

Sensor Data Analysis Report

Statistics Summary

| Available Row | Missing Rows | Duplicates | Frequency | mean | Standard Deviation | min | 25% | |
|---------------|--------------|------------|-----------|------------------|--------------------|--------------|------------------|--|
| 1162 | 0 | 0 | 3600.0 | 0.00206294802... | 0.00036081248... | 0.00095611 | 0.00175072574... | |
| 1162 | 0 | 6 | 3600.0 | 94.3248527783... | 15.0282958895... | -17.91932146 | 94.0381191125 | |
| 1162 | 0 | 0 | 3600.0 | 55.1219504276... | 9.46489890465... | 0.581809133 | 51.4189773 | |
| 1162 | 0 | 0 | 3600.0 | 2505.78131510... | 72.4150203834... | 1311.946773 | 2503.054293 | |
| 1162 | 0 | 0 | 3600.0 | 2385.59023884... | 29.3319405111... | 2073.656268 | 2372.60761675 | |
| 1162 | 0 | 0 | 3600.0 | 242.779298002... | 29.9699781697... | 33.68069906 | 227.26365545 | |
| 1162 | 0 | 0 | 3600.0 | 794.515215543... | 29.8567051097... | 442.9929689 | 798.689639875 | |
| 1162 | 0 | 0 | 3600.0 | -1.8477068030... | 0.13469582080... | -2.050539077 | -1.97908947675 | |
| 1162 | 0 | 10 | 3600.0 | 8370.29077752... | 803.267896736... | 0.0 | 8063.99737775 | |
| 1162 | 0 | 0 | 3600.0 | 547.584803738... | 26.2078454982... | 376.9629398 | 537.53636955 | |
| 1162 | 0 | 1 | 3600.0 | 43.2224496321... | 16.4992697812... | 25.17604865 | 25.1964433375 | |
| 1162 | 0 | 0 | 3600.0 | 39.1496431509... | 16.1282440539... | 24.79283688 | 24.81303756 | |
| 1162 | 0 | 0 | 3600.0 | 2334.04716919... | 113.190014098... | 1732.858754 | 2265.26894425 | |
| 1162 | 0 | 0 | 3600.0 | 9.78245528782... | 0.53252012543... | 7.743709801 | 9.520459667 | |
| 1162 | 0 | 0 | 3600.0 | 7.58186587209... | 0.36442878130... | 6.578536078 | 7.3552632615 | |
| 1162 | 0 | 0 | 3600.0 | 2.20058941570... | 0.33476126510... | 1.070777225 | 2.06685422499... | |
| 1162 | 0 | 0 | 3600.0 | 22.9472266884... | 1.68572083376... | 9.547503507 | 22.268713725 | |
| 1162 | 0 | 7 | 3600.0 | 0.16214318137... | 0.16916004078... | 0.0 | 0.10511150500... | |
| 1162 | 0 | 6 | 3600.0 | 0.16438442790... | 0.15676312052... | 0.0 | 0.10698170725 | |
| 1162 | 0 | 0 | 3600.0 | 5.86729627152... | 1.29346719455... | -30.08977316 | 5.6247956025 | |

Sensor Health Check

| Missing Values % | Duplicates % | Outliers | Isolation Forest Anom | One-Class SVM Anom | Robust Filter Anom | Cp | Cpk | K-S Statistic | K-S p-value | Skewness | |
|------------------|--------------|----------|-----------------------|--------------------|--------------------|------|------|---------------|-------------|----------|--|
| 0.0 | 0.0 | 0 | 59 | 135 | 24 | 0.96 | 0.9 | 0.11704 | 0.00069 | 0.175 | |
| 0.0 | 0.52 | 432 | 59 | 44 | 9 | 5.54 | 2.49 | 0.57315 | 0.0 | 14.704 | |
| 0.0 | 0.0 | 70 | 59 | 117 | 29 | 1.29 | 0.66 | 0.1704 | 0.0 | -1.386 | |
| 0.0 | 0.0 | 62 | 59 | 36 | 14 | 2.93 | 0.37 | 0.39415 | 0.0 | -10.659 | |
| 0.0 | 0.0 | 39 | 59 | 128 | 6 | 2.12 | 0.7 | 0.30809 | 0.0 | -3.781 | |
| 0.0 | 0.0 | 39 | 59 | 231 | 30 | 1.6 | 0.87 | 0.45095 | 0.0 | -2.382 | |
| 0.0 | 0.0 | 217 | 58 | 39 | 15 | 2.11 | 0.29 | 0.61962 | 0.0 | -6.326 | |
| 0.0 | 0.0 | 3 | 59 | 32 | 15 | 1.45 | 0.5 | 0.36833 | 0.0 | 0.322 | |
| 0.0 | 0.86 | 33 | 59 | 291 | 18 | 2.41 | 1.34 | 0.08778 | 0.0227 | -3.137 | |
| 0.0 | 0.0 | 45 | 59 | 153 | 12 | 1.39 | 0.61 | 0.15491 | 0.0 | -1.818 | |
| 0.0 | 0.09 | 0 | 59 | 38 | 15 | 0.43 | 0.36 | 0.51807 | 0.0 | -0.115 | |
| 0.0 | 0.0 | 0 | 59 | 26 | 24 | 0.5 | 0.3 | 0.51291 | 0.0 | 0.278 | |
| 0.0 | 0.0 | 12 | 59 | 229 | 8 | 1.33 | 0.89 | 0.13081 | 9e-05 | -0.881 | |
| 0.0 | 0.0 | 51 | 59 | 282 | 27 | 1.57 | 1.28 | 0.13253 | 7e-05 | 0.888 | |
| 0.0 | 0.0 | 25 | 59 | 273 | 31 | 1.58 | 0.92 | 0.19793 | 0.0 | 1.699 | |
| 0.0 | 0.0 | 88 | 59 | 112 | 11 | 1.67 | 1.12 | 0.15663 | 0.0 | -0.587 | |

