NOTES FROM SEA

Readers are invited to discuss either the extracts or the comments in the Correspondence section of the Journal.

Y.100 'Whitby'—Allen's 350 kW Turbo Alternator

During post-refit trials in a Type 12 frigate it was found that the turbo alternator would not govern and with both 1st and 2nd stage nozzle control valves shut, the machine would continue to accelerate up to tripping speed. It was noted that although no relay oil pressure showed on the first and second stage relay valve gauges, there was a gradual build-up to 160—180 p.s.i. on the 2nd stage relay valve steam pressure gauge.

Initially it was thought that the 2nd stage control valve lids and associated double cage were leaking; these were renewed but the same symptoms were present on the subsequent run up. The alignment of the control valve to the cage was checked and found to be misaligned.

The top-half casing was removed from the ship and in the Yard factory the misalignment was corrected. New valve spindles, lids and cages were fitted to both 1st and 2nd stages. Under cold water-pressure test of 800 p.s.i. both valves and casings were tight. The top casing was subsequently tested in the steam test shop and found to leak.

Magnetic crack detection techniques applied to the rather complicated steam chest casting revealed no cracks. As a last resort, the top casing was again put under cold water-pressure test and a 1-inch crack was detected between the emergency valve chest and the 2nd stage control valve steam chest. No leaks could be seen between the control valve steam chest and turbine nozzle ring.

No major work was carried out on the turbine during the refit; the emergency valve, 1st and 2nd stage control valves were stripped and examined by F.M.U. and a new valve complete with spindle was fitted to the 1st stage relay valve and cage seats were lapped in on all three valves.

Because of the age of the machine (13 years), its previous history (two years previously the turbine had shed a blade with consequent damage to the top-half casing) and the likelihood of more cracks being present but not detectable, it was considered to be beyond economical repair. The A.M.D. spare top-half casing was fitted and the machine has since been satisfactory in service.

Durability Inspections of Boilers

DCI(RN) 931/69 introduced the use of non-destructive techniques by a newly constituted Central Boiler Inspection Unit to determine the life of boiler pressure parts. The Unit, in association with the Staff Boiler Technician are also able to carry out a more thorough examination than hitherto of the non-pressure parts of the boiler installations, and to make recommendations for repair action and re-tubing.

These recommendations will normally be available to refitting authorities very early in the ship's period in hand. It would obviously be desirable for this information to be available before the take-in-hand date, but proposals to carry out the inspections at an Assisted Maintenance Period are naturally not popular with ship staffs.

Economizer Element Failures

It was reported in the *Journal* (Vol. 18, No. 1, 'Notes from Sea') that due to a series of unexpected failures, all wedge fin economizer elements were being replaced by a modified design, and all elements would be ceramically coated.

The first ships fitted with these coated elements reported a failure within a few weeks of installation. The subsequent investigation revealed serious preferential corrosion of the small uncoated areas of the elements adjacent to the headers, although this was not the direct cause of the failure.

In consequence, it has been decided to defer the fitting of coated elements. Arrangements have also been made for changes in manufacturing techniques to reduce the risks of tube weld failures.

G6 Gas Turbines

In the 'Notes from Sea' of the December, 1969, *Journal* (Vol. 18, No. 3), an incident of over-temperaturing in a G6 gas turnine was reported. The report, together with the 'Comment' which followed, suggested that the over-temperaturing fault condition is not properly defined.

This is not true. Full details of the turbine entry temperature (TET) limitations are given in BRs 3609(1), 3110 and 3112, together with the actions to be taken during both starting and running conditions. The relevant references are:

BR	*Starting*	*Running*
3609(1)	Chap. 3, para. 2 Chap. 3, para. 32	Chap. 3, para. 4 Chap. 3. para. 41
3110	Chap. 1, para. 23(a) Chap. 4, para. 53 Chap. 4, para. 31	Chap. 1, para. 23 (b) Chap. 4, para. 53
3112	Chap. 1, para. 7(4)(a) Chap. 3, para. 45	Chap. 1, para. 7(4)(b)

The limiting TETs currently in use are:

Engine Condition	*G6/1 Engine*	*G6/2 Engine*
Running	(*i*) 850 degrees C, any one thermocouple	(*i*) 850 degrees C, any one thermocouple
	(*ii*) 810 degrees C, mean of all thermocouples	(*ii*) 835 degrees C, mean of all thermocouples
Starting	(*i*) Greater than 110 degrees C	(*i*) Greater then 110 degrees C
	(*ii*) 1000 degrees C for more than 20 seconds	(*ii*) 1000 degrees C for more than 20 seconds

Note: BRs have not yet been amended to show the 835 degrees C limit with G6/2 engines, and 810 degrees C is currently shown for all engines.

When these limitations are reached during running, power should be decreased until the TET does not exceed the limitation. In the case reported, on discovery that the TET was more than 300 degrees C higher than the limiting figure, there should have been no hesitation in immediately shutting down the engine.

When the limitations are reached during starting, the start should be immediately terminated.

The BR instructions on G6 limitations are not provided for guidance. They are intended to be mandatory, and are for the protection of the machinery.

A Lubricating Oil Fire

In a Y.136 *Leander* oil can be 'run down' to the main lubricating oil drain tank via the separators. The separators discharge into the tank through pipe fittings sited on the tank top. The Engine Room M(E) was instructed to check the amount of oil separated into the drain tank and report when it contained 380 gallons. He checked it, found that it contained 380 gallons and, without reporting, decided to shut the separator discharge. Unfortunately he mistakenly shut the thrust block lubricating oil return to the drain tank. This caused the sight glass return to flood and oil to be discharged over the turbine driven FL pump. This then caught fire!

Comment

Surely tallies are fitted and can be read by watchkeepers!

Trouble with Lubricating Oil Pressure

A *Leander* had a history of low lubricating oil pressure—approximately 30 psi. The motor driven pump had always been cut in as a matter of practice at about 50 per cent power. This practice can cause 'churning' in the gearbox and a rapid rise in gearbox bearing temperatures. It is not recommended.

After refit, the lubricating oil pressure showed no improvement, the turbo driven FL pump having been repaired by replacement. Aeration was thought to be the cause and supplies to the bearings and sprays were reduced to a minimum in order to increase the dwell time in the drain tank.

As a result of this the pressure varied intermittently between 30 and 50 psi—some improvement. A basic check of the system was instituted and 3 of the 6 filters were found shut off. These were opened up for use, in accordance with the operating BR, and a substantial quantity of air was vented from them. The result was an increase of lubricating oil pressure to approximately 50 psi at full power.

Moral—Operate systems in accordance with the regulations.

Alkalinity 3 per cent Sir! Where's the Point?

A Type 12 frigate carrying out Harbour Acceptance Trials recently obtained a most unusual boiler water test reading. For the first two weeks after raising steam all had been well. During the weekend before the occurrence both boilers had been washed through and refilled with fresh distilled water. After flashing up and going auxiliary on the Tuesday, six pounds of compound were added to the steaming boiler. This should have resulted in a reasonable boiler water condition.

The test taken in the late afternoon gave a reading of some 60 ppm salinity and *3 per cent alkalinity*. All feed tanks were immediately tested. Only a slight cloud could be found with no trace of alkalinity. The boiler compound used was analysed by the Dockyard Laboratory and confirmed correct. The non-steaming boiler was clear.

The cause was finally traced to the auxiliary boiler which had been re-coiled during the refit. Its feed pump takes suction from the auxiliary feed pump reserve feed tank suction line and excess water from the steam separator is returned to the same point.

Setting to work of the auxiliary boiler had only completed that day and initial trials were being conducted. The return water from the separator, when tested, had an alkalinity of 0·45 per cent N. This contaminated water had been drawn into the auxiliary feed pump suction and delivered direct to the main boilers.

The auxiliary boiler had been washed through before being put into use. This was not sufficiently effective to remove all the preservative and MEOs are advised when first firing these boilers to ensure that the separator drain is put to bilge.

