

# STAMFORD®

## S5L1D-E4 Wdg.311 - 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	AS440	MX341	MX321		
Voltage Regulation	± 1%	± 1%	± 0.5%		with 4% Engine Governing
AVR Power	Self-Excited	PMG	PMG		

No Load Excitation Voltage (V)	9.0 - 8.7
No Load Excitation Current (A)	0.58 - 0.56
Full Load Excitation Voltage (V)	44
Full Load Excitation Current (A)	2.6
Exciter Time Constant (seconds)	0.099

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Electrical Data								
Insulation System	H							
Stator Winding	Double Layer Lap							
Winding Pitch	2/3							
Winding Leads	12							
Winding Number	311							
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	14.41							
50 Hz					60 Hz			
Telephone Interference	THF<2%				TIF<50			
Cooling Air Flow	1.12 m³/sec				1.34 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 Series Delta (V)	220	230	240	254	240	254	266	277
kVA Base Rating (Class H) for Reactance Values (kVA)	600	610	600	600	681	713	731	750
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	3.14	2.88	2.63	2.34	3.57	3.34	3.13	2.95
X'd Dir. Axis Transient	0.16	0.15	0.14	0.12	0.19	0.17	0.16	0.15
X''d Dir. Axis Subtransient	0.12	0.11	0.10	0.09	0.14	0.13	0.12	0.11
Xq Quad. Axis Reactance	2.45	2.25	2.06	1.83	2.79	2.61	2.45	2.31
X''q Quad. Axis Subtransient	0.26	0.24	0.22	0.20	0.30	0.28	0.26	0.25
XL Stator Leakage Reactance	0.05	0.05	0.05	0.04	0.06	0.06	0.05	0.05
X2 Negative Sequence Reactance	0.17	0.16	0.15	0.13	0.20	0.19	0.17	0.16
X0 Zero Sequence Reactance	0.09	0.08	0.07	0.07	0.10	0.09	0.09	0.08
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	3.77	3.46	3.16	2.81	4.28	4.01	3.76	3.54
X'd Dir. Axis Transient	0.19	0.17	0.16	0.14	0.21	0.20	0.19	0.18
X''d Dir. Axis Subtransient	0.14	0.13	0.12	0.10	0.16	0.15	0.14	0.13
Xq Quad. Axis Reactance	2.53	2.32	2.12	1.88	2.87	2.69	2.52	2.37
X''q Quad. Axis Subtransient	0.31	0.29	0.26	0.23	0.36	0.33	0.31	0.30
XL Stator Leakage Reactance	0.06	0.06	0.05	0.05	0.07	0.07	0.06	0.06
Xlr Rotor Leakage Reactance	0.09	0.08	0.08	0.07	0.10	0.10	0.09	0.09
X2 Negative Sequence Reactance	0.21	0.19	0.18	0.16	0.24	0.22	0.21	0.20
X0 Zero Sequence Reactance	0.10	0.09	0.09	0.08	0.12	0.11	0.10	0.10

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Time Constants (Seconds)		
T'd Transient Time Const.	0.08	
T''d Sub-Transient Time Const.	0.0120	
T'do O.C. Field Time Const.	2.5	
Ta Armature Time Const.	0.0190	
T''q Sub-Transient Time Const.	0.0190	
Resistances in Ohms ( $\Omega$ ) at 22°C		
Stator Winding Resistance (Ra), per phase for series connected	0.0043	
Rotor Winding Resistance (Rf)	1.96	
Exciter Stator Winding Resistance	17	
Exciter Rotor Winding Resistance per phase	0.092	
PMG Phase Resistance (Rpmg) per phase	1.91	
Positive Sequence Resistance (R1)	0.0054	
Negative Sequence Resistance (R2)	0.0062	
Zero Sequence Resistance (R0)	0.0054	
Saturation Factors	400V	480V
SG1.0	0.268	0.313
SG1.2	1.149	1.049
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	SAE 1, 0, 0.5	
Moment of Inertia	8.9828 kgm <sup>2</sup>	-
Weight Wound Stator	722kg	-
Weight Wound Rotor	617kg	-
Weight Complete Alternator	1563kg	-
Shipping weight in a Crate	1655kg	-
Packing Crate Size	166 x 87 x 124(cm)	-
Maximum Over Speed	2250 RPM for two minutes	
Bearing Drive End	-	-
Bearing Non-Drive End	BALL.6314(ISO)	-

