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DEPARTMENT OF CIVIL AVIATION

Male'

Republic of Maldives

MALDIVIAN AIRWORTHINESS REQUIREMENTS

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Subject:- Weight and Balance of Aircraft

1. Introduction

- 1.1 Civil Aviation Regulations Maldives Part 6 requires that every aircraft for which certificate of airworthiness is in force, shall be weighed and the position of its centre of gravity determined at such times and in such manner as the Director may require or approve in the case of that aircraft.

2. Applicability

- 2.1 This MAR prescribes the requirements for the weighing of the aircraft registered in the Maldives, the determination of the corresponding centre of gravity position, preparation of weight schedule and the provision of information from which the loading for flight can be correctly determined.

3. Definitions

- 3.1 **Basic Weight.** Basic weight is the weight of the aircraft and all its Basic Equipment, plus that of the declared quantity of unusable fuel and unusable oil. In the case of turbine-engined aircraft and aircraft the Maximum Total Weight Authorised of which does not exceed 5700kg, it may also include the weight of usable oil.
- 3.2 **Basic Equipment.** Basic Equipment is the unconsumable fluids (eg. hydraulic fluid) and the equipment which is common to all roles for which the operator intends to use the aircraft.
- 3.3 **Variable Load.** Variable load is the weight of the crew, of items such as a crew's baggage, removable units, and other equipment the carriage of which depends upon the role for which the operator intends to use the aircraft for the particular flight.

3.4 **Disposable Load.** Disposable Load is the weight of all persons (eg. passengers) and items of load, including fuel and other consumable fluids carried in the aircraft, other than the Basic Equipment and Variable Load.

Note: To obtain the total loaded weight it is necessary to add to the Basic Weight the weights of those Variable and Disposable Load items which are to be carried for the particular role for which the aircraft is to be used.

3.5 **Operating Weight.** The operating weight is the sum of the Basic Weight and Variable Load.

3.6 **Maximum Zero Fuel Weight.** The Maximum Zero Fuel Weight is the maximum allowable weight of a loaded aircraft without fuel. Included in the Zero Fuel Weight is the weight of cargo, passengers and crew. All weights in excess of Maximum Zero Fuel Weight must consist of usable fuel.

3.7 **Maximum Total Weight Authorised (MTWA)** Maximum Total Weight Authorised is the maximum total weight authorised for the aircraft and its contents, at which the aircraft may take-off anywhere in the world, in the most favourable circumstances in accordance with the Certificate of Airworthiness or Flight Manual.

4. **Weighing of Aircraft**

4.1 **Initial Weighing**

4.1.1 Every aircraft shall be weighed to determine the Basic Weight and the corresponding c.g. position before the first issue of a Maldivian Certificate of Airworthiness.

4.1.2 New aircraft, less than two years of age after manufacture, need not be weighed for the purpose of para 4.1.1 provided the manufacturer's certified Weight and Balance report is available and the aircraft has not undergone a major modification.

4.2 **Reweighing**

4.2.1 Aircraft the Maximum Total Weight Authorised of which exceeds 5700kg shall be re-weighed within two years after the date of manufacture, and subsequent check weighing shall be made at intervals not exceeding 5 years, and at such other times as the Director may require.

4.2.2 Aircraft the Maximum Total Weight Authorised of which does not exceed 5700kg, shall be re-weighed at such times as the Director may require.

4.2.3 An aircraft shall be required to be re-weighed if it has undergone major repair, or major alteration or there has been major change in the interior arrangement of flight deck, passenger or cargo compartments which affect the already determined weight and balance data and which cannot be accurately computed without fresh weighing.

4.3 **General**

4.3.1 When an aircraft is weighed, the condition of the aircraft (ie. the equipment and other items of load such as fluids in the tank) shall be recorded. The equipment installed should not differ from that included in the declared list of Basic Equipment associated

with the Weight and Centre of Gravity Schedule or the Loading and Distribution Schedule as appropriate.

4.3.2 The Basic Weight and a corresponding C.G. position shall be determined and entered in the weight and centre of gravity schedule or in the loading and distribution schedule as appropriate.

4.3.3 The Director may require that the actual weight of items of Variable Load be ascertained.

4.3.4 A Weighing Record containing records of the weighing and calculations involved shall be made available to the Department of Civil Aviation, and such records shall be retained by the operator. When the aircraft is again weighed, the previous Weighing Record shall be retained with the aircraft records.

4.3.5 Operators shall maintain records of all known weight and C.G. changes which occur after the aircraft has been weighed, and such records shall be retained by the operator.

5. Weight and Balance Report-Aircraft Exceeding 5700kg

5.1 A copy of the Weight and Balance Report in respect of each Maldivian registered aircraft, the Maximum Total Weight Authorised of which exceeds 5700kg, shall be supplied to the Department of Civil Aviation at the time of initial issue of Certificate of Airworthiness.

5.2 The Weight and Balance Report shall record such loading data as is essential to enable the particular aircraft to be correctly loaded, and shall include sufficient information for an operator to produce written loading instructions in compliance with the requirements of Civil Aviation Regulations, Maldives.

