LIFEBOAT LAUNCHING GRAVITY DAVIT

A PROJECT REPORT

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CERTIFICATE

This is to certify that the project report entitled "**LIFEBOAT LAUNCHING GRAVITY DAVIT**" submitted by **RAHUL RAMACHANDRAN, ROOPITH K.R., RUPAK C.K., SARAN RAJ, S. SARAN, SARAN VINAYAK ARAVIND** to K.M School of Marine engineering, CUSAT, cochin-22, in partial fulfillment of the requirements for the award of B-Tech degree in marine engineering is a bona-fide record of the project work carried out by them under my supervision.

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ABSTRACT

It is intended to present a report on the project “LIFEBOAT LAUNCHING GRAVITY DAVIT” which covers familiarization of the topic and details about the fabrication of a working model and the testing of the same. The scope of the discussion is generally to understand the working of the gravity davit launching system of a lifeboat and its retrieval. The project was undertaken to bring the attention of the budding seafarers to understand about the lifeboat launching procedures and the various mechanisms involved. As life is the most precious asset, it is our obligation to propagate an understanding about the working of a lifeboat and how it becomes inevitable on a vessel.

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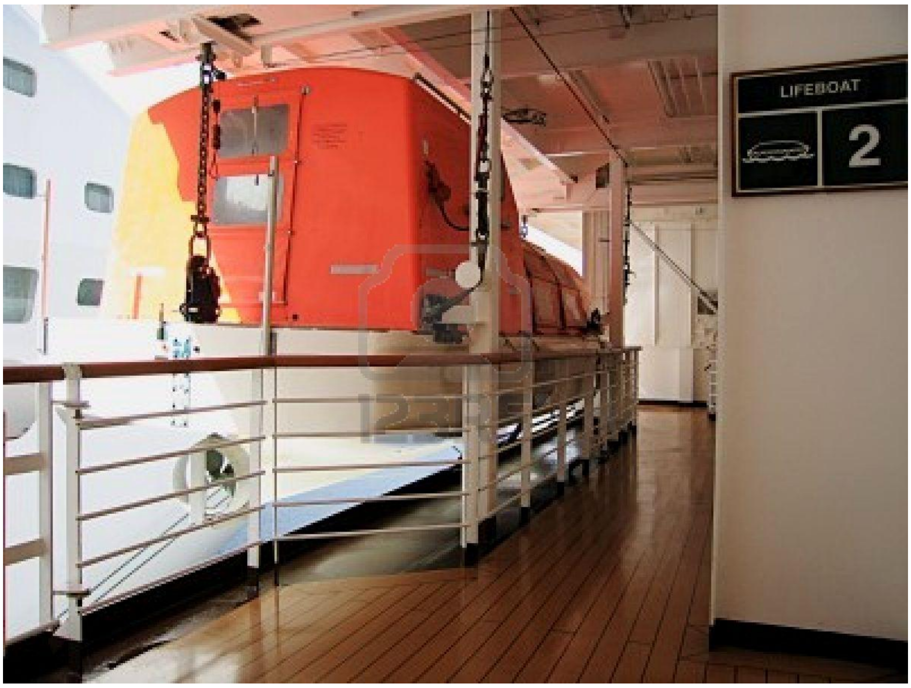
CHAPTER 1 - INTRODUCTION

The lifeboat is a water craft used to help passengers on boats and ships in trouble. It is a small craft aboard a ship to allow for emergency escape. A lifeboat is a kind of boat that is used to escape a larger sinking structure such as a cruise ship, commercial vessel, or aircraft that has landed in the water. A lifeboat is a small, rigid or inflatable watercraft carried for emergency evacuation in the event of a disaster aboard ship.

Figure no 1.1: Life boat



Source: Internet

Even though the life boat is not expected to be put to use every now and then, utmost care has to be taken in maintaining the condition of the lifeboat and its launching unit in perfect order. The reason for this being that an emergency cannot be foreseen.

The essentiality that a lifeboat launching unit has to satisfy is that it should be capable of holding the life boat in the secured position during voyage and must be capable of launching the lifeboat into water without the aid of any external power source in case of an emergency.

Figure no 1.2: Embarkation deck

Source: Internet

The davit holds the boat in position during voyage. In Davit launching the life boat is launched into the water by its own weight.

The Winch driven by an electric motor helps in recovering the boat from water.

Lifeboats have traditionally been made out of wood, and some still are. However, these days, it is very common for a lifeboat to be made out of durable plastic or water-resistant tarp. A plastic lifeboat is usually inflatable. Furthermore, they are often referred to as life rafts. Military ships also usually have lifeboats on board. In the military, such water vessels are usually referred to as "gigs", "whaleboats" or "dinghies". Offshore platforms used by both the military and civilians are also often equipped with lifeboats or life rafts. The ship's tenders of cruise ships often double as lifeboats.

It is important that the lifeboat be quite durable, as the passengers sometimes have to wait quite a while before they are rescued. Many of the boats come equipped with materials that allow passengers to protect themselves from the elements until help arrives. Some even come with a package of materials which may include first aid kit, oars, flares, mirrors which can be used for signalling, food, potable water, tools to catch drinkable rainwater, and fishing equipment. Some lifeboats are prepared for self-rescue. This means that they have supplies such as navigational equipment and a small engine or sail.

Ship-launched lifeboats are lowered from davits on a ship's deck, and cannot be sunk in normal circumstances. The cover serves as protection from sun, wind and rain, can be used to collect rainwater, and is normally made of a reflective or fluorescent material that is highly-visible. Lifeboats have oars, flares and mirrors for signalling, first aid supplies, food and water for days, etc. Some lifeboats are more capably equipped to permit self-rescue; with supplies such as a radio, an engine and sail, heater, navigational equipment, solar water stills, rainwater catchment and fishing equipment.

1.1 LIFE BOAT V/S LIFE RAFT

Life-rafts in general are collapsible, and stored in a heavy-duty fiberglass canister, and also contain some high-pressure gas (in commercial models, usually compressed air) to allow automatic inflation to the operational size. SOLAS and military regulations require these to be sealed, never to be opened by the ship's crew; they are removed at a set periodicity (annually on merchant vessels) and sent to a certified facility to open and inspect the life-raft and its contents. In contrast, a lifeboat is open, and regulations require a crew member to inspect it periodically and ensure all required equipment are present.

Modern lifeboats have a motor; life-rafts usually do not. Large lifeboats use a davit or launching system (there might be multiple lifeboats on one), that requires a human to launch. Lifeboat launching takes longer and has higher risk of failure due to human factors. However lifeboats do not suffer from inflation system failures as inflatable liferafts do.

Figure no 1.3: Life-raft

Source: internet

Recently, smaller self-rescue lifeboats have been introduced for use by boats with fewer people aboard: these are rigid dinghies with CO2-inflated exposure canopies and other safety equipment. Like the lifeboats used before the advent of the gasoline engine, these self-rescue dinghies are designed to let the passengers propel themselves to safety by sailing or rowing. In addition to their use as proactive lifeboats, these self-rescue dinghies are also meant to function as yacht tenders.

The International Convention for the Safety of Life at Sea (SOLAS) has made it a requirement for merchant ships to have liferafts on each side of the ship, sufficient for all the people on board (the stated capacity of the lifeboat, irrespective of the fact that there may actually be lesser people onboard). However, if the lifeboats are "easily transferable" (viz. have an open deck between port and starboard lifeboat decks), the number of liferafts may be reduced to a total sufficient for the ships capacity.

CHAPTER 2- HISTORY

One of the first lifeboats ever made was by Lionel Lukin of the UK in 1785. The boat was constructed from wood and it had ten oars, five on one side. Another model of the lifeboat was made in 1790 by Henry Greathead. The oldest lifeboat still in existence is the Zetland. It was made in 1802. The lifeboat is now being displayed in the Zetland museum in Redcar in the UK.

The lifeboat dimensions and features changed when they became steam powered. The first steam driven lifeboat was used in the Great Britain in 1890. It was called - the Duke of Northumberland. By 1905, the gas powered lifeboats started appearing. One of the first gas powered lifeboat tried out was in Tynemouth in Britain.

By the turn of the 20th century larger ships meant more people could travel, but safety rules regarding lifeboats remained out dated; for example, the British legislation concerning the number of lifeboats was based on the tonnage of a vessel and only encompassed vessels of "10,000 gross tonnage and over". It was after the sinking of the RMS Titanic on April 15, 1912, that a movement began to require a sufficient number of lifeboats on passenger ships for all the people on board. The Titanic, with a gross tonnage of 46,000 tonnes and carrying 20 lifeboats, met and exceeded the regulations laid down by the Board of Trade, which required a ship of her size (i.e. over 10,000 tons) to carry boats capable of carrying a total of 1,060 people. The Titanic's boats had a capacity of 1,178 people on a ship capable of carrying 3,330 people.

The need for so many more lifeboats on the decks of passenger ships after 1912 led to the use of most of the deck space available even on the large ships, creating the problem of restricted passageways. This was resolved by the introduction of collapsible lifeboats, a number of which (Berthon Boats) had been carried on the Titanic.

Figure no 2.1: Titanic lifeboats

Source: internet

One of the biggest innovations occurred in 1930 when the Sir William Hillary lifeboat was utilized in the English Channel. The lifeboat had a top speed of 18 knots. This was nearly twice the maximum speed of other boats.

During the World War II and the Battle of the Atlantic with convoys going to northern Russia through the Arctic Ocean it was found that the chance of the crew of merchant ships surviving in open lifeboats was not very good unless they were rescued in a couple of hours. The US Navy asked various groups and manufacturers to suggest solutions to this. The result was the first enclosed, unsinkable, self-righting lifeboat that was manufactured in Delanco, New Jersey, USA. The first units were delivered in 1944. These radically different new lifeboats were 24 feet in length and weighed 5,000 lbs. They had two enclosed cabins at each end which could hold a total of 25 persons. The space in between was designed to help persons in water to be pulled aboard, and could be enclosed with a canvas top. The new type lifeboat could be driven either by a small motor or a sail.

Also, in 1943 the US developed a balsa wood life-raft that would not sink, irrespective of the number of holes (from enemy fire) in it. These balsa life-rafts were designed to hold five to ten men on a platform suspended on the inside or fifteen to twenty-five hanging lines placed on the outsides. They were inexpensive, and during the war thousands were stored in any space possible on US warships and merchant ships. These life rafts were intended only for use during a short term before lifeboats or another ship in the convoy or group could bring them aboard. When the USS Indianapolis operating alone was sunk in 1945, none of its larger lifeboats were launched and instead the survivors had to rely on these balsa liferafts which were automatically released as the ship sank. While many of the crew perished, if it had not been for these balsa liferafts it is likely all would have perished.

During the 1960s, the inflatable lifeboats became common. These were preferred by the rescuers for rescues that can be done near the shore.

The stiffer and more rigid inflatable boats became widely available in the 1970s.

Today, enclosed lifeboats are the preferred lifeboats fitted on modern merchant ships, due to their superior protection against the elements (especially heat, cold and rough seas) in case of their deployment.

Generally each merchant ship has one lifeboat fitted on the port side and one on the starboard side. The logic being that a lifeboat is always available irrespective of which side the vessel is listed / heeled over. Lifeboat capacity is pre-determined and pre-defined (volume having been estimated typically via Simpson's rule, from a set of cross-section area measurements) and mentioned on the ship's "Safety equipment certificate". Further details of the boats are found in "Form E" of this certificate.

Ship's fitted with "Free fall" lifeboats are an exception - they have a total of only one boat, located at the stern of the ship.

As the years advanced, more sophisticated types have emerged like the hovercraft. The US Coast Guard has some of the most advanced lifeboats in the world. One of the biggest is the 44 ft MLB lifeboat which was put out of service in the year 2009 by the US Coast Guard.

CHAPTER 3 - RULES AND REQUIREMENTS

Recent amendments to regulations 19 & 20 of SOLAS Chapter III drop the requirement for carrying crew in the lifeboats while they are lowered into the water during lifeboat drills. This amendment was adopted by the MSC and it became effective from July 2006. For NZ ships, MSA (and AMSA for that matter) have taken this one step further and with immediate effect no person is allowed in the lifeboat when it is lowered into the water, however the lifeboat must still be exercised in the water as before.

This amendment has serious potential repercussions for the emergency preparedness of the crew in the event of a real emergency. The crew are no longer able to practice using the tricing-in-pendant to bring the lifeboat alongside the embarkation deck; or release the pendant to clear the ship's side before lowering into the water. Neither can the much maligned release gear be worked in a practical exercise. Some Masters claim that they will hire a launch in port to take the crew to the lifeboat as it is suspended above the water, transfer the crew to the lifeboat and operate the release gear. Others have suggested that the crew climb down a pilot ladder into the lifeboat for the same purpose. None of these suggestions will address the issue of the practical exercise with the tricing-in-pendants.

Although it is unacceptable that crew are injured during mandatory drills, neither should a lack of proper training, reduce the preparedness of a crew to lower lifeboats during an emergency evacuation of the ship. Anybody who has taken the time to read the accident reports will be aware that the common thread in these lifeboat accidents are the difficulties in operating the release gear and lack of training.

3.1 IMO GENERAL REQUIREMENTS FOR LIFEBOATS ON SHIPS BUILT AFTER 1ST JULY 1986.

3.1.1 Construction Of Lifeboats

a) All lifeboats should be properly constructed and shall be of such form and proportions that they have ample stability in a sea-way and sufficient freeboard when loaded with their full complement of persons and equipment. All lifeboats shall have rigid hulls and shall be capable of maintaining positive stability when in an upright position in calm water and loaded with their full complement of persons and equipment and holed in any one location below the waterline, assuming no loss of buoyancy material and no other damage.

b) All lifeboats shall be of sufficient strength to:-

Enable them to be safely lowered into the water when loaded with their full complement of persons and equipment; and

c) Be capable of being launched and towed when the ship is making headway at a speed of 5 knots in calm water.

Hulls and rigid covers shall be fire retarding or non-combustible.

d) Seating shall be provided on thwarts, benches or fixed chairs fitted as low as practicable in the lifeboat and constructed so as to be capable of supporting the numbers each weighing 100kg. For which spaces are provided in compliance with requirements of paragraph 2(b) (2) of this Regulation.

e) Each lifeboat shall be of sufficient strength to withstand a load, without residual deflection on the removal of that load:

In the case of boats with metal hulls, 1.25 times the total mass of the lifeboat when loaded with its full complement of persons and equipment; or

in case of other boats, twice the total mass of the lifeboat when loaded with its full complement of persons and equipment.

f) Each lifeboat shall be of sufficient strength to withstand, when loaded with its full complement of persons and equipment and with, where applicable, skates or fenders in position, a lateral impact against the ship's side at an impact velocity of at least 3.5 m/s and also a drop into the water from a height of at least 3 metres.

g) The vertical distance between the floor surface and the interior of the closure or canopy over 50percent of the floor area shall be:

Not less than 1.3 m (4.25 ft.) for a lifeboat permitted to accommodate nine persons or less:

Not less than 1.7 m (5 ft. 7 in.) for a lifeboat permitted to accommodate 24 persons or more;

Not less than the distance as determined by linear interpolation between 1.3 m and 1.7 m for a lifeboat permitted to accommodate between 9 and 24 persons.

3.1.2 Carrying Capacity Of Lifeboats

a) No lifeboat shall be approved to accommodate more than one hundred and fifty persons.

The number of persons which a lifeboat shall be permitted to accommodate shall be equal to the lesser of :-

The number of persons having an average mass of 75 kg.(165 lbs.), all wearing life jackets, that can be seated in a normal position without interfering with the means of propulsion or the operation of any of the lifeboat's equipment; or

The number of spaces that can be provided on the seating arrangement is as per approved seating plan. The shapes may be overlapped, provided foot-rests are fitted and there is sufficient room for legs and vertical separation between the upper and lower seat is not less than 350 mm. (14 in.)

Each seating position shall be clearly indicated in the lifeboat.

3.1.3 Access Into Lifeboats

a) Every passenger ship lifeboat shall be so arranged that it can be rapidly boarded by its full complement of persons. Rapid disembarkation shall also be possible.

b) Every cargo ship lifeboat shall be so arranged that it can be boarded by its full complement of persons in not more than 3 minutes from the time of instruction to board is given. Rapid disembarkation shall also be possible.

c) Lifeboats shall have a boarding ladder that can be used on either side of the lifeboat to enable persons in the water to board the lifeboat. The lowest step of the ladder shall not be less than 0.4 m (16 ins.) below the lifeboat's light waterline (the bottom step should be weighed to prevent it from floating).

d) The lifeboat shall be so arranged that helpless people can be brought on board either from sea or on stretchers.

e) All surfaces on which persons might walk shall have a non-skid finish.