| | | | | | | | | | | | |
|-----|------|----|----|-----|----|------|------|---------|---------|---------|--|
| 0.0 | 0.0 | 36 | 59 | 131 | 25 | 1.78 | 0.91 | 0.09466 | 0.01093 | -1.642 | |
| 0.0 | 0.6 | 58 | 59 | 40 | 9 | 4.14 | 0.32 | 0.31842 | 0.0 | 15.506 | |
| 0.0 | 0.52 | 64 | 59 | 64 | 10 | 3.02 | 0.35 | 0.30981 | 0.0 | 11.277 | |
| 0.0 | 0.0 | 39 | 59 | 68 | 11 | 6.65 | 4.04 | 0.358 | 0.0 | -16.884 | |

Feature Stability Analysis

| Feature Name | CV | PSI | KS Test | KL Divergence | Outliers (%) | Rolling Mean S |
|------------------|--------|-------|---------|---------------|--------------|----------------|
| MAGMA Melter/... | 0.175 | inf | 0.952 | 0.415 | 0.09 | Unstable |
| Gob Propertie... | 0.159 | inf | 0.578 | inf | 0.69 | Unstable |
| Simplified Ba... | 0.172 | 0.896 | 0.143 | 0.438 | 1.38 | Unstable |
| MAGMA Melter/... | 0.029 | inf | 0.315 | 5.377 | 0.95 | Unstable |
| MAGMA Melter/... | 0.012 | inf | 0.361 | 0.624 | 1.55 | Unstable |
| Glass Propert... | 0.123 | 6.825 | 0.694 | 4.038 | 2.41 | Unstable |
| MECS/Line Uti... | 0.038 | inf | 0.212 | 0.058 | 2.75 | Unstable |
| MAGMA Melter/... | -0.073 | inf | 0.917 | inf | 0.26 | Unstable |
| MECS/Stack Fl... | 0.096 | inf | 0.062 | inf | 0.6 | Unstable |
| MECS/Line Uti... | 0.048 | inf | 0.275 | 0.15 | 2.07 | Unstable |
| MECS/Exhaust ... | 0.382 | inf | 0.552 | 0.866 | 0.0 | Unstable |
| MECS/Exhaust ... | 0.412 | inf | 0.551 | inf | 0.0 | Unstable |
| MAGMA Melter/... | 0.048 | inf | 0.518 | inf | 0.6 | Unstable |
| Water_Cooling | 0.054 | 1.559 | 0.117 | 0.763 | 1.46 | Unstable |
| Circuit_Q | 0.048 | 0.736 | 0.231 | 0.313 | 1.2 | Unstable |
| Burner_Q | 0.152 | inf | 0.225 | 1.316 | 0.52 | Unstable |
| MAGMA Melter/... | 0.073 | inf | 0.119 | 0.425 | 1.55 | Unstable |
| Gob Propertie... | 1.043 | inf | 0.341 | 1.272 | 0.43 | Unstable |
| Gob Propertie... | 0.953 | inf | 0.348 | 0.897 | 0.43 | Unstable |
| Energy per ton | 0.22 | inf | 0.284 | inf | 0.52 | Stable |

Model Stability Summary

| Mean MAE | MAE Variance | Mean MSE |
|------------------|------------------|------------------|
| 0.31036023571... | 7.70011801961... | 7.45784305776... |

