# S0L2-M1 - Technical Data Sheet

**Standards**

Stamford industrial alternators meet the requirements of IEC EN 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2-100 and AS1359. Other standards and certifications can be considered on request.

**Quality Assurance**

Alternators are manufactured using production procedures having a quality assurance level to BS EN ISO 9001.

**Excitation and Voltage Regulators**

| Excitation System | |
|---|---|
| **AVR Type** | **AVR Power** |
| AS540 | Self-Excited / Aux winding |
| Voltage Regulation | ± 1% |
| No Load Excitation Voltage (V) | 13 V |
| Full Load Excitation Voltage (V) | 51 V |

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**S0L2-M1 Winding 311 / 711**

| Electrical Data | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Insulation System | Class H | | | | | | | |
| Stator Winding | Double Layer Concentric | | | | | | | |
| Winding Pitch | Two Thirds | | | | | | | |
| Winding Leads | 12 | | | | | | | |
| Winding Number | 311/711 | | | | | | | |
| Number of Poles | 4 | | | | | | | |
| IP Rating | IP23 | | | | | | | |
| RFI Suppression | EN 61000-6-2 & EN 61000-6-4, refer to factory for others | | | | | | | |
| Waveform Distortion | NO LOAD < 2.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0% | | | | | | | |
| Short Circuit Ratio | 1/Xd | | | | | | | |
| Steady State X/R Ratio | 6.0 | | | | | | | |
| | **50 Hz** | | | | **60 Hz** | | | |
| Telephone Interference | THF<2% | | | | TIF<75 | | | |
| Voltage Series Star | 380/220 | 400/231 | 415/240 | 440/254 | 416/240 | 440/254 | 460/266 | 480/277 |
| Voltage Parallel Star | 190/110 | 200/115 | 208/120 | 220/127 | 208/120 | 220/127 | 230/133 | 240/138 |
| Voltage Series Delta | 220/110 | 230/115 | 240/120 | 254/127 | 240/120 | 254/127 | 266/133 | 277/138 |
| kVA Base Rating (Class H) | 22.9 | 25 | 25 | N/A | 26.4 | 28 | N/A | 30 |
| **Saturated Values in Per Unit at Base Ratings and Voltages** | | | | | | | | |
| Xd Dir. Axis Synchronous | 2.318 | 2.284 | 2.122 | | 2.676 | 2.537 | | 2.284 |
| X'd Dir. Axis Transient | 0.154 | 0.152 | 0.141 | | 0.178 | 0.169 | | 0.152 |
| X"d Dir. Axis Subtransient | 0.129 | 0.127 | 0.118 | | 0.149 | 0.141 | | 0.127 |
| Xq Quad. Axis Reactance | 1.439 | 1.418 | 1.317 | | 1.661 | 1.575 | | 1.418 |
| X"q Quad. Axis Subtransient | 0.162 | 0.159 | 0.148 | | 0.187 | 0.177 | | 0.159 |
| XL Stator Leakage Reactance | 0.083 | 0.082 | 0.076 | | 0.096 | 0.091 | | 0.082 |
| X2 Negative Sequence Reactance | 0.236 | 0.233 | 0.216 | | 0.272 | 0.258 | | 0.233 |
| X0 Zero Sequence Reactance | 0.050 | 0.050 | 0.046 | | 0.058 | 0.055 | | 0.050 |
| **Unsaturated Values in Per Unit at Base Ratings and Voltages** | | | | | | | | |
| Xd Dir. Axis Synchronous | 3.153 | 3.106 | 2.886 | | 3.639 | 3.450 | | 3.106 |
| X'd Dir. Axis Transient | 0.177 | 0.175 | 0.162 | | 0.204 | 0.194 | | 0.175 |
| X"d Dir. Axis Subtransient | 0.151 | 0.149 | 0.138 | | 0.174 | 0.165 | | 0.149 |
| Xq Quad. Axis Reactance | 1.482 | 1.460 | 1.357 | | 1.711 | 1.622 | | 1.460 |
| X"q Quad. Axis Subtransient | 0.194 | 0.191 | 0.178 | | 0.224 | 0.212 | | 0.191 |
| XL Stator Leakage Reactance | 0.094 | 0.092 | 0.086 | | 0.108 | 0.103 | | 0.092 |
| X2 Negative Sequence Reactance | 0.283 | 0.279 | 0.259 | | 0.327 | 0.310 | | 0.279 |
| X0 Zero Sequence Reactance | 0.059 | 0.058 | 0.054 | | 0.068 | 0.064 | | 0.058 |
| **Time Constants (Seconds)** | | | | | | | | |
| T'd TRANSIENT TIME CONST. | 0.021 | | | | | | | |
| T''d SUB-TRANSTIME CONST. | 0.002 | | | | | | | |
| T'do O.C. FIELD TIME CONST. | 0.552 | | | | | | | |
| Ta ARMATURE TIME CONST. | 0.006 | | | | | | | |