3.1.4 Lifeboat Buoyancy

All lifeboats shall have inherent buoyancy or shall be fitted with inherently buoyant material which shall not be adversely affected by sea water, oil or oil products, sufficient to float the lifeboat, with all its equipment on board when flooded and open to sea. Additional inherently buoyant material, equal to 280N of buoyant force per person shall be provided for the number of persons the lifeboat is permitted to accommodate. Buoyant material, unless in addition to that required above, shall not be installed external to the hull of the lifeboat.

3.1.5 Lifeboat Freeboard And Stability

All lifeboats, when loaded with 50 percent of the number of persons the lifeboat is permitted to accommodate seated in their normal positions to one side of the centreline, shall have a freeboard, measured from the waterline to the lowest opening through which the lifeboat may become flooded, of at least 1.5 percent of the lifeboat's length or 100 mm (4 ins.), whichever is the greater.

3.1.6 Lifeboat Propulsion

a) Every lifeboat shall be powered by a compression ignition engine. No engine shall be used for any lifeboat if its fuel has a flash point of 43°C (109°F) or less (close cup test.)

b) The engine shall be provided with either a manual starting system or a power starting system with two independent rechargeable energy sources. Any necessary starting aids shall also be provided. The engine starting systems and starting aids shall start the engine at an ambient temperature of -15°C (+5°F) within two minutes of commencing the start procedure. The starting system shall not be impeded by the engine casing, thwarts or other obstructions.

c) The engine shall be capable of operating for not less than 5 minutes after starting from cold with the lifeboat out of water.

d) The engine shall be capable of operating when the lifeboat is flooded up to the centreline of the crankshaft.

e) The propeller shafting shall be so arranged that the propeller can be disengaged from the engine. Provision shall be made for ahead and astern propulsion of the lifeboat.

f) The exhaust pipe shall be so arranged as to prevent water from entering the engine is normal operation.

g) All lifeboats shall be so designed with due regard to the safety of persons in the water and to the possibility of damage to the propulsion system by floating debris.

h) The speed of a lifeboat when proceeding ahead in calm water, when loaded with its full complement of persons and equipment and with all engine powered auxiliary equipment in operation, shall be at least 6 knots and at least 2 knots when towing a 25 person liferaft loaded with its full complement of persons and equipment or its equivalent. Sufficient fuel, suitable for use throughout the temperature range expected in the area in which the ship operates, shall be provided to run the fully loaded lifeboat at 6 knots for a period of not less than 24 hours.

i) The lifeboat engine, transmission and engine accessories shall be enclosed in a fire retarding casing or other suitable arrangements providing similar protection. Such arrangements shall also protect the engine from exposure to the weather and sea. Adequate means shall be provided to reduce engine noise. Starter batteries shall be provided with the casing, which form a watertight enclosure around the bottom and sides of batteries. The battery casings shall have a tight fitting top which provides for necessary gas venting.

j) The lifeboat engine, transmission and engine accessories shall be designed to limit electromagnetic emissions so that the engine operations does not interfere with the operation of the radio life saving appliances used in lifeboat.

k) Means shall also be provided for recharging all engine starting, radio and searchlight batteries. Radio batteries shall not be used to provide power to engine starting. Means shall be provided for recharging lifeboat batteries from the ship's power supply at a supply voltage not exceeding 55V which can be disconnected at the lifeboat embarkation station.

l) Water resistant instruction for starting and operating the engine shall be provided and mounted in a conspicuous place near to the engine starting controls.

3.1.7 Lifeboat Fittings

a) All lifeboats shall be provided with not less than one drain valve fitted near the lowest point in the hull, which shall automatically open to drain water from the hull when the lifeboat is not waterborne and automatically close to prevent entry of water when the lifeboat is waterborne. Each drain valve shall be provided with a cap or plug to close the valve, which shall be attached to the lifeboat by a lanyard, a chain or other suitable means. Drain valves shall be readily accessible from inside the lifeboats and their position shall be clearly indicated.

b) All lifeboats shall be provided with a rudder and tiller. When a wheel or other remote steering mechanism is also provided, the tiller shall be capable of controlling the rudder in case of a failure of the steering mechanism. The rudder shall be permanently attached to the lifeboat. The tiller shall be permanently installed on, or linked to, the rudder stock; however, if the lifeboat has a remote steering mechanism, the tiller may be removable and securely stowed near the rudder stock. The rudder and tiller shall be so arranged as not to be damaged by operation of the release mechanism or the propeller.

c) Except in the vicinity of the rudder and the propeller, a buoyant lifeline shall be bucketed around the outside of the lifeboat.

d) Lifeboats which are not self-righting when capsized shall have suitable handholds on the underside of the hull to enable people to cling on the lifeboat. The handholds shall be fastened to the lifeboat in such a way that, when subjected to an impact sufficient to cause them to break away from the lifeboat they break away without damaging the lifeboat.

e) All lifeboats shall be fitted with sufficient watertight lockers or compartments to provide for the storage of the small items or equipment, water and provisions required by the regulations. Means shall be provided for the storage of collected rain water.

f) Every lifeboat to be launched by a fall or falls shall be fitted with a release mechanism complying with the following:--

(1) The mechanism shall be so arranged that all hooks are released simultaneously;

(2) The mechanism shall have two release capabilities as follows:-

i. A normal release capability which will release the lifeboat when it is waterborne or when there is no load on the hooks;

ii. An on-load release capability which will release the lifeboat with the load on the hooks. This release shall be so arranged as to release the lifeboat under any conditions of loading from no load with the lifeboat waterborne to a load 1.1 times the total mass of the lifeboat when loaded with its full complement of persons and equipment. This release capability shall be adequately protected against accidental or premature use;

iii. The release control shall be clearly marked in a colour that contrasts with the surroundings;

iv. The mechanism shall be designed with a factor of safety of 6 based on the ultimate strength of materials used. Assuming the mass of the lifeboat is equally distributed between the falls.

g) Every lifeboat shall be fitted with a release device to enable the forward painter to be released when under tension.

h) Lifeboats intended for launching down the side of the ship shall have skates and fenders as necessary to facilitate launching and prevent damage to the lifeboat.

i) A manually controlled lamp visible on a dark night with a clear atmosphere at a distance of at least two miles for a period of not less than 12 hours shall be fitted to the top of the cover or enclosure. If the light is a flashing light, it shall initially flash at a rate not less than 50 flashes a minute over the first two hours of the operation of the 12 hour s operating period.

j) A lamp or source of light shall be fitted inside the lifeboat to provide illumination for not less than 12 hours to enable reading of survival and equipment instructions; however, oil lamps shall not be permitted for this purpose.

k) Unless expressly provided otherwise, every lifeboat shall be provided with effective means of bailing or be automatically self-bailing.

l) Every lifeboat shall be so arranged that an adequate view forward, aft and to both sides is provided from the control and steering position for safe launching and manoeuvring.

3.1.8 Marking Of A Lifeboat

Lifeboats are to be marked in permanent characters on one side of the stem or the sheer strake with the ministry of transport stamp, the surveyor's initials, the date on which the boat was built, the length, breadth and depth of the boat. The number of persons the boat is certified to carry must be marked on both sides. The name of the ship, the port of registry of the ship and the number of the boat is to be painted on each side of the bow of the lifeboat.

Usually lifeboats fitted on the starboard side are allotted odd numbers, from forward to aft, whilst those on the port side are allotted even numbers in a similar manner.

3.1.9 Lifeboat Equipment

All items of the lifeboat equipment, with the exception of boat hooks which shall be kept free for fending off purposes, shall be secured within the lifeboat by lashings, storage in lockers and compartments, storage in brackets or similar mounting arrangements or other suitable means. The equipment shall be secured in such a manner so as not to interfere with any abandonment procedures. The normal equipment of every lifeboat shall consist of:--

1) Sufficient buoyant oars to make headway in calm seas. Thole-pin crutches, or equivalent arrangements shall be provided for each oar provided. Thole-pins or crutches shall be attached to the boat by lanyards or chains;
2) Two boat hooks;
3) A buoyant bailer and two buckets (buckets should have lanyards spliced onto the handles);
4) A survival manual;
5) A binnacle containing an efficient compass which is luminous or provided with suitable means of illumination. In a totally enclosed lifeboat, the binnacle shall be permanently fitted at the steering position; in any other lifeboat, it shall be provided with suitable mounting arrangements;
6) A sea anchor of adequate size fitted with a shock resistant hawser and a tripping line which provides a firm hand grip when wet. The strength of the sea-anchor, hawser and tripping line should be adequate for all sea conditions;
7) Two efficient painters of a length equal to not less than twice the distance from the stowage position of the lifeboat to the waterline in the lightest sea-going conditions or 15m (49 ft.) whichever is greater. One painter attached to the release device shall be placed at the forward end of the lifeboat and the other shall be firmly secured at or near the bow of the lifeboat ready for use;
8) Two hatchets, one at each end of the lifeboat;
9) Watertight receptacles containing a total of 3 litres (5.3 pints) of fresh water for each person the lifeboat is permitted to accommodate, of which 1 litre (1.8 pints) per person may be replaced by de-salting apparatus capable of producing an equal amount of fresh water in 2 days; fresh water stored in tanks is to be frequently changed;
10) A rust proof dipper with lanyard;

11) A rust proof graduated drinking vessel;
12) A food ration totalling not less than 10,000KJ for each person the lifeboat is permitted to accommodate these rations shall be kept in airtight packaging and be stowed in a watertight container;
13) Four rocket parachute flares;
14) Six hand flares;
15) Two buoyant smoke signals;
16) One water proof electric torch suitable for Morse signalling together with one spare set of batteries and one spare bulb in a waterproof container;
17) One daylight signalling mirror with instructions for its use for signalling to ships and aircraft;
18) One copy of the life saving signals prescribed by these regulations, on a waterproof card or in a waterproof container;
19) One whistle or equivalent sound signal;
20) A first-aid outfit in a waterproof case capable of being tightly closed after use;
21) Six doses of anti-seasickness medicine and one seasickness bag for each person;
22) A jack-knife to be kept attached to the boat with a lanyard;
23) Three tin openers;
24) Two buoyant rescue quoits, attached to not less than 30m (100ft) of buoyant line;
25) A manual pump;
26) One set of fishing tackle;
27) Sufficient tools for minor adjustments to the engine and its accessories;
28) Portable fire extinguishing equipment suitable for extinguishing oil fires;
29) A searchlight capable of effectively illuminating a light coloured object at night having a width of 18 m (60 ft) at a distance of 180 m (585 ft) for a total period of 6 hours and for working not less than 3 hours continuously;
30) An efficient radar reflector;
31) Thermal protective aids sufficient for 10 percent of the number of persons the lifeboat is permitted to accommodate or two, whichever is greater;
32) In the case of ships engaged on voyages of such nature and duration that in the opinion of the administration, the items specified in subparagraph (12) and (26) are unnecessary, the administration may allow these items to be dispensed with.

3.1.10 Launching Appliances (All Ships)

Launching appliances shall be provided for all survival craft except for.

- Survival craft which is boarded from a position on deck which is less than 4.5 meters above waterline in lightest sea going condition and weighs less than 185 kg. or is stowed for launching directly from stowed position with an unfavourable trim 10 degree and 20 degree on either side
- Survival craft which are additional to 200 percent capacity. Every lifeboat rescue boat shall be provided with an appliance which is capable of launching and recovering the lifeboat. .

3.2 REQUIREMENTS FOR LAUNCHING AND EMBARKATION APPLIANCES

General requirements:

A) Each launching appliances together with lowering and recovery gear shall be so arranged that the fully equipped survival craft or rescue boat it serves can be safely lowered against a trim of up to 10 degree and list of up to 20 degree either way;

I) When embarked as required with its full complement of persons;

II) Notwithstanding the requirement of paragraph

(1) Above, lifeboat launching appliances for oil tankers, chemical tankers and gas carriers with a final angle of heel greater than 20 degrees calculated in accordance with the international convention for prevention of Pollution from ship, 1973, as modified by the 19798 Protocol, shall be capable of operating at the final angle of heel on the lower side of the ship;

(2) Without persons in the survival craft or rescue boat ,

B) A launching appliance shall not depend on any means other than gravity or stored mechanical power which is dependent of the ship's power supplies to launch the survival craft or rescue boat it serves, in the fully loaded and equipped condition and also in the light condition.

C) A launching mechanism shall be arranged that it may be actuated by one person from position on the ship's deck, and from a position within the survival craft to rescue boat; the survival craft shall be visible to the person on deck operating the launching mechanism.

D) Each launching appliance shall be constructed that a minimum amount of routine maintenance is necessary. All parts require regular maintenance by the ship's crew shall be readily accessible and easily maintained.

E) The winch brakes of launching appliance shall be of sufficient strength to withstand:

   I) A static test with a proof load of not less than 1.5 times the maximum load; and

   II) A dynamic test with proof load of not less than 1.1 times the maximum working load at maximum lowering speed.

F) The launching appliance and its attachments other than winch brakes shall be of sufficient strength to withstand a static proof load on test of not less than 2.2 times the maximum working load.

G) Structural member and all blocks, falls, pad eyes, links, fastening and all other fitting used in connection with launching equipment shall be designed with not less than a minimum factor of safety on the basis of maximum working load assigned and ultimate strength of the material used construction. A minimum factor of safety of 4.5 shall be applied to all davits and winch structural members and minimum factor of six shall be applied to falls, suspension chain, links and blocks.

H) Each launching, appliance shall, as far as practicable, remain effective under conditions icing.

I) A lifeboat launching appliance shall be capable of recovering the lifeboat with its crew.

J) The arrangement of launching appliance shall be such as enable safe boarding of the survival craft in accordance with these regulation.

Chapter 111, Regulation 48: this regulation should be studied in conjunction with Regulation 15, Survival Craft Launching and Recovery Arrangement and Regulation 16, Rescue Boat Embarkation, Launching and Recovery Arrangements.

Launching appliances must be capable of being lowered against an adverse heel of 20^0 and a trim of 10^0. However, in oil tankers, chemical carriers and gas carriers, with a final angle of heel greater than 20^0, launching appliances must be capable of operating at the final angle of heel on the lower side of the ship.

A launching mechanism shall be arranged so that it may be actuated by one person, it must depend on gravity or stored mechanical power (i.e. launching power must be independent of the ship's power supplies) and it shall remain effective under conditions of icing.

Every rescue boat launching appliance shall be fitted with a powered winch motor of a capacity which will enable the rescue boat to be raise from the water with its full complement of persons and equipment. An efficient hand gear shall be provided for the recovery of each survival craft and rescue boat. Where davit arms are recovered by power, safety devices are to be fitted to cut off the power automatically before the arms reach the stops.

Every launching appliance is to be fitted with brakes capable of stopping and holding a fully loaded survival craft or rescue boat during launching. Manual brakes must be arranged so that the brake is always applied unless the operator bold the control in the 'off' position.

3.3 LAUNCHING APPLIANCE USING FALLS AND A WINCH

A. Falls shall be of rot and corrosion resistant steel wire rope.In case of multiple drum winches, unless an effective compensatory device fitted, fall s shall be so arranged as to wind off drum at same rate when lowering, and to wind onto the drums evenly at the same rate when hosting.

B. Every rescue boat launching appliance shall be fitted with a powered winch motor of such capacity that the rescue boat can be raised from water with its full complement of person and equipment.

C. An effective hand gear shall be provided for recovery of each survival craft and rescue boat. Hand gear handles or wheels shall not be rotated by moving parts of the winch when the survival craft or rescue boat is being lowered or when it is being hoisted by power.

D. Where davit arms are recovered by power, safety devices shall be fitted which automatically cut off the power before the davit arms reach the stops in order to avoid overstressing the fall or davit, unless the motor is designed to prevent such overstressing.

E. The speed at winch the survival craft of rescue boat is lowered into the water shall be not less than that obtained from formula: S=0.4 + (0.02*H) where S = is speed of lower in m/sand H =height o=in m from davit head to waterline at the height sea going condition.

F. The maximum lowering speed shall be established by the Administration having regard to design of the survival craft or rescue boat, the protection of its occupants from excessive forces and the strength of the launching arrangement taking into account the inertia forces during an emergency stop means shall be incorporated into appliance to ensure that this speed is not exceeded.(normally a centrifugal brake).

G. Every rescue boat launching appliance shall be capable of hosting the rescue boat when loaded with its full rescue boat complement of person and equipment at rate of not less than 0.3 m/s.

H. Every launching appliance shall be fitted with brakes capable of stopping the descent of survival craft or rescue boat and holding it securely when loaded with its full complement of persons not equipment: brake pads shall, where necessary, be protected from water and oil.

I. Manual brakes shall be so arranged that the brake is always applied unless the operator, or a mechanism activated by the operator, holds the brake control in the “OFF” position.

