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S6L1D-E4 Wdg.311/312 - Technical Data Sheet

Standards

STAMFORD industrial alternators meet the requirements of the relevant parts of the 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	MX341	MX321	DECS100		
Voltage Regulation	± 1%	± 0.5%	± 0.25%		with 4% Engine Governing
AVR Power	PMG	PMG	PMG		

No Load Excitation Voltage (V)	13.5 - 13.6
No Load Excitation Current (A)	0.69 - 0.68
Full Load Excitation Voltage (V)	62
Full Load Excitation Current (A)	2.8
Exciter Time Constant (seconds)	0.16

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Electrical Data

Insulation System	H							
Stator Winding	Double Layer Concentric							
Winding Pitch	2/3							
Winding Leads	12/6							
Winding Number	311/312							
Number of Poles	4							
IP Rating	IP23							
RFI Suppression	BS EN 61000-6-2 & BS EN 61000-6-4,VDE 0875G, VDE 0875N. Refer to factory for others							
Waveform Distortion	NO LOAD < 1.5% NON-DISTORTING BALANCED LINEAR LOAD < 5.0%							
Short Circuit Ratio	1/Xd							
Steady State X/R Ratio	22.07							
	50 Hz				**60 Hz**			
Telephone Interference	THF<2%				TIF<50			
Cooling Air Flow	1.41 m³/sec				1.69 m³/sec			
Voltage Series Star (V)	380	400	415	440	416	440	460	480
Voltage Parallel Star (V) *	190	200	208	220	208	220	230	240
Voltage Delta (V)	220	230	240	254	240	254	266	277
kVA Base Rating (Class H) for Reactance Values (kVA)	1000	1050	1050	1010	1150	1200	1250	1300
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	2.79	2.64	2.45	2.10	3.21	2.99	2.85	2.72
X'd Dir. Axis Transient	0.18	0.17	0.16	0.13	0.20	0.19	0.18	0.17
X"d Dir. Axis Subtransient	0.14	0.14	0.13	0.11	0.16	0.15	0.15	0.14
Xq Quad. Axis Reactance	2.17	2.05	1.91	1.63	2.50	2.33	2.22	2.12
X"q Quad. Axis Subtransient	0.34	0.32	0.30	0.25	0.39	0.36	0.34	0.33
XL Stator Leakage Reactance	0.08	0.07	0.07	0.06	0.09	0.08	0.08	0.08
X2 Negative Sequence Reactance	0.20	0.19	0.18	0.15	0.23	0.21	0.20	0.20
X0 Zero Sequence Reactance	0.08	0.07	0.07	0.06	0.09	0.08	0.08	0.08
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	3.34	3.17	2.94	2.52	3.85	3.59	3.42	3.27
X'd Dir. Axis Transient	0.20	0.19	0.18	0.15	0.23	0.22	0.21	0.20
X"d Dir. Axis Subtransient	0.17	0.16	0.15	0.13	0.19	0.18	0.17	0.16
Xq Quad. Axis Reactance	2.23	2.12	1.97	1.68	2.57	2.40	2.29	2.18
X"q Quad. Axis Subtransient	0.40	0.38	0.35	0.30	0.46	0.43	0.41	0.39
XL Stator Leakage Reactance	0.09	0.08	0.08	0.07	0.10	0.09	0.09	0.09
Xlr Rotor Leakage Reactance	0.10	0.09	0.09	0.07	0.11	0.11	0.10	0.10
X2 Negative Sequence Reactance	0.24	0.23	0.21	0.18	0.28	0.26	0.24	0.23
X0 Zero Sequence Reactance	0.09	0.09	0.08	0.07	0.10	0.10	0.09	0.09

* Parallel Star connection only available with Wdg 311

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Time Constants (Seconds)	
T'd Transient Time Const.	0.101
T''d Sub-Transient Time Const.	0.0161
T'do O.C. Field Time Const.	3.57
Ta Armature Time Const.	0.0236
T''q Sub-Transient Time Const.	0.0104

