

S4L1D-F41 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
Excitation Type	Self-Excited	PMG	PMG		

No Load Excitation Voltage (V)	10 - 8
No Load Excitation Current (A)	0.55 - 0.44
Full Load Excitation Voltage (V)	41 - 37.5
Full Load Excitation Current (A)	2.3 - 2.1
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	13.7389							
	50 Hz				60 Hz			
Telephone Interference	THF<2%				TIF<50			
Cooling Air	0.76 m³/sec				0.92 m³/sec			
Voltage Star	380	400	415	440	416	440	460	480
kVA Base Rating (Class H) for Reactance Values	400	415	415	400	455	500	500	520
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	2.71	2.54	2.36	2.02	3.28	3.23	2.95	2.82
X'd Dir. Axis Transient	0.18	0.17	0.16	0.13	0.18	0.18	0.16	0.16
X''d Dir. Axis Subtransient	0.13	0.13	0.12	0.10	0.13	0.13	0.12	0.11
Xq Quad. Axis Reactance	2.34	2.19	2.03	1.74	2.90	2.84	2.60	2.49
X''q Quad. Axis Subtransient	0.31	0.29	0.27	0.23	0.42	0.42	0.38	0.36
XL Stator Leakage Reactance	0.06	0.05	0.05	0.04	0.07	0.07	0.07	0.06
X2 Negative Sequence Reactance	0.22	0.21	0.20	0.17	0.29	0.29	0.26	0.25
X0 Zero Sequence Reactance	0.09	0.08	0.08	0.07	0.10	0.10	0.09	0.08
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	3.26	3.05	2.83	2.43	3.94	3.87	3.54	3.38
X'd Dir. Axis Transient	0.21	0.19	0.18	0.15	0.21	0.21	0.19	0.18
X''d Dir. Axis Subtransient	0.16	0.15	0.14	0.12	0.16	0.15	0.14	0.13
Xq Quad. Axis Reactance	2.41	2.26	2.10	1.80	2.98	2.93	2.68	2.56
X''q Quad. Axis Subtransient	0.37	0.35	0.32	0.28	0.51	0.50	0.46	0.44
XL Stator Leakage Reactance	0.06	0.06	0.05	0.05	0.08	0.08	0.07	0.07
Xlr Rotor Leakage Reactance	0.10	0.09	0.09	0.07	0.11	0.11	0.10	0.10
X2 Negative Sequence Reactance	0.27	0.25	0.23	0.20	0.35	0.34	0.31	0.30
X0 Zero Sequence Reactance	0.10	0.10	0.09	0.08	0.11	0.11	0.10	0.10

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Time Constants (Seconds)		
T'd TRANSIENT TIME CONST.		0.08
T''d SUB-TRANSTIME CONST.		0.019
T'do O.C. FIELD TIME CONST.		1.7
Ta ARMATURE TIME CONST.		0.018
T''q SUB-TRANSTIME CONST.		0.08
Resistances in Ohms (Ω) at 22°C		
Stator Winding Resistance (Ra), per phase for series connected		0.0073
Rotor Winding Resistance (Rf)		1.37
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)		0.009125
Negative Sequence Resistance (R2)		0.010512
Zero Sequence Resistance (R0)		0.009125
Saturation Factors	400V	480V
SG1.0	0.36	0.38
SG1.2	1.46	1.52
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	5.4292kgm ²	N/A
Weight Wound Stator	535kg	N/A
Weight Wound Rotor	463kg	N/A
Weight Complete Alternator	1160kg	N/A
Shipping weight in a Crate	1230kg	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

