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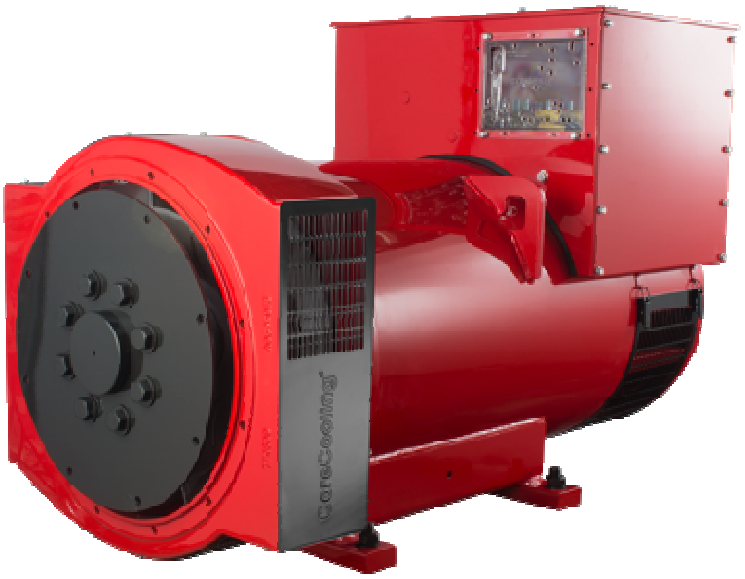
S4L1D-G41 Wdg.311 - Technical Data Sheet

Standards

Stamford industrial alternators meet the requirements of the relevant parts of the BS 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)	12-10
No Load Excitation Current (A)	0.7-0.6
Full Load Excitation Voltage (V)	48-45
Full Load Excitation Current (A)	2.6-2.4
Exciter Time Constant (seconds)	0.105

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Electrical Data

Insulation System	Class H							
Stator Winding	Double Layer Lap							
Winding Pitch	Two Thirds							
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	15.8292							
	50 Hz				**60 Hz**			
Telephone Interference	THF<2%				TIF<50			
Cooling Air	0.78 m³/sec				0.94 m³/sec			
Voltage Star	380	400	415	440	416	440	460	480
kVA Base Rating (Class H) for Reactance Values	430	450	450	430	500	535	540	560
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	3.39	3.20	2.97	2.53	3.96	3.79	3.50	3.33
X'd Dir. Axis Transient	0.18	0.17	0.16	0.13	0.20	0.19	0.18	0.17
X"d Dir. Axis Subtransient	0.11	0.10	0.09	0.08	0.13	0.12	0.11	0.11
Xq Quad. Axis Reactance	2.63	2.48	2.31	1.96	3.07	2.93	2.71	2.58
X"q Quad. Axis Subtransient	0.32	0.30	0.28	0.24	0.37	0.36	0.33	0.31
XL Stator Leakage Reactance	0.09	0.09	0.08	0.07	0.10	0.10	0.09	0.09
X2 Negative Sequence Reactance	0.19	0.18	0.17	0.15	0.22	0.21	0.19	0.19
X0 Zero Sequence Reactance	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	4.07	3.84	3.57	3.03	4.75	4.54	4.20	4.00
X'd Dir. Axis Transient	0.20	0.19	0.18	0.15	0.23	0.22	0.20	0.19
X"d Dir. Axis Subtransient	0.13	0.12	0.11	0.09	0.15	0.14	0.13	0.13
Xq Quad. Axis Reactance	2.71	2.56	2.38	2.02	3.16	3.02	2.79	2.66
X"q Quad. Axis Subtransient	0.38	0.36	0.34	0.29	0.45	0.43	0.39	0.38
XL Stator Leakage Reactance	0.10	0.10	0.09	0.08	0.12	0.11	0.10	0.10
Xlr Rotor Leakage Reactance	0.11	0.11	0.10	0.09	0.13	0.13	0.12	0.11
X2 Negative Sequence Reactance	0.23	0.22	0.21	0.17	0.26	0.25	0.23	0.22
X0 Zero Sequence Reactance	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03

