

# STAMFORD®

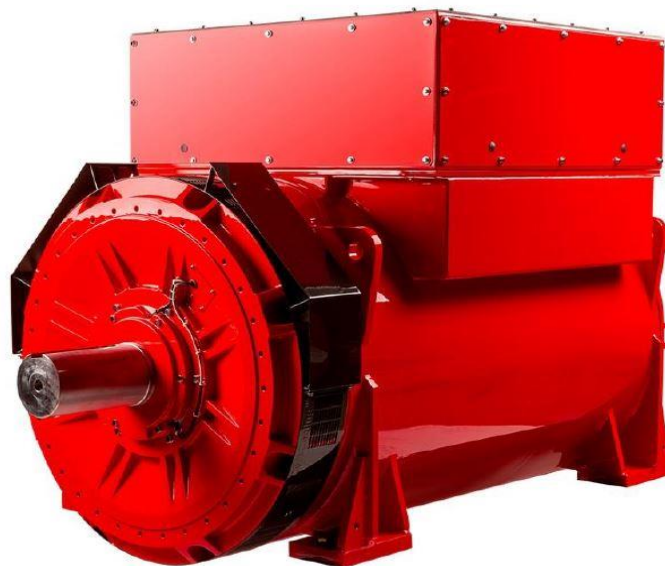
## S9L1D-F4 Wdg.312 - Technical Data Sheet

### 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)	10 - 10
No Load Excitation Current (A)	0.8 - 0.8
Full Load Excitation Voltage (V)	46
Full Load Excitation Current (A)	3.9
Exciter Time Constant (seconds)	0.34

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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	28.77							
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)	3715	3911	3911	3675	3870	4090	4278	4464
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	2.873	2.730	2.536	2.120	2.997	2.831	2.710	2.597
X'd Dir. Axis Transient	0.227	0.216	0.201	0.168	0.237	0.224	0.214	0.205
X''d Dir. Axis Subtransient	0.123	0.117	0.109	0.091	0.128	0.121	0.116	0.111
Xq Quad. Axis Reactance	1.460	1.387	1.289	1.077	1.523	1.438	1.377	1.319
X''q Quad. Axis Subtransient	0.151	0.143	0.133	0.111	0.157	0.148	0.142	0.136
XL Stator Leakage Reactance	0.078	0.074	0.069	0.057	0.081	0.077	0.073	0.070
X2 Negative Sequence Reactance	0.232	0.220	0.204	0.171	0.242	0.228	0.218	0.209
X0 Zero Sequence Reactance	0.083	0.079	0.073	0.061	0.087	0.082	0.078	0.075
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	3.448	3.276	3.043	2.544	3.597	3.398	3.251	3.116
X'd Dir. Axis Transient	0.261	0.248	0.231	0.193	0.273	0.258	0.247	0.236
X''d Dir. Axis Subtransient	0.144	0.137	0.127	0.106	0.150	0.142	0.136	0.130
Xq Quad. Axis Reactance	1.504	1.429	1.327	1.109	1.568	1.482	1.418	1.359
X''q Quad. Axis Subtransient	0.181	0.172	0.159	0.133	0.188	0.178	0.170	0.163
XL Stator Leakage Reactance	0.088	0.084	0.078	0.065	0.092	0.087	0.083	0.080
Xlr Rotor Leakage Reactance	0.091	0.086	0.080	0.067	0.094	0.089	0.085	0.082
X2 Negative Sequence Reactance	0.278	0.264	0.245	0.205	0.290	0.274	0.262	0.251
X0 Zero Sequence Reactance	0.097	0.092	0.086	0.072	0.101	0.096	0.092	0.088

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Time Constants (Seconds)		
T'd Transient Time Const.	0.243	
T''d Sub-Transient Time Const.	0.016	
T'do O.C. Field Time Const.	4.8	
Ta Armature Time Const.	0.04	
T''q Sub-Transient Time Const.	0.01	
Resistances in Ohms ( $\Omega$ ) at 22°C		
Stator Winding Resistance (Ra), per phase for series connected	0.000281	
Rotor Winding Resistance (Rf)	0.741	
Exciter Stator Winding Resistance	11.1	
Exciter Rotor Winding Resistance per phase	0.016	
PMG Phase Resistance (Rpmg) per phase	1.91	
Positive Sequence Resistance (R1)	0.00035	
Negative Sequence Resistance (R2)	0.00040	
Zero Sequence Resistance (R0)	0.00035	
Saturation Factors	400V	480V
SG1.0	0.134	0.146
SG1.2	0.618	0.655
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	-	115 kgm <sup>2</sup>
Weight Wound Stator	-	3740kg
Weight Wound Rotor	-	2615kg
Weight Complete Alternator	-	7450kg
Shipping weight in a Crate	-	7916kg
Packing Crate Size	-	300 x 200 x 220(cm)
Maximum Over Speed	2250 RPM for two minutes	
Bearing Drive End	-	6236
Bearing Non-Drive End	-	6324

