

STAMFORD®

S4L1D-D Wdg.311 (Single Phase) - 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 | AS440 | MX341 | MX321 | | |
| Voltage Regulation | ± 1% | ± 1% | ± 0.5% | | with 4% Engine Governing |
| Excitation Type | Self-Excited | PMG | PMG | | |

| | |
|-----------------------------------------|-----------|
| No Load Excitation Voltage (V) | 12 - 9 |
| No Load Excitation Current (A) | 0.7 - 0.5 |
| Full Load Excitation Voltage (V) | 41 - 39 |
| Full Load Excitation Current (A) | 2.3 - 2.2 |
| Exciter Time Constant (seconds) | 0.105 |

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| Electrical Data | | | | | | |
|------------------------------------------------------------|----------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|
| Insulation System | Class H | | | | | |
| IP Rating | IP23 | | | | | |
| Stator Winding | Double Layer Concentric | | | | | |
| Winding Pitch | 2/3 | | | | | |
| Winding Leads | 12 | | | | | |
| Winding Number | 311 | | | | | |
| Number of Poles | 4 | | | | | |
| RFI Suppression | EN 61000-6-2 & EN 61000-6-4, refer to factory for others | | | | | |
| Waveform Distortion | NO LOAD < 2.5% NON-DISTORTING LINEAR LOAD < 5.0% | | | | | |
| Short Circuit Ratio | 1/Xd | | | | | |
| Steady State X/R Ratio | 19.68 | | | | | |
| | 50Hz | | | 60Hz | | |
| VOLTAGE DOUBLE DELTA | 220 / 110 | 230 / 115 | 240 / 120 | 220 / 110 | 230 / 115 | 240 / 120 |
| VOLTAGE PARALLEL DELTA | 110 | 115 | 120 | 110 | 115 | 120 |
| POWER FACTOR | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| KVA BASE RATING FOR REACTANCE VALUES | 150 | 150 | 150 | 155 | 165 | 170 |
| Saturated Values in Per Unit at Base Ratings and Voltages | | | | | | |
| Xd Dir. Axis Synchronous | 2.35 | 2.15 | 1.97 | 2.91 | 2.84 | 2.69 |
| X'd Dir. Axis Transient | 0.15 | 0.14 | 0.13 | 0.19 | 0.18 | 0.17 |
| X" d Dir. Axis Subtransient | 0.11 | 0.10 | 0.09 | 0.14 | 0.13 | 0.12 |
| Xq Quad. Axis Reactance | 1.98 | 1.81 | 1.66 | 2.45 | 2.39 | 2.26 |
| X"q Quad. Axis Subtransient | 0.30 | 0.27 | 0.25 | 0.37 | 0.36 | 0.34 |
| Xl Leakage Reactance | 0.05 | 0.05 | 0.05 | 0.07 | 0.07 | 0.06 |
| X2 Negative Reactance | 0.20 | 0.18 | 0.17 | 0.24 | 0.24 | 0.22 |
| X0 Zero Sequence | 0.08 | 0.07 | 0.06 | 0.09 | 0.09 | 0.09 |
| Unaturated Values in Per Unit at Base Ratings and Voltages | | | | | | |
| Xd Dir. Axis Synchronous | 2.82 | 2.58 | 2.37 | 3.50 | 3.41 | 3.22 |
| X'd Dir. Axis Transient | 0.18 | 0.16 | 0.15 | 0.22 | 0.21 | 0.20 |
| X" d Dir. Axis Subtransient | 0.13 | 0.12 | 0.11 | 0.16 | 0.15 | 0.15 |
| Xq Quad. Axis Reactance | 2.04 | 1.86 | 1.71 | 2.53 | 2.46 | 2.33 |
| X"q Quad. Axis Subtransient | 0.35 | 0.32 | 0.30 | 0.44 | 0.43 | 0.40 |
| Xl Leakage Reactance | 0.06 | 0.06 | 0.05 | 0.08 | 0.07 | 0.07 |
| X2 Negative Reactance | 0.24 | 0.22 | 0.20 | 0.29 | 0.29 | 0.27 |
| X0 Zero Sequence | 0.09 | 0.08 | 0.08 | 0.11 | 0.11 | 0.10 |
| Time Constants (seconds) | | | | | | |
| T'd TRANSIENT TIME CONST. | 0.08 | | | | | |
| T" d SUB-TRANSTIME CONST. | 0.019 | | | | | |
| T'do O.C. FIELD TIME CONST. | 1.7 | | | | | |
| Ta ARMATURE TIME CONST. | 0.018 | | | | | |