| Resistances in Ohms (Ω) at 22°C | |
|---|---|
| Stator Winding Resistance (Ra) | 0.290 Ω per phase series star connected |
| Rotor Winding Resistance (Rf) | 0.747 Ω |
| Exciter Stator Winding Resistance | 15.42 Ω |
| Exciter Rotor Winding Resistance | 0.106 Ω per phase |
| Positive Sequence Resistance (R1) | 0.362 Ω |
| Negative Sequence Resistance (R2) | 0.417 Ω |
| Zero Sequence Resistance (R0) | 0.362 Ω |
| Aux Winding Resistance (with winding 711 only) | 5.160 Ω |

| Mechanical data | | |
|---|---|---|
| Cooling Air | 0.105 m³/sec (50Hz) | 0.126 m³/sec (60Hz) |
| Shaft and Keys | All alternator rotors are dynamically balanced to better than BS6861: Part 1 Grade 2.5 for minimum vibration in operation. | |
| Bearing | Single Bearing | |
| Weight Complete Alternator | 121.1 kg | |
| Weight Wound Stator | 49 kg | |
| Weight Wound Rotor | 43.4 kg | |
| Moment of Inertia | 0.159 $kgm^2$ | |
| Shipping weight in a Crate | 159 kg | |
| Packing Crate Size | 930X590X760 mm | |
| Maximum Over Speed | 2250 RPM for two minutes | |
| Bearing Drive End | N/A | |
| Bearing Non-Drive End | Ball Bearing, 6305-2RS1 | |

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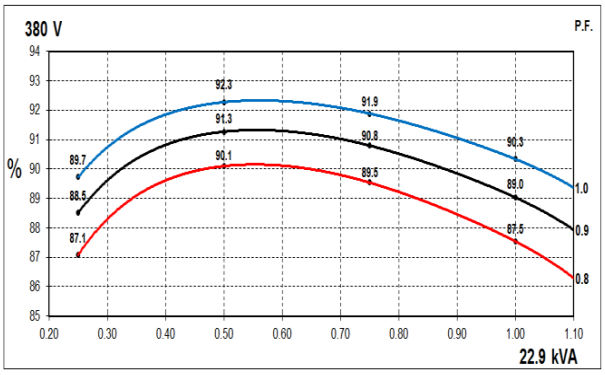
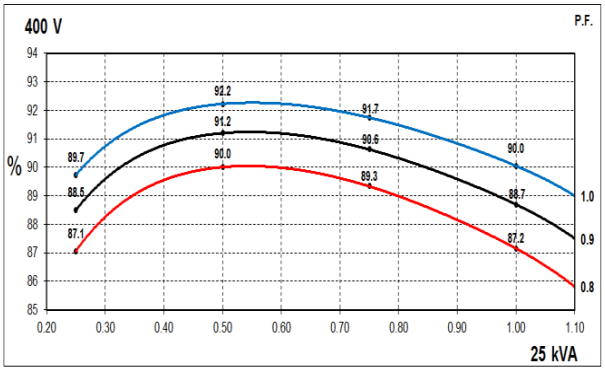
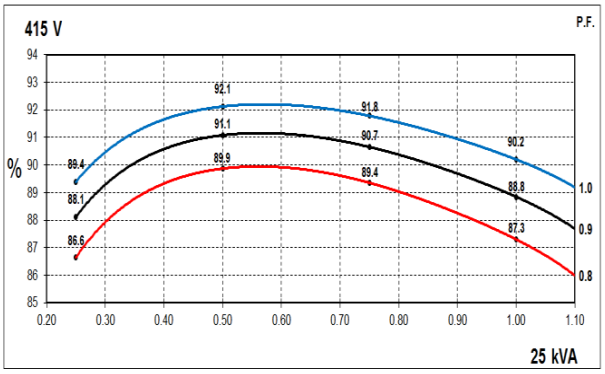
## S0L2-M1 Winding 311 / 711

