

# STAMFORD®

## S5L1D-H4 Wdg.311 - 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	AS440	MX341	MX321	MX322	
Voltage Regulation	± 1%	± 1%	± 0.5%	± 0.5%	with 4% Engine Governing
AVR Power	Self-Excited	PMG	PMG	PMG	

No Load Excitation Voltage (V)	10.1 - 9.1
No Load Excitation Current (A)	0.58 - 0.52
Full Load Excitation Voltage (V)	49
Full Load Excitation Current (A)	2.8
Exciter Time Constant (seconds)	0.099

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Electrical Data								
Insulation System	H							
Stator Winding	Double Layer Lap							
Winding Pitch	2/3							
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	15.18							
	50 Hz				60 Hz			
Telephone Interference	THF<2%				TIF<50			
Cooling Air Flow	1.25 m³/sec				1.5 m³/sec			
Voltage Series Star (V)	380	400	415	440	416	440	460	480
Voltage Parallel Star (V)	190	200	208	220	208	220	230	240
Voltage Series Delta (V)	220	230	240	254	240	254	266	277
kVA Base Rating (Class H) for Reactance Values (kVA)	710	750	750	710	800	844	887	937
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	3.95	3.77	3.50	2.95	4.46	4.21	4.05	3.92
X'd Dir. Axis Transient	0.18	0.17	0.16	0.13	0.20	0.19	0.18	0.18
X''d Dir. Axis Subtransient	0.14	0.13	0.12	0.10	0.16	0.15	0.14	0.14
Xq Quad. Axis Reactance	2.62	2.50	2.32	1.95	2.95	2.79	2.68	2.60
X''q Quad. Axis Subtransient	0.24	0.23	0.21	0.18	0.27	0.25	0.24	0.24
XL Stator Leakage Reactance	0.06	0.06	0.05	0.04	0.07	0.06	0.06	0.06
X2 Negative Sequence Reactance	0.17	0.16	0.15	0.12	0.19	0.18	0.17	0.17
X0 Zero Sequence Reactance	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.02
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	4.75	4.52	4.20	3.54	5.35	5.05	4.85	4.71
X'd Dir. Axis Transient	0.21	0.20	0.18	0.15	0.23	0.22	0.21	0.21
X''d Dir. Axis Subtransient	0.16	0.15	0.14	0.12	0.18	0.17	0.16	0.16
Xq Quad. Axis Reactance	2.70	2.57	2.39	2.01	3.04	2.87	2.76	2.68
X''q Quad. Axis Subtransient	0.29	0.27	0.25	0.21	0.32	0.30	0.29	0.28
XL Stator Leakage Reactance	0.07	0.06	0.06	0.05	0.07	0.07	0.07	0.07
Xlr Rotor Leakage Reactance	0.10	0.09	0.08	0.07	0.11	0.10	0.10	0.09
X2 Negative Sequence Reactance	0.20	0.19	0.18	0.15	0.23	0.21	0.20	0.20
X0 Zero Sequence Reactance	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02

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Time Constants (Seconds)		
T'd Transient Time Const.	0.074	
T''d Sub-Transient Time Const.	0.021	
T'do O.C. Field Time Const.	4.471	
Ta Armature Time Const.	0.018	
T''q Sub-Transient Time Const.	0.0120	
Resistances in Ohms ( $\Omega$ ) at 22°C		
Stator Winding Resistance (Ra), per phase for series connected	0.00370	
Rotor Winding Resistance (Rf)	2.356	
Exciter Stator Winding Resistance	17	
Exciter Rotor Winding Resistance per phase	0.092	
PMG Phase Resistance (Rpmg) per phase	1.91	
Positive Sequence Resistance (R1)	0.0046	
Negative Sequence Resistance (R2)	0.0053	
Zero Sequence Resistance (R0)	0.0046	
Saturation Factors	400V	480V
SG1.0	0.206	0.204
SG1.2	0.801	0.696
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	SAE 1, 0, 0.5	
Moment of Inertia	11.5362 kgm <sup>2</sup>	-
Weight Wound Stator	921kg	-
Weight Wound Rotor	751kg	-
Weight Complete Alternator	1850kg	-
Shipping weight in a Crate	1890kg	-
Packing Crate Size	160 x 90 x 115(cm)	-
Maximum Over Speed	2250 RPM for two minutes	
Bearing Drive End	-	-
Bearing Non-Drive End	Ball 6314	-

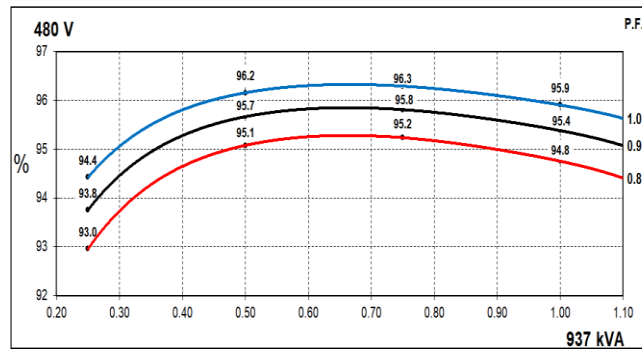
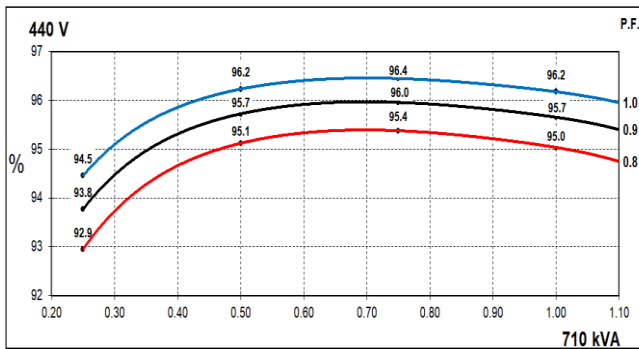
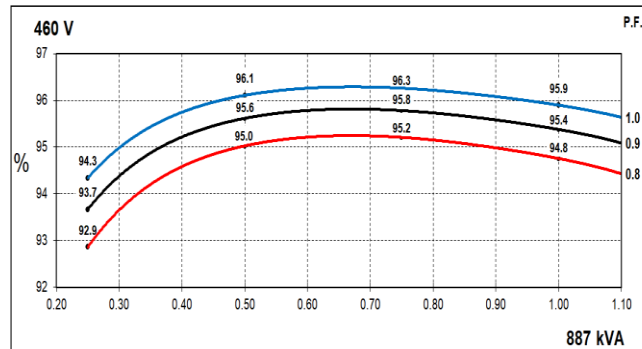
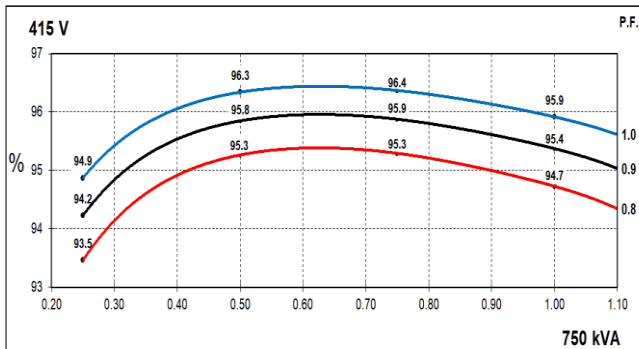
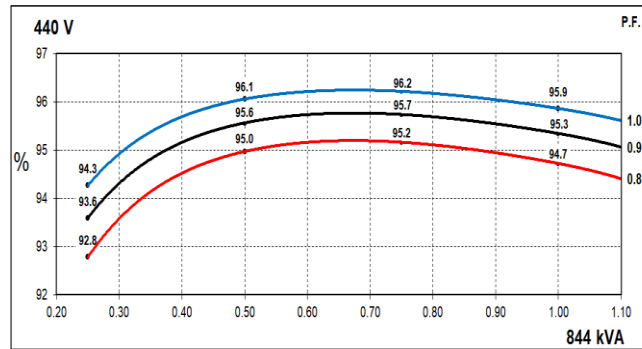
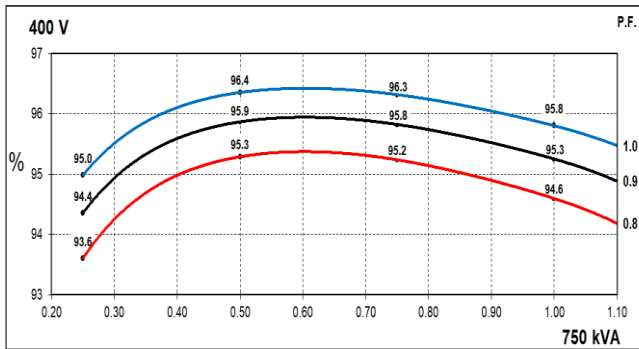
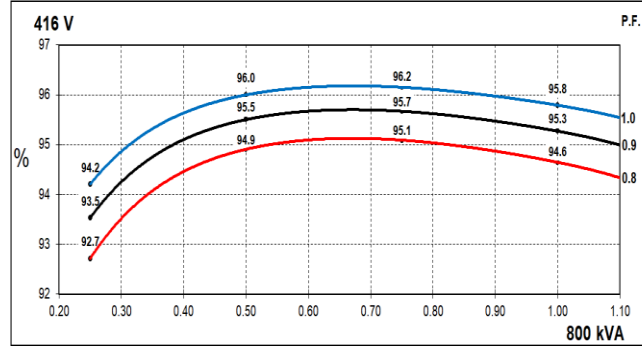
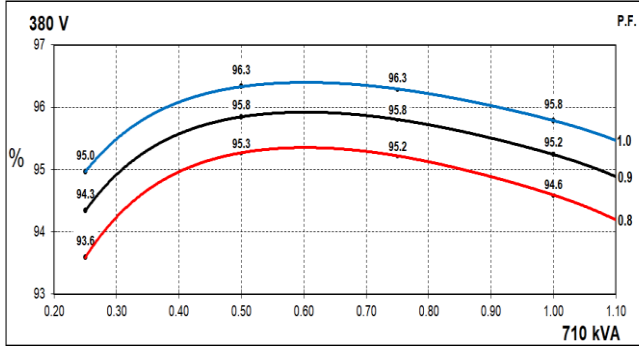
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### THREE PHASE EFFICIENCY CURVES

50Hz

60Hz