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Time Constants (Seconds)		
T'd TRANSIENT TIME CONST.	0.068	
T''d SUB-TRANSTIME CONST.	0.014	
T'do O.C. FIELD TIME CONST.	2.1	
Ta ARMATURE TIME CONST.	0.016	
T''q SUB-TRANSTIME CONST.	0.0092	
Resistances in Ohms (Ω) at 22^{0}C		
Stator Winding Resistance (Ra), per phase for series connected	0.0066	
Rotor Winding Resistance (Rf)	1.44	
Exciter Stator Winding Resistance	18	
Exciter Rotor Winding Resistance per phase	0.068	
PMG Phase Resistance (Rpmg) per phase	1.9	
Positive Sequence Resistance (R1)	0.00825	
Negative Sequence Resistance (R2)	0.009504	
Zero Sequence Resistance (R0)	0.00825	
Saturation Factors	400V	480V
SG1.0	0.24	0.24
SG1.2	0.99	0.99
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 Bearings
SAE Adaptor	SAE 0.5, 1	N/A
Moment of Inertia	5.6754kgm^2	N/A
Weight Wound Stator	561kg	N/A
Weight Wound Rotor	482kg	N/A
Weight Complete Alternator	1190kg	N/A
Shipping weight in a Crate	1260kg	N/A
Packing Crate Size	155 x 87 x 107 (cm)	N/A
Maximum Over Speed	2250 RPM for two minutes	
Bearing Drive End	N/A	N/A
Bearing Non-Drive End	Ball 6314	N/A

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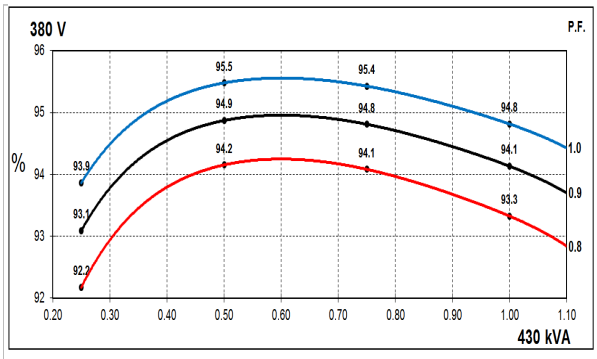
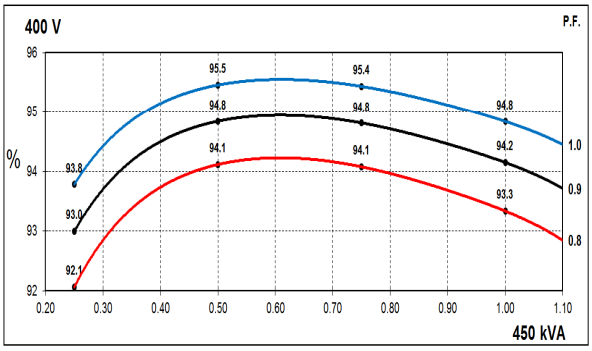
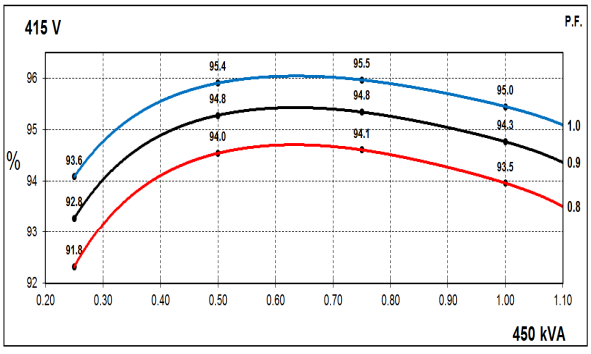
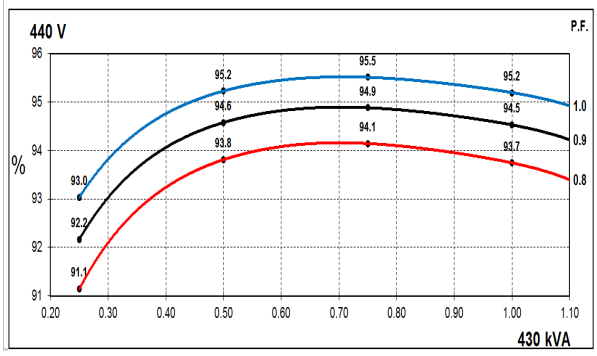
THREE PHASE EFFICIENCY CURVES

