MAINTENANCE EVALUATION

BY

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Introduction

The Director-General Ships is responsible for the production of the first draft maintenance schedule for an equipment. He remains responsible for the content of the schedule for the first two years after a new equipment goes into

FIG. 1—HAMWORTHY FIRE PUMP—ERECTED IN TANK AT AMEE FOR TOTALLY SUBMERGED TRIALS

service. The Ship Maintenance Authority cannot alter the substance of maintenance items without reference to D. G. Ships during this period. A maintenance policy is decided upon during the design stage: whether the equipment is to be replaced in part or completely at specific intervals, or whether it is to be refitted *in situ*. A contract is placed with the Manufacturer or a Technical Publications firm to produce a BR, including operating and maintenance instructions.

Upkeep Policies

The standard upkeep policies which have been adopted are:—

A. Replacement by new equipments—scrap old

B. Replacement by new or reconditioned equipments —return old for reconditioning

C. Repair *in situ*.

D. Remove, recondition and replace.

The following subsidiary qualifications are to be applied to each of the above policies:—

1. On equipment becoming defective
2. As a result of survey or test of sample equipments
3. As a result of survey or test of each equipment
4. On attaining a specified life.

The facility that would normally be used to implement the above repair policies in a ship will be:—

A. Ships staff using on-board facilities

B. Ships staff or maintenance unit during an assisted maintenance period

C. Dockyard or specialized repair yard or contractor other than the manufacturer

D. Manufacturer.

The facility that would be used to recondition equipment ashore would be:—

1. Nil
2. Maintenance unit
3. Dockyard or specialized repair yard or contractor other than the manufacturer
4. Manufacturer.

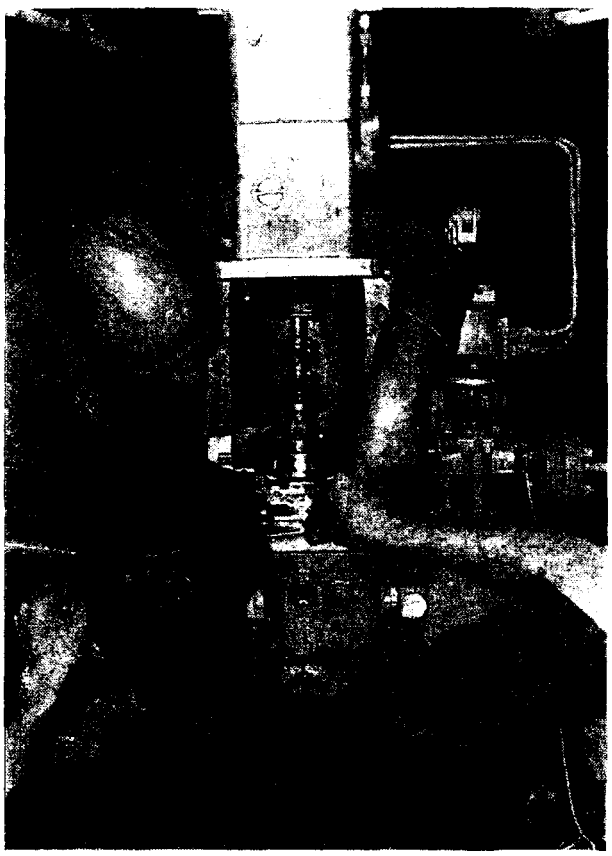

FIG. 2—Y.150 MAIN EXTRACTION PUMP—TAKING AXIAL CLEARANCE

For example, the upkeep policy code for a pump might be B4C3.

Despite efforts made at the design stage to define the maintenance task, it is still necessary to evaluate and validate that task before the equipment goes into service. Some shortcomings do not become evident until after manufacture. If these can be recognized early enough, and possibly rectified, and if the maintenance measures contained in the planned maintenance schedule are really adequate from the time the equipment first enters service, future reliability will be very much improved.

Maintenance Evaluations

For the above reasons maintenance evaluations in the sense of the upkeep philosophy prevailing are now carried out on all new equipments at some convenient stage in their test programmes. This is usually at a time when the equipment will be stripped down for dimensional inspection between test runs. The need for maintenance which can be quickly and easily undertaken is borne constantly in mind.