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| Resistances in Ohms (Ω) at 22°C | |
|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Stator Winding Resistance (Ra) per phase series star connected | 0.008 |
| Rotor Winding Resistance (Rf) | 1.05 |
| Exciter Stator Winding Resistance | 18 |
| Exciter Rotor Winding Resistance per phase | 0.068 |
| Positive Sequence Resistance (R1) | 0.0155 |
| Negative Sequence Resistance (R2) | 0.017856 |
| Zero Sequence Resistance (R0) | 0.0155 |
| PMG Phase Resistance (R _{pmg}) per phase | 1.9 |
| Mechanical data | |
| Cooling Air | 0.83 m ³ /sec (50Hz) 0.99 m ³ /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 | 940 kg |
| Weight Wound Stator | 415 kg |
| Weight Wound Rotor | 361 kg |
| Moment of Inertia | 4.0771 kgm ² |
| Shipping weight in a Crate | 1010 kg |
| Packing Crate Size | 155 x 87 x 107 (cm) |
| Maximum Over Speed | 2250 RPM for two minutes |
| Bearing Drive End | N/A |
| Bearing Non-Drive End | Ball Bearing, 6314 |

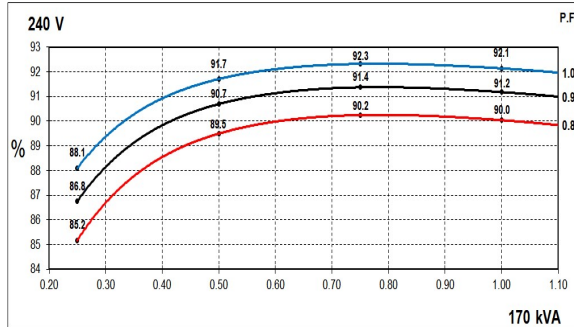
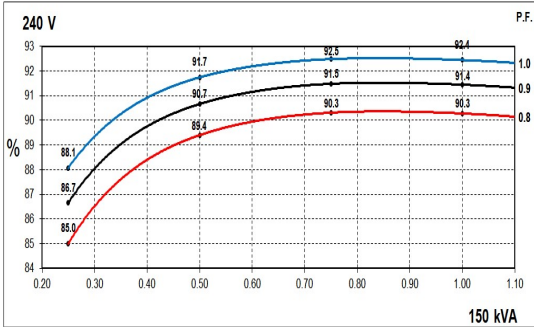
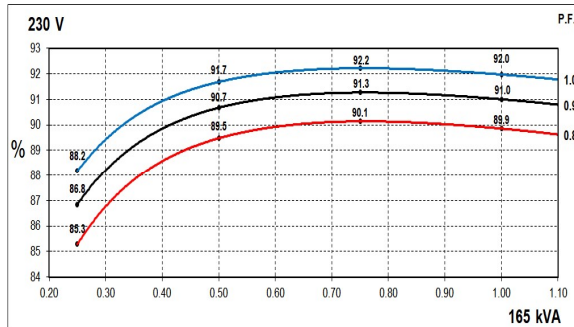
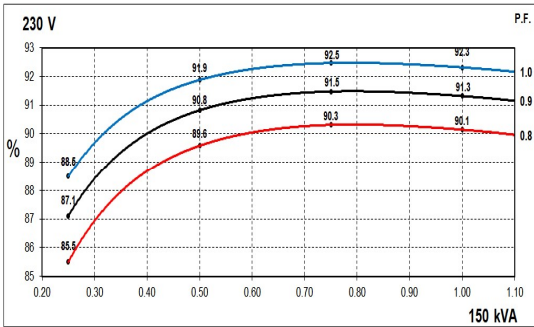
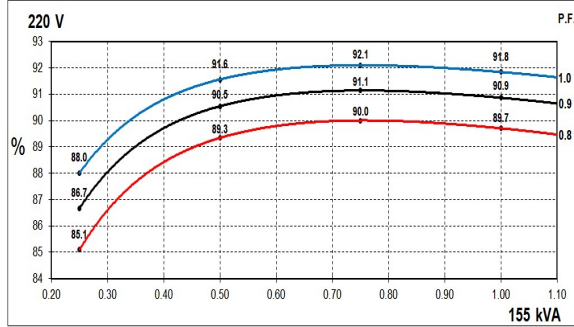
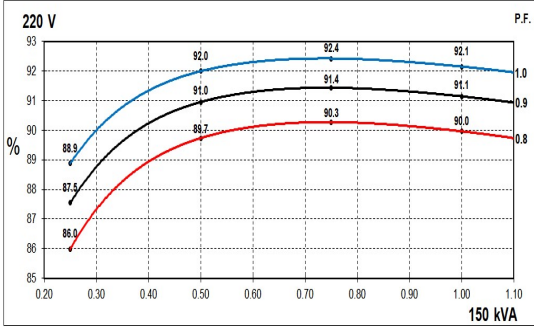
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Double Delta Efficiency Curves

