

# STAMFORD®

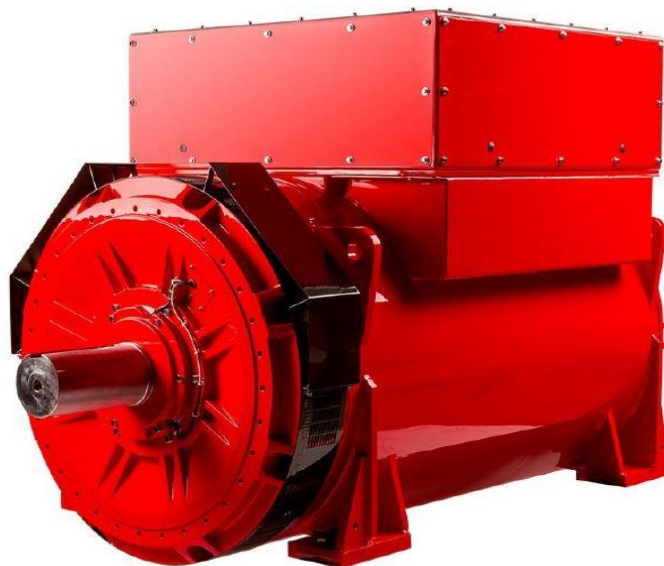
## S9L1D-D4 Wdg.312 - Technical Data Sheet

### 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)	10.7 - 10.3
No Load Excitation Current (A)	1 - 1
Full Load Excitation Voltage (V)	49.4
Full Load Excitation Current (A)	4.2
Exciter Time Constant (seconds)	0.18

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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	29.19							
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)	2895	3050	3050	2865	3170	3355	3508	3660
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	2.366	2.250	2.090	1.747	2.595	2.455	2.348	2.250
X'd Dir. Axis Transient	0.212	0.201	0.187	0.156	0.232	0.220	0.210	0.201
X''d Dir. Axis Subtransient	0.154	0.147	0.136	0.114	0.169	0.160	0.153	0.147
Xq Quad. Axis Reactance	1.239	1.178	1.095	0.915	1.359	1.285	1.230	1.178
X''q Quad. Axis Subtransient	0.134	0.128	0.119	0.099	0.147	0.139	0.133	0.128
XL Stator Leakage Reactance	0.071	0.068	0.063	0.053	0.078	0.074	0.071	0.068
X2 Negative Sequence Reactance	0.216	0.205	0.190	0.159	0.236	0.224	0.214	0.205
X0 Zero Sequence Reactance	0.077	0.073	0.068	0.057	0.084	0.080	0.076	0.073
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	2.840	2.700	2.508	2.096	3.113	2.945	2.818	2.700
X'd Dir. Axis Transient	0.244	0.232	0.215	0.180	0.267	0.253	0.242	0.232
X''d Dir. Axis Subtransient	0.181	0.172	0.160	0.133	0.198	0.187	0.179	0.172
Xq Quad. Axis Reactance	1.276	1.214	1.127	0.942	1.399	1.324	1.266	1.214
X''q Quad. Axis Subtransient	0.161	0.153	0.142	0.119	0.177	0.167	0.160	0.153
XL Stator Leakage Reactance	0.081	0.077	0.071	0.059	0.088	0.084	0.080	0.077
Xlr Rotor Leakage Reactance	0.100	0.095	0.088	0.074	0.109	0.104	0.099	0.095
X2 Negative Sequence Reactance	0.259	0.246	0.229	0.191	0.284	0.268	0.257	0.246
X0 Zero Sequence Reactance	0.090	0.085	0.079	0.066	0.098	0.093	0.089	0.085

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Time Constants (Seconds)		
T'd Transient Time Const.	0.225	
T''d Sub-Transient Time Const.	0.018	
T'do O.C. Field Time Const.	4.04	
Ta Armature Time Const.	0.037	
T''q Sub-Transient Time Const.	0.01	
Resistances in Ohms ( $\Omega$ ) at 22°C		
Stator Winding Resistance (Ra), per phase for series connected	0.00044	
Rotor Winding Resistance (Rf)	1.36	
Exciter Stator Winding Resistance	10.7	
Exciter Rotor Winding Resistance per phase	0.0302	
PMG Phase Resistance (Rpmg) per phase	1.91	
Positive Sequence Resistance (R1)	0.00055	
Negative Sequence Resistance (R2)	0.00063	
Zero Sequence Resistance (R0)	0.00055	
Saturation Factors	400V	480V
SG1.0	0.184	0.186
SG1.2	0.833	0.857
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	0, 00, None
Moment of Inertia	89 kgm <sup>2</sup>	87.5 kgm <sup>2</sup>
Weight Wound Stator	2998kg	2998kg
Weight Wound Rotor	2059kg	2005kg
Weight Complete Alternator	6100kg	6050kg
Shipping weight in a Crate	6521kg	6487kg
Packing Crate Size	260 x 200 x 220(cm)	260 x 200 x 220(cm)
Maximum Over Speed	2250 RPM for two minutes	
Bearing Drive End	-	6232
Bearing Non-Drive End	6324	6324

