STAMFORD

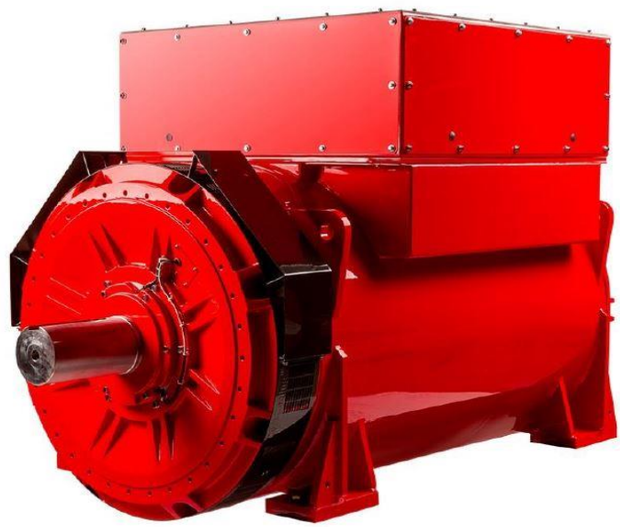
S9L1D-C4 Wdg.312 - Technical Data Sheet

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)	13.6 - 13.4
No Load Excitation Current (A)	0.9 - 0.9
Full Load Excitation Voltage (V)	64
Full Load Excitation Current (A)	4.2
Exciter Time Constant (seconds)	0.18

STAMFORD

S9L1D-C4 Wdg.312

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	24.29							
	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)	2650	2800	2800	2620	2900	3070	3210	3350
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	2.706	2.580	2.397	1.995	2.965	2.805	2.684	2.572
X'd Dir. Axis Transient	0.276	0.264	0.245	0.204	0.303	0.287	0.274	0.263
X"d Dir. Axis Subtransient	0.149	0.142	0.132	0.110	0.163	0.154	0.148	0.142
Xq Quad. Axis Reactance	1.367	1.304	1.211	1.008	1.498	1.418	1.356	1.300
X"q Quad. Axis Subtransient	0.155	0.148	0.137	0.114	0.170	0.161	0.154	0.148
XL Stator Leakage Reactance	0.085	0.081	0.075	0.063	0.093	0.088	0.084	0.081
X2 Negative Sequence Reactance	0.251	0.239	0.222	0.185	0.275	0.260	0.249	0.238
X0 Zero Sequence Reactance	0.084	0.080	0.074	0.062	0.092	0.087	0.083	0.080
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	3.247	3.096	2.876	2.394	3.558	3.366	3.221	3.087
X'd Dir. Axis Transient	0.318	0.303	0.282	0.234	0.348	0.330	0.315	0.302
X"d Dir. Axis Subtransient	0.174	0.166	0.154	0.128	0.191	0.181	0.173	0.166
Xq Quad. Axis Reactance	1.408	1.343	1.248	1.039	1.543	1.460	1.397	1.339
X"q Quad. Axis Subtransient	0.186	0.178	0.165	0.137	0.204	0.193	0.185	0.177
XL Stator Leakage Reactance	0.096	0.092	0.085	0.071	0.105	0.100	0.095	0.091
Xlr Rotor Leakage Reactance	0.114	0.109	0.101	0.084	0.125	0.119	0.113	0.109
X2 Negative Sequence Reactance	0.301	0.287	0.266	0.222	0.330	0.312	0.298	0.286
X0 Zero Sequence Reactance	0.098	0.094	0.087	0.072	0.108	0.102	0.097	0.093

