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Seakeeping Of A 60 Gt Cast Nets Fishing Vessel At Muara Angke Fishing Port

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Abstract

Based on the provisions made by the International Maritime Organization (IMO), turning ability and zig-zag maneuvers are the main criteria for safety standards for every ship that will sail. This decree was made as an effort to improve sailing skills, especially for ship crew. Calculation of the turning ability of a ship is greatly influenced by the design of the ship's hull and the design of the rudder that will be used on the ship. So the analysis of turning circles and zig-zag maneuvers is the main point that will be carried out in this research. The research was carried out on cast net vessels anchored at the Muara Angke fishing port with the vessel size taken being 60 GT. The standard provisions used in the analysis of turning ability and zig-zag maneuver are based on IMO MSC 137 (76) with the main size of the vessel used as the main research material is LOA=25.7 m, LPP =22.2 m, B=7 m, H=2.3 m, T=1.7 m. With the results obtained by the movement of the fishing vessel which meets standardization based on IMO MSC 137 (76) 2002, the turning circle maneuver has a Tactical Diameter of 46.07 m, with an Advanced value of 56.23 m, with a heading transfer value of 24.48 m, the zig-zag maneuver meets the IMO standard criteria stated for angels 10°/10° and 20°/20° do not exceed 30 seconds

Keyword : Fishing Vessel,Cast Net, Seakeeping, Zig-zag Maneuver, Turning Circle

1. INTRODUCTION

Based on the provisions made by the International Maritime Organization (IMO), turning ability and zig-zag maneuvers are the main criteria for safety standards for every ship that will sail. This decree was made as an effort to improve sailing skills, especially for ship crew [1]. The ship's ability to maneuver is the ship's ability to rotate or move when the ship is in port or on the high seas. Maneuverability is also based on the design of the ship's hull, engine selection. as well as planning the propellers used by ships [2]. The calculation of the turning ability of a ship is greatly influenced by the design of the ship's hull and the design of the rudder that will be used on the ship [3].

Referring to the standards set by IMO, fishing vessels with 60 GT cast net fishing gear really require analysis of both turning circles and zig-zag maneuvers because these two criteria must be possessed by vessels when the vessel is carrying out fishing operations on the high seas. With the draft that must be fulfilled on board the ship, namely changing, starting, stopping, maintaining the course, and checking its capability.

Regarding turning circle maneuverability, experiments can be carried out on each type of skeg variation in order to find out the best efficiency value in turning maneuvers, where the non-skeg turning maneuver value has a better value so that the smaller the diameter of the maneuver, the more efficient the ship will be in maneuvering, so that Fishing vessels are easier to maneuver when the vessel is carrying out fishing operations and the criteria for zig-zag vessel maneuvering are based on IMO standardization Resolution MSC 137 (76) (2002). So the analysis regarding turning circles and zig-zag maneuvers is the main point that will be carried out in this research.

2. METHODS

The location used as a research location is Muara Angke Fishing Harbor. The ship that is the object of research is a fishing vessel with Cast Net fishing gear with a size of 60 GT. Data on the size of fishing vessels used as research material is based on data obtained from the fisheries supervisory agency (Waski) of Muara Angke Fishing Port. The data obtained is then processed and used as the main dimensions of the fishing vessel design which is made with the main dimensions of the resulting vessel being as follows:

Table 1. Main Dimension of Ship

No	Item	Ukuran	Satuan
1	Length of All (LOA)	25,70	m
2	Length of Between Perpendicular (LBP)	22,2	m
3	Breadth (B)	7,00	m
4	Height (H)	2,30	m
5	Draft (T)	7,70	m
6	Vertical distance from midship	520	mm