50Hz

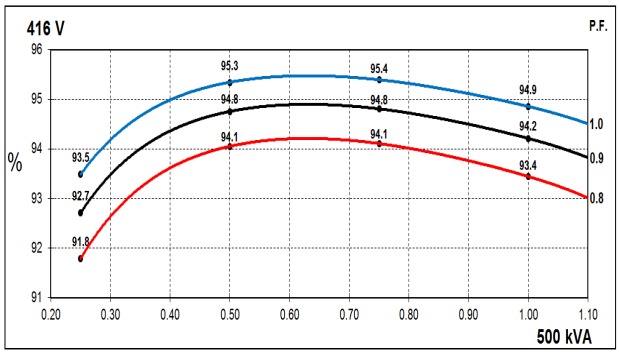


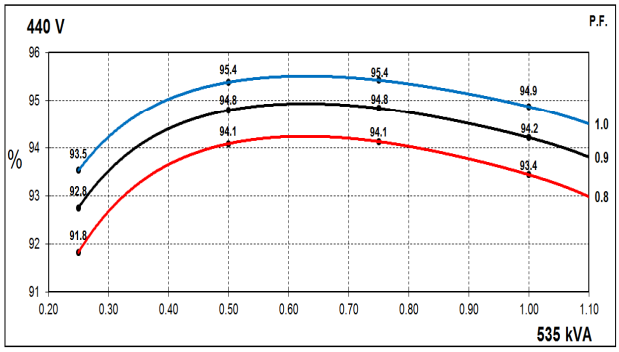


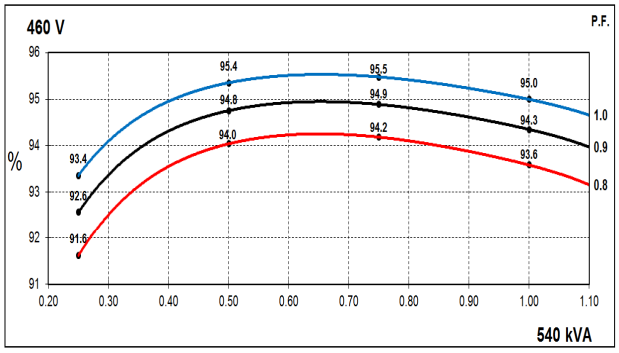


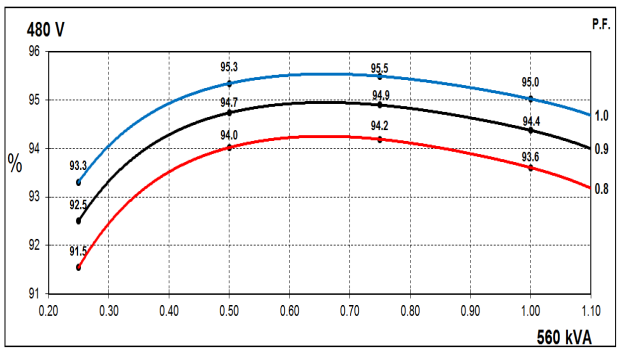


60Hz