50Hz Curves

60Hz Curves

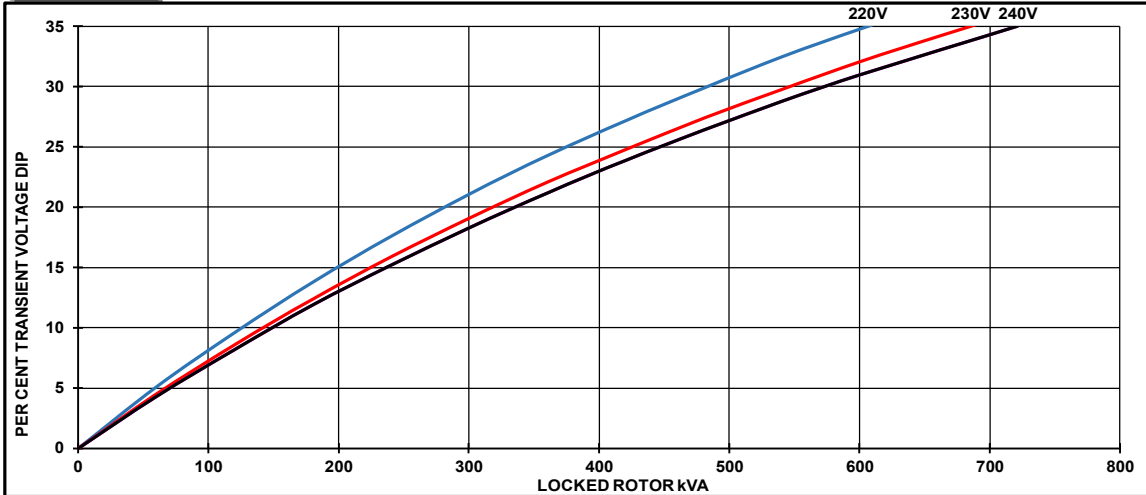


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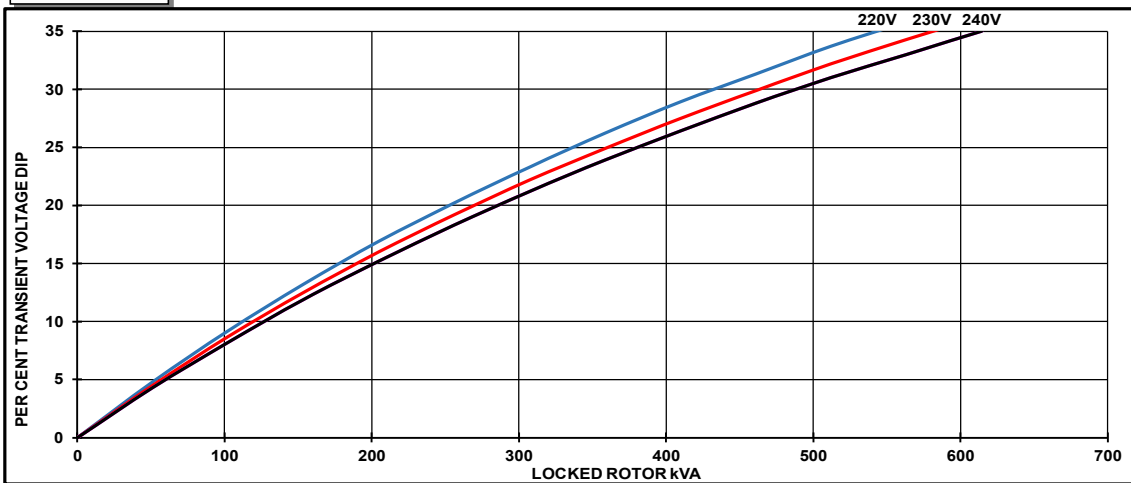
S4L1D-D Wdg.311 (Single Phase)

