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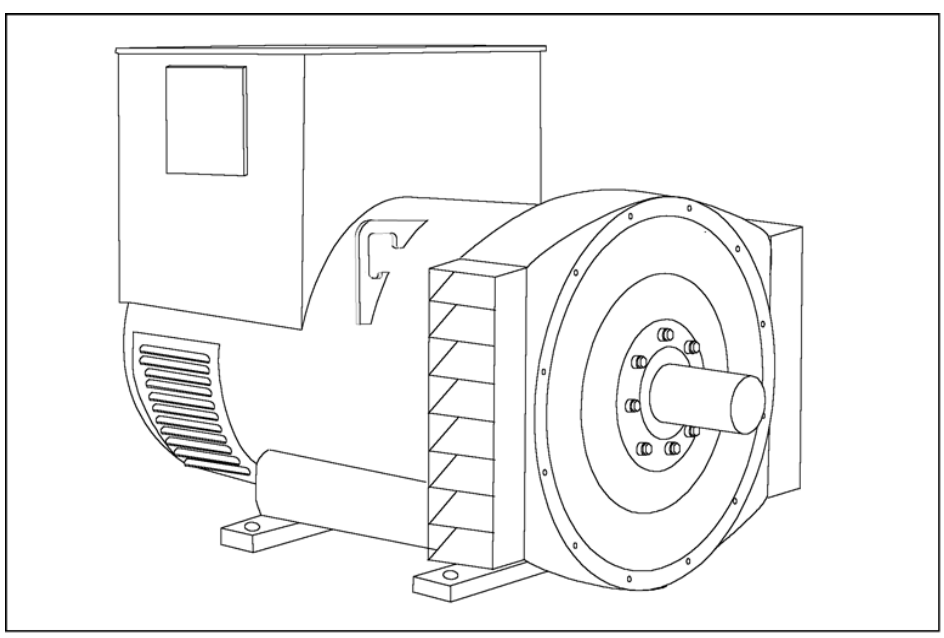
S4L1M-F4 Wdg.311 - Technical Data Sheet

Standards

STAMFORD industrial alternators meet the requirements of the relevant parts of the IEC 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	MX341	MX321			
Voltage Regulation	± 1%	± 0.5%			with 4% Engine Governing
Excitation Type	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	0.8 m³/sec				0.99 m³/sec			
Voltage Star	380	400	415	440	416	440	460	480
kVA Base Rating (Class H) for Reactance Values	340	340	340	340	395	405	415	425
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	2.32	2.09	1.94	1.73	2.85	2.61	2.45	2.30
X'd Dir. Axis Transient	0.16	0.14	0.13	0.12	0.16	0.15	0.14	0.13
X''d Dir. Axis Subtransient	0.11	0.10	0.09	0.08	0.11	0.10	0.10	0.09
Xq Quad. Axis Reactance	1.99	1.80	1.67	1.49	2.51	2.30	2.16	2.03
X''q Quad. Axis Subtransient	0.27	0.24	0.22	0.20	0.37	0.34	0.32	0.30
XL Stator Leakage Reactance	0.06	0.05	0.05	0.04	0.06	0.06	0.05	0.05
X2 Negative Sequence Reactance	0.19	0.17	0.16	0.14	0.25	0.23	0.21	0.20
X0 Zero Sequence Reactance	0.07	0.06	0.06	0.05	0.09	0.08	0.07	0.07
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	2.78	2.51	2.33	2.07	3.42	3.13	2.93	2.76
X'd Dir. Axis Transient	0.18	0.16	0.15	0.13	0.18	0.17	0.16	0.15
X''d Dir. Axis Subtransient	0.13	0.12	0.11	0.10	0.13	0.12	0.11	0.11
Xq Quad. Axis Reactance	2.05	1.85	1.72	1.53	2.59	2.37	2.22	2.09
X''q Quad. Axis Subtransient	0.32	0.29	0.27	0.24	0.45	0.41	0.38	0.36
XL Stator Leakage Reactance	0.06	0.06	0.05	0.05	0.07	0.06	0.06	0.06
Xlr Rotor Leakage Reactance	0.10	0.09	0.08	0.07	0.12	0.11	0.10	0.09
X2 Negative Sequence Reactance	0.23	0.20	0.19	0.17	0.30	0.27	0.26	0.24
X0 Zero Sequence Reactance	0.08	0.07	0.07	0.06	0.10	0.09	0.09	0.08