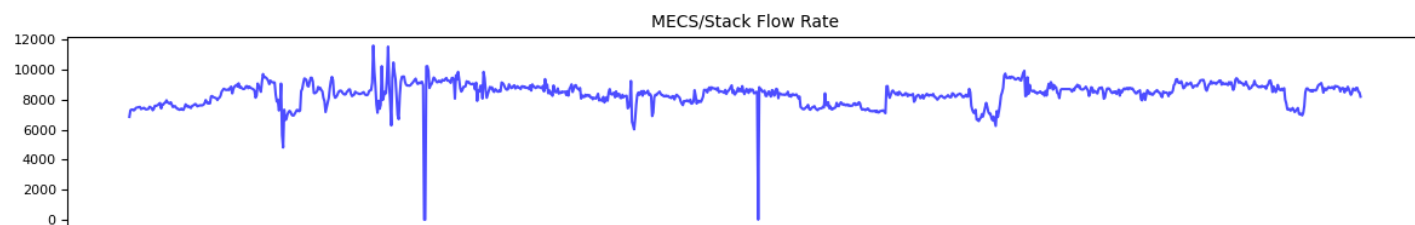
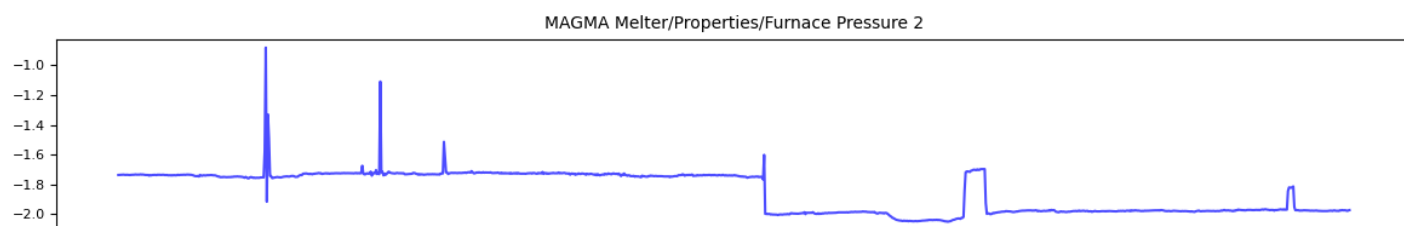
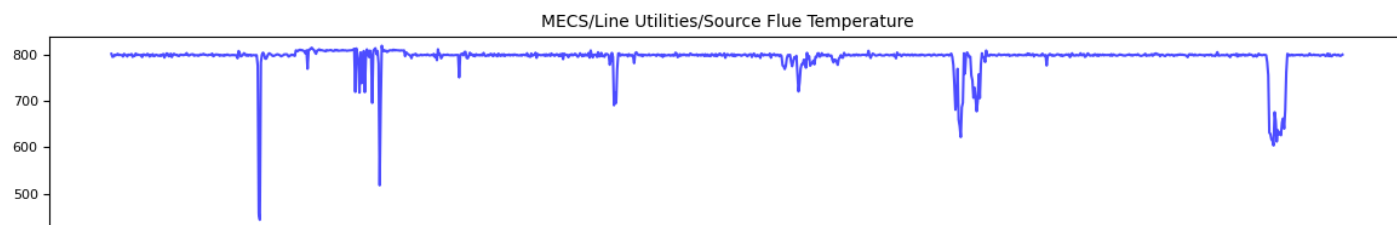
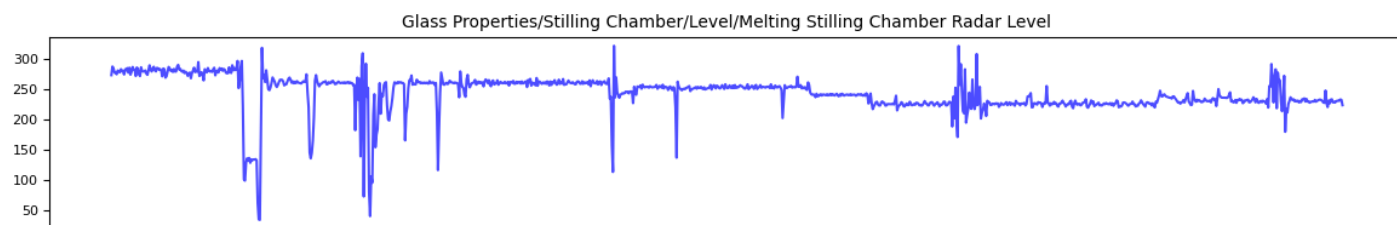
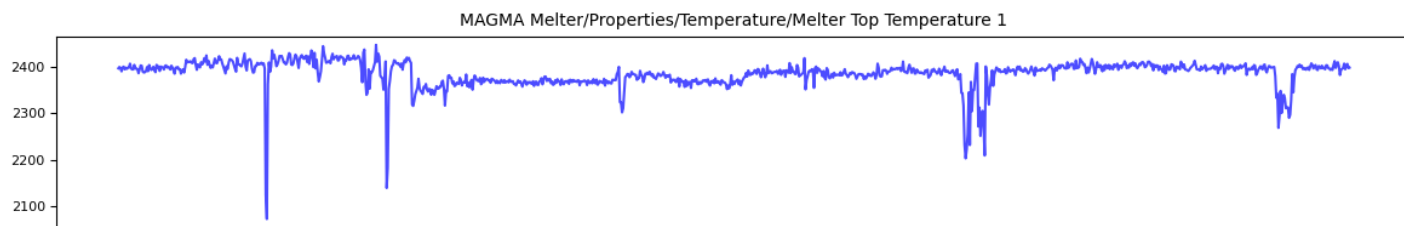
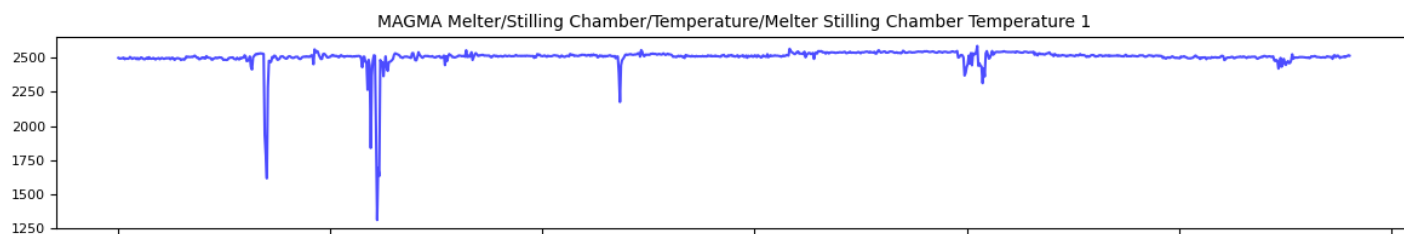
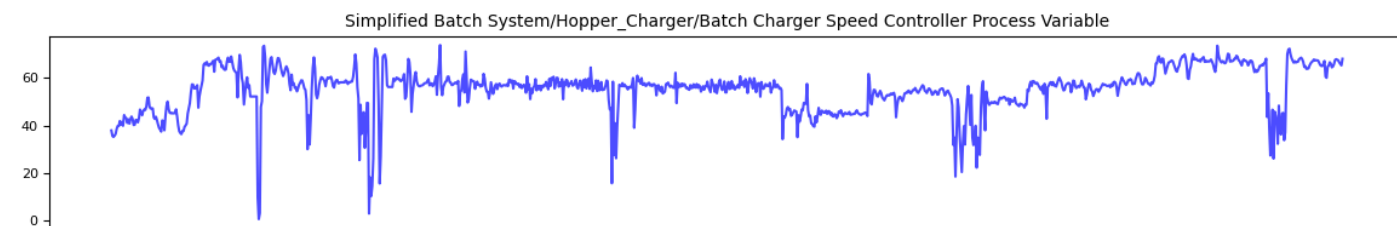
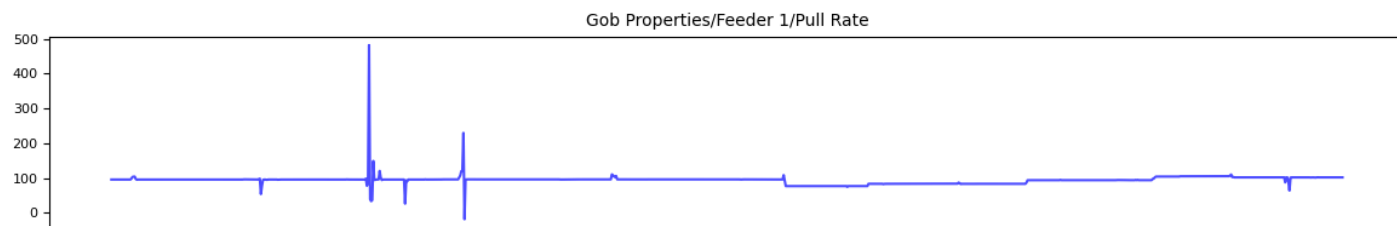
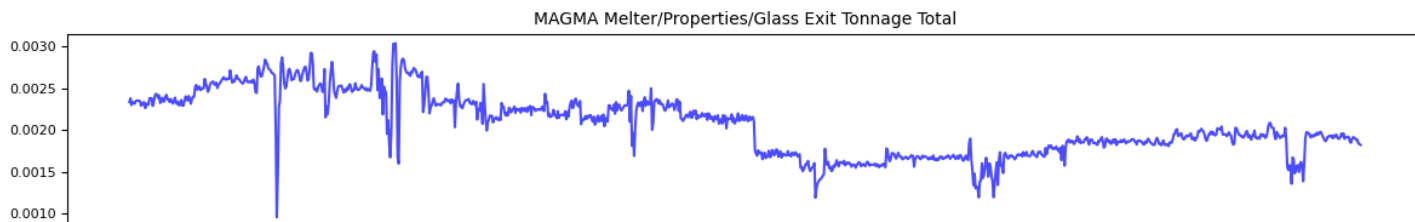
Cluster Summary

