NOTES FROM THE SEA

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Grease Packed Stern Tubes

Three ships have recently suffered excessive temperature of stern tube bushes while conducting post refit trials. On each occasion the overheating proved due to overpacking with grease.

Grease is supplied to the bushes from a spring-loaded reservoir, the spring being of the correct rate to provide a steady feed. The spring carrier is mounted on a threaded spindle which can be followed up to maintain a constant spring rate. Excessive use of the follow-up results in the spring becoming close-coiled and the grease being injected under high pressure. In extreme cases the grease packs solid to the extent of permitting removal of the gland packing without leakage of water occurring. In this condition both lubrication and cooling is lost.

In the above three cases, two were cured by slackening back on the stern gland until sea water leakage at the gland was achieved, and in the third case it was necessary to connect firemain pressure to the gland greasing connection. In all three cases subsequent trials were satisfactory.

Comment

Care should be taken that only spring force is applied to the grease. A small water leakage is desirable in that it indicates that the bushes are not being overpacked.

'Leander' Class Air-Conditioning Plant Chiller Failures

Several ships have suffered failures of chillers through freezing. In one instance the chilled water system pressure was observed to rise when the plant was shut down for a short period. Testing the pressure tank vent with a lamp revealed that Freon was present and further investigation showed water in the compressor sump.

On opening the chiller, the tubes at the liquid inlet end were found to have collapsed and several were leaking.

The resulting cleaning and dehydration took several days and involved a complete strip and reassembly of the compressor, vacuum dehydration of the gas circuit and replacement of the chiller.

Because of the complex form of the flow retarders and baffles in the condensers, it was not considered practicable to dehydrate them in place and they were removed from the ship for this purpose. It has subsequently been found possible to dehydrate them in place.

The failure is attributed to the compressor starter contacts welding on so that when power was restored after a short interruption during a damage control exercise, the compressor restarted without the chilled water pump.

It is strongly suspected that freezing conditions can be obtained in the chiller after a power failure when both the compressor and chilled water pump stop simultaneously and it is recommended that, if it is known that a power failure is imminent, e.g., in a damage control exercise, the compressor is stopped some ten minutes before the power failure, leaving the chilled water pump running.

Comment

These failures highlight the lack of adequate protection devices to safeguard the chillers in these plants. All failures so far have occurred in temperate waters when chilled water temperatures have been at a maximum and extremely little margin for local freezing within the chiller exists. The low temperature cut-out thermostat is sited in the chiller outlet pipe and gives no protection if flow ceases.

For the future, the fitting of a chilled water differential pressure or flow switch, and the re-siting of the low temperature cut-out thermostat within the chiller are being investigated and one ship is carrying out a trial with an ethylene glycol solution in the chilled water system.

Lubricating Oil Pressure Failure

Shortly after proceeding to sea after undocking, both turbo-driven lubricating oil pumps tripped resulting in a total lubricating oil failure to the main engines. The engines were stopped rapidly and damage to bearings was avoided.

Subsequent investigation revealed that the F.L. pumps had tripped on overspeed due to the high lubricating oil temperature which resulted from air locks in the lubricating oil coolers.

Comment

(*i*) Heat exchangers should always be vented after undocking.

(*ii*) A continuous check should be kept on lubricating oil temperatures on getting under way.

(*iii*) Watchkeepers should keep F.L. pump speed under continuous observation.

Scab Pitting of Main Boilers

Internal examination and a Wear and Waste Test showed active scab pitting, in varying degrees, on all main boilers in an aircraft carrier. At the previous Wear and Waste Test nine months before, all boilers were in good condition.

Probable causes were:

(*a*) A short period of high salinity of 'about 140 ppm' with no subsequent internal clean.

(*b*) Frequent use of cold, aerated water when pumping up and changing water in boilers.

(*c*) Failure to add compound when pumping up to WW.

(*d*) Difficulty in keeping boilers dry while E and O during the previous refit, in spite of the use of heaters.

(*e*) In the boiler worst affected, the scab pitting had been seen some months before, but its significance had not been appreciated.

All boilers were chemically cleaned by Atlas McAlpine. The hard scabbing was successfully removed using Condenflu. A deposit of copper was then found on the internal surfaces of all boilers. This was successfully removed from two of them using a mixture of citric acid, ammonia and sodium nitrite. In the other boilers, treatment with 'Thiorea' was less successful in that traces of copper were left. This was accepted.

Comment

This incident emphasizes that the instructions in BR 3000, though sometimes inconvenient, are based on good common sense. Had they been followed, the scab pitting would probably not have occurred.

The copper deposit was almost certainly derived from the feed system where it was picked up by acidic made water.

Failure of Boiler Furnace Refractory

During a prolonged period of high power steaming in an aircraft carrier the gas casings at the rear of several boilers were found glowing red down the line of the fire row tubes. Casings and struts were badly distorted.

This was caused by the laning of furnace gases behind the back fire-row tube, combined with inferior insulation in this area.

The rear fire-row tubes were removed from all boilers and the insulation was re-designed.

Comment

This defect had almost certainly occurred before, but had passed unnoticed. The same conditions have since been found in other ships fitted with similar boilers.