### Three Phase Efficiency Curves

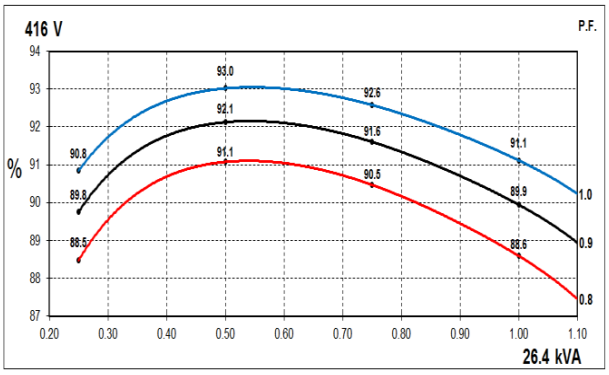
#### 50Hz Curves

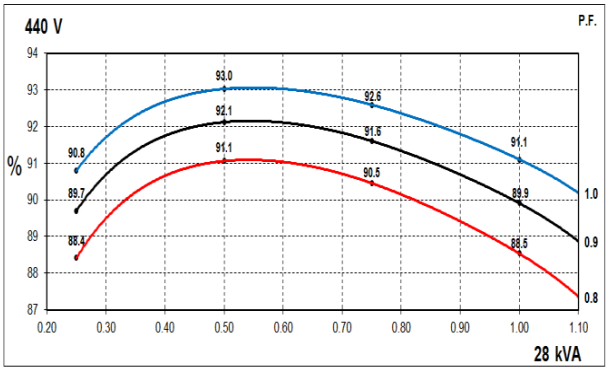


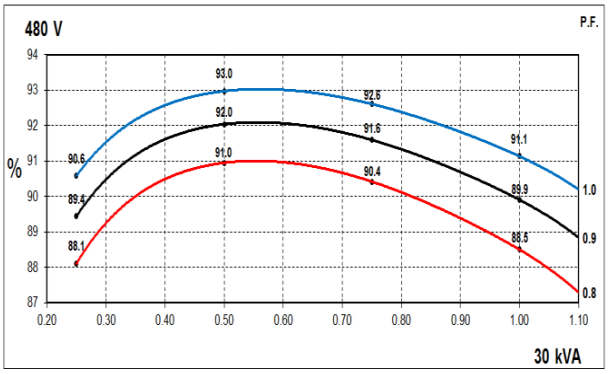




#### 60Hz Curves

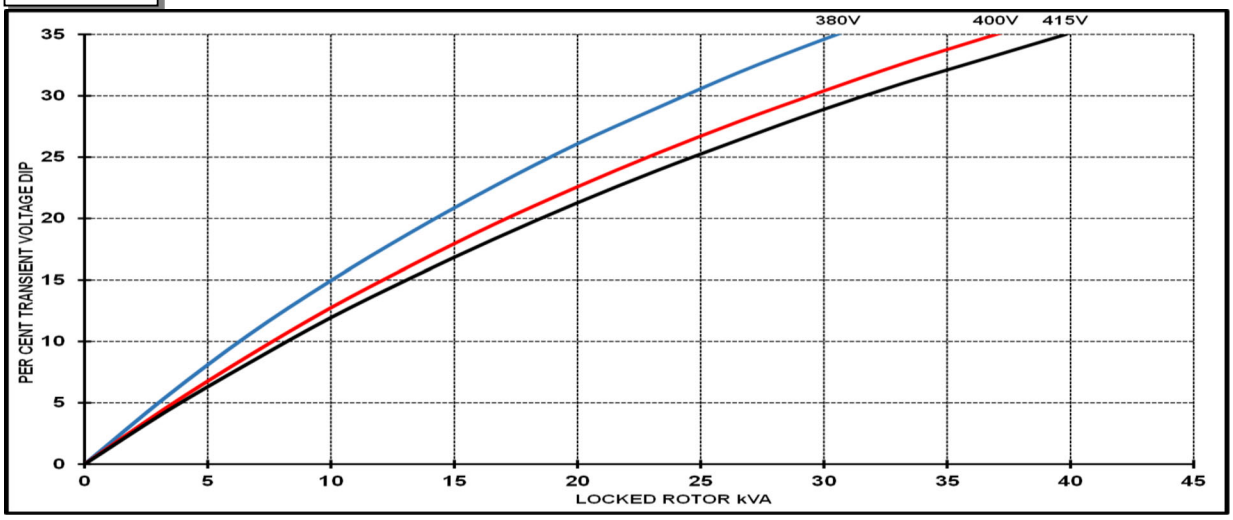


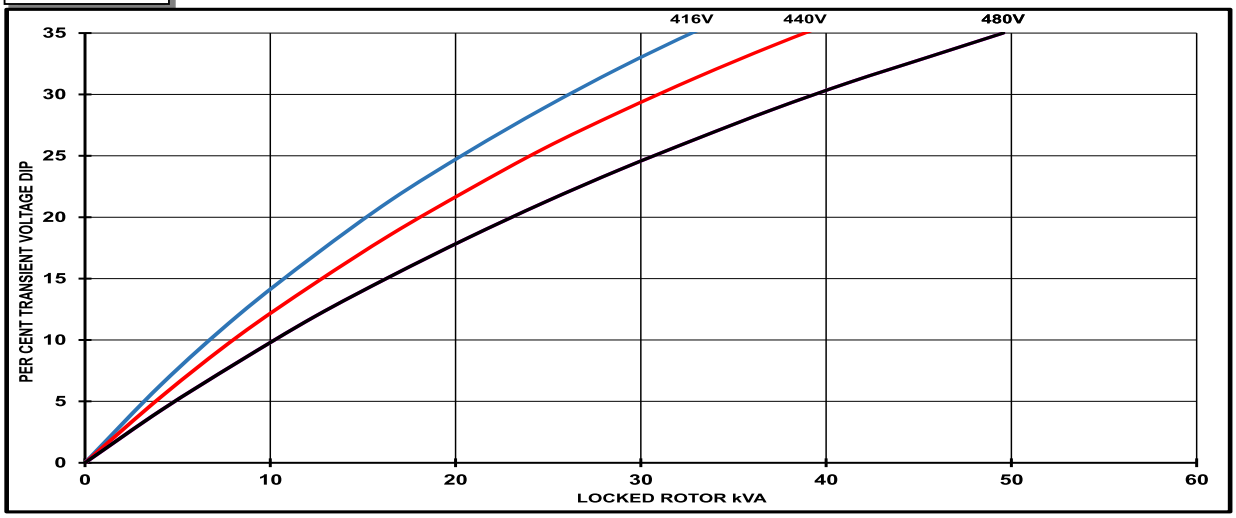



