks with large unsupported sides, integral and non-metallic tank tests.	–	Not required for a ferry fuel tank designed for temporary use.
23.967(a)	Is each tank installed and supported so that high-localised stresses are not imposed on the tank surface or mounting structure?		
23.967(a)(1)	Are suitable anti-chafing and bonding provisions incorporated?		
23.967(b)	Are all areas containing a ferry fuel or oil tank ventilated to reduce fire, explosion and toxicity hazards? Special attention should be paid to electrical equipment if located near the installation.		
23.967(d)	Fuel tanks must be isolated from personnel compartments by a fuel-proof and fume-proof enclosure.	–	This section need not be specifically addressed provided all the other applicable guidelines of this AC are met, and the aircraft is classified in the Restricted Category.

23.967(e)(1)	<p>Has each ferry tank installation been substantiated structurally against the applicable design requirements including emergency landing conditions?</p> <p><u>NOTES</u></p> <ol style="list-style-type: none"> 1. For agricultural hoppers used as tanks it may be assumed the hopper has adequate strength to retain a weight of fuel equal to the permitted hopper contents. It will be necessary to carry out the pressure test of FAR 23.965(a)(1) and to substantiate the strength of blanking plates, lids and attachments. For hoppers forward of the pilot, separate consideration of the emergency landing conditions may be required. 2. Regardless of the original certification basis of the aircraft, the load factors of FAR 23.561 at amendment 7 may be used. I.e. Upward n = 3.0; Forward n = 9.0; Sideward n = 1.5. <p>If for any particular installation the aircraft or ferry tank configuration makes it impracticable or impossible to meet this requirement, contact the CAA Aircraft Certification Unit for further guidance.</p>		
23.967(e)(2)	Retention of fuel on landing and with undercarriage collapsed.	–	This section need not be specifically addressed provided all the other applicable guidelines of this AC are met, and the aircraft is classified in the Restricted Category.
23.969	Is there a 2% expansion space provided or do the vents discharge clear of the aircraft under all anticipated ground and flight conditions?		

23.971(a)(b)	<p>Does each ferry fuel tank have a sump capacity of 0.25% of the tank capacity, or 1/16 gallon, whichever is greater, and provision for drainage of any accumulated water?</p> <p>NOTE: This requirement need not be complied with for <i>top-up</i> systems.</p>		
23.973(a)(b) & (d)	<p>Are the additional tank filler connections placarded and designed to prevent spillage within the aircraft during servicing?</p> <p>Is a suitable electrical bonding point provided?</p>		
23.975(a)	<p>Is there a vent provided for each ferry tank that has no low points?</p> <p>Is the vent designed to prevent icing or clogging with dirt?</p> <p>Does the vent discharge outside the aircraft?</p>		
23.975(b)	<p>For engines that require carburettor or injector fuel vapour return—</p> <p>Has provision for this been made for the temporary fuel system?</p>		
23.977(a)(1)	<p>Are sumps and tank outlet screens (8 to 16 mesh per inch) provided?</p> <p>NOTE: This requirement need not be complied with for <i>top-up</i> systems.</p>		
23.979	Pressure Fuelling Systems	–	Not generally applicable for ferry systems.
23.991(a) & 23.1357(b)(d) & (e)	<p>Is a new main pump required (<i>alternative</i> systems)?</p> <p>Does it have its own independent power supply and fuse, with a re-setting facility and placard, or spare fuses?</p>		

23.991(b)	<p>Is a new emergency pump required?</p> <p>And if electric, does it have an independent power supply?</p>		
23.993	<p>Are all lines and plumbing in accordance with good aeronautical practice?</p> <p>Is provision for flexibility incorporated and are flexible lines suitable for the purpose?</p>		
23.994	Fuel System Components	–	This section need not be specifically addressed provided all the other applicable guidelines of this AC are met, and the aircraft is classified in the Restricted Category.
23.995(b)(c) (d)(g)	<p>Are all ferry fuel valves—</p> <ol style="list-style-type: none"> 1. Guarded against inadvertent operation? 2. Supported so loads are not transmitted to fuel lines? 3. Not affected by gravity and vibration? and 4. Do they require a distinct action for OFF? 		
23.997	<p>Is the ferry fuel system plumbed in upstream of the existing fuel strainer?</p> <p>Or is a suitable new strainer installed?</p>		
23.999(a)	Fuel system drain capable of draining entire system.	–	This section need not be specifically addressed provided all the other applicable guidelines of this AC are met, and the aircraft is classified in the Restricted Category.
23.1001	Fuel Jettisoning System	–	Not generally applicable for ferry systems.