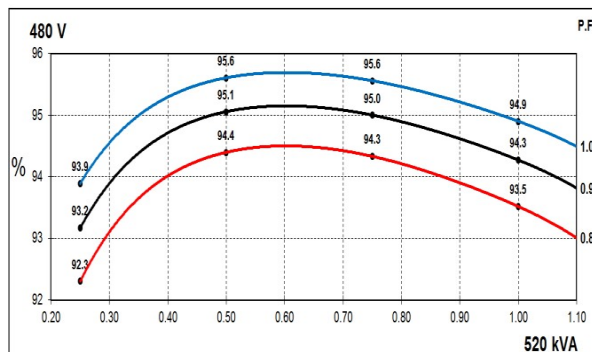
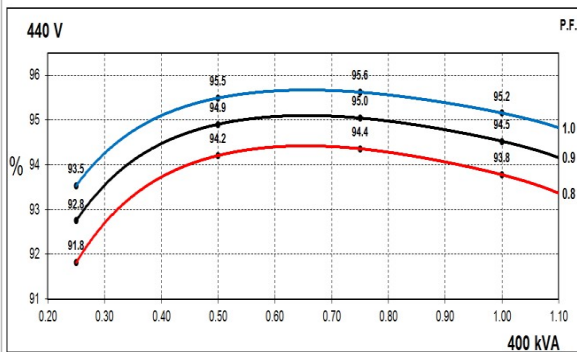
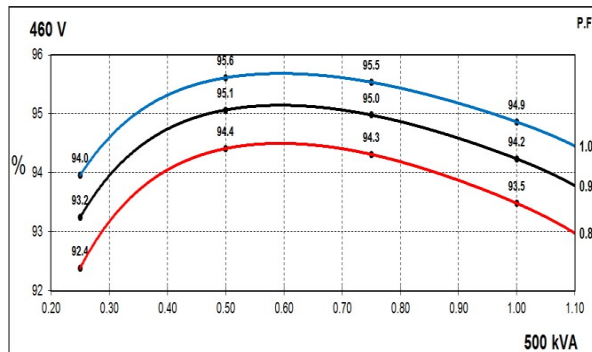
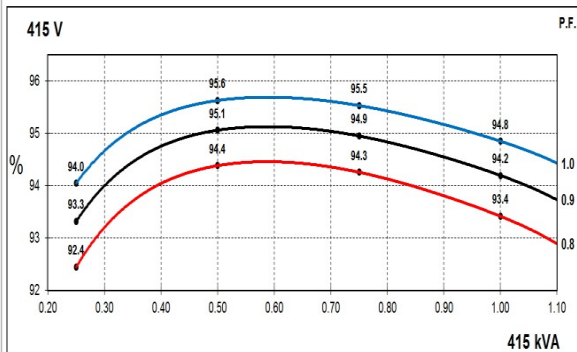
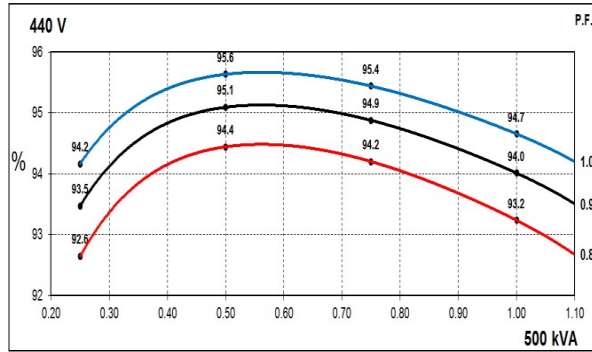
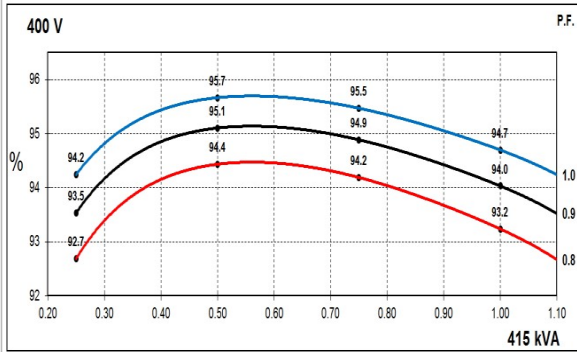
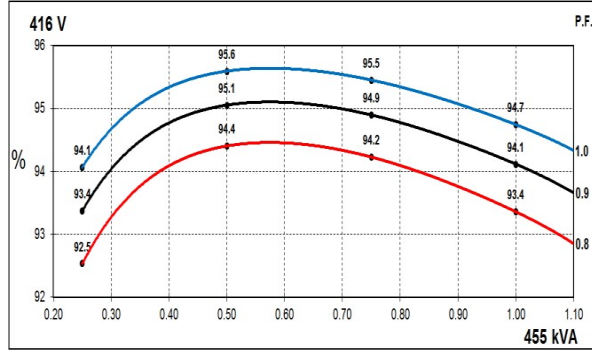
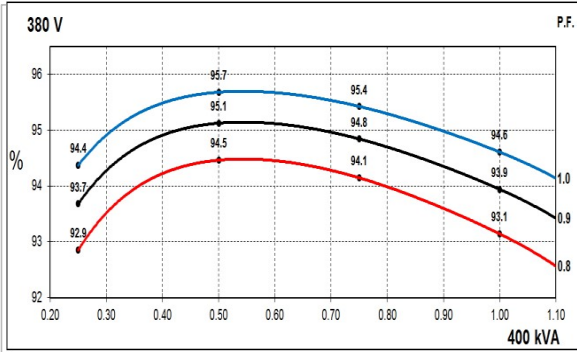
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THREE PHASE EFFICIENCY CURVES