## Locked Rotor Motor Starting Curves

### 50Hz




### 60Hz




| Transient Voltage Dip Scaling Factor | | Transient Voltage Rise Scaling Factor |
|---|---|---|
| PF | Factor | For voltage rise multiply voltage dip by 1.25 |
| < 0.5 | 1.00 | |
| 0.5 | 0.97 | |
| 0.6 | 0.93 | |
| 0.7 | 0.90 | |
| 0.8 | 0.85 | |
| 0.9 | 0.83 | |
| 1.0 | 0.80 | |

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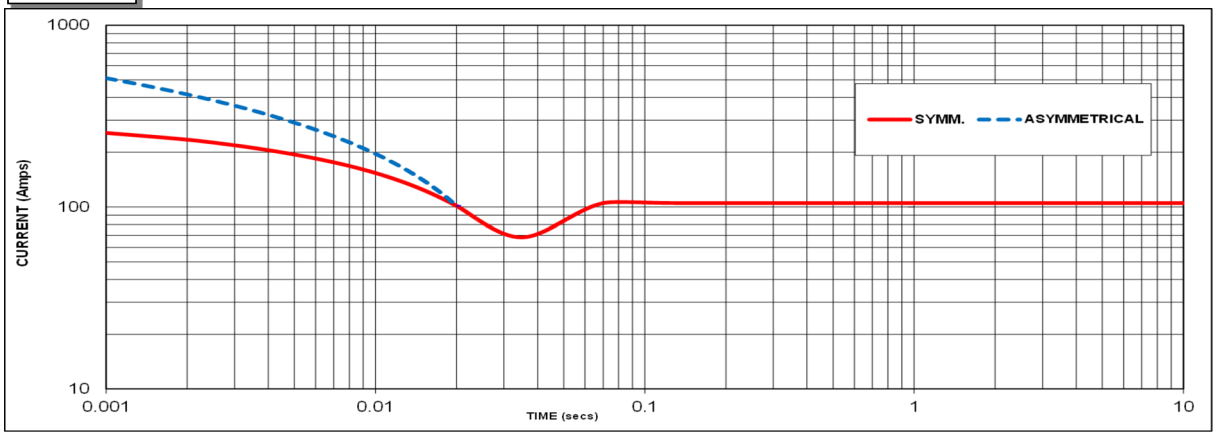
**S0L2-M1 Winding 711**

**Three-phase Short Circuit Decrement Curve**

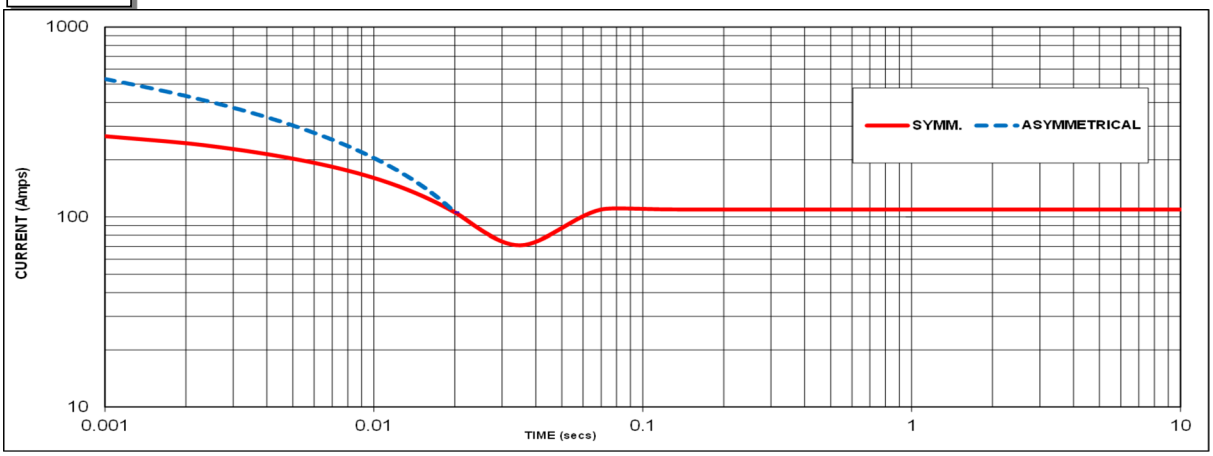
***Note: Applicable only for Winding 711 ( Auxiliary winding).***
***Winding 311 (no Auxiliary winding) will not provide short circuit capability.***

