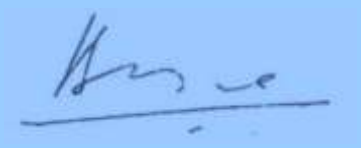
FROM THE DESK OF DEPUTY DIRECTOR GENERAL (M&M)

I am pleased to learn that Indian Coast Guard Ship Maintenance Authority (ICGSMA) is publishing third issue of "ICGSMA Bulletin". Within a short span of time, the bulletin has found wide acceptance in the field. It has served as a medium to share information on practical challenges our men encounter at sea and the dedicated efforts made by them to overcome the same within limited available resources. The articles on the marine field in 'Ready Reckoner' and 'Technology Savvy' sections add to the quality of the bulletin which makes it more informative and interesting for the readers.

I am sure, in the years to come, the bulletin would continue to bring articles on the current issues and serve as a valuable information bank which will be handy for the CG personnel, especially at sea. I wish members of ICGSMA all the best in their efforts.



(Suresh Kumar Goyal)
Inspector General
Deputy Director General (M&M)

From Editor's Desk

Greetings to all. I am grateful to all our readers for their overwhelming response towards contribution of valuable articles. ICGSMA has been flooded with articles from various afloat and ashore units. Each and every article is valuable and important to us. We are able to incorporate only few articles in the current issue due to space constraints. However all the articles received are stored in ICGSMA database and efforts are on to upload the same shortly in planned ICGSMA website on CGWAN. This issue also contains special information on vibration and harmonization.

Once again I thank all officers and men who took pain to share their professional experience by way of contributing articles and helping the venture inspiring. Any suggestions and comments for incorporating in the bulletin to make it more informative are welcome.

(VN Pillai)
Commandant
Staff Officer (ICGSMA)
For Editorial Board

Contents

Comdt(JG) Dipu CR
ICGS Savitribai Phule

PRACTICAL SHIP STABILITY FOR MARINERS: CENTRE OF GRAVITY

Stability of the ship is its state of being stable in floating condition against any forces or moments which may overturn and sink it. This article presents some practical aspects of maintaining your ship's stability by controlling the position of your ship's centre of gravity. All other technical jargons associated with ship stability like metacentric height, range of stability, static and dynamic stability etc. are not considered under the scope of this article.

The deciding factor: Centre of Gravity

A point through which all the weight of the ship acts vertically downwards is known as the centre of gravity of the ship. It is calculated and fixed for a ship by the designers at the time of construction and later confirmed through inclining experiment.

How to find out your ship's Centre of Gravity?

Refer the stability booklet of your ship. You will find different conditions of loading of the ship. Some standard conditions are

- Lightship condition
- Fully loaded departure
- Half loaded entry
- Damaged condition.

Check for the value KG at various conditions and note down. K stands for Keel and G stands for Centre of Gravity. KG is the height of Centre of Gravity from the keel. For e.g. If the KG reading for a particular condition is 3.1 m , that means the Centre of Gravity of your ship at that particular loading condition is 3.1 m above the keel .

How does the Centre of Gravity affect your ship?

The main factor of stability, metacentric height known as GM is inversely proportional to KG and is given by GM = KM-KG . The only parameter which a mariner can practically alter knowingly or unknowingly is the KG. How the same can be done is mentioned in the succeeding paragraph.

What every mariner should know and can practically do about Centre of Gravity?

The Centre of Gravity of the ship follows every moveable weight you carry around on the ship. The quantum of movement is directly proportional to the heaviness of the weight and the distance to which the weight is moved. So whenever you add/shift/remove any weight takes into account the following steps:-

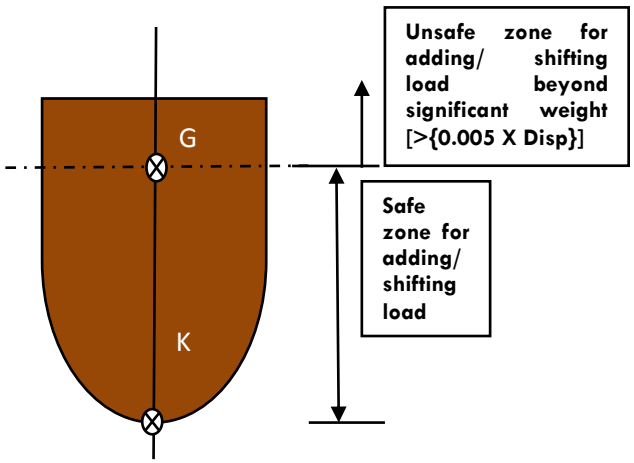
(a) Check the stability booklet and find out the largest KG value of the ship from the various conditions given.

(b) Note the position of G on the ship with respect to the main deck. For example if your ships depth till main deck is 5 m and your KG max is, say 4.1 m, it should be noted that the G is below main deck by around 0.9 m.

(c) Any loading on the ship should preferably be done in areas below this level of 'G' which may be termed as safe zone for adding / shifting of load. In the above

example the safe zone will be areas below 4.1 m from the keel so as not to deter the stability parameters of the ship.

(d) Care is to be taken before adding / shifting any significant weight in areas above this level which may be termed as unsafe zone for adding / shifting of load. As a thumb rule, any weight more than 0.5 percent of the ship's total displacement may be considered as a significant **weight**. This can include oil drums, provision stores, boatswain stores, new carpentry items etc.



(e) Removing of **significant weight** from the ship also has the same effects, but the safe zone and unsafe zones get interchanged while removing the weights from ship. Ie, removing weights from areas above 'G' is considered safe and doing same from areas below 'G' is considered unsafe.

(f) In case there is no other alternative than to add/ load / move/ remove any significant weight against the norms mentioned , an expert / naval architect should be consulted for precise calculation of the shift of 'G' as well as other stability parameters.