Chapter III, regulation 41, deals with the general requirements for lifeboats and regulations 42 to 46 inclusive deals with the permitted ‘sub-species’ of lifeboats. Totally enclosed lifeboats, which must comply with regulation 44, are required on new cargo ships in place of the traditional open lifeboat. In general, the open lifeboat will gradually disappear by July 1991. Once again the Regulations should be studied in full bur mariners should note that all lifeboats should be of sufficient strength to enable them to be safely lowered into the water when fully loaded and should be capable of being launched and towed when the ship is making headway at a speed of 5 knots in calm water. Other pertinent features are:

1. Every cargo ship lifeboat to be so arranged that it can be boarded by its full complement of persons in not more than three minutes from the time the instruction to board is given.
2. A boarding ladder to be provided that can be used on either side of the lifeboat to enable persons in the water to board, the lowest step of the ladder to be not less than 0.4 metres below the lifeboat's light waterline.
3. The lifeboat to be so arranged that helpless people can be brought on board either from the sea or on stretchers.
4. All surfaces on which persons might walk to have a non-skid finish.
5. Every lifeboat to be powered by a compression ignition engine with either a manual starting system or a power starting system with two independent rechargeable energy sources, both systems to be capable of starting the engine at an ambient temperature of -15° c within 2 minutes (unless otherwise permitted by the administration).
6. Every lifeboat engine to be capable of being operated for not less than 5 minutes after starting from cold with the lifeboat out of the water and to be capable of operation when the lifeboat is flooded up to the crankshaft.
7. Lifeboat speed to be at least 6 knots with sufficient fuel to run for a period of not less than 24 hours.
8. The engine arrangements to be enclosed in a fire-retardant casing.
9. Means to be provided for recharging all engine-starting, radio and search light batteries.
10. Water-resistant instructions for starting and operating the engine to be mounted in a conspicuous place near the engine mounting.
11. Each lifeboat to have at least one drain valve which shall automatically open to drain water from the hull when the lifeboat is not waterborne and which shall automatically close when the vessel is waterborne, the position of the drain valve to be clearly indicated.
12. Each lifeboat to be fitted with a release device to enable the forward painter to be released when under tension.
13. A manually controlled light visible on a dark night for not less that 12 hours to be fitted to the top of the cover or tension.
14. A lamp which provides illumination for not less than 12 hours to be fitted inside the lifeboat (an oil lamp is not permitted for this purpose).

The carrying capacity of a lifeboat is calculated by using either the number of persons wearing lifejackets that can be seated in a normal position without interfering with the operation of the lifeboat or standard dimensions for seated personnel. Every lifeboat that is launched by a fall or falls is to be fitted with a release mechanism complying with the following requirements:

1. The mechanism to be arranged so that all hooks are released simultaneously.
2. The mechanism to have two release capabilities, 'normal' when there is no load on the hooks, and 'on-load' when there is a load on the hooks, the latter capability to be adequately protected against accidental or premature release.
3. The release control to be clearly marked in a colour that contrasts with its surroundings.
4. The mechanism to be designed with a factor safety of 6.

Regulation 41 should be studied to ascertain the items of equipment that must be carried. As is the case with the liferafts, some items such as a survival manual and few thermal protective aids are additional to earlier regulations and other items such as painters and a sea-anchor are designed to higher standards.

A life boat must be marked as follows:

1. The dimensions and the number of persons which it carries to be marked in clear permanent characters.
2. The name and port of registry marked on each side of the bow in block roman capitals.
3. Means of identifying the ship to which the lifeboat belongs and the lifeboat's number to be marked so as to be visible from above.

CHAPTER 4- DAVIT

A **davit** (pronounced /ˈdævɨt/ *dă′·vət* or /ˈdeɪvɨt/ *dā′·vət*) is a structure, usually made of steel, which is used to lower things over an edge of a long drop off such as lowering a maintenance trapeze down a building or launching a lifeboat over the side of a ship.

The development of the davit from its original "goose neck form" to the current devices advanced greatly when A.P. Schat patented a number of systems in 1926 that allowed the lifeboat to glide over obstructions on a ship's hull known as the "Schat Skate". This was followed by a self-braking winch system that allowed the lifeboat to be lowered evenly and then the modern davit was invented.

Davits have always been designed to fit into deck spaces that the naval architects deemed necessary and a variety of designs emerged:

- **GRA** - Gravity Roller track davit (Miranda) – usually above the promenade decks.

Figure no 4.1: Gravity roller track davit

Source: Internet

- **SPG** - Single pivot gravity davit (Radial) – for many different deck spaces.

Figure no 4.2: Single pivot gravity davit

Source: Internet

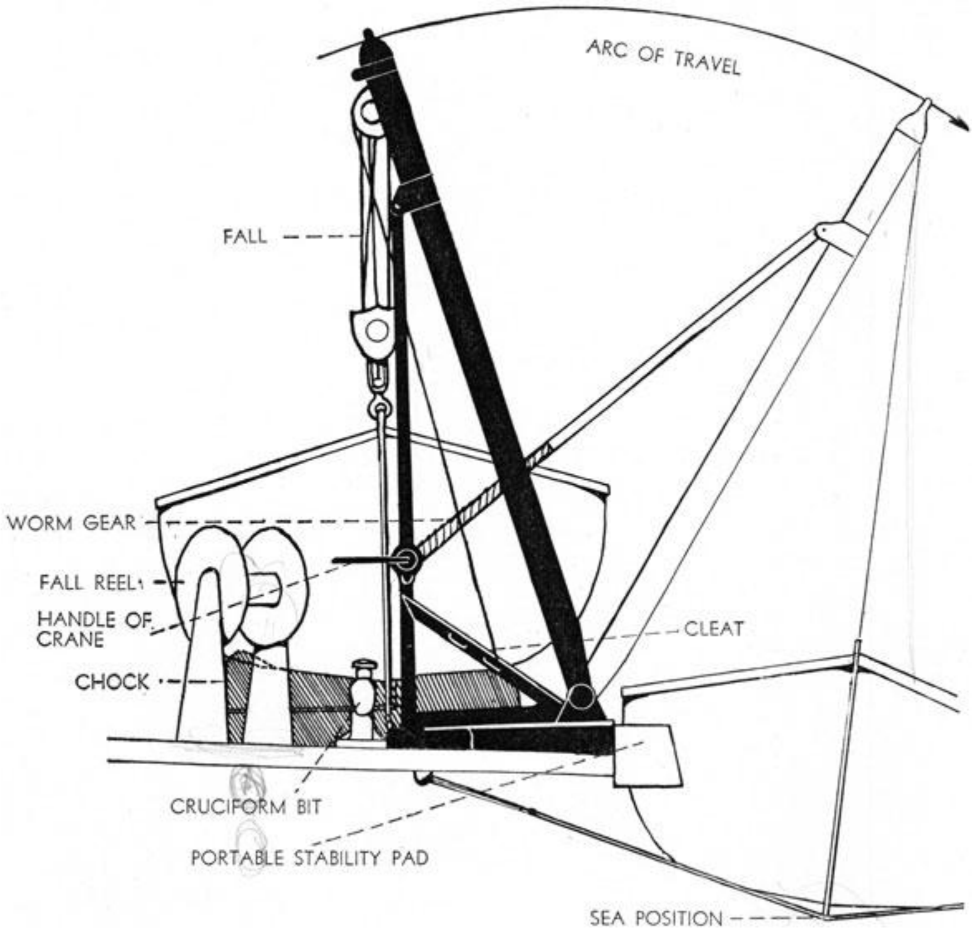
- **FFD** - Free Fall davit – For Free Fall Lifeboats on stern.

Figure no 4.3: Free fall davit

Source: Internet

- **QD** - Quadrantal Davit – Old mechanical style, often hand cranked into outboard position.

Figure no 4.4: Quadrantal davit



Source: Internet

The standard became so common that shipyard specifications call for Schat type davits from whatever source.

Davits can also refer to single mechanical arms with a winch for lowering life rafts and raising spare parts onto a vessel.

Recent developments are based on aft-launched ramps where the lifeboat is allowed to free fall, as opposed to being lowered by a winch, into the ocean. Thus

Free Fall Lifeboat. Similar systems developed by Schat companies are used on offshore oil/gas rigs placed around the structure.

4.1 TYPES OF DAVITS

4.1.1 Hinged Screw Type

The majority of the older frigates and destroyers retain the hinged screw type of davits for general use. These davits can be turned in or out to the desired out-reach by rotating a handle connected to a worm and worm wheel, the latter operating a screw thread on the extending arm. The davit arms are of I-bar section and so shaped that the boat, in the inboard stowed position, is upright when bearing against the griping pads. The weight of the boat is taken on keel chocks fitted to each davit.

The disadvantage of this type of davit lies in their hand operation and the fact that independent control of each of a pair can result in undue strains on the davits and operating gear due to unsynchronized movements.

Figure no 4.5: Hinged screw type

Source: Internet

4.1.2 Gravity Type

This consists of two portions, the davit arm and the deck frame which forms the runway for the arm. When the boat is being lowered the davit arm travels down the runway until it reaches a fixed stop by which time the boat is clear of the ship's side and disengaged from the davit head hook or 'tusk' which takes the weight of the boat when turned in. Continued veering on the winch allows the boat to travel vertically downwards. During the hoisting operation the ball-weight on the hoist wire engages a stop at the davit head, whereupon the boat and davit arm move as one until the fully housed position is reached. During this latter stage the weight of the boat is automatically transferred to the hook or tusk, thus relieving the tension in the hoist wire.

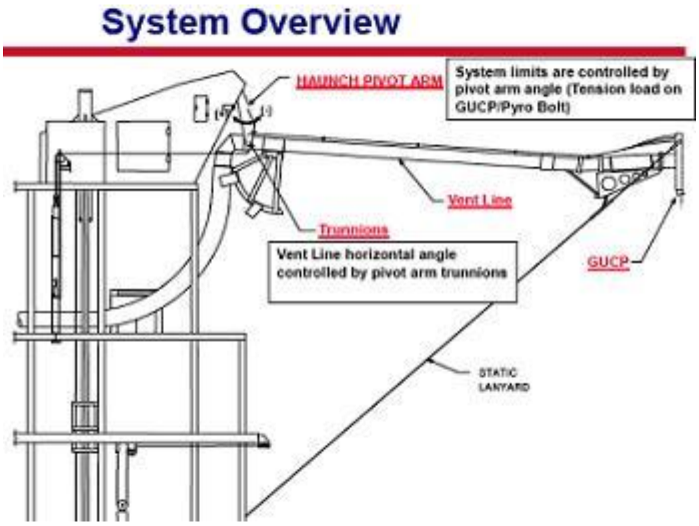
Figure no 4.6: Gravity davit

Source: Internet

4.1.3 Pivot torque type

This has a deck frame and davit arm which together with the boat hinges about the deck pivot. To overcome the initial resistance to hinging outboard, should the ship have an adverse heel, a coiled spring is fitted between deck frame and davit arm. This spring is designed with sufficient effort to bring the C.G. of the davit outboard of the pivot pin under all normal angles of ship heel. As in the gravity type davit the weight of the boat is taken by a hook or tusk at the davit head, engagement or disengagement with which occurs during the hinging process.

Figure no 4.7: Pivot torque type



Source: Internet

4.1.4 Traversing gantries

Traversing gantries are employed in aircraft carriers where the boats are stowed in boat bays at gallery deck level. These enable the boats to be lifted clear of the crutches (usually hinged), traversed outboard and lowered well clear of the ship's side. To allow for the rise and fall of the boat whilst still attached to the falls, a compensating mechanism is fitted in the lead of wire from the winch. This gear is designed to automatically 'shorten' or 'lengthen' the falls in phase with the boat's vertical movement. A man at the forward and after ends of the boat is able to retain the disengaging hook and the fall block together without difficulty.

The latest ships are equipped with either gravity or pivot torque types. Both are fully power operated and employ a single wire for boat hoisting and turning the boat to the stowed position, thus economizing considerably in manpower. Both davits of a pair are operated by a common drive and the problem of synchronized operation does not arise.

Power is not required for lowering a boat, control being exercised simply by a brake on the winch. The winches are fitted with cranked handles for operation should power fail when raising a boat. Neither of these types of davit have arrangements for combating wave motion so that the use of the nylon grommet or strop (foul weather pendant) becomes an essential safety measure.

All davits are tested with a static load of twice the working load and a running load of one and a half times the working load. In the latter case the boat is raised and lowered (or traversed if applicable) so as to test all parts of the system throughout its designed range.

Figure no 4.8: Traversing gantries

Source: Internet

4.2 GRAVITY DAVITS

figure no 4.9: Gravity davit

Source: Internet

In our project we are using the Gravity davit to launch the lifeboat. Gravity davits are very popular and fitted on most of the ships these days. Gravity davits use the weight of the boat to do the work required to launch the boat over the side and have a cradle mounted on roller track ways, which are fixed normally to the deck. The rate of the boats descent is controlled by an independent centrifugal brake. These davits must be fitted with wire rope falls and winches. The Welin Maclachlan Gravity Davits are very simple and reliable. These davits consist of a pair of track ways and a pair of cradles. The inner flange of the channel track ways form the path along which the rollers of the cradles run. These track ways are inclined at an angle of 30°. Therefore, the davits can be operated in extreme conditions of list. The regulations require that the davits should be able to launch the boat against an adverse list of 25°.

The boat, when in secured position, rests on chocks and is on the pair of cradles. The gripes are released and safety pins removed. The brake handle is then lifted (which releases the friction brake) and the boat including the cradles move along the track ways by gravity and inclined track ways till the boat comes to the embarkation deck level and then by lowering the boat a bit more, the boat is brought alongside the embarkation deck by means of the tricing pendant (which must be provided). The brake is friction brake and as soon as the brake lever is lowered, it will immediately stop the boat lowering any further. The bowsing tackles are then hooked on and the tricing pendant removed. The boat is thus kept alongside the embarkation deck for passengers to embark and the weight of the boat is transferred to the falls.

The passengers and crew embark the boat. The bowsing tackle is then released and unhooked, thereby taking the boat outboard. The davit is in such a position now that the boat is well clear of the shipside and it can be lowered into the water by gravity, by just releasing/lifting the brake handle.

The advantage of the use of these davits is that the boat deck is completely clear of obstructions and provides clear deck right up to the ship’s rails. Further it requires minimum manpower to launch the boat.

The boat in stowed position is prevented from any fore and aft surge in a seaway, as the boat is resting its full weight on the keel and is supported by the cradle, and is not suspended by the falls of the davit head. The cradles are held rigidly by means of gripes. The safety harbour pins serve as an extra preventer.

4.3 EMBARKATION LADDERS

Figure no 4.10: Embarkation ladder

Source: Internet

There should be a ladder for each set of davits. The ladder should be of such a length that it should reach the waterline when the ship is at her lightest draft and listed to 20 degrees either way. It should be carried in such a manner that it should be available for embarking persons in the lifeboat. Handholds shall be provided to ensure a safe passage from the deck to the head of the ladder and vice versa.

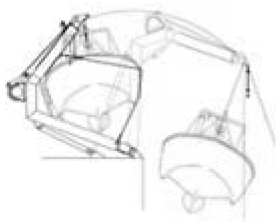
The steps of the ladder shall be :--

i. Made of hardwood, free from knots or other irregularities, smoothly machined and free from sharp edges and splinters or of suitable material of equivalent properties;
ii. Provided with an efficient non-slip surface either by longitudinal grooving or by the application of an approved non-slip coating;
iii. Not less than 480 mm (19 in.) long, 115 mm (4.5 in.) wide and 25 mm (1 in.) in depth, excluding any non-slip surface or coating;
iv. Equally spaced not less than 300 mm (12 in.) not more than 380 mm (15-1/4 in.) apart and be secured in such a manner that they will remain horizontal.

v. The side ropes of the ladder shall consist of two uncovered manila ropes, not less than 20 (2.5 inches), on each side. Each rope shall be continuous with no joints below the top step. Other materials may be used, provided the dimensions, breaking strain, withering, stretching and gripping properties are at least equivalents to those of manila rope.

4.4 OTHER TYPES OF DAVITS

Figure no 4.11: Rescue boat davit



Source: Internet

Figure no 4.12: Crane Davit

Source: Internet

Figure no 4.13: Cantilever Davit

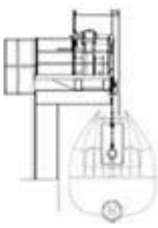


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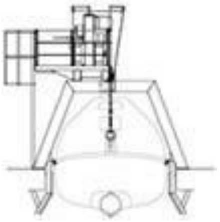
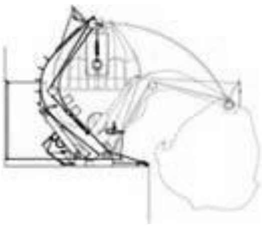
Figure no 4.14: A-Frame Davit



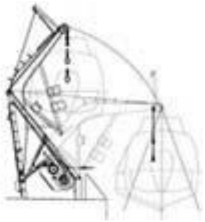
Source: Internet

Figure no 4.15: Stored Power Davit



Source: Internet

Figure no 4.16: Single Pivot Gravity Davit



Source: Internet

Figure no 4.17: Overhead Davit

Source: Internet

CHAPTER 5- TYPES OF LIFEBOAT RELEASE MECHANISM

There are different types of lifeboats used on board a ship on the basis of the type of ship and other special requirements. Not all the lifeboats have the same type of releasing mechanisms, for the launching of a lifeboat depends on several other factors. In this article we will take a look at the main types of lifeboat releasing mechanisms and also learn about the SOLAS requirements for lifeboats.