Locked Rotor Motor Starting Curves - Separately Excited

50Hz



60Hz



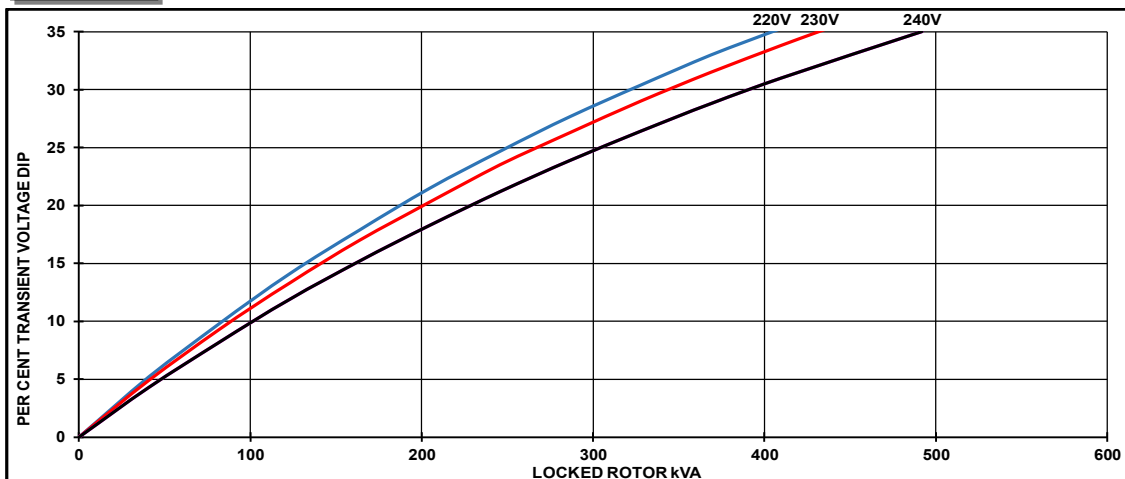
| Transient Voltage Dip Scaling Factor | | Transient Voltage Rise Scaling Factor |
|--------------------------------------|--------|-----------------------------------------------|
| PF | Factor | |
| < 0.5 | 1.00 | For voltage rise multiply voltage dip by 1.25 |
| 0.5 | 0.97 | |
| 0.6 | 0.93 | |
| 0.7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