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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.	0.0304

Resistances in Ohms (Ω) at 22^{0}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, 0.5, 1, 2, 3	SAE 0, 0.5, 1, 2
Moment of Inertia	5.4292kgm^2	5.2304kgm^2
Weight Wound Stator	535kg	535kg
Weight Wound Rotor	463kg	440kg
Weight Complete Alternator	1160kg	1160kg
Shipping weight in a Crate	1230kg	1230kg
Packing Crate Size	155 x 87 x 107 (cm)	155 x 87 x 107 (cm)
Maximum Over Speed	2250 RPM for two minutes	
Bearing Drive End	N/A	Ball 6317
Bearing Non-Drive End	Ball 6314	Ball 6314

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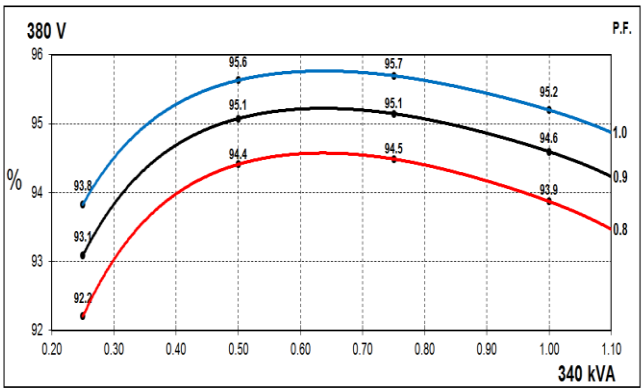
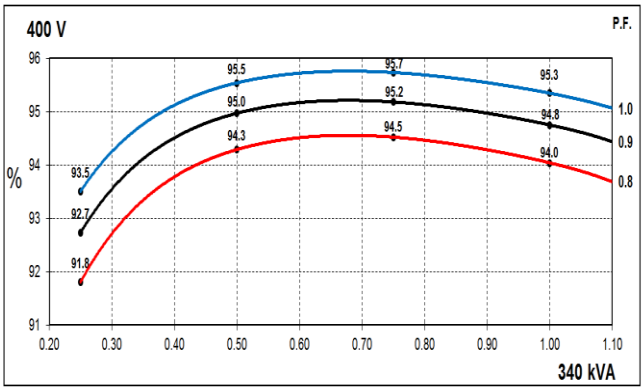
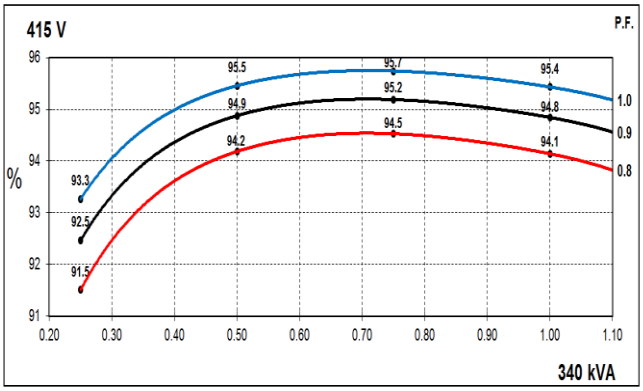
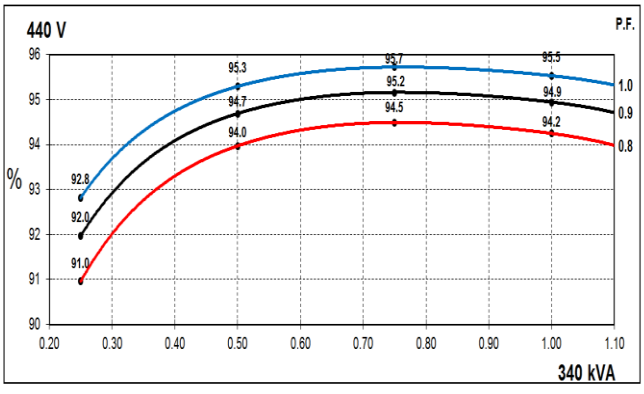
THREE PHASE EFFICIENCY CURVES