KC Bhatt, U/Ytk(R)
ICGS Vivek

VARIOUS TV DISPLAYS AND THEIR COMPARISION

High-Definition Television. High definition television (or HDTV, or just HD) refers to video having resolution substantially higher than traditional television systems (standard-definition TV, or SDTV, or SD). HD has one or two million pixels per frame, roughly five times that of SD. Early HDTV broadcasting used analog techniques, but today HDTV is digitally broadcast using video compression. Some personal video recorders (PVRs) with hard disk storage but without high-definition tuners are legitimately described as "HD", for "Hard Disk", which can be a cause of confusion. Some of HDTV are given below.

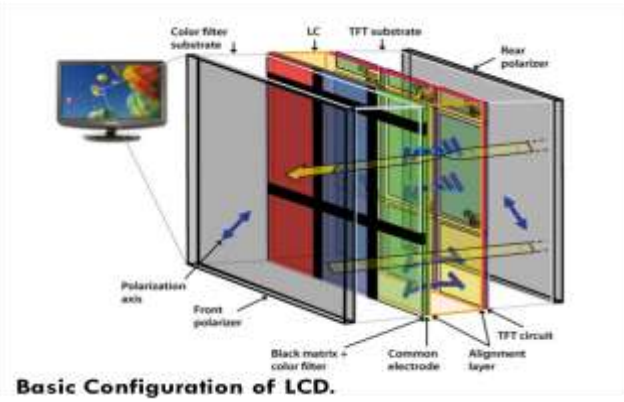
Thin Film Transistor Liquid Crystal Display.

A thin film transistor liquid crystal display (TFT-LCD) is a technology which is used in LCD monitor and television displays. TFT technology can be used to give one of the clearest pictures of any flat screen display and it uses much less electricity than older screens. TFT displays are very fragile because they are made as thin and light as possible but this means they need far less space than the older CRT displays.TFT displays are also known as flat screen, flat-panel, and liquid crystal display (LCD) but these types are not always TFTs.

TFT displays are made with a special chemical technology called chemical vapor deposition. With this special technology very thin glass can be coated with electrically conductive metal and still be transparent. Chemical vapor deposition makes the thinnest computer and television display screens possible. Some points of comparison are as follows:-

- Easy to construct and uses less electricity
- More pixels and therefore higher resolution
- Makes less radiation
- Is digital
- A format of 16:9 is much easier to produce
- Purchase price of the TFT displays is very expensive
- Display screen is very sensitive to touch (easily scratched or broken)
- In some TFT displays the view from an angle (from the side) is very dark

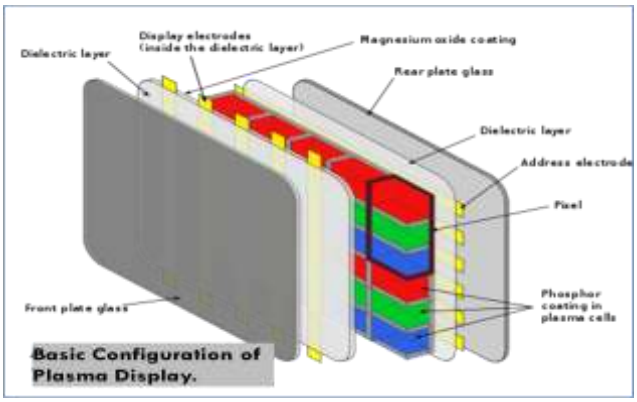
Plasma Display.



Basic Configuration of LCD.

A plasma display panel (PDP) is a type of flat panel display common to large TV displays (80 cm/30 in or larger). They are called "plasma" displays because the pixels rely on plasma cells, or what are in essence chambers more commonly known as fluorescent lamps. A panel typically has millions of tiny cells in compartmentalized space between two panels of glass. These compartments, or "bulbs" or "cells", hold a mixture of noble gases and a minuscule amount of mercury. Just as in the fluorescent lamps over an office desk, when the mercury is vaporized and a voltage is applied across the cell, the gases in the cells form a plasma. With flow of electricity (electrons), some of the electrons strike mercury particles as the electrons move through the plasma, momentarily increasing the energy level of the molecule until the excess energy is shed. Mercury sheds the energy as ultraviolet (UV) photons. The UV photons then strike phosphor that is painted on the inside of the cell. When the UV photon strikes a phosphor molecule, it momentarily raises the energy level of an outer orbit electron in the phosphor molecule, moving the electron from a stable to an unstable state; the electron then sheds the excess energy as a photon at a lower energy level than UV light; the lower energy photons are mostly in the infrared range but about 40% are in the visible light range. Thus the input energy is shed as mostly heat (infrared) but also as visible light. Depending on the phosphors used, different colors of visible light can be achieved. Each pixel in a plasma display is made up of three cells comprising the primary colors of visible light. Varying the voltage of the signals to the cells thus allows different perceived colors.

Plasma displays should not be confused with liquid crystal displays (LCDs), another lightweight flat-screen display using very different technology. LCDs may use one or two large fluorescent lamps as a backlight source, but the different colors are controlled by LCD units, which in effect behave as gates that allow or block the passage of light from the backlight to red, green, or blue paint on the front of the LCD panel.



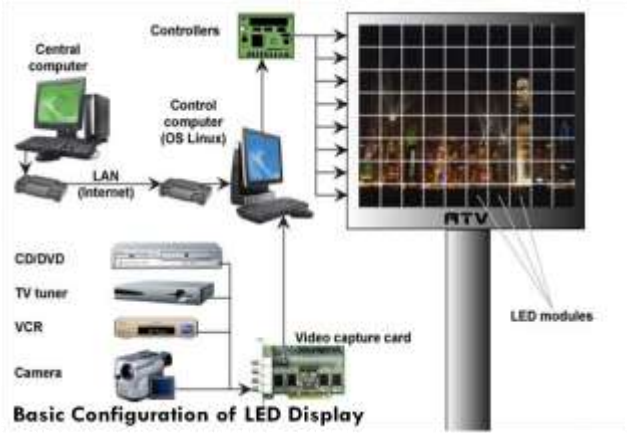
Basic Configuration of Plasma Display.