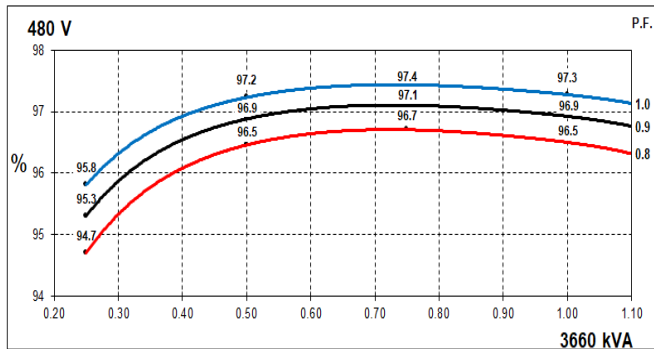
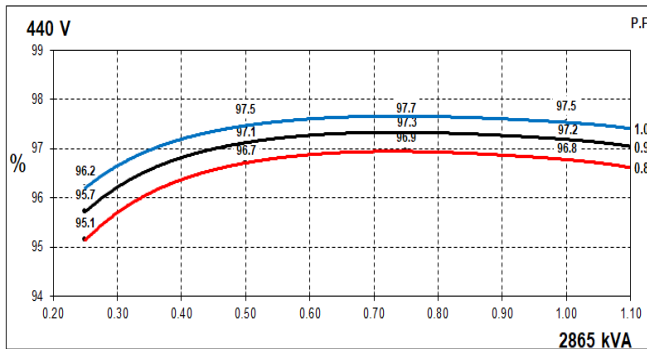
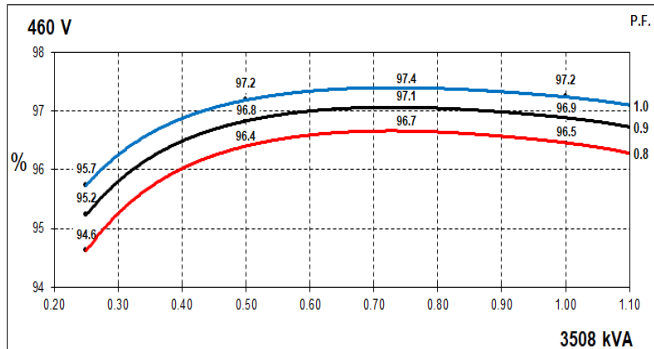
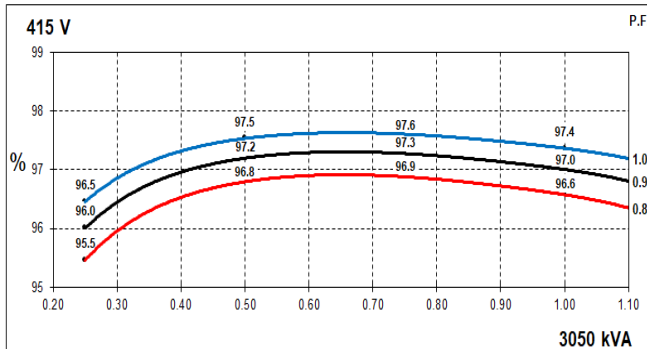
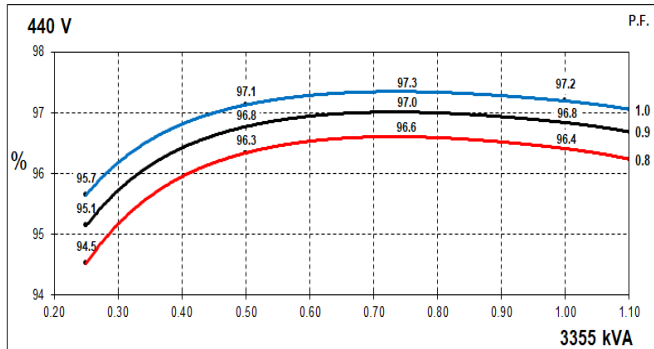
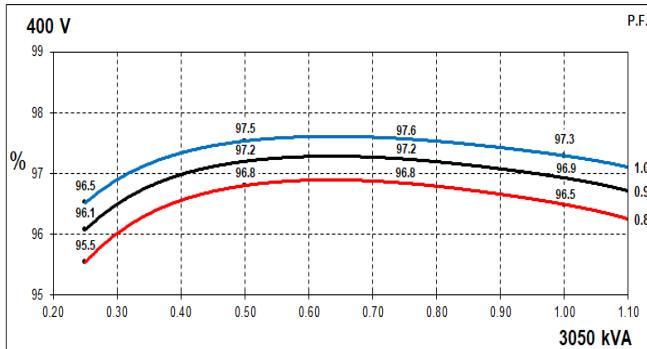
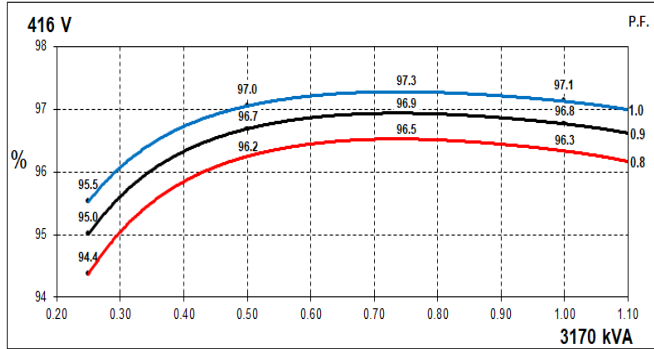
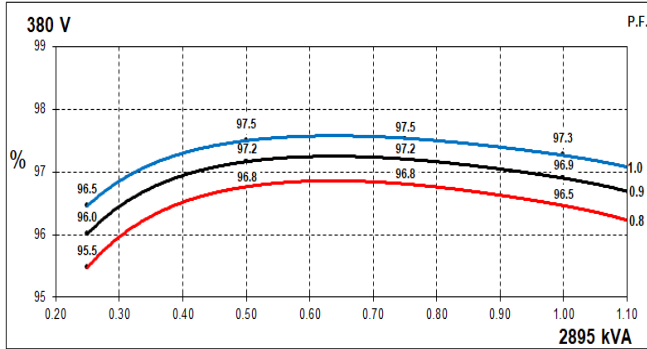
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## THREE PHASE EFFICIENCY CURVES

