Refrigerated Sea Water (RSW) For Handling of Fish Catches

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***Abstract*—Most fishermen use ice (icing) as a fish preservative for fresh fish products and use the frezer as a frozen fish product.Handling of fish catches in the sea on fishing boats is the first stage that determines the quality of fish that directly impact on the selling price. RSW to overcome the weakness of the use of ice in the fish preservation on the ship. It's technique of cooling and preserving fish by inserting fish into a hold or chamber containing cold sea air temperature of about -5^{0}C which is cooled manually by a refrigeration system.**

RSW ship's does not need to carry ice blocks so as to reduce the cost of supplies, no need to hold a special hatch to ice, fish temperatures fall faster because the cold sea air can enter the fish body, the fish get no pressure because of the buoyancy of the air, durable due to the salting process from the sea air and the quality of the fish remain awake as fresh fish products higher prices.

Keywords— RSW , handling of fish catches, icing

I. INTRODUCTION

RWS technology method of cooling using cold seawater fish obtained from the refrigeration mechanism using a mechanical system. Then just inserted into the live fish cargo fish already filled the cold sea water[1]. From these existing cooling techniques of fish using the cold water has many advantages compared to the other due to the fish faster cold caused can enter into the body of the fish and the fish are not subjected to the pressure caused by the power fish floating in the water.see Fig. 1

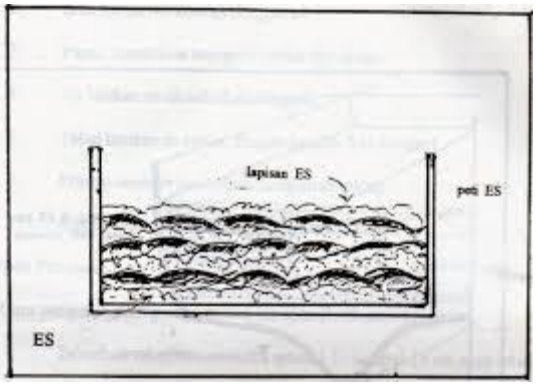

Fig 1. Cooling techniques handling of fish catches

Currently for ships above 60GT most fishing boats using the frezer to freeze fish. The making of the frezer is much more expensive than the technique of RSW plus also the selling price higher because the fish technique RSW produce fresh fish while the frezer produces frozen fish [3].

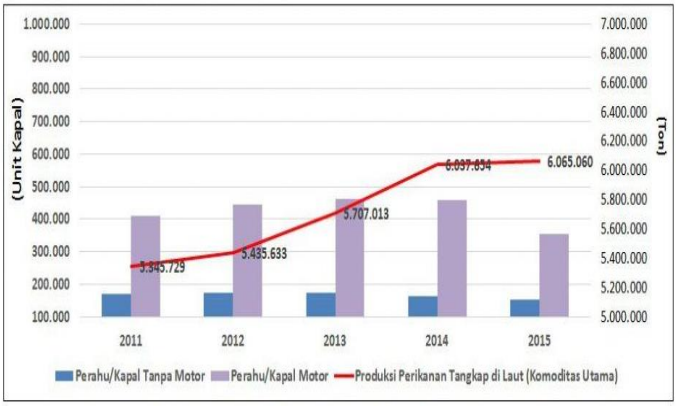

Fig 2. Production of Fishing Ship in Indonesia

Advantages of the use of the technique of RSW between other;(1) temperature of the fish faster down so that the quality of the fish stay awake ; (2) Easy work because only put in the hold containing sea water would like to not have to put in the basket or basket. ; (3) physical damage, such as cuts or abrasions and skin color is relatively small ; (4) fish

are in a State that still regormortis for processing so as to speed up the cutting and weeding; (5) more efficient processing Time due to soaking in a solution of salt is also one of the stages of the process of freezing and canning fish.[2]

This observation is done by the method of approach. observation of air temperature on the box with the environment, RSW and observations and P Psuction pressure discharge on the compressor unit. [6]

As an illustration, Observation of temperature on the box with the RSW environment . The initial temperature of the box is 29,4 ° C, and the temperature of the environment is 32.7 ° c. The process of running the tool is preceded by setting the rotation of diesel engines at 1000 RPM. On the operation of the cooling system obtained the final temperature is 20 ° C with the temperature of the environment is 31.7 ° C.