Vibration

It is sometimes difficult to decide what is a vibration and what is not. A few year ago some engineers of USA had the idea that oil could be transported cheaply by sea in 'nylon oil barges'. Experience has shown that it is indeed a commercially acceptable proposition. The oil is pumped into a long Sausage-shaped nylon bag which floats on the sea water because of the relatively low specific gravity of oil. Only the top of the bag shows above th4e surface of the water. A tug tows this 'barge' in the direction of its longitudinal axis. It all sounds rather simple. One of the most interesting of these was a vibration problem. For it was discovered that, unless proper precautions are taken, the barge executes erroneous ' Snacking ' oscillations instead of following its tug with modest docility, it prefer to follow a wild zig zag course. Vibration in which the stakes may be high, it can be a matter of life or death.

LED Display. Video LED screen is in fact a large television set. Unlike TV, LED systems are made of separate LED modules into video screens of different sizes and shapes. Information is relayed to LED modules by controllers which are connected to the controlling computer. A video processor in a PC receives video signals from different sources - standard TV signal, signal from the VCR, DVD-player, video camera, another computer and so on.

Video clips prepared in advance could be recorded on hard drive of the controlling computer and could be displayed according to a required schedule. When sufficient number of video LED



Basic Configuration of LED Display

screens was installed, a new idea of connecting all of these LED screens into a network with the unified control center emerged. Separate standing LED screens are controlled by a central computer through any of the available channels - modem, radio modem, fiber-optics, etc.

DP Singh, USE(ER)
ICGS Tarabai

LOW LOAD RUNNING OF IC ENGINE

Low load running of IC Engine is a well known concept for marine engineers and chief of the watch. However it is most ignorant part not judicially adhered to while exploiting the main propulsion machinery and diesel alternators on board ships. The reason behind this is that no sudden or immediate defect occurs but it gradually affects the health of engine and shortens the engine maintenance period. The affects of low load running of engine can be observed after long period of operation results excessive deterioration of engine components and thus higher maintenance cost.

When an IC engine is running with a load of less than 25% (naturally aspirated engine) or less than 33% (supercharged engine) of its rated load it is considered to be running at low load. Low load running is extremely harmful for the engine. Low load running of diesel engines is a serious problem faced on board ships. It is primarily due to prolong deployment/exercises at sea, evolutions requiring two D/As, excess running in under load condition leads to two basic problems.

- Insufficient air for combustion.
- Low engine oil and coolant temperature.

The turbocharger is designed to supply air for combustion in required quantities only at loads above 30%. Thus when the load on the engine is less than that the turbocharger cannot cop up with the air intake gets reduced, due to low exhaust temperatures. This leads to incomplete combustion and consequently carbonization at all parts in the vicinity of the combustion chamber surfaces like the piston crown, piston ring, fuel injectors, inlet and exhaust valves and fouling of air inlet passages. This results in deterioration in performance of the engine, fuel dilution, blow by etc. Excess carbonization of the piston crown may alter the bumping clearance of the engine.

Effects of Low Load Running

- Working temp and pressures will not be maintained.
- Partially burnt gases will leave from combustion chamber.
- Carbon particles will deposit on valves and cylinder.
- Some carbon particles form hard deposits on piston.
- Interval between successive major overhauls will be reduced.
- Piston rings will become sticky.
- Lub oil will become sticky or more viscous.
- Explosion may occur.
- Blow by may occur (combustion products leaking into crankcase is called blow by) and may lead to crankcase explosion.
- High fuel consumption.
- High lub oil consumption.
- Longer delay period.
- After burning may occur due to flames moving out in exhaust manifold.
- Overheating of crankcase and other parts.
- Over all life of engine will be reduced.
- Loss of power.
- Pre-ignition may take place (In Spark Ignition engine).

- Clogging of Injector nozzle.
- Deflection of Crank shaft.
- Deflection of Crank shaft.

Remedial Actions

(a) When low load running is unavoidable due to operational necessity, the engine should be operated at above 50% of rated load for a minimum period of 30 minutes immediately following low load running to blow through exhaust and clear carbon deposit as much as possible.

(b) Maintain the fresh water temperature of the engine to its upper limit as close as possible. This can be done either by throttling the sea water supply or by adjusting the thermostat.

(c) Try alternating the engines, if low load running is unavoidable.

Comdt(JG) VS Thakur
ICGS Vishwast

IMPRESSED CURRENT ANTI FOULING SYSTEM

Like every type of ship cooling systems exposed to the seawater, box coolers are potential victims of fouling. Although a safety margin of approximately 20% is included in each box coolers sizing, excessive biological marine growth like barnacles, mussels, algae and other types of shellfish can affect its heat transfer. Ships operating in coastal waters run the greatest risk of excessive marine growth. As a result, box coolers need to be protected. The Impressed Current Antifouling (ICAF) is a highly environmentally-friendly option for prevention of fouling.

Impressed current anti fouling system is a system designed for protection of sea water system pipe lines for protection against formation of sea weeds.

The basic function of ICAF is to prevent biological marine growth in the sea water system onboard. Barnacles, mussels, algae and another type of shell fish growth in system pipe lines and adversely affect the performance of sea water system mainly used for cooling of air conditioning system, refrigeration system, fire fighting system.

Its functional principle is based on an artificially triggered voltage difference between the copper anode and a suitable cathode. These causes a minor electric current to flow from these copper anodes, so that they dissolved to a certain amount into water for protection of cooling water system.

The ICAF system utilizes specially alloyed anodes which release low levels of copper and aluminium or soft iron into the seawater. Ionic products hostile to the marine growth are formed at the anodes and dissolve into the seawater to form a gelatinous 'floc' which is then carried by the flow of water throughout the system. This heavier floc tends to settle out into the slower-moving areas where marine growth is most likely to be a problem. The amounts of copper and aluminium released by this process are very small (typically less than 2 µg/l each), but because the action is continuous, the products accumulate, forming a thin protective coating throughout the seawater system. This coating is most effective in reducing marine fouling and corrosion.

