

Bearing calculation test plan

Propulsion system simulation

Fangzhou chen Jiacong li Marco Hoogesteger Martijn Crombeen

*Organisation: Solar Boat Sealander*

*Client: Mr. R. Eijlers*

*Tutor: Mr. W. Haak*

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# Aim & Hypothesis

## Aim

The aim of this test is to verify the simulated mathematical model of the bearing calculations.

## Hypothesis

The bearing simulation has the same desired output values, compared to 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 | Value |
| Bearing friction coefficient | 0,0015 – 0,0050 |
| Seal friction coefficient | 0,0015 – 0,0050 |
| Load [N] | 0 – 1000 |
| Radius shaft [m] | 0 – 0,2 |
| Rotation speed [rpm] | 0 - 620 |

## Outputs

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

|  |  |
| --- | --- |
| Outputs | Value |
| Bearing power output [W] | 0 - 8400 |
| Bearing torque output [Nm] | 0 - 3500 |
| Power loss [W] | 0 – 8400 |
| Power loss [%] | 0 – 1 |

# 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 |

# 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.
5. Compare the two answers

# 5.Expected results

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

# 6.Conclusion

If the outputs have the same values as their calculated counterparts, the test is considered as passed.  
If not, the test is considered as failed.

# Appendix

**Friction force**

=loss due to friction [N]

=load from axis on bearing [N]

µ=friction coefficient

**Powerloss due to friction**

= output power [W].

= input power [W].

=loss due to friction [N]

=radius driving shaft [m]

ω=angular velocity [rad/s]

T=torque [Nm].

P=power [W].

n=rotation speed [rpm].

|  |  |
| --- | --- |
| Bearing Type | Coefficient of friction µ |
| Deep Groove Ball Bearing | 0,0015 |
| Angular Contact Bearing | 0,0020 |
| Cylindrical Roller Bearing, Cage | 0,0010 |
| Cylindrical Roller Bearing, Full Comp. | 0,0020 |
| Tapered Roller Bearing | 0,0020 |
| Spherical Roller Bearing | 0,0020 |
| Ball Thrust Bearing | 0,0015 |
| Cylindrical Roller Thrust Bearing | 0,0050 |
| Tapered Roller Thrust Brg. Cage | 0,0020 |
| Tapered Roller Thrust Brg. Full Comp | 0,0050 |

(FRICTION & FREQUENCY FACTORS, sd)