

# STAMFORD®

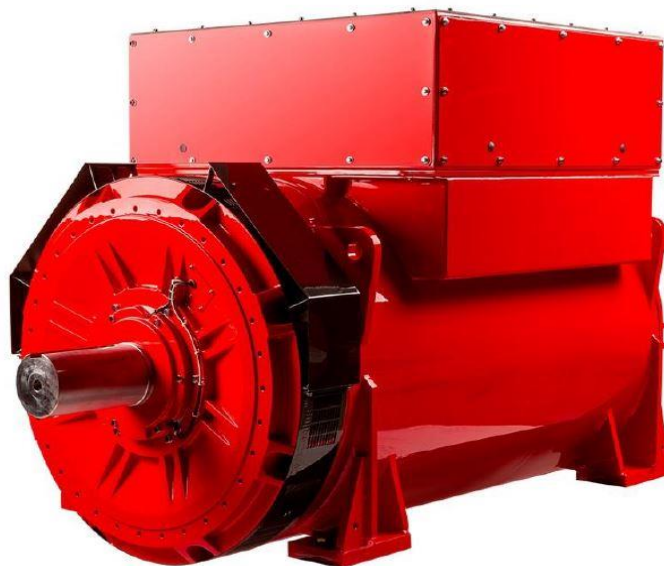
## S9L1D-E4 Wdg.312 - Technical Data Sheet

### Standards

STAMFORD industrial alternators meet the requirements of the relevant parts of the IEC 60034 and the relevant sections of other international standards such as BS5000-3, ISO 8528-3, VDE 0530, NEMA MG1-32, CSA C22.2-100 and AS 60034. 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	DM110	DECS100	DECS150		
Voltage Regulation	± 0.25%	± 0.25%	± 0.25%		with 4% Engine Governing
AVR Power	PMG	PMG	PMG		

No Load Excitation Voltage (V)	17.1 - 15.8
No Load Excitation Current (A)	1 - 0.9
Full Load Excitation Voltage (V)	71
Full Load Excitation Current (A)	4
Exciter Time Constant (seconds)	0.194

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Electrical Data								
Insulation System	H							
Stator Winding	Double Layer Concentric							
Winding Pitch	2/3							
Winding Leads	6							
Winding Number	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	NON-DISTORTING BALANCED LINEAR LOAD < 5.0%							
Short Circuit Ratio	1/Xd							
Steady State X/R Ratio	27.85							
	50 Hz				60 Hz			
Telephone Interference	THF<2%				TIF<50			
Cooling Air Flow	2.78 m³/sec				3.33 m³/sec			
Voltage Star (V)	380	400	415	440	416	440	460	480
Voltage Parallel Star (V)	-	-	-	-	-	-	-	-
Voltage Delta (V)	-	-	-	-	-	-	-	-
kVA Base Rating (Class H) for Reactance Values (kVA)	3375	3555	3555	3340	3590	3800	3969	4142
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	2.304	2.190	2.035	1.700	2.454	2.322	2.219	2.126
X'd Dir. Axis Transient	0.217	0.206	0.192	0.160	0.231	0.219	0.209	0.200
X''d Dir. Axis Subtransient	0.115	0.109	0.101	0.085	0.122	0.115	0.110	0.106
Xq Quad. Axis Reactance	1.220	1.160	1.078	0.901	1.300	1.230	1.175	1.126
X''q Quad. Axis Subtransient	0.126	0.120	0.111	0.093	0.134	0.127	0.122	0.117
XL Stator Leakage Reactance	0.074	0.070	0.065	0.054	0.078	0.074	0.071	0.068
X2 Negative Sequence Reactance	0.205	0.195	0.181	0.151	0.218	0.207	0.198	0.189
X0 Zero Sequence Reactance	0.083	0.079	0.073	0.061	0.089	0.084	0.080	0.077
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	2.764	2.628	2.441	2.041	2.944	2.786	2.662	2.552
X'd Dir. Axis Transient	0.249	0.237	0.220	0.184	0.266	0.251	0.240	0.230
X''d Dir. Axis Subtransient	0.134	0.127	0.118	0.099	0.143	0.135	0.129	0.124
Xq Quad. Axis Reactance	1.257	1.195	1.110	0.928	1.339	1.267	1.210	1.160
X''q Quad. Axis Subtransient	0.151	0.144	0.134	0.112	0.161	0.153	0.146	0.140
XL Stator Leakage Reactance	0.083	0.079	0.073	0.061	0.089	0.084	0.080	0.077
Xlr Rotor Leakage Reactance	0.095	0.090	0.084	0.070	0.101	0.095	0.091	0.087
X2 Negative Sequence Reactance	0.246	0.234	0.217	0.182	0.262	0.248	0.237	0.227
X0 Zero Sequence Reactance	0.097	0.092	0.086	0.072	0.104	0.098	0.094	0.090