50Hz

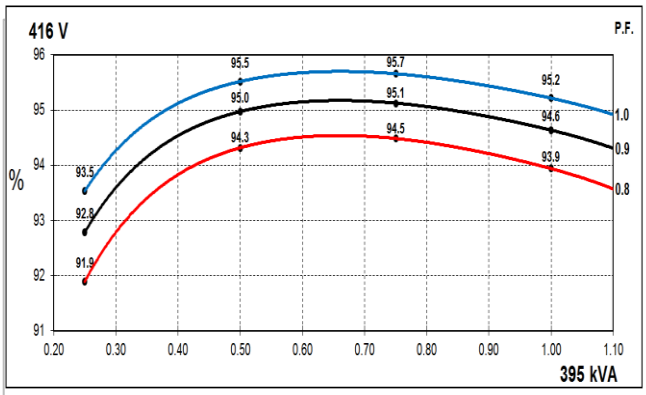


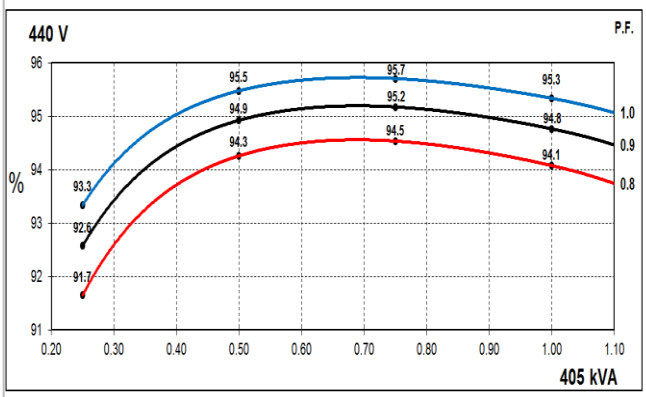


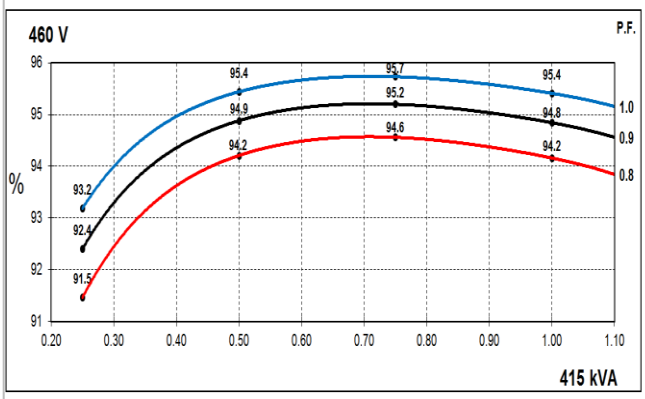


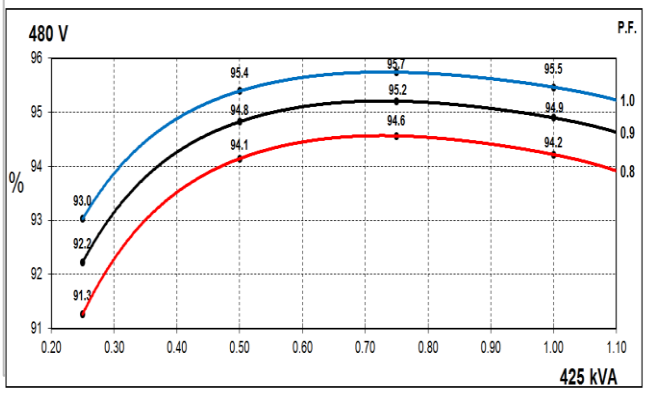


60Hz









