

# Experimental Comparison of Elastomeric Materials for Hydraulic Seal Durability under Reciprocating Conditions

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## Analysis of Variance (ANOVA) Results for COF and Specific Wear Rate

### Material E1

**Table S1: ANOVA for Coefficient of Friction (COF)**

| Source of Variation        | Sums of Squares SS | Degrees of freedom DF | Mean Squares MS | F calculated | F0.05 | p-value   |
|----------------------------|--------------------|-----------------------|-----------------|--------------|-------|-----------|
| Between Load               | 0.05029            | 2                     | 0.02514         | 180.84       | 3.55  | 1.209e-12 |
| Between Speed              | 0.02596            | 2                     | 0.01298         | 93.35        | 3.55  | 3.143e-10 |
| Load × Speed (Interaction) | 0.27782            | 4                     | 0.06945         | 499.54       | 2.92  | 1.11e-16  |
| Error (residual)           | 0.0025             | 18                    | 0.00014         |              |       |           |
| Total                      | 0.35657            | 26                    |                 |              |       |           |

**Table S2: ANOVA for Specific Wear Rate**

| Source of Variation        | Sums of Squares SS | Degrees of freedom DF | Mean Squares MS | F calculated | F0.05   | p-value   |
|----------------------------|--------------------|-----------------------|-----------------|--------------|---------|-----------|
| Between Load               | 0.97354            | 2                     | 0.486           | 27.93        | 3.55456 | 3.028e-6  |
| Between Speed              | 9.77049            | 2                     | 4.885           | 280.36       | 3.55456 | 2.72e-14  |
| Load × Speed (Interaction) | 11.79638           | 4                     | 2.942           | 169.24       | 2.92774 | 5.118e-14 |

|                  |          |    |        |  |  |  |
|------------------|----------|----|--------|--|--|--|
| Error (residual) | 0.31365  | 18 | 0.0172 |  |  |  |
| Total            | 22.85406 | 26 |        |  |  |  |

## Material E2

**Table S3: ANOVA for Coefficient of Friction (COF)**

| Source of Variation        | Sums of Squares SS | Degrees of freedom DF | Mean Squares MS | F calculated | F0.05   | p-value   |
|----------------------------|--------------------|-----------------------|-----------------|--------------|---------|-----------|
| Between Load               | 0.14485            | 2                     | 0.07243         | 151.59       | 3.55456 | 3.028e-6  |
| Between Speed              | 0.19455            | 2                     | 0.09727         | 203.59558    | 3.55456 | 2.72e-14  |
| Load × Speed (Interaction) | 0.62368            | 4                     | 0.15592         | 326.34337    | 2.92774 | 5.118e-14 |
| Error (residual)           | 0.0086             | 18                    | 0.00048         |              |         |           |
| Total                      | 0.97168            | 26                    |                 |              |         |           |

**Table S4: ANOVA for Specific Wear Rate**

| Source of Variation        | Sums of Squares SS | Degrees of freedom DF | Mean Squares MS | F calculated | F0.05   | p-value  |
|----------------------------|--------------------|-----------------------|-----------------|--------------|---------|----------|
| Between Load               | 20.07512           | 2                     | 10.03756        | 5606.18222   | 3.55456 | 1.11e-16 |
| Between Speed              | 43.50989           | 2                     | 21.75494        | 12150.58287  | 3.55456 | 1.11e-16 |
| Load × Speed (Interaction) | 62.7782            | 4                     | 15.69455        | 8765.72839   | 2.92774 | 1.11e-16 |
| Error (residual)           | 0.03223            | 18                    | 0.00179         |              |         |          |
| Total                      | 126.39543          | 26                    |                 |              |         |          |

### Material E3

**Table S5: ANOVA for Coefficient of Friction (COF)**

| Source of Variation        | Sums of Squares SS | Degrees of freedom DF | Mean Squares MS | F calculated | F0.05   | p-value   |
|----------------------------|--------------------|-----------------------|-----------------|--------------|---------|-----------|
| Between Load               | 1.81769            | 2                     | 0.90884         | 436.63345    | 3.55456 | 5.551e-16 |
| Between Speed              | 0.17696            | 2                     | 0.08848         | 42.50712     | 3.55456 | 1.518e-7  |
| Load × Speed (Interaction) | 0.33176            | 4                     | 0.08294         | 39.84609     | 2.92774 | 1.037e-8  |
| Error (residual)           | 0.03747            | 18                    | 0.00208         |              |         |           |
| Total                      | 2.36387            | 26                    |                 |              |         |           |