| | | | | | | | | | | | | | | |
|------------------|----------------|------------------|------------------|------------------|----------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|---------------|-----------|
| MAGMA Melter/... | Gob Properties | Simplified Ba... | MAGMA Melter/... | MAGMA Melter/... | Gob Properties | MECS/Line Uti... | MAGMA Melter/... | MECS/Stack Fl... | MECS/Line Uti... | MECS/Exhaust ... | MECS/Exhaust ... | MAGMA Melter/... | Water_Cooling | Circuit_Q |
| 0.0 | 96.52 | 57.41 | 2511.37 | 2378.43 | 253.64 | 801.48 | -1.75 | 8609.33 | 554.71 | 25.19 | 57.87 | 2402.65 | 9.66 | 7.52 |
| 0.0 | 83.19 | 48.29 | 2514.84 | 2386.97 | 219.45 | 795.13 | -1.96 | 8147.44 | 541.15 | 48.79 | 32.5 | 2379.75 | 10.36 | 8.09 |
| 0.0 | 97.63 | 52.17 | 2492.28 | 2402.11 | 272.9 | 798.29 | -1.73 | 7789.96 | 525.95 | 54.09 | 26.72 | 2313.83 | 9.85 | 7.39 |
| 0.0 | 98.83 | 62.19 | 2509.61 | 2398.85 | 229.25 | 799.41 | -1.97 | 8723.16 | 565.99 | 59.12 | 25.39 | 2221.36 | 9.48 | 7.37 |
| 0.0 | 94.34 | 33.89 | 2412.23 | 2283.46 | 240.74 | 655.55 | -1.8 | 7028.77 | 465.69 | 44.28 | 28.22 | 2184.24 | 9.34 | 7.32 |