Lubricating Oil in the Feed Water System

This was discovered when a sample of water taken from the overflow tank for a nitrate test was found to be contaminated. Examination of the overflow tank revealed a thick film of oil covering the surface of the water. The source was quickly traced to the boiler room T/A where a dirty oil drain between the HP bearing oil gland and the turbine gland was found blocked. Lub oil had leaked from the bearing through the glands and into the T/A condenser. The machine was stopped and the drain unblocked. The steam drum of one boiler was then examined for grease and found clear but afterwards, while steaming, the alkalinity of both boilers was maintained at the upper limit of 0·5 per cent to kill any grease present. All steam and water drums remained clear but a layer of grease was found on the internal surfaces of the economizer inlet headers, and to get rid of this both boilers were boiled out. The reciprocating feed pump, running on LP air, took a suction from the water drum running-down valve and recirculated water through the auxiliary feed check for 4 hours. 56 lb of boiler compound were used in each of the boilers, and a 200 lb/hr burner maintained 10 lb/sq in. boiler pressure. After recirculation the pressure was raised to 200 lb/sq in. and the boiler blown down to sea. This effectively cleared all the grease.

A weekly examination of the overflow feed tank has now been scheduled and six weeks after this incident traces of lub oil were again found, this time coming from the blower gland condensate drain. Because of the high ambient temperature and lack of space it was not possible to work on the blower while flashed up and as the ship had a long period at sea (7 weeks) before shutting down, a grease trap was devised to conserve the gland condensate (2 tons/day). This consisted of a boiler compound drum suitably drilled for an inlet pipe at the top and an outlet pipe and cork at the bottom. Connections were made using plastic hose and sheets of felt were packed into the bottom of the drum. The level was maintained above the felt and the lub oil skimmed off the surface at intervals.

Comment

These are two of the three most usual causes of oil contamination, the other being the failure of the turbo generator vacuum trip.

This failure is frequently caused by choking of the oil baffle drain. This is not easy to detect as it returns to the oil sump. This drain should be checked clear periodically; in some instances blockage of this drain has been caused by carbonized oil, particularly when the drain has been lagged into the turbine insulation.

Main Steam Failure

Several days on passage without replenishment, including a diversion at high speed to land a compassionate case, meant that fuel remaining in the ship was down to 15 per cent at the start of a R.A.S. Fuel pumps were put to high level suctions on the midship fuel tanks, but towards the end of the fuelling operation, because these tanks also required topping up, the suctions were changed over after tests for water had been made, to tanks containing fuel just received. Despite no evidence of water on testing, water had been received and 15 minutes later the boiler furnaces blacked out. The main engines were stopped, and the astern fuelling hose parted. Both boilers were completely shut down, and the fuel discharge systems cleared of water before re-flashing could take place. This ship moved ahead again after 68 minutes. Electrical power was not lost and no damage was done to any machinery. Shortly after the main steam failure, at 1100 in accordance with the Daily Orders, the 'Last Post' for Remembrance Sunday was sounded over the ship's broadcast system, and this was heard with amazement down below where all the machinery was dying. In retrospect it was a fitting touch.

The normal routine had been carried out for testing tanks, i.e., with water-finding paste down the sounding tube but the water present had remained undetected because the sounding tubes in this particular case did not extend to the bottom of the tanks. The approved A and A to fit new tubes for testing purposes only, that should have given warning of the deficiency, was overlooked. A suitable notice is now displayed at each sounding tube.

Comment

This total steam failure highlights the need to maintain a separate fuel suction to each boiler at all times. However, a problem exists in *Rothesay* and *Whitby* Class frigates which are fitted with a common suction and fuelling system when the quantity of fuel remaining is less than that required to enable both Nos. 3 and 4 tanks to be used on high suctions. In this case one fuel tank should be filled and after sufficient settling time both boilers transferred to this tank on high suction.

As soon after the commencement of the R.A.S. as possible (i.e., when there is no danger of air in the pump suction) one service pump should be put on the fuelling line. It must be clearly understood that the high level fuel tank is the most reliable suction and the other boiler is to be carefully watched. The loss of a boiler at R.A.S. speeds need not interfere with the evolution if the watchkeepers are aware of the situation. After fuelling, as soon as tanks are proved clear of water, the system should be returned to normal operation.