23.1301(a)	Are all components of the ferry system suitable for the intended purpose?		
23.1301(b), (c), (d)	<p>Are all components labelled As to their function and their Method of operation?</p> <p>Are components installed in accordance with any limitations? and</p> <p>Do they function correctly when installed?</p> <p>NOTE. A functional flight test is required to verify correct operation of the system as installed.</p>		
23.1305(a)(1)	<p>Is a fuel quantity indicator provided?</p> <p>If not, has the capacity of each tank been physically checked by filling?</p> <p>Is there a means provided to measure the fuel contents prior to flight?</p> <p>NOTE: If not practicable, (such as an agricultural aircraft hopper) a fuel quantity indicator need not be fitted provided the flight manual supplement contains clear procedures for the pilot to calculate initial fuel quantities and fuel consumption on route.</p>		
23.1309	Systems failure analysis.	–	This section need not be specifically addressed provided all the other applicable guidelines of this AC are met, and the aircraft is classified in the Restricted Category.
23.1557(c)(1)	Has the ferry fuel tank filler cap been placarded with the fuel type, grade and quantity?		

23.1581	Has a flight manual supplement been prepared using the supplement in Appendix III of this AC as a guideline?		
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4 Ferry oil tank installation

FAR Reference	Check	Y / N / NA	Details
23.1011(c)	If the ferry oil tank transfers oil to the original oil tank or sump— Is a means provided to prevent depletion of oil available to the engine below the level for safe operation?		
23.1013(a)(1) & 23.1015(a)	Has the ferry oil tank met the installation and test requirements for ferry fuel tanks (except pressure testing must be carried out to 5.0 psi)?		
23.1013(b)	Is a means provided to prevent overfilling of the original oil tank or sump?		
23.1557(c)(2)	Has the oil tank filler cap been placarded with the word <i>Oil</i> and the <i>grade</i> ?		

5. Technical data checklist

Check	Y- N/A - N
Modified Fuel system schematic diagram (all modifications).	
Definition of modification: Marked-up sketches, photographs etc, (one-off modifications), or Engineering drawings, parts list, installation instructions, (“series” modification)	
Testing Schedules: – Pressure Testing (23.965(a)(1)) – Fuel Flow testing (23.951(a)) – Post-installation functional test schedule (23.1301(d)) (See Appendix II)	
Flight Manual Supplement (See Appendix III)	
Modification removal instructions	
Application to re-issue Airworthiness Certificate in the Restricted Category (Form CAA 24021/05)	

APPENDIX II

Post-installation functional test schedule

Flight test

AIRCRAFT REG: ZK-	PILOT:
TIME FLIGHT COMMENCED:	TIME FLIGHT COMPLETED:
TOTAL FLIGHT TIME (Minimum 1 hour):	DATE:
CERTIFICATE OF FITNESS FOR FLIGHT issued by:	

I certify that I have carried out the flight detailed above and have recorded the results below:

Functional test

Functional Test	Note
Quantity of fuel in main tank(s) at commencement of flight:	
Quantity of fuel in main tank(s) at completion of flight:	
Quantity of fuel in ferry tank(s) at commencement of flight:	
Quantity of fuel in ferry tank(s) at completion of flight:	
Was the aircraft flown to the cruise altitude of _____ ft?	
Was the fuel system switched back and forth from the main to the ferry system several times with intermittent periods of operation on each system?	
Were all normal manoeuvres carried out during this time including periods on climb and descent?	
Was there any indication of fuel system malfunction?	
Was there any indication of engine malfunction or power loss?	
<p>Is the ferry fuel system a top-up type that transfers fuel from the ferry system to the main system?</p> <p>If so, was it checked that fuel could be transferred under all flight conditions with critical quantities in the main and ferry tanks, without causing overfilling of the main tanks?</p>	

Is the ferry fuel system an <i>alternative</i> type that is selected in lieu of the main fuel system? If so , was there any interruption to the engine fuel supply when changing to or from the ferry tank?	
Has the engine oil consumption been verified?	
Is the modification fit for ferry flight purposes?	

Signed: _____ CPL#: _____ Date: _____

Post-flight inspection

I certify that I have carried out a complete inspection of the ferry fuel system installed in ZK-_____ at the completion of the test flight carried out by _____ on _____, with the results as given below:

Check	Y / N
Does the installation conform to the technical data of modification _____?	
Was there any evidence of dirt or foreign matter in the following auxiliary fuel system components: Tank(s)? Sump(s)? Drain(s)? Vent(s)? Filter(s)?	
Was there any evidence of fuel leakage?	
Was there any evidence of malfunction of the engine or the fuel system?	
Is the aircraft fit for flight with the modification installed?	

Signed: _____ LAME #: _____ Date: _____

APPENDIX III

Sample flight manual supplement

CAA Approved Flight Manual Supplement

Aircraft Type _____

Serial Number _____

Ferry Fuel Installation – Modification _____

General

This Supplement is applicable to _____ aircraft serial number _____ when a ferry fuel system is installed in accordance with modification _____. The system comprises _____.