Missing Timestamps

| Column | Missing |
|--------|---------|
| N/A | Unsup |

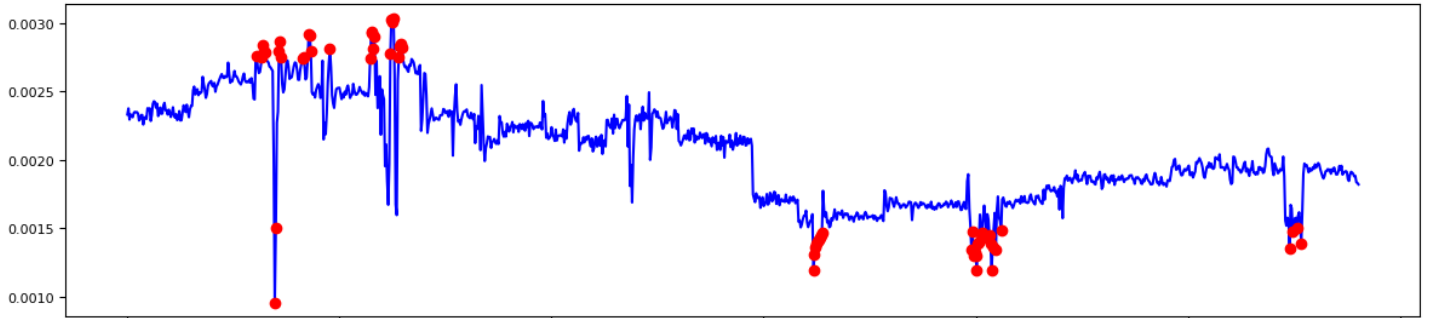
Time Series Plot



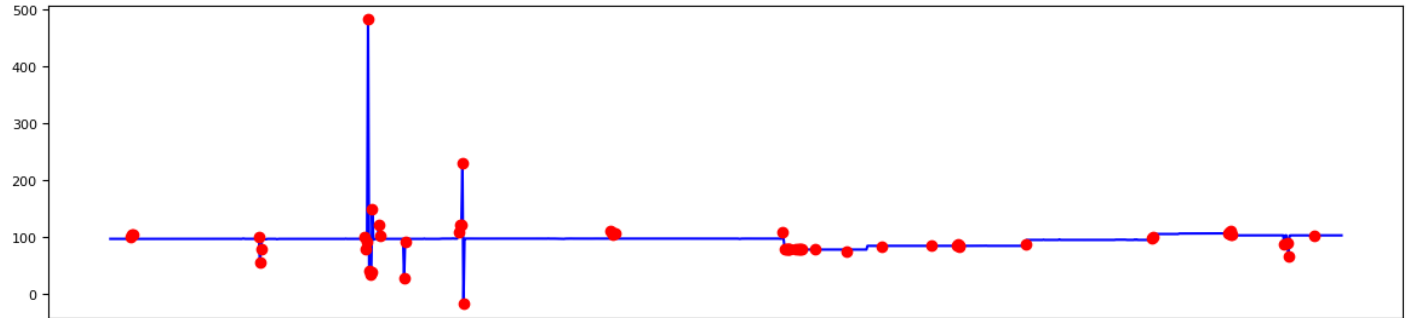
MECS/Line Utilities/Exhaust System Inlet Duct Temperature