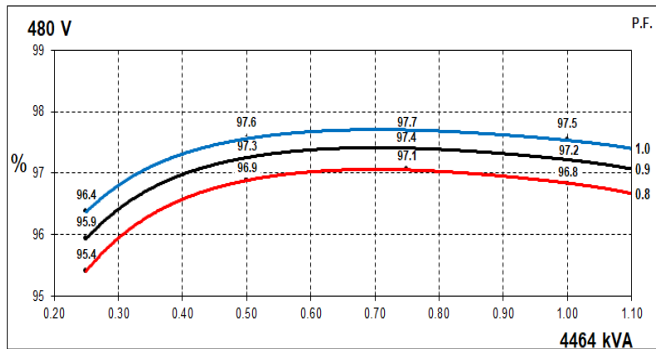
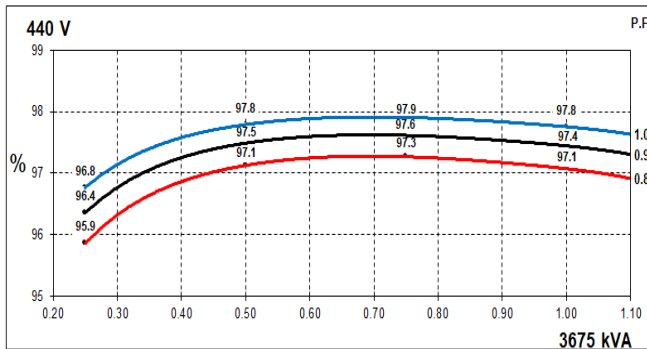
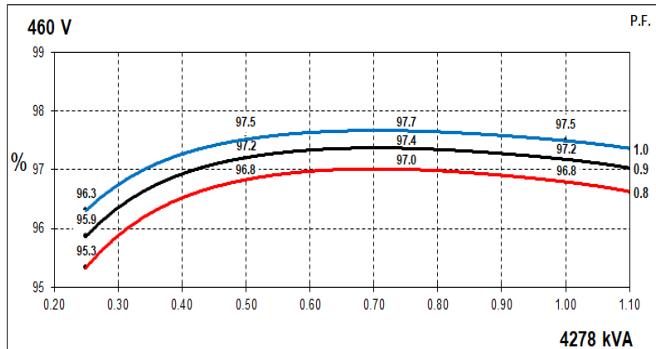
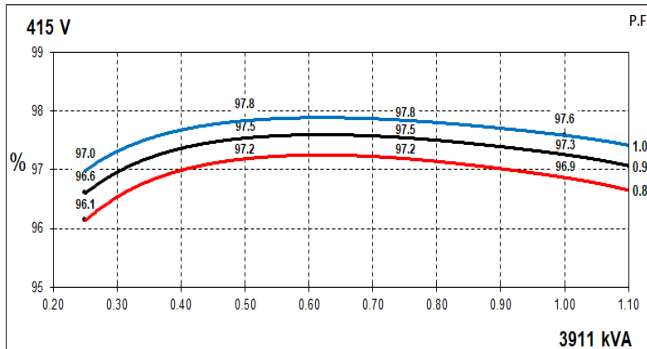
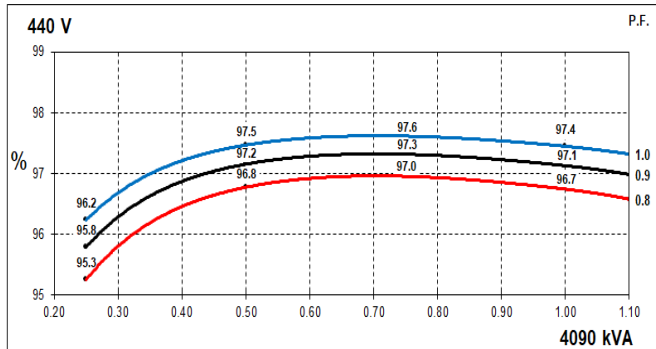
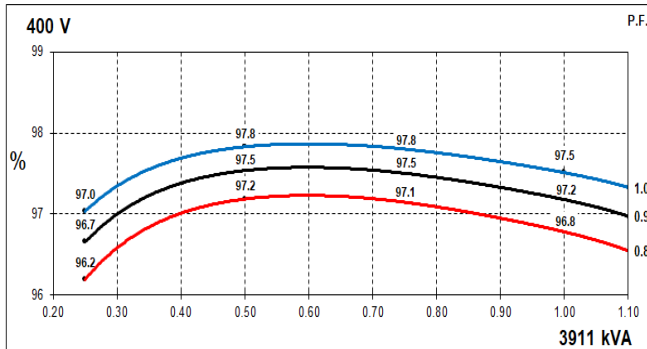
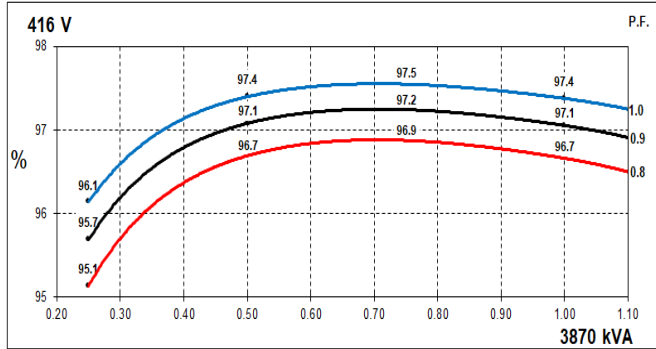
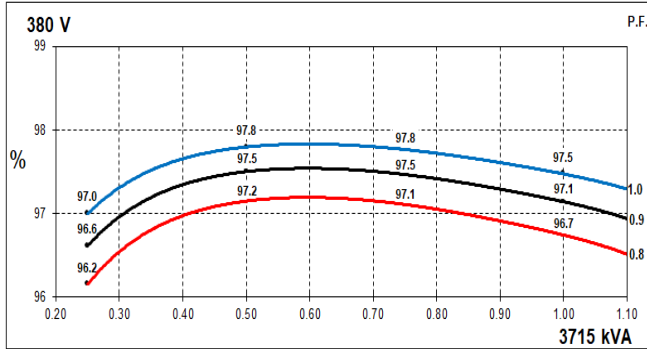
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## THREE PHASE EFFICIENCY CURVES