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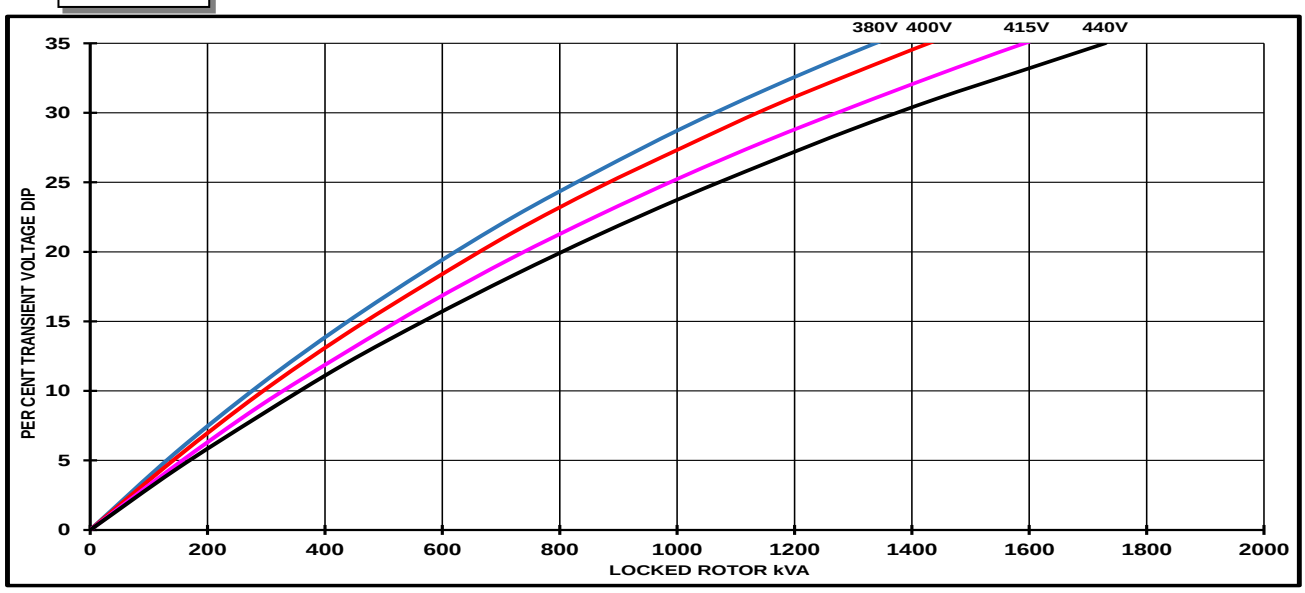
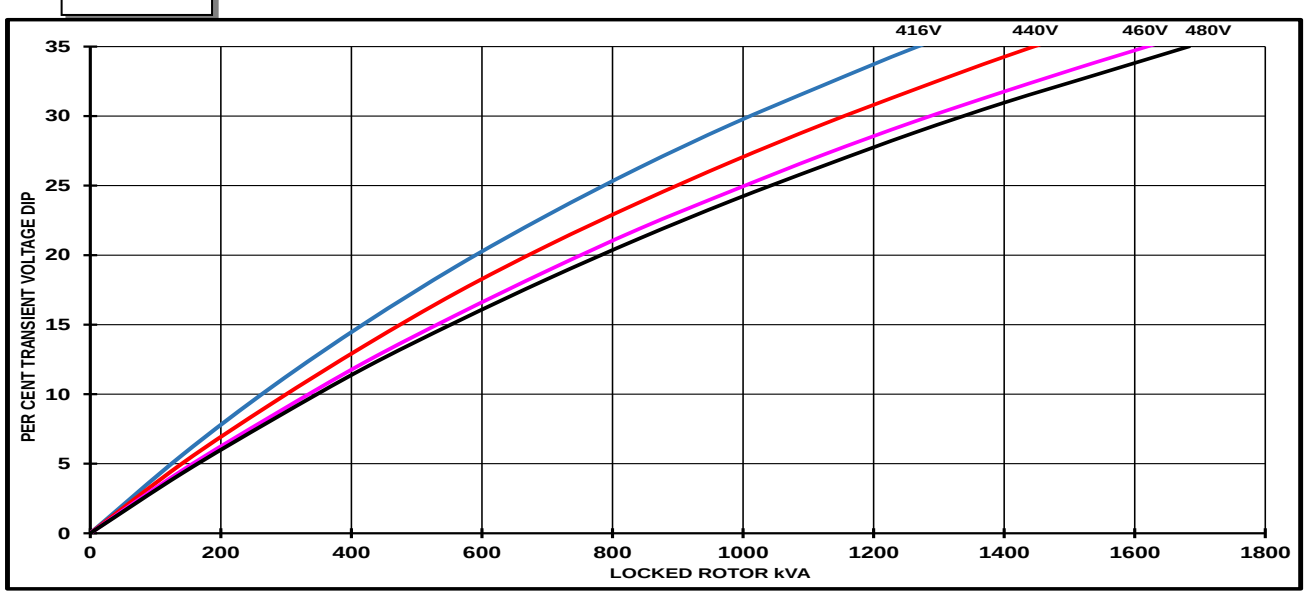
Locked Rotor Motor Starting Curves - Separately Excited