5.3 The Weight and Balance Report shall apply to the aircraft in the condition in which it is delivered to the user.

5.4 The Weight and Balance Report shall include the following items:-

- a) Reference number and date.
- b) Designation, Nationality, Registration Marks and the Constructor's serial number.
- c) A copy of the weighing record.
- d) A copy of the Weight and Centre of Gravity Schedule including the list of Basic Equipment, if this is separate from part "A" of the Schedule.
- e) A diagram and a description of the datum points which are used for weighing and loading and an explanation of the relationship of these points to the fuselage frame numbering system or other identifiable points, and where applicable, to the standard mean chord (SMC).
- f) Information on the lever arms appropriate to items of Disposable Load. (This should include the lever arm of fuel, oil and other consumable fluids in the various tanks which, if necessary, should be shown diagrammatically or graphically; lever arm or passengers in seats appropriate to the various seating layouts; mean lever arms of the various baggage holds or compartments).

- g) Details of any significant effect on the aircraft C.G. of any change in configuration, such as retraction of the landing gear.

6. **Weight and Centre of Gravity Schedule**

- 6.1 A Weight and Centre of Gravity Schedule shall be provided for each aircraft except that for an aircraft the Maximum Total Weight Authorised of which exceeds 2730kg. The information contained in parts "B" and "C" of the Schedule may, for new aircraft, be given as part of the Weight and Balance report.
- 6.2 For aircraft not exceeding 2730 MTWA either a Weight and Centre-of-Gravity Schedule or alternatively, a Load and Distribution Schedule shall be provided.
- 6.3 Each schedule shall be identified by aircraft designation, nationality and registration marks. The date of issue of the Schedule shall be given and the Schedule shall be signed by a representative of an approved organisation or a person acceptable to the Director. A statement shall be included indicating that the schedule supersedes all previous issues.
- 6.4 The date and reference number of the Weight and Balance report or other acceptable information upon which the Schedule is based, shall be given.
- 6.5 A copy of each issue of the Schedule shall be retained by the operator, and where the Schedule is re-issued, the previous issue shall be retained with the aircraft records. A copy of the current Schedule and any related list of Basic Equipment (Ref para 6.9) shall be sent to Department of Civil Aviation. Further, a copy of the Schedule shall be included in the Flight Manual or an approved Operations Manual, if a Flight Manual is applicable, or if this is not the case, displayed or retained in the aircraft in a suitably identified stowage.
- 6.6 Operators shall issue a revised Weight and Centre of Gravity Schedule when the weight and C.G. is known to have changed to an extent greater than that which has been agreed by the Department of Civil Aviation as applicable to a particular aircraft type.

Note: The following changes in Basic Weight or C.G. positions are considered significant and must be reported to Department of Civil Aviation.

- a) The Basic Weight of the aircraft is known to have undergone changes in excess of .5% of the Maximum Total Weight Authorised, or;
 - b) the total moment applicable to the Basic Weight is known to have changed to an extent greater than that which have been agreed by the Director as applicable to a particular aircraft type.
- 6.7 If the aircraft has not been reweighed, the revised Weight and Centre of Gravity Schedule shall contain a statement that calculation has been based on the last Weight and Balance report or weighing record and the known weight and C.G. changes.

Note: The Weight and Centre of Gravity Schedule may be in the form as shown in appendix I to this MAR. Variations in presentation are permitted provided the same are acceptable to the Director.

6.8 The datum to which the C.G. limits relate is defined in part “A” (Ref para 6.9) and this may be different from the datum defined in the Certificate of Airworthiness or Flight Manual. When a different datum is used it shall be adequately defined, its precise relationship to

the datum in the Certificate of Airworthiness or Flight Manual shall be given, and any lever arms and moments which appear in any parts of the Schedules shall be consistent with the datum so declared.

Note: In the case of helicopters, it may be necessary to present lever arms and moments about more than one axis, depending on the C.G. limits specified in the Flight Manual.

6.9 PART “A” BASIC WEIGHT

6.9.1 The Basic Weight and associated position of the C.G. of the aircraft as derived from the most recent Weight and Balance report or weighing record together with any subsequent weight and C.G. changes, shall be stated. The position (retracted or extended) of the landing gear associated with this information shall be stated.

6.9.2 Where the MTWA does not exceed 5700kg, Part “A” shall also include the list of Basic Equipment showing the weight and lever arm of each item or this information may form separate pages attached to the Weight and Centre of Gravity Schedule, with a suitable reference in Part “A” of the Schedule to this procedure.

6.9.3 When the MTWA exceeds 5700kg, Part “A” shall include the list of Basic Equipment showing the weight, lever arm and moment of each item, or shall make reference to the document in which such a list is included.

6.10 PART “B” VARIABLE LOAD

The variable load may be detailed for as many roles as the operator wishes, but for every role the weights and moments shall be given. Weights of crew members may be assumed to be not less than the weights shown in the Civil Aviation Regulations Part 15, provided that the MTWA exceeds 5700kg, or the aircraft has a total seating capacity for 12 or more persons. Otherwise, the weight of each person must be determined by weighing.