There are two types of lifeboat releasing mechanisms- on load and off load. These mechanisms release the boat from the davit, which is attached to a wire or fall by means of a hook. By releasing the hook the lifeboat can be set free to propel away from the ship.

5.1 OFF LOAD MECHANISM

The off load mechanism releases the boat after the load of the boat is transferred to water or the boat has been lowered fully into the sea. When the boat touches the surface of water, the load on the fall and hence the hook releases and due to its mechanism the hook detaches from the fall. If the detachment dose not takes place, any of the crew members can remove the hook from the fall. Most of the times the offload mechanism is manually disengaged in case of malfunction; however, in case of fire, it is dangerous to go out and release the hook.

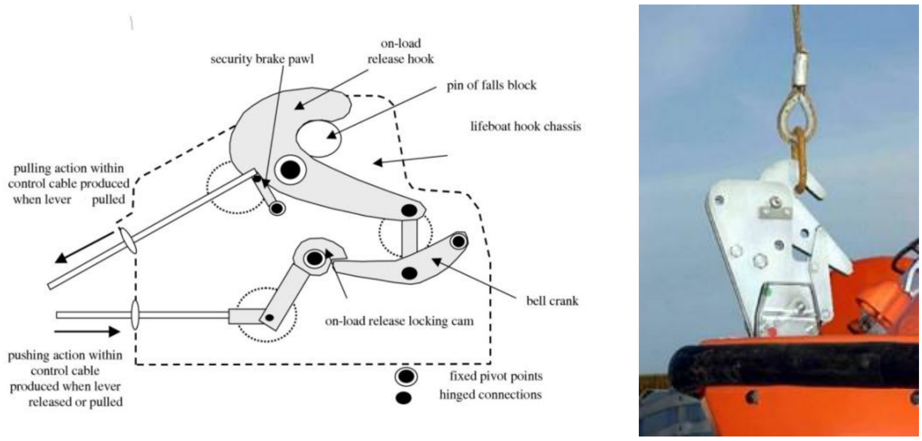
Figure no 5.1: Off load release mechanism

Source: Internet

5.2 ON LOAD MECHANISM

On load mechanism can release the lifeboat from the wire, with the ship above the water level and with all the crew members inside the boat. The load will be still on the fall as the boat would not have touched the water. Normally the height of about 1 m is kept for the on load release, so that the fall is smooth without damaging the boat and harming the crew inside. A lever is provided inside the boat to operate this mechanism. As the lever is operated from inside, it is safe to free the boat without going of the out lifeboat, when there is a fire on ship.

Figure no 5.2: On load release mechanism



Source: Internet

On-Load Release systems were developed in the early 1980s and are mandatory under SOLAS regulations. They allow the lifeboat to be released with the load on the hooks when waterborne, unlike traditional hook-and-eye systems.

During a real abandon ship operation, a lifeboat would not normally return to the ship. However, during drills, the lifeboat has to be recovered from the water and returned to the davits. It is this stage of the lifeboat drill that is the point of greatest risk.

On-Load Release gear if correctly used and maintained is a vital and reliable element of a ship’s safety system. Incorrectly operated, or neglected, it can easily become a real danger to life.

5.3 FREE FALL LIFE BOAT RELEASE

In Free fall life boat, the launching mechanism is similar to the on load release mechanism. The only difference is that the free fall lifeboat is not lowered till 1m above water level, it is launched from the stowed position by operating a lever located inside the boat which releases the boat from rest of the davit and boat slides through the tilted ramp into the water.

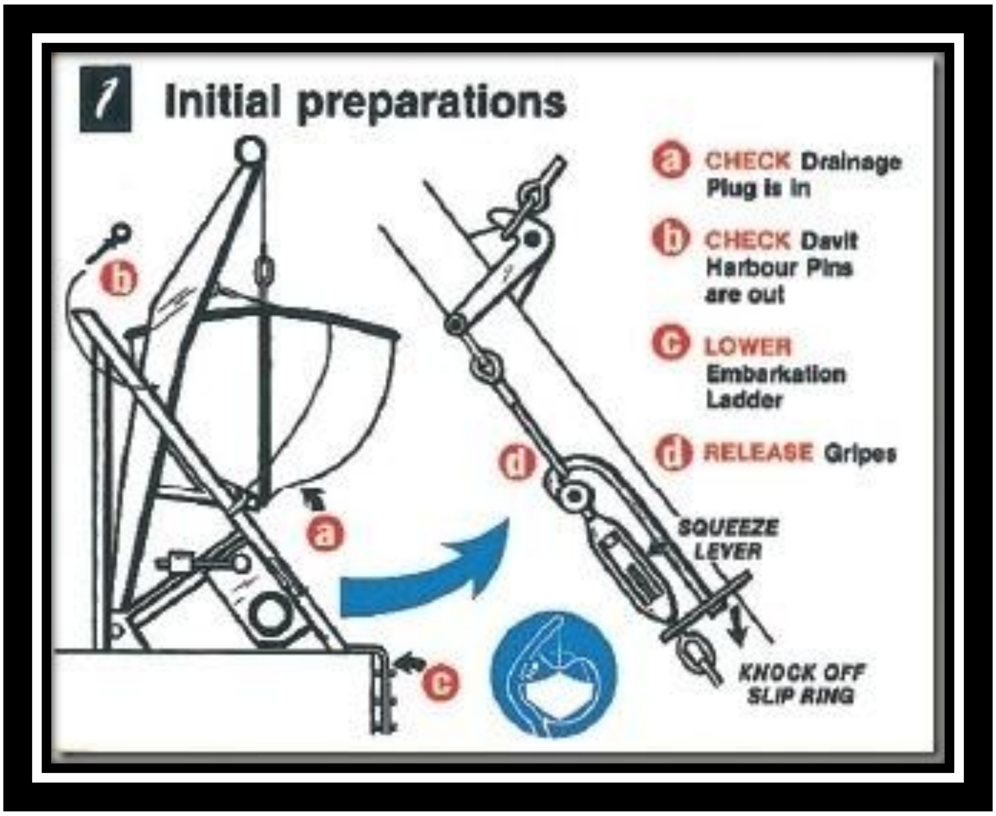
Figure no: 5.3: Free fall lifeboat release mechanism

Source: Internet

CHAPTER 6-LIFEBOAT LAUNCHING PROCEDURE

Six easy steps to launch an open life boat are given below which are self - explanatory.

Figure no 6.1: Lifeboat launching procedure

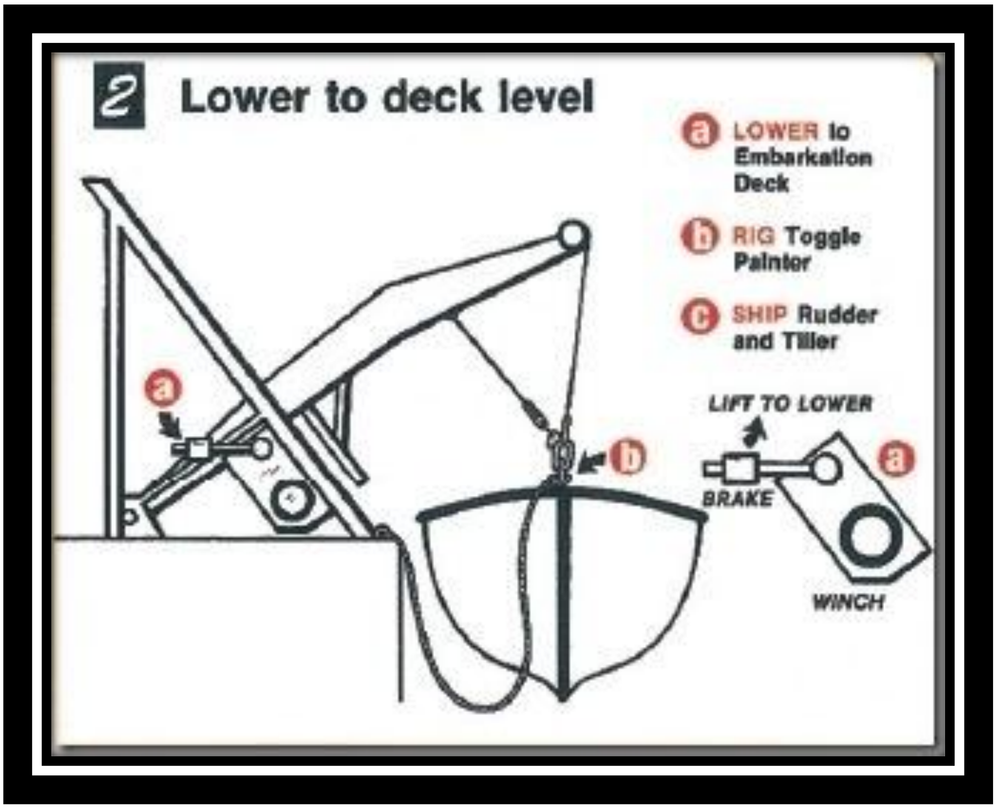


Source: Internet

The initial preparations to be carried out before lowering the davit are

- Check if the drainage plug is in.
- Check if the Davit Harbour pins are out.
- Lower the Embarkation ladder.
- Release the Gripes.

Figure no 6.2: Lower to deck level



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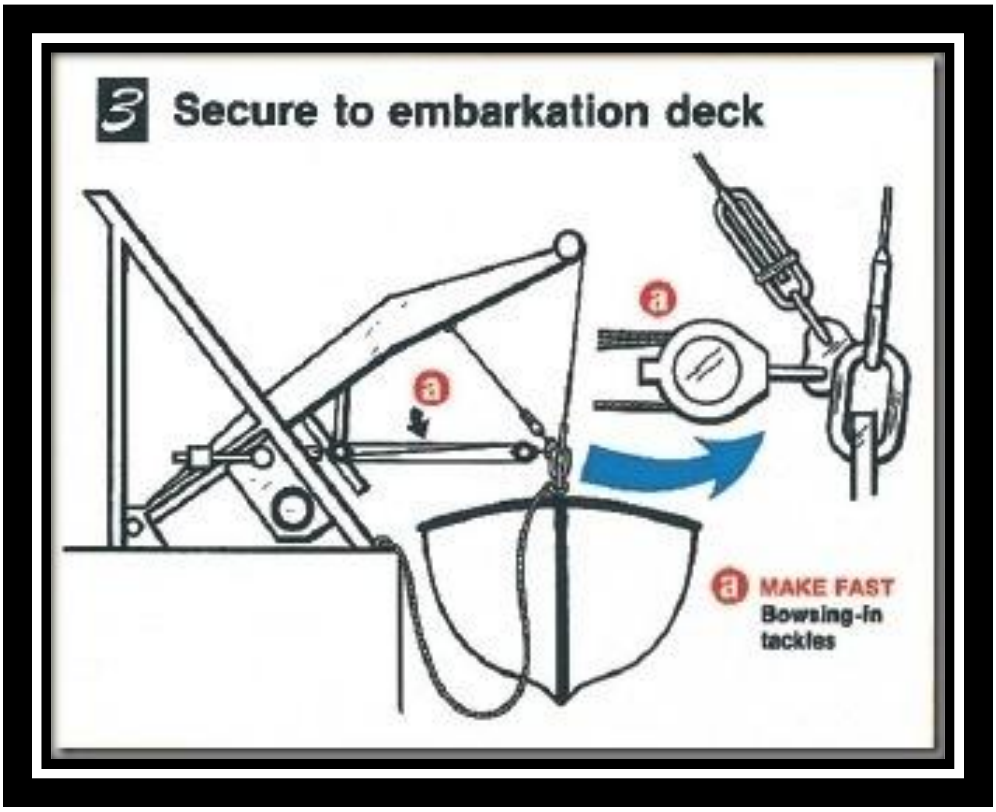
The davit is now lowered so that the life boat reaches the Embarkation deck. The next step is to rig toggle the painter lines.

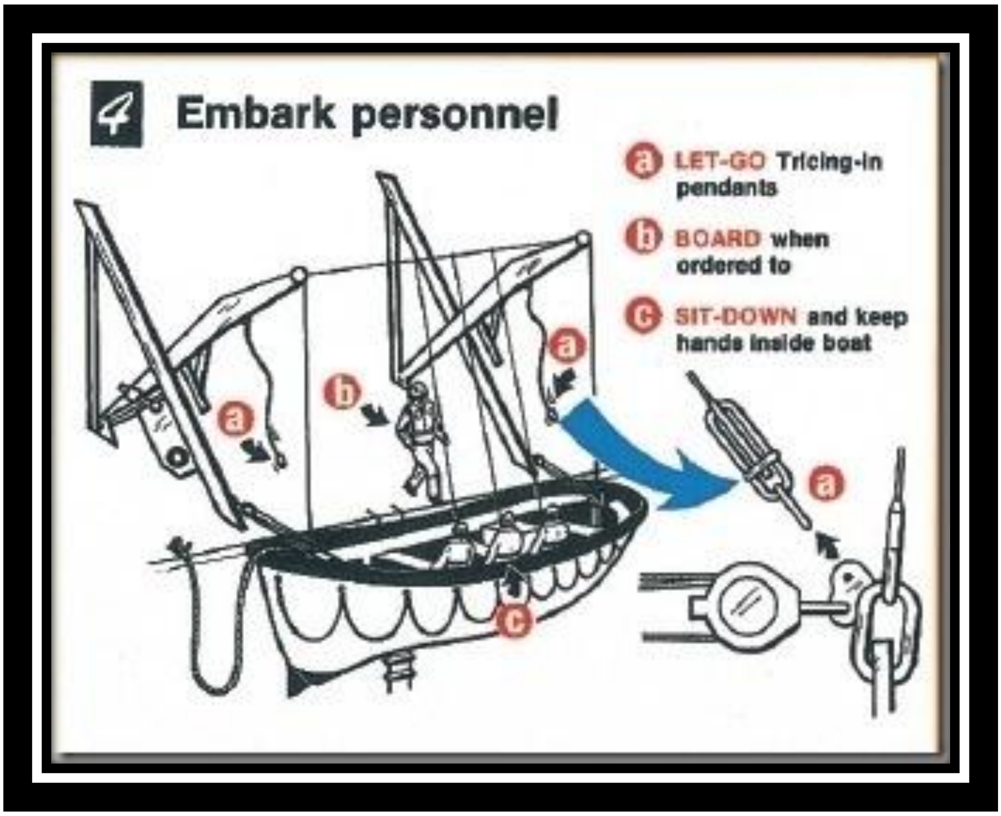
Figure no 6.3: Secure to embarkation deck



Source: Internet

The life boat has to be secured to the embarkation deck by making fast the Bowsing-in-tackles.

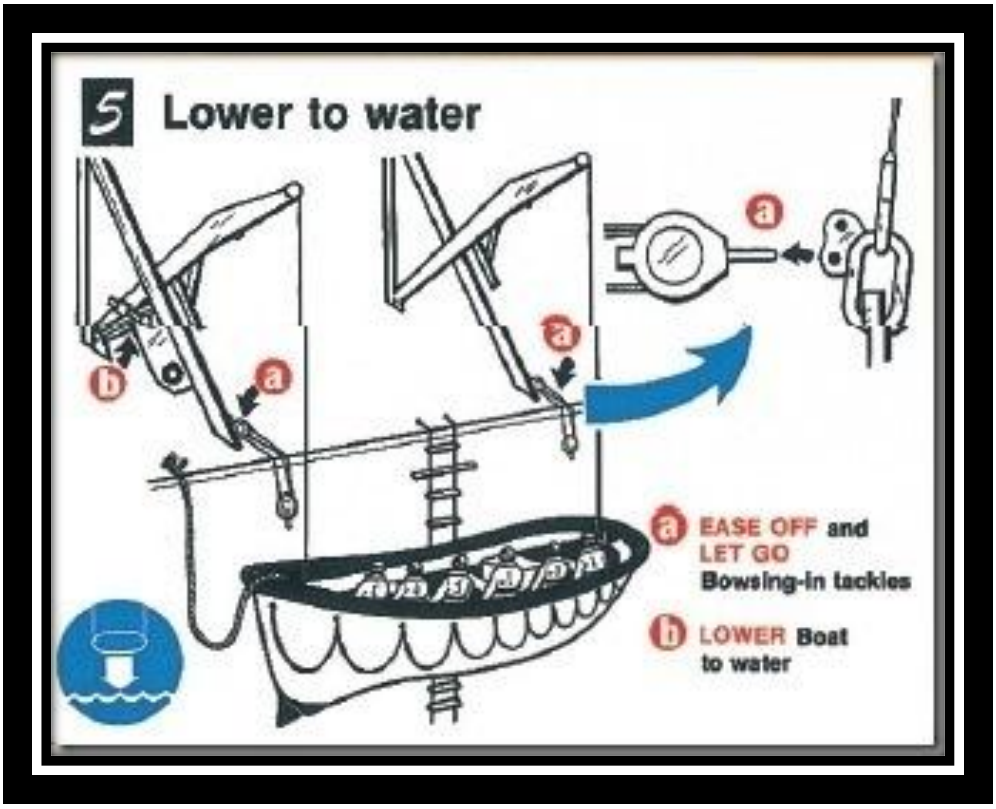
Figure no 6.4: Embark personnel



Source: Internet

Let-go the tricing in pendant. The personnel are boarded onto the lifeboat when ordered to. The personnel are to sit down in the life boat in the designated position keeping the hands inside the boat.