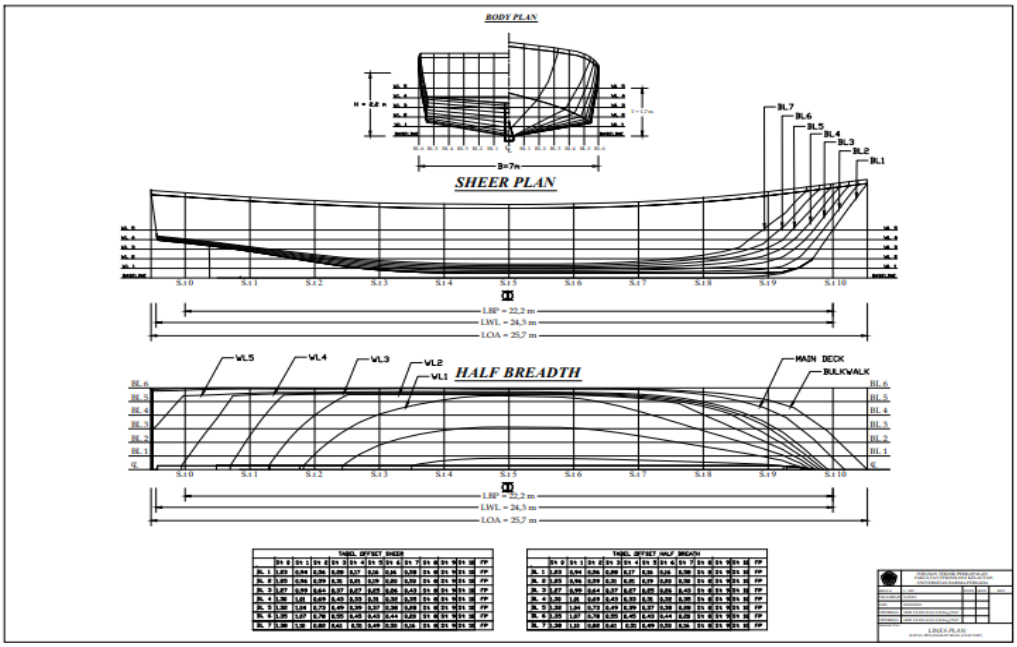

Fig 1. Result of Design Fishing vessel 60 GT

2.1 Seakeeping

This research was carried out using a Cast Net 60 GT fishing vessel, the analysis was carried out using AutoCad software and Matlab software where simulations were carried out based on IMO standards [4] in the zig-zag maneuver test with standard criteria of 10°/10° and 20°/20°. ° states that the overshoot value of 10/10 and the criteria of 20°/20° must not exceed 30 seconds and for turning circles an analysis is carried out. This test starts with a straight forward movement until it meets a constant speed. Then, the ship's rudder is turned on to maximum speed and remains at maximum rudder angle until the ship experiences a circular motion of at least up to an angle of 540°. This experiment was carried out in 2 directions port and starboard or left and right directions.

2.2 Turning Circle

$$\rho = K3.\ V / Cn\ A \cos\alpha \quad (1)$$

K3 = Coefficient From table. 2

Table 2. Coefficient of K3

S.L	K3	S.L	K3
0.050	1.140	0.10	0.460
0.055	1.285	0.11	0.400
0.060	1.100	0.12	0.370
0.065	0.960	0.13	0.355
0.070	0.845	0.14	0.345
0.080	0.670	0.15	0.340
0.090	0.550		

Description :

V = *Volume Displacment*
A = *Area Rudder*
S = *Midship Area*
L = *Length Waterlin*e (m)
α = *Max. steering leaf angle* (35°-40°)
Cn = *Normal style coeff.*
Cn = *0,811 sinα* / (0,195 + 0,305 sinα)
Dimana :

$$\rho = K3.\ V / Cn.\ A.\ Cos\alpha \quad (2)$$

$$K3 = V / S.L \quad (3)$$

2.3 Zig Zag Manuever

Pengujian zig-zag pertama pada 20°/20° dilakukan pada saat kapal bergerak maju dengan kecepatan kapal The first zig-zag 10°/10° test is performed when the ship is moving forward at a maximum speed of 9 knots with a bow of 0° and then the ship's rudder is directed at an angle of 10° to the left.
The first overshoot angle value in the 10°/10° zig-zag test must not exceed:
1.10° if L/V is less than 10 seconds; .
2.20° if the L/V is 30 seconds or more
3.5 + 1/2(L/V)) degrees if the L/V is 10 seconds or more, but less than 30 seconds.