6.11 PART “C” LOADING INFORMATION

This shall include all relevant information so that, knowing the Disposable Load which is intended to be carried, the weight and the position of Centre of Gravity of the aircraft can be calculated. At least the following shall be given:

- a) The lever arm of the C.G. of a passenger in each seat.

- b) The mean lever arm of each compartment or area in the aircraft where Disposable Load, such as luggage or freight, may be placed.
- c) Any significant change in the C.G. of the aircraft (change in moment) which will result from a change in configuration, such as the retraction and extension of the landing gear.
- d) The lever arm of the C.G. of fuel, oil, and other consumable fluids or substances in each tank including any significant variation of the lever arm with the quantity loaded.
- e) The maximum total usable capacities of the tanks for fuel, oil and other consumable fluids or substances and the weight of fluids or substances when the tanks are filled to the capacities assuming typical densities.

6.12 A statement shall be made in the Schedule to the effect that it is a requirement of Civil Aviation Regulation, Maldives that the Commander satisfies himself before take-off that the load is of such weight, and is so distributed and secured, that it may safely be carried on the intended flight.

6.13 The weights, distances, moments and quantities may be given in any units provided that these are used consistently and do not conflict with the markings and placards on the aircraft.

7. *Preservation of Weight Schedule*

The Weight and Centre of Gravity Schedule shall be preserved by the operator of the aircraft until the expiration of a period of 6 months following the next occasion on which the aircraft is weighed for the purposes of this MAR.



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DIRECTOR OF CIVIL AVIATION

SPECIMEN WEIGHT AND CENTRE OF GRAVITY SCHEDULE

1. This appendix presents a specimen Weight and C.G. Schedule which constitutes an acceptable means of compliance with the appropriate requirements of MAR C 10.

Note: Imperial Units are shown on the specimen. Where it is necessary to use S.I. units these should be used through.

Specimen Schedule

Reference : NAL/286
Produced by : Loose Aviation Ltd.
Aircraft Designation : Flynor 2E
Nationality and Registration Marks : 8Q-xxx
Constructor : F.L.Y. Co. Ltd
Constructor's Serial Number : 44
Maximum Total Weight Authorised : 7300 lb
Centre of Gravity Limits : Refer to Flight Manual reference number 90/946

Part A Basic Weight

The Basic Weight of the aircraft as calculated from Weight and Balance Report/Weighing Record*

NAL/W/95 dated 31 August 1988 is : 5516 lb

The c.g. of the aircraft in the same condition at this weight and with the landing gear extended is : 127 in aft of datum

The total moment about the datum in this condition in lb in/100 is : 7015

Note: The datum is at fuselage station 0 situated 114 inches forward of the wing leading edge. This is the datum defined in the Flight Manual. All lever arms are distances in inches aft of datum.

The Basic Weight includes the weight of 5 gal unusable fuel and 1 gal unusable oil and the weight of the following items which comprise the list of Basic Equipment:-

* Delete as appropriate

	WEIGHT (lb)	LEVER ARM (in)
Two Marzell propeller type BL-H3Z30	127 each	76
Two engine driven 100 ampere alternators Type GE-361	27 each	117
One 13 Ah Ni-Cd battery CB-7	31	153
etc.	etc.	etc.

Part B Variable Load

The weight, lever arms and moments of items of Variable Load are shown below. The Variable Load depends upon the equipment carried for the particular role.

	WEIGHT (lb)	LEVER ARM (in)	MOMENT (100 lb in)
Pilot (one)		108	
De-icing fluid 1.5 gal	12	140	17
Life-jackets (7)	14	135	19
Row 1 passenger seats (two)	60	173	104
Row 2 passenger seats (two)	60	215	129
Row 3 passenger seats (two)	60	248	149
Table	8	256	20
One stretcher and attachments (in place of seat rows 2 and 3)	45	223	100
Medical stores	15	250	37

PART C LOADING INFORMATION (DISPOSABLE LOAD)

The total moment change when the landing gear is retracted in lb in/100 is : -18.

The appropriate lever arms are:-

	WEIGHT (lb)	LEVER ARM (in)	CAPACITY (Imp. gal)
Fuel in tanks 1 and 2	1368*	145	190
Engine Oil	50*	70	5.5
Forward baggage		21	
Rear baggage		261	
Passengers in row 1 seats		171	
Passengers in row 2 seats		213	
Passengers in row 3 seats		246	
Patient in stretcher		223	

Note: To obtain the total loaded weight of aircraft, add to the Basic Weight the weights of the items of Variable and Disposable Load to be carried for the particular role.

This Schedule was prepared(date).....and supersedes all previous issues

Signed.....Inspector/Engineer
on behalf of.....
DCA Approval Reference.....

*Densities - Petrol 7.2 lb imp gal; kerosene 8.1 lb imp gal; oil 9.0 lb imp gal;

Note: (Not part of the specimen Schedule) In Part B, Variable Load, of this Schedule the actual weight of the pilot is required in accordance with the Civil Aviation Regulation, Maldives for aircraft the Maximum Total Weight Authorised of which does not exceed 5700 kg or with less than 12 persons seating capacity. Hence the pilot's weight and calculated moment are omitted in the example.