These exercises are carried out by the staff of the Captain-in-Charge, Ship Maintenance Authority, either at a test establishment or at the maker's works. The majority take place at the Admiralty Marine Engineering Establishment, Haslar. The exercises are attended by the maker's representative, from whom advice is sought on the best methods and tools to be used. A Senior Experimental Officer and a Petty Officer Photographer of the Directorate of Fleet Work Study and Management Services attend to give advice and to take photographs. Representatives of D. G. Ships Design Sections visit during the exercise.

Aims of Maintenance Evaluation

Maintenance evaluations are undertaken to cover the following aspects:—

Maintainability

The equipment is to be examined for design, accessibility and ease of maintenance, constructively criticized as necessary.

Support Equipment

The need for special tools, test equipment, lifting and guide gear, etc., is to be examined and expressed. Where available the items should be proved in their intended function.

Maintenance Appraisal

(*a*) The maintenance schedule provided is to be critically examined, each routine being challenged for need and frequency. Additional routines

No. of Sheets:
Sheet No. 1

MAINTENANCE SCHEDULE

H.M.S. CLASS:

Schedule Item	MAINTENANCE INSTRUCTION	S.S. work except where shown	Schedule No.	

TITLE	Number Fitted
	SCHEDULE No.

BREAKDOWN SCHEDULE

EQUIPMENT :—

IDENTITY LIST No. :—

TASK No.	DESCRIPTION AND LIKELY LIMITS OF FAILURE	REPAIR ACTION		
		S.S.	B	D

FIG. 4

are to be proposed as necessary. A revised draft maintenance schedule is to be provided.

(*b*) For each routine in the revised draft maintenance schedule (FIG.3):

(*i*) Prepare a job method, or state 'self-evident'

(*ii*) State the spare gear, tool and stores requirements

(*iii*) State the skill and level and time content for each skill

(*iv*) State the total down-time

(*v*) State where necessary, the test facilities/operations required.

Breakdown Appraisal

The areas of likely breakdown not covered by maintenance schedule items are to be identified and stated. The actions in para (*b*) (*i*)-(*v*) are to be carried out for each likely breakdown (FIG. 4).

Equipment Upkeep Summary

The information required under 'Maintenance and Breakdown Appraisals' above is to be described in an Upkeep Sheet (FIG. 5), a separate sheet being used for each task. The sheets are to be grouped by equipments to form the Equipment Upkeep Summary (EUS).

Equipment Support Summary

(*a*) An abstract of the spare gear and tool requirements is to be made into a single document to be known as the Equipment Support Summary (FIG. 6). For each item, the recommended 1st, 2nd, 3rd and 4th category spares are to be stated.

(*b*) An abstract of the consumable stores requirement is to be made into a single document known as the Consumables List (FIG. 7). The estimated annual usage is to be stated.

SHEET No. 4

EQUIPMENT UPKEEP SHEET

EQUIPMENT/ASSEMBLY/SUB ASSEMBLY/COMPONENT:— POWER TURBINE REAR BEARING IDENTITY No. 02331

MAINTENANCE BREAKDOWN 3000 hr TASK No. /R.3. | DESCRIPTION OF TASK: REMOVAL, EXAMINATION, REPLACEMENT OF P.T. REAR BEARING. | B.R./T.P.No. ARTICLE