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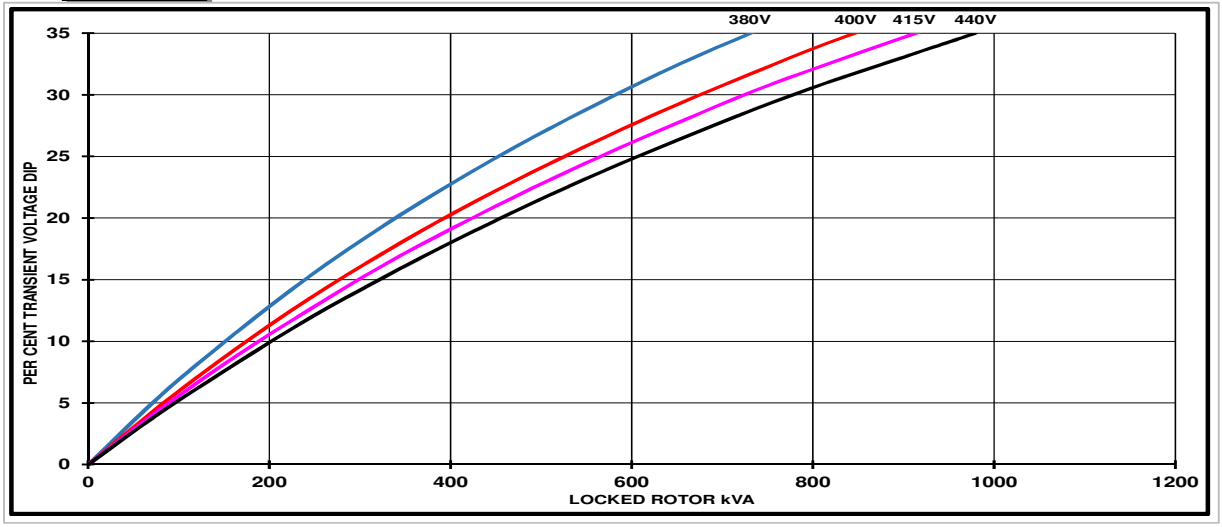
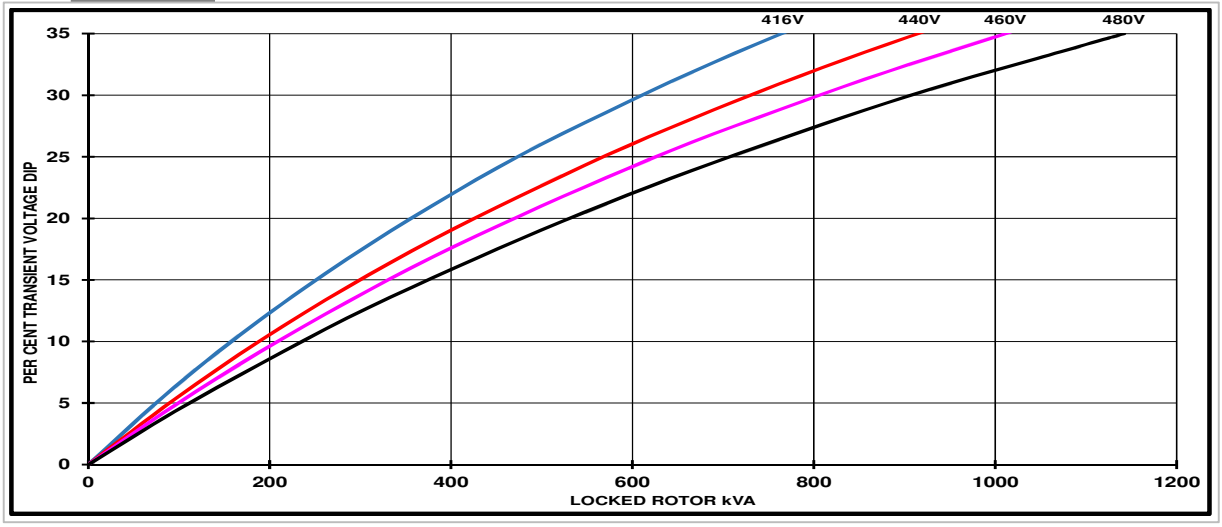
Locked Rotor Motor Starting Curves - Separately Excited