Vibration

Electronic apparatus which is carried in aircraft or missiles as often to be supported on anti vibration mountings in order that the shaking of its environment shall not affect it. If a nut is tightened on a bolt which withstands a fluctuating load, it may work loose. For this reason slotted and castellated nuts, holding down bearing caps, split pins being inserted to lock them. One method is to tie them with wire in such a way that any tendency to slacken puts the locking wire in tension. An engine room EP, a boat operator has to pay great attention to details like this as the opening up of a bearing or the parting of a shroud could be serious.

The number and composition of anodes fitted varies in accordance with the size and type of system requiring protection. They are generally positioned at the entrance of the seawater system, although additional or 'booster' anodes are sometimes fitted downstream of the primary anodes. For corrosion reduction these anodes can be purely sacrificial or more commonly of the sacrificial / impressed current type. Anodes can alternatively be fitted in strainers or on a suitable mounting assembly installed directly into the pipeline if appropriate to the type of seawater system being protected.

The life of the anodes is calculated in accordance with factors such as volume of water to be treated, inlet size and accessibility and dry-docking schedule for the vessel.

These factors will affect the size, weight and number of anodes used and the strength of electrical current that is required. Anodes mounted inboard of the sea chest can most often be accessed / replaced without needing to wait until a vessel has been dry-docked, before gaining access.

The system is regulated by a control panel which includes instrumentation to monitor and control anode performance. The control panel also indicates when anodes need replacing providing a 2 months emergency extension period in which to carry this out. Mains voltage current is converted by the panel to low voltage DC, passing through ammeters and resistors to the anodes.

Power consumption is minimal at between 0.02 and 0.5 KW/hr which is far lower than in systems using cathodic-type protection or electro-chlorination. Location of ICAF anodes (16 Nos.) onboard ICGS VISHWAST

(a) ME seawater cooling pump (P) - 01 No.

(b) ME seawater cooling pump (S)-01 No.

(c) Gear box driven seawater pump (P) - 02 Nos.

(d) Gear box driven seawater pump (S) -02 Nos.

(e) Motor driver gearbox S/bySW pump(P)-01No.

(f) Motor driver gearbox S/by SW pump(S)-01No.

(g) DG-1 seawater cooling suction -02 Nos.

(h) DG-2 seawater cooling suction -02 Nos.

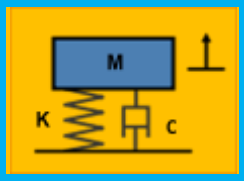
(j) DG-3 seawater cooling suction -02 Nos.

(k) DG-4 seawater cooling suction -02 Nos.

Vibration

Whenever vibration occurs, there are actually four forces involved that determine the characteristics of vibrations. These forces are:-

- Exciting force, such as unbalance or misalignment.
- The mass of system (M).
- The stiffness of vibrating system (K).
- Damping Characteristics of vibrating system (C).



The exciting force is trying to cause vibration, whereas the stiffness, mass and damping forces are trying to oppose the exciting force and control or minimize the vibrations.

UN Bharati, P/Ytk (R)
ICGS Samrat

INTERFACING OF PC WITH INMARSAT- C TERMINAL

The INMARSAT-C terminal of the ship has been provided with the floppy drive for storage of the messages in the duly inserted floppy. The drive was defective as it was unable to read the floppy.

Difficulties Experienced

As no other memory/recording device was available and if the message is not printed on receipt it would have been lost which was not acceptable at sea. The set was therefore required to be monitored constantly at sea and availability of paper roll at the printer was mandatory all the times to get the print out of the message on receipt.

Case study by Ships Staff

The repair of floppy drive was not considered as viable solution as the floppies are the obsolete data storage medium and moreover are not readily available in the market. The electrical department deliberated on the most viable option available to ensure storage of the data in an alternate medium and after analysis of the available ports on the PC and INMARSAT-C terminal, interfacing of PC with the INMARSAT-C terminal was considered and requirement of relevant software was established. However, the source and cost of the software was the stumbling block which was overcome with internet search for freeware and the software (Easy Mail) was down loaded from the internet and loaded in the PC.

Interfacing of PC with INMARSAT-C Terminal

This in-house innovation of interfacing the PC with the INMARSAT utilizing the available resources on board have ensured that the messages received are now being stored in the hard disc of PC and print outs of the received signals can be taken at the convenience of the watch keeper.

Conclusion

The latest recording medium for the signals for INMARSAT-C may be considered in the building specifications of the future project in view of floppy is the obsolete data recording medium.

Comdt (JG) GD Suresh Kumar
ICGS Vishwast

RENEWAL OF MAIN ENGINE POWER UNIT ON BOARD

Introduction. ICGS Vishwast is fitted with 02 numbers MTU 8000 series main engines having capacity of 9100 KW each. The main engines represent cutting edge marine technology with the special features namely common rail fuel injection system, sequential turbo charging, electronic engine management system, single bank cut-out mechanism, split-circuit cooling system and consolidated service end(opposite to power take-off end). ICGS Vishwast was commissioned on 17 Mar 2010 at Goa Shipyard Ltd, Goa. The ship operated nearly for about 02 months in North-West and Western region after her commissioning prior arrival at her base port Chennai.

Brief description of the defect. During passage to base port on 17 May 10, A-10 cylinder exhaust temperature of PME was found to be very low,

resulting in engine power reduction and restriction of RPM to 620 against rated full speed of 1150 RPM. Representatives of MTU (India), Pune commenced defect analysis on 20 May 10 at Chennai. During the defect analysis, the representatives cannibalized/ renewed temperature sensors, fuel injector and the MDEC to localize the defect. Based on ship staffs' proposal, endoscopic examination was carried out inside the cylinder on 31 May 10. It was confirmed during the examination by the MTU representatives that inlet valve spindle of A-10 cylinder was broken. The broken metallic particles of the spindle spoiled internal surface of the liner and piston crown.

Challenges faced during the rectification

(a) Unlike other diesel engines, the cylinder head alone cannot be removed in MTU 8000 series engines as it is a part of the power unit. The Power unit consists of cylinder head, valve gear, cylinder liner, piston assembly, connecting rod, exhaust manifold, coolant outlet jacket and big end bearings. For any repairs/ renewal of any one of the aforesaid items, the complete power unit is required to be renewed.

