

# STAMFORD

## S4L1S-E 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					
<b>AVR Type</b>	AS440	MX341	MX321		
<b>Voltage Regulation</b>	± 1%	± 1%	± 0.5%		with 4% Engine Governing
<b>Excitation Type</b>	Self-Excited	PMG	PMG		

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

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Electrical Data						
Insulation System	Class H					
IP Rating	IP23					
Stator Winding	Double Layer Concentric					
Winding Pitch	Two Thirds					
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	16.87					
	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	175	175	175	185	195	200
Saturated Values in Per Unit at Base Ratings and Voltages						
Xd Dir. Axis Synchronous	2.24	2.05	1.88	2.84	2.74	2.58
X'd Dir. Axis Transient	0.15	0.14	0.13	0.19	0.19	0.18
X''d Dir. Axis Subtransient	0.11	0.10	0.09	0.14	0.13	0.13
Xq Quad. Axis Reactance	1.92	1.76	1.62	2.44	2.35	2.22
X''q Quad. Axis Subtransient	0.26	0.24	0.22	0.33	0.32	0.30
Xl Leakage Reactance	0.05	0.05	0.05	0.07	0.07	0.06
X2 Negative Reactance	0.17	0.16	0.15	0.22	0.21	0.20
X0 Zero Sequence	0.08	0.07	0.06	0.10	0.09	0.09
Unaturated Values in Per Unit at Base Ratings and Voltages						
Xd Dir. Axis Synchronous	2.69	2.46	2.26	3.41	3.29	3.10
X'd Dir. Axis Transient	0.18	0.16	0.15	0.22	0.22	0.20
X''d Dir. Axis Subtransient	0.13	0.12	0.11	0.16	0.16	0.15
Xq Quad. Axis Reactance	1.98	1.81	1.66	2.51	2.42	2.28
X''q Quad. Axis Subtransient	0.31	0.29	0.26	0.40	0.39	0.36
Xl Leakage Reactance	0.06	0.06	0.05	0.08	0.08	0.07
X2 Negative Reactance	0.21	0.19	0.18	0.27	0.26	0.24
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 ( $\Omega$ ) at 22°C		
Stator Winding Resistance (Ra) per phase series star connected	0.006	
Rotor Winding Resistance (Rf)	1.19	
Exciter Stator Winding Resistance	18	
Exciter Rotor Winding Resistance per phase	0.068	
Positive Sequence Resistance (R1)	0.01125	
Negative Sequence Resistance (R2)	0.01296	
Zero Sequence Resistance (R0)	0.01125	
PMG Phase Resistance (Rpmg) per phase	1.9	
Mechanical data		
Cooling Air	0.8 m <sup>3</sup> /sec (50Hz)	0.96 m <sup>3</sup> /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	Double Bearing
Weight Complete Alternator	1024 kg	1030 kg
Weight Wound Stator	470 kg	470 kg
Weight Wound Rotor	400 kg	377 kg
Moment of Inertia	4.6331 kgm <sup>2</sup>	4.4343 kgm <sup>2</sup>
Shipping weight in a Crate	1095 kg	1100 kg
Packing Crate Size	155 x 87 x 107 (cm)	155 x 87 x 107 (cm)
Maximum Over Speed	2250 RPM for two minutes	2250 RPM for two minutes
Bearing Drive End	N/A	Ball Bearing, 6317
Bearing Non-Drive End	Ball Bearing, 6314	