Table I. Table of Observation RSW

No	Time	Temperatur (^{0}C)			P (Psi)	
		Fish Hold 1	Fish Hold 2	Hull	Suction	Discharge
1	11.00	29,4	30,7	32,7	23	150
2	11.10	25,8	28,5	32,4	23	150
3	11.20	22,8	28	32,6	25	170
4	11.30	21,6	27	31,9	25	170
5	11.40	21,1	26,5	31,6	24	160
6	11.50	20	25	31,7	24	160

from the table we can know that the value if the lower the room temperature then the higher the calories expended, see table 1.

II. METHODS

The workings of the system of Refrigerated Sea Water (RSW) according to :

A. RSW System

RWS the system describes the flow and management of sea water from the outside towards the system in cargo hold, see Fig 3.

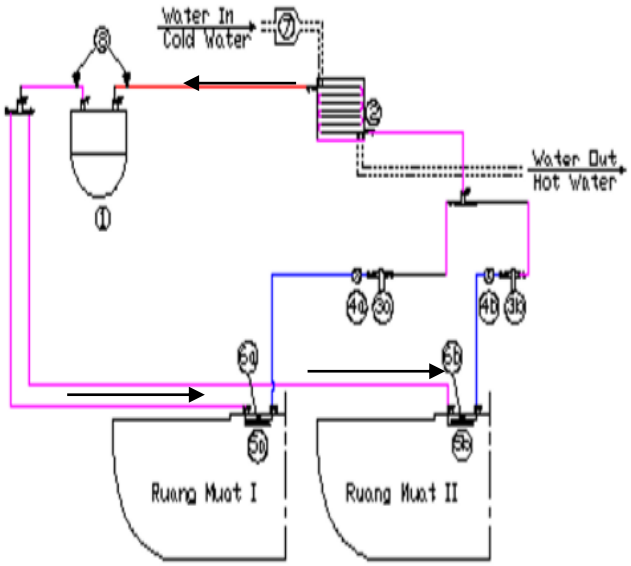

Fig 3. RWS system.

Description :
1) Compressor
2) Condensor
3 a) Receiver Dryer to Cargo Hold I
3 b) Receiver Dryer to Cargo Hold II
4 a) Expantion Valve to Cargo Hold I
4 b) Expantion Valve to Cargo Hold II
5 a) Evaporator to Cargo Hold I
5 b) Evaporator to Cargo Hold II
6 a) Fan for Cargo Hold I
6 b) Fan for Cargo Hold II
7) Water Pump
8) Pressure Gauge

B. Fish Hold Capacity

Volume of a space fit based on the size of the obtained field is capacity reductions due to the addition of insulation on the walls of the hold. see Fig 4.

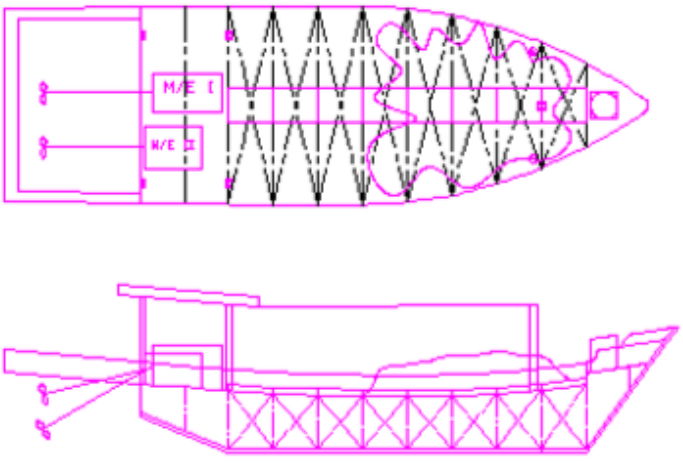

Fig 4. Cargo Layout

C. Ship Capacity

Ship capacity of hull calculated by the method of the Simpsons. See Fig 5.

