# Motor Test Results and Analysis

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Test done with a motor that is believed to be damaged/not in optimal conditions

Data ingested from 20230815_224137_1.mp4 using dataIngest.m

```
clear
close all
T =
readtable("data\motorTestData_20230815_224137_1.csv","VariableNamingRule","preserve"
);
T = fillmissing(T,"nearest");
T.omega = (2*pi/60).*T.RPM;
T.P_in_W = T.("Voltage (V)") .* T.("Current (A)");
T.P_out_W = T.("Torque (Nm)") .* T.omega;
T.eta = T.P_out_W ./ T.P_in_W
```

T = 2813×9 table

...

| | Time (s) | Current (A) | Voltage (V) | Torque (Nm) | RPM | omega |
|---|---|---|---|---|---|---|
| 1 | 1.6996 | 0.6100 | 24.6900 | 0.2000 | 0 | 0 |
| 2 | 1.7329 | 0.6310 | 24.6900 | 0.2000 | 0 | 0 |
| 3 | 1.7662 | 0.6300 | 24.6900 | 0.2000 | 0 | 0 |
| 4 | 1.7996 | 0.6300 | 24.8690 | 0.2000 | 0 | 0 |
| 5 | 1.8329 | 0.6300 | 24.8690 | 0.2000 | 0 | 0 |
| 6 | 1.8662 | 0.6300 | 24.6900 | 0.2000 | 0 | 0 |
| 7 | 1.8995 | 0.6300 | 24.6900 | 0.2000 | 0 | 0 |
| 8 | 1.9329 | 0.6300 | 24.6900 | 0.2000 | 0 | 0 |
| 9 | 1.9662 | 0.6300 | 24.6900 | 0.2000 | 0 | 0 |
| 10 | 1.9995 | 0.6300 | 24.6900 | 0.2000 | 0 | 0 |
| 11 | 2.0328 | 0.6300 | 24.6900 | 0.2000 | 0 | 0 |
| 12 | 2.0664 | 0.6300 | 24.6900 | 0.2000 | 0 | 0 |
| 13 | 2.0995 | 0.6300 | 24.6900 | 0.2000 | 0 | 0 |
| 14 | 2.1328 | 0.6300 | 24.6900 | 0.2000 | 34 | 3.5605 |
| 15 | 2.1661 | 0.6300 | 24.6900 | 0.2000 | 34 | 3.5605 |
| 16 | 2.1994 | 0.6000 | 24.6900 | 0.2000 | 34 | 3.5605 |
| 17 | 2.2328 | 0.6100 | 24.6900 | 0.2000 | 34 | 3.5605 |
| 18 | 2.2661 | 0.6100 | 24.6900 | 0.2000 | 34 | 3.5605 |
| 19 | 2.2999 | 0.6100 | 24.6900 | 0.2000 | 34 | 3.5605 |