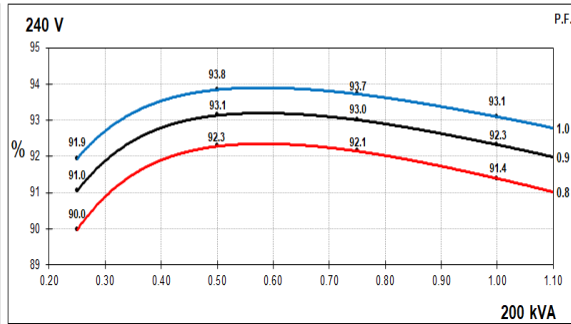
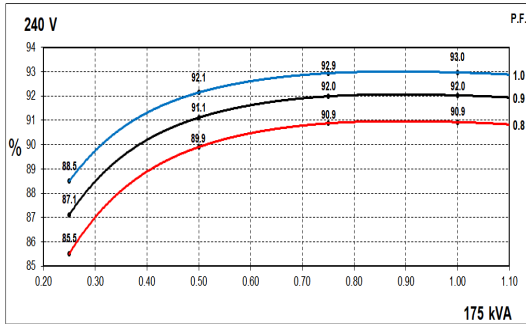
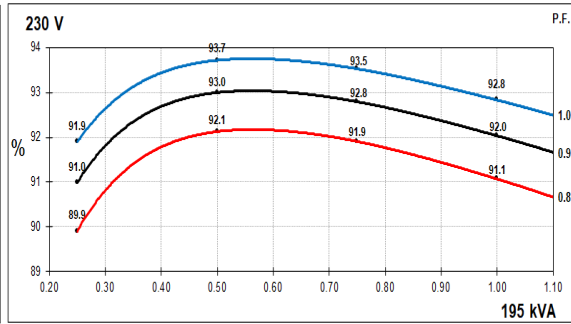
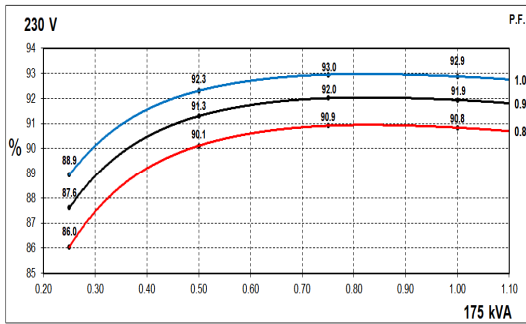
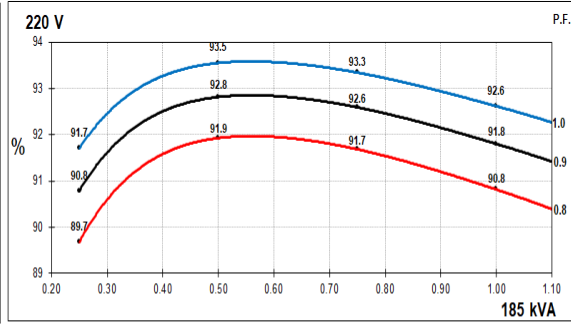
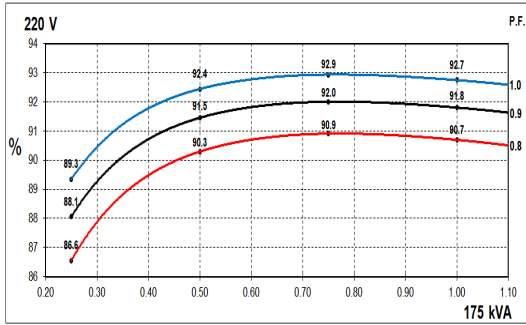
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## S4L1S-E Wdg.311 (Single Phase)