If the fuel tank in use during the R.A.S. has to be topped up and two separate suctions cannot be guaranteed, the R.A.S. should be discontinued until such time as both fuel tanks are topped up by transferring fuel and then settled. Both boilers should then be put on their respective high level suctions and the R.A.S. continued.

Condenseritis

The main condenser tubes are packed with Cranes S.I.A. packing at the inlet end and Branda packing at the outlet end. Due to the ferrules binding in the tube plate stuffing boxes and failing to compress the fibre ring and the cone piece, about 50 tubes have walked back in each main condenser.

The occasion of condenseritis involved one serious leak and one minor leak. The ship was on passage and it was decided not to attempt the Canterbury Test; instead the condenser was isolated and the shaft trailed. In harbour a water pressure test was carried out using the Agouti air compressor to apply pressure on top of the water; the output was sufficient to achieve 10 lb/sq in. without using the turbine gland rubber sealing rings.

The tubes concerned were tapped back and new packing was fitted at the inlet ends. The remaining tubes that had walked back were not disturbed as it was considered that tapping them back and tightening the ferrules was likely to precipitate leakage; the motto 'Leave well alone' being applicable in this case.

Comment

The policy of 'leave well alone' in the case of tubes that have walked back but which do not leak is agreed. The only permanent cure is to completely repack the inlet ends of the tubes that have walked back at the first available opportunity.

Evaporators

Now that the evaporators are fitted with demisters they produce approximately 2·4 tons/hour and the happy situation exists that one plant is adequate to meet all requirements. However, both plants can break down simultaneously and this recently happened when No. 2 evaporator circulating water/brine pump motor burnt out and No. 1 evaporator primed, fouling the demister, so that M.U.F. could no longer be produced.

A jury rig was devised on No. 2 evaporator using firemain for circulating water and the megator pump (500 gall/hr) for the brine. However, with feed water reserves running low, there was in sufficient time to prove this system and a simpler method of producing feed water, namely by re-distillation, was adopted. Ships tanks water was fed into the evaporator shell dispensing altogether with the need for a brine pump. Restriction in the use of fresh water to build up stocks was achieved by exhortation rather than by cutting off supplies. Consumption dropped from an average of 30 down to 19 tons per day and after 5 days all feed and fresh water tanks were full. On arrival in harbour the demister was removed through the top of the evaporator shell, descaled in Condenflu and replaced. On starting up, the plant quickly made pure water.

Since this incident, the Aquair pump/fresh water pump motor burnt out and another jury rig was devised, though once again the rig was not completely proved due, this time, to a delay while fitting the megator pump shoes, and the speedy arrival of a replacement motor. A satisfactory vacuum was obtained in the distiller by connecting up the air suction to the T/A condenser, and connecting the megator pump between the distiller and the fresh water cooler to replace the fresh water pump. Air connections were made using standard copper armoured hose.

Main Condensers

Soon after being built in a private shipyard, condenseritis was experienced in both main condensers of a Y.136 *Leander* Class frigate. The cause was thought to be incorrect tightening of the tube inlet ferrules (Cranes S.I.A.) which were therefore individually tightened. This was temporarily successful but after a time condenseritis reappeared in both condensers and normal corrective action was taken by identifying the leaking tube and tightening of the ferrule. No leakage occurred on the Branda outlet packing. The frequency of the occurrences of condenseritis increased and it was decided to re-tighten all 4,800 ferrules. This was done and all was well for a couple of months, and then just before the ship entered a normal refit condenseritis reappeared.

In the meantime arrangements had been made to open both main condensers and to repack all tubes. The following was found:—

All ferrules were slack requiring only 15lb ft torque to remove.

Approximately 15 tubes in each condenser were not fitted with cones at the inlet end.

The inlet end tube plates were incorrectly manufactured; tube packing stuffing boxes were threaded to the bottom with no housing to accommodate the fibre sealing ring. This allowed expansion of the ring into the thread.

Approximately 150 tubes were corroded in the vicinity of the cone.