

# Determination of the requirement resistant

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## Determination of the requirement resistant for Ship-RUV trust power to maneuvering and performance

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**Abstract.** The resistance requirement of Ship-RUV is very much needed for the maneuvering process by placing the motor and the propeller as the driving force. In this case the propeller and motor components in the Ship-RUV component are installed with a KV 1000 KV motor with 12000 RPM with a number of 6 Motor-propellers. Propeller conditions are installed in the rear and bottom conditions of the Ship-RUV. This function is used for operational movement when the hull of the ship. Where the design of the motor propeller selection is based on the calculation of resistance obtained from the empirical calculation formula. In the calculation of resistance, the amount of resistance of the Ship-RUV is 16 N to be able to move and operate. The condition of the speed of the Ship-RUV in its operation is planned to be able to move in the air reaching a service speed of 5 knots.

### 1. Introduction.

The large number of operational needs for ROVs at the speed required for operation is not fulfilled because the speed of operation is still very minimal. This will result in the ROV not being able to work properly. Or also excess power consumption which causes energy needs to be too large resulting in waste in operations. The design of power requirements to encourage the selection of power and propulsion at Ship-RUV is a mandatory requirement to get good results in performance. This is in order to provide an overview of the needs in designing Ship-RUV effectively and efficiently. In the calculation of resistance based on theory, it is focused on two existing resistance conditions, namely water resistance and wind resistance. However, for calculations in the design of the ROV, wind resistance can be interpreted as being eliminated because the operational conditions of the Ship-RUV are mostly in water conditions. So in this case the focus of the resistance calculation on the Ship-RUV focuses on water resistance.

### 2. Focus Research

#### 2.1. Operational of Ship-RUV

In the Ship-RUV operation, it conducts hull investigation activities which in this case are used to replace the direct dive process. Therefore, the design and main function of each component can be calculated in the right way by referring to the existing calculation formulas. In its operation, the Ship-RUV is planned to use several equipment components that function as a propulsion motor as a driving force. This provides good conditions by placing the materials to the marine used specifications [13]. The Ship-RUV



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1 operation is generally planned for operation in seawater where conditions have a fairly strong current and a high corrosion rate. Apart from that, certain locations are indeed dealing with bad locations with many environments that are polluted with waste from ships [4]. Therefore, the Ship-RUV in its design is designed to be capable of all operational conditions [5]. The following shows the component design of the planned Ship-RUV as shown below:

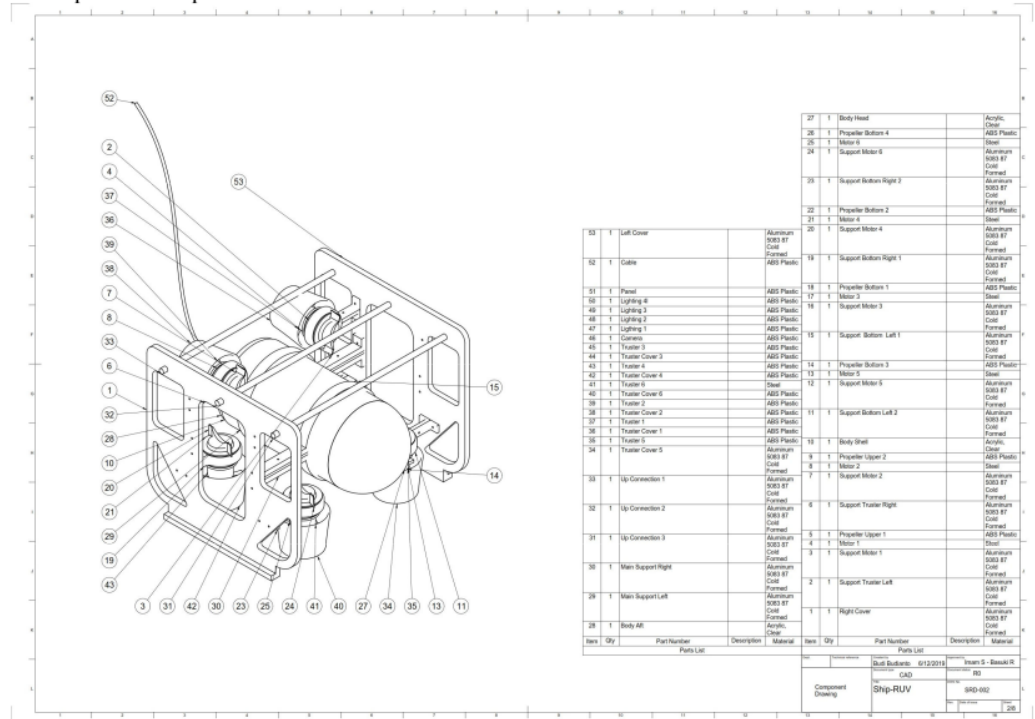


Figure 1. Ship-RUV Detail Component

2.2. Loading Condition

Various types of loading that occur in the structure of Ship-RUV, among others:

1. Dynamic Load

Dynamic load is a load condition whose magnitude changes from time to time with the incentives of certain events that produce a reaction response to the Ship-RUV structure. In the analysis of the behavior of the existing Ship-RUV structure, it must be planned in such a way so as to get effective results and get the weight of the Ship-RUV structure which will affect the Ship-RUV resistance. In the Ship-RUV calculation, the amount of displacement that is there is one part of the calculation of the resistance formula [1].

2. Static Load

The static load Condition, especially the impact load, is the load that occurs due to the sudden impact force which has a force response to the Ship-RUV structure [2][3]. In the analysis of the strength behavior of the Ship-RUV analysis on the structure take into account with each other. Because the result of this structure produces have a weight that will affect the size of the existing displacement. So that the process of calculating the structure that produces the weight of the ship-RUV construction also affects the existing resistance conditions [11].

2.3. Formula Resistance

The following shows the formula conditions in general, the calculation of resistance where calculations can be made into two conditions [7], namely:

- a. Water Resistance
- b. Wind Resistance

The formulae to calculate the value of the maximum water resistance that occurs is as follows:

$$W = f.s.V_1.83 + P.Fx.V^2 \dots\dots\dots (1)$$

The formulae to calculate the value of the maximum wind resistance that occurs is as follows:

$$W = 0,0041 \cdot (0,3A_1 + A_2). Va^2 \dots\dots\dots (2)$$

Where:

F	=	Material Constants	
WSA	=	Wet Surface Area	(m <sup>2</sup> )
Vs	=	Ship Speed	(m/s)
P	=	Shape constants	
Fx	=	Midship cross-sectional area	(m <sup>2</sup> )
A <sub>1</sub>	=	The cross-sectional area of the ship above the surface	(ft <sup>2</sup> )
A <sub>2</sub>	=	Transverse projection area of superstructure	(ft <sup>2</sup> )
Va	=	Relative wind speed	(ft/sec)

2.4 Selection of motor propulsion

Selection of the propulsion motor can be demonstrated by meeting the constituent material criteria. In this case, the corrosive conditions and extreme operational fields require the selection of the propulsion motor specifications to be in accordance with the marine used standards [10]. This is to ensure the reliability of the components applied.

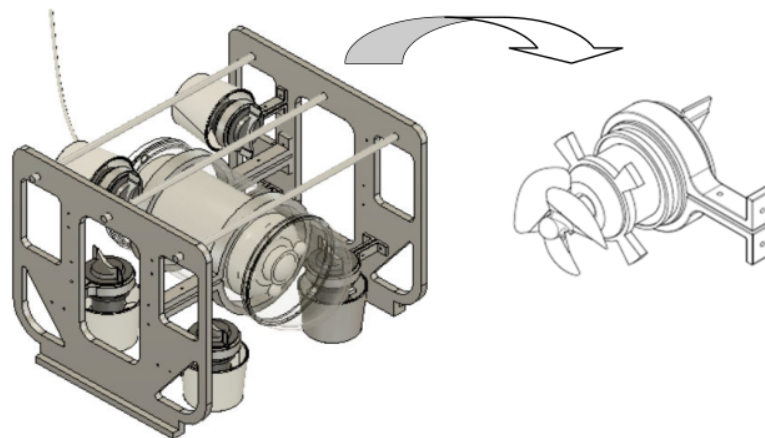


Figure 2. Motor Propulsion Position

In addition to using marine used material, the choice of propulsion motor is also conditioned by the resulting properties and trust ability to meet the resistance calculation.

### 3. Resistance Calculation Process

Here is explained the stages in the completion of resistance calculations at Ship-RUV operations.