**50Hz**




Sustained Short Circuit = 105 Amps

**60Hz**




Sustained Short Circuit = 109.3 Amps

**Note 1**
The following multiplication factors should be used to adjust the values from curve between time 0.001 seconds and the minimum current point in respect of nominal operating voltage :

| **50Hz** | | **60Hz** | |
|---|---|---|---|
| Voltage | Factor | Voltage | Factor |
| 380V | N/A | 416V | X 1.00 |
| 400V | X 1.00 | 440V | X 1.06 |
| 415v | X 1.04 | 460V | N/A |
| 440V | N/A | 480V | X 1.15 |

The sustained current value is constant irrespective of voltage level

**Note 2**
The following multiplication factor should be used to convert the values calculated in accordance with NOTE 1 to those applicable to the various types of short circuit :

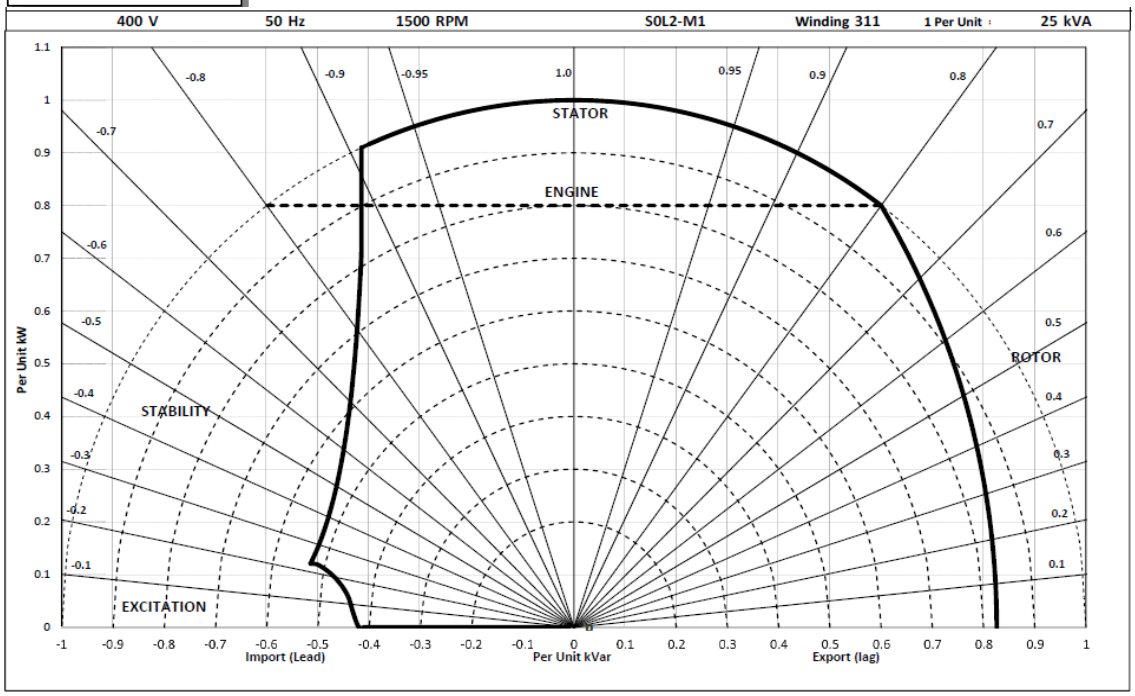
| | 3-phase | 2-phase L-L | 1-phase L-N |
|---|---|---|---|
| Instantaneous | x 1.00 | x 0.87 | x 1.30 |
| Minimum | x 1.00 | x 1.80 | x 3.20 |
| Sustained | x 1.00 | x 1.50 | x 2.50 |
| Max. sustained duration | 10 sec. | 5 sec. | 2 sec. |