Resistances in Ohms (Ω) at 22^{0}C	
Stator Winding Resistance (Ra), per phase for series connected	0.0022
Rotor Winding Resistance (Rf)	1.91
Exciter Stator Winding Resistance	19.56
Exciter Rotor Winding Resistance per phase	0.1
PMG Phase Resistance (Rpmg) per phase	1.91
Positive Sequence Resistance (R1)	0.0028
Negative Sequence Resistance (R2)	0.0032
Zero Sequence Resistance (R0)	0.0028

Saturation Factors	400V	480V
SG1.0	0.29	0.289
SG1.2	1.181	1.063

Mechanical Data		
Shaft and Keys	All alternator rotors are dynamically balanced to better than BS6861: Part 1 Grade 2.5 for minimum vibration in operation. Two bearing generators are balanced with a half key.	
	1 Bearing	2 Bearing
SAE Adaptor	SAE0,1	SAE0,1
Moment of Inertia	20.014 kgm²	19.49 kgm²
Weight Wound Stator	999kg	999kg
Weight Wound Rotor	853kg	811kg
Weight Complete Alternator	2020kg	2102kg
Shipping weight in a Crate	2063kg	2145kg
Packing Crate Size	170x90x153(cm)	170x90x153(cm)
Maximum Over Speed	2250 RPM for two minutes	
Bearing Drive End	-	BALL 6224
Bearing Non-Drive End	BALL 6317	BALL 6317

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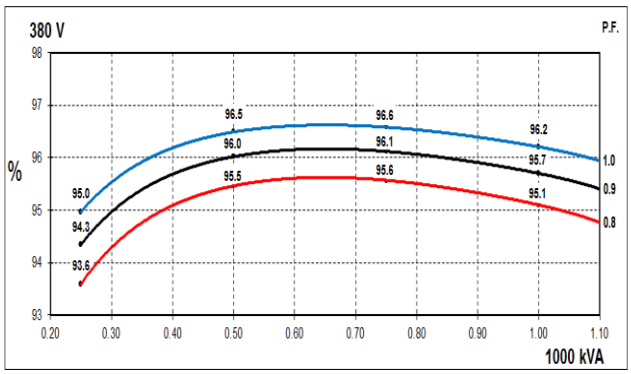
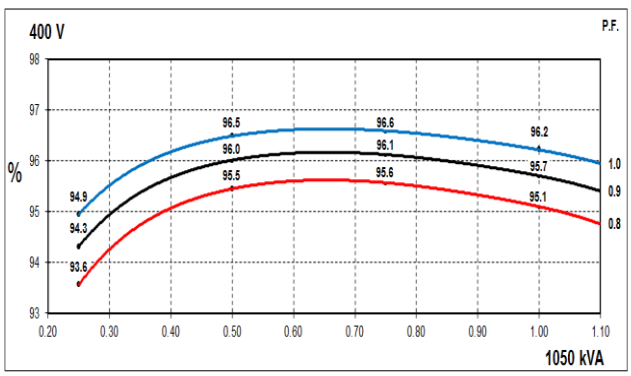
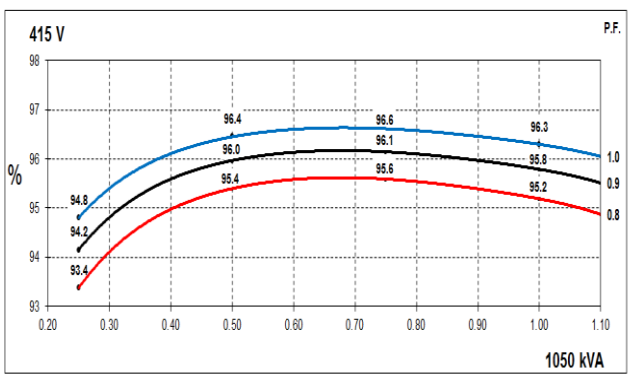
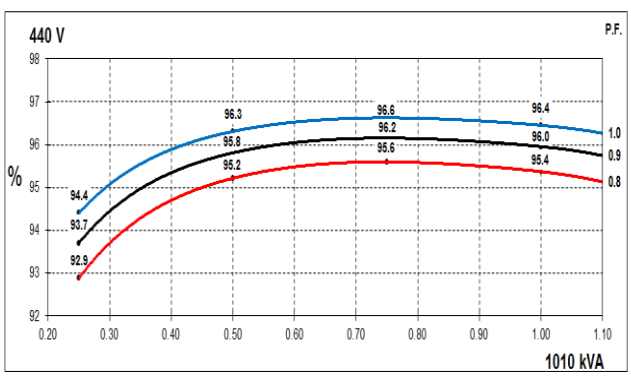
THREE PHASE EFFICIENCY CURVES

