PRESERVATION OF MACHINERY SPACE BILGES

BY

D. K. BROWN, M.ENG., C.ENG., F.R.I.N.A., R.C.N.C.
(*Ship Department*)

Introduction

Since the introduction of steam as a means of propulsion in warships, those responsible for the design of machinery spaces have tended to regard the bilges as a natural sump into which may be drained hot and cold water—both fresh and salt—and a variety of oils, some of which are remarkably good paint strippers. Before World War II, there was no serious problem since the galvanized plating then in use was able to withstand this attack. Galvanizing was abandoned during the War, initially as an economy measure and later because of serious welding problems.

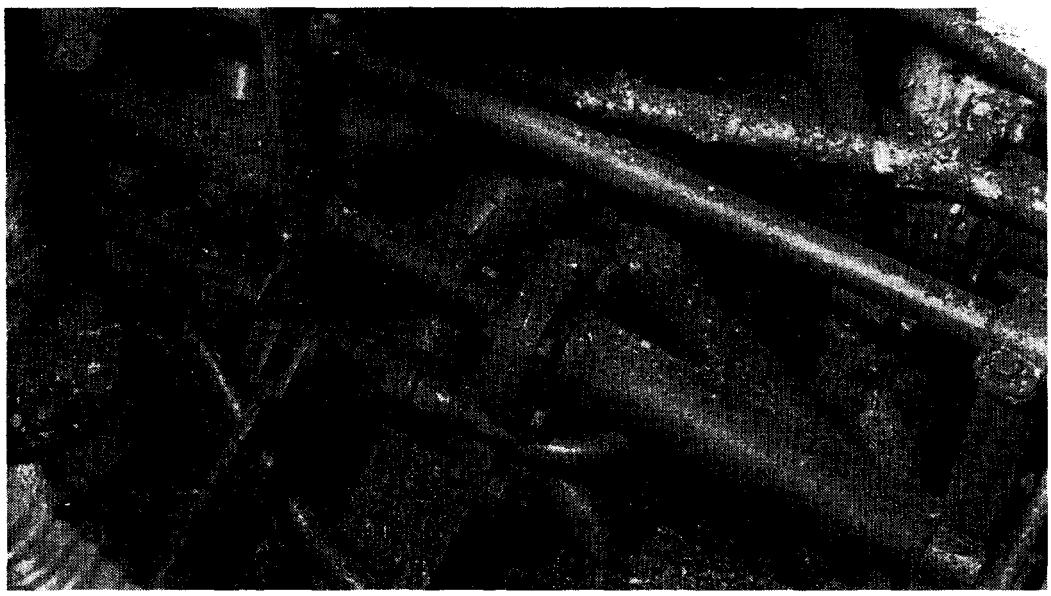

FIG. 1—THE PROBLEM

For some years after the War, the practice of building warships with uncoated mild steel protected by simple oil-based paints continued. By 1958 it was obvious that the rate of corrosion in the Fleet was causing a serious and expensive problem in the renewal of plating during refits and it was decided to introduce an improved protective scheme.

This scheme is in two parts: firstly, the steel is sprayed with metallic zinc to a thickness of 150 microns, and, secondly, since zinc itself will waste away at about 25 microns per year when unprotected in bilge conditions, the zinc has to be given a secondary protection using paint. It is difficult to find a suitable paint for this task as it is necessary to resist not only mechanical damage during machinery installation but also chemical attack from all the liquids present in the bilges. In some areas there can also be impingement attack by boiling water. The material chosen in 1958, and endorsed by several working parties since, is chlorinated rubber paint (CRP). This material is tough and relatively impervious to water and oils and also, when clean and dry, is easier to overcoat than alternative high-duty paints.

Oleoresinous paints, such as Admar, are not suitable for this purpose since they are softened by oils found in bilges and, worse still, can saponify with the coating forming zinc soaps. Unfortunately, the great majority of ships in service have had their bilges contaminated with such paints and, since it is not possible to put CRP over an oil-based paint, the whole paint scheme has to be removed at great expense during the refit.