50Hz

60Hz

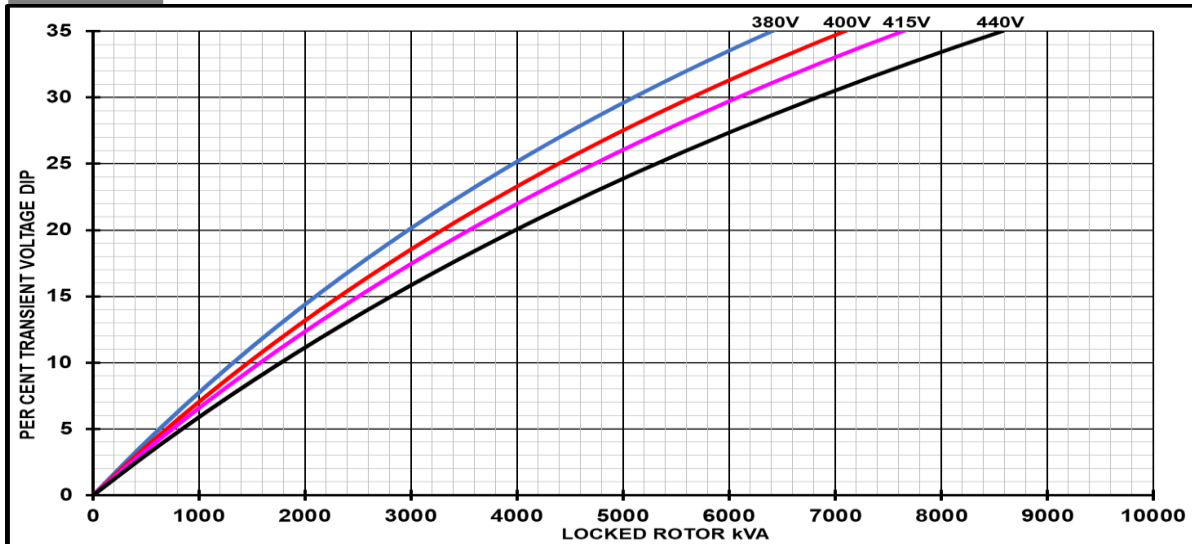


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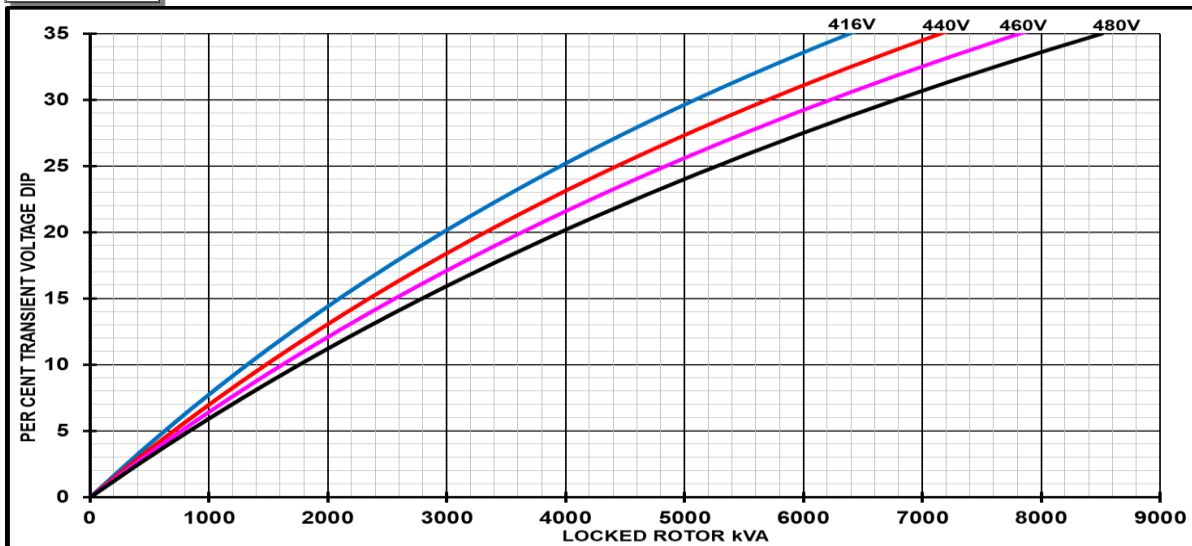
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## Locked Rotor Motor Starting Curves - Separately Excited