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Time Constants (Seconds)		
T'd Transient Time Const.	0.24	
T''d Sub-Transient Time Const.	0.0163	
T'do O.C. Field Time Const.	4.16	
Ta Armature Time Const.	0.034	
T''q Sub-Transient Time Const.	0.01	
Resistances in Ohms ( $\Omega$ ) at 22°C		
Stator Winding Resistance (Ra), per phase for series connected	0.0003292	
Rotor Winding Resistance (Rf)	1.56	
Exciter Stator Winding Resistance	16.1	
Exciter Rotor Winding Resistance per phase	0.03415	
PMG Phase Resistance (Rpmg) per phase	1.91	
Positive Sequence Resistance (R1)	0.00041	
Negative Sequence Resistance (R2)	0.00047	
Zero Sequence Resistance (R0)	0.00041	
Saturation Factors	400V	480V
SG1.0	0.191	0.19
SG1.2	0.892	0.902
Mechanical Data		
Shaft and Keys	All alternator rotors are dynamically balanced to better than ISO 21940-11 Grade 2.5 for minimum vibration in operation. Two bearing generators are balanced with a half key.	
	1 Bearing	2 Bearing
SAE Adaptor		0, 00, None
Moment of Inertia	-	102.6 kgm <sup>2</sup>
Weight Wound Stator	-	3530kg
Weight Wound Rotor	-	2387kg
Weight Complete Alternator	-	7050kg
Shipping weight in a Crate	-	7442kg
Packing Crate Size	-	280 x 200 x 220(cm)
Maximum Over Speed	2250 RPM for two minutes	
Bearing Drive End	-	6236
Bearing Non-Drive End	-	6324