### Double Delta Efficiency Curves

50Hz Curves

60Hz Curves

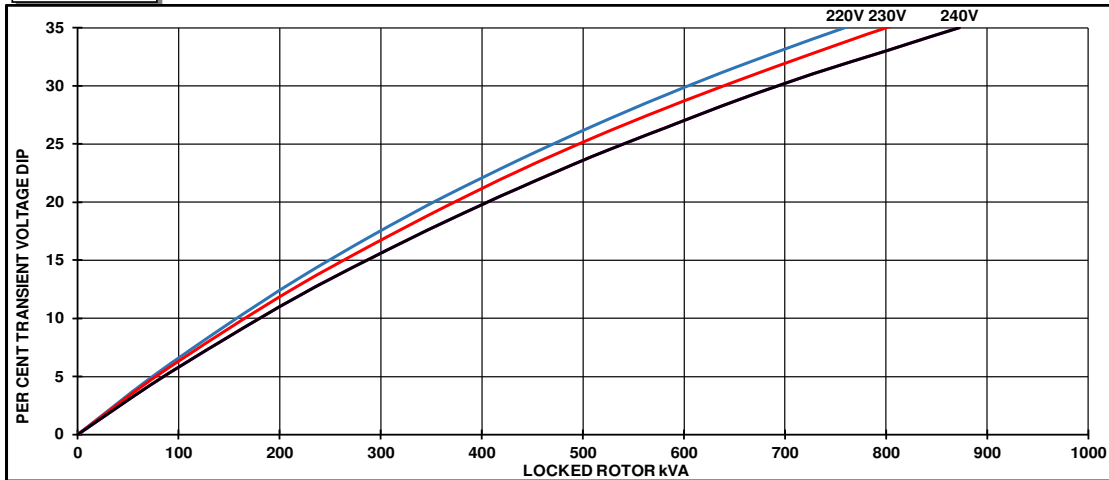


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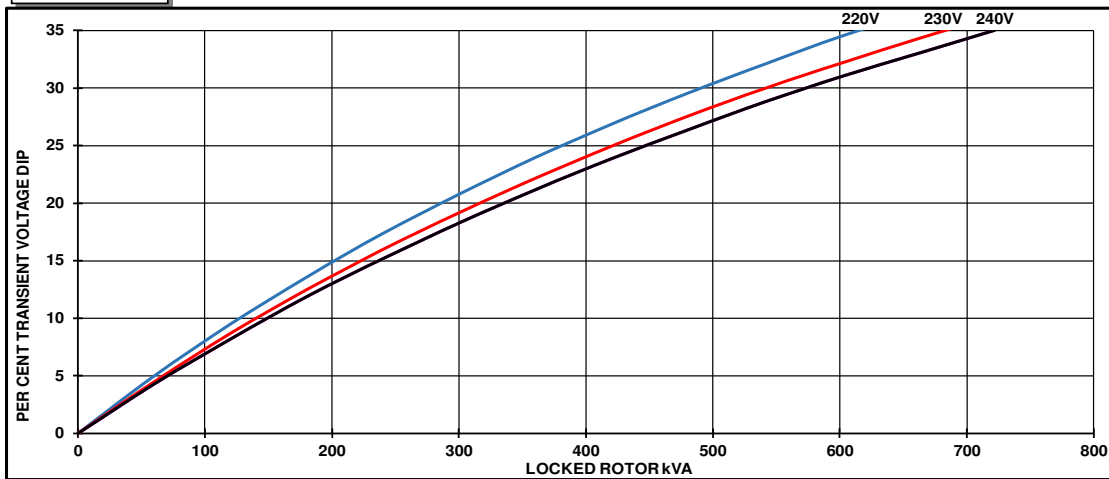
S4L1S-E Wdg.311 (Single Phase)

## Locked Rotor Motor Starting Curves - Separately Excited

**50Hz**



**60Hz**



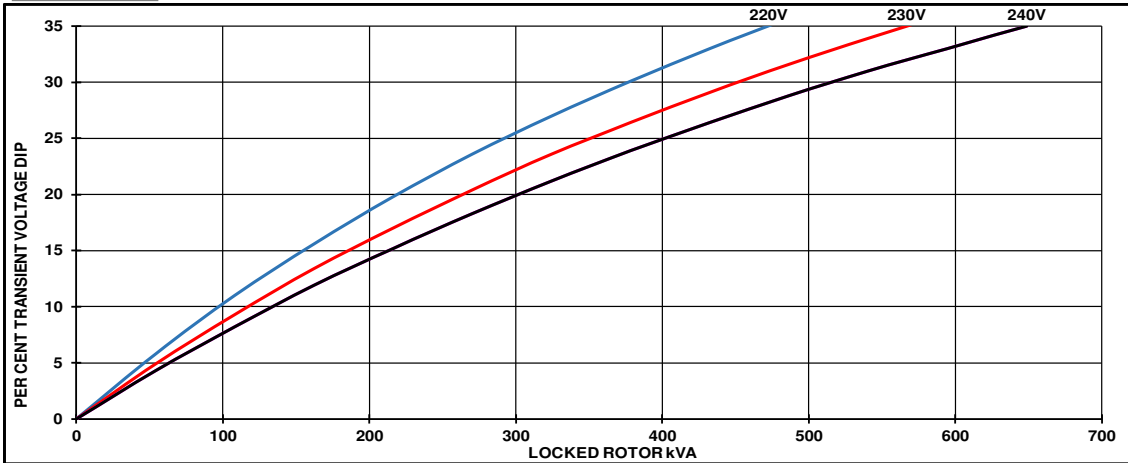
Transient Voltage Dip Scaling Factor		Transient Voltage Rise Scaling Factor
PF	Factor	
< 0.5	1.00	For voltage rise multiply voltage dip by 1.25
0.5	0.97	
0.6	0.93	
0.7	0.90	
0.8	0.85	
0.9	0.83	
1.0	0.80	