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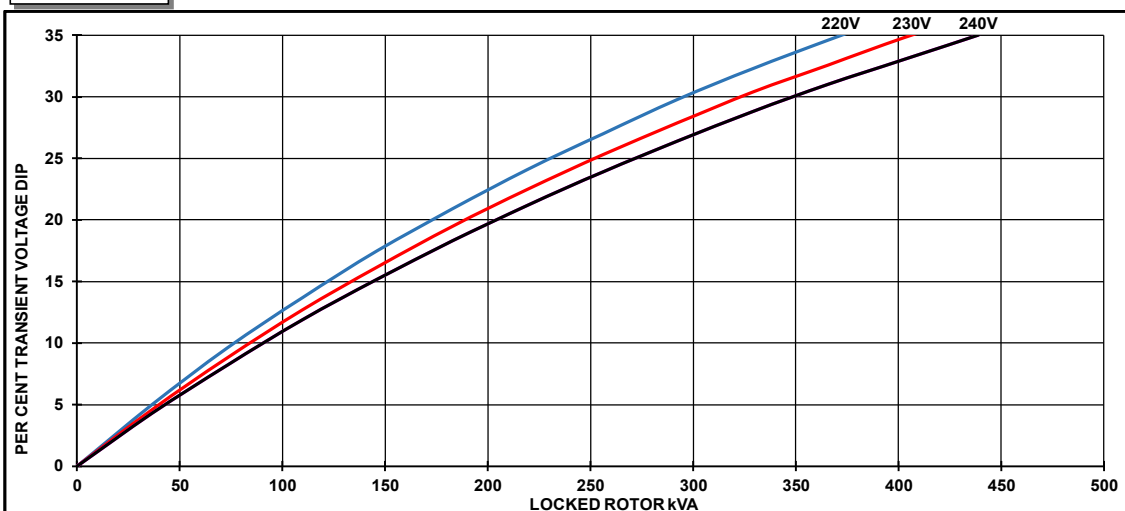
S4L1D-D Wdg.311 (Single Phase)

Locked Rotor Motor Starting Curves - Self Excited

50Hz



60Hz

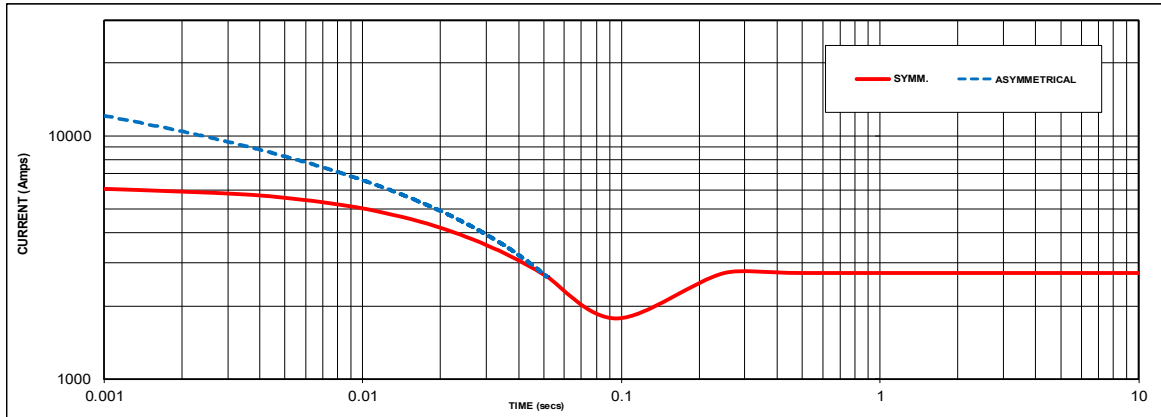


| Transient Voltage Dip Scaling Factor | | Transient Voltage Rise Scaling Factor |
|--------------------------------------|--------|-----------------------------------------------|
| PF | Factor | |
| < 0.5 | 1.00 | For voltage rise multiply voltage dip by 1.25 |
| 0.5 | 0.97 | |
| 0.6 | 0.93 | |
| 0.7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

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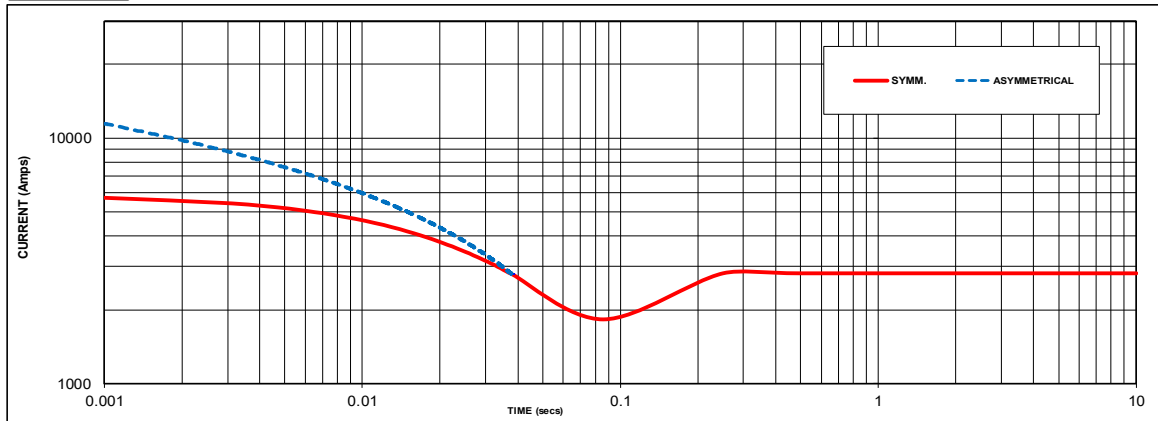
S4L1D-D Wdg.311 (Single Phase) Double Delta Short Circuit Decrement Curve