**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		

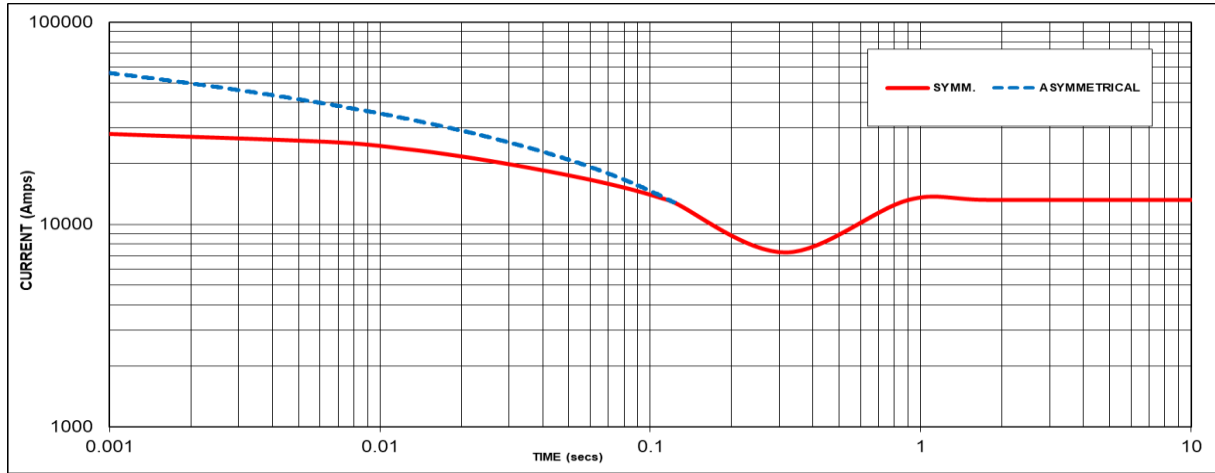
Note: To determine % Transient Voltage Dip or Voltage Rise at various PF, multiply the % Voltage Dip from the curve directly by the Scaling Factor.