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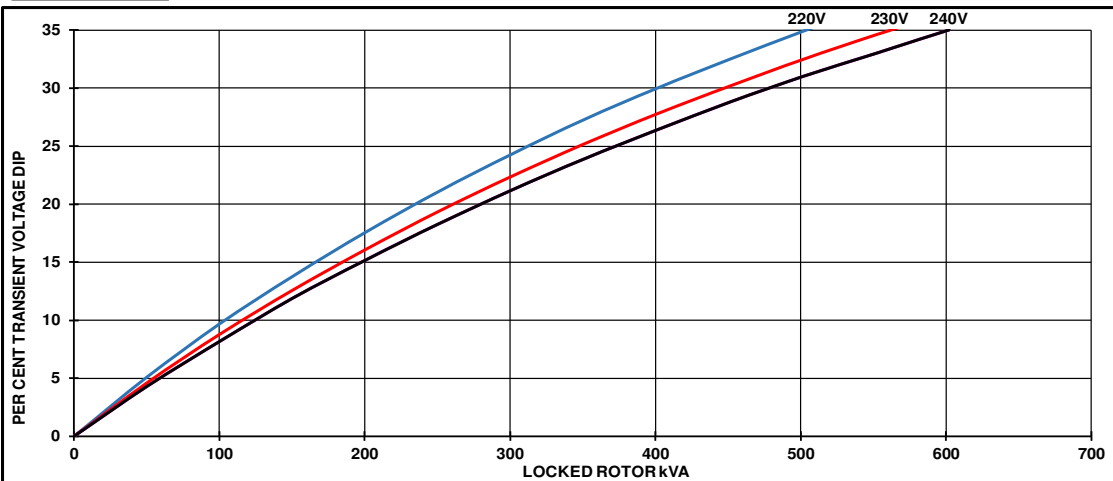
S4L1S-E Wdg.311 (Single Phase)

## Locked Rotor Motor Starting Curves - Self Excited

**50Hz**



**60Hz**



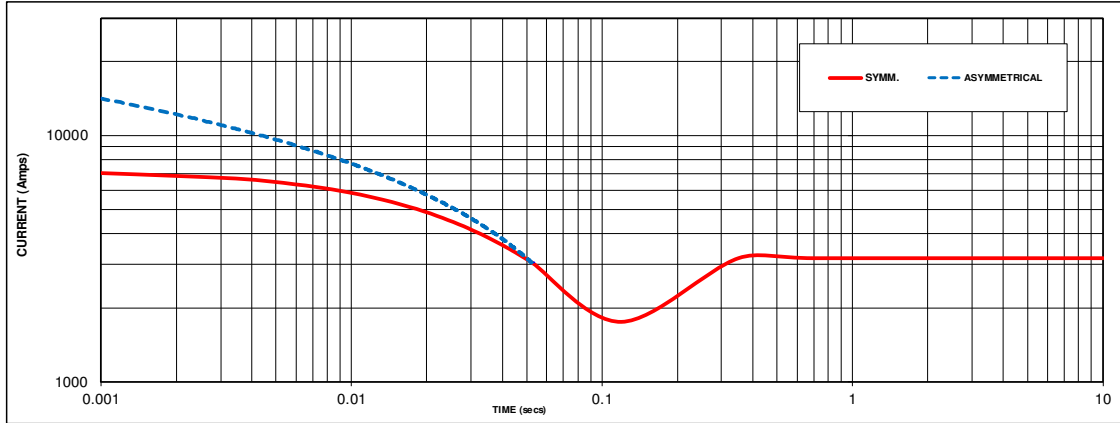
Transient Voltage Dip Scaling Factor		Transient Voltage Rise Scaling Factor
PF	Factor	For voltage rise multiply voltage dip by 1.25
< 0.5	1.00	
0.5	0.97	
0.6	0.93	
0.7	0.90	
0.8	0.85	
0.9	0.83	
1.0	0.80	