50Hz

60Hz

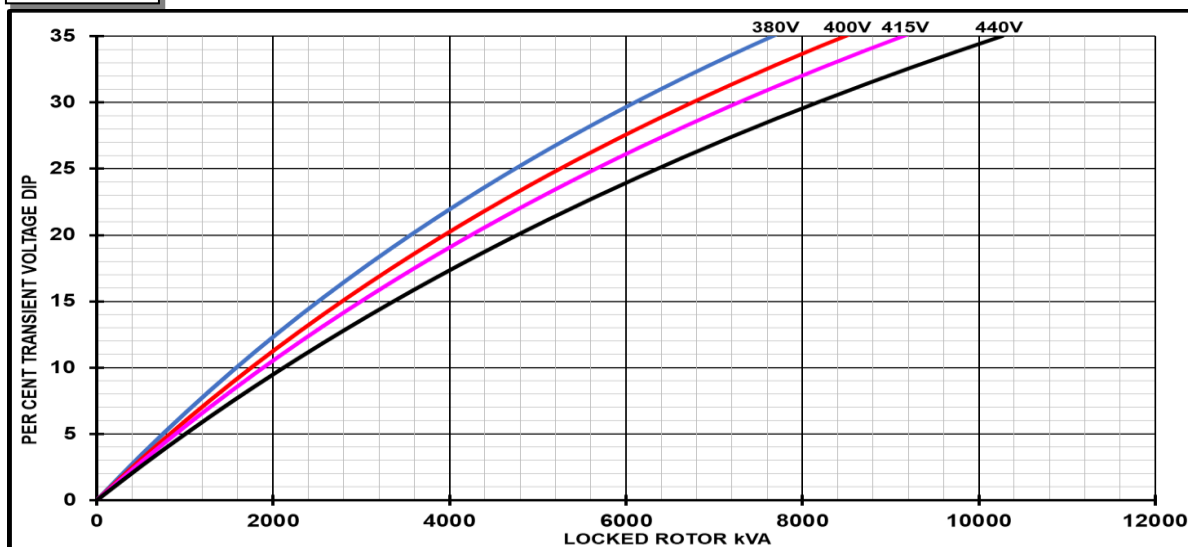


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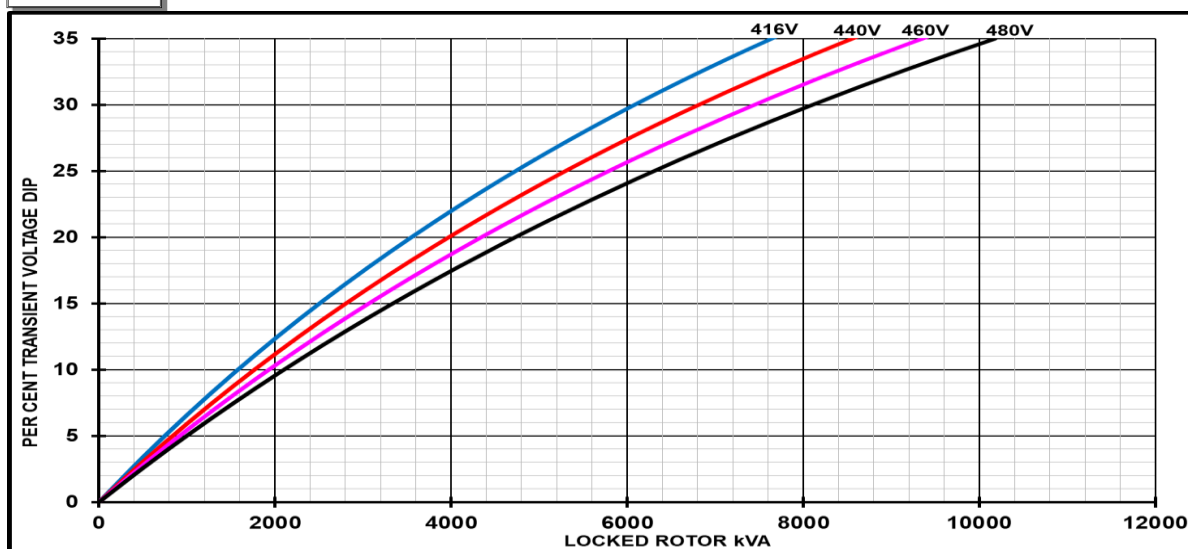
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## Locked Rotor Motor Starting Curves - Separately Excited