50Hz

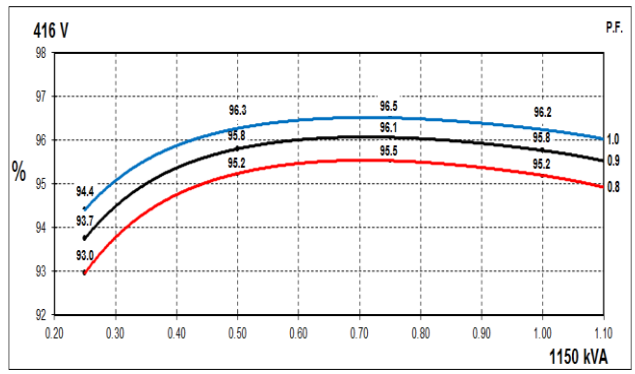


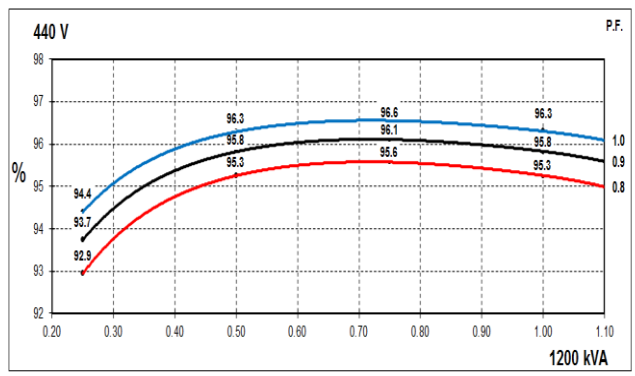


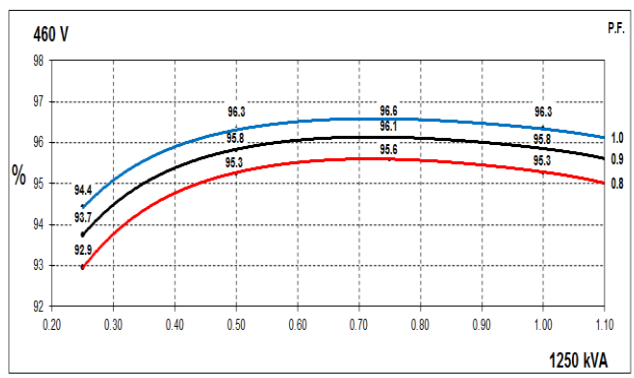


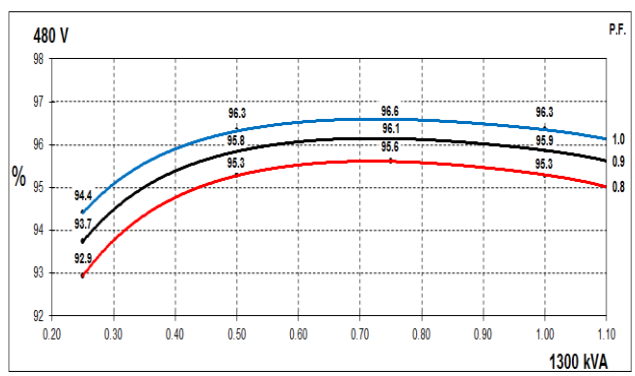


60Hz



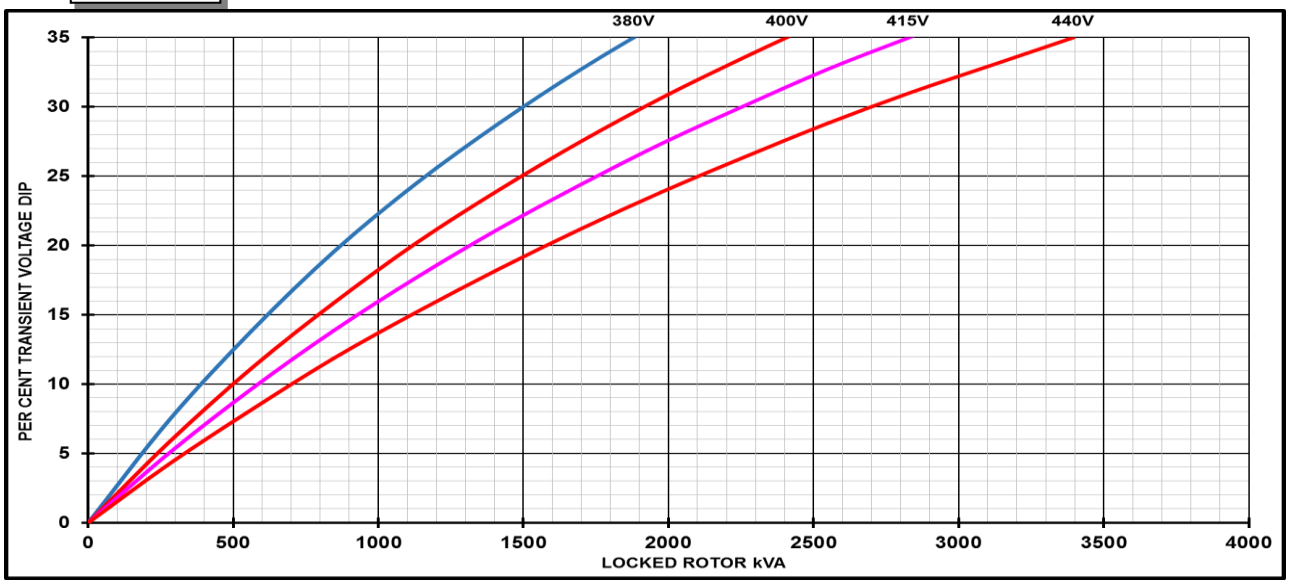