50Hz

60Hz

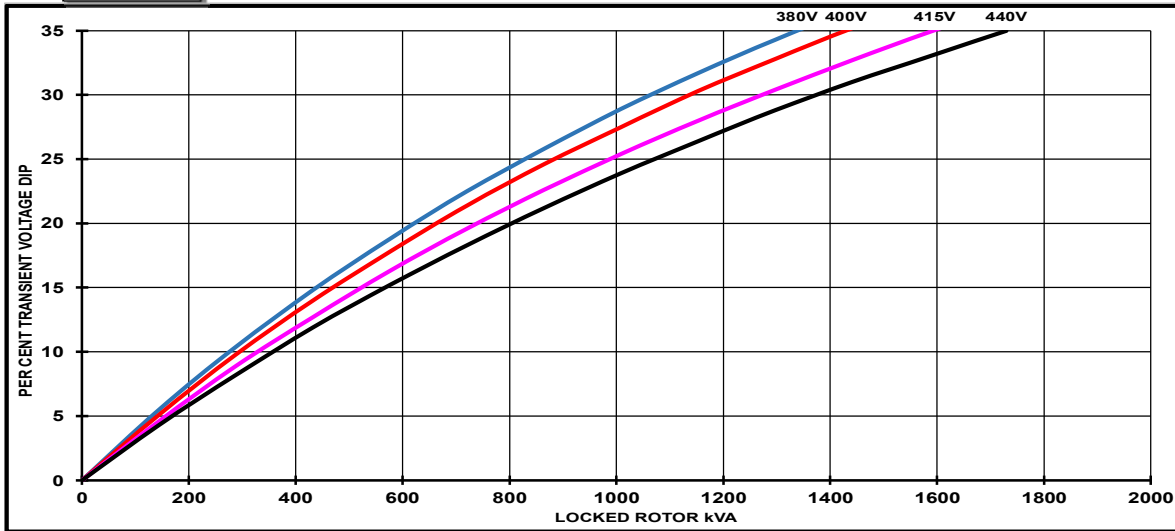


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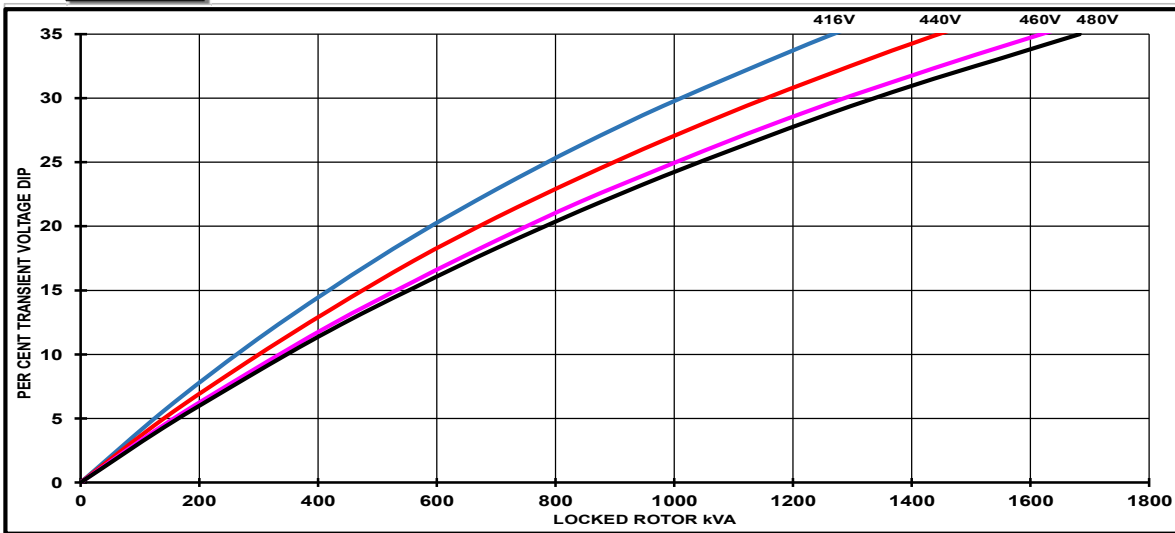
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Locked Rotor Motor Starting Curves - Separately Excited