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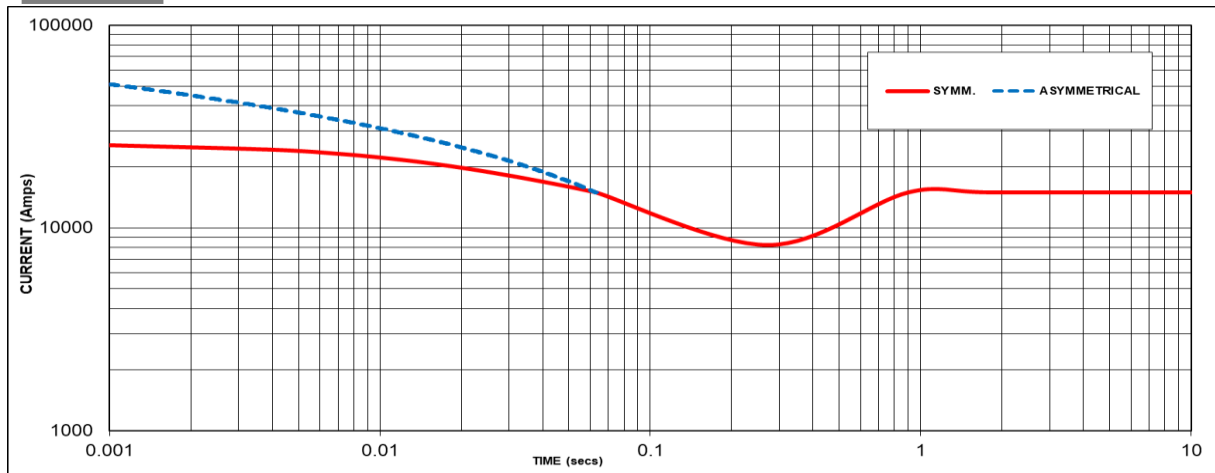
### Three-phase Short Circuit Decrement Curve - Separately Excited

**50Hz**



Sustained Short Circuit = 13210 Amps

**60Hz**



Sustained Short Circuit = 14958 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**

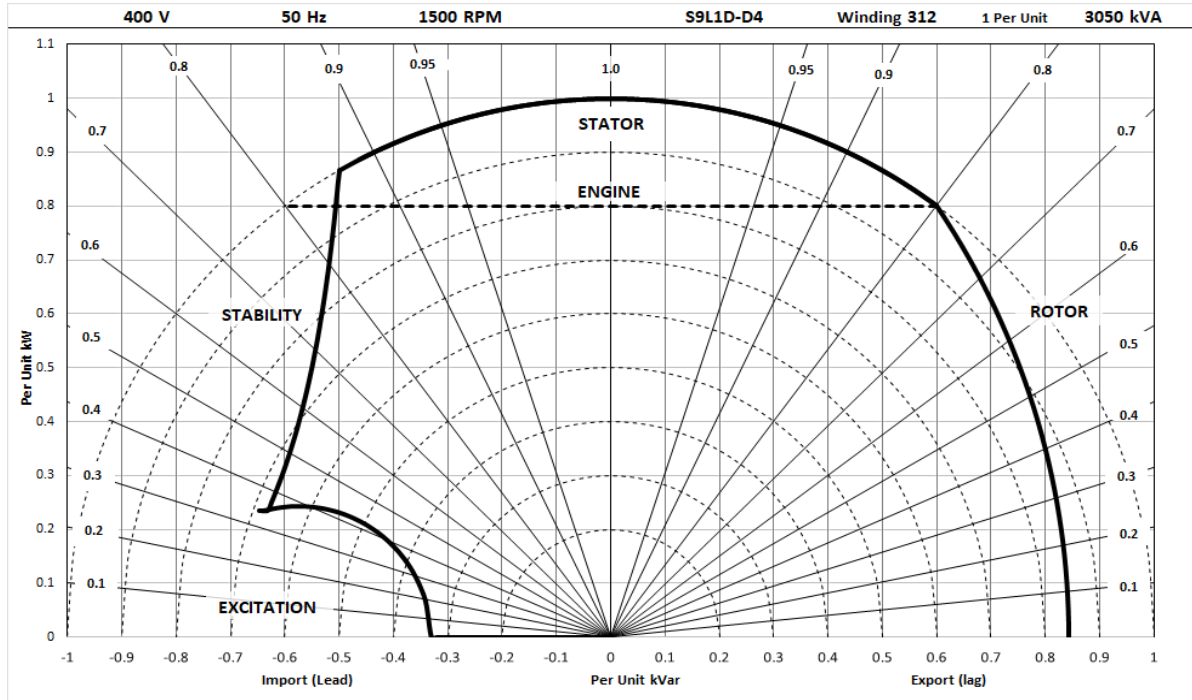
All other times are unchanged  
 Curves are drawn for Star connections under no-load excitation at rated speeds. For other connection (where applicable) the following multipliers should be applied to current values as shown :  
 Parallel Star = Curve current value X 2  
 Series Delta = Curve current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