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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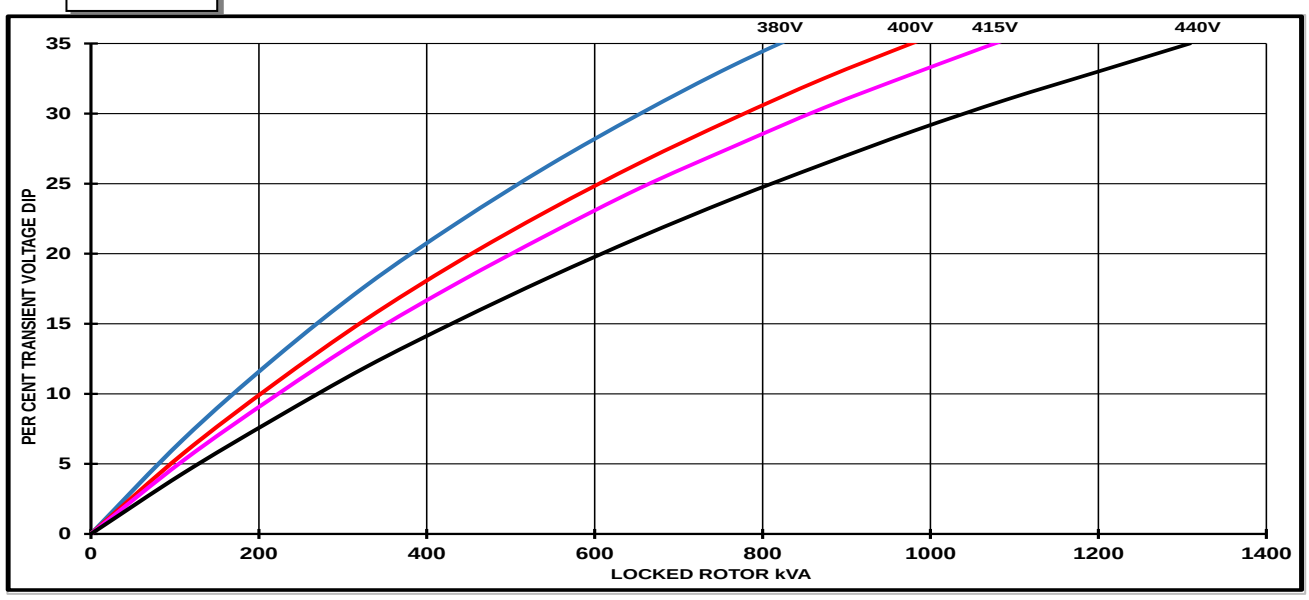
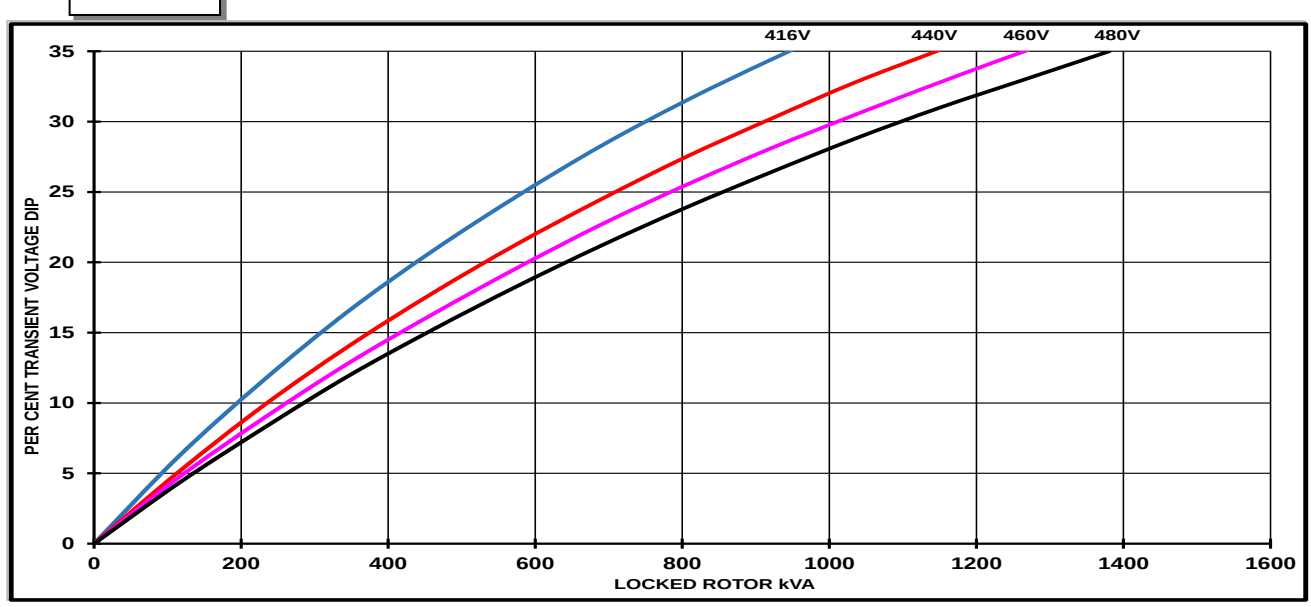
Locked Rotor Motor Starting Curves - Self Excited