When operated in this configuration the aircraft does not comply with the International Airworthiness Standards of Annex 8 to the Convention on International Civil Aviation. For this reason written permission to operate in accordance with this Flight Manual Supplement must be obtained from each country over whose territory the aircraft is to be flown. That written permission must be carried aboard the aircraft and made available to the CAA or the authority of the country of operation at any time.

The information contained herein supplements or supersedes the basic Flight Manual only in those areas described. For Limitations, Procedures and Performance Data not contained in this supplement consult the basic Flight Manual.

CAA approved: _____

Date: _____

Modification Reference: _____

CAA APPROVED FLIGHT MANUAL SUPPLEMENT

Aircraft serial number _____

Modification _____

Limitations

1. **When operated in this configuration the aircraft does not comply with the International Airworthiness Standards of Annex 8 to the Convention on International Civil Aviation.** For this reason written permission to operate in accordance with this Flight Manual Supplement must be obtained from each country over whose territory the aircraft is to be flown. That written permission must be carried aboard the aircraft and made available to the CAA or the authority of the country of operation at any time.
2. Ferry tank(s) fuel capacity:
_____ Litres Total
_____ Litres Useable
3. Fuel: _____ minimum octane Aviation gasoline (or JET A1 etc).
4. All flights are to be conducted to avoid populous areas except as may be necessary for the purposes of take-off and landing.
5. Essential flight-crew only shall be carried.
6. Fuel from ferry tank(s) to be used in level flight only.
7. No cargo shall be carried.
8. No smoking.
9. No flight shall be attempted unless it is calculated that the quantity of oil in the oil system of an operative engine would be sufficient for the engine to continue to operate safely, until arrival at the intended destination and at each alternate destination.
10. Avoid all turbulence in an overweight condition. Flight shall not proceed unless a weather forecast indicates minimal turbulence expected for the first _____ hours of the flight. (*Overweight operations only*).
11. Airspeed Limitations: (*Overweight operations only*)
When in an overweight condition: $V_A =$ _____
 $V_{NE} =$ _____

CAA APPROVED FLIGHT MANUAL SUPPLEMENT**Aircraft serial number** _____**Modification** _____**Limitations (continued)**

12. Weight Limitations: (
- Overweight operations only*
-)

Maximum weight = _____

Maximum landing weight = _____

13. Take-offs at weights in excess of _____ shall be from paved runways only.
-
- (
- Overweight operations only*
-)

14. The route of the flight shall be over water, sparsely inhabited or uninhabited terrain.
-
- (
- Overweight operations only*
-)

15. Use of autopilot while in overweight condition is prohibited.
-
- (
- Overweight operations only*
-)

16. Placards:

In clear view of pilot,

NO SMOKING**IN OVERWEIGHT CONDITION**

VA = _____ KIAS VNE = _____ KIAS

FERRY FUEL SYSTEM FUEL MANAGEMENT PLACARD_____
(Give details of the ferry fuel management procedures)_____

Adjacent to each ferry tank filler cap,

FUEL CAPACITY: _____

FUEL GRADE: _____

Emergency procedures

Give details of any additional procedures required as a result of installation of a ferry fuel system, or overweight operation. E.g. FERRY FUEL PUMP FAILURE

CAA APPROVED FLIGHT MANUAL SUPPLEMENT**Aircraft serial number** _____**Modification** _____**Normal procedures**

1. Before refuelling, check ferry fuel vents for evidence of possible blockage. During refuelling, ensure the main fuel cock(s), the ferry fuel cock(s) (and the ferry fuel pumps) are in the **OFF** position. The main tank(s) must be replenished first.
2. After refuelling, check fuel drains for presence of water.
3. Before flight, visually check both main and ferry tank(s) that fuel and oil quantities are sufficient for the intended flight.
4. Prior to engine start, check ferry fuel pumps, if installed, and ferry fuel cock(s) at **OFF** position. Use fuel from main fuel system normally.
5. After starting engine, check engine operation with fuel supplied from ferry tank(s) by _____. Return to main fuel system.
6. When manoeuvring on the ground before and after flight, avoid fast or very acute turns and heavy braking. (*Overweight operations only*).
7. Use main fuel system for take-off and climb to cruise altitude.
8. On attaining cruise altitude, select the ferry fuel system by _____.
9. When ferry fuel is exhausted or on leaving cruise altitude, return to the main fuel system by _____.
10. If an overweight landing must be made, or if the aircraft encounters moderate or severe turbulence while in an overweight condition, the aircraft must be inspected by an appropriately licensed engineer before the next take-off to determine that the aircraft is still airworthy. The inspections performed and the findings made shall be entered in the aircraft logbook. (*Overweight operations only*).

Performance

No change

(Or, a statement regarding overweight operations.)