50Hz



Sustained Short Circuit = 2727 Amps

60Hz



Sustained Short Circuit = 2818 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 |
| 220V | X 1.00 | 220V | X 1.00 |
| 230V | X 1.05 | 230V | X 1.05 |
| 240V | X 1.09 | 240V | X 1.09 |

The sustained current value is constant irrespective of voltage level

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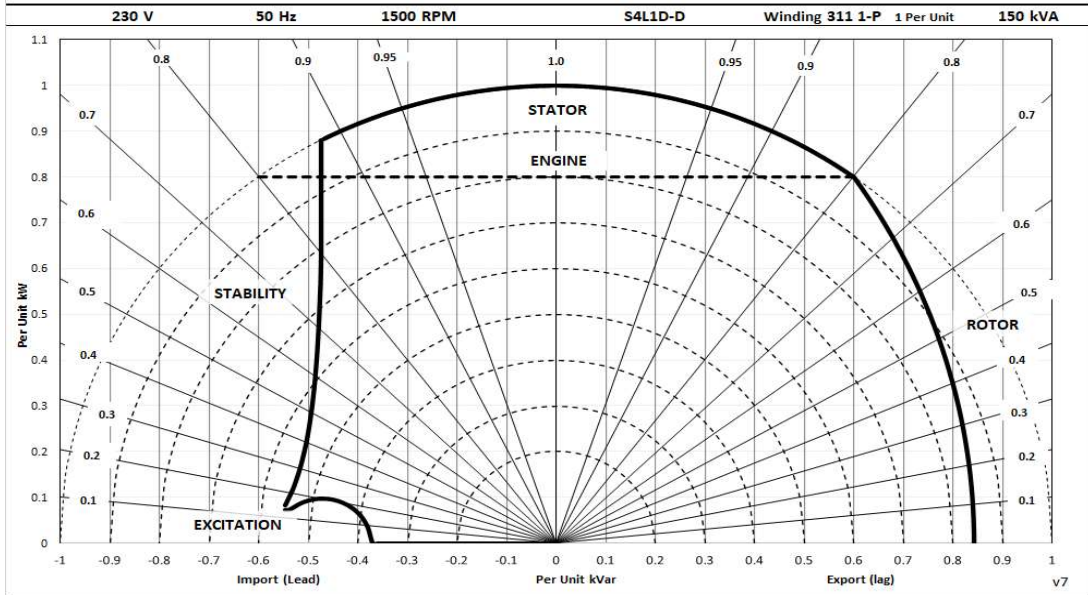
S4L1D-D Wdg.311 (Single Phase)

