CHAPTER 8

LIFED ITEMS

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1. INTRODUCTION

1.1 A life limited item is one which has a limited and quantifiable useful life, and could be considered for replacement on a pre-planned basis for reliability, economic or safety reasons.

1.2 All of the items which constitute an equipment or system should ideally have an expected life at least equal to that of the parent equipment. Items whose expected life is limited should be identified during the development of equipment. Design action to eliminate the life limited item should be considered where the life of such items is less than the design life of the overall equipment.

2. SCOPE

This chapter considers the implications of using items which have an expected life which is less than the design life of the parent equipment or system. It explains that in order to determine the periodicity at which limited life items should be replaced it is necessary to firstly determine the expected life of the equipment under the and then to evaluate the effect, in terms of the planned replacement period.

3. MANAGEMENT OF LIFED ITEMS

Lifed items should be managed in the following manner:

a) Avoid the use of lifed items where reasonably possible.

b) Extend the life of lifed items by redesign or re-selection.

c) Manage lifed items using scheduled maintenance and/or condition monitoring.

4. USE OF LIFED ITEMS

4.1 The use of items whose expected life of the parent equipment will incur a support anticipated conditions of use cost of ownership, of varying is less than the design life cost. This cost will arise from the need to replace the item on a planned basis during the life of the equipment, or from the failure of the equipment if it is not replaced on a planned basis. It is therefore essential that every consideration is given to avoid the use of life limited items when designing equipments.

4.2 The planned replacement of a life limited item may incur additional support costs in the form of spare items or piece parts, maintenance personnel, test facilities, technical manuals etc. Moreover, the inclusion of life limited items in equipment may decrease the availability of the parent equipment due to the need to carry out additional planned maintenance.

4.3 Life limited items, where possible, should be designed to be replaceable in minimum time and cost.

5. DETERMINATION OF EXPECTED LIFE

5.1 The expected life of an item may be known from manufacturer's data or may be determined from trials or laboratory testing. Since the actual life of an item is likely to vary with the environmental and operating conditions under which it is used such data should be used judiciously.

5.2 Where an item has an expected life which is less than the design life of the parent equipment it does not automatically mean that the item should be considered life limited. Before an item is assigned a limited life an analysis should be conducted to determine the comparative cost of planned replacement against allowing the item to operate until failure. Where the failure of an item would result in a safety related or catastrophic system failure it is likely that such analysis will conclude in assigning a limited life. However, in many cases, the economic benefits of a repair on failure policy are significant. In order to complete such analyses a thorough understanding of the item function within the parent equipment or system is essential, as is knowledge of the envisaged operating scenario and use of the equipment. Analytic techniques such as Failure Modes, Effect and Criticality Analyses and Fault Tree Analysis (FMECA) may assist this evaluation.

6. DETERMINATION OF PLANNED REPLACEMENT INTERVALS

6.1 If lifed items are replaced too infrequently a significant number of items may fail before reaching their planned replacement age. On the other hand, if the planned replacement is too frequent, items may be removed unnecessarily early in their life decreasing system availability and increasing cost. Hence, when the use of items with an expected life of less than the design life of the parent equipment is unavoidable, the planned replacement period should be optimised to reduce the potential support costs due to early failure or premature removal.

6.2 In determining planned replacement intervals, optimisation for any single item should include an assessment of the replacement intervals of other items since support costs could be reduced and availability increased if maintenance, overhaul and item replacement periods are concurrent.

7. CONDITION MONITORING

7.1 When appropriate, the condition of items subject to degradation, due for example to fatigue, wear, corrosion or other chemical/physical processes, should be monitored as part of the maintenance schedule. This is particularly necessary for critical items whose failure might lead to hazards or high cost repair. Condition monitoring techniques include Non-Destructive Test (NDT) and inspection. Continuous monitoring techniques are also applied in certain cases, eg vibration monitoring on engines and gearboxes.

7.2 Factors that need to be considered in determining the maintenance schedule requirements are:

a) Significance of failure (hazard, cost etc).

b) Rate of propagation of deterioration.

c) Observation of deterioration (cracks, wear, corrosion etc).

d) Relevance of repair or replacement.

e) Reliability Centred Maintenance (RCM).