Anomaly Detection Plot

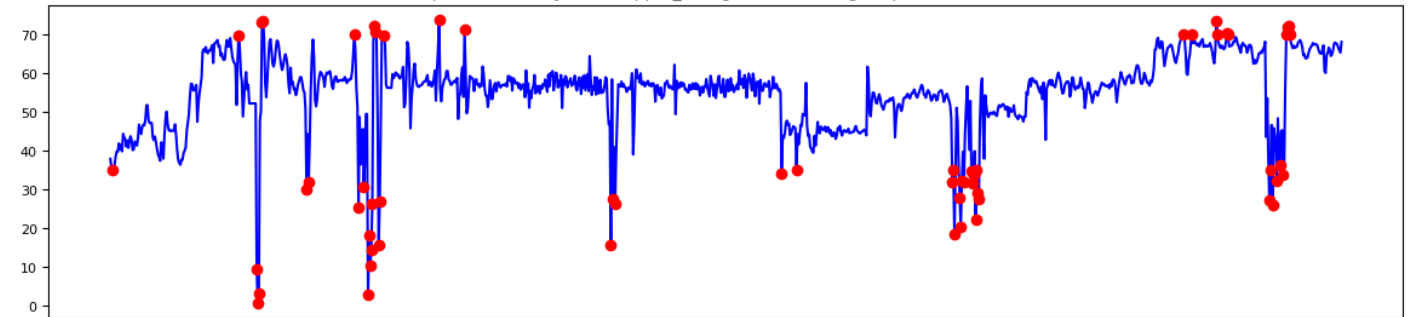
Anomalies in MAGMA Melter/Properties/Glass Exit Tonnage Total



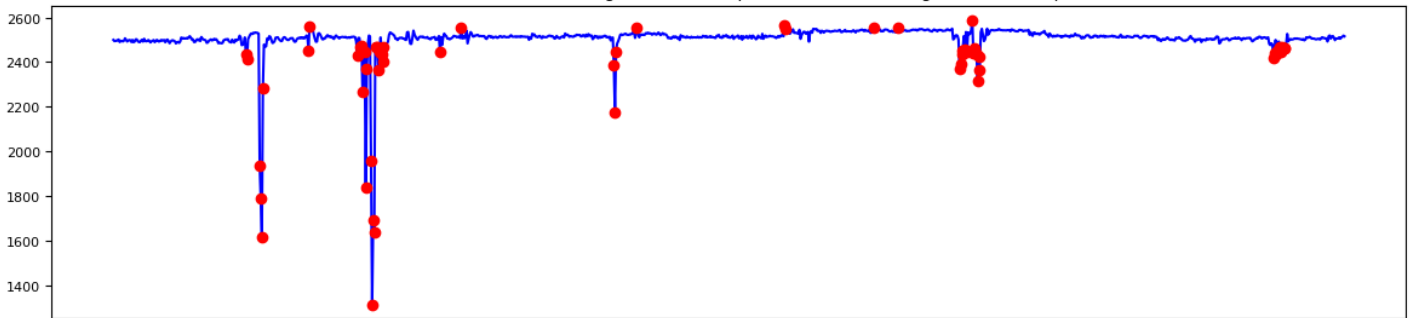
Anomalies in Gob Properties/Feeder 1/Pull Rate



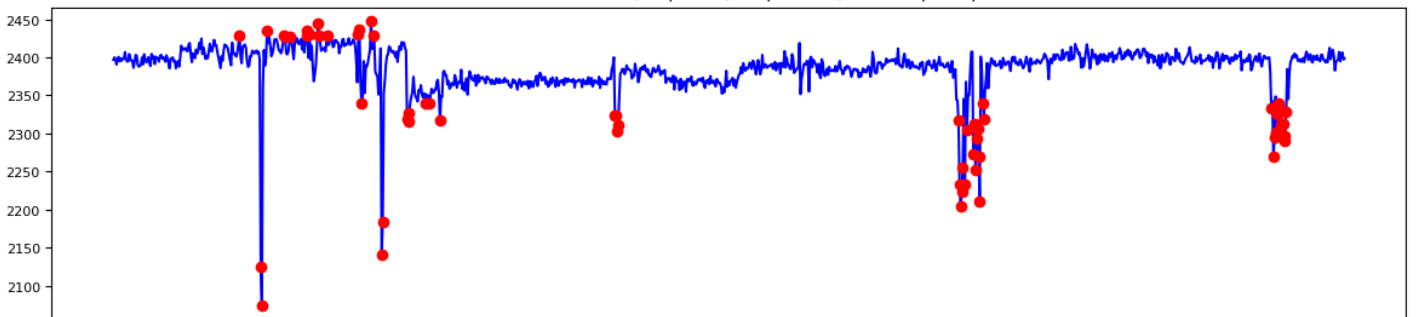
Anomalies in Simplified Batch System/Hopper_Charger/Batch Charger Speed Controller Process Variable