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## S4L1S-E Wdg.311 (Single Phase)

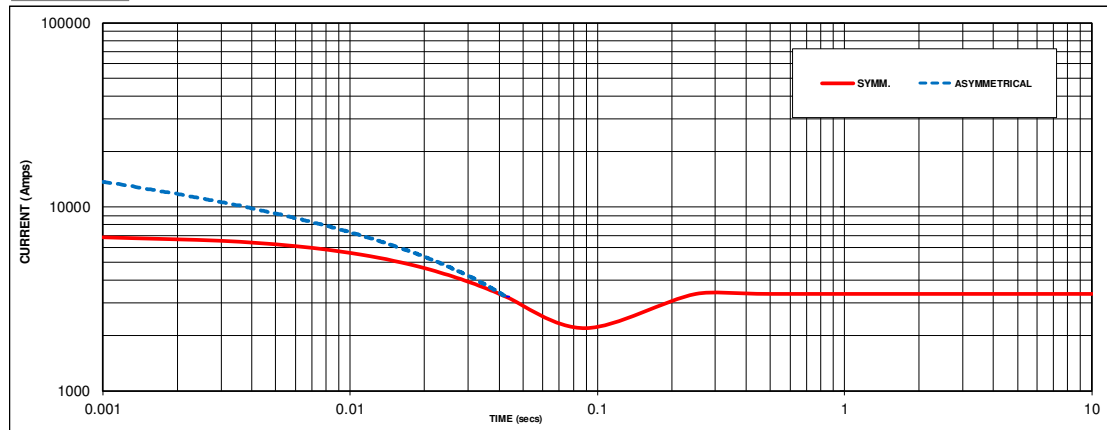
### Double Delta Short Circuit Decrement Curve

**50Hz**



Sustained Short Circuit = 3181 Amps

**60Hz**



Sustained Short Circuit = 3364 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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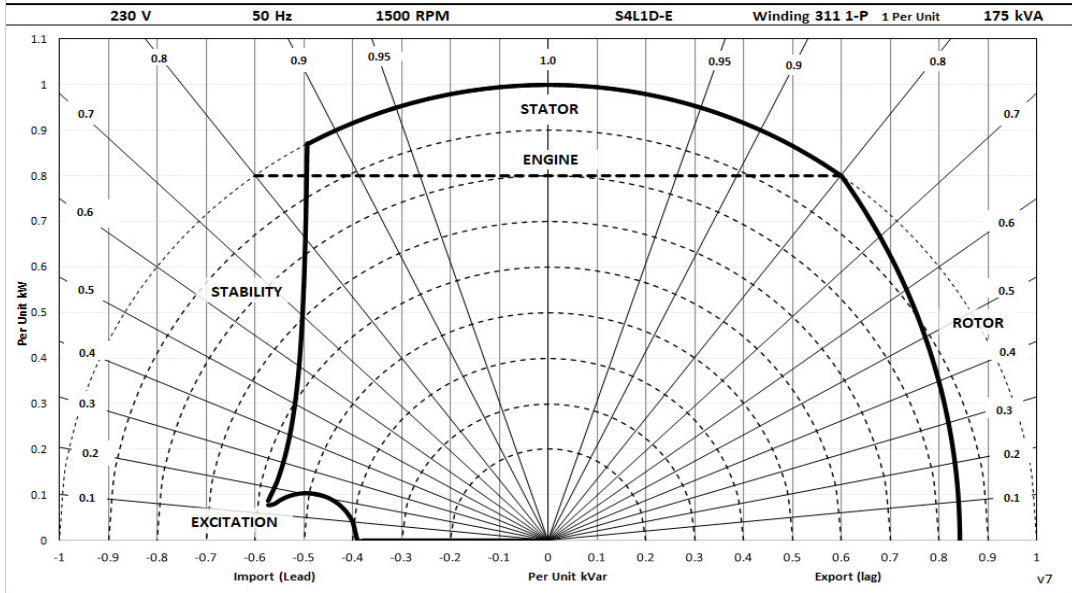
S4L1S-E Wdg.311 (Single Phase)