Burning-out a Boiler

Soon after connecting a boiler in a destroyer, the POM(E) in charge of the boiler room noticed that the desuperheater outlet temperature was 800 degrees F. Shortly afterwards, a hissing sound was heard coming from the back of the boiler and the boiler was shut down. It was later established that two generator tubes had split and that they had been heated to over 1,000 degrees F while starved of water.

At the subsequent Board of Inquiry, it was established:

(*a*) That the IGEMA had been shut off from the time the boiler was flashed until the hissing of steam was heard.

(*b*) That the boiler was on hand feed from both auxiliary feed pumps with the main feed check wide open. No attempt was made, however, to speed up the pumps after the boiler had been connected.

(*c*) That the LM(E) who connected the boiler, whose primary duty was water tending, did not look at the water level either before or after opening the stop valves.

(*d*) Readings of feed water, taken while the boiler was partly empty, showed a gain of seven tons in an hour but no one on watch attached any significance to the readings or attempted to verify them.

Comment

Boilers are still burnt out because the water level is allowed to fall until catastrophic overheating occurs. As in this case, the subsequent Board of Inquiry discloses numerous shortcomings in organization. The simple fact remains, however, that the only way to ensure that the correct level of water is kept in a boiler is to watch it. Another point which should be understood is that it is never necessary or desirable to shut off an Igema unless some maintenance is to be carried out on the Igema itself.

Weir T.M.F.P. 15 Feed Pump

In May, 1967, a Weir T.M.F.P. 15 feed pump overspeeded and exploded while being tested after routine maintenance. Two senior engine room ratings were severely injured by flying debris from the turbine wheelcase.

The ship was steaming auxiliary in harbour and water level in the deaerator was lost. The feed pump supplying the boiler overspeeded and tripped. Almost simultaneously, the pump being tested overspeeded but failed to trip. Overspeeding shed the first row of moving blades. These accumulated within the wheelcase and machined off the second row of moving blades. The accumulated debris forced the turbine shaft upwards until the wheelcase flange bolts sheared and the top half flew off, releasing the blade fragments which injured the ratings.

Subsequent investigation showed that, although the overspeed trip bolt had operated and unlatched the trip gear, there was sufficient friction, caused by machining errors in the stop valve assembly, to prevent the spring closing the stop valve.

Immediately after the accident, all similar assemblies in other ships were examined. These examinations revealed that in some or all cases:

(*a*) The cross-section of the piston was such that at each trip-initiated closing of the stop valve, stresses in the material caused plastic deformation of the piston. This progressive 'barreling' deformation slowly absorbed the piston/cylinder clearance.

(*b*) The length of the spindle gland studs was such that the piston bottomed on the studs before the steam valve was firmly shut.

(*c*) The cross spindle which holds the stop valve in the Open position was stiff in its bushes and burred on the back face.

Comment

Any one of the defects found would be sufficient to prevent the effective operation of the emergency trip gear.

Action has been taken to alter the design of future assemblies and every effort is being made to improve quality control to prevent a recurrence of the faults discovered. In particular, the piston will have one axial slot and one associated guide screw in future.

It is not a design requirement for the wheelcases of auxiliary turbines to contain blades or fragments resulting from overspeeding. Therefore, as an additional safety measure, special guards are now being fitted to these pumps.

Failure of Lubricating Oil Supply to Turbo-driven Air Conditioning Plant

During a damage control exercise, a power failure was simulated which brought off a 3-million BTU turbo-driven air conditioning plant. On re-starting, there was a complete failure of lubricating oil to the centrifugal compressor which was extensively damaged.

Heaters in the lubricating oil sump which should come on when a machine is stopped, to keep the lubricating oil above the temperature at which it will absorb refrigerant gas, failed to do so because of the power failure. Some gas was absorbed for this reason and to make matters worse the oil cooler coolant control valve jammed open at the same time. This allowed further cooling of the oil which then absorbed a considerable quantity of refrigerant. There was a gas lock on the lubricating oil system when the machine was re-started.

Comment

An unfortunate and expensive combination of circumstances. The cooler control valve is of poor design and will be replaced. To make absolutely certain that a similar failure cannot recur, independant auxiliary lubricating oil pumps are now being fitted.

Main Refrigerating Machinery

The main refrigerator M(E) of a ship turned to with a hangover after a heavy run ashore. As usual, he set the main 'fridge to 'defrost' but forgot to re-set it to 'auto' before he secured. It was still defrosting when the duty ERA did his rounds but he did not check the temperature of the rooms, nor did he notice that the plant was still switched to defrost.

Twenty-five hours elapsed before the switch was changed from defrost to auto. Despite what had happened, the facts were not reported to the MEO and he did not become aware of them until several days later, because he failed to comply with the instruction in S.1178, Refrigerator Log (now obsolete) that 'the log is to be inspected and signed daily by an engineering specialist officer'.

The long period of defrosting in hot weather was too much for most of the contents of the cold and cool rooms which had to be condemned as unfit for human consumption. The cost to the taxpayer was considerable.

Comment

Human errors were entirely responsible for this expensive accident but the incident served one useful purpose. It focussed attention on an instruction in BR 3,000 Art. 2413 which is far from satisfactory: 'Readings need only be taken once daily on fully automatic plants, and in the case of air conditioning machinery, once every watch'. This is now being amended to read: 'Readings need only be taken once every watch on fully automatic refrigerating and air conditioning plants'. The instruction 'at least one set of readings per day is to be taken when the plant is actually running' remains unchanged.