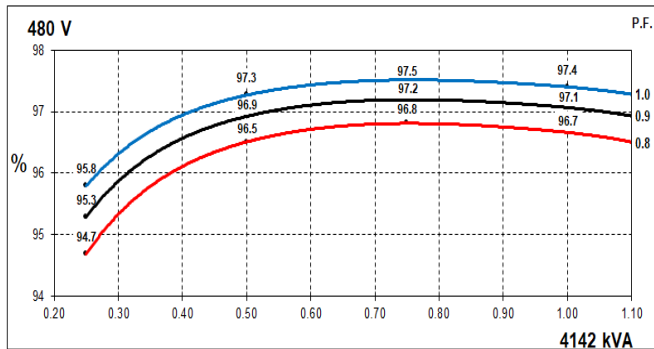
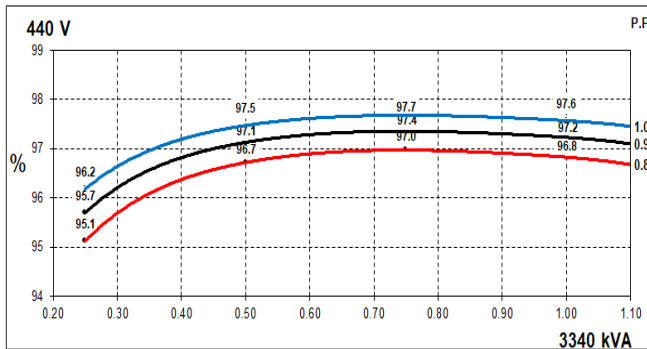
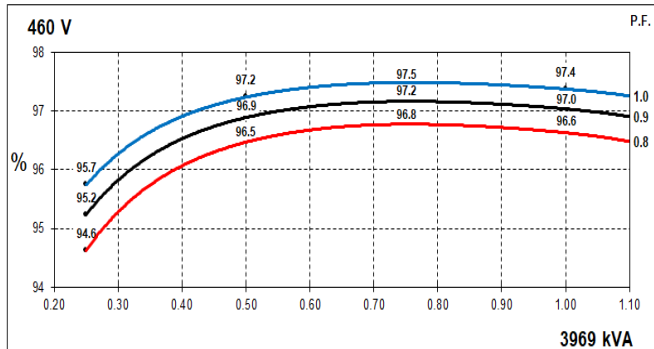
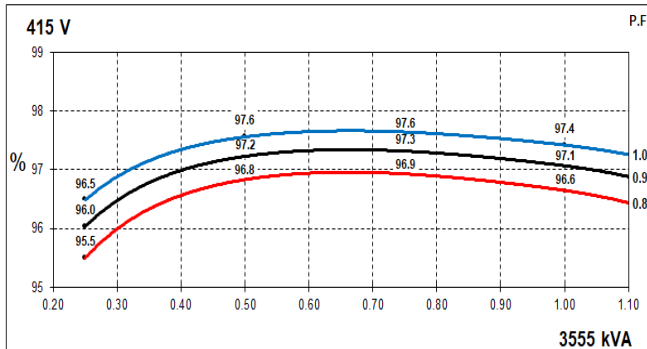
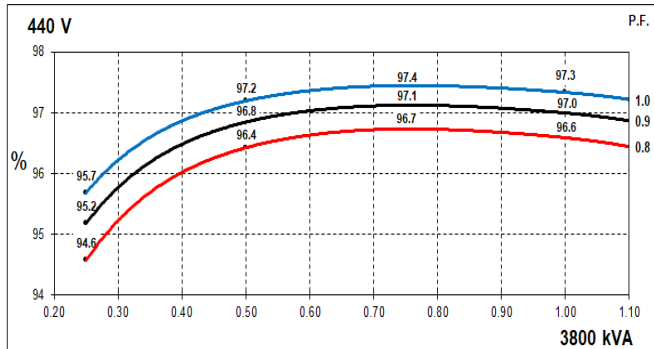
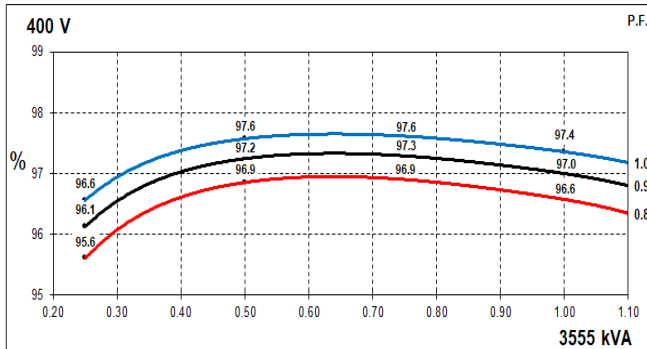
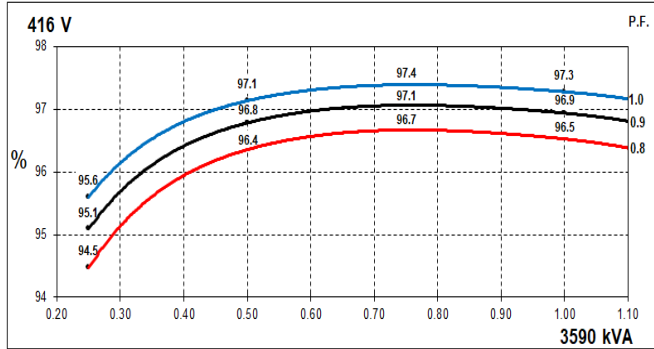
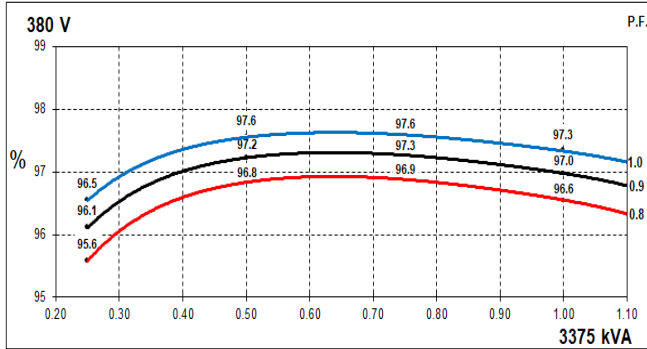
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## THREE PHASE EFFICIENCY CURVES