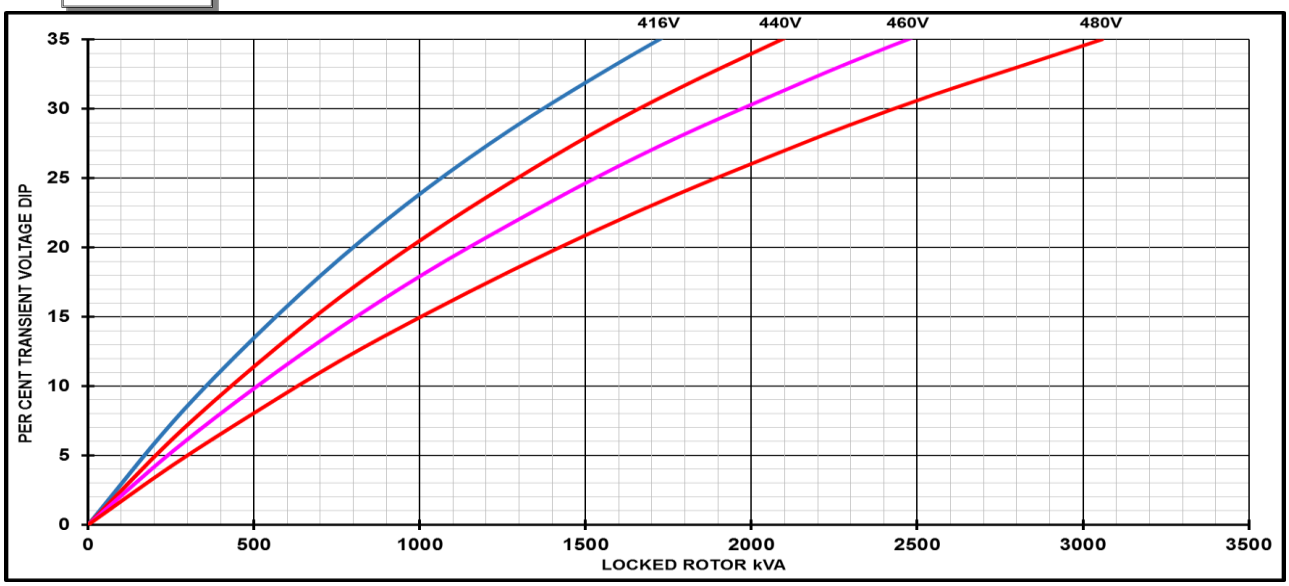


Locked Rotor Motor Starting Curves - Separately Excited

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	
0.5	0.97	
0.6	0.93	
0.7	0.9	
0.8	0.85	
0.9	0.83	