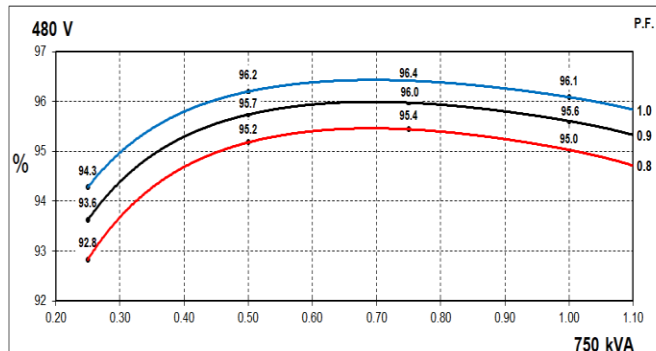
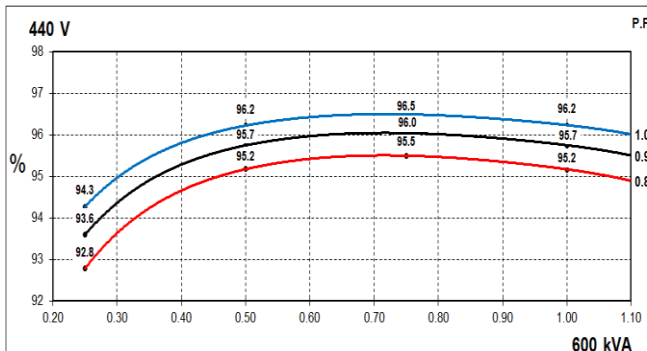
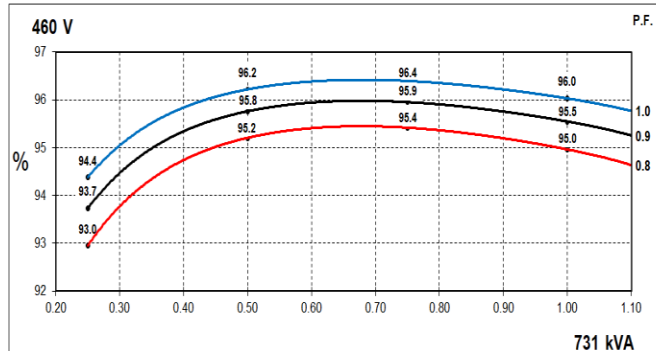
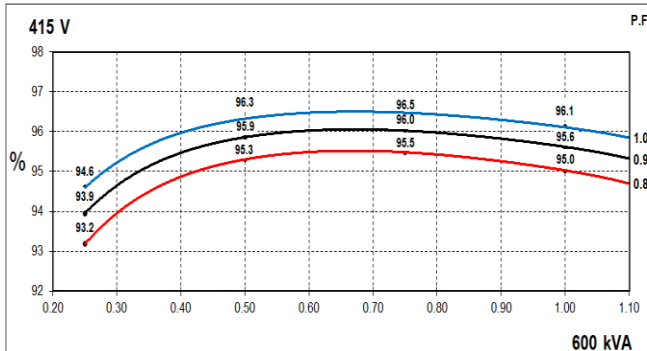
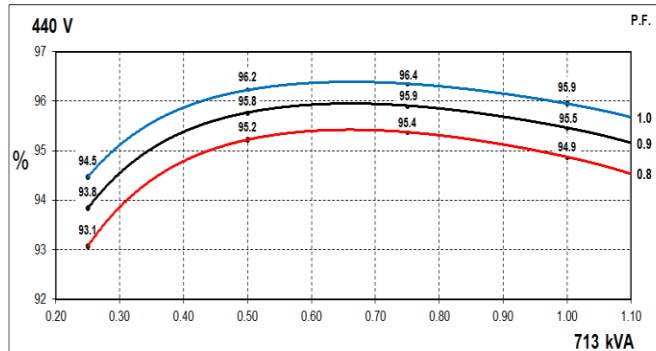