**Table S6: ANOVA for Specific Wear Rate**

| Source of Variation        | Sums of Squares SS | Degrees of freedom DF | Mean Squares MS | F calculated | F0.05   | p-value  |
|----------------------------|--------------------|-----------------------|-----------------|--------------|---------|----------|
| Between Load               | 222.98206          | 2                     | 111.49103       | 33173.44402  | 3.55456 | 1.11e-16 |
| Between Speed              | 114.40289          | 2                     | 57.20144        | 17019.9243   | 3.55456 | 1.11e-16 |
| Load × Speed (Interaction) | 29.22695           | 4                     | 7.30674         | 2174.07289   | 2.92774 | 1.11e-16 |
| Error (residual)           | 0.0605             | 18                    | 0.00336         |              |         |          |
| Total                      | 366.67239          | 26                    |                 |              |         |          |

#### Material E4

**Table S7: ANOVA for Coefficient of Friction (COF)**

| Source of Variation        | Sums of Squares SS | Degrees of freedom DF | Mean Squares MS | F calculated | F0.05   | p-value |
|----------------------------|--------------------|-----------------------|-----------------|--------------|---------|---------|
| Between Load               | 93.75556           | 2                     | 46.87778        | 0.97851      | 3.55456 | 0.395   |
| Between Speed              | 95.77922           | 2                     | 47.88961        | 0.99963      | 3.55456 | 0.3876  |
| Load × Speed (Interaction) | 189.42121          | 4                     | 47.3553         | 0.98847      | 2.92774 | 0.4388  |
| Error (residual)           | 862.33508          | 18                    | 47.9075         |              |         |         |
| Total                      | 1241.29107         | 26                    |                 |              |         |         |

**Table S8: ANOVA for Specific Wear Rate**

| Source of Variation        | Sums of Squares SS | Degrees of freedom DF | Mean Squares MS | F calculated | F0.05   | p-value  |
|----------------------------|--------------------|-----------------------|-----------------|--------------|---------|----------|
| Between Load               | 1204.73776         | 2                     | 602.36888       | 173760.25321 | 3.55456 | 1.11e-16 |
| Between Speed              | 421.79449          | 2                     | 210.89724       | 60835.74359  | 3.55456 | 1.11e-16 |
| Load × Speed (Interaction) | 1125.34742         | 4                     | 281.33686       | 81154.86218  | 2.92774 | 1.11e-16 |
| Error (residual)           | 0.0624             | 18                    | 0.00347         |              |         |          |
| Total                      | 2751.94207         | 26                    |                 |              |         |          |

## Material E5

**Table S9: ANOVA for Coefficient of Friction (COF)**

| Source of Variation        | Sums of Squares SS | Degrees of freedom DF | Mean Squares MS | F calculated | F0.05   | p-value   |
|----------------------------|--------------------|-----------------------|-----------------|--------------|---------|-----------|
| Between Load               | 0.61521            | 2                     | 0.3076          | 835.0365     | 3.55456 | 1.11e-16  |
| Between Speed              | 0.09529            | 2                     | 0.04765         | 129.34275    | 3.55456 | 2.087e-11 |
| Load × Speed (Interaction) | 0.03661            | 4                     | 0.00915         | 24.84406     | 2.92774 | 4.043e-7  |
| Error (residual)           | 0.00663            | 18                    | 0.00037         |              |         |           |
| Total                      | 0.75374            | 26                    |                 |              |         |           |

**Table S10: ANOVA for Specific Wear Rate**

| Source of Variation        | Sums of Squares SS | Degrees of freedom DF | Mean Squares MS | F calculated | F0.05   | p-value  |
|----------------------------|--------------------|-----------------------|-----------------|--------------|---------|----------|
| Between Load               | 171.83045          | 2                     | 85.91523        | 21964.25747  | 3.55456 | 1.11e-16 |
| Between Speed              | 231.99176          | 2                     | 115.99588       | 29654.38634  | 3.55456 | 1.11e-16 |
| Load × Speed (Interaction) | 32.10298           | 4                     | 8.02574         | 2051.78438   | 2.92774 | 1.11e-16 |
| Error (residual)           | 0.07041            | 18                    | 0.00391         |              |         |          |
| Total                      | 435.9956           | 26                    |                 |              |         |          |