(b) Ship is not provided with any soft patch through which the power unit could be brought-in/taken-out.

(c) The new power unit was required to be imported from ex-MTU (Germany). The special tools and consumable spares were required to be imported from ex-MTU (Germany) and MTU (Singapore).

(d) The service engineers were required to be deputed from MTU (A), Singapore which involves cumbersome process of obtaining security clearance of foreign nationals from CGHQ, Immigration and Port authorities at Chennai and Eastern Naval Command, Visakhapatnam.

Execution of the repairs

(a) The shipping-in/out route for the power unit was worked out in consultation with MTU representatives. It required cutting of port exhaust fan base, deck coming in the main engine room and funnel deck(above the helo hangar top) to provide vertical opening.

(b) In addition, huge quantity of inway jobs were also required to be carried out prior removal of the power unit and post fitment. The details are as follows.

(i) Removal/fitment of port air cooler in FER and its system pipes.

(ii) Removal/fitment of port exhaust fan including its grill/mesh in port funnel compartment to ship-in and ship-out the power unit (approx size 1650 x 650 x 500 mm) through the exhaust fan duct.

(iii) Cutting/welding of deck coming inside the port exhaust duct and supporting frames inside funnel compartment and port funnel deck plate in consultation with Naval architect.

(c) The renewal of power unit on PME was commenced on 25 Jun 10 at Naval Dockyard Visakhapatnam. Along with renewal of the power unit, the defective lub oil pump and fuel pump PRVs were also renewed. The inway jobs post renewal of the power unit was carried out at CG Jetty, Visakhapatnam. The sea trials was completed successfully on 14 Jul 10.

Noteworthy Points/ Issues

(a) Localizing the defect took nearly about 10 days and thereafter, the materializing the special tools/spares at different stages of work progress took about 21 days. The defect could be identified earlier by the endoscopic exam.

(b) Provision of necessary soft patches for removal/renewal of major items to be considered at ship's design level. The design deficiency has been projected to concerned authorities.

(c) ICGS Vishwast is the first ship in India fitted with MTU 8000 series engines. The removal of

power unit is a rare occasion and the requirement arises during 18,000 hourly routines only.

(d) The defective power unit was sent to MTU (Asia) for failure analysis. The firm intimated that the defect is attributable to material failure of the valve spindle. The probable reasons for the material failure are improper heat treatment, pitting, scratch on the polished surface, localized/ residual stress occurred during manufacturing etc.

C-142

EXCESSIVE CORROSION ON TRANSOM FLANGE ASSEMBLY AND SHAFT PROTECTION TUBE

Brief History.

ICGS C-142 is originally designed by M/s Thornycroft Maritime and Associates, Australia and has been constructed at ABG Shipyard, Surat. The vessel is aluminum construction and is of LRS Class + 100 A1 SSC Patrol Mono + LMC HSC G5. The Interceptor boat was commissioned on 08 Feb 2002.She is based at Porbandar. The Coast Guard has 10 Nos Interceptor boat.

TRANSOM FLANGE ASSEMBLY AND SHAFT PROTECTION TUBE

The Interceptor boat is fitted with two water jet propulsion system, which is made by KAMEWA, Sweden.

The principal components are inlet duct, pump unit with an outlet nozzle shaping jet and steering & reversing gear. The inlet duct is integrated into hull along with shaft protection tube and transom flange assembly for fairing up to hull.

Defect. The Interceptor boat was docked on 23 Jan 11 for annual under water jet routines at Ourum ship yard, Okha by M/S Vishwakarma mechanical works. On dismantling, water jet assembly

TRANSOM FLANGE ASSMBLY AND SHAFT PROTECTION TUBE

"excessive metal erosion from both transom flange assembly and shaft protection tubes " were observed. The state of material can be seen from the attached photographs. The sacrificial anodes were also not consumed.

Suggested Remedial Measures:

(a) M/S Rolls Royce recommended grinding and welding of both Transom flange with welding rod Esab OK Autrod 18.04 or Esab OK Tig rod 18.04.

(b) The old records of the boat also revealed erosion of material on above mentioned components on previous docking in 2007.The cold repairs were undertaken by applying Belizona putty.

(c) LRS recommended for crop and renewal of shaft protection tube.

ICGS Sagar

FAILURE OF AIR CONDITIONING PLANT

Introduction

ICGS Sagar is fitted with two BITZER, Germany make AC plants, type CSH 8561 125 (Y), hermetically sealed compressor, capacity 240000 Kcal/hr (80 TR) using R-22 as refrigerant. The AC Plant is extremely compact for its capacity of 80 tons refrigeration and technologically quite superior equipment. However, these AC Plants had a history of 12 major failures since commissioning.

Both the AC plants had a major failure each since last refit which was completed in Jan 10. All the failures were due to burning of motor stator winding. To repair the same not only the stator need to be replaced, but the whole compressor had to be overhauled because the motor and compressor are within a single housing and the burnt motor remnants tend to contaminate the compressor chamber.

Defect No. 2 AC plant motor stator was burnt in Jun 10 and No.1 AC plant motor stator was burnt in Sep10. The cause of the failure in both the case was overheating of the motor stator leading to loss of insulation and complete burn out of motor.

Defect Analysis The motor stator by design has extremely dense and compacted armature winding inside the hermetically sealed compressor. The motor is cooled by the super chilled gas flowing over the motor into compressor suction chamber. Interruption or inadequate cooling of the motor would raise the motor temperature rapidly leading to failure. The existing protection designed to prevent such failure are:-

PTCT Thermisters. These Thermisters are rooted in stator winding to trip the motor on temperature reaching 120 Deg C. Calibration or testing of this cut out cannot be undertaken during the service life of the motor. Moreover his device failed to save the motor during both the failures.

Condenser low SW pressure cut out. The failure or loss of pressure of sea water cooling for the condenser will trip the AC plant. This however cannot provide protection against rise of Freon gas temperature due to reason other than sea water cooling failure. The other reason which can lead to rise in gas temperature could be loss of gas due to leakage and inadequate gas flow into compressor suction due to malfunction on TEV/ liquid solenoid valve.