| | Time (s) | Current (A) | Voltage (V) | Torque (Nm) | RPM | omega |
|---|---|---|---|---|---|---|
| 20 | 2.3328 | 0.6100 | 24.6900 | 0.2000 | 34 | 3.5605 |
| 21 | 2.3661 | 0.6100 | 24.6900 | 0.2000 | 34 | 3.5605 |
| 22 | 2.3994 | 0.6100 | 24.6900 | 0.2000 | 34 | 3.5605 |
| 23 | 2.4327 | 0.6100 | 24.6900 | 0.2000 | 34 | 3.5605 |
| 24 | 2.4660 | 0.6100 | 24.6900 | 0.2000 | 34 | 3.5605 |
| 25 | 2.4994 | 0.6100 | 24.6900 | 0.2000 | 34 | 3.5605 |
| 26 | 2.5327 | 0.6100 | 24.6900 | 0.2000 | 34 | 3.5605 |
| 27 | 2.5661 | 0.6100 | 24.6900 | 0.2000 | 34 | 3.5605 |
| 28 | 2.5993 | 0.6100 | 24.8690 | 0.2000 | 34 | 3.5605 |
| 29 | 2.6327 | 0.6100 | 24.8900 | 0.2000 | 34 | 3.5605 |
| 30 | 2.6660 | 0.6100 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 31 | 2.6993 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 32 | 2.7326 | 0.6200 | 24.7900 | 0.2000 | 35 | 3.6652 |
| 33 | 2.7660 | 0.6200 | 24.7900 | 0.2000 | 35 | 3.6652 |
| 34 | 2.7993 | 0.6200 | 24.7900 | 0.2000 | 35 | 3.6652 |
| 35 | 2.8327 | 0.6200 | 24.7900 | 0.2000 | 35 | 3.6652 |
| 36 | 2.8660 | 0.6200 | 24.7900 | 0.2000 | 35 | 3.6652 |
| 37 | 2.8993 | 0.6200 | 24.7900 | 0.2000 | 35 | 3.6652 |
| 38 | 2.9327 | 0.6200 | 24.7900 | 0.2000 | 35 | 3.6652 |
| 39 | 2.9659 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 40 | 2.9993 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 41 | 3.0326 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 42 | 3.0659 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 43 | 3.0993 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 44 | 3.1326 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 45 | 3.1659 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 46 | 3.1992 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 47 | 3.2325 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 48 | 3.2658 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 49 | 3.2992 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 50 | 3.3325 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 51 | 3.3660 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 52 | 3.3991 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |

| | Time (s) | Current (A) | Voltage (V) | Torque (Nm) | RPM | omega |
|---|---|---|---|---|---|---|
| 53 | 3.4325 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 54 | 3.4658 | 0.6300 | 24.8690 | 0.2000 | 35 | 3.6652 |
| 55 | 3.4991 | 0.6300 | 24.8690 | 0.2000 | 35 | 3.6652 |
| 56 | 3.5328 | 0.6300 | 24.8690 | 0.2000 | 35 | 3.6652 |
| 57 | 3.5658 | 0.6300 | 24.6900 | 0.2000 | 35 | 3.6652 |
| 58 | 3.5991 | 0.6300 | 24.6900 | 0.2000 | 35 | 3.6652 |
| 59 | 3.6324 | 0.6300 | 24.6900 | 0.2000 | 35 | 3.6652 |
| 60 | 3.6657 | 0.6300 | 24.6900 | 0.2000 | 35 | 3.6652 |
| 61 | 3.6991 | 0.6300 | 24.6900 | 0.2000 | 35 | 3.6652 |
| 62 | 3.7324 | 0.6300 | 24.6900 | 0.2000 | 35 | 3.6652 |
| 63 | 3.7657 | 0.6300 | 24.6900 | 0.2000 | 35 | 3.6652 |
| 64 | 3.7991 | 0.6300 | 24.6900 | 0.2000 | 35 | 3.6652 |
| 65 | 3.8324 | 0.6300 | 24.6900 | 0.2000 | 35 | 3.6652 |
| 66 | 3.8657 | 0.6300 | 24.6900 | 0.2000 | 35 | 3.6652 |
| 67 | 3.8990 | 0.6300 | 24.6900 | 0.2000 | 35 | 3.6652 |
| 68 | 3.9323 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 69 | 3.9657 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 70 | 3.9990 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 71 | 4.0323 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 72 | 4.0656 | 0.6300 | 24.7000 | 0.2000 | 35 | 3.6652 |
| 73 | 4.0990 | 0.6300 | 24.7290 | 0.2000 | 35 | 3.6652 |
| 74 | 4.1324 | 0.6300 | 24.7700 | 0.2000 | 35 | 3.6652 |
| 75 | 4.1656 | 0.6300 | 24.7290 | 0.2000 | 35 | 3.6652 |
| 76 | 4.1989 | 0.6300 | 24.7900 | 0.2000 | 35 | 3.6652 |
| 77 | 4.2323 | 0.6300 | 24.7700 | 0.2000 | 35 | 3.6652 |
| 78 | 4.2656 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 79 | 4.2989 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 80 | 4.3323 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 81 | 4.3656 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 82 | 4.3990 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 83 | 4.4322 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 84 | 4.4657 | 0.6300 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 85 | 4.4988 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |

| | Time (s) | Current (A) | Voltage (V) | Torque (Nm) | RPM | omega |
|---|---|---|---|---|---|---|
| 86 | 4.5322 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 87 | 4.5655 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 88 | 4.5988 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 89 | 4.6322 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 90 | 4.6655 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 91 | 4.6988 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 92 | 4.7321 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 93 | 4.7655 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 94 | 4.7988 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 95 | 4.8321 | 0.6200 | 24.8900 | 0.2000 | 35 | 3.6652 |
| 96 | 4.8654 | 0.6200 | 24.8690 | 0.2000 | 35 | 3.6652 |
| 97 | 4.8988 | 0.6200 | 24.8690 | 0.2000 | 35 | 3.6652 |
| 98 | 4.9321 | 0.6200 | 24.8690 | 0.2000 | 35 | 3.6652 |
| 99 | 4.9654 | 0.6300 | 24.8690 | 0.2000 | 35 | 3.6652 |
| 100 | 4.9988 | 0.6300 | 24.8690 | 0.2000 | 35 | 3.6652 |

⋮
⋮

```matlab
% Energy (J) = Power (W) * Time (s)
E_total_in = sum(10*T.P_in_W);
E_total_out = sum(10*T.P_out_W);
eta_total = E_total_out/E_total_in;
fprintf('Total Energy In: %0d W\n',round(E_total_in)); fprintf('Total Energy Out:
%0d W\n',round(E_total_out)); fprintf('Total Efficiency: %.2f%%',100*eta_total)
```

```
Total Energy In: 435145 W
Total Energy Out: 16355 W
Total Efficiency: 3.76%
```

## Plots

```matlab
figure
hold on
plot(T.("Time (s)"), T.P_in_W, DisplayName = "Power In (W)")
plot(T.("Time (s)"), T.P_out_W, DisplayName = "Power Out  (W)")
title('Power over time')
xlabel('Time (s)')
ylabel('Power (W)')
legend
```

Power over time
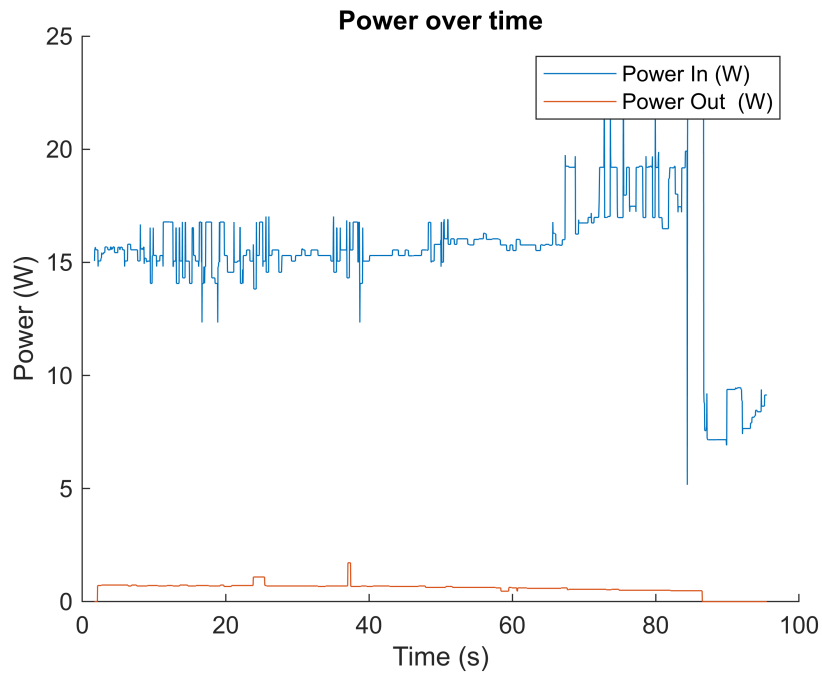
```
figure
plot(T.("Time (s)"), T.eta, DisplayName="Efficiency")
title('Efficiency over Time')
xlabel('Time (s)')
ylabel('Efficiency')
legend
```



Efficiency over Time