Typical Alternator Operating Charts

230V/50Hz



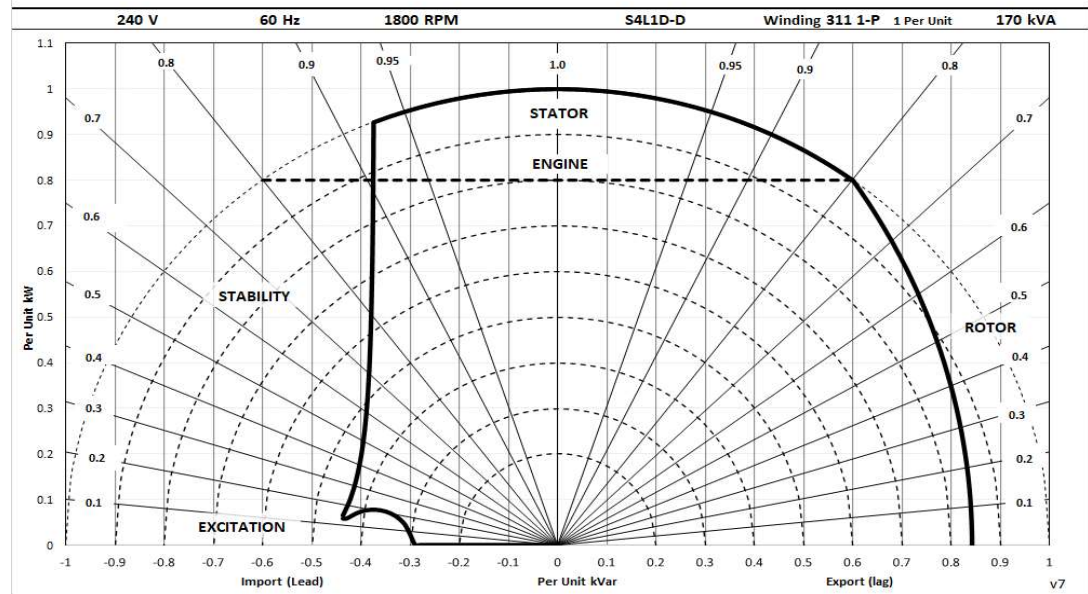
ALTERNATOR OPERATING CHART



240V/60Hz



ALTERNATOR OPERATING CHART



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RATINGS

50Hz

| Class - Temp Rise | Cont. F - 105/40°C | | | Cont. H - 125/40°C | | | Cont. F - 105/40°C | | | Cont. H - 125/40°C | | |
|--------------------|--------------------|------|------|--------------------|------|------|--------------------|------|------|--------------------|------|------|
| | 0.8pf | | | 0.8pf | | | 1.0pf | | | 1.0pf | | |
| Double Delta (V) | 220 | 230 | 240 | 220 | 230 | 240 | 220 | 230 | 240 | 220 | 230 | 240 |
| Parallel Delta (V) | 110 | 115 | 120 | 110 | 115 | 120 | 110 | 115 | 120 | 110 | 115 | 120 |
| kVA | 140 | 140 | 140 | 150 | 150 | 150 | 140 | 140 | 140 | 150 | 150 | 150 |
| kW | 112 | 112 | 112 | 120 | 120 | 120 | 140 | 140 | 140 | 150 | 150 | 150 |
| Efficiency (%) | 90.1 | 90.2 | 90.3 | 90.0 | 90.1 | 90.3 | 92.3 | 92.4 | 92.5 | 92.1 | 92.3 | 92.4 |
| kW Input | 124 | 124 | 124 | 133 | 133 | 133 | 152 | 152 | 151 | 163 | 163 | 162 |

60Hz

| Class - Temp Rise | Cont. F - 105/40°C | | | Cont. H - 125/40°C | | | Cont. F - 105/40°C | | | Cont. H - 125/40°C | | |
|--------------------|--------------------|------|------|--------------------|------|------|--------------------|------|------|--------------------|------|------|
| | 0.8pf | | | 0.8pf | | | 1.0pf | | | 1.0pf | | |
| Double Delta (V) | 220 | 230 | 240 | 220 | 230 | 240 | 220 | 230 | 240 | 220 | 230 | 240 |
| Parallel Delta (V) | 110 | 115 | 120 | 110 | 115 | 120 | 110 | 115 | 120 | 110 | 115 | 120 |
| kVA | 145 | 155 | 160 | 155 | 165 | 170 | 145 | 155 | 160 | 155 | 165 | 170 |
| kW | 116 | 124 | 128 | 124 | 132 | 136 | 145 | 155 | 160 | 155 | 165 | 170 |
| Efficiency (%) | 89.8 | 90.0 | 90.1 | 89.7 | 89.9 | 90.0 | 91.9 | 92.1 | 92.2 | 91.8 | 92.0 | 92.1 |
| kW Input | 129 | 138 | 142 | 138 | 147 | 151 | 158 | 168 | 174 | 169 | 179 | 185 |

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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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