Repairs Undertaken

In addition to rewinding of motor, the compressor and the complete gas system were sanitised to obviate presence of remnants of burnt winding and carbon particles through the PAC firm M/s Cool Care, Chennai. The details of the works undertaken are as follows:-

- Rewinding of motor stator.
- Compressor was completely overhauled and all bearings renewed.

Imposed Vibration

Forced vibration can be set up in a very large number of ways. For instance, the shaking near the stern of a ship is caused by hydro dynamic forces which are generated as the propeller blades pass the nearest point of a ship's hull. A fluctuating force will give rise to a vibration which has the same frequency as itself. If that frequency happens to coincide with the natural frequency then resonance will occur and the vibration will be violent. Normally even a small party of soldiers will stop marching and 'break up' when it comes to a bridge. If the cadence of their marching were to correspond to a natural frequency, then it is possible that they might even destroy the bridge. This actually happened in 1831 in Manchester when 60 men broke the Broughten bridge over the river Irwell.

- Oil seal between motor and compressor was replaced.
- Gas system was flushed with Freon 141B.
- System pressure tested with nitrogen up to 120 psi.
- System vacuumised and vacuum held for 30 min.
- Fresh F-22 charged due to contamination of old gas with carbon particles.
- Plant proved.

Additional Protection Device

Analysis of failure of the equipment revealed the inadequacy of the existing protection devices. The catalogues of latest model of similar compressor of BITZER make was downloaded from internet revealed that the manufacturer has

incorporated following additional protection devices in their latest model compressors:-

- High Freon gas discharge temperature at compressor discharge trip.
- High compressor sump lub oil temperature trip.
- Low compressor sump lub oil level cut trip.

An inexpensive variable temperature trip mechanism for high Freon gas discharge temperature at compressor discharge was designed, manufactured and installed with the help of a local trade. This additional protection device will appreciably increase the reliability of the AC compressor.

Recommendations

It is understood that **hermetically sealed compressor** of BITZER make is being fitted in the new induction ships of Coast Guard, and it is recommended that the additional protection devices as brought out at previous need to be catered during initial procurement. Further, modification of the existing AC plants with similar compressor in service to include additional protection devices may be undertaken.

It is brought out that the **hermetically sealed compressor** should not be selected for the ships where space constraint is not a criteria. A relatively easy to maintain **open type compressor** may be considered for initial fitment for new induction ships when space constraint do not exist. The purity of Freon gas also has a bearing on health of the motor on **sealed compressor** as the Freon gas flows over the motor stator whereas this restriction do not apply on the open compressor.

M S Mandal, USE
ICGS Varuna

INNOVATIVE ENGINEERING TRIALS OF MACHENERY

Refit alongwith 24000 hourly routine on both main engines for a duration of 270 days of ICGS Varuna was carried out at Mumbai by a Private refit yard. During the refit and major overhauling of main engines, lot of systems pipes and main fuel tank, RU tanks were opened and extensive works were undertaken. All the DAs partial overhaul work also was carried out and ship was awaiting for trials. The degutting and refitting of system/other units were slow and even trials need all these system in place which were not possible. Keeping in mind to timely completion of refit and to put the power generation in line so that all related trials can be progressed, an innovative idea of supply tank prepared from empty lub oil drum was designed by the ship staff. The design was so simple. A clean lub oil drum (210 litres capacity) was positioned portside platform in the auxiliary engine room adjacent to expansion tank.

Two flexible hoses approx length of 50 meters each were connected with two cocks and union so as to fitting the tank (supply & return line). Other ends were connected to respective DA's (under trial) inlet before filter and outlet line from engine with additional 02 cocks. It was so simple by which all 4 DA's trials were taken. It helped to undertake all Navaids trials and major machineries before the main engine became ready by which ship could complete the refit with full power trials 62 days ahead of schedule. It is an example of dedicated effort, meticulous planning with practical experience, by the ship staff who can better utilize the available restricted resources in a better way.

Sudeb Sikdar U/Ytk (P)
ICGS Ahalyabai

PLC: PROGRAMMABLE LOGIC CONTROLLERS

The PLC is basically a programmed interface between the field input elements like limit switches, sensors, transducers, push buttons etc and

the final control elements like actuators, solenoid valves, dampers, drives, LEDs hooters etc. As the desired logic control is achieved through a 'program', these controllers are referred to as **Programmable Logic Controllers (PLC).**

Advantage of PLC. PLCs are fully solid state and hence extremely compact as compared to hard-wired controller wherein electromechanical devices are used.

(a) **Energy Saving.** Average power consumption is just $1/10^{th}$ of power consumed by an equivalent relay logic control.

(b) **Ease of Maintenance.**

(i) Modular replacement.

(ii) Easy Trouble Shooting.

(iii) Error diagnostics with programming unit.

Dampening Vibration

Attaching a damper in crankshaft have the effect of augmenting and so changing the vibrating system. It will rotate bodily but which dissipates energy by friction when subjected to superimposed torsional vibration. Suppose, for instance that a ship's propeller is driven by a engine. The engine runs at a higher speed than the propeller does and the speed reduction is effected by a pair of gear wheels in the gearbox. If one of the gears were badly made periodic advancement and retardation as they went round, this in turn could set up a torsional motion of the shafting which would be superimposed on the steady rotation which drives the ship along. The type of motion can become violent under the resonant conditions that prevail when the frequency of the relative moment at the mating gears has the same value as a natural frequency of shaft system.

(c) **Economical.**

(j) Considering one time investment, PLC is most economical system.

(ii) Cost of PLC recovers within a short period.

(d) **Greater Life & Reliability.** Static devices hence lesser number of moving parts, reduces wear and tear. In case of hard-wired logic, the control hardware is either electromechanical or pneumatic and therefore it is more prone to faults due to wear and tear of moving parts resulting in lesser **on time** of the system.

(e) **Tremendous Flexibility.** To implement charges in control logic no rewiring is required so considerable time is saved. PLC can carry out complex functions such as generation of time delays, counting, comparing, arithmetic operations etc. High processing speed and great flexibility in the processing of both analog and digital signals.