**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		

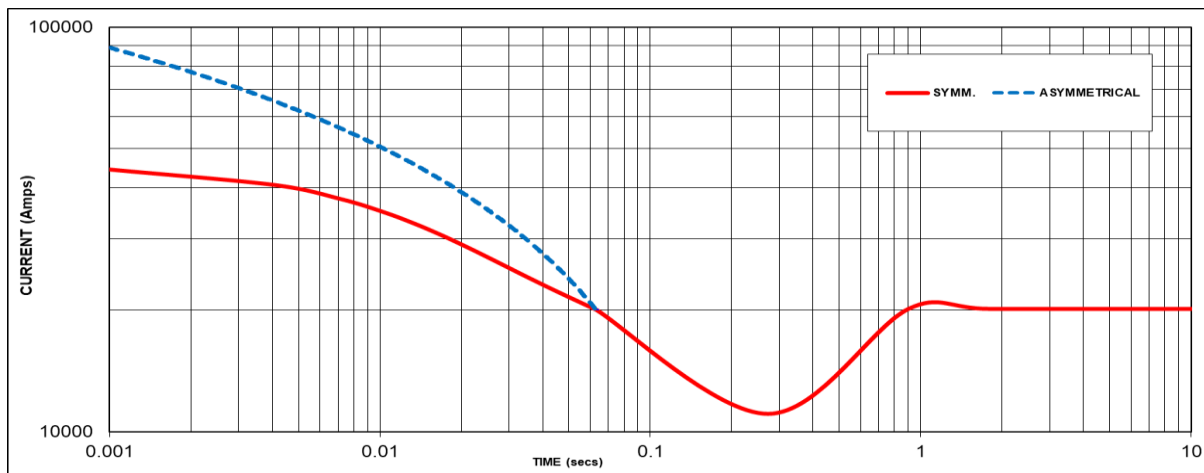
Note: To determine % Transient Voltage Dip or Voltage Rise at various PF, multiply the % Voltage Dip from the curve directly by the Scaling Factor.