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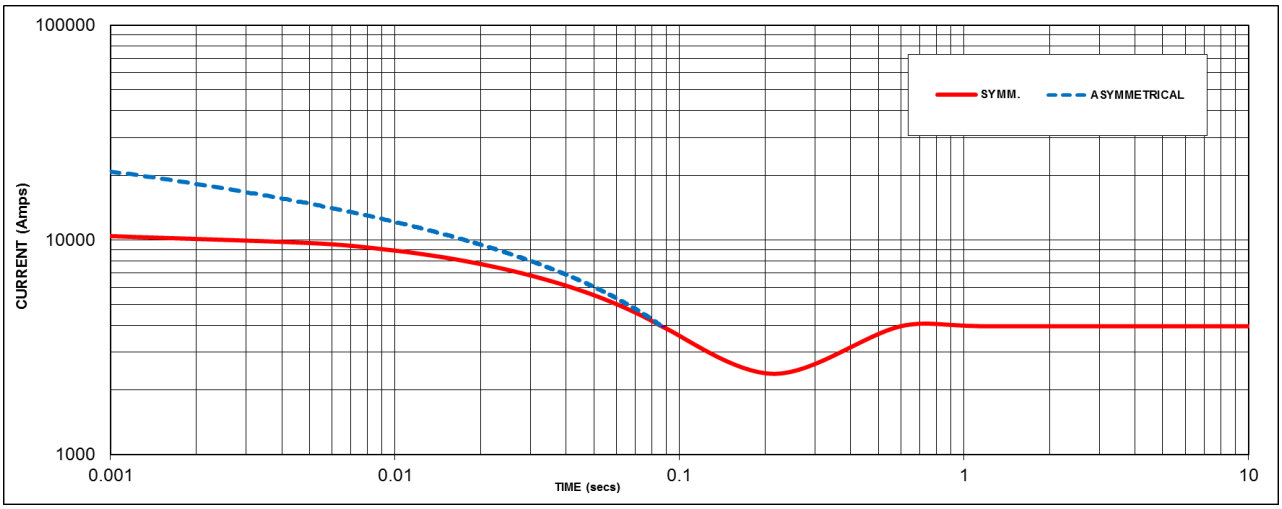
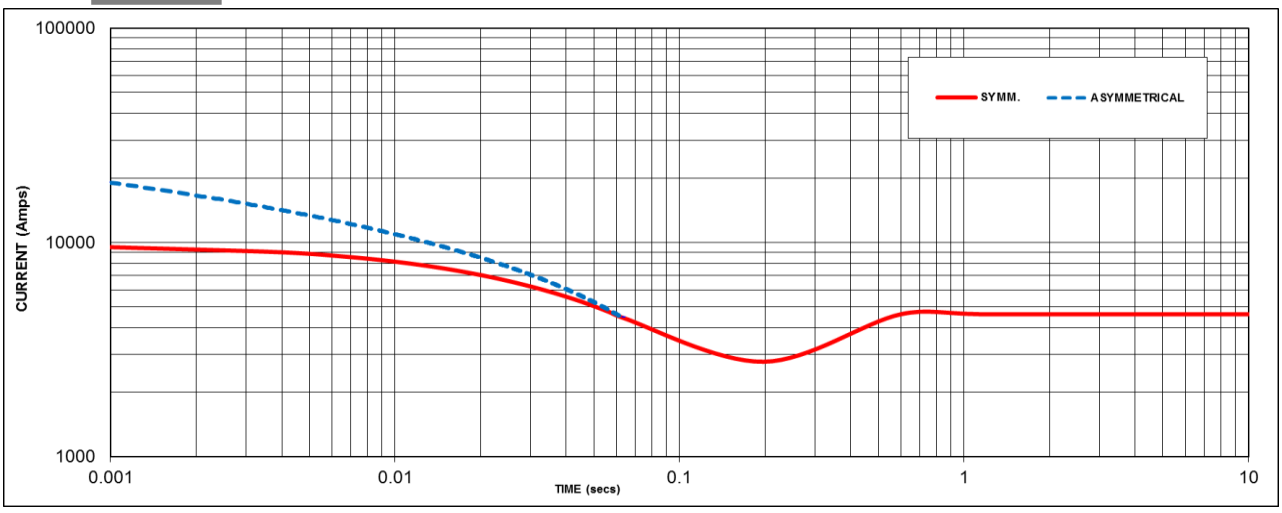
Three-phase Short Circuit Decrement Curve - Separately Exited