STAMFORD

S9L1D-C4 Wdg.312

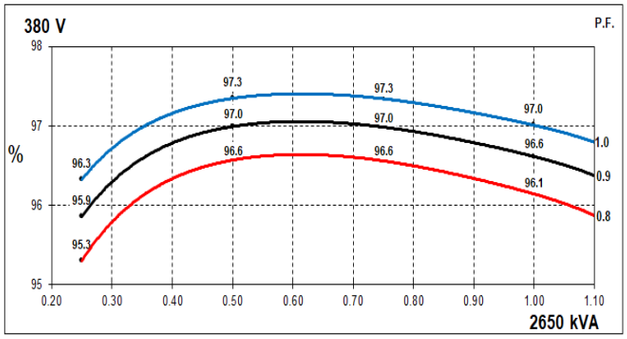
Time Constants (Seconds)		
T'd Transient Time Const.	0.29	
T''d Sub-Transient Time Const.	0.015	
T'do O.C. Field Time Const.	3.74	
Ta Armature Time Const.	0.043	
T''q Sub-Transient Time Const.	0.009	
Resistances in Ohms (Ω) at 22^{0}C		
Stator Winding Resistance (Ra), per phase for series connected	0.00053	
Rotor Winding Resistance (Rf)	1.3	
Exciter Stator Winding Resistance	13.8	
Exciter Rotor Winding Resistance per phase	0.0302	
PMG Phase Resistance (Rpmg) per phase	1.91	
Positive Sequence Resistance (R1)	0.00066	
Negative Sequence Resistance (R2)	0.00076	
Zero Sequence Resistance (R0)	0.00066	
Saturation Factors	400V	480V
SG1.0	0.146	0.134
SG1.2	0.621	0.601
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	81.4 kgm²	80 kgm²
Weight Wound Stator	2750kg	2750kg
Weight Wound Rotor	1920kg	1865kg
Weight Complete Alternator	5750kg	5700kg
Shipping weight in a Crate	6144kg	6099kg
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