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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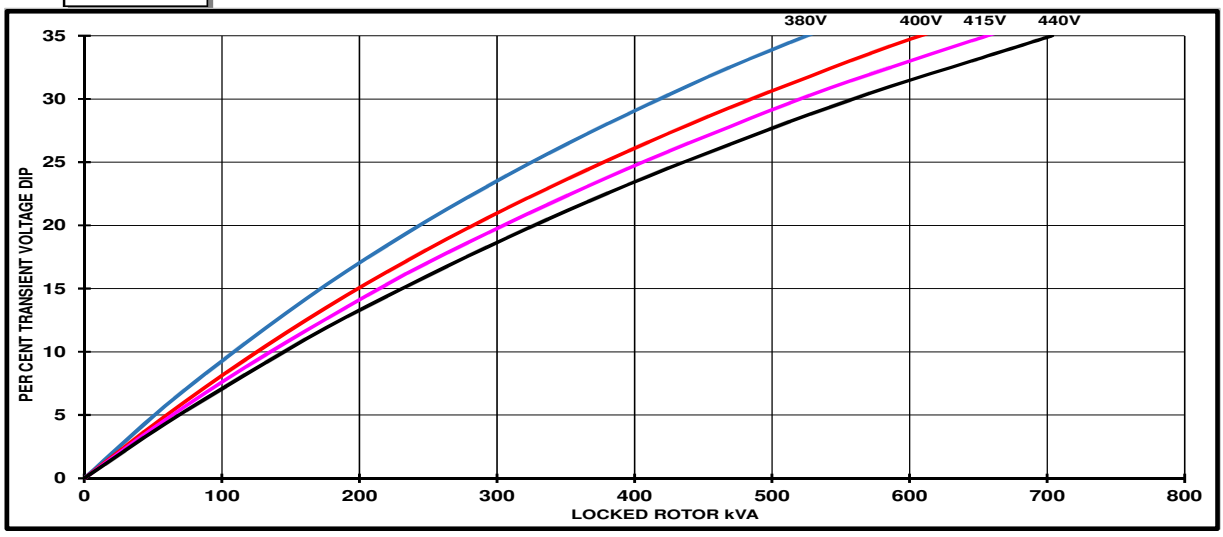
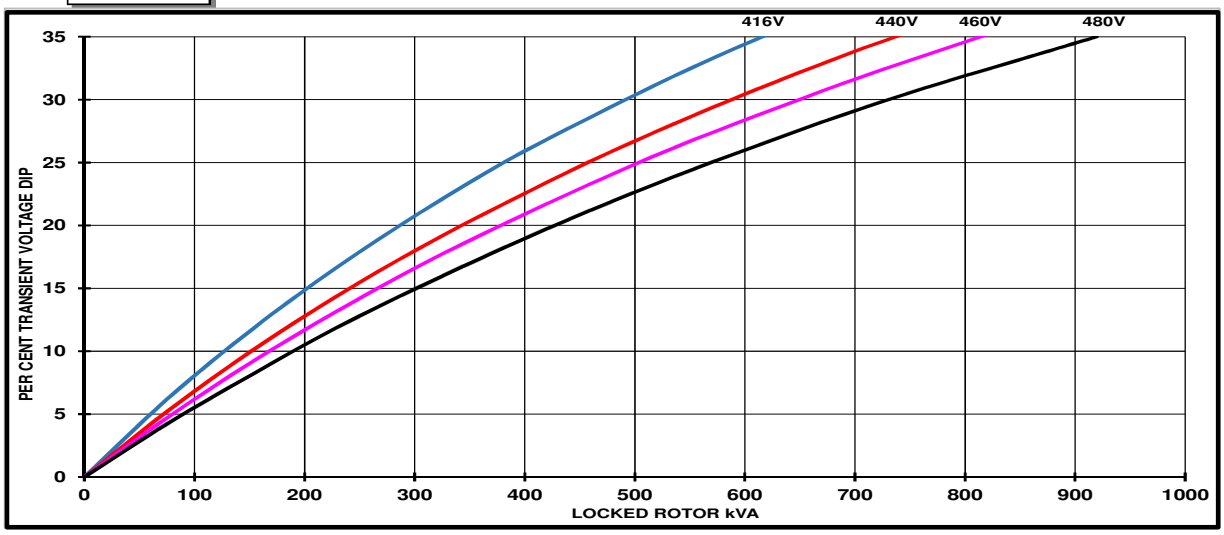
Locked Rotor Motor Starting Curves - Self Excited