Dimana :

$$(10°) = 5+0.5\ L/V)° \quad (4)$$

3. Result And Discussion

3.1 General Arrangement

Based on the results of the design of fishing vessels [5] that the ship has met the standards based on MLC 2006 [6] and in Torremolinos International Convention For The Safety Of Fishing Vessels, 1977 [7] so that the crew gets comfort when sailing, with a general plan drawing of a 60 GT Cast Net fishing vessel as follows:

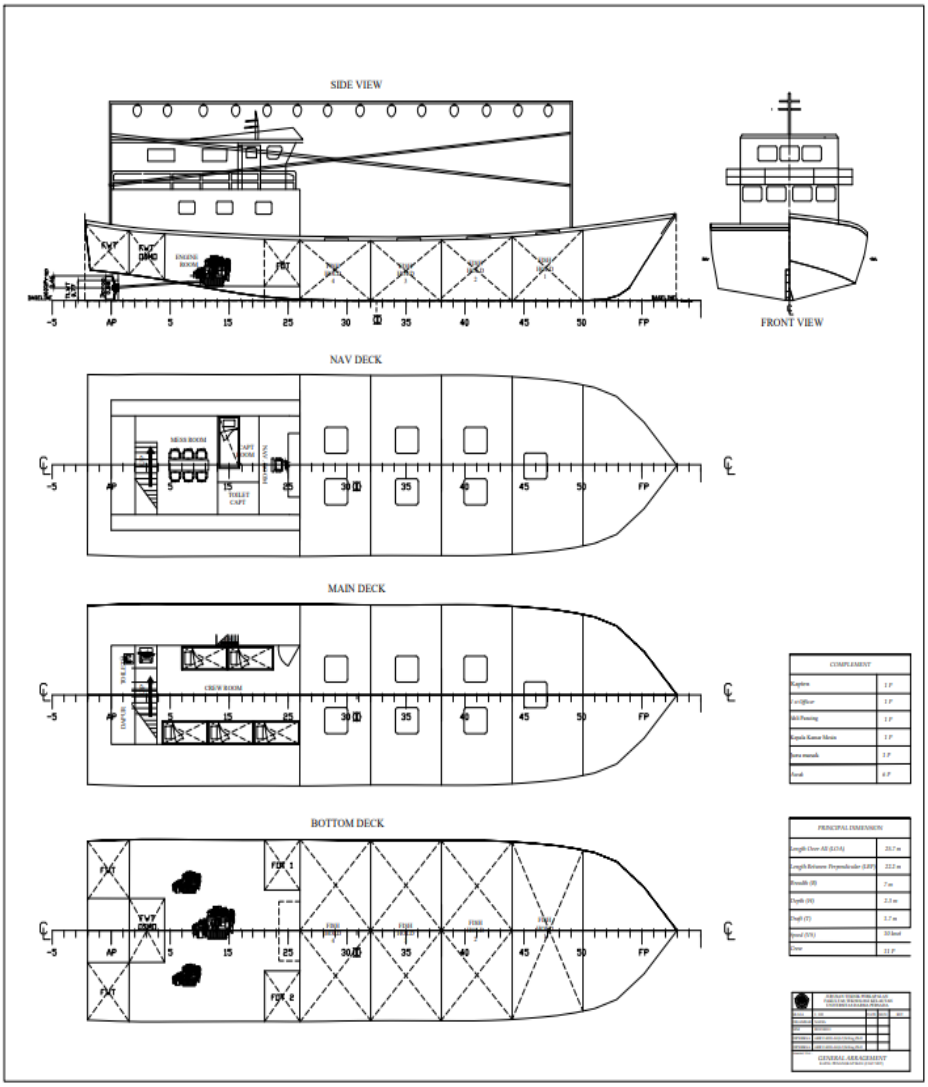

Fig.2 General Arrangement of Fishing Vessel 60 GT

3.2 Seakeeping

In this study, the results of the analysis of the ship's motion are obtained based on simulations carried out in maxsurf motion software. by simulating the ship to analyse seakeeping performance, with the type of Cast Net fishing boat with the destination of the shipping area, which is around the Java Sea Waters which has a wave height ranging from 0.75 m to 1.25m.

As a criterion for acceptance of seakeeping, the maximum angle criteria for roll and pitch set out in the general operating limitation criteria for fishing vessels are required [8]. With the criteria that can be seen in table.3 Regarding standard criteria

Table 3. Criteria of Tello

No	Criterion	Prescribe Maximum value
1	C1 Roll	6° (rms)
2	C2 Pitch	3° (rms)
3	Lateral acceleration	0,1 g (rms)
4	Vertical acceleration	0,2 g (rms)

This study was conducted using angles from 90° to 180° with ship speeds from 0 and 9 knots, the following analyses were obtained:

Table 4. Comparison of Amplitude Values

Item	Wave Heaving (deg)	Amplitudo	
		0 Knot	9 knot
Heaving	90	0,309	0,314
	180	0,304	0,325
Rolling	90	0,412	0,413
	180	0,00	0,00
Pitching	90	0,64	0,78
	180	1,40	1,45

In the motion analysis of the 60 GT Cast Nets fishing vessel, using Maxsurf motion software, the ship's heaving value reached 9 knots at sat, and the rolling and pitching values were equally good under all conditions. The standard [9] has met all the acceptance criteria, and the results are compared with the acceptance criteria.