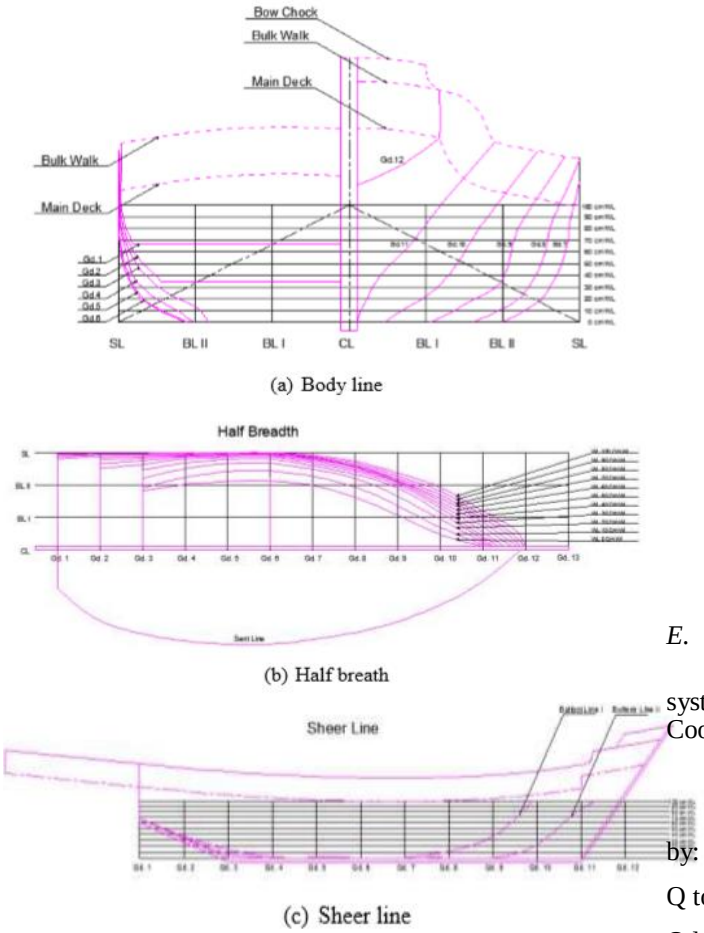

Fig 5. Ship Capacity Design

D. Load of Hull Temperature

Design insulation of Hull RSW system, see Fig 6.

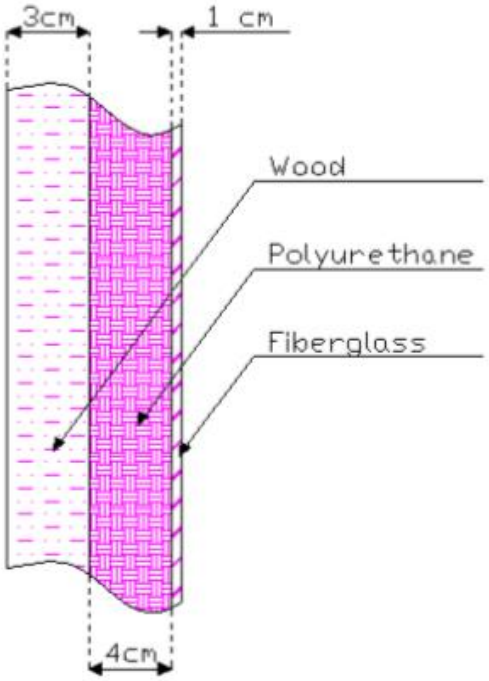

Fig 6. Insulation of RSW

E. Basic Theory Insulation of RSW

Who needs to be on notice to measure the load on the system of RSW (Qtot) is ; Area of Hull, Temperature , Load Cool of System , Load Cool of Product [4], by formula like :

$$Qtot = Qd + Qp \quad (1)$$

by:

Q tot = Load Total (watt)

Qd =Load Cool of System (watt)

Qp = Load Cool of Product (watt)

To calculated load of system, use formula :

$$qd = \frac{T1 - T4}{\frac{\Delta Xa}{kaA} + \frac{\Delta Xb}{kbB} + \frac{\Delta Xc}{kcC}} \quad (2)$$

by:

qd = Load Cool of System (watt)

T1 = Temperature on Top (^oC)

T4 = Temperature on Base (^oC)

kaA = Termal Conductifity Fish Hold (W/m.C)

kaB = Termal Conductifity Fish (W/m.C)

kaC = Termal Conductifity Hull (W/m.C)