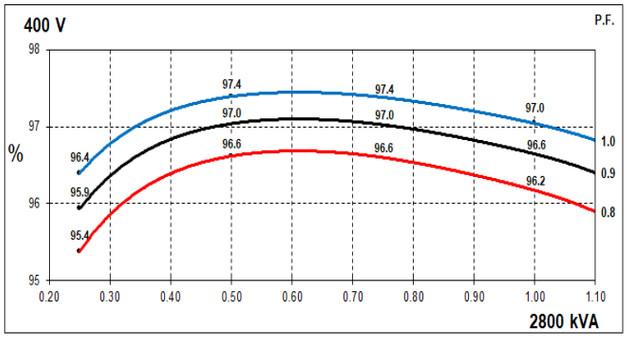
STAMFORD

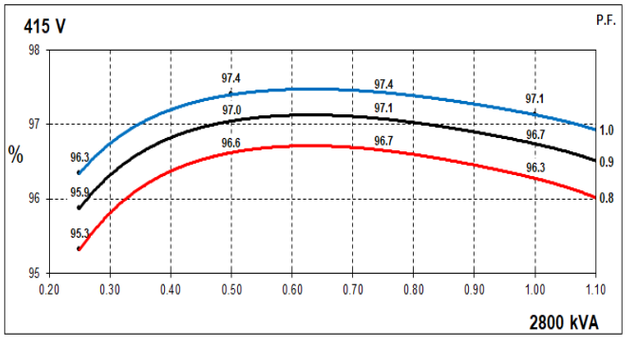
S9L1D-C4 Wdg.312

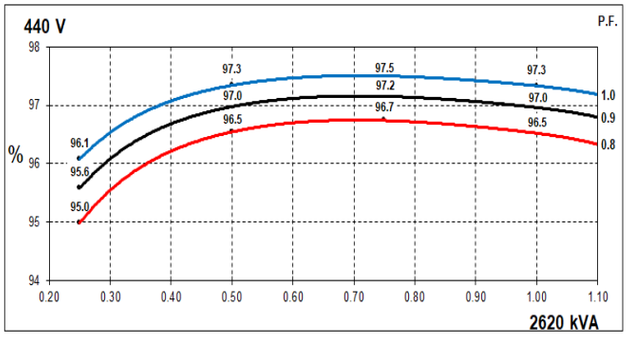
THREE PHASE EFFICIENCY CURVES

50Hz

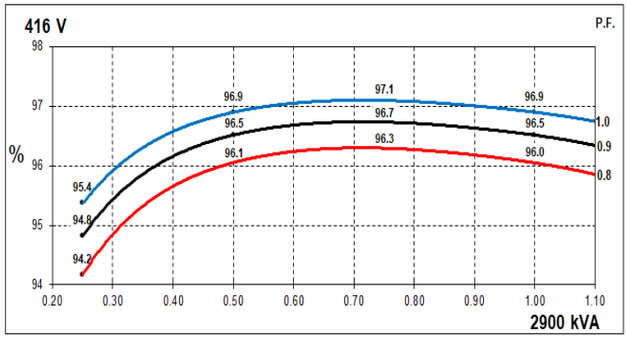


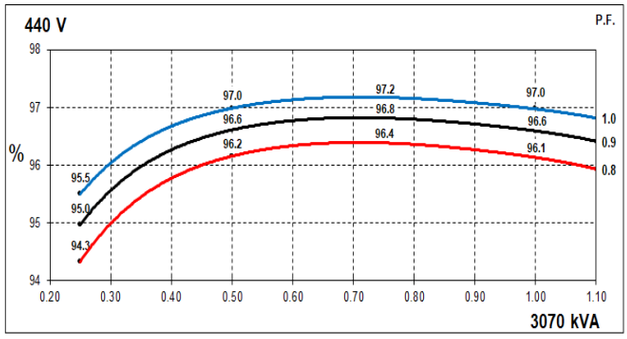


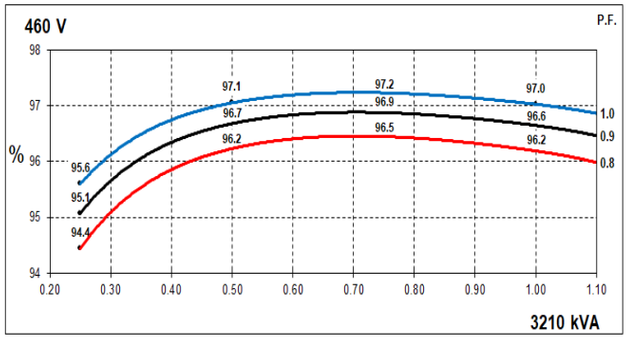


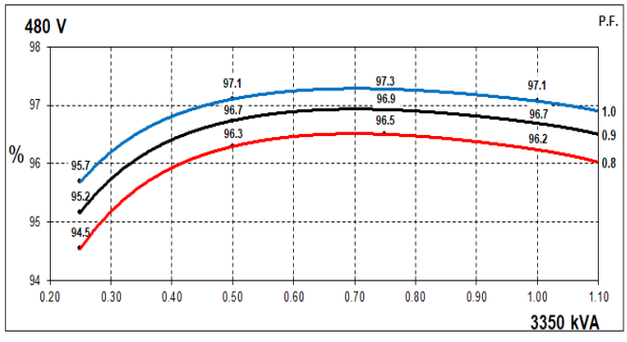


60Hz



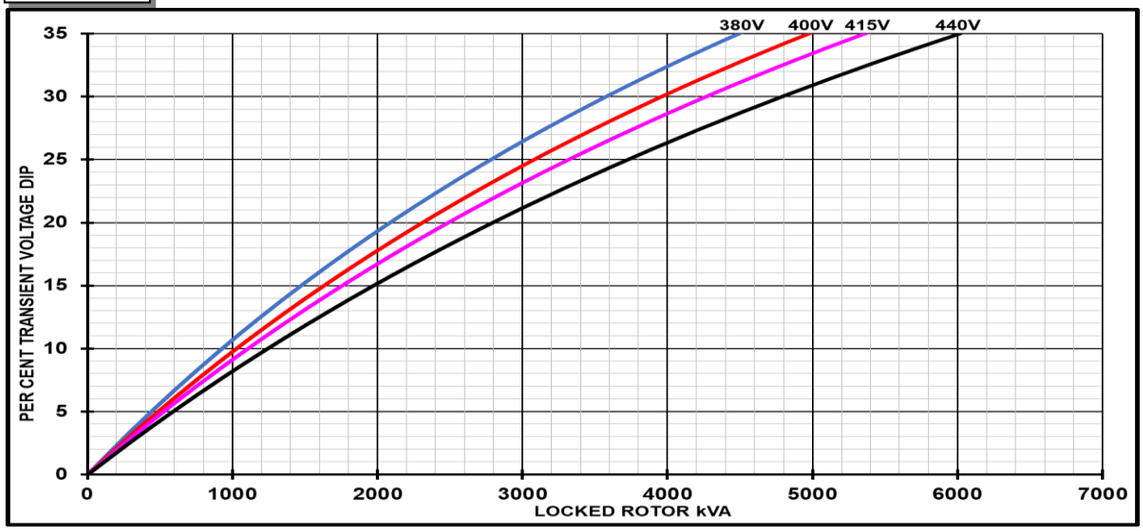




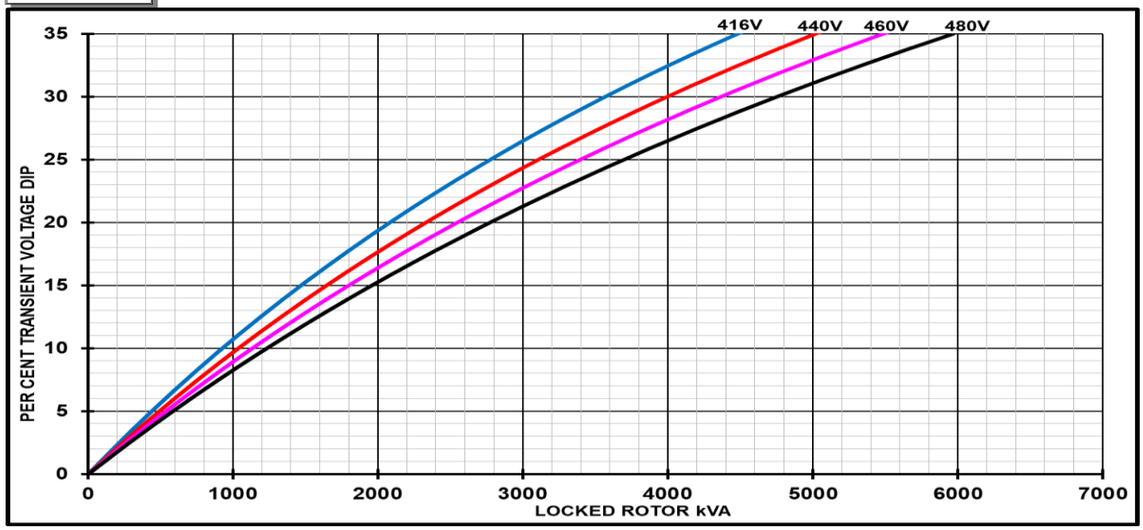