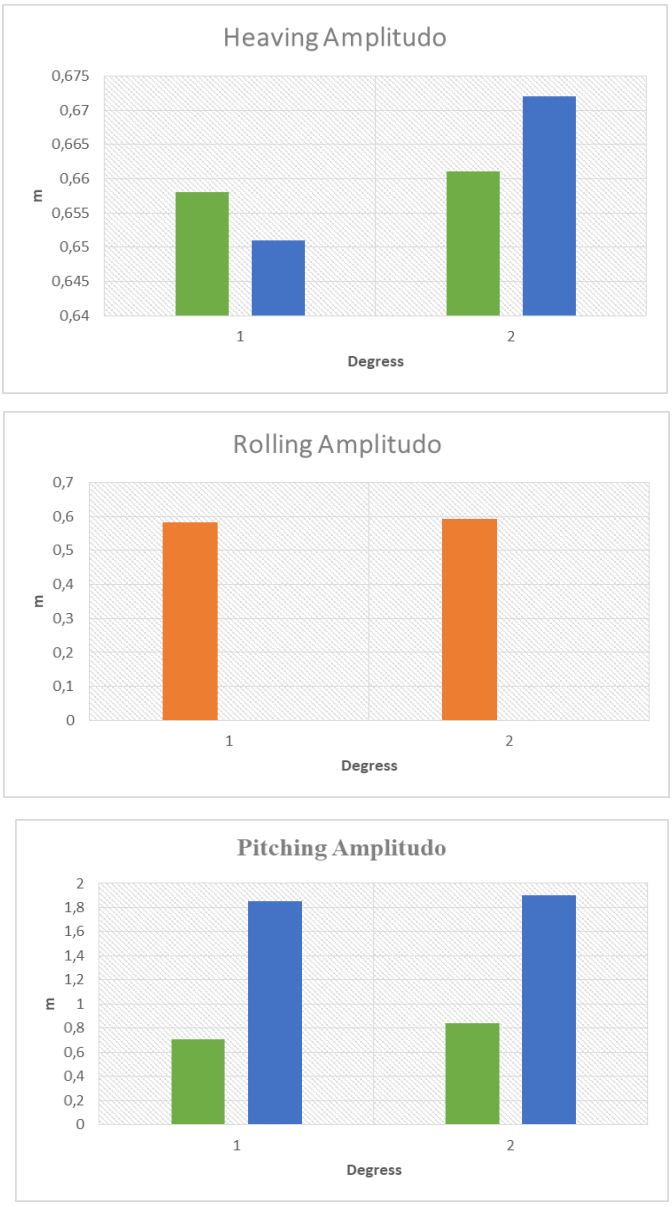

Fig. 3 Comparison Chart of Heaving, Rolling and Pitching Amplitude

3.3 Turning Circle

In this manoeuvre calculation, there are two analyses, namely turning circle and zig-zag manoeuvre. For the turning circle analysis, a manual calculation is carried out using the calculation reference in [10] and the manoeuvre graph is drawn using CAD software. The following calculation for the turning circle is:

Tabel 5. Turning Circle Calculation

Model	Tr (m)	Td (m)	Ad (m)	ρ (m)	Kriteria
Fishing Vessel 60 GT	24,48	46,07	56,23	123,034	PASS

According to IMO regarding the turning ability of a ship is the value of the advance < 4.5x times the LOA of the ship, the value of the tactical diameter < 5x the LOA of the ship. Another criterion is the initial turning ability where the steering angle is set to be 10o to the right or left, then the distance traveled by the ship must be < 2.5x the LOA of the ship from its original position Then the value of the advanced along 56.23 m provisions 89.55 and tactical diameter 46.07 m provisions 99.5 m has met the standardisation of IMO MSC 137 (76) 2002. With a description of the turning circle results as follows:

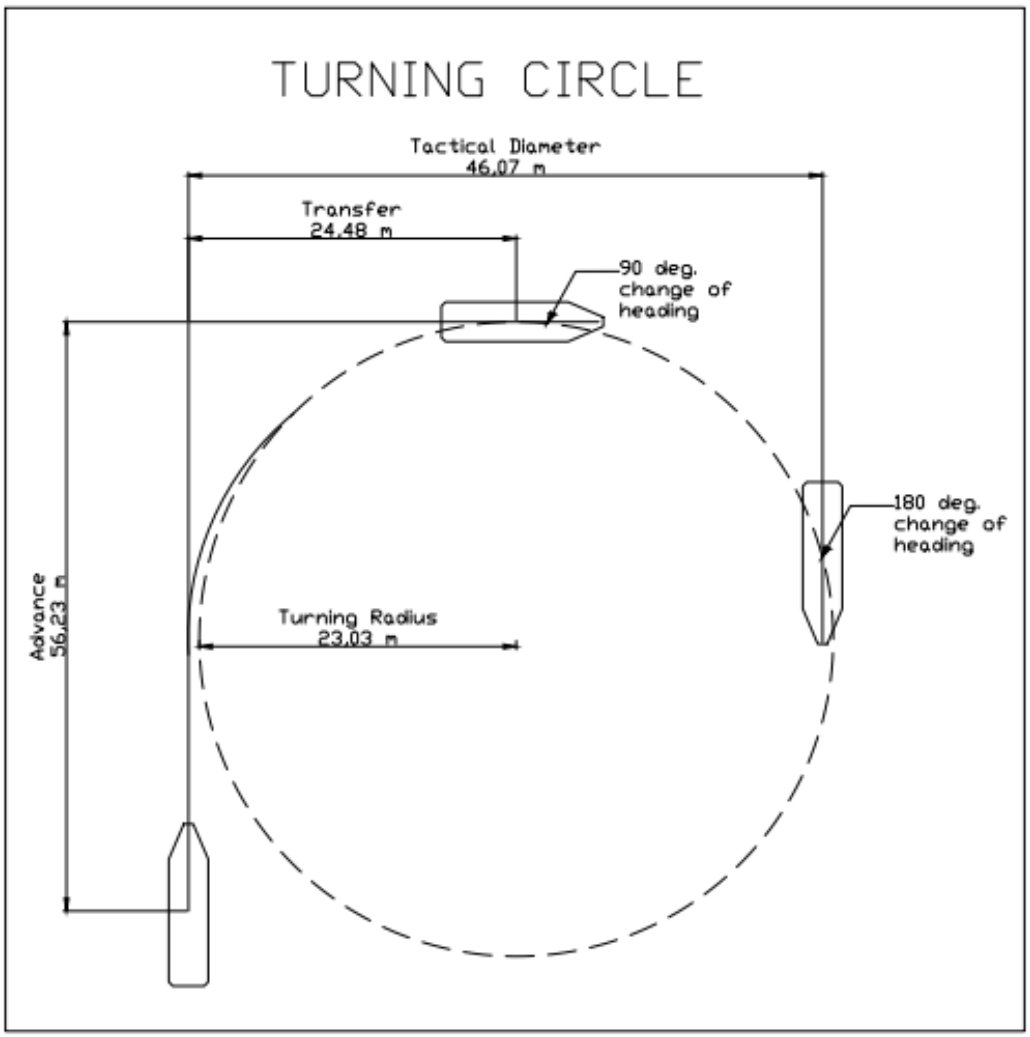

Fig.4 Result Of Turning Circle

3.4 *Zig-zag Manuever*

In the calculation of zig-zag manoeuvres to describe the zig-zag manoeuvre graph, it is taken using simulations in Matlab and AutoCAD software. There is some information in reading the zig-zag manoeuvre graph, for validation obtained from 10° and 20° overshoot values on each manoeuvre in accordance with the manoeuvre criteria by IMO MSC 137 (76) 2002.