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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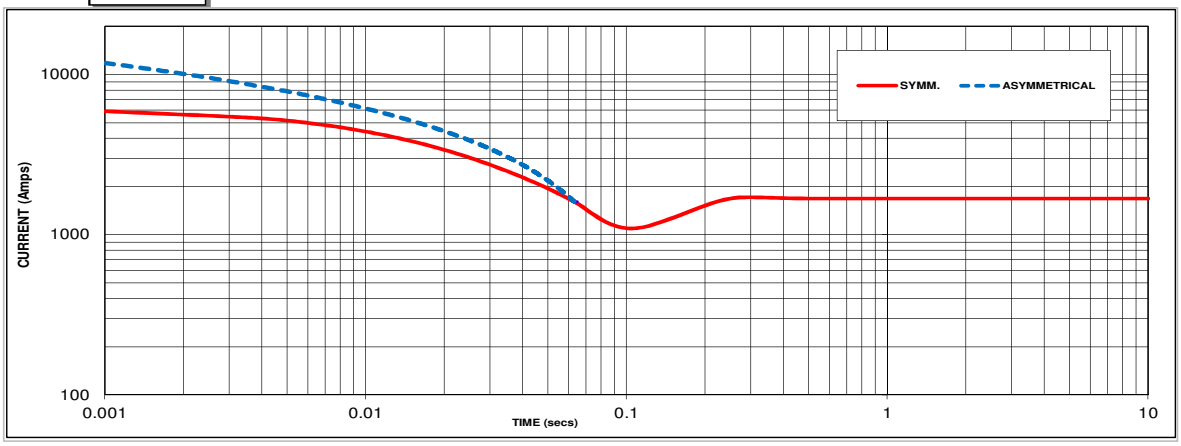
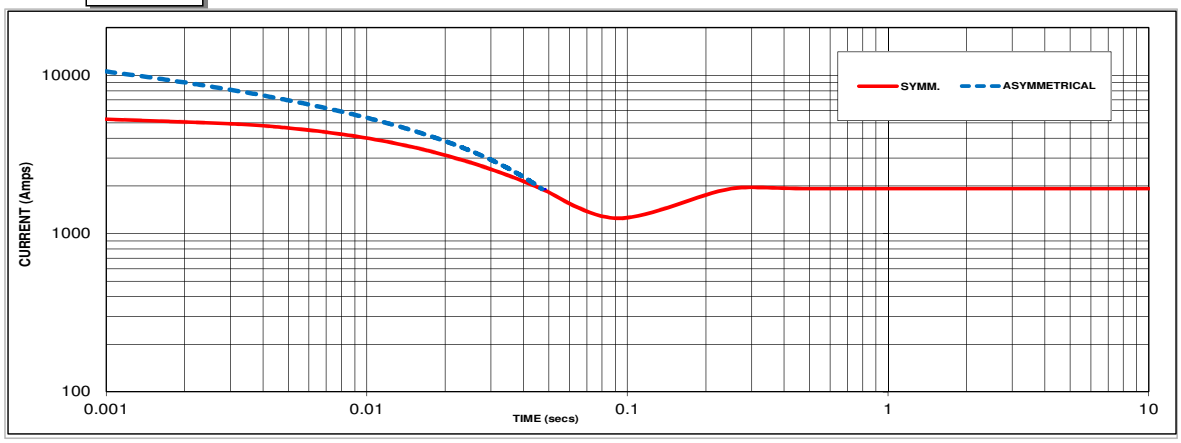
Three-phase Short Circuit Decrement Curve