OPERATION No.	OPERATION	TOOLS/MATERIALS/SPARE GEAR /SUPPORT EQUIPMENT	MAKER'S BASIC PART Nos.	AD REF No.	RATINGS		TOTAL TIME		EQUIPMENT DOWN TIME
					SK	UNSK	SK	UNSK	
9.	Insert 4 holding down bolts complete with new tabwashers. Tighten down diagonally and torque load to 150 lb Ft. clench tabs.	'C'—Bolts $\frac{3}{4}$ U.N.F. 'A'—Tabwashers 112 AF socket $\frac{1}{2}$" Sq. Dr. Extension $12\frac{1}{2}$" Sq. Dr. Handle Ratchet $\frac{1}{2}$" Sq. Dr. Torque Spanner	9100890294 8100710023 EVT. 2700 R.	 0277/910-6366 0277/910-6320 0277/910-6330 	1	1	0·15	0·15	
10.	Replace resistance bulb ensuring bulb is fully inserted without bottoming. Tighten gland nut and wire lock.	'B'—Resistance bulb * 11/16 × $\frac{5}{8}$" DSF OJ.DE Spanner Locking wire St.St. 22 S.W.G. Wire locking tool	BDA. 1708 81003740166 	 0277/910-6321 0277/124/0460	1	1	0·10	0·10	
11.	Replace oil restrictor in cap oil inlet aperture, remove red caps and insert ringed end of oil supply pipe in oil feed block secure retaining plate with 3 × $\frac{1}{4}$" studs and tabwashers and new 'O' seal. Secure pipe to bearing cap with 4 in No. $\frac{3}{8}$ U.N.F. bolts and tabwashers and new gasket. *Note:* 2 off $\frac{3}{8}$ U.N.F. bolts are longer to take wear detector bracket. Clench all tabs.	'A'—'O' seal (pipe to dist. block) Gasket (pipe to brng cap) Tabwasher (3 off) Tabwasher (4 off) 'B'—Restrictor—oil metering * 'C'—Setbolt $1\frac{1}{4}$ U.N.F. (3 off) Setbolt $\frac{3}{8}$ U.N.F. (2 off) Setbolt $\frac{3}{8}$ U.N.F. (2 off) 44 × 40 AF D.E. Ring 56 × 62 AF D.E. Ring NB. STAR * RECLAIMABLE, RETURNABLE, PERMANENT SPARE GEAR, ETC.	FBS. 1210 47-11-024945 S100710016 8100710018 47-11-036589 9100890072 9100899135 9100890136 	 0277/910-5968 0277/910-5969	1	1	0·15	0·15	

FIG. 5

SHEET No.

EQUIPMENT SUPPORT SUMMARY

EQUIPMENT/SYSTEM:— IDENT. No.

LINE	MAKER'S BASIC PART No.	AD. REF. No.	CLASSIFICATION P—PERMANENT C—CONSUMABLE	SUPPORTING ESU No.	PROPOSED ALLOWANCES				M.O.D. (N) REMARKS
					1	2	3	4	

FIG. 6

SHEET No.

CONSUMABLES LIST

EQUIPMENT/SYSTEM :— IDENT. No.

LINE	DESCRIPTION OF ITEM	PATT. No. MAKER'S No.	SOURCE	ESTIMATED ANNUAL USAGE	MOD (N) REMARKS

FIG. 7

Operator/Maintainer Information

The information provided for the following is to be critically examined and, where possible, physically proved:—

(*a*) Setting to work
(*b*) Testing and tuning
(*c*) Operation
(*d*) Breakdown drills
(*e*) Fault finding.

The schedule, recording and summary sheets are forwarded to D. G. Ships with the final report of evaluation for distribution on a need basis. Additionally, the clear area round the equipment to allow for maintenance is defined and included in the final report.

Reporting and Discussion

On completion of the exercise an initial report is prepared by the SMA in which recommendations are made for the revision of the draft maintenance schedule, items for inclusion in the BR, and any changes in design to improve maintainability. The standards of manufacture, assembly and finish are criticized. The emphasis is on the 'coal face' opinion of the naval personnel of the SMA based on their own experience, and the background data on similar equipments held in the SMA. The report is discussed at a meeting attended by representatives of D. G. Ships, the makers, AMEE and SMA. The actions to be taken resulting from the report remain the responsibility of D. G. Ships, but an attempt is made to bring the recognized maintenance shortcomings of the equipment to the attention of his representatives in the presence of the makers.

As a result of the exercise and subsequent discussion, a final report is prepared and forwarded to D. G. Ships for distribution to the Headquarters Sections concerned with design, manning, stores and spare gear and book-writing.

The information on the Equipment Upkeep Sheets is also used by the SMA to compile the Job Method Cards. These cards accompany the appropriate planned maintenance cards in the E2 system.

Machinery Evaluated to Date

Some of the equipments on which maintenance evaluation exercises have been carried out are:—

Type 82 GMD	2000 kW AEI turbo alternator 3 ton/hr Buckley & Taylor flash evaporator Y. 150 Weir T/D extraction pump Y. 150 Weir M/D deaerator extraction pump
Type 42 Destroyer	Reavell HP air compressor Hamworthy M/D fire pump

A maintenance evaluation team has been established at Rolls-Royce Works, Ansty. This team is evaluating the maintenance and support requirements of the main propulsion system of the Type 42 destroyer.

Conclusion

In some instances all the aims cannot be realized but, in general, maintenance evaluations will allow better material support and information to be provided to the user/maintainer on the first introduction of an equipment into service.