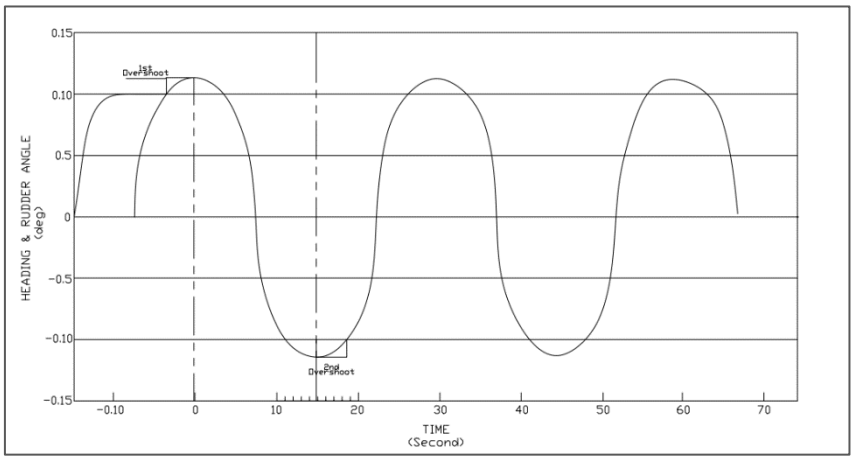

Fig. 5 Chart of *Zig-zag maneuver* 10°/10°

The figure above shows the simulation graph of the zig-zag manoeuvre of a 30 GT Cast Nets fishing vessel in full load conditions at a heading angel of 10°/10° that for the zigzag manoeuvre it is compliant, based on IMO MSC 137 (76) 2002 states that for an angel of 10°/10° it should not exceed 30 seconds, where for overshoot 1 gets a value of 0 seconds, and for overshoot 2 gets a value of 15 seconds.

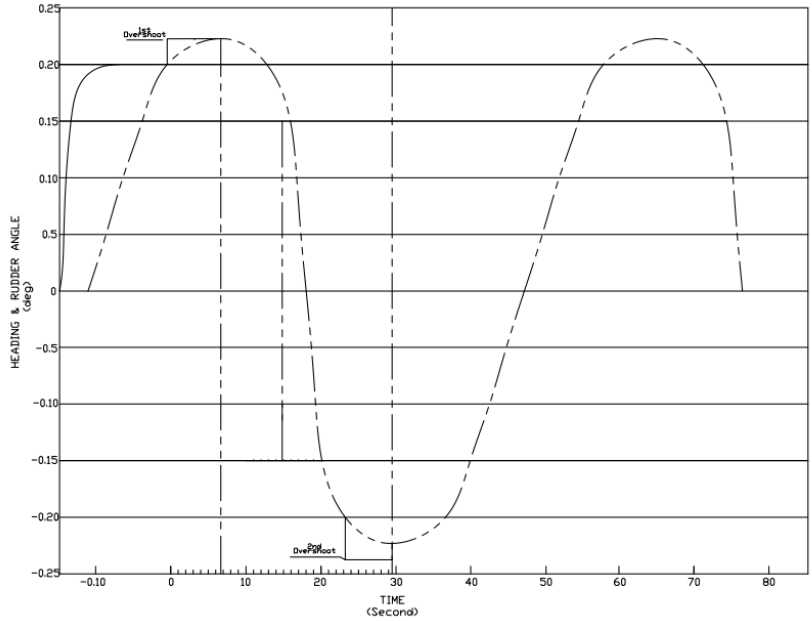

Fig.6 Chart of *Zig-zag maneuver* 20°/20°

The figure above shows the simulation graph of the zig-zag manoeuvre of a 60 GT Cast Nets fishing vessel in full load conditions at a heading angel of 20°/20° has met the standardisation, based on IMO MSC 137 (76) 2002 states for angel 20°/20° should not exceed 30 seconds, where at angel 20°/20° for overshoot value 1 get a value of 7 seconds, and for overshoot 2 get a value of 29 seconds.

CONCLUSION

- In the design of the 60 GT Cast Nets fishing vessel at the Muara angke fishing port for the analysis of motion on the fishing vessel has met the standardisation based on IMO MSC 137 (76) 2002.
- In the analysis of turning circle manoeuvre calculations, it has an area of 46.07 m Tactical Diameter, with an Advanced value of 56.23 m, with a heading transfer value of 24.48 m long. Based on IMO for the turning ability of the ship is the value obtained from the advance must not exceed 4.5 times the length of the ship and the value of the tactical diameter does not exceed 5 times the length of the ship, so the ship has met the IMO MSC 137 (76) 2002 standard.
- In the analysis of zig-zag manaeuvre calculations, it meets the standard IMO criteria mentioning for angles of 10°/10° and 20°/20° not exceeding 30 seconds, it meets the IMO MSC 137 (76) 2002 standard.

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