50Hz



Sustained Short Circuit = 1680 Amps

60Hz



Sustained Short Circuit = 1920 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 1.10
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.

All other times are unchanged

Note 3
Curves are drawn for Star connected machines under no-load excitation at rated speeds. For other connection 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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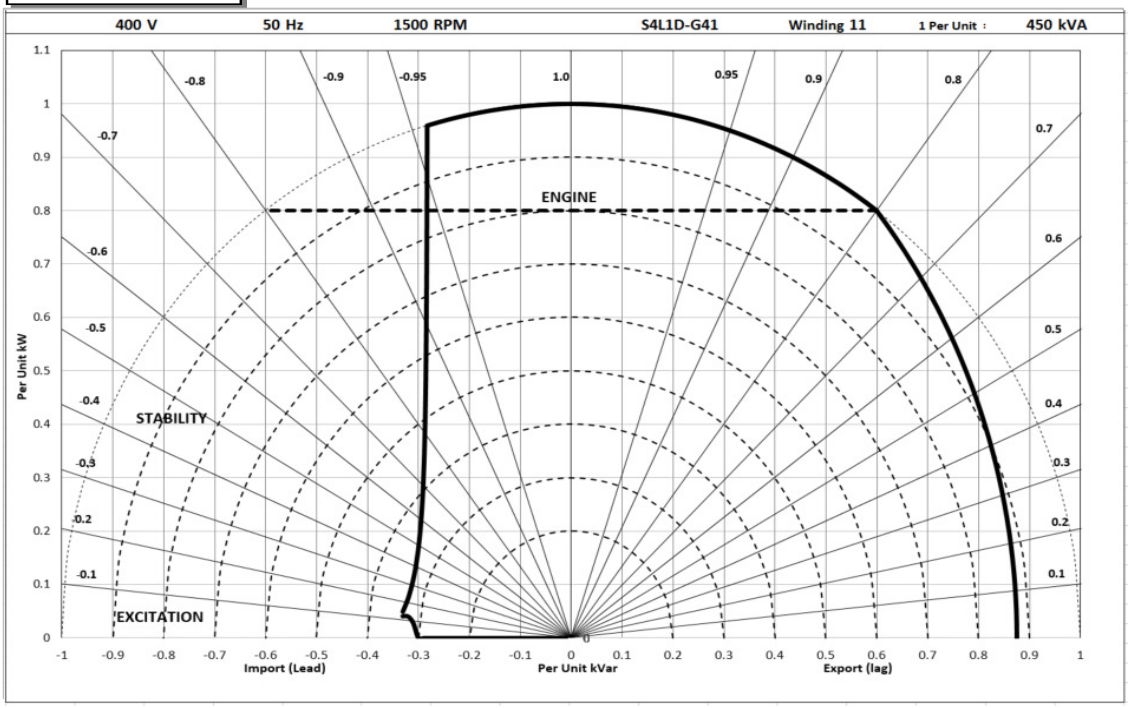
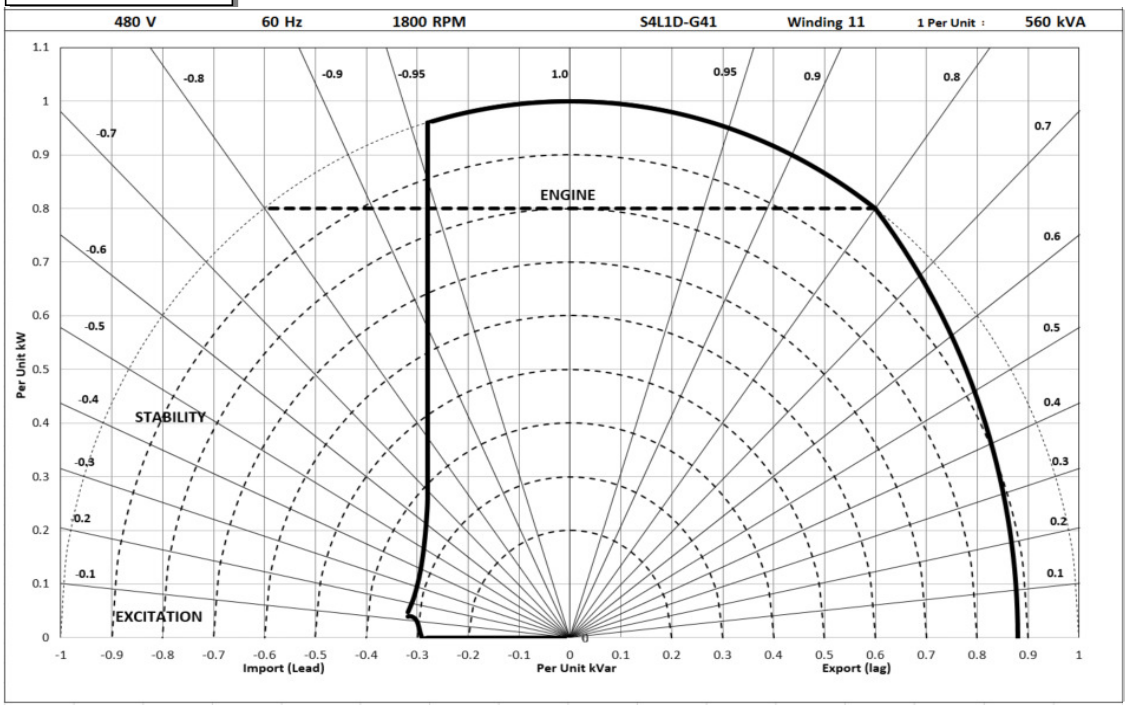
Typical Alternator Operating Charts