50Hz



60Hz



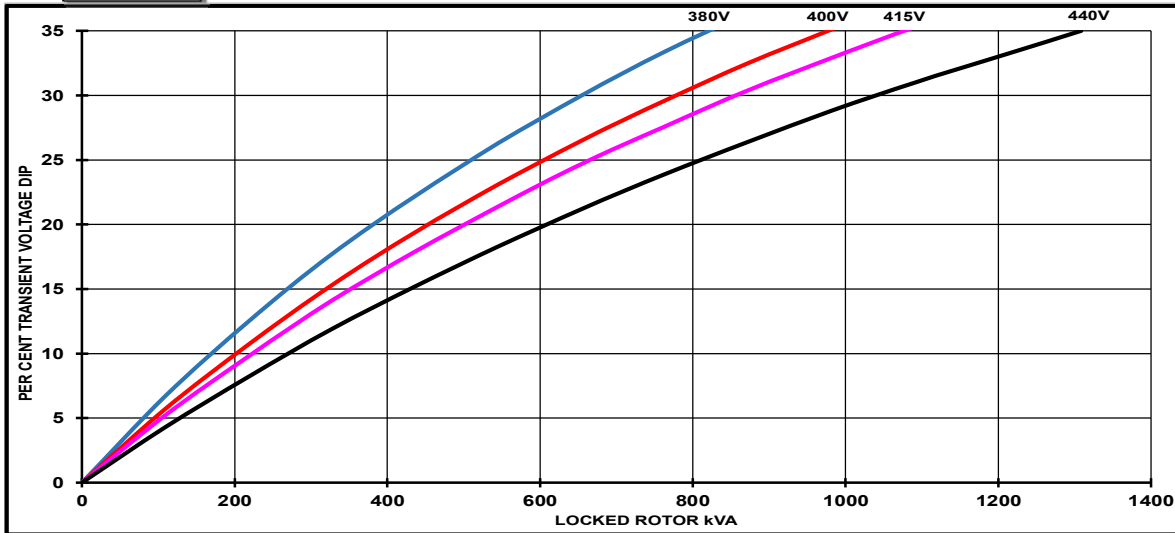
Transient Voltage Dip Scaling Factor		Transient Voltage Rise Scaling Factor
PF	Factor	
< 0.5	1	For voltage rise multiply voltage dip by 1.25
0.5	0.97	
0.6	0.93	
0.7	0.9	
0.8	0.85	
0.9	0.83	