Locked Rotor Motor Starting Curves - Separately Excited

50Hz



60Hz



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

Transient Voltage Rise Scaling Factor	
Lagging PF	Scaling Factor
<= 0.4	1.25
0.5	1.20
0.6	1.15
0.7	1.10
> 0.7	1.00

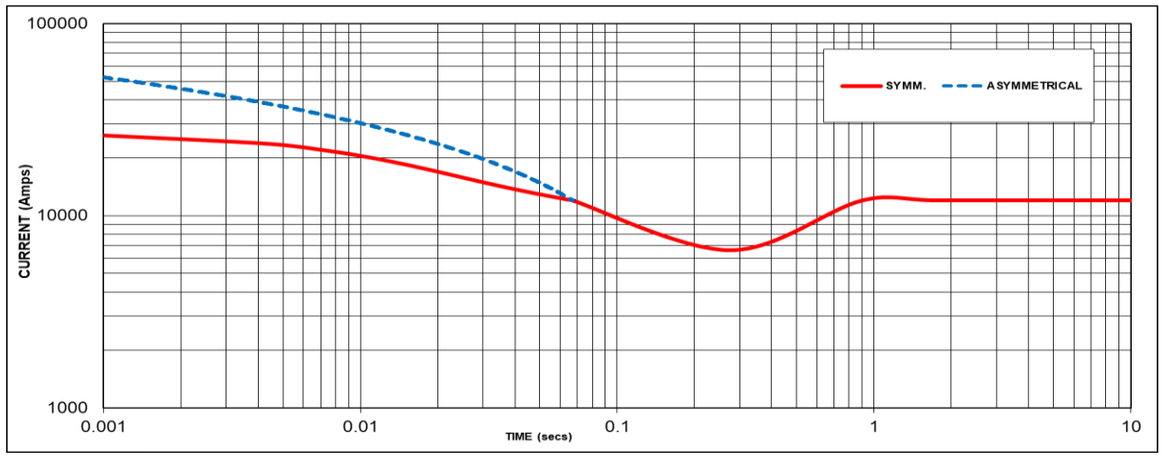
Note: To determine % Transient Voltage Dip or Voltage Rise at various PF, multiply the % Voltage Dip from the curve directly by the Scaling Factor.