400V/50Hz



480V/60Hz



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RATINGS AT 0.8 POWER FACTOR

	Class - Temp Rise	Standby - 163/27℃				Standby - 150/40℃				Cont. H - 125/40℃				Cont. F - 105/40℃			
50 Hz	Series Star (V)	380	400	415	440	380	400	415	440	380	400	415	440	380	400	415	440
	kVA	475	500	500	475	455	480	480	455	430	450	450	430	390	410	410	390
	kW	380	400	400	380	364	384	384	364	344	360	360	344	312	328	328	312
	Efficiency (%)	92.9	92.8	93.0	93.4	93.1	93.0	93.2	93.6	93.3	93.3	93.5	93.7	93.7	93.7	93.8	94.0
	kW Input	409	431	430	407	391	413	412	389	369	386	385	367	333	350	350	332

60 Hz	Series Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	kVA	565	600	600	625	535	575	575	600	500	535	540	560	455	485	490	510
	kW	452	480	480	500	428	460	460	480	400	428	432	448	364	388	392	408
	Efficiency (%)	92.9	92.9	93.1	93.1	93.2	93.1	93.3	93.3	93.4	93.4	93.6	93.6	93.7	93.8	93.9	93.9
	kW Input	487	517	515	537	459	494	493	514	428	458	462	479	388	414	418	435

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℃ by which the operational ambient temperature exceeds 40℃
- For any other operating conditions impacting the cooling circuit please refer to applications

Note: Requirement for operating in an ambient exceeding 60℃ and altitude exceeding 4000 meters 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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