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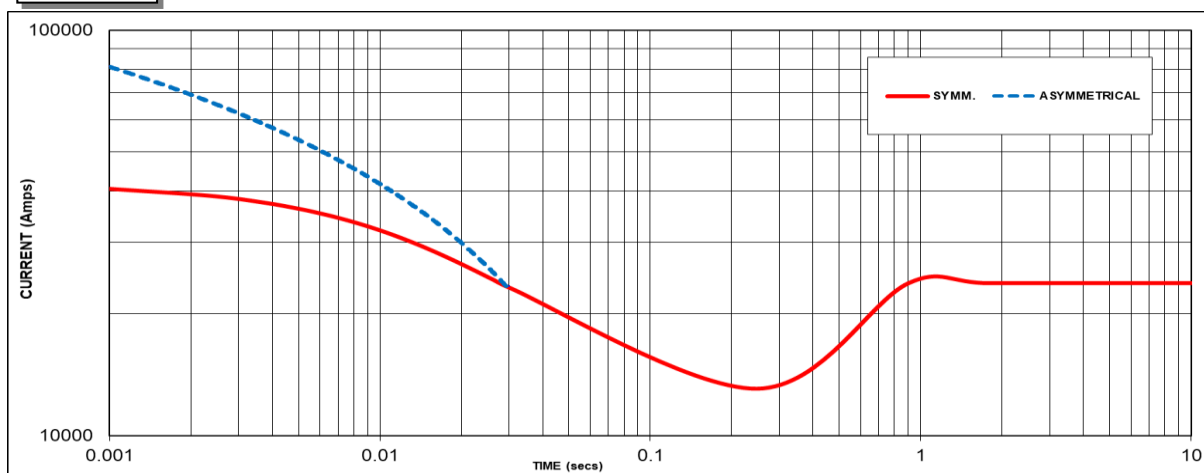
### Three-phase Short Circuit Decrement Curve - Separately Excited

**50Hz**



Sustained Short Circuit = 20112 Amps

**60Hz**



Sustained Short Circuit = 23765 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**

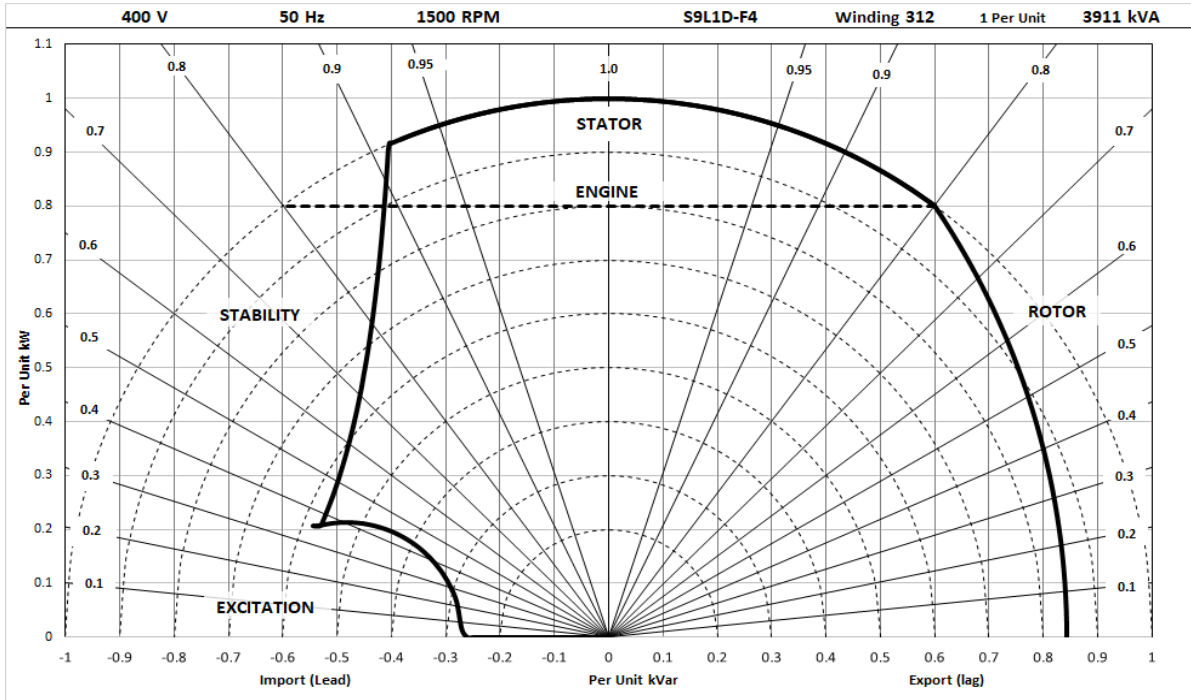
All other times are unchanged  
 Curves are drawn for Star connections under no-load excitation at rated speeds. For other connection (where applicable) the following multipliers should be applied to current values as shown :  
 Parallel Star = Curve current value X 2  
 Series Delta = Curve current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