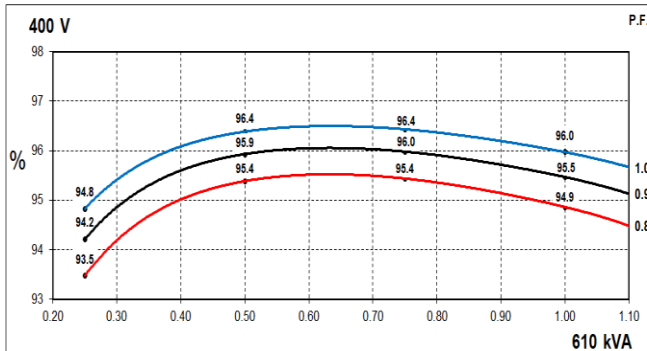
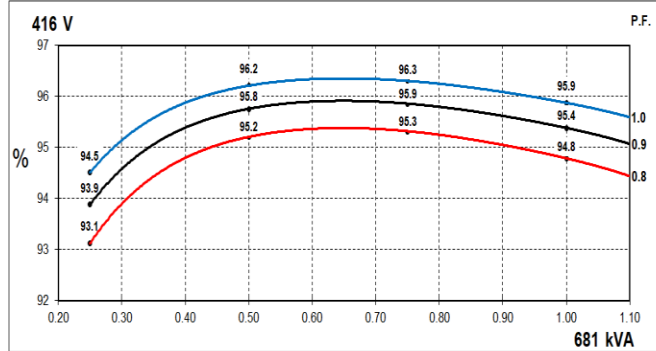
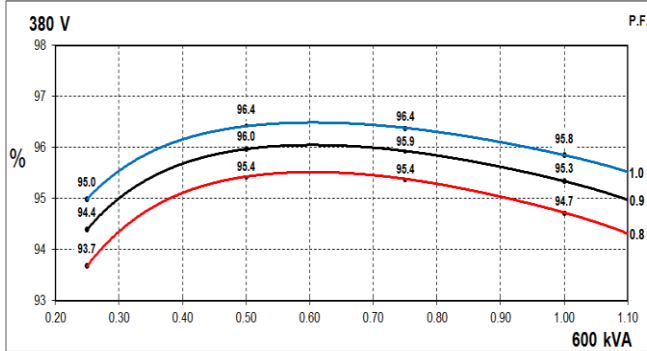
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### THREE PHASE EFFICIENCY CURVES