STAMFORD

S9L1D-C4 Wdg.312

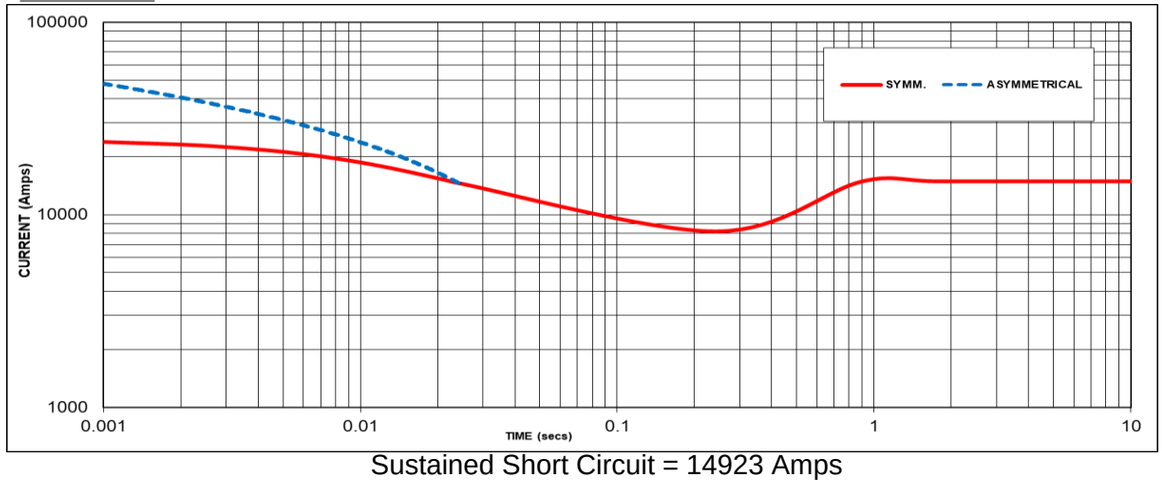
Three-phase Short Circuit Decrement Curve - Separately Excited

50Hz



Sustained Short Circuit = 12024 Amps

60Hz



Sustained Short Circuit = 14923 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.

All other times are unchanged

Note 3

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

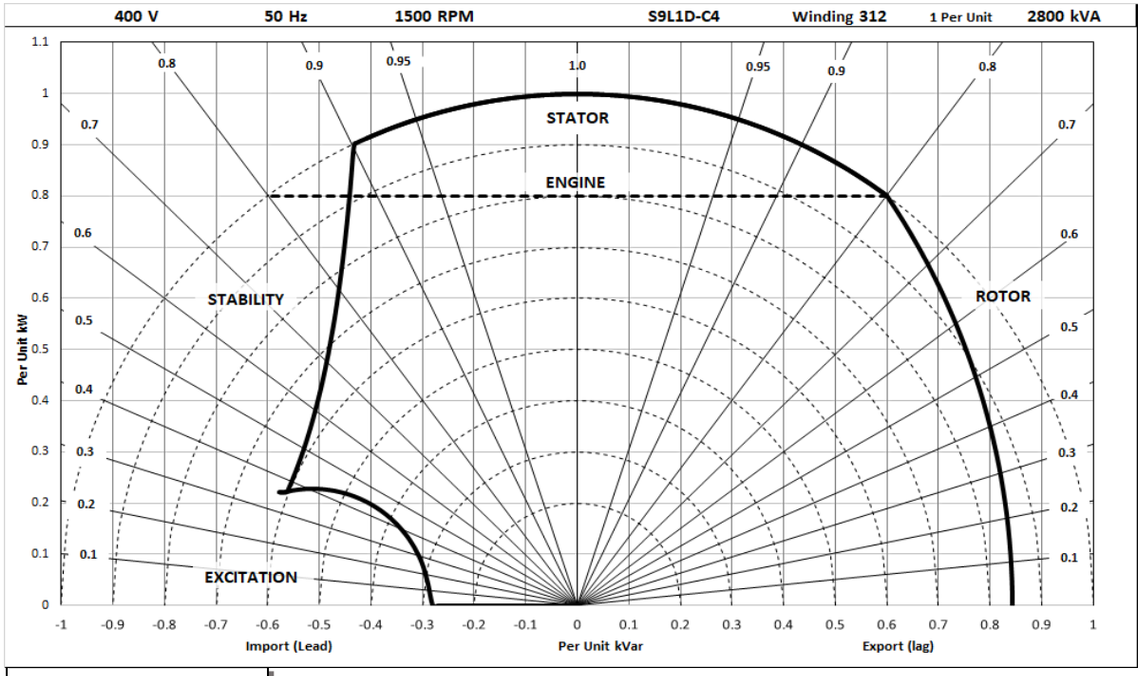
Series Delta = Curve current value X 1.732