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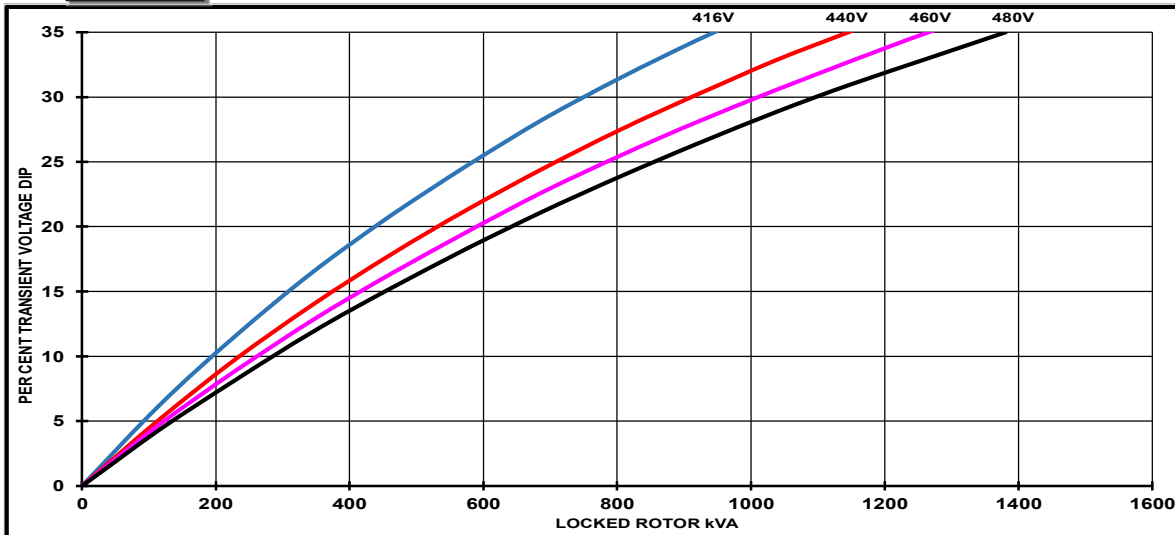
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Locked Rotor Motor Starting Curves - Self Excited

50Hz



60Hz



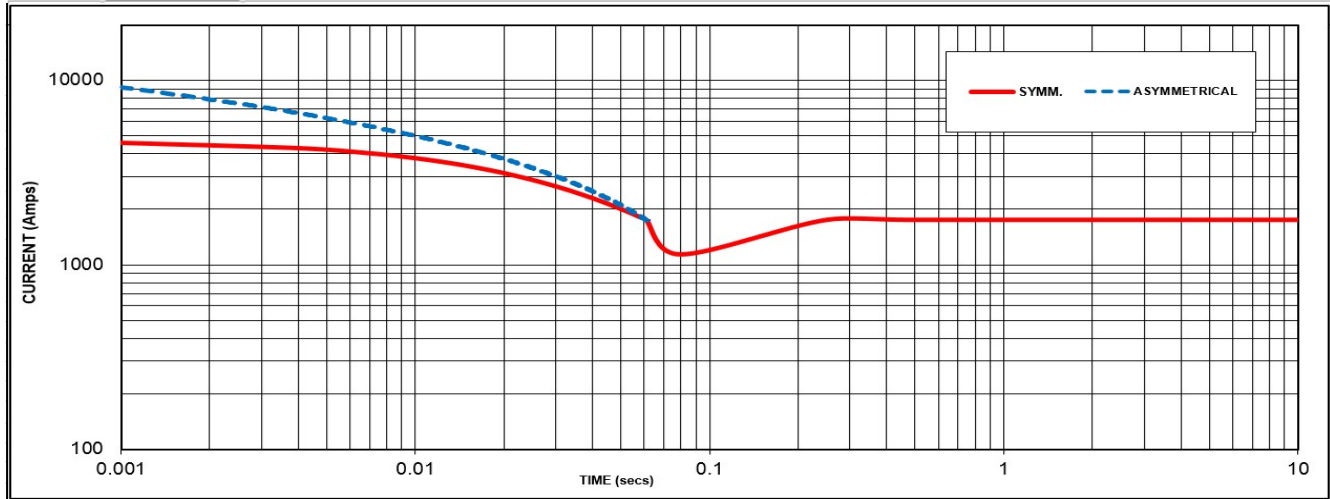
Transient Voltage Dip Scaling Factor		Transient Voltage Rise Scaling Factor
PF	Factor	
< 0.5	1	For voltage rise multiply voltage dip by 1.25
0.5	0.97	
0.6	0.93	
0.7	0.9	
0.8	0.85	
0.9	0.83	