(f) **Short Project Time.** The hard wired control system can be constructed only after the task is fully defined. In the PLC, however the construction of the controller and wiring are independent of control program definition. This means that the total hardware is standard and desired control is achieved through program.

(g) **Quality of Product.** In industry, there are many production tasks which are of highly repetitive nature. Although repetitive and monotonous, each stage needs careful attention of operator to ensure good quality of final product. The desired control is achieved through program.

PLC leads towards achieving the following.

- Higher productivity.
- Superior quality of end product.
- Efficient usage of energy and raw materials.
- Improved safety in working conditions.

Few examples of industries where PLC's are used for control and automation.

Tyre industry, food processing plants, bulk material handling system at ports, ship unloader, wagon loaders, steel plants, blast furnace charging, galvanizing plant, dairy automation, pulp factory, printing industry etc.

Recommendation With the using of PLC in our marine application we get various benefits. Such as reduced space requirements, energy saving, less maintenance and hence greater reliability etc. This method served the purpose for many years, although it had certain limitations (like bulky and complex wiring, involves lot of rework to implement changes in control logic). The above all such conditions moreover PLCs can be used effectively in totally eliminating the possibilities of human error also.

Asst.Comdt BD Paste
ICGS Annie Besant

DROOP SETTING ON DIESEL ALTERNATORS

The preliminary checks carried out prior taking Diesel Alternators in parallel are keeping voltage and frequency of incoming DA exactly same as that of running DA. If these parameters are adjusted but still paralleling is not feasible view shooting up of current / load and subsequent tripping of incoming DA breaker, then the other possible causes may be:-

(a) AVR may be malfunctioning / defective.

(b) Synchronising circuit may be malfunctioning/ defective.

(c) Droop setting of any one or both alternators may be disturbed.

Remedies

(a) Repair/ replace AVR.

(b) Repair/ replace Synchronising PCB.

(c) Droop setting is to be carried out for both the alternators. The procedure for same is as follows:-

(i) Check terminal voltage with identical multimeter in both alternators of DAs which are to be paralleled, in "no load condition". Adjust the voltage equally with help of V-Trim in both the alternators.

(ii) Take first alternator on load. Check voltage droop (change in voltage) from "no load" to "load" condition and note it down.

(iii) Same way check frequency droop from no load to set load conditions.

(iv) Transfer same load in second DA and carry out checks as per serial (i) and (ii) above.

Causes of Vibrations

How many times have you touched an machine to see if it was running right? With experience, you have developed a 'feel' for what is normal and what is abnormal in terms of machinery vibrations. Vibration is caused by unbalance, misalignment, worn gears or bearings, looseness etc. Vibration is simply the cyclic or oscillating motion of a machine component from its position of rest. Some of most common machine problems that cause vibrations are :-

- Misalignment of couplings, bearings and gears.
- Unbalance of rotating components.
- Looseness
- Deterioration of rolling element bearings.
- Gear wear
- Rubbing
- Aerodynamic/hydraulic problems in fan, blowers and pumps.
- Electrical Problems (Unbalanced magnetic forces) in motion.
- Resonance.
- Eccentricity of rotating components such as V-belts, pulleys or gears.

(v) If the droop voltage is different in both the alternator, adjust the same with the help of QDC pot which is fitted near AVR (10Ω, 3 W)

(vi) Check frequency droop. If it is different, necessary adjustments are to be carried out in DA Governor.

(vii) Keep voltage droop and frequency droop for both alternators same.

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HULL MAINTENANCE

Hull Maintenance and Cleaning

If not properly controlled, hull maintenance activities, including scraping, sanding, pressure washing, and painting, can put toxic pollutants into the marine environment. Where marinas do not provide these services, Do-It-Yourselfers and outside contractors may be performing this work on the marina's property. In all cases, this section provides you with tools to reduce the potential negative impacts from hull maintenance.

Best Management Practices Hull Scraping, Sanding, and Washing

Hull scraping, sanding, and washing releases pollutants that are bound up in hull paint and exposes marine organisms to those pollutants. Employing the following BMPs will minimize the potential for pollutants associated with hull paint to reach coastal waters.

Designated Maintenance Areas:

Restrict all major vessel repair and maintenance work to designated work areas that are located away from the bulkhead. Activities that should be restricted to designated areas include abrasive blasting, pressure washing,
hull scraping and sanding, and hull painting. Maintenance work such as painting, scraping, and hull cleaning should be done on land, not at marina slips or moorings. Underwater cleaning of hulls must be prohibited. The area should be provided with containment.

Pressure Wash water Management:

Pressure wash water is considered to be a "process" wastewater (or industrial wastewater). Therefore, discharge of pressure wash water to coastal waters, the ground, or a sewer system is illegal without a permit. To meet permit conditions, significant pretreatment of the wastewater prior to discharge would likely be required regardless of the discharge option chosen. In addition, most pretreatment systems (for discharge) must be operated by staff properly certified by the state. The significant investments in permitting, training, and operator certification for discharge systems likely make them cost prohibitive. Therefore, recycling systems that treat the wastewater for reuse as wash water without discharge may be a more viable option. The recycling systems without discharge need no operational permit if there is no hazardous waste involved. However, these systems will require periodic maintenance. No matter the disposal option selected, all pressure wash facilities must develop a system to collect the wastewater for treatment, recycling, or offsite disposal. For smaller yards that wash fewer boats, collecting all wash water for offsite disposal may be the most cost effective option.

ICGS Lakshmibai

DEGAUSSING

A steel vessel has a certain amount of **permanent magnetism** in its "hard" iron and **induced magnetism** in its "soft" iron. Whenever two or more magnetic fields occupy the same space, the total field is the vector sum of the individual fields. Thus, near the magnetic field of a vessel, the total field is the combined total of the earth's field and the vessel's field. Therefore, the earth's magnetic field is altered slightly by the vessel.

A unit sometimes used for measuring the strength of a magnetic field is the **gauss**. Reducing of the strength of a magnetic field decreases the number of gauss in that field. Hence, the process is called **degaussing**.