$\triangle Xa$ = Space / Area component Fish Hold (m^2)

△Xb = Space / Area frame Fish Hold (m^2)

△Xc = Space / Area thickness of insulation Fish Hold (m^2)

To calculated load of product, use formula :

$$qp = W \times C \times (T_2 - T_1) \quad (3)$$

by:

qp = Load Cool of Product

W = Air Density

C = Specific heat (from table of Alimetri) Kj/kg

T1 = Temperature on Base (°C)

T2 = Temperature on Top (°C)

Overview of the basic theory of RSW is present on the following chart , see Fig 7 :

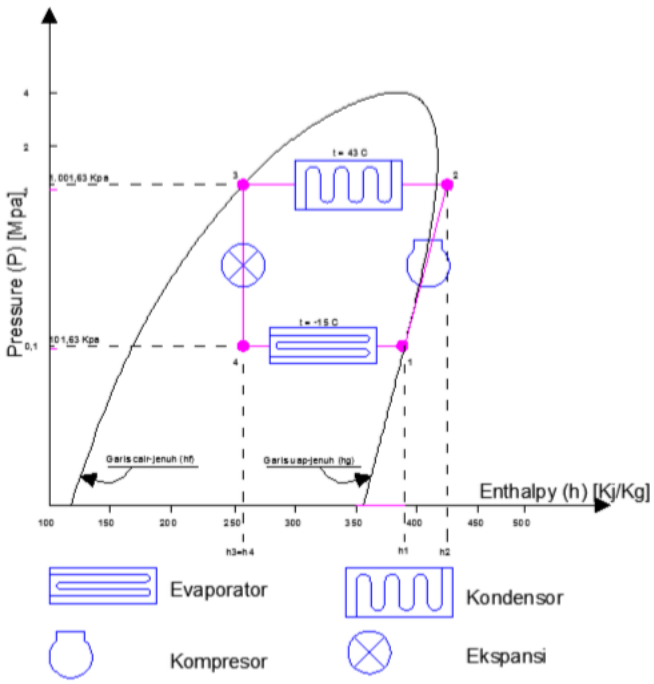

Fig 7. Cooling System

F. Basic Calculation of Compressor, Condensor, Evaporator

F1. Compressor

The work done by the compressor to run the system, the process of compression are isentropic in compressor. (kJ/kg), by formula :

$$q - w = \triangle h \quad (4)$$

by :

q = Load (kJ/kg)

w = Energy (kJ/kg)

△h = Range of Temperature (°C)

F2. Condenser

Heat dissipation in isobaric in condenser, by formula :

$$q - w = \triangle h \quad (5)$$

by :

q = Load (kJ/kg)

w = Energy (kJ/kg)

△h = Range of Temperature (°C)

F3. Evaporator

The absorption of heat in evaporator of refrigerant phase changed the environment of the vapour phase mixture (point 4) menjai satured Vapour (1 point) [5], by formula :

$$q - w = \triangle h \quad (6)$$

by :

q = Load (kJ/kg)

w = Energy (kJ/kg)

△h = Range of Temperature (°C)

III. RESULTS AND DISCUSSION

Test results of RSW system from calculations, are as follows:

A. Compression Refrigeration System Steam

Looking for the value of the enthalpy (h), see table 2:

Table II. Table of Result Enthalpy

No	Enthalpy (h)	Value (kJ/kg)
1	H1	389,96
2	H2	261,164
3	H3	231,4
4	H4	261,164

Result from the table maximum energy enthalpy on H1 the value 389,96 kJ/kg. and RSW can replace use ice for Handling of Fish Cathes.

B. Coefisien of Performace (COP)

Coefisein to calculated a comparison between the value of the evaporator with the energy of compressor :

$$COP = \frac{qevap}{WKompresor} \quad (7)$$

Result of COP calculation is 3,24

C. Prosentase of System

This prosentase use to know the result of efisiency this system and the result is 40,7 %

IV. CONCLUSION

Note the value of the coefficient of performance / achievement's of Performance (COP) refrigeration system design is the cooling capacity of 3.24, meaning greater than the work done by the compressor. Performance (COP) > 1 means it deserves.

ACKNOWLEDGMENT

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