50Hz

60Hz

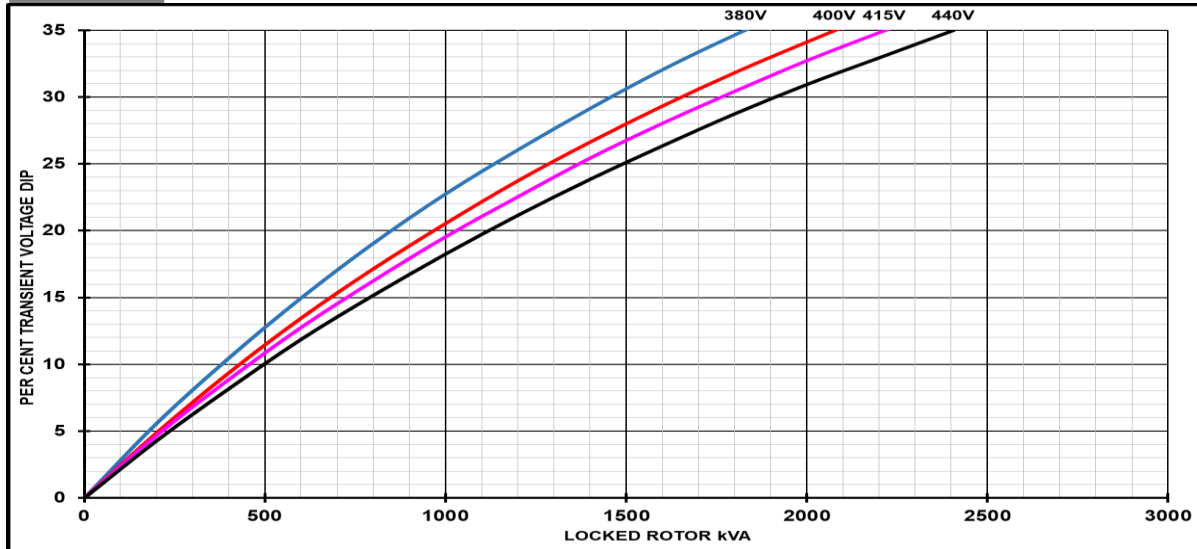


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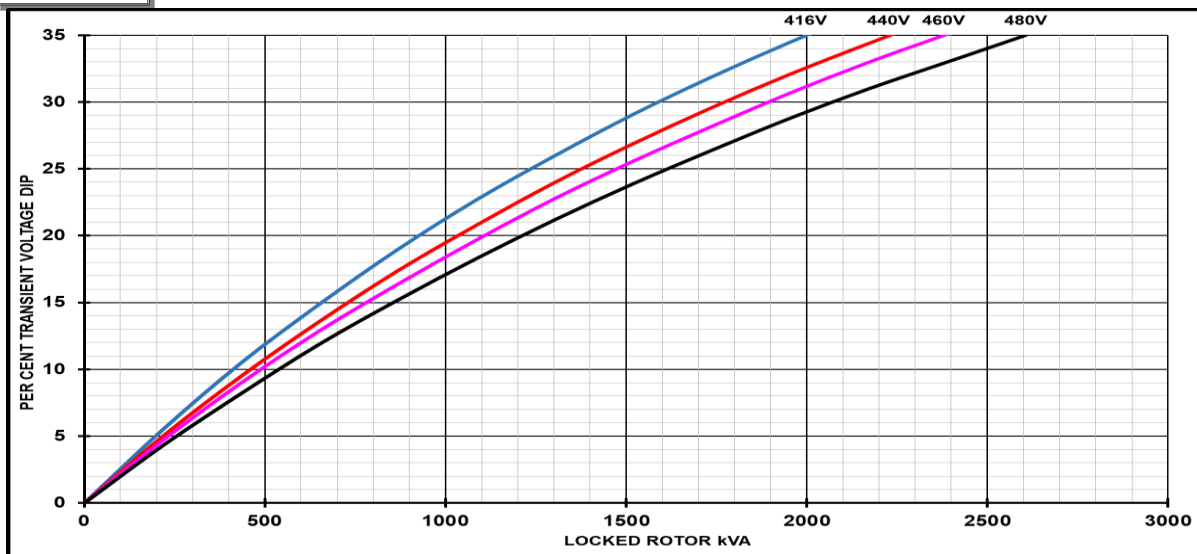
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## Locked Rotor Motor Starting Curves - Separately Excited