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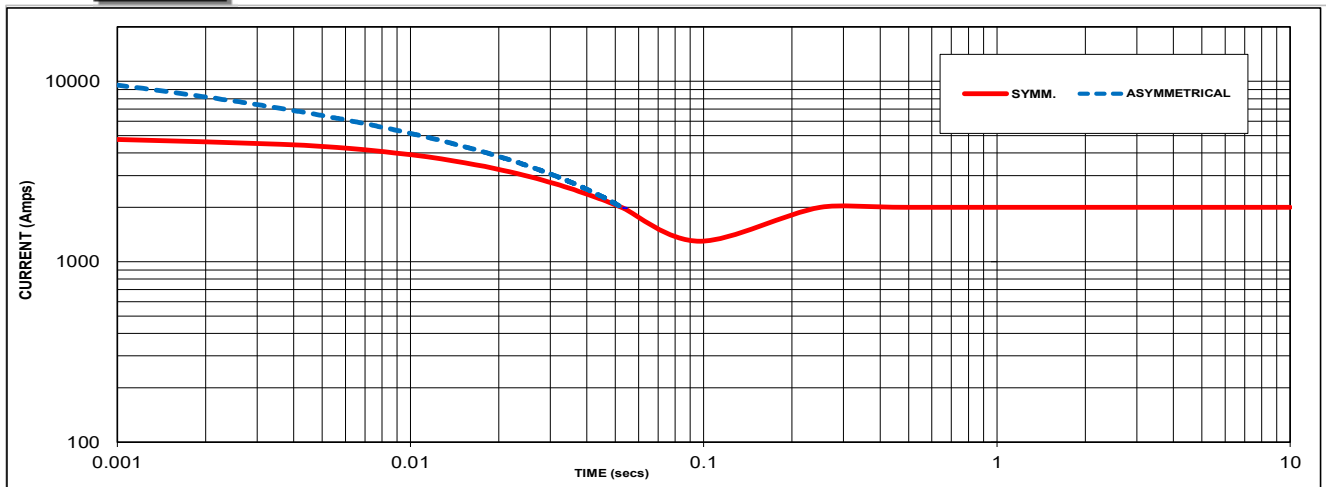
Three-phase Short Circuit Decrement Curve

50Hz



Sustained Short Circuit = 1750 Amps

60Hz



Sustained Short Circuit = 2000 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