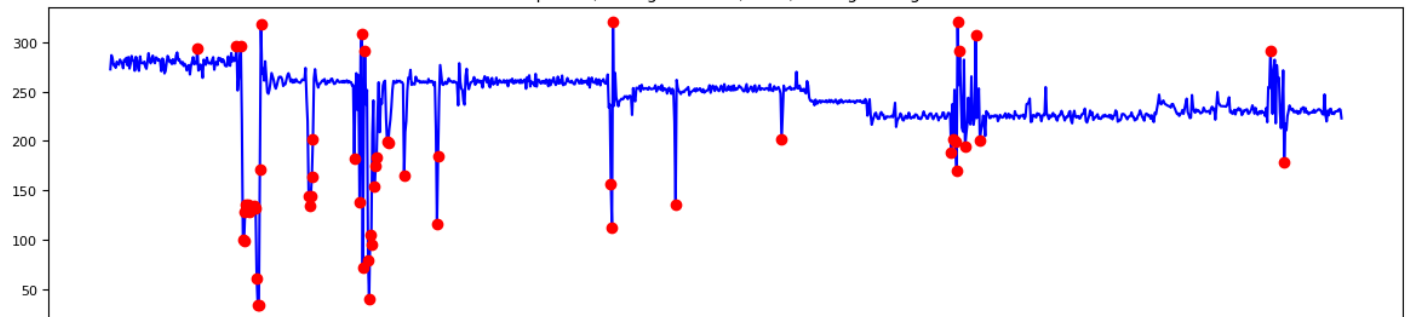
Anomalies in MAGMA Melter/Stilling Chamber/Temperature/Melter Stilling Chamber Temperature 1



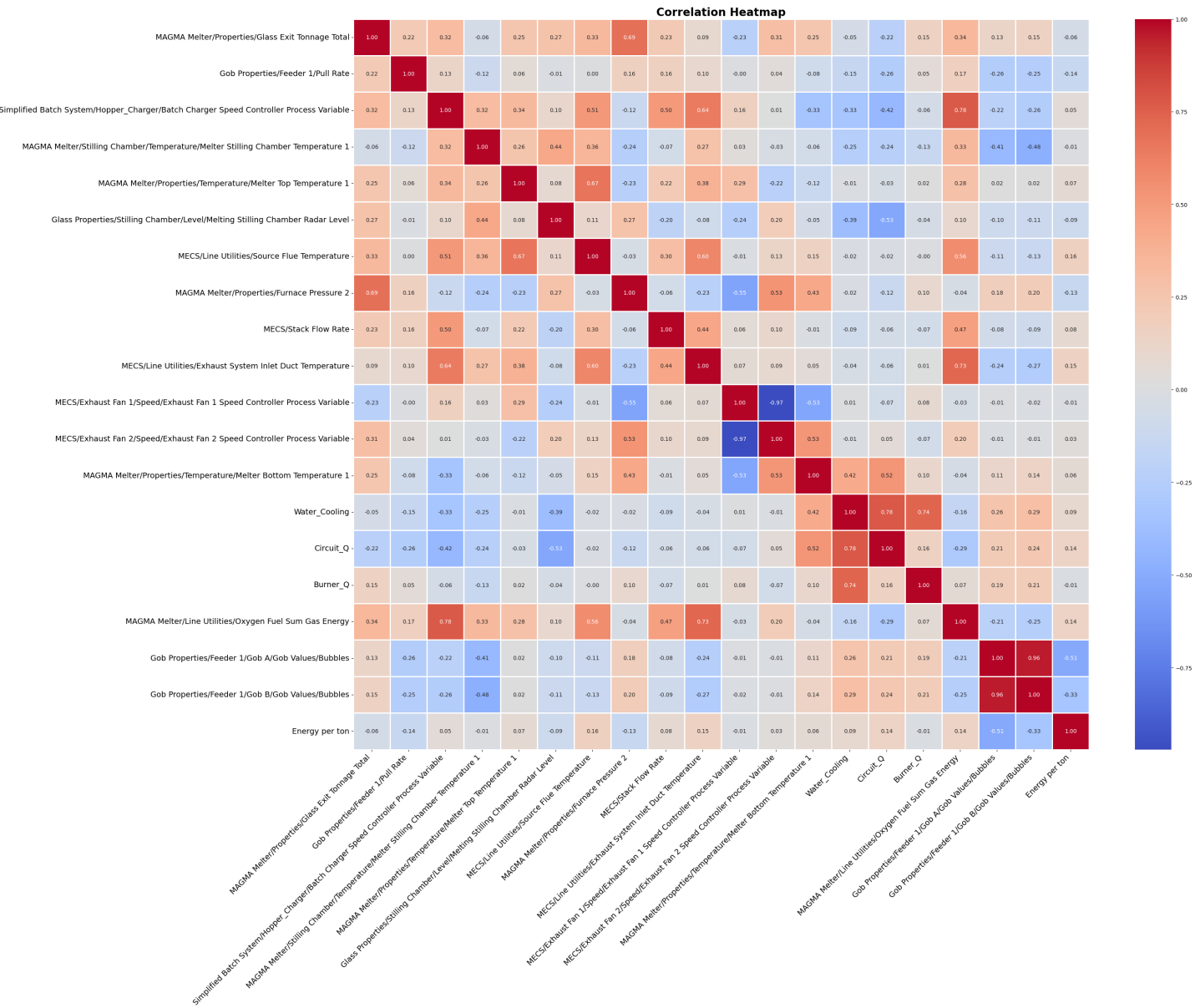
Anomalies in MAGMA Melter/Properties/Temperature/Melter Top Temperature 1