**50Hz**



**60Hz**



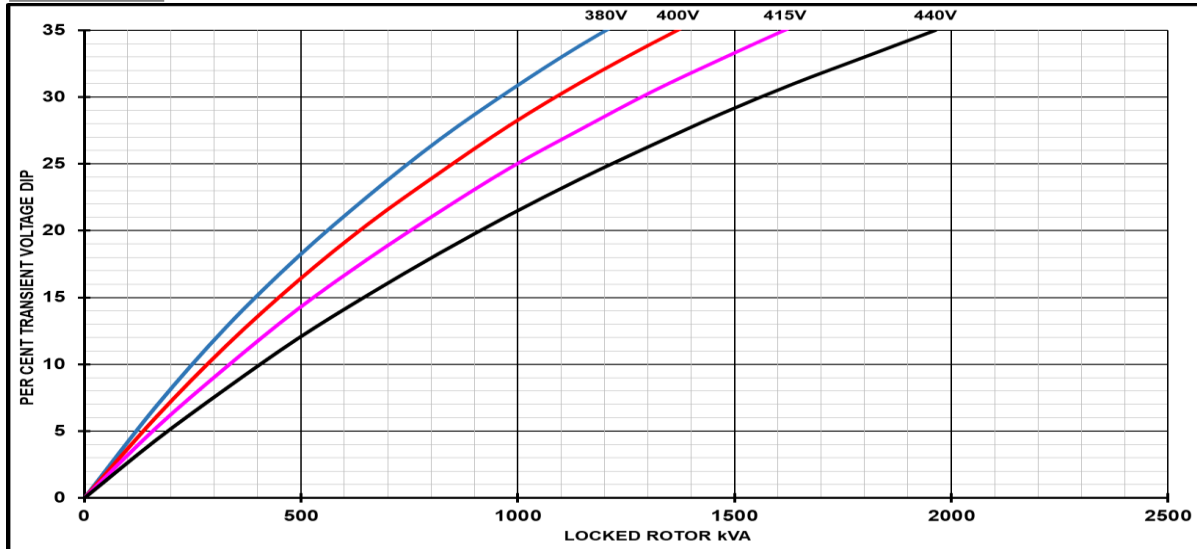
Transient Voltage Dip Scaling Factor		Transient Voltage Rise Scaling Factor
PF	Factor	For voltage rise multiply voltage dip by 1.25
< 0.5	1	
0.5	0.97	
0.6	0.93	
0.7	0.9	
0.8	0.85	
0.9	0.83	

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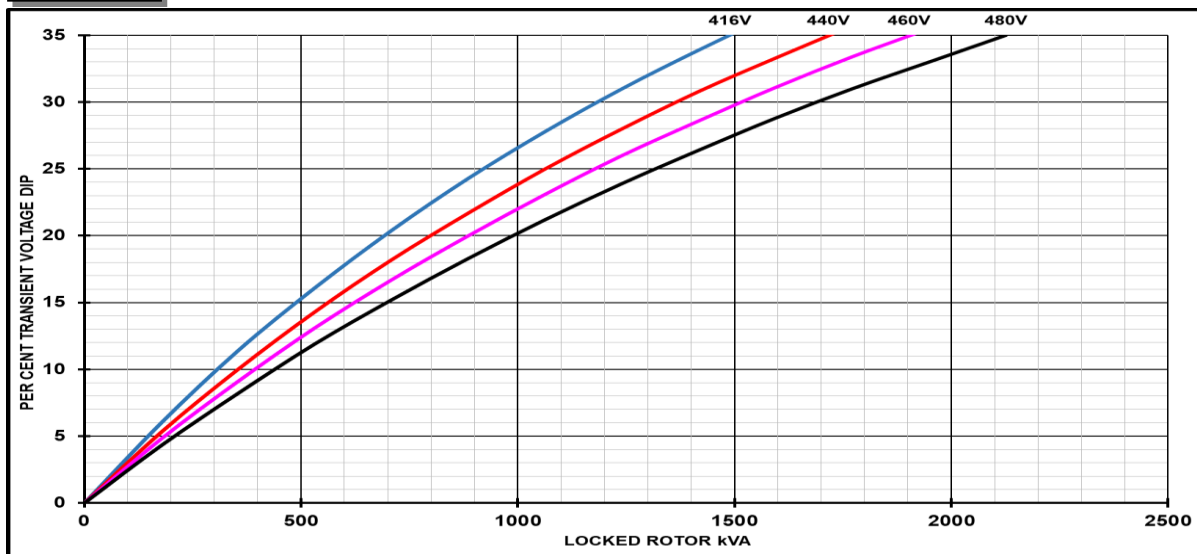
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## Locked Rotor Motor Starting Curves - Self Excited