STAMFORD

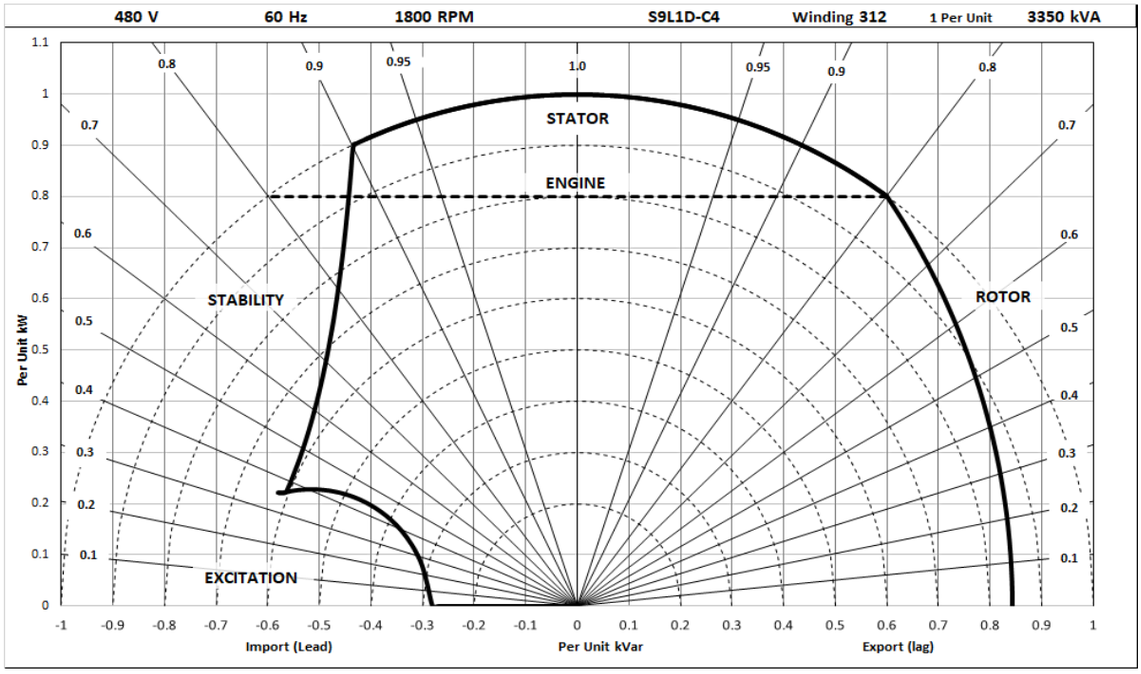
S9L1D-C4 Wdg.312

Typical Alternator Operating Charts

400V/50Hz



480V/60Hz



STAMFORD

S9L1D-C4 Wdg.312

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			
50 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	2835	2985	2985	2805	2650	2800	2800	2620	2430	2560	2560	2405	2125	2240	2240	2105
	kW	2268	2388	2388	2244	2120	2240	2240	2096	1944	2048	2048	1924	1700	1792	1792	1684
	Efficiency (%)	96.0	96.0	96.1	96.4	96.1	96.2	96.3	96.5	96.3	96.4	96.4	96.6	96.5	96.6	96.6	96.7
	kW Input	2363	2487	2484	2328	2205	2329	2327	2171	2018	2125	2124	1991	1762	1856	1855	1741

60 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	3105	3285	3435	3585	2900	3070	3210	3350	2665	2820	2947	3075	2325	2455	2569	2680
	kW	2484	2628	2748	2868	2320	2456	2568	2680	2132	2256	2358	2460	1860	1964	2055	2144
	Efficiency (%)	95.9	96.0	96.1	96.1	96.0	96.1	96.2	96.2	96.2	96.3	96.3	96.4	96.3	96.4	96.4	96.5
	kW Input	2590	2737	2861	2984	2415	2555	2670	2785	2217	2344	2448	2553	1932	2038	2131	2222

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.

Follow us @stamfordavk

Cummins Generator Technologies

View our videos at youtube.com/stamfordavk

stamford-avk.com

For Applications Support:
applications@cummins.com

For Customer Service:
emea.service@cummins.com

For General Enquiries:
Stamford-avk@cummins.com