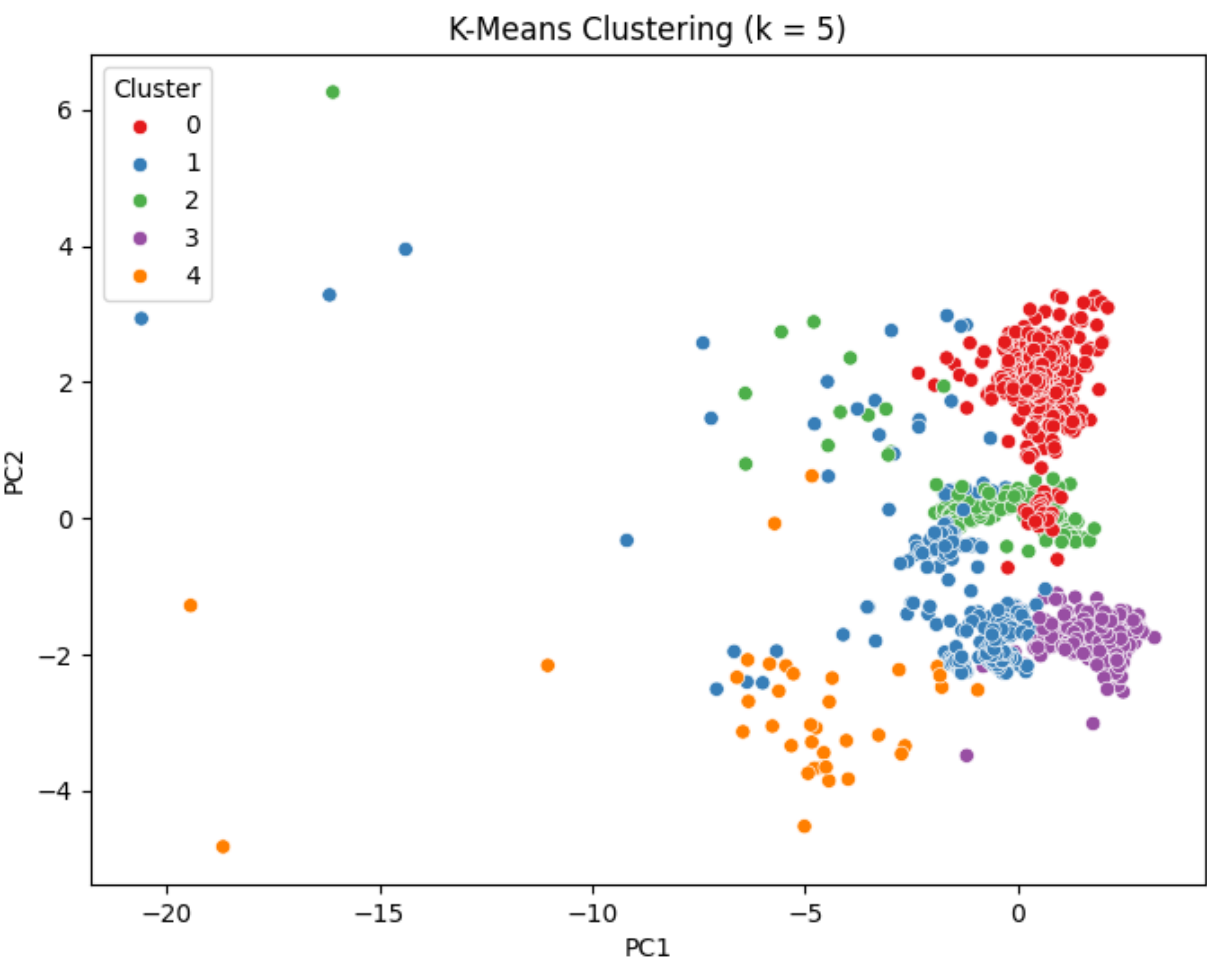
Anomalies in Glass Properties/Stilling Chamber/Level/Melting Stilling Chamber Radar Level



Correlation Heatmap



Cluster PCA Plot



K-Selection Plot