50Hz

60Hz

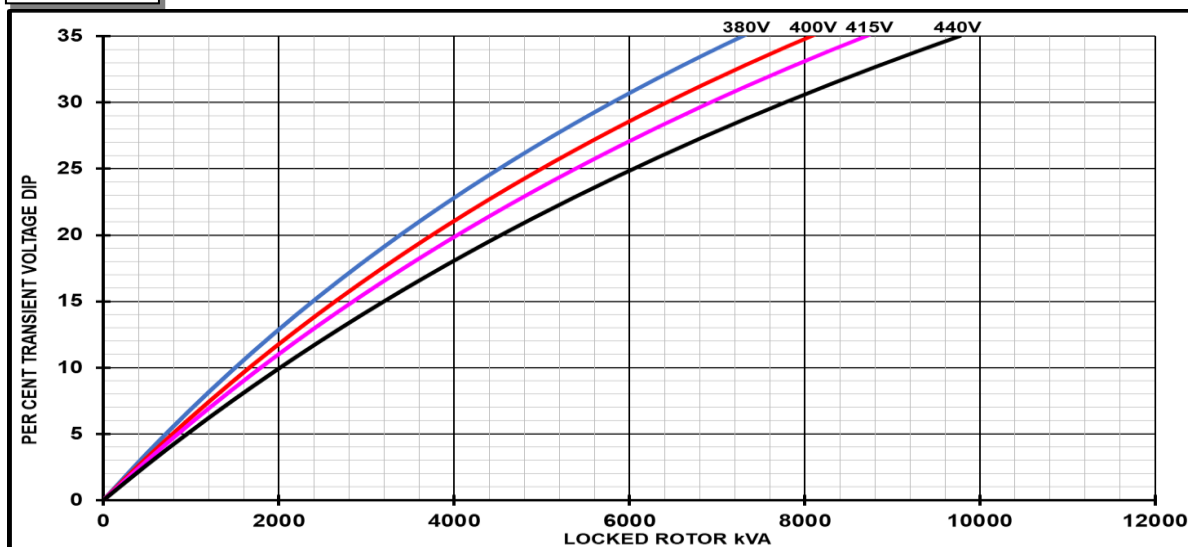


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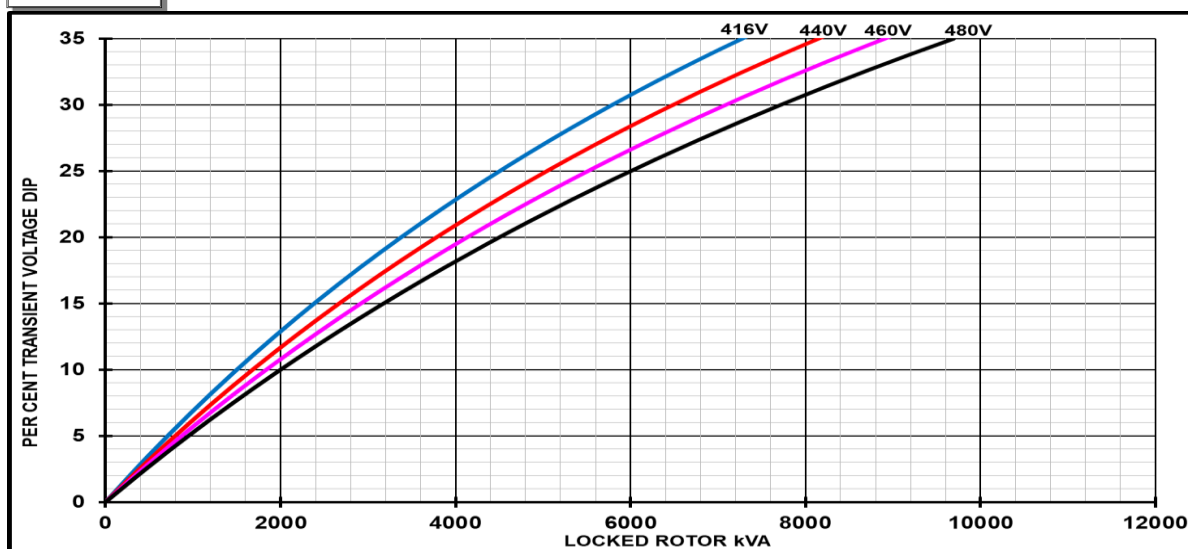
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## Locked Rotor Motor Starting Curves - Separately Excited