All other times are unchanged

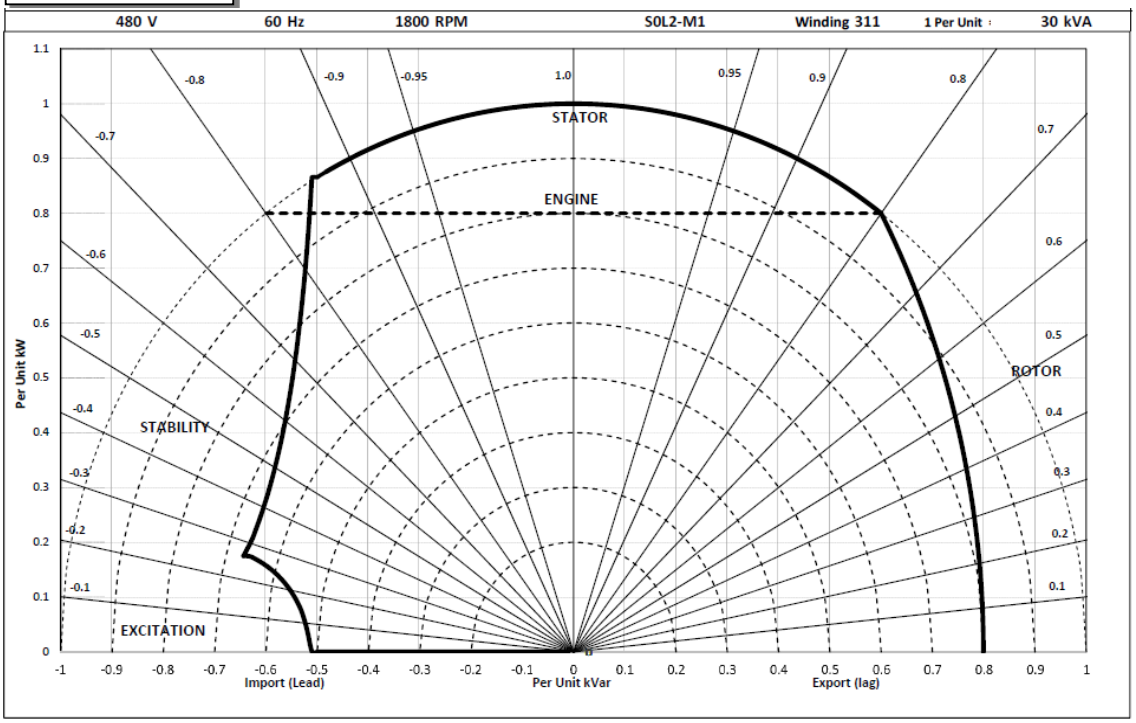
**Note 3**
Curves are drawn for Star connected machines under no-load excitation at rated speeds. For other connection the following multipliers should be applied to current values as shown :
Parallel Star = Curve current value X 2
Series Delta = Curve current value X 1.732

## Typical Alternator Operating Charts

### 400V/50Hz




### 480V/60Hz



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## S0L2-M1 Winding 311 / 711