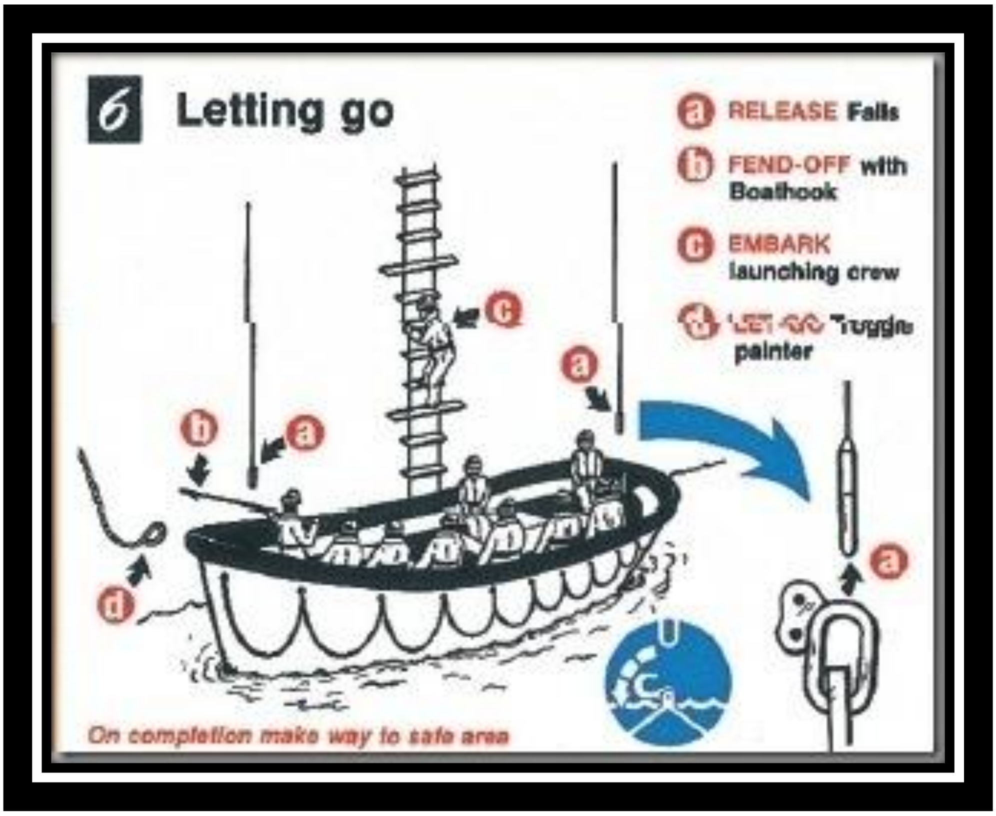
Figure no 6.5: Lower to water



Source: Internet

Prior to lowering the life boat to the water ease off and let go the Bowsing-in tackles.

Figure no 6.6: Letting go



Source: Internet

The falls are released. The lifeboat is fended off from the sides of the ship using the boat hook. The launching crew are embarked on to the lifeboat with the help of ladder. Once this is done, Let-go the toggle painter.

In order to lower the boat , 6 , crew, apart from the cox-wain are required. Their duties are as follows:-

1. Bowman.
2. For'd gripes, safety pins and painter.
3. Brakesman .
4. After gripes and safety pin.
5. Jacob ladder and help passengers man the boat.
6. Stern sheet.

The order to the crew members are given as follow:-

6.1 STATIONS

Upon this order, the boat's crew proceed to their stations. Clear away. When this order is given, the boat's crew sees that there is no obstruction for launching the boat.

1. ***"Unship the safety pins".*** Upon this order from the cox-wain. No. 2 and No. 4 unship the harbour safety pins forward and aft.
2. ***"Let go gripes forward and aft".*** No.2 and No.4 let go the forward ant aft gripes. Make sure that the gripes triggers have fallen. The bowman passes the painter well forward making sure that it is clear. The stern-sheet sees that the rudder and plug is shipped. The bowman and stern-sheet make sure that the falls and life line report to the cox-wain that they carried out the above duties.
3. ***"Lower the boat to the embarkation deck".*** Upon this order the brakes-man lower the boat to the embarkation deck by releasing the brake. Every time the boat is lowered, the cox-wain and the bakes-man must make sure that the crank handle is unshipped (especially if the boat was hoisted with crank handle) otherwise when boat is lowered and thus may injure the brakeman and any other person in the vicinity. Regulation, however , now require that the crank handles must not rotate, when the boat is being lowered or hoisted under the power .The winch man will lower the boat by the brake and the boats moves on track-ways, till pendants have brought the boats alongside to embarkation deck. The full weight of the boat should not be allowed to come on tricing pendent. If the brakes-man release the brake and the boat dose come down, that means there is some obstruction preventing the boat from sliding on the track-ways. The obstruction should be

removed. In the case there is no obstruction and the boat does not come sliding down the track-ways, that means that all probabilities, the brake can released by moving the brake drum By hand.

4. ***"Makes fast bowsing in tackles".*** The bowman and the stern sheet in the boat hook the bowsing in tackles on to the floating blocks, on the ring bolts provided on the ship's side, or on the davits, making sure that the hauling parts coming from them are the ones that are hooked on the shipside. Then haul on the bowsing tackles taut and make fast in the boat. The purpose of the bowsing in tackles is to keep boat alongside the embarkation deck.
5. ***"Let go tricking pendant".*** The tricing pendant must be removed and the weight of the boat is taken by falls and the browsing in tackles. Tricing pedant must be released before persons are allowed to embark; that will ensure that the full weight of the boat is taken by the boat falls.
6. ***"Embark passenger and crew ".*** The women and children embark first, then the rest of passengers and finally crew. All the person in the boat must be seated as low as possible and their hands and elbows must be off the gunwale.
7. ***"Ease the bowsing in tackles ".*** And then "Let got the bowsing in tackles ". The browsing in tackles are eased off and then let go the browsing in tackles. The bowsing in tackles should be passed out kept hanging on the shipside.
8. ***"Lower away the boat".*** The boat is lowered by the brakesman on the crest of the waves then allowed to drop into the trough while afloat. This will overhaul the falls so that when the boat rises on the next crest, the falls can be unlocked. The bowman and stern-sheet make sure that both the falls are hooked together. If , however, the ship has any headway on her, it is better to let go after first, rather than risk the boat being towed by the after falls. In a calm sea it is better to let the boat go last 3 meters (10 feet) with run , so the boat will plunge and overhaul the fall sufficiently for them to be unhooked.

   After the falls are unhooked, care should be taken so that the blocks of the falls do not injure any one because blocks will swing about after they have been let go. Therefore, as soon as the blocks are released, if emergency power is available on the winch, the falls can be heaved up by the winch-man so as to be well clear of the survivors. If the power is not available, boat could be pulled little away forward by means of toggle painter, while waiting for the winch-man to come down ladder. After the winch-man and the cox-wain have come down, pass the toggle painter aft, put the tiller towards the shipside and get the boat away from the shipside and then let go the toggle painter. The boat should be pulled about ¼ mile away from the ship, then stream the sea anchor and wait for orders from the senior officer's boat.

If the order "STILL" is given whilst the boat is being swung out and lowered, everyone stops whatever he is doing. This order is given when some fault is found and there may be immediate danger of an accident taking place. When the fault is corrected "carry on" is given.

CHAPTER 7-LIFE BOAT CONSTRUCTION

Lifeboats may be built of Aluminium Alloy (AA); Galvanised steel (GS); Reinforced Plastic (GRP) or wood. Lifeboats must be constructed with rigid sides and the boat should have ample stability in bad weather. The boat should have sufficient freeboard, when fully laden. It should be strong enough so that is can be lowered safely, when loaded with full complement of persons and equipment. The total weight of the boat when thus fully laden should not exceed 20 tonnes. The weight per person is to be taken as 75 Kg. (165 lbs). All the lifeboats shall be of such strength that they will not suffer residual deflection, if subjected to an overload of 25 percent. All lifeboats shall be capable of maintaining positive stability, when open to the sea and loaded with full complement and equipment.

Figure no 7.1: Enclosed type lifeboat (Aluminium alloy)

Source: Internet

The lifeboat shall not be less than 4.9 metres (16 ft) in length, except when it is carried as an alternative to class ‘C’ boat. All the thwarts and the side benches are to be fitted as low as possible and bottom boards must be fitted.

Every lifeboat must have internal buoyancy by watertight air cases or other non- corrodible buoyant material not adversely affected by oil, equal to 10 percent of the total volume of the boat. In mechanically propelled boats and motor boats the amount of buoyancy is to be increased so that the boat will float when fully loaded, the top of the gunwale amidships is not submerged.

The buoyancy to the lifeboats is provided by air tanks. Air tanks are normally made of muntz material or copper in both wooden and steel lifeboats. In G.R.P. boats, the air cavity is filled with expanded plastic material.

Figure no 7.2: Open type lifeboat

Source: Internet

Lifeboats should have a whaler stern, so that they will rise to a following sea and also they can be “hove to” from aft. The motorboat may have a transom stern, to assist in protecting the propeller. No lifeboats shall carry more than 150 persons. If more than 100 persons are carried, it should be a motor boat.

The block co-efficient of the cubic capacity shall not be less than 0.64 unless specially approved by the Mercantile Marine Department. All lifeboats shall have a mean sheer at least equal to 4 percent of their length. The sheer shall be approximately parabolic in form.

7.1 ALUMINIUM ALLOY AND GALVANISED STEEL BOATS

Both these boats are constructed in the same way as a ship having a bar keel, frames and plates. The interior fittings are however, of wood because under extreme weather conditions metal would make the occupants of the boat uncomfortable. In the aluminium lifeboats, the buoyancy tanks are also made of aluminium alloy or plastic foam, so that corrosion is avoided. Any other metal must not come in contact with aluminium, otherwise corrosion will set in. The gripes wires must have canvas covering so that the wire does not come in contact with aluminium. The paints used should have zinc chromate or zinc oxide as the base. The copper and lead paints should never be used.

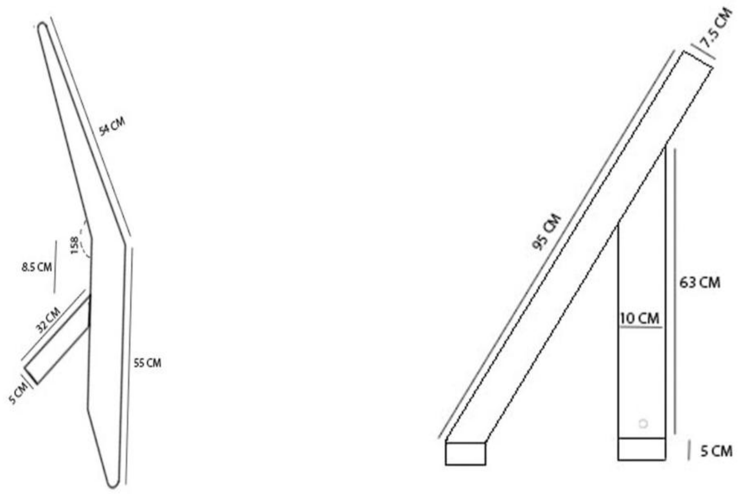
7.2 GLASS REINFORCED PLASTIC LIFEBOATS

The glass reinforced plastic lifeboats are constructed by moulding in two halves and they are joined together by riveting the two moulded halves into an alloy keel frame. The keel frame has an attachment for the lifting hooks. The glass reinforced plastic lifeboat can also be moulded in one piece. The buoyancy is given by blocks of expanded plastic foam. In some cases it is built into the boat. The bilge grab rails and all the interior fittings like bottom boards and thwarts are made of wood.

The glass reinforced boats are non-corrosive, resistant and rust proof. However, since these are light and sensitive boats, the heavier gear inside the boat must be chocked off and lashed. The wire gripes must have canvas covering the wire ropes.