**50Hz**



**60Hz**



Transient Voltage Dip Scaling Factor		Transient Voltage Rise Scaling Factor	
Lagging PF	Scaling Factor	Lagging PF	Scaling Factor
<= 0.4	1.00	<= 0.4	1.25
0.5	0.95	0.5	1.20
0.6	0.90	0.6	1.15
0.7	0.86	0.7	1.10
0.8	0.83	> 0.7	1.00
0.9	0.75		
0.95	0.70		
1	0.65		

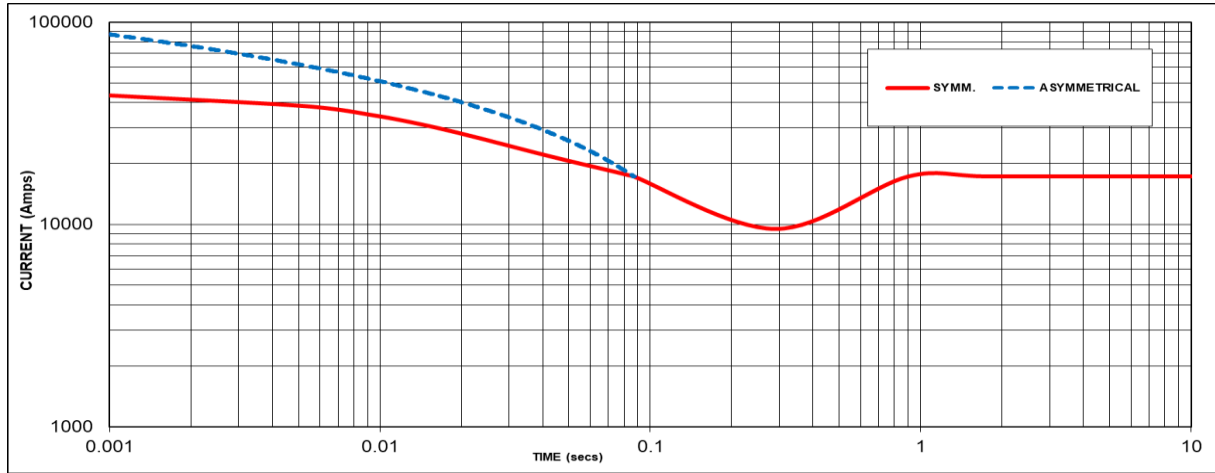
Note: To determine % Transient Voltage Dip or Voltage Rise at various PF, multiply the % Voltage Dip from the curve directly by the Scaling Factor.

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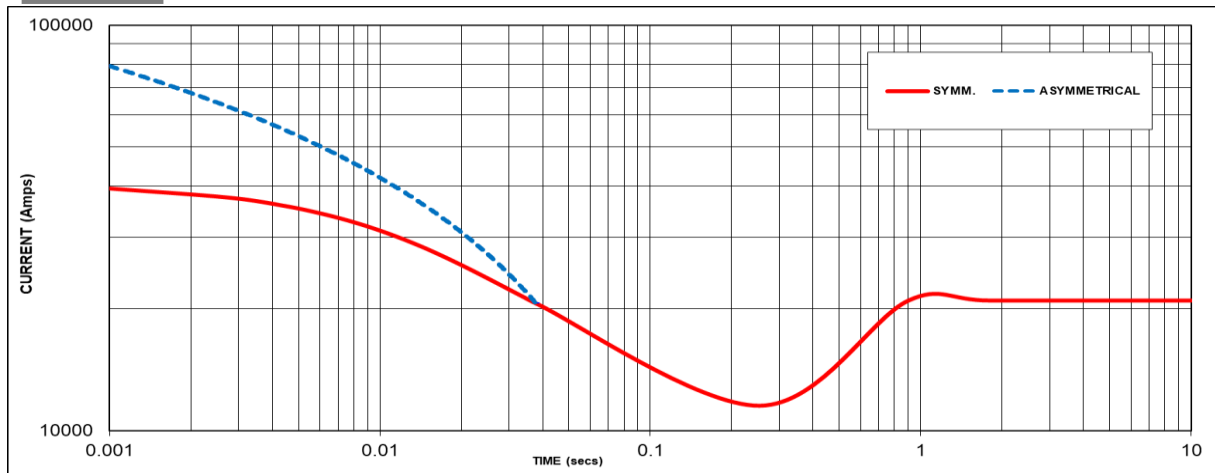
### Three-phase Short Circuit Decrement Curve - Separately Excited