## Typical Alternator Operating Charts

230V/50Hz



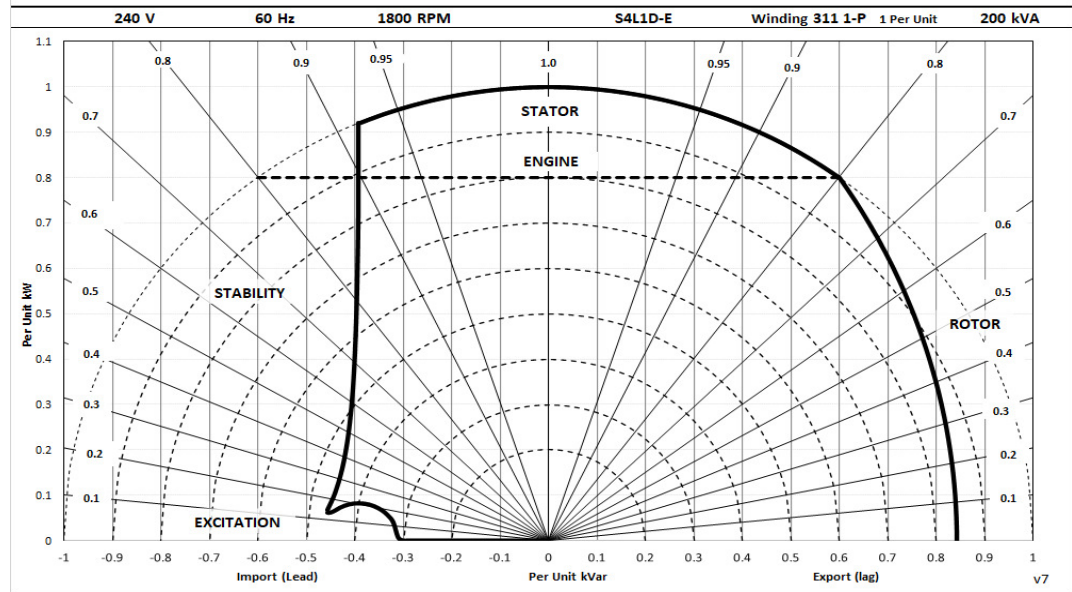
### ALTERNATOR OPERATING CHART



240V/60Hz



### ALTERNATOR OPERATING CHART





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## S4L1S-E Wdg.311 (Single Phase)

### RATINGS

#### 50Hz

Class - Temp Rise	Cont. F - 105/40°C <b>0.8pf</b>			Cont. H - 125/40°C <b>0.8pf</b>			Cont. F - 105/40°C <b>1.0pf</b>			Cont. H - 125/40°C <b>1.0pf</b>		
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	160	160	160	175	175	175	160	160	160	175	175	175
kW	128	128	128	140	140	140	160	160	160	175	175	175
Efficiency (%)	90.8	90.9	90.0	90.7	90.8	90.9	92.8	92.9	93.0	92.7	92.9	93.0
kW Input	141	141	142	154	154	154	172	172	172	189	188	188

#### 60Hz

Class - Temp Rise	Cont. F - 105/40°C <b>0.8pf</b>			Cont. H - 125/40°C <b>0.8pf</b>			Cont. F - 105/40°C <b>1.0pf</b>			Cont. H - 125/40°C <b>1.0pf</b>		
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	165	180	185	185	195	200	165	180	185	185	195	200
kW	132	144	148	148	156	160	165	180	185	185	195	200
Efficiency (%)	91.2	91.3	91.6	90.8	91.1	91.4	92.9	93.1	93.3	92.6	92.8	93.1
kW Input	145	158	162	163	171	175	178	193	198	200	210	215

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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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