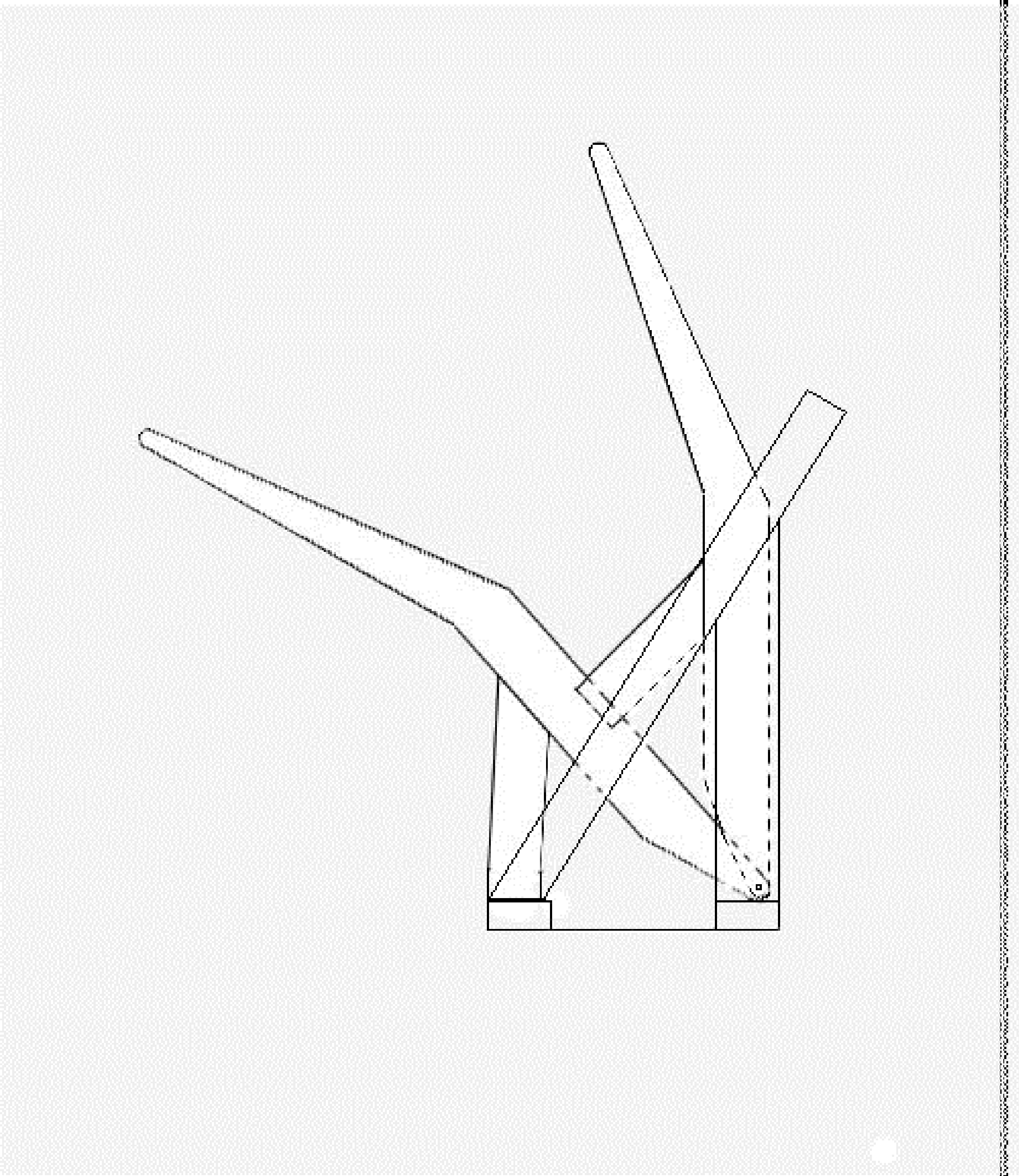
CHAPTER 8-DESIGN OF GRAVITY DAVIT

Figure no 8.1: Dimensions of davit and stay



Source: team

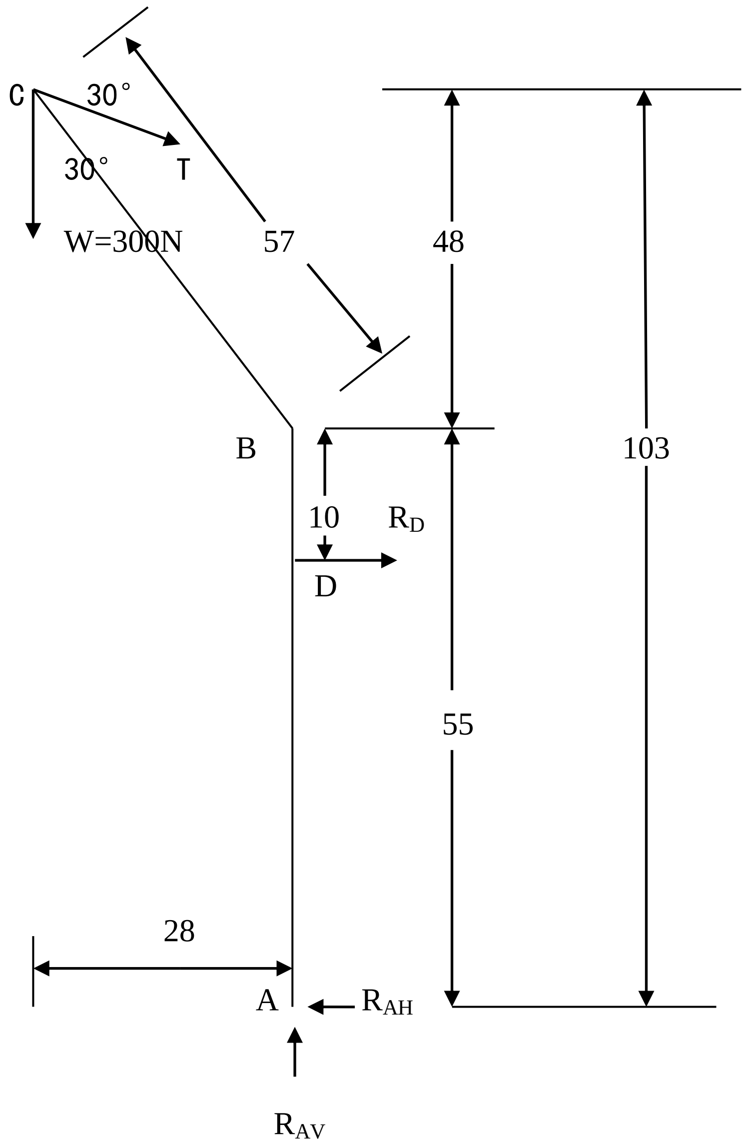
Figure no 8.2: Davit boom



Source: Team

8.1 DESIGN CALCULATION OF DAVIT ARM

Figure no 8.3: Free body diagram of davit arm



Source: Team

$\Sigma M_A = 0.$

$(300*28) - (300Cos30°*103) + (300sin30°*28)-(R_D*45) = 0.$

$R_D*45 = -14160.18$

$R_D = -314.67N.$

$\sum M_c = 0.$

$(R_{AV}*28) - (R_{AH}*103) + (R_D*58) = 0.$

$R_{AV}*28 – R_{AH}*103 = 18250.7.$

$\sum M_D = 0.$

$(300*28) + (300Sin30°*28) - (300Cos30°*58) - (R_{AH}*45) = 0.$

$R_{AH}*45 = -2468.84$

$R_{AH} = -54.86N.$

$(R_{AV}*28) - (R_{AH}*103) = 18250.9$

$R_{AV}*28 = 18250.9 - 5650.58$

$= 12599.09.$

$R_{AV} = 450.01N.$

Consider BC,

Taking B as the origin,

$M = 300x – 300Cos30°y$

$y = 0.86P$,

$x = 0.5P$

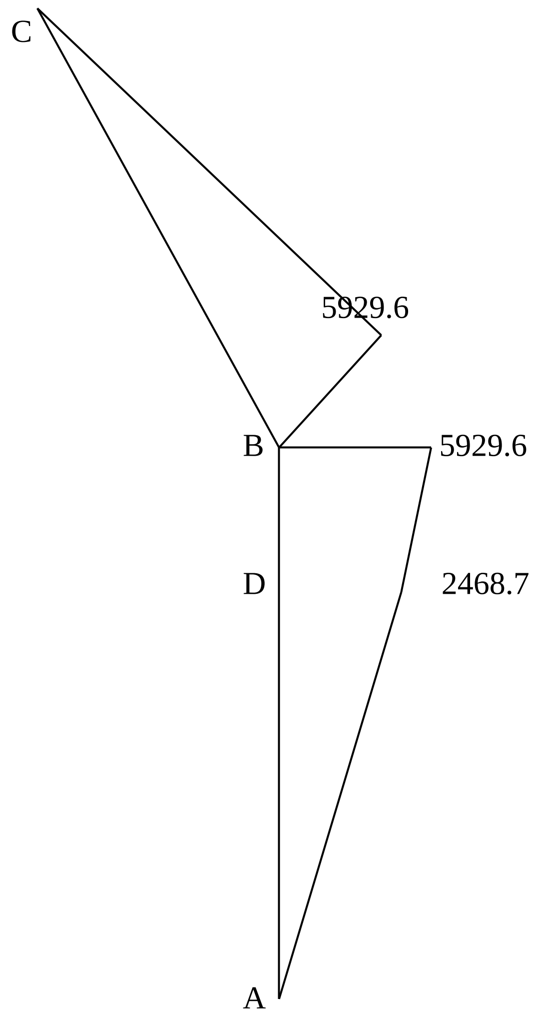
M = 150P - 259.8P

Therefore, Moment at B, Put P = 54.

M = (150*54)-(259.8*54)

= -5959.6 N.cm.

Figure no 8.4: Bending moment diagram



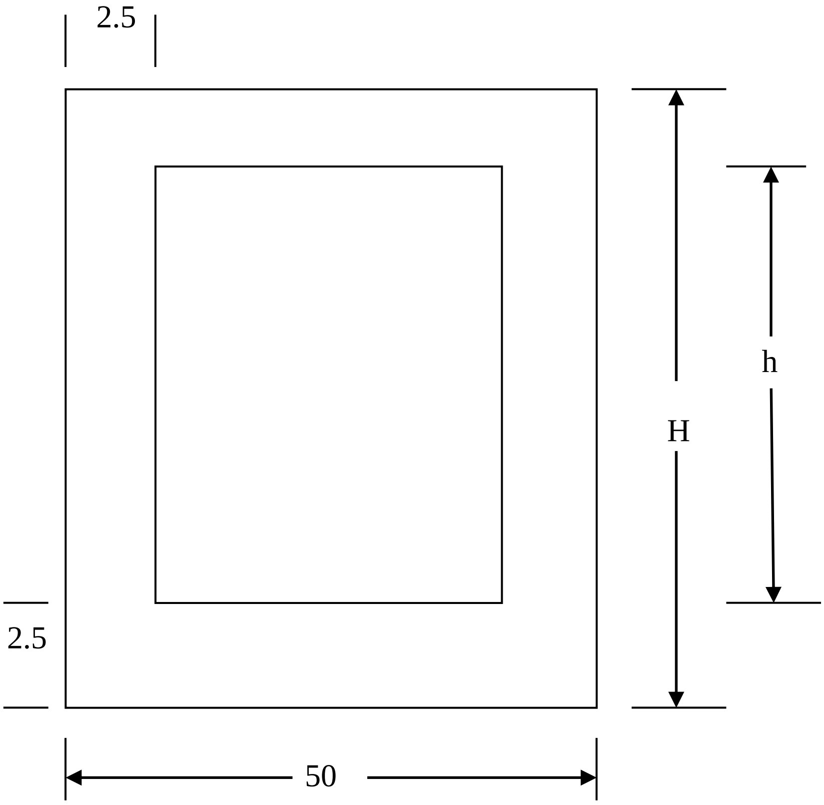
Source: Team

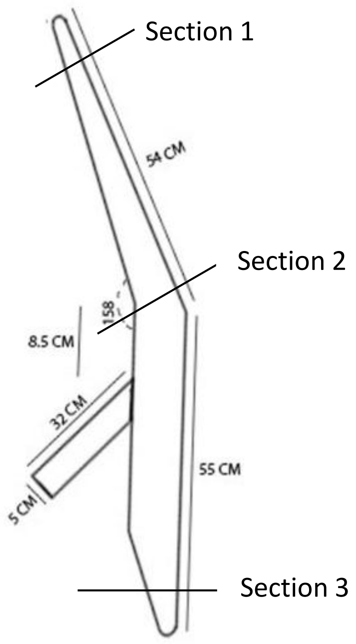
Equations used

$\sigma = \frac{M}{Z}$

$Z = \frac{BH^3 - bh^3}{6H}$

Figure no 8.5: Cross section of davit arm





Source: Team

At first section,

P = 12cm.

Then, M = 150x12 – 259.8x12

= -1316.6 N.cm.

At this section, H = 50mm

Then, h = 50-5 = 45 mm.

Therefore,

Z = $\frac{5*5^3-4.5*4.5^3}{6*5}$

= $7.1645 cm^3$.

σ = $\frac{M}{Z}$

= $\frac{1317.6}{7.1645}$

= 1.839 MN/m^2.

Yield stress of mild steel is 250 MPa,

Considering a factor of safety of 5,

$\sigma_y = \frac{250}{5}$

= 50MPa.

Therefore, $\sigma_y >> \sigma$

At second section,

P = 54cm.

Then, M = 5926.6 N.cm.

At this section, H = 9cm

Then, h = 9-0.5 = 8.5 cm.

Therefore,

$Z = \frac{5*9^3-4.5*8.5^3}{6*9}$

$= 16.32cm^3$.

$\sigma = \frac{M}{Z}$

$= \frac{5926.6}{16.32}$

$= 3.63$ MN/m^2.

$\sigma_y = \frac{250}{5}$

= 50MPa.

Therefore, $\sigma_y >> \sigma$

At third section,

Then,

M= 54.86x15

= 822.9 N.cm.

At this section, H = 6cm

Then, h = 6-0.5 = 5.5 cm.

Therefore,

$Z = \frac{5*6^3-4.5*5.5^3}{6*6}$

$= 9.2cm^3$.

$\sigma = \frac{M}{Z}$

$= \frac{822.9}{9.2}$

$= 0.89$ MN/m^2.

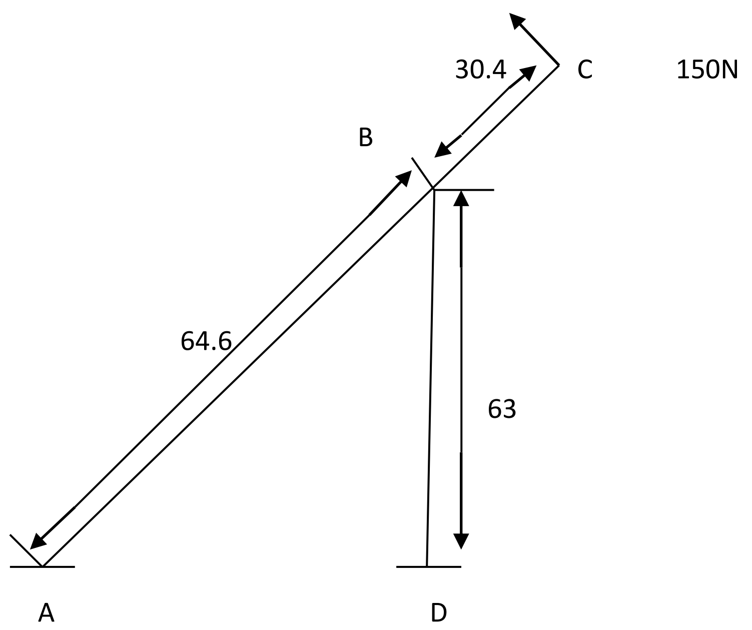
$\sigma_y = \frac{250}{5}$

= 50MPa.

Therefore, $\sigma_y >> \sigma$

8.2 DESIGN CALCULATION OF DAVIT STAY

Figure no 8.6: Free-body diagram of stay



Source: Team

Fixed end moments

$Mf_{AB} = 0$, $Mf_{BA} = 0$.

$Mf_{BC} = 150*30.4 = 4560$ N.cm.

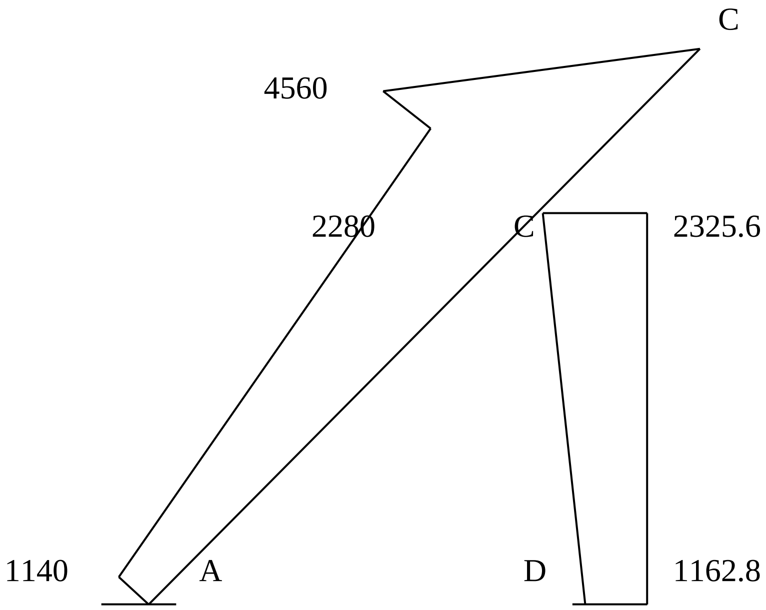
Table no 8.1: Distribution factors

Joint	Member	Relative stiffness	Sum	Distribution factor
B	BA	$\frac{I}{64.6}$	_	0.5
	BC	_	0.031	
	BD	$\frac{I}{63}$	_	0.51

Table no 8.2: Moment distribution

A		B		D	
AB	BA	BC	BD	DB	
-	0.5	0	0.51	-	Distribution factor
-	- 2280	+4360 0	- -2325.6	-	Fixed end moment balance
-1140	-	-	-	-1162.8	Carry over
-1140	-2280	+4560	-2325.6	-1162.8	Final moments

Figure no 8.7: Bending moment diagram of davit stay



Source: Team

$\sigma = -\frac{M*y}{I}$

$Io = \frac{(4.5*7.62^3)-(6.62^3*4)}{3}$

$= 276.85\ cm^4$.

A = (7.62x0.5) + (4x2x0.5)

$= 7.81\ cm^2$.

$Y = \frac{7.62}{2}$ = 3.31cm.

Therefore,

$I = Io + Ay^2$

$= 276.85 + (7.81x3.31)$

$= 302.7\ cm^4$.

$\sigma = \frac{M*y}{I}$

$= \frac{(4559*3.31)}{302.7}$

$= 49.85\ N/cm^2$.

$= 0.4985\ MN/m^2$.

Yield stress of mild steel is 250MPa,

Considering the factor of safety as 5,

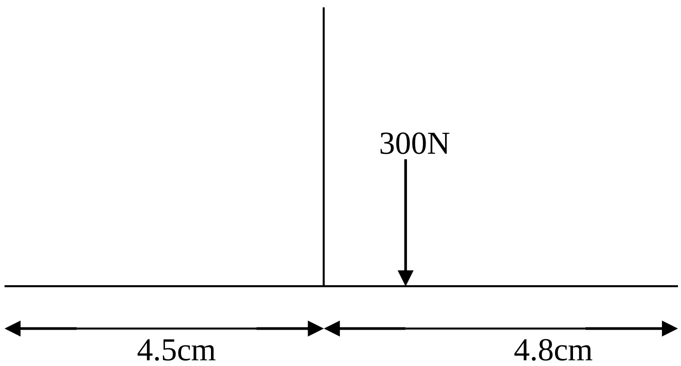
i.e, $\sigma_y = \frac{250}{5}$

$= 50MPa$.

Since, $\sigma_y >> \sigma$, the stay can work without failure.

8.3 DESIGN CALCULATION OF BOAT SUPPORT

Figure no 8.8: Free body diagram of life boat support

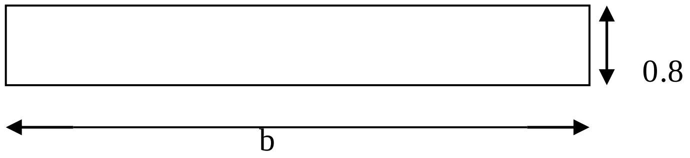


Source: Team

$M = 300 \text{ x } (4.5 + \frac{4.8}{2})$

= 2070 N cm.