During Building

Application of the protective scheme during building costs about £25 000, a considerable figure even at today's prices. Work cannot start until all the structure, even small brackets and clips, is complete and welded in place not only in the machinery spaces but also on the other side of the bulkheads. The whole area is then cleaned by abrasive blast to a white metal finish. This is a slow process: one man can clean about 32 m^2 per day so it takes about five weeks to cover the machinery spaces. All grit particles must then be removed from the structure, staging and ladders before the spraying can start.

Metal spraying must be done as soon as possible after the blasting and this is followed by the painting. The whole operation is checked by the shipbuilder's

QA staff, monitored by naval overseers. Machinery installation will inevitably damage the paintwork as will the bits of welding work which have been forgotten. These areas will be touched up with CRP as soon as possible.

By the time the ship is complete, the paint coat should be intact but it will have got very dirty. The paint will be cleaned as far as possible and a cosmetic coat of CRP applied for the final inspection. At least one case has been discovered where a shipbuilder ruined the whole scheme by applying a gloss paint at this stage.

In Service

There is much that a ship can do to improve the life of bilge coatings. First and foremost, no liquid should be dumped into the bilge if alternative arrangements can be made. The bilges should be kept as dry as possible and regularly cleaned with detergent. It will not be possible to remove all discolouration by detergent washing and marks remaining must be accepted. Any attempt to hide the discolouration by painting over will do more harm than good. Where jets of hot water or oil impinge on the surface, GRP trays should be made and used to take the shock.

If the paint breaks down exposing bare metal, the best procedure is to leave well alone until specialist advice can be obtained (e.g. C.-in-C. Fleet's technical staff or D.G. Ships (253)). If it is possible to get the area really clean and dry, then the damage can be made good with chlorinated rubber paint. For small areas (up to 3 m^2) the safety precautions required are minimal and mainly involve keeping welders and naked lights away. A D.C.I. will be published shortly giving full details.

Only if corrosion is severe and rapid should material other than CRP be applied to the bilges. The instructions will allow, under these circumstances, not more than two frame bays to be painted with Red Admar and will require a written report to be rendered giving the details.

Refit Painting

At normal refits, it should be possible to make good a basically sound CRP coating. If the coating has been contaminated with oleoresinous paint, then all the dockyard can do will be to overpaint with yet more of the same paint leaving the ship with a heavier maintenance task.

In a long refit, the old paint will usually be removed with a rinsable paint stripper and a new coat of CRP applied. This is a long job and, because of fire and health hazards, will delay work not only in the compartment but also in neighbouring compartments. The present estimate for the job is about £20 000 and it will add about two weeks to the length of the refit.

Alternatives

Over the years many alternative preservation schemes have been tried without any notable success. Both coal-tar epoxy and straight epoxy paints have been tried over bare steel though not over a sprayed zinc coat. It is now thought that an epoxy paint, similar to that used in fuel tanks, applied over a zinc coat offers the most promise for the future and trials will begin this year. Unfortunately such trials are not easy to plan or supervise since to prove that a paint will last ten years takes ten years. Over this long period test patches or panels get forgotten or overcoated with incorrect materials and it is hard to draw the correct conclusions.

Some effort is being put into improving cleaning methods so that touching up or re-coating is less difficult. The standard of cleanliness required for the application of high-duty paints is very severe and, once again, no easy answer is likely to be forthcoming.

A more radical thought is to use really thick steel plate, unpainted, and accept the corrosion. Whilst it is quite possible that such a solution would be economic in the long run, it is felt that the resulting accumulation of rust would be quite unacceptable.

Through various collaboration projects, the Ship Department is aware of the preservation techniques of NATO and Commonwealth navies who have very similar problems and no better solution. The Royal Navy's liking for shiny white bilges is unique amongst NATO navies and not only restricts the choice of protection coatings but also leads to a greater tendency to apply the wrong sort of paint.

Conclusions

The real problem in bilge maintenance is that of access and, with the pressures to keep ships small, there is little likelihood of any great improvement in this area.

Preservation of machinery space bilges is a difficult, probably insoluble problem and dreams of the ideal coating are too often used as an excuse for doing nothing now. The aim of marine engineer officers of ships must be to keep the bilges reasonably clean and dry with an intact coat of chlorinated rubber paint and no rust. Shiny white bilges are almost always a sign that the wrong material has been used and that much time and money has been wasted.