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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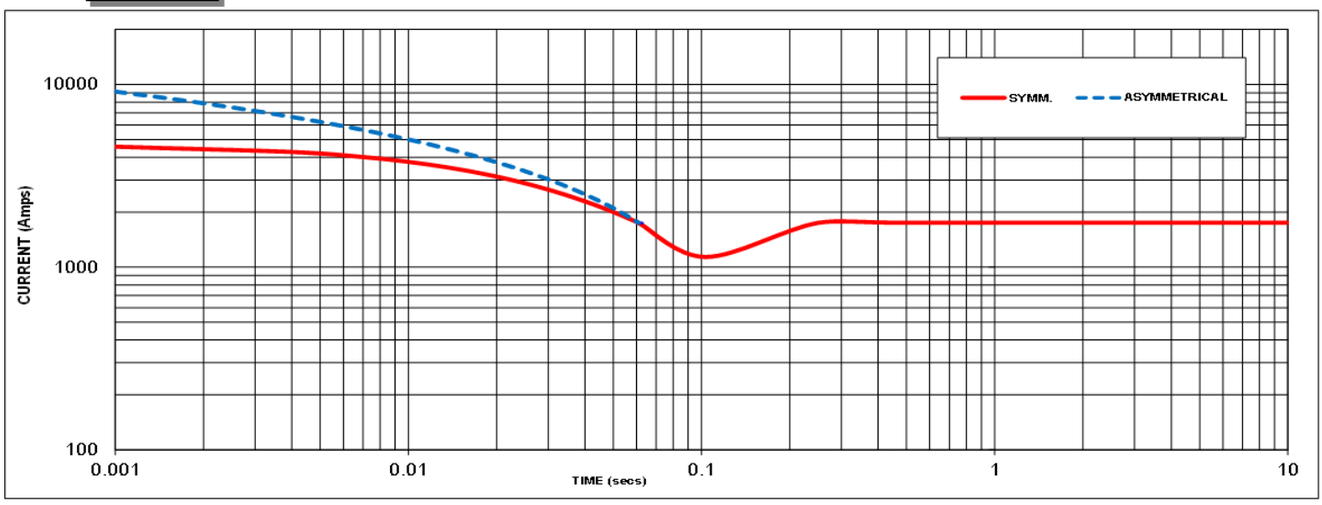
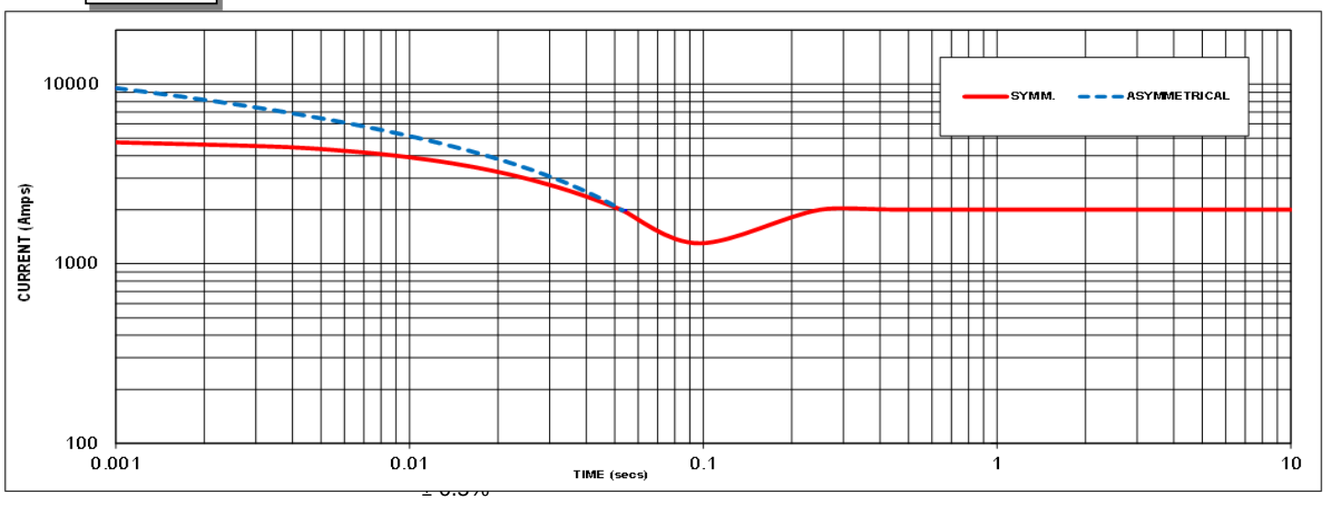
Three-phase Short Circuit Decrement Curve