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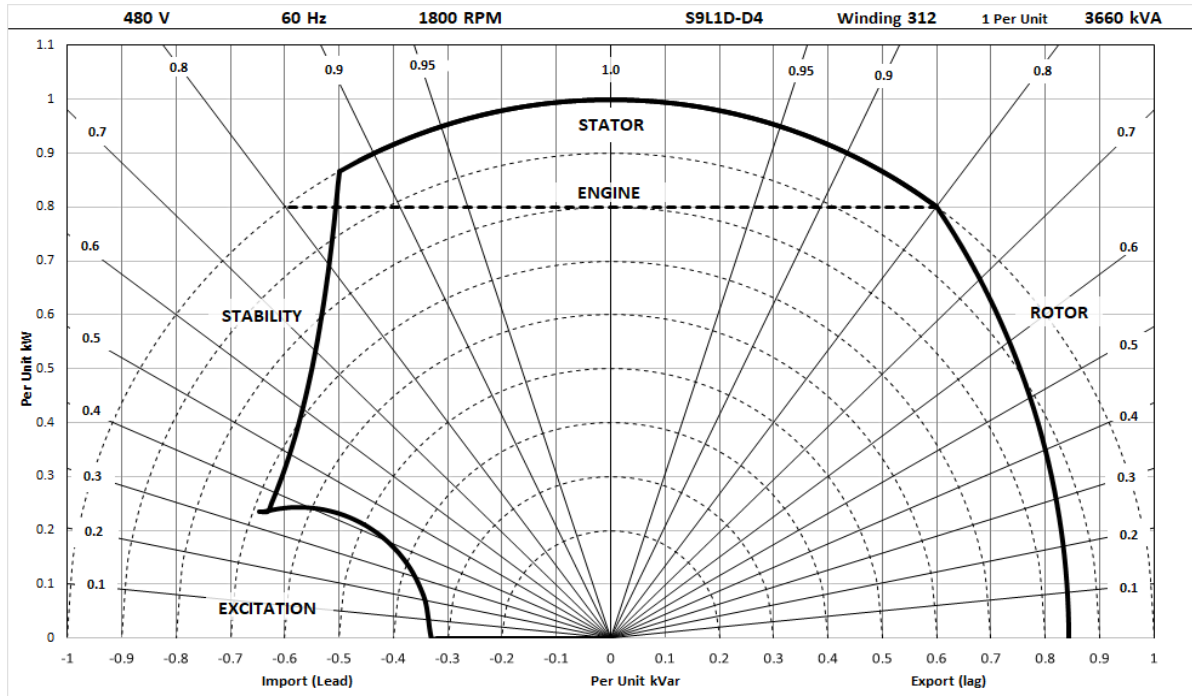
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## Typical Alternator Operating Charts

**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	3095	3260	3260	3065	2895	3050	3050	2865	2660	2800	2800	2630	2325	2450	2450	2300
	kW	2476	2608	2608	2452	2316	2440	2440	2292	2128	2240	2240	2104	1860	1960	1960	1840
	Efficiency (%)	96.3	96.3	96.4	96.7	96.5	96.5	96.6	96.8	96.6	96.6	96.7	96.9	96.8	96.8	96.9	96.9
	kW Input	2571	2707	2704	2536	2401	2529	2526	2368	2203	2318	2316	2172	1922	2025	2024	1898

<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	3390	3590	3752	3915	3170	3355	3508	3660	2910	3080	3220	3360	2600	2750	2875	3000
	kW	2712	2872	3002	3132	2536	2684	2806	2928	2328	2464	2576	2688	2080	2200	2300	2400
	Efficiency (%)	96.2	96.3	96.4	96.4	96.3	96.4	96.5	96.5	96.4	96.5	96.6	96.6	96.5	96.6	96.6	96.7
	kW Input	2818	2982	3115	3249	2633	2784	2909	3034	2414	2553	2668	2782	2155	2278	2380	2482

#### 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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