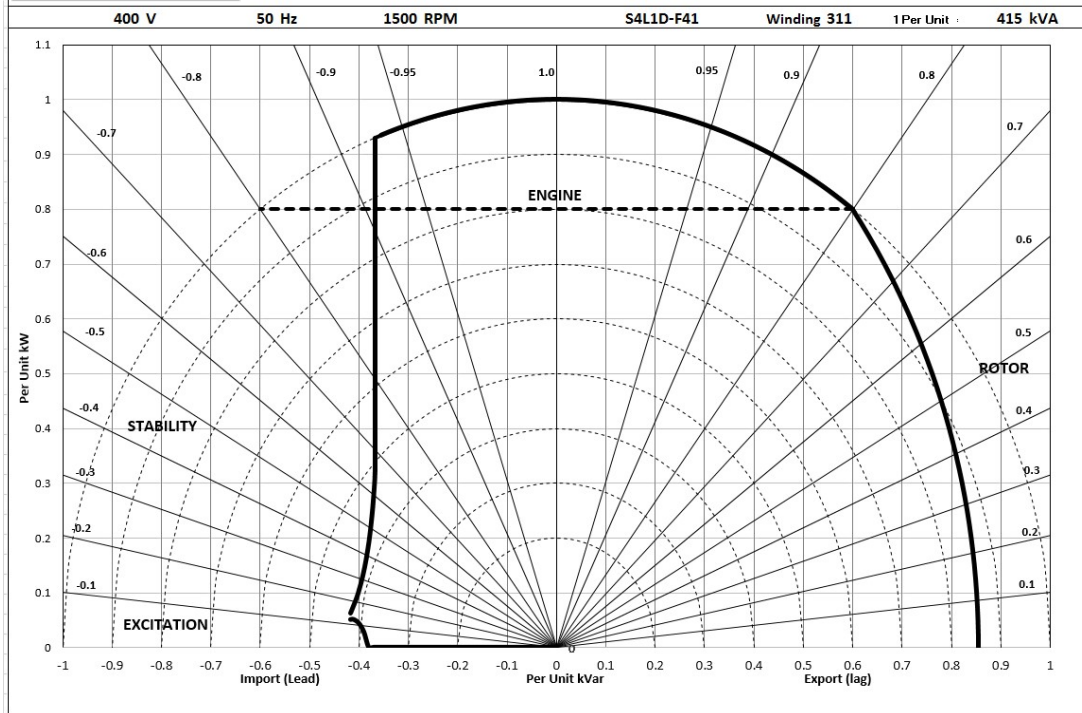
Series Delta = Curve current value X 1.732

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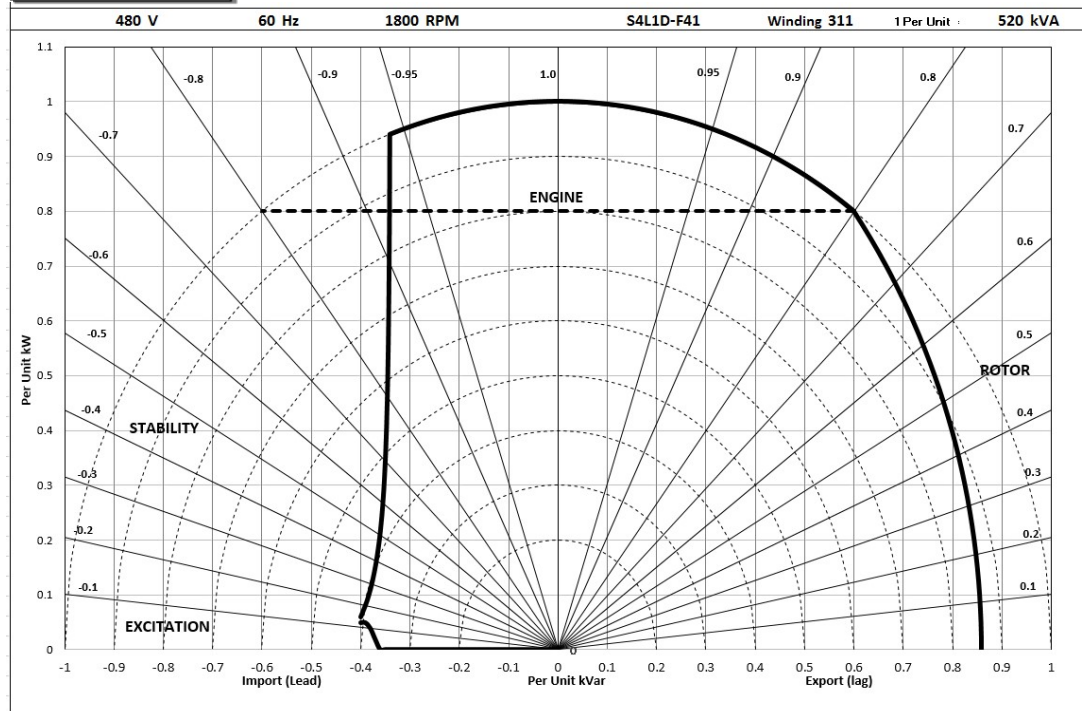
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Typical Alternator Operating Charts