### RATINGS AT 0.8 POWER FACTOR

| | Class - Temp Rise | Standby - 163/27°C | | | | Standby - 150/40°C | | | | Cont. H - 125/40°C | | | | Cont. F - 105/40°C | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **50** Hz | Series Star (V) | 380 | 400 | 415 | 440 | 380 | 400 | 415 | 440 | 380 | 400 | 415 | 440 | 380 | 400 | 415 | 440 |
| | Parallel Star (V) | 190 | 200 | 208 | 220 | 190 | 200 | 208 | 220 | 190 | 200 | 208 | 220 | 190 | 200 | 208 | 220 |
| | Series Delta (V) | 220 | 230 | 240 | 254 | 220 | 230 | 240 | 254 | 220 | 230 | 240 | 254 | 220 | 230 | 240 | 254 |
| | kVA | 25.2 | 27.5 | 27.5 | N/A | 24.4 | 26.7 | 26.7 | N/A | 22.9 | 25.0 | 25.0 | N/A | 20.8 | 22.8 | 22.8 | N/A |
| | kW | 20.2 | 22.0 | 22.0 | N/A | 19.5 | 21.4 | 21.4 | N/A | 18.3 | 20.0 | 20.0 | N/A | 16.6 | 18.2 | 18.2 | N/A |
| | Efficiency (%) | 86.3 | 85.8 | 86.0 | N/A | 86.7 | 86.2 | 86.4 | N/A | 87.5 | 87.2 | 87.3 | N/A | 88.4 | 88.0 | 88.1 | N/A |
| | kW Input | 23.4 | 25.6 | 25.6 | N/A | 22.5 | 24.8 | 24.7 | N/A | 20.9 | 22.9 | 22.9 | N/A | 18.8 | 20.7 | 20.7 | N/A |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **60** Hz | Series Star (V) | 416 | 440 | 460 | 480 | 416 | 440 | 460 | 480 | 416 | 440 | 460 | 480 | 416 | 440 | 460 | 480 |
| | Parallel Star (V) | 208 | 220 | 230 | 240 | 208 | 220 | 230 | 240 | 208 | 220 | 230 | 240 | 208 | 220 | 230 | 240 |
| | Delta (V) | 240 | 254 | 266 | 277 | 240 | 254 | 266 | 277 | 240 | 254 | 266 | 277 | 240 | 254 | 266 | 277 |
| | kVA | 29.0 | 30.8 | N/A | 33.0 | 28.2 | 29.9 | N/A | 32.0 | 26.4 | 28.0 | N/A | 30.0 | 24.0 | 25.5 | N/A | 27.3 |
| | kW | 23.2 | 24.6 | N/A | 26.4 | 22.6 | 23.9 | N/A | 25.6 | 21.1 | 22.4 | N/A | 24.0 | 19.2 | 20.4 | N/A | 21.8 |
| | Efficiency (%) | 87.5 | 87.4 | N/A | 87.3 | 87.8 | 87.7 | N/A | 87.7 | 88.6 | 88.5 | N/A | 88.5 | 89.4 | 89.3 | N/A | 89.3 |
| | kW Input | 26.5 | 28.2 | N/A | 30.2 | 25.7 | 27.3 | N/A | 29.2 | 23.8 | 25.3 | N/A | 27.1 | 21.5 | 22.8 | N/A | 24.5 |

**De-Rates**

All values tabulated above are subject to the following reductions:

- 3% for every 500 meters by which the operating altitude exceeds 1000 meters above mean sea level
- 3% for every 5°C by which the operational ambient temperature exceeds 40°C
- For any other operating conditions impacting the cooling circuit please refer to applications

Note: Requirement for operating in an ambient exceeding 60°C and altitude exceeding 4000 meters must be referred to applications.

**Dimensional and Torsional Drawing**

For dimensional and torsional information please refer to the alternator General Arrangement and rotor drawings available on our website (http://stamford-avk.com/)

**Note:** Continuous development of our products means that the information contained in our data sheets can change without notice, and specifications should always be confirmed with Cummins Generator Technologies prior to purchase.

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