Where the steps can be shown as follows:

1. Data requirement

In this case, the requirement data refers to the Ship-RUV design conditions which include the principle dimension data, immersed wet area, and midship area.

2. Determination of the type of design by study

Before the analysis process is done, must determine the name of the problem (study), the type of analysis required (analysis type).

3. Determination of water resistance

This is to calculate the amount of water resistance that occurs during operations, where the dominant value is due to the majority of operational movements in the water.

4. Determination of wind resistance

In fact, in ROV, wind resistance conditions have no effect, this is due to the operating pattern in sea water. Therefore, it can be ignored

5. Determination of total resistance

This is a combination of wind resistance and water resistance; in this case it will give the total value of the resulting resistance.

6. Selection Motor Propulsion

This provides an overview in determining and selecting an effective and efficient way of designing a Ship-RUV

7. Analysis

The analysis is carried out to perform the analysis results of the existing calculations so as to provide consideration in the Ship-RUV design

### 4. Analysis and Discussion

Analysis of resistance requirements is very much needed in determining the motor and propulsion Ship-RUV this will provide effective and efficient motor and propulsion selection. The request for data requirements in the calculation of Ship-RUV resistance can include, among others, the Ship-RUV dimension principle, the area of the submerged part and the midship area. The details of the calculation data request can be shown in the following table:

**Table 1.** Calculation Data Requirement

Description	Value	Unit
Lwl	= 0,30	m
B	= 0,25	m
H	= 0,30	m
f	= 0,11	m
s	= 0,26	m <sup>2</sup>
V	= 5	knot
P	= 1	
F <sub>x</sub>	= 0,075	m <sup>2</sup>
V <sub>a</sub>	= 4	knot

From the data of the above requirements, it can be seen that the objects from Ship-RUV that affect the resistance mostly come from the area of the immersed and moving objects that were planned from the

start. So that we get the results of an effective and efficient Ship-RUV design [6][8][9]. Then it is done by calculating the resistance calculation formula at Ship-RUV which is shown in the calculation results below:

$$\begin{aligned}
 W_{\text{water}} &= f.s. V_1 . 83 + P. Fx. V^2 \\
 &= 0,65 \text{ kg} \\
 &= 0,01 \text{ KN} \quad 6,42 \text{ N} \\
 W_{\text{wind}} &= 0,0041. (0,3A_1 + A_2). Va^2 \\
 &= 0 \text{ lbs} \\
 &= 0 \text{ Kg} \\
 &= 0 \text{ KN}
 \end{aligned}$$

So that the total calculation of resistance ship-RUV is obtained as follows:

$$\begin{aligned}
 W_{\text{total}} &= W_{\text{water}} + W_{\text{wind}} && \dots\dots\dots (3) \\
 &= 0,01 \text{ KN} \\
 R_T &= W_{\text{total}} + \text{margin } 15\% && \dots\dots\dots (4) \\
 R_T &= 0,0074 \text{ KN}
 \end{aligned}$$

1 The condition of the speed of the Ship-RUV in its operation is planned to be able to move in the air reaching a service speed of 5 knots. The power propulsion with the specifications technic by Ship-RUV can be shown in the following feature table below:

**Table 2.** Motor Propulsion Specification

Product information:	Note	
Motor KV	1000KV	Marine Use
Wire length	250mm	Marine Use
Diamètre	75 mm	Marine Use
RPM	12000	
8 Motor 304 Stainless steel bearing, Aluminum alloy, Shell PLA ,Propeller PC		

The number of propulsion motors installed on the ship-RUV is 6 for operational investigation of the ship's hull. This gives the propeller thrust to move the force. With the assumption that the total amount of resistance applied is at least 16 N.

**1 Conclusion**

In this case the propeller and motor components in the Ship-RUV component are installed with a KV 1000 KV motor with 12000 RPM with a number of 6 Motor Propellers. Propeller conditions are installed in the rear and bottom conditions of the Ship-RUV. This function is used for operational movement when the hull of the ship. Where the design of the motor propeller selection is based on the calculation of resistance obtained from the empirical calculation formula. In the calculation of resistance, the amount of resistance of the Ship-RUV is 16 N to be able to move and operate. The condition of the speed of the Ship-RUV in its operation is planned to be able to move in the air reaching a service speed of 5 knots.

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