50Hz



Sustained Short Circuit = 3963 Amps

60Hz



Sustained Short Circuit = 4624 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	X 1.00	416V	X 1.00
400V	X 1.05	440V	X 1.06
415V	X 1.09	460V	X 1.10
440V	X 1.16	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

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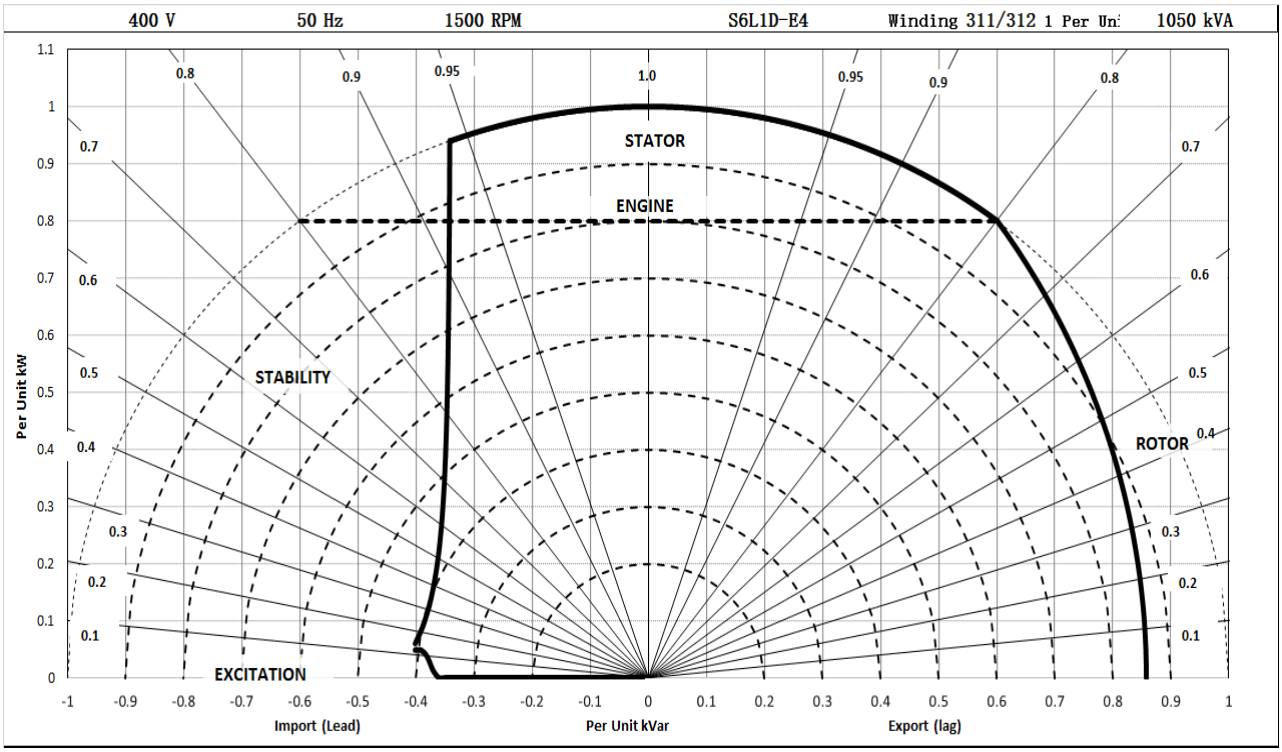
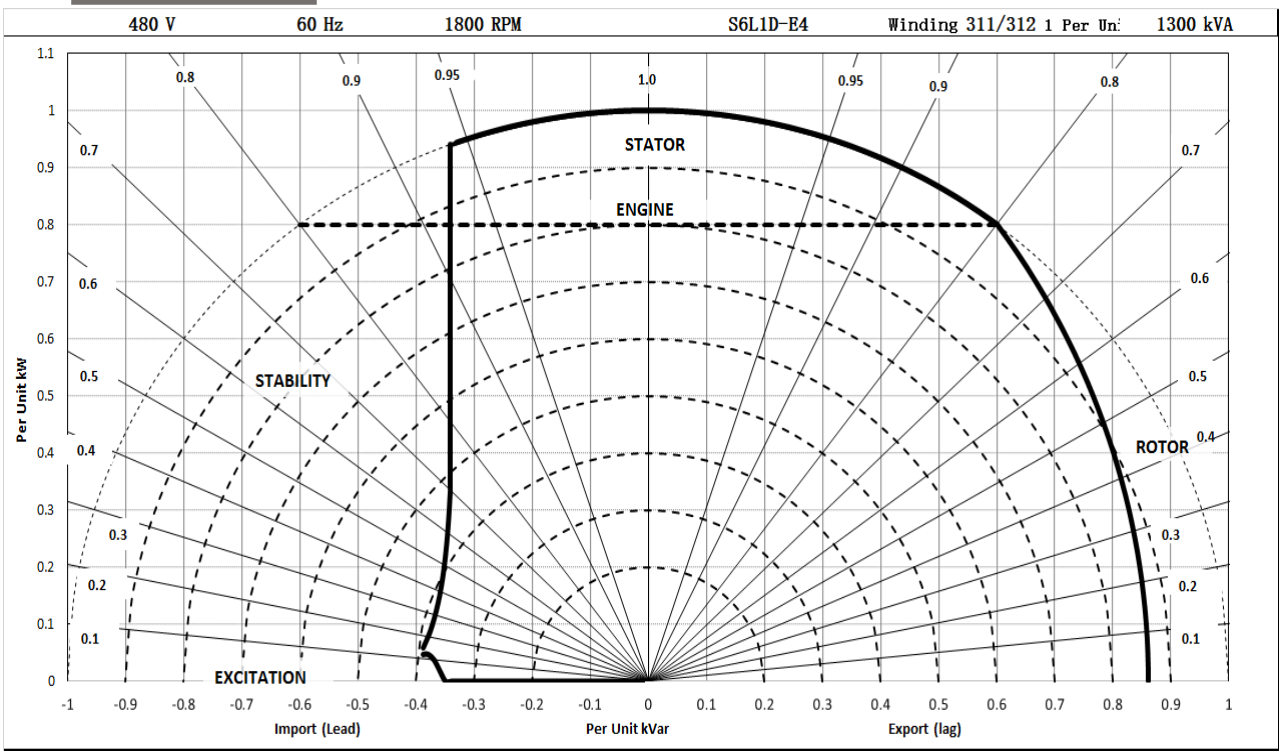
Typical Alternator Operating Charts