**50Hz**



**60Hz**



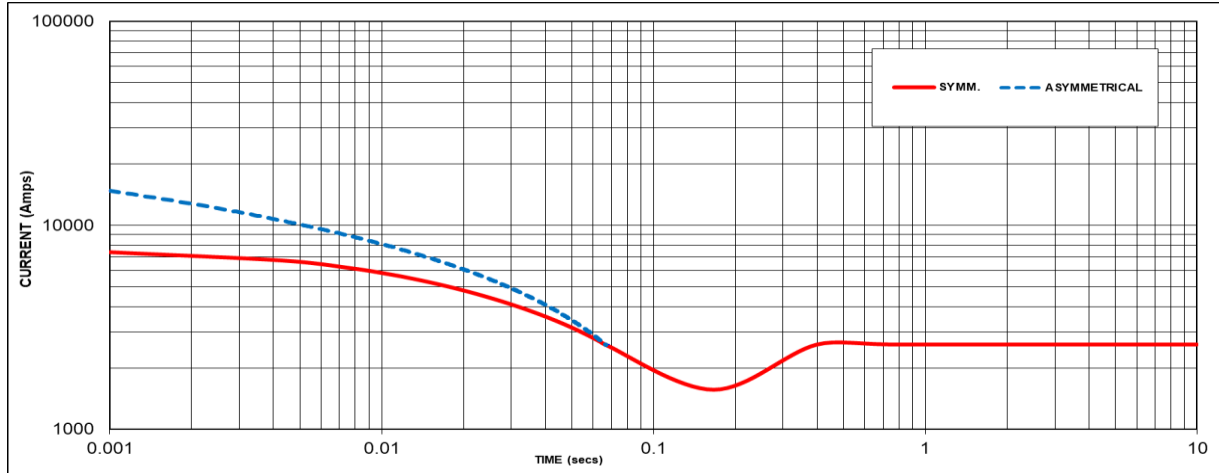
Transient Voltage Dip Scaling Factor		Transient Voltage Rise Scaling Factor
PF	Factor	For voltage rise multiply voltage dip by 1.25
< 0.5	1	
0.5	0.97	
0.6	0.93	
0.7	0.9	
0.8	0.85	
0.9	0.83	

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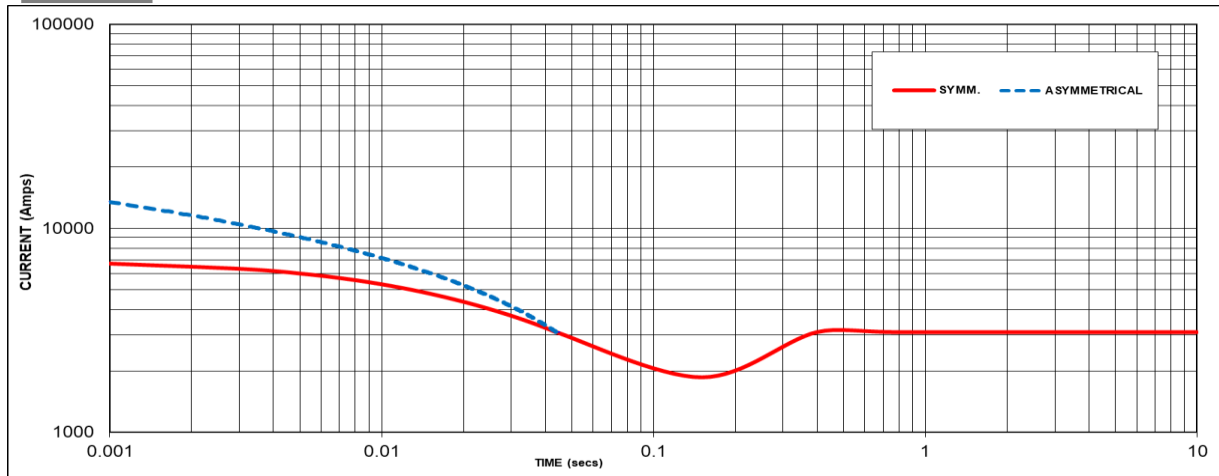
### Three-phase Short Circuit Decrement Curve - Separately Exited