Figure no 8.9: Cross section of boat support



Source: Team

Section Modulus = z = $\frac{1}{c}$

$= \frac{1}{c}$

$= \frac{bh^2}{6}$

$= \frac{b*0.8^2}{6}$

= 0.1b cm^3.

$\sigma = \frac{M}{z}$

$= \frac{2070}{0.1b}$

$= \frac{20700}{0.1b}$

$b = \frac{20700}{\sigma}$

σ_y = 250 MPa.

Assuming factor of safety = 5.

$\sigma_s = \frac{250}{5}$

= 50MPa

= $50x10^2$ N/cm2.

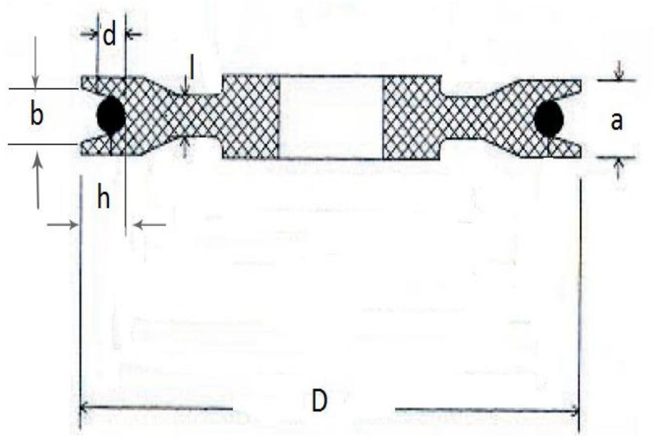
$b = \frac{20700}{50x10^2}$

= 4.18cm.

In our design, we used a angle section having b = 7.5 cm.

8.4 DESIGN CALCULATION OF PULLEY

Figure no 8.10: Cross section of pulley



Source: Team

d = 4mm.

a = 2.7d = 10.8mm.

b = 2.1d = 8.4mm.

l = 0.75d = 3mm.

h = 1.6d = 6.4mm.

D/d = 12 (minimum sheave diameter).

D = 12x4 = 48mm.

8.5 DESIGN CALCULATION OF WIRE ROPE

Load = 50 x 9.81 = 490.5 N

We select a rope of type 6 x 19

ie, 6 strands and 19 wires in each strand.

Since the design load is calculated by selecting a factor of safety 7 for electric and air hoists

Design load for the wire rope

Service load = 7 x 490.5 N

F_s = 3433.5 N

Since 4 rope supp....... $f_s = \frac{3433.5}{4} = 858.376$ N

We found out that the tensile strength of 6 x 19 wire rope made of wire with tensile strength of 1600 MPa is 530 d^2 , where d is the diameter of the rope in mm.

Equating this tensile strength to the desired level, we get

530 d^2 = 3433.5

d^2 = 6.478

or

d = 2.54 mm.........

From table 14.34 of Design Data Book

Diameter of wire, d_w = 0.063 d

=0.063 x 4

=0.252 mm

And area of rope A = 0.38 d^2

=0.38 x 42 = 6.08 mm^2

Weight of the rope,

W = 0.0363d2 = 0.0363 x 42 = 0.58 N/m

= 0.58 x 2 = 1.16 N

Breaking load Fd = KA $\frac{dw}{D}$ K = 82.8 X 10^3 N/m^2

$= \frac{82.8 \times 10^3 \times 6.08 \times 0.25^2}{150}$

= 845.75 N

F_b= 845.75(f_s) = 5920.46 N

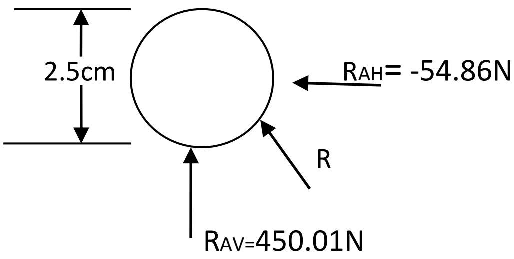
$\frac{Fu}{Fs} > F_b + F_s$

$F_b + F_s$ = 5020.46 +858.376 = 6778.836 N

F_u = ultimate strength of rope for 6 x 19 rope of having 4mm diameter is 8.720 KN = 8728N

$\therefore\ F_u > F_b > F_s$

8.6 DESIGN CALCULATION OF HINGE PIN



$R_{AV} = \sqrt{R_{AV}^2 + R_{AH}^2}$

$= \sqrt{450.01^2 + 54.86^2}$

$= 453.34N$

$A_S = \frac{\pi d^2}{4}$

$= \frac{\pi * (0.022)^2}{4}$

$= 3.8 * 10^{-4}\ m^2$

$\tau = \frac{FS}{AS}$

$= \frac{450.01}{3.8*10^{-4}}$

= 1183823.4 N/m^2

= 1.1835 MPa

τ_y = 145 MPa

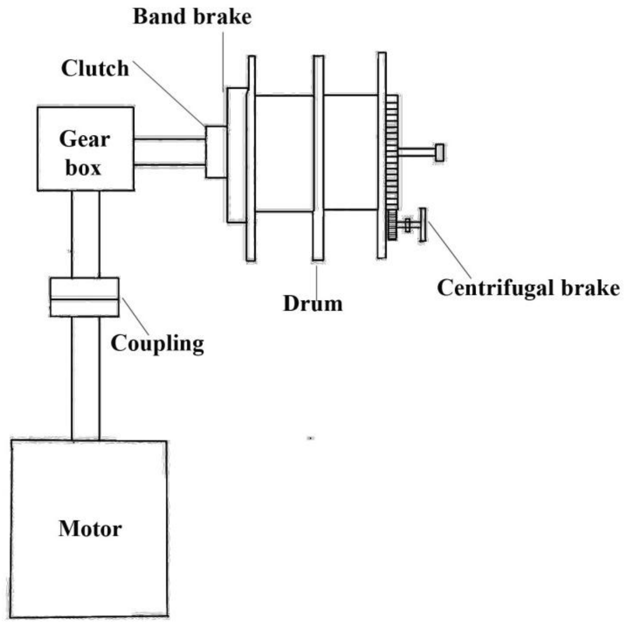
Taking Factor of Safety as 5

The $\tau_w = \frac{145}{5}$ = 29 MPa

$\tau << \tau_w$

CHAPTER 9-DESIGN OF ELECTRIC WINCH

Figure no 9.1: Layout of electric winch



Source: Team

9.1 ELECTRIC MOTOR

Specification of the electric motor

1 phase, AC, 50 Hz

Power – 1 HP

Rpm -1420

Calculation of the load lifted by the motor

Power (P) = 750 watts

Angular velocity (ω) = 1420 RPM

Power (watts) = $\frac{Torque\ produced\ by\ the\ motor(Nm) * Angular\ velocity(RPM)}{60}$

$$P = \frac{T*\omega}{60}$$

$$T_m = \frac{P*60}{\omega}$$

$$= \frac{750*60}{2*\pi*1420}$$

= 5.04 N.m.

$$= \frac{5.04}{9.81}$$

= 0.513761467kg.m.

Torque produced on the drum = 0.5137*50

= 25.68kg.m.

Mass = $\frac{T}{r}$

$$= \frac{25.68}{0.0763}$$

= 336.566 kg

Assuming 50 percent losses due to friction, the maximum mass that can be lifted by the motor is

Mass = 50 percent *336.566 = 168.283

9.2 GEAR BOX

Gear type – worm gear

Gear ratio – 50:1

Figure no 9.2: Gear box

Source: Team

9.3 DRUM

Drum diameter

We select our hoisting speed to 15m/min

Therefore, v = 15m/min

Motor speed , N= 1420 RPM

Gear ratio = 50:1

Therefore,

Shaft speed, n = $\frac{1420}{50}$

= 28.48 RPM

ω= 2πn

= 2$*$ π $*$28.4

= 178.44 rad/ min

V= rω

r = $\frac{v}{\omega}$

= $\frac{15}{178.44}$

= 0.084m

= 8.4cm

i.e, Diameter is 16.6 cm.

So we select a 6inch diameter drum.

Figure no 9.3: Drum

Source: Team

9.4 BAND BRAKE

A band brake is a primary or secondary brake, consisting of a band of friction material that tightens concentrically around a cylindrical piece of equipment to either prevent it from rotating (a static or "holding" brake), or to slow it (a dynamic brake). This application is common on winch drums and chain saws and is also used for some bicycle brakes. Another application is the locking of gear rings in epicyclic gearing.

9.4.1 Advantages And Disadvantages

Band brakes can be simple, compact, rugged, and can generate high force with a light input force. However, band brakes are prone to grabbing or chatter and loss of brake force when hot. These problems are inherent with the design and thus limit where band brakes are a good solution.

9.4.2 Effectiveness

One way to describe the effectiveness of the brake is as $e^{\mu\theta}$, where μ is the coefficient of friction between band and drum, and θ is the angle of wrap. With a large $\mu\theta$, the brake is very effective and requires low input force to achieve high brake force, but is also very sensitive to changes in μ. For example light rust on the drum may cause the brake to “grab” or chatter, water may cause the brake to slip, and rising temperatures in braking may cause the coefficient of friction to drop slightly but in turn cause brake force to drop greatly. Using a band material with low μ increases the input force required to achieve a given brake force, but some low-μ materials also have more consistent μ across the range of working temperatures.

Figure no 9.4: Band brake

Source: Team

This is a very simple type of brake using the principle that a band is wrapped part round a rotating drum. Tension can be applied to the band using a lever. The restraining torque results from the difference in tension between the two ends of the belt. The two band brake options are shown below:

Nomenclature

F = Applied Force (N)

P = Brake Power kW

M = Torque (Nm)

F_i = Actuating Force (N)

μ = Coefficient of Friction.

θ_t = Total band lap angle (rad)

w = Band width

a = Pivot- Actuating force radius (m)

b = Distance from tensioning belt to fulcrum point

n = Rotational Speed (RPM)

T_1 = Maximum band tension(N)

T_1 = Minimum band tension(N)

T_c = Band tension associated with centrifugal force (N)

p = pressure between band and drum surface (N/m^2)

p_{max} = maximum pressure for friction surface(N/m^2)

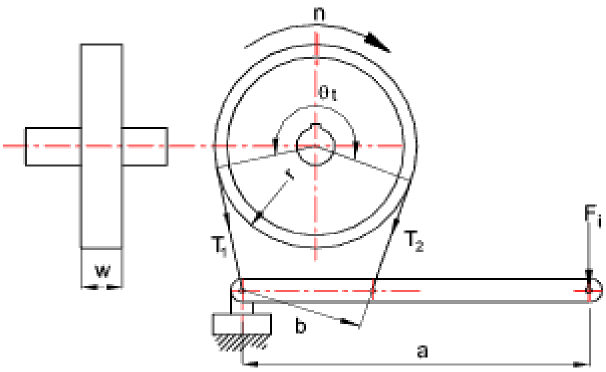
The principles of operation of the band brake is the same as for belt drives.The following formula relates the band tensions (T_1 , T_2) , the lap angle(θ), and the coefficient of friction (μ).

$$e^{\mu\theta_t} = \frac{(T_1 - T_c)}{(T_2 - T_c)}$$

The tension due to the belt rotational inertia for $T_c = 0$ because the band is not moving for the brake application.

$$T_1 / T_2 = e^{\mu\theta_t}$$

Figure no 9.5: Band brake dimensions



Source: Internet

For the Normal Band Brake arrangement shown the relationship between the actuating force and the slack side belt tension is,

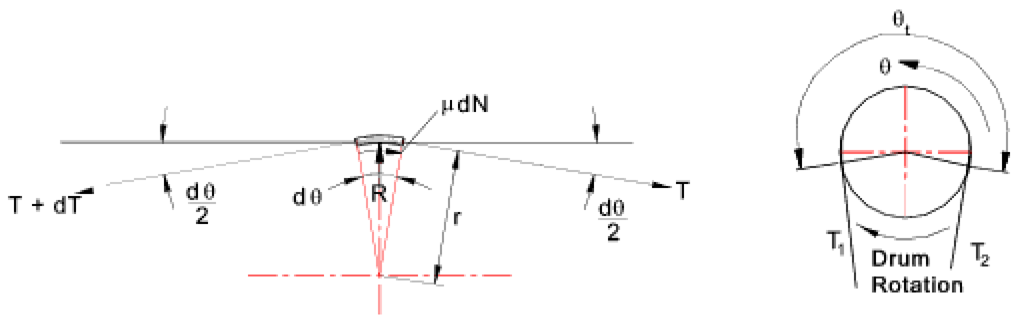
$$F_i = T_2 * b / a$$

9.4.3 Brake Torque Capacity

The torque capacity of the band brake = $M = (T1 - T2) * r$

9.4.4 Maximum Belt Tension

Figure no 9.6: Drum rotation



Source: Internet

The force acting upon an element band width, $w = R = p\ wr\ d\theta$

Resolving the band forces in the vertical direction,

$$R = (T + dT + T) \sin (d\theta /2)$$

Ignoring dθ. dT term. For small angle sin θ - > θ .. Therefore

$$R = T * d\theta$$

Substituting for R,

$$T * d\,\theta = pwrd\theta$$

Therefore,

$$T = p*w*r$$

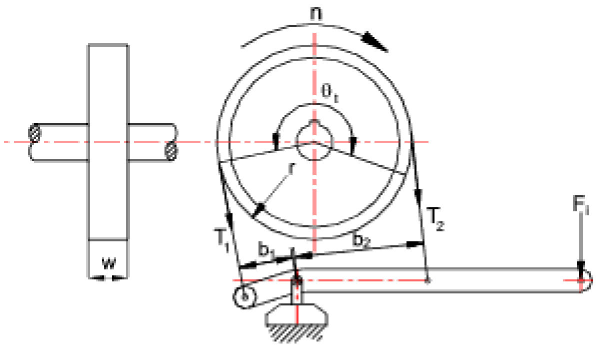
The maximum tension in a belt is provided by the formula below.

$T_{1\ max} = p_{\ max} * w * r$

9.4.5 Differential Band Brake

The differential band brake as shown below can be configured to be self energising and can be arranged to operate in either direction.

Figure no 9.7: Differential band brake



Source: Internet

The actuating force equation obtained by summing moments about the pivot points is shown below

$$F_i = (b_2 T_2 - b_1 T_1) / a$$

If $b_2 T_2 = b_1 T_1$, the zero actuating force is required and the brake is self locking. It is also apparent that the brake is effectively free-wheeling in the opposite direction. The differential brake can therefore be arranged to enable rotation in one direction only.

9.5 CENTRIFUGAL BRAKE

A centrifugal brake is provided to avoid the boat 'running away' while being lowered o hoisted due to the main brake being released by mistake. This limits the rate of descent of the boat when the hand brake is not engaged. Shoes of calculated weights act on the inner surface of a stationary drum, being thrown outward by centrifugal effect against the restraining springs. The lowering speed of the boat can be kept within the required 36 m/min. A ratchet arrangement ensures that the drums will not reverse and drop the boat back towards the water in the event of a power failure when the boat is being hoisted.

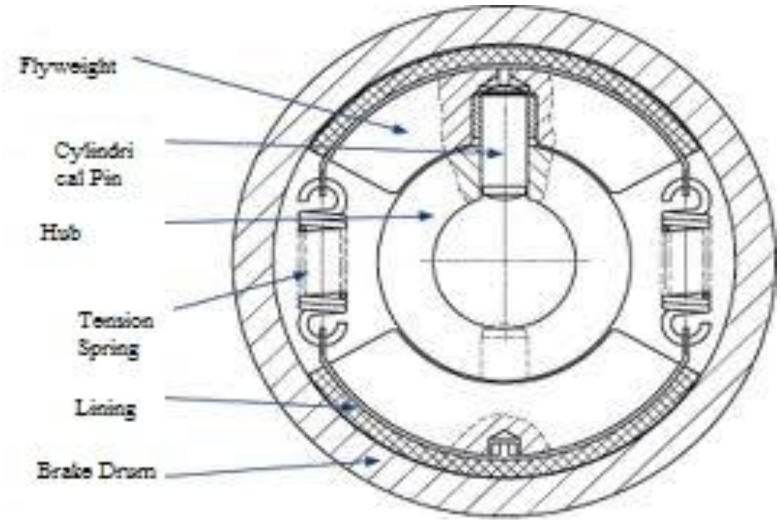
Besides centrifugal clutches, centrifugal brakes are becoming increasingly important. A decisive advantage of centrifugal brakes over conventional brakes is that they operate without an external power supply. The brake, mounted on a shaft, starts to brake the drive shaft at a defined speed. Centrifugal force causes the flyweights to lift from the hub so that their linings contact the inside diameter of the brake drum. This action creates a braking torque. As soon as the speed of rotation of the system falls, the tension springs return the flyweights to their initial positions. It is a fundamental principle of the centrifugal brakes that they cannot brake a system to a standstill, i.e. the system speed searches for an equilibrium condition between the speeds determined by load torque and braking torque. Although centrifugal brakes are governed by the same technical principles as centrifugal clutches and also use similar components, brakes call for additional investigation of their conditions of use.