400V/50Hz



480V/60Hz



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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
	kVA	1100	1125	1125	1100	1060	1100	1100	1060	1000	1050	1050	1010	900	945	945	900
	kW	880	900	900	880	848	880	880	848	800	840	840	808	720	756	756	720
	Efficiency (%)	94.8	94.9	95.0	95.2	94.9	95.0	95.1	95.3	95.1	95.1	95.2	95.4	95.3	95.3	95.4	95.5
	kW Input	928	949	947	925	893	927	926	890	841	883	882	847	755	793	792	754

60 Hz	Series Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	kVA	1250	1300	1350	1400	1206	1250	1300	1350	1150	1200	1250	1300	1063	1100	1150	1188
	kW	1000	1040	1080	1120	965	1000	1040	1080	920	960	1000	1040	850	880	920	950
	Efficiency (%)	95.0	95.1	95.1	95.1	95.1	95.2	95.2	95.2	95.2	95.3	95.3	95.3	95.3	95.4	95.4	95.5
	kW Input	1053	1094	1136	1178	1015	1051	1093	1134	966	1008	1050	1091	892	922	964	996

De-Rates

All values tabulated above are subject to the following reductions:

- 5% when air inlet filters are fitted
- 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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For Applications Support:
applications@cummins.com

For Customer Service:
emea.service@cummins.com

For General Enquiries:
Stamford-avk@cummins.com

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