Degaussing Effects

The degaussing of ships for protection against magnetic mines creates additional effects upon magnetic compasses, which are somewhat different from the permanent and induced magnetic effects. The degaussing effects are electromagnetic, and depend on:

(a) Number and type of degaussing coils installed.

(b) Magnetic strength and polarity of the degaussing coils.

(c) Relative location of the different degaussing coils with respect to the binnacle.

(d) Presence of masses of steel, which would tend to concentrate or distort magnetic fields in the vicinity of the binnacle.

(e) The fact that degaussing coils are operated intermittently, with variable current values, and with different polarities, as dictated by necessary degaussing conditions.

Degaussing Compensation

The magnetic fields created by the degaussing coils would render the vessel's magnetic compasses useless unless compensated. This is accomplished by subjecting the compass to compensating fields along three mutually perpendicular axes. These fields are provided by small **compensating coils** adjacent to the compass. In nearly all installations, one of these coils, the **heeling coil**.

Step 1. The compass is removed from its binnacle and a dip needle is installed in its place. The M coil and heeling coil are then energized, and the current in the heeling coil is adjusted until the dip needle indicates the correct value. Type K degaussing compensation installation. The system is then secured by the reversing process.

Step 2. The compass is replaced in the binnacle. With auxiliary magnets, the compass card is deflected until the compass magnets are parallel to one of the compensating coils or set of coils used to produce a horizontal field. The compass magnets are then *perpendicular* to the field produced by that coil. One of the degaussing circuits producing a horizontal field, and its compensating winding, are then energized, and the current in the compensating winding is adjusted until the compass reading returns to the value it had before the degaussing circuit was energized. The system is then secured by the reversing process. The process is repeated with each additional circuit used to create a horizontal field. The auxiliary magnets are then removed.

Step 3. The auxiliary magnets are placed so that the compass magnets are parallel to the other compensating coils or set of coils used to produce a horizontal field. The procedure of step 2 is then repeated for each circuit producing a horizontal field.

Anupam Bhabak USE (P)
ICGS Ramadevi

HOW TO ADJUST SPEED PICK- UP SENSOR GAP IN 6 BT5.9 CUMMINS MAKE ENGINES

To maintain 2-3 mm gap between fly wheel and speed pick up sensor.

(a) Disconnect sensor.

(b) Remove defective sensor from the pocket using suitable open head spanner.

(c) Take a good sensor and full tight the sensor in its pocket.

(d) Mark both sensor and DA body.

(e) Rotate anti-clock wise $2^{1/2}$ turns.

(f) Sensor will come between 2-3 mm gap

Sensor will be perfect position for correct pick up of signals.

ICGS Aruna Asaf Ali

ALL DAY EFFICIENCY OF TRANSFORMER

The ordinary /commercial efficiency of a transformer is defined as the ratio of output power to the input power. ie

$$\text{Commercial Efficiency} = \frac{\text{Output Power}}{\text{Input Power}}$$

The ratio of output in KWH to the input in KWH of a transformer over a 24 hrs period is known as all day efficiency.

$$\text{All Day Efficiency} = \frac{\text{KWH Output in 24 Hrs}}{\text{KWH Input in 24 Hrs}}$$

DO NOT PAINT SACRIFICIAL ANODE FITTED IN OBM TO PREVENT CORROSION

BMU is undertaking overhauling of 25/30/40 HP capacities OBM and repair of 90 HP capacities OBM. Whenever these OBMs are landed at BMU, it is observed that the exhaust housing assembly including the propeller is corroded despite fitment of sacrificial anode on it. Investigation was carried out by BMU staff and it was found that in all OBMs, the sacrificial anodes were painted which defeats the very purpose of fitment of sacrificial anode and leads to corrosion. All ships are requested to ensure that the sacrificial anode fitted in OBM are not to be painted and kept clean to prevent corrosion.

TIPS FOR MAINTENAINING GOOD HEALTH OF DIESEL ENGINE

Most failures give an early warning. Look and listen for changes in performance, sound or engine appearance. Some reasons for failure / symptoms of de-gradation of performance:

(a) Engine misfire
(b) Unusual vibration
(c) Sudden changes in engine operating temperature or pressure
(d) Excessive power
(e) An increase in oil consumption
(f) An increase in fuel consumption
(g) Fuel, oil or coolant leaks

If any of the parameters is not within limits then reduce the power output of the engine by transmission to a lower gear until the temperature returns to normal operating range. If engine temperature does not return to normal, shut down the engine and carry out troubleshooting or contact an authorised repair location.

Continuous operation with low coolant temperature, below 60°C (140°F), or high coolant temperature, above 100°C (212°F) can damage the engine.

Before shutting down, after a full load operation, allow the engine to idle for three to five minutes. This allows adequate cool down of piston, cylinder liners, bearings and turbocharger components.

DP Balaiah, SE(ER)
ICGS C-132

TWENTY COMMANDMENTS FOR ENGINE ROOM STAFFS

(a) Keep your engine and its surroundings clean and dry at all times.

(b) Keep all covers and guards properly secured at all times.

(c) All pipes and hoses should be correctly secured.

(d) Use correct quality fuel, lub oil and coolant.

(e) Keep your engine free of leaks, however, minor they may be.

(f) Maintain hygiene of engine fluid system.

(g) Land fuel and lub oil samples for analysis, at least once in a month.

(h) Carry out first line maintenance routines scrupulously.

(j) Keep shock mount clean, dry and properly maintained.

(k) Use correct tools and instruments to work on your engine.

(l) Maintain your log books correctly, neatly and meticulously.

(m) Ensure that all protection devices and instrumentation are operational.

(n) Ensure proper trials are carried out post installation/overhaul.

(p) Inspect the engine and its system completely before starting.

(q) Follow the correct engine starting procedure.

(r) Always turn/blow through engine before starting and after stopping.

(s) Do not idle / run engine on low load for prolonged period.

(t) Always load/unload engines gradually.

(u) If engine trips on load, turn engine for at least 10 minutes with priming.

(v) Do not restart a tripped engine unless rectifying the fault.

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