**50Hz**



Sustained Short Circuit = 17262 Amps

**60Hz**



Sustained Short Circuit = 20954 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 1.11
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**

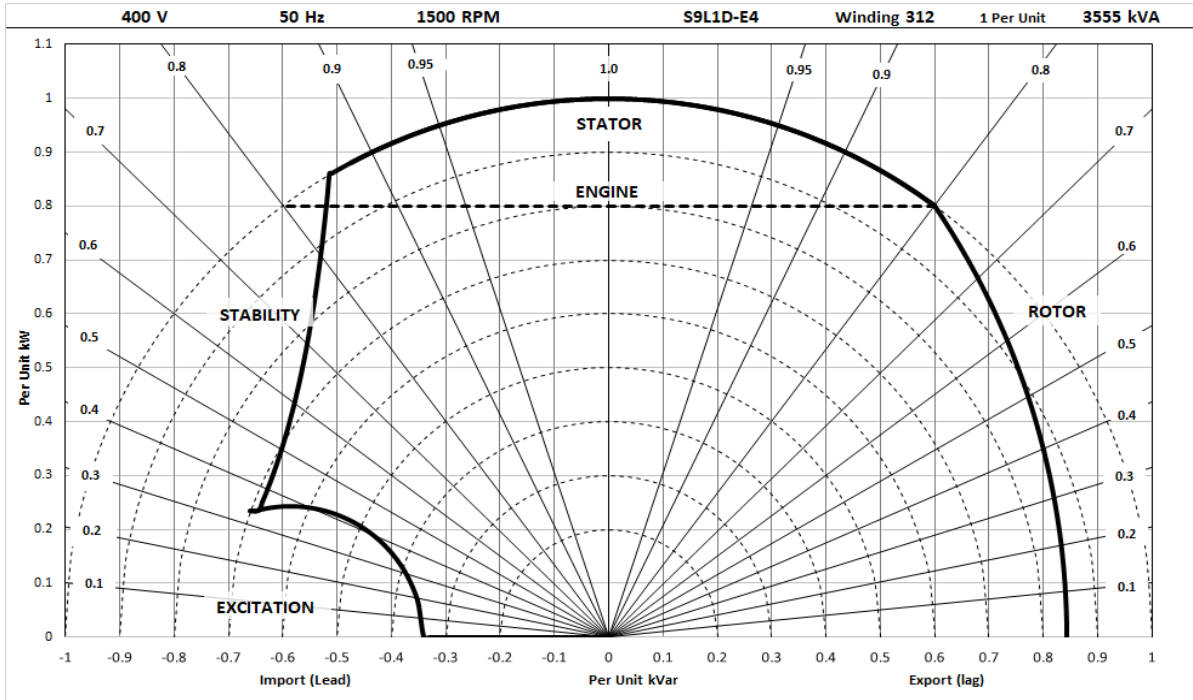
All other times are unchanged  
 Curves are drawn for Star connections under no-load excitation at rated speeds. For other connection (where applicable) the following multipliers should be applied to current values as shown :  
 Parallel Star = Curve current value X 2  
 Series Delta = Curve current value X 1.732