50Hz



Sustained Short Circuit = 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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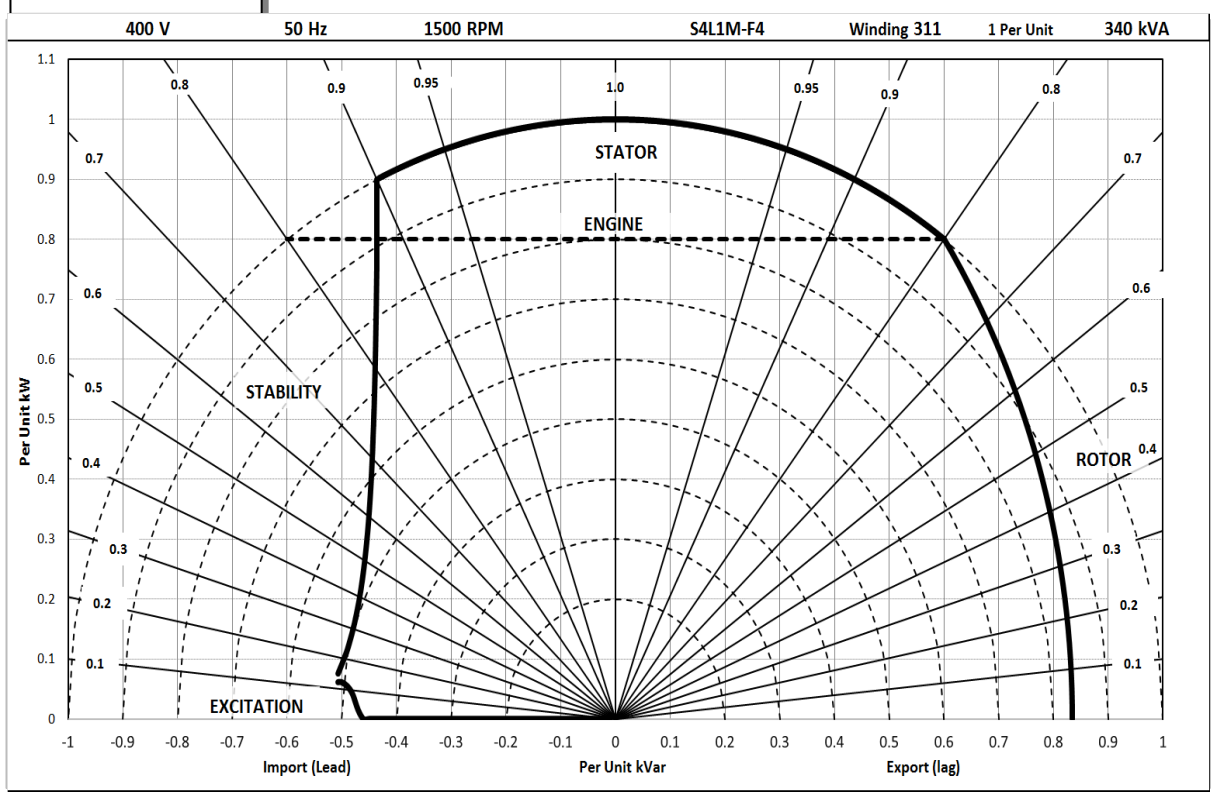
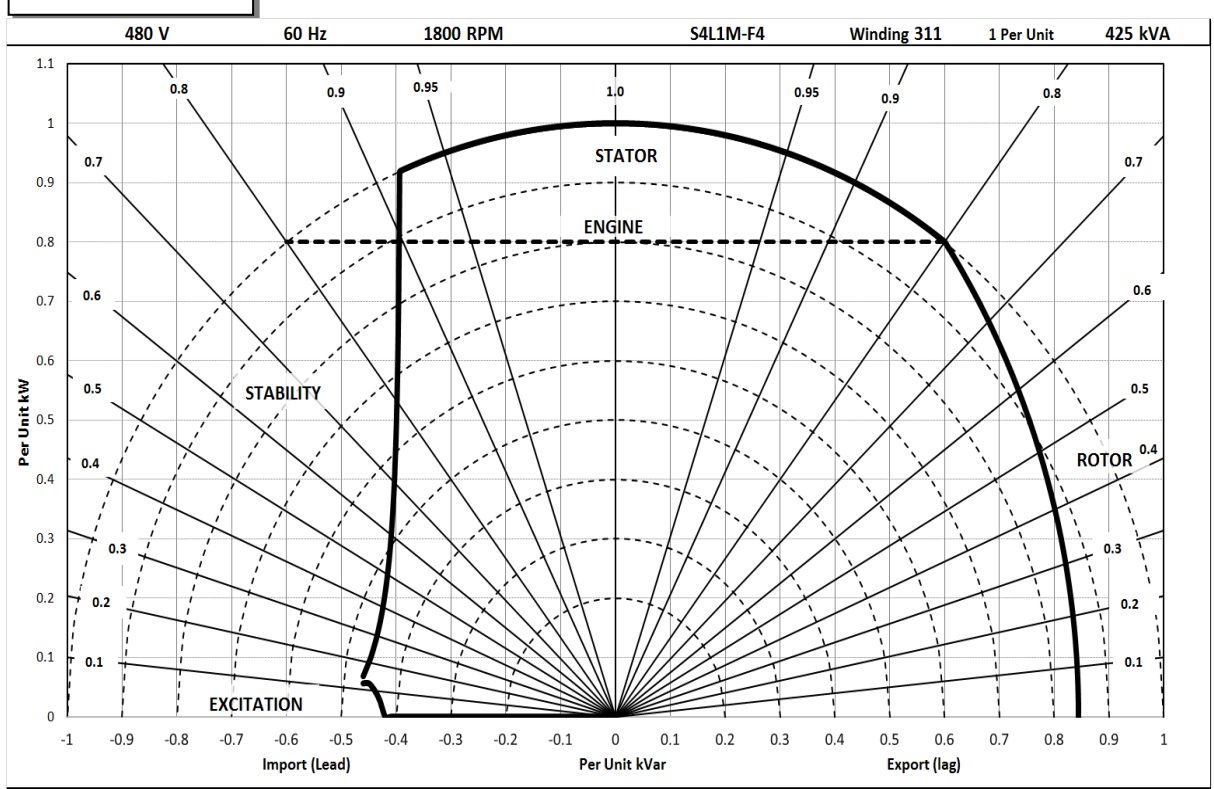
Typical Alternator Operating Charts