The winch shall be furnished with a fully automatic, tamper-resistant, centrifugal overspeed, disk, and brake. This secondary brake shall provide protection from a failure of a winch drive component or the primary motor brake. This brake shall engage automatically if the winch drum exceeds a preset rotational speed, in the down direction, and smoothly stop the winch load within a travel not to exceed 6 inches, from point of engagement. The speed at which the brake engages and the brake torque shall be factory pre-set and no user adjustment shall be required or needed. The over speed brake shall engage solely by centrifugal mechanical action, operate independently, and require no sensors, power sources, or controls.

The winch shall be furnished with a fully automatic, tamper-resistant, centrifugal overspeed, disk, and brake. This secondary brake shall provide protection from a failure of a winch drive component or the primary motor brake. This brake shall engage automatically if the winch drum exceeds a pre-set rotational speed, in the down direction, and smoothly stop the winch load within a travel not to exceed 6 inches, from point of engagement. The speed at which the brake engages and the brake torque shall be factory pre-set and no user adjustment shall be required or

needed. The over speed brake shall engage solely by centrifugal mechanical action, operate independently, and require no sensors, power sources, or controls.

Figure no 9.8: Centrifugal brake



Source: Internet

9.6 WIRE ROPE

A steel wire rope is composed of three parts – wires, strands and the heart. The heart is made of natural fibre, though recently synthetic fibre has been used when resistance to crushing is required. With the many changes in the marine industry the needs in wire rope have altered considerably from the early production days of 1840. Then the first wire ropes, known as selvagee type ropes, were constructed of strands laid together then seized to form the rope. Modern ropes are designed with specific tasks in mind, and their construction varies accordingly. However, all wire ropes are affected by wear and bending, especially so when the ropes are operated around drum ends or sheaves. Resistance to bending fatigue and to abrasion require two different types of rope. Maximum resistance to bending fatigue is obtained from a flexible rope with small outer wires, whereas maximum resistance to abrasion needs a less flexible rope with larger outer wires. When selecting a wire rope, choose a wire which will provide reasonable resistance to both bending fatigue and abrasion. The wire should also be protected as well as possible against corrosive action, especially in a salt laden atmosphere. Where corrosive conditions exist, the use of a galvanised wire is recommended. All wires should be governed by a planned maintenance system to ensure that they are coated with lubricant at suitable intervals throughout their working life. Internal lubrication will occur if the wire has a natural fibre heart, for when the wire comes under tension, the heart will expel its lubricant into the wires, so causing the desired internal lubrication. If synthetic material is used for the heart of a wire, this also acts to reduce corrosion. Being synthetic, the heart is impervious to moisture; consequently, should the rope become wet any moisture would be expelled from the interior of the wire as weight and pressure are taken up.

Figure no 9.9: Wire rope

Source: Internet

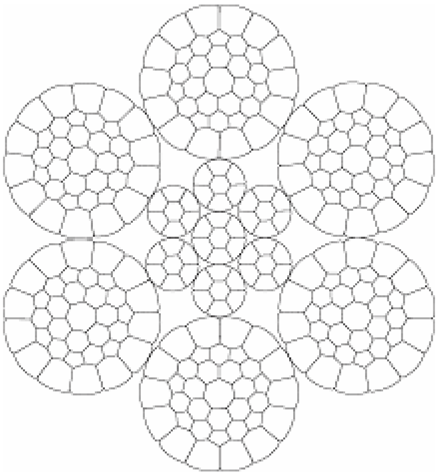
9.6.1 Lubrication

Steel wire ropes are lubricated both internally and externally in the course of manufacture, to provide the wire with protection against corrosion. During its working life the rope will suffer pressure both externally and internally as it is flexed in performing its duty. The original lubricant may soon dry up and it will be necessary to apply supplementary lubricant at periodic intervals.

9.6.2 Main Core (Heart)

Within the shipping industry the majority of steel wire ropes, of the flexible nature, are equipped with a hemp or jute natural fibre heart. The non-flexible wires are usually built up about a steel core. The natural fibre heart is impregnated with grease, to supply internal lubrication when the rope comes under tension.

Figure no 9.10: Cross section of wire rope



Source: Internet

9.6.3 Preforming

This is a manufacturing process which gives the strands and the wires the helical shape they will assume in the finished rope. Preformed rope has certain advantages over non-preformed:

1. It does not tend to unravel and is less liable to form itself into loopsand kinks, making stowage considerably easier.

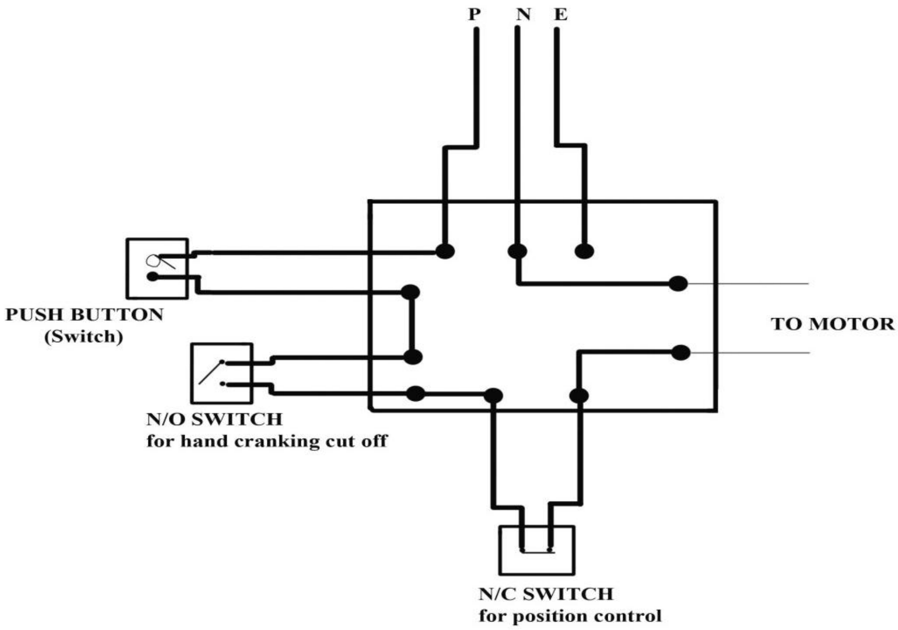
2. It is slightly more flexible and conforms better with the curvature of sheaves and drums.

3. It provides reduced internal stresses and possesses a greater resistance to bending fatigue.

When cutting preformed wire rope, it is not essential to whip the bight either side of the intended cut, though it is good practice to do so. Whippings should be applied to all non-preformed wires when they are to be cut.

9.7 CONNECTION DIAGRAM

Figure no 9.11: Electrical connection diagram



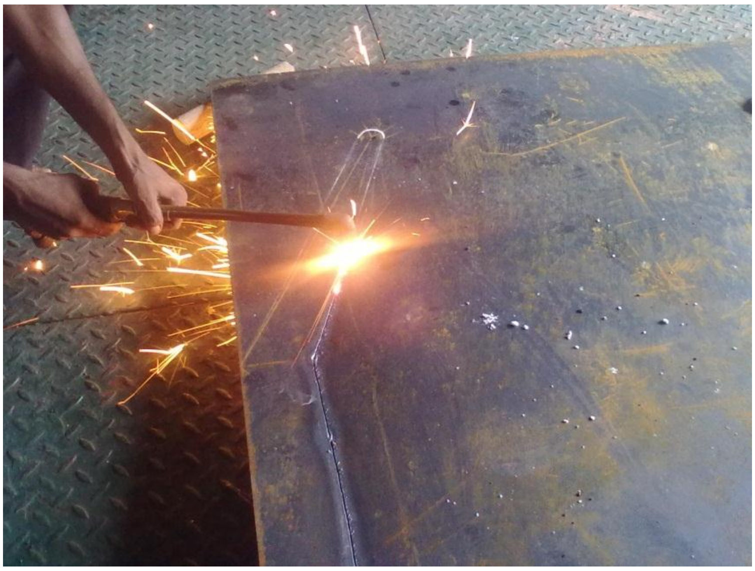
Source: Team

CHAPTER 10 - METHODOLOGY AND CONSTRUCTIONAL DETAILS

For integrating the project activities effectively and to make it more cost effective we decided to fabricate the structure in the campus work shop itself.

We started with a davit arm. For this, four drawings of the davit arm end view was made on the plate using chalk utilising the minimum plate area. After this it was cut out from the plate by using a gas cutter. For improving the edge finish grinding was done on it using a hand held grinder on all four pieces. On the bottom of the four pieces provision for the pin to pass through was made by cutting out holes and for getting the correct dimension they were reamed. Then two plates were joined together by welding strips of width (cut out from the same plate) between them to form the three dimensional closed structure of the davit arm. For improving the edge finish after welding, grinding was done again on the edges. Angles were welded to the davit arm to act as stoppers. The same method was employed to make a second davit arm. The stoppers were further strengthened by welding angles of the same kind between the davit arm and stopper. For running the wire rope two pulleys were fitted on both sides of the top most part of the davit arms with the help of pins welded on both sides. To limit the movement, a metal block was welded tangential to the pulleys on both the davit arms. For improving the surface finish NC putty was applied on the entire surface of the davit arms followed by the application of the first coat of primer.

Figure no 10.1: Cutting the plate



Source: Team

Figure no 10.2: Davit arm

Source: Team

10.1 Davit stay

After completing the work of the davit arm we moved on to the fabrication of the davit stay. As the first step, channels were cut out as per the drawings made earlier. Two vertical channels were welded at a distance to accommodate the davit arm. The holes for passing the davit arms were cut out and reamed. Next, the standing channel which supports the vertical structure was welded on to the platform (as per the drawing). For further improving the strength, angles were welded between the vertical and slanting structure. The same methodology was followed for fabricating a second davit stay of similar dimensions.

A solid shaft of MS of slightly higher diameter was bought for making the pin. For this the solid shaft was first mounted in the lathe machine and centred. It was turned till the required diameter was obtained. Then it was cut into two pieces of length as was required to function as the pin for the davit.

The pulleys for running the wire rope were welded at the positions as per the drawing. For improving the surface finish after welding, grinding was done again on the surface of the structure

Figure no 10.3: Davit stay

Source: Internet

10.2 Platform

For serving the purpose of an embarkation deck a table was made. It was made from sheet plate. Four hollow GI pipes were welded to the plate as legs. The material selection of the table was done as per the strength calculation (in order to withstand the weight of the whole structure). Angles were welded to give more strength. To further strengthen the base, angles were welded in a cross manner below the plate. For giving the surface finish final grinding was also done.

10.3 Winch

For winding up the wire rope a winch arrangement was made. For this, after detailed calculations and studies we came to the conclusion that a reduction gear box (worm gear) of gear ratio 1:50 will be sufficient. We bought a second hand gear box from a textile mill having the above said specifications. For making the drum, we bought 6 inch MS pipe of 3 mm thickness and length 30 cm. We also bought three circular plates of diameter slightly more than that of the pipe. One of the plates was centred and the pipe diameter was drilled out from it. Then it was welded at half the length of the pipe. The remaining two plates were welded on both sides of the pipe. After this a polished shaft was passed through the centre of the drum and welded by cutting out holes of the same diameter as that of the shaft from the centre of the disc (the shaft of the drum is to be supported by a bearing at one end and the gearbox at the other end). For making the manual brake a thin metal strip of was bent in the form of a circle. After this brake lining made of synthetic rubber was glued to it using araldite as the adhesive. A manual clutch was made from a hollow shaft and a key was put to it to prevent it from slipping. A rod was welded on to the movable part of the clutch in order to be able to engage and disengage it during operation.

The shaft and the drum arrangement supported by a bearing at one end and gear box at the other end. For the centrifugal break to act a speed of above thousand rpm was required. This was achieved by increasing the speed by welding a large gear on to the drum and meshing it with a smaller pinion which was on the same shaft of centrifugal break.

10.4 Driving unit

A single phase AC motor (1 horse power) of the double end type was bought and engaged to the gear box at one end. At the other end of the motor shaft provision for manually operation of the winch was also provided.

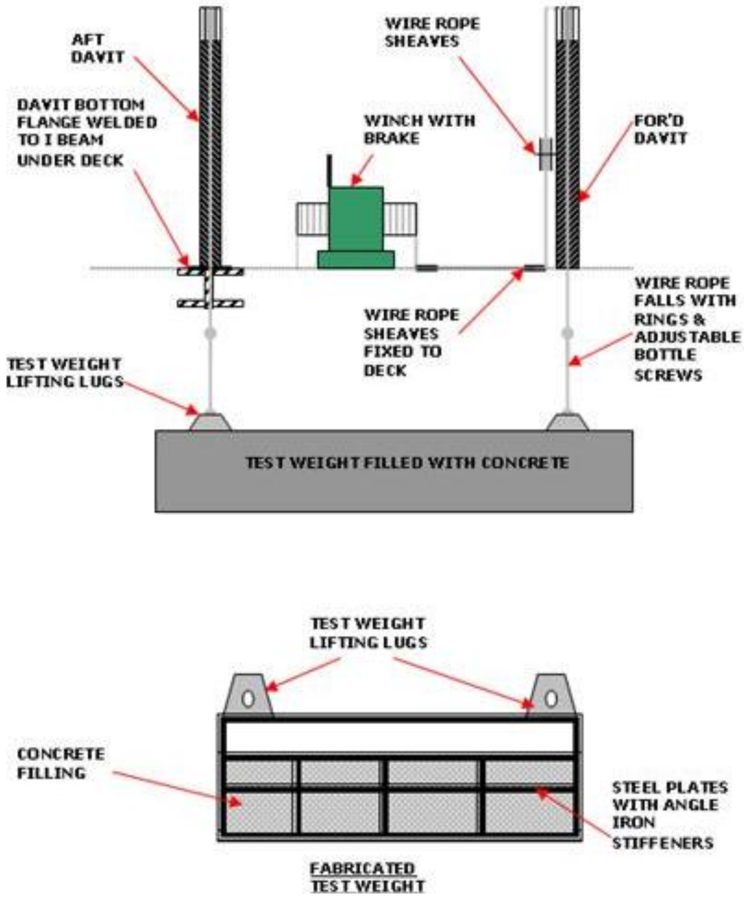
CHAPTER 11 - TEST AND TRIAL

Before any testing is carried out, a thorough examination of the sheaves, wire ropes, winch and attachments should be carried out to ensure all these components are in working order and well lubricated and greased. The supporting welds between the deck and the davits are tested by visual examination.

Once these examinations have been carried out, and welds have been passed the relative positions of the davits are measured using a dial gauge and a protractor, testing can commence in the following sequence,

1. The Safe Working Load (SWL test) weight is attached to the davit ropes and the winch operated to raise the weight to the normal height that the lifeboat would be stowed.
2. The winch brake is released and the weight allowed to free-fall a few meters before being applied again. The weight should stop and not creep downwards. Any deviation from this will require the winch brake to be adjusted.
3. The positions of the davits are again measured and any deflections recorded.
4. The SWL test weight is removed
5. This procedure is repeated, this time using the proof load weight. (The proof load is 2.2 times the weight of a fully laden boat including equipment, plus the weight of the max number of persons it can carry.)
6. The weight is removed from the davit ropes.
7. The positions of the davits are again recorded using the dial gauge and the protractor. Any deflection is noted.
8. The supporting welding is then subjected to visual examination, and the data recorded.

Figure no 11.1: Load test of life boat davit



Source: Internet

CHAPTER 12 - CONCLUSION

Life is the most important concern anywhere so is the case on board the vessel. Though the circumstances that may lead to the use of a lifeboat is much dreaded onboard the vessel, it is necessary for each and every person onboard to have the basic knowledge and understanding on how to launch a lifeboat, familiarize with the escape and rescue procedures, the etiquettes to be followed in an emergency situation etc.

A working model of the gravity davit launching system of a lifeboat was made by the project team. The necessary safety cut outs have been included in the working model and all existent rules and regulations have been taken into consideration. The project team has made a thorough study about the various methods of launching the lifeboat, the rule requirements regarding the lifeboat, the choice of material etc. During the completion of the project, each member of the team was able to get a first-hand experience on the various methods of fabrication and designing.

The working model of the lifeboat launching gravity davit was tested and has been found in excellent working condition.

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