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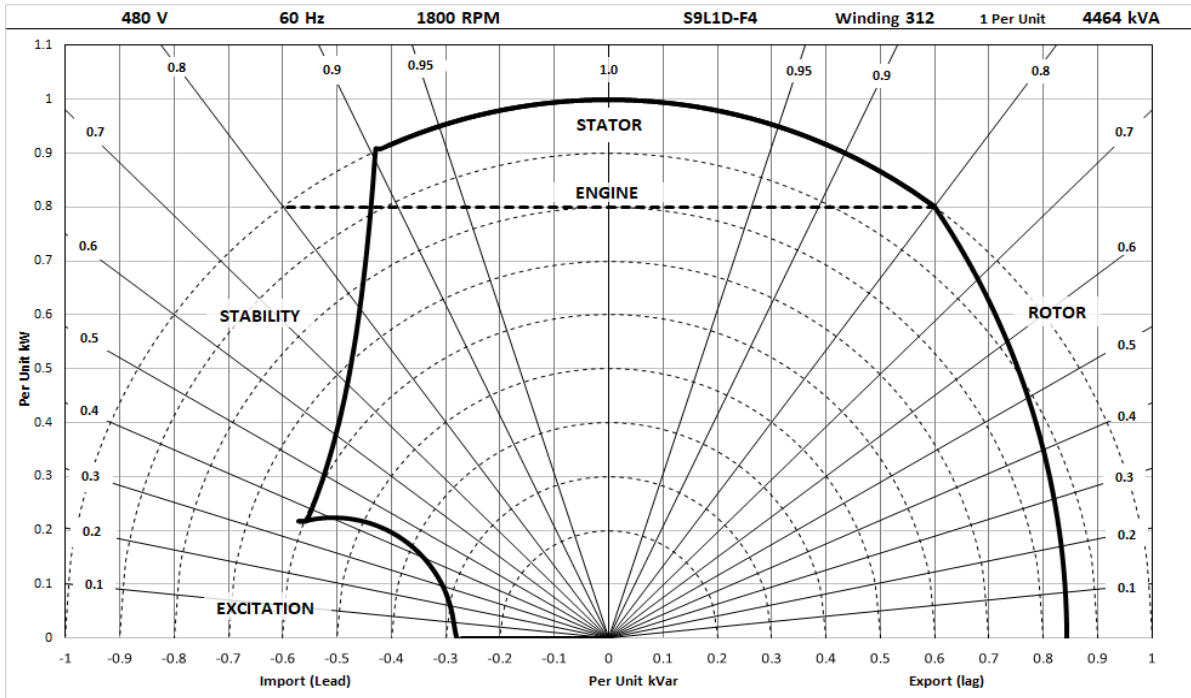
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## Typical Alternator Operating Charts

**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 Hz</b>	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	3970	4180	4180	3970	3715	3911	3911	3675	3470	3655	3655	3435	3015	3177	3177	2980
	kW	3176	3344	3344	3176	2972	3129	3129	2940	2776	2924	2924	2748	2412	2542	2542	2384
	Efficiency (%)	96.6	96.6	96.7	97.0	96.7	96.8	96.9	97.1	96.9	96.9	97.0	97.2	97.0	97.1	97.1	97.3
	kW Input	3288	3460	3457	3275	3072	3233	3230	3029	2866	3017	3015	2829	2485	2618	2616	2451

<b>60 Hz</b>	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	4130	4370	4571	4770	3870	4090	4278	4464	3615	3820	3998	4172	3140	3300	3474	3625
	kW	3304	3496	3657	3816	3096	3272	3422	3571	2892	3056	3198	3338	2512	2640	2779	2900
	Efficiency (%)	96.6	96.6	96.7	96.7	96.7	96.7	96.8	96.8	96.7	96.8	96.9	96.9	96.9	96.9	97.0	97.0
	kW Input	3422	3617	3782	3945	3203	3382	3536	3688	2989	3156	3301	3444	2594	2724	2866	2989

#### 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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