

Motor calculation test plan

Propulsion system simulation

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# Aim & Hypothesis

## Aim

The aim is to verify the simulated model of the motor calculations.

## Hypothesis

The output power, torque, and rotation speed can be calculated by the input voltage and are the same as the calculations.

# Variables

These are the constants and variables that will be used during the test.

|  |  |
| --- | --- |
| Constants simulation | Keep constant at... |
| Battery level computer | Constant power source. |
| All input variables | Real positive numbers & ISO-notation. |

## Inputs

The limits stated are the limits of the real world. If values out of this range are entered, the outputs will be unreliable.

|  |  |
| --- | --- |
| Inputs | Range |
| Motor input voltage [V] | 0 - 48 |
| Motor data array(U-I) | - |
| Motor data array(I-T) | - |
| Motor data array(U-E) | 0 - 1 |

## Outputs

These are the outputs that will be monitored and will be used to see variations or changes in the system.

|  |  |
| --- | --- |
| Outputs | Range |
| Motor power output [W] | 0 - 8800 |
| Motor torque output [Nm] | 0 - 40 |
| Motor rotation speed output [rpm] | 0 - 2400 |
| Power used (V\*I) [W] | 0 – 8400 |
| Power loss [W] | 0 - 8400 |

# Tools

|  |  |
| --- | --- |
| Testing tools | Demand |
| Computer | Windows 10 compatible |
| Excel | Newest version |
| Keyboard | No limit |
| Mouse | No limit |
| Calculator | Basic calculator |
| Pen & Paper | Basic pen & paper |
| Mathematical model | Using correct formulas |

# Method

The simulation will be compared to the actual calculations to see if they are the same.

## 4.1 Steps

1. Put the different values from 2.1 in the simulation
2. Note the outputs
3. Calculate the outputs based on the mathematical model (7.Appendix) using pen, paper and calculator
4. Note the answers.

# Expected results

The expected outputs are according to the mathematical models and between the range stated in the table 2.2

# Conclusion

After the user enters the motor's input voltage, the motor's output power, torque and speed can be calculated.

# Appendix

## Data collection

Input different voltages to the motor and measure the input current and efficiency of the motor under different voltages. Collect ten sets of data respectively, make the U-I, U-, of the motor and find the approach line and expression of the curve.

## Calculate current & efficiency

According to the expression of the U-I, U- approach line, the motor input current and motor efficiency corresponding to different input voltages can be calculated. By using the user's input voltage, the current and efficiency are calculated.

## Build I-T curve

From the input voltage U and the U-Thrust diagram obtained through experiments on the ship, the thrust of the propeller at this time can be obtained. The speed at this time can be obtained by calculating the required thrust on the propeller. Use the speed to calculate the load torque at that time. And by measuring the current value at that moment.

## Calculate output power

We can use input voltage and current to calculation input power because we get the efficiency of the motor under given voltage, we can easily calculate output power of the motor.

## Calculate rotation speed from motor

T=torque [N\*m].

P=power [W].

n=rotation speed [rpm].

Since we calculated the output power and output torque in the previous steps, we can use the formula to calculate the output rotation speed.