**50Hz**



Sustained Short Circuit = 2600 Amps

**60Hz**



Sustained Short Circuit = 3100 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 1.06	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.

**Note 3**

All other times are unchanged

Curves are drawn for Star connection under no-load excitation at rated speeds. For other connection (where applicable) the following multipliers should be applied to current values as shown :

Parallel Star = Curve current value X 2

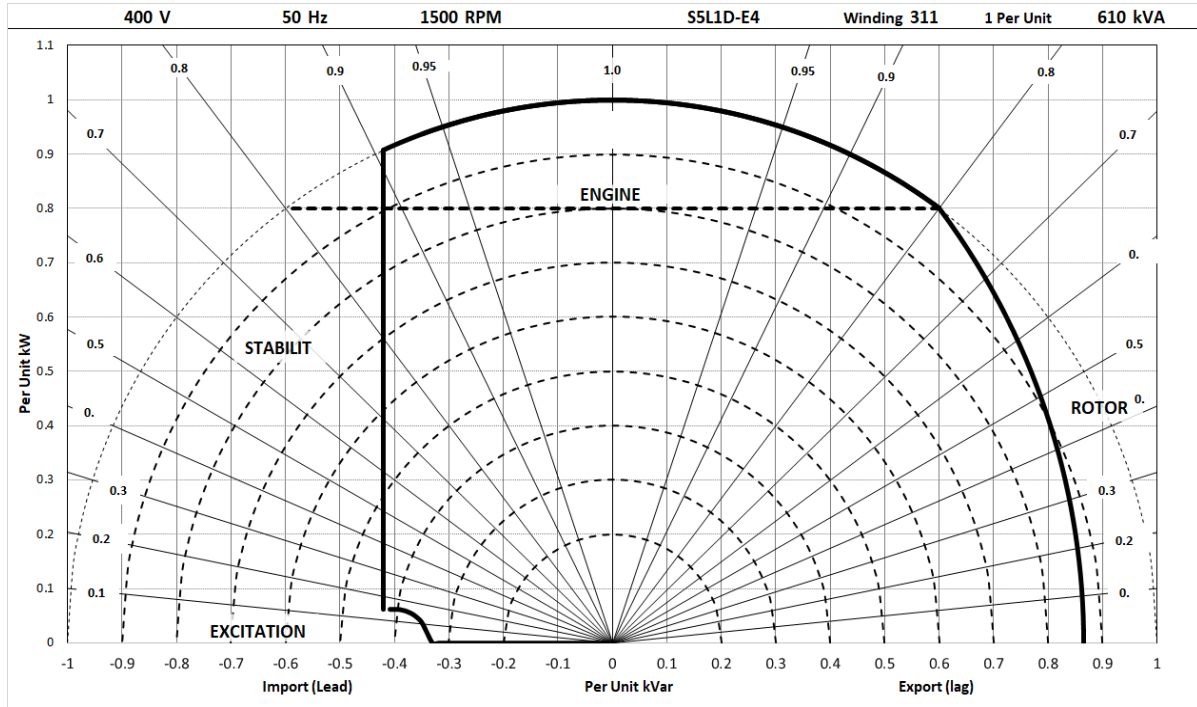
Series Delta = Curve current value X 1.732

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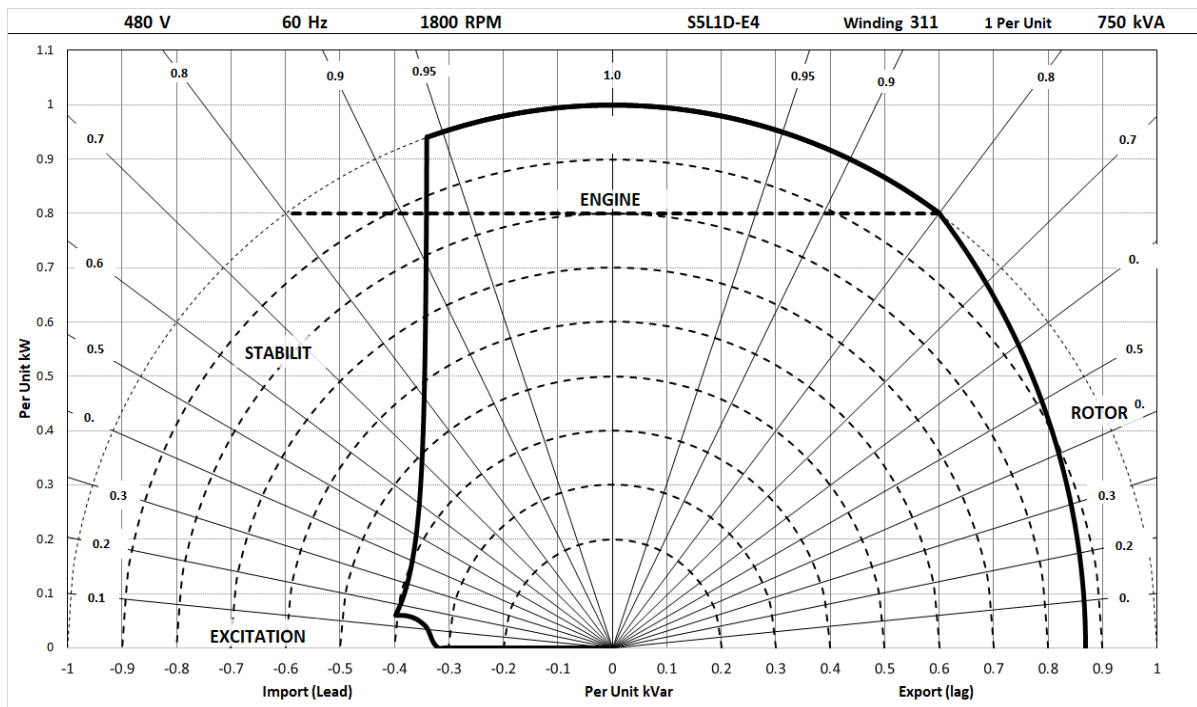
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## Typical Alternator Operating Charts

**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			
<b>50</b> 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	660	665	660	660	636	640	636	636	600	610	600	600	550	560	550	550
	kW	528	532	528	528	509	512	509	509	480	488	480	480	440	448	440	440
	Efficiency (%)	94.3	94.5	94.7	94.9	94.5	94.7	94.8	95.0	94.7	94.9	95.0	95.2	95.0	95.1	95.2	95.3
	kW Input	560	563	557	556	538	541	536	535	507	514	505	504	463	471	462	462

<b>60</b> 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
	Series Delta (V)	240	254	266	277	240	254	266	277	240	254	266	277	240	254	266	277
	kVA	738	769	798	819	719	750	780	800	681	713	731	750	625	650	663	675
	kW	590	615	638	655	575	600	624	640	545	570	585	600	500	520	530	540
	Efficiency (%)	94.5	94.6	94.7	94.8	94.6	94.7	94.8	94.8	94.8	94.9	95.0	95.0	95.0	95.1	95.2	95.3
	kW Input	625	650	674	691	608	634	659	675	575	601	616	631	526	547	557	567

#### 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 @ Class H temperature rise (please refer to applications for ambient temperature de-rates at other temperature rise classes)
- 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 (for <690V) or 1500 meters (for >690V) 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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