400V/50Hz



480V/60Hz



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RATINGS AT 0.8 POWER FACTOR

Class - Temp Rise		Standby - 163/27°C				Standby - 150/40°C				Cont. H - 125/40°C				Cont. F - 105/40°C			
50 Hz	Series Star (V)	380	400	415	440	380	400	415	440	380	400	415	440	380	400	415	440
	kVA	425	465	455	440	415	445	445	430	400	415	415	400	370	380	380	370
	kW	340	372	364	352	332	356	356	344	320	332	332	320	296	304	304	296
	Efficiency (%)	92.8	92.6	92.9	93.4	92.9	92.9	93.1	93.5	93.1	93.2	93.4	93.8	93.5	93.6	93.8	94.0
	kW Input	366	402	392	377	357	383	383	368	344	356	355	341	317	325	324	315

60 Hz	Series Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	kVA	500	550	550	575	485	535	535	555	455	500	500	520	420	465	465	480
	kW	400	440	440	460	388	428	428	444	364	400	400	416	336	372	372	384
	Efficiency (%)	92.9	92.7	93.0	93.0	93.0	92.9	93.2	93.2	93.4	93.2	93.5	93.5	93.7	93.6	93.8	93.8
	kW Input	431	475	473	495	417	461	459	476	390	429	428	445	359	398	397	409

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
- 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 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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For Applications Support:
applications@cummins.com

For Customer Service:
service-engineers@stamford-avk.com

For General Enquiries:
info@cumminsgeneratortechnologies.com

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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	13.74							
	50 Hz				60 Hz			
Telephone Interference	THF<2%				TIF<50			
Cooling Air	0.76 m³/sec				0.92 m³/sec			
Voltage Star	380	400	415	440	416	440	460	480
kVA Base Rating (Class H) for Reactance Values	400	415	415	400	455	500	500	520
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	2.71	2.54	2.36	2.02	3.09	3.03	2.78	2.65
X'd Dir. Axis Transient	0.18	0.17	0.16	0.13	0.20	0.20	0.18	0.17
X''d Dir. Axis Subtransient	0.13	0.13	0.12	0.10	0.15	0.15	0.14	0.13
Xq Quad. Axis Reactance	2.34	2.19	2.03	1.74	2.66	2.62	2.39	2.29
X''q Quad. Axis Subtransient	0.31	0.29	0.27	0.23	0.35	0.35	0.32	0.30
XL Stator Leakage Reactance	0.06	0.05	0.05	0.04	0.06	0.06	0.06	0.05
X2 Negative Sequence Reactance	0.22	0.21	0.20	0.17	0.26	0.25	0.23	0.22
X0 Zero Sequence Reactance	0.09	0.08	0.08	0.07	0.10	0.10	0.09	0.09
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	3.26	3.05	2.83	2.43	3.71	3.64	3.33	3.18
X'd Dir. Axis Transient	0.21	0.20	0.19	0.16	0.24	0.24	0.22	0.21
X''d Dir. Axis Subtransient	0.16	0.15	0.14	0.12	0.18	0.18	0.16	0.16
Xq Quad. Axis Reactance	2.81	2.63	2.44	2.09	3.20	3.14	2.87	2.74
X''q Quad. Axis Subtransient	0.37	0.35	0.32	0.28	0.42	0.42	0.38	0.36
XL Stator Leakage Reactance	0.07	0.06	0.06	0.05	0.08	0.07	0.07	0.07
Xlr Rotor Leakage Reactance	0.10	0.09	0.09	0.07	0.10	0.09	0.09	0.08
X2 Negative Sequence Reactance	0.27	0.25	0.23	0.20	0.31	0.30	0.28	0.26
X0 Zero Sequence Reactance	0.10	0.10	0.09	0.08	0.12	0.12	0.11	0.10