400V/50Hz



480V/60Hz



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RATINGS AT 0.8 POWER FACTOR

	Class - Temp Rise	Cont. E - 65/50°C				Cont. B - 70/50°C				Cont. F - 90/50°C				Cont. H - 110/50°C			
50 Hz	Series Star (V)	380	400	415	440	380	400	415	440	380	400	415	440	380	400	415	440
	kVA	260	260	260	260	275	275	275	275	310	310	310	310	340	340	340	340
	kW	208	208	208	208	220	220	220	220	248	248	248	248	272	272	272	272
	Efficiency (%)	94.5	94.5	94.6	94.5	92.8	92.8	93.1	93.4	92.9	93.0	93.2	93.5	93.2	93.4	93.6	93.8
	kW Input	220	220	220	220	237	237	236	236	267	267	266	265	292	291	291	290

60 Hz	Series Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	kVA	305	315	320	330	320	330	335	345	365	375	380	395	395	405	415	425
	kW	244	252	256	264	256	264	268	276	292	300	304	316	316	324	332	340
	Efficiency (%)	94.5	94.5	94.6	94.6	92.9	92.9	93.0	93.2	93.1	93.1	93.1	93.4	93.4	93.4	93.5	93.7
	kW Input	258	267	271	279	276	284	288	296	314	322	326	338	338	347	355	363

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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