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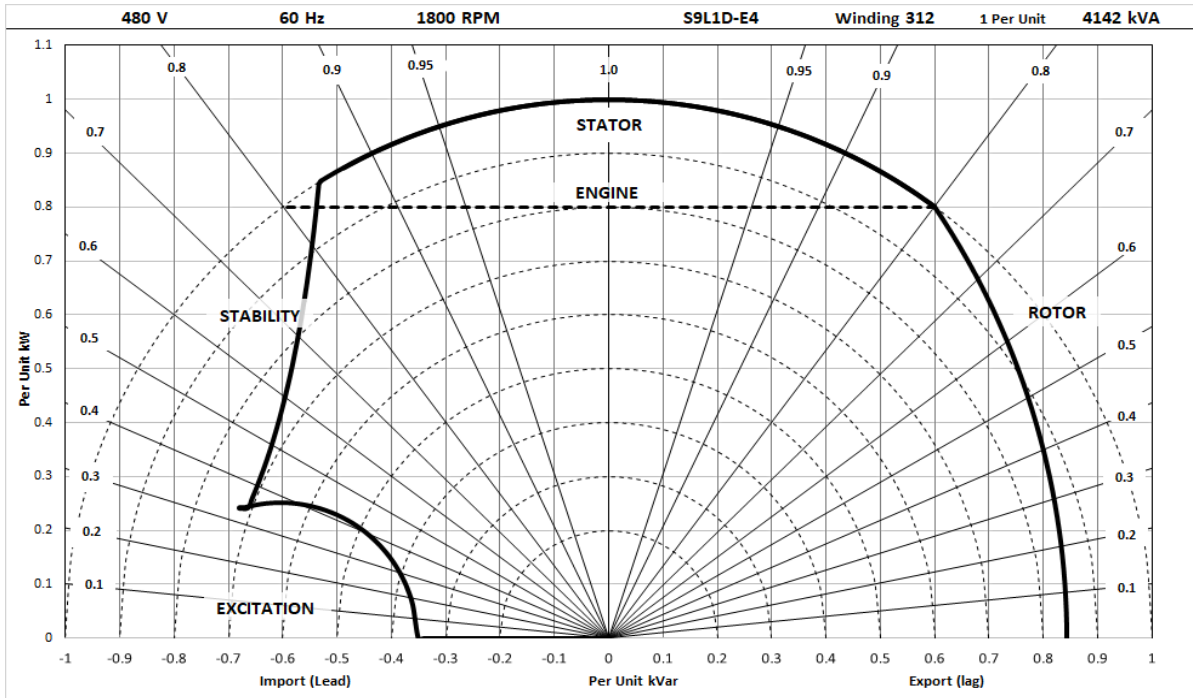
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## Typical Alternator Operating Charts

**400V/50Hz**



**480V/60Hz**



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### RATINGS AT 0.8 POWER FACTOR

Class - Temp Rise		Standby - 150/40°C				Cont. H - 125/40°C				Cont. F - 105/40°C				Cont. B - 80/40°C			
<b>50</b> Hz	Star (V)	380	400	415	440	380	400	415	440	380	400	415	440	380	400	415	440
	Parallel Star (V)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Delta (V)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	kVA	3610	3800	3800	3570	3375	3555	3555	3340	3155	3322	3322	3122	2740	2887	2887	2715
	kW	2888	3040	3040	2856	2700	2844	2844	2672	2524	2658	2658	2498	2192	2310	2310	2172
	Efficiency (%)	96.4	96.4	96.5	96.7	96.6	96.6	96.6	96.8	96.7	96.7	96.8	96.9	96.8	96.9	96.9	97.0
	kW Input	2995	3152	3150	2952	2796	2945	2943	2760	2611	2749	2747	2578	2264	2385	2384	2240

<b>60</b> Hz	Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	Parallel Star (V)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Delta (V)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	kVA	3840	4060	4245	4430	3590	3800	3969	4142	3350	3550	3710	3871	2915	3085	3224	3364
	kW	3072	3248	3396	3544	2872	3040	3175	3314	2680	2840	2968	3097	2332	2468	2579	2691
	Efficiency (%)	96.4	96.5	96.5	96.6	96.5	96.6	96.6	96.7	96.6	96.7	96.7	96.7	96.7	96.7	96.8	96.8
	kW Input	3186	3366	3518	3670	2975	3147	3286	3428	2775	2938	3069	3201	2413	2551	2665	2780

#### 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 marine alternators, 3% for every 5°C by which the operational ambient temperature exceeds 50°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 (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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