Chapter 3C FATIGUE INDEX DATA

(completely revised)

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INTRODUCTION

General

1. The fatigue index is defined as a figure indicating the fatigue consumption of an aircraft as obtained from the application of the fatigue formula of fatigue-meter readings or other assessments. It follows that the fatigue index figure will be inaccurate if recording is slovenly or should the fatigue meter be unserviceable. It is imperative that all personnel are aware of these two vital aspects to the conservation and safety of aircraft.

Assessing consumption of fatigue index

2. The most accurate method of determining the fatigue index consumed is by using a fatigue meter. This instrument includes a number of counters which indicate when g thresholds are exceeded. The substitution of the g counts in a formula gives the fatigue index consumed for the period concerned. There may be several formulae for one type of aircraft to correspond with different all-up weights, different weight distribution or different marks of fatigue meter fitted.

Unmetered flying

3. Unless a fatigue meter is fitted to the aircraft, or when an installed fatigue meter is unserviceable, fatigue consumption is assessed from details of the flying carried out. Different types of manoeuvre impose varying loads on the aircraft and it is necessary to break down the flying carried out into the various sortie patterns expected in service. The particular theatre of operations may also affect the fatigue consumption of an aircraft and, in such cases, a separate factor or formula will be quoted for each theatre. It is then possible for the design authority to estimate a fatigue index consumption rate for each sortie pattern. Because fatigue damage estimates based on sortie patterns are derived from the average expected loadings, the rates are factored to allow for worst case situations. Thus, fatigue consumption assessed on a sortie pattern basis is extravagant when compared with the more accurate fatigue meter based index. Hence, it is essential that priority is always given to the replacement of defective fatigue meters.

Recording fatigue consumption data

4. The consumption of fatigue index is recorded on Form 725 (Lightning). Instructions for compilation in the Form 725 are contained in the associated Form 799/4. All personnel responsible for the collection and compilation of fatigue data should appreciate the need for accuracy, neatness and legibility of the entries. Careless or incomplete recording is dangerous if it causes a less damaging sortie to be assumed and it is wasteful if, in the interests of safety, the worst case has to be assumed. In extreme cases, continued careless or incomplete recording can result in the expensive premature removal of an air-

craft from service because of doubt regarding the true situation.

Aircraft with fatigue meters

5. The fatigue data for aircraft fitted with fatigue meters is to be recorded on Form 725 (Lightning). In respect of Form 725, the aircraft captain is responsible for action in the columns relating to the flying data. The responsibility for reading the meter and recording the information may rest with either a crew member or servicing personnel depending on the type of aircraft. The Unit Engineering Records Section is responsible for calculating the fatigue index consumed. The attention of all personnel responsible for reading fatigue meters is to be drawn to the serviceability checks described in A.P. 112G-0203-1, Chap. 2 – Fatigue Meters.

Aircraft without fatigue meters

6. The captain of the aircraft is responsible for the accuracy of columns relating to the flying data in Form 725 and, the Unit Engineering Records Section is responsible for completing the cumulative totals, factorizing the flying hours and expressing the life used as the fatigue index.

Refining of fatigue index

7. When the fatigue records for an aircraft show that its fatigue index is 80, action is to be taken in accordance with A.P.3158, Vol.2, Leaflet C6.

Changes in recording to be made on fitment of a fatigue meter

8. On fitment of a fatigue meter it will be necessary to obtain the fatigue index already consumed from the last Form 725 and carry it forward to the first Form 725 which will be brought into use on fitment of the meter.

APPLICATION

General

9. The Lightning Fatigue Information Handbook G/P1/FAT37/Book 3, available at Command Headquarters, contains the lives and relevant information for all critical components.

10. The fatigue life of the aircraft is based on that of the wing, for which there is no planned replacement. The metered formulae and unmetered factors given below, which are based on a standard average all-up weight, relate mainly, therefore, to the wing. They must also, however, be taken as applicable to the fuselage shell, because this has not been tested beyond wing failure and must thus be presumed to have a life not greater than that of the wing.

Fatigue life

11. The wing is critical in fatigue on the lower skin at the intersection with the fuselage, adjacent to the rear spar. The life of the wing, as given by the fatigue meter formulae, is governed partly by the amount of flying time spent in excess of 0.9M. It is expected, based on the current utilization programme and sortie profiles, that this amount will not exceed a certain level during the life of the aircraft. It is essential to record time spent above this speed, however, for the following reasons:-

(1) To enable the rate of build-up of these times to be monitored, so as to ensure that the limit is NOT exceeded.

(2) To allow for any changes in utilization programmes and for possible increased intensity of operations in emergencies.

(3) To facilitate the refined assessment of fatigue life required to be made at 80 Index *(A.P.3158, Vol.2, Leaflet C6 refers)*.

CRITICAL COMPONENTS AND STRUCTURES

Fin

12. The fin life is dependent on two types of damage, viz:-

(1) Thermal degradation, mainly through usage at high altitude and high speed.

(2) Fatigue damage in the spar booms at the root, mainly caused by gust loadings at low altitude combined with high speed.

Other structure

13. The CRL contains details of items with a finite life, particularly where these lives are unrelated to fatigue index.

FATIGUE CALCULATIONS

Metered flying

14. The aircraft are fitted with Mk.14 fatigue meters. The g counts recorded in the meter windows are to be multiplied by the appropriate factors in Columns A to H in the following table,

and then added together to give the fatigue index consumed.

	MULTIPLYING FACTOR
A −1.50g	0.006200
B −0.50g	0.004670
C 0.25g	0.001430
D 1.75g	0.000164
E 2.50g	0.001340
F 3.50g	0.004460
G 5.00g	0.012800
H 7.00g	0.027700

Unmetered flying

15. The fatigue index consumed during periods when fatigue meter records are not available is to be obtained by multiplying the hours flown during such periods by 0.04518.

Flight patterns

16. Any changes in sortie profiles or utilization programmes from those given in the current training syllabi may affect the fatigue formulae and factors given and are, therefore, to be reported to Ministry of Defence (Air) without delay to Ops (F) 1 (RAF) and MOD DD Air Eng.3.

Recording of fatigue data

17. Recording of fatigue data is to be on Form 725 (Lightning), which makes provision for recording of time spent in excess of 0.9M and at high speed, low level. Should the fatigue meter become unserviceable, recording is to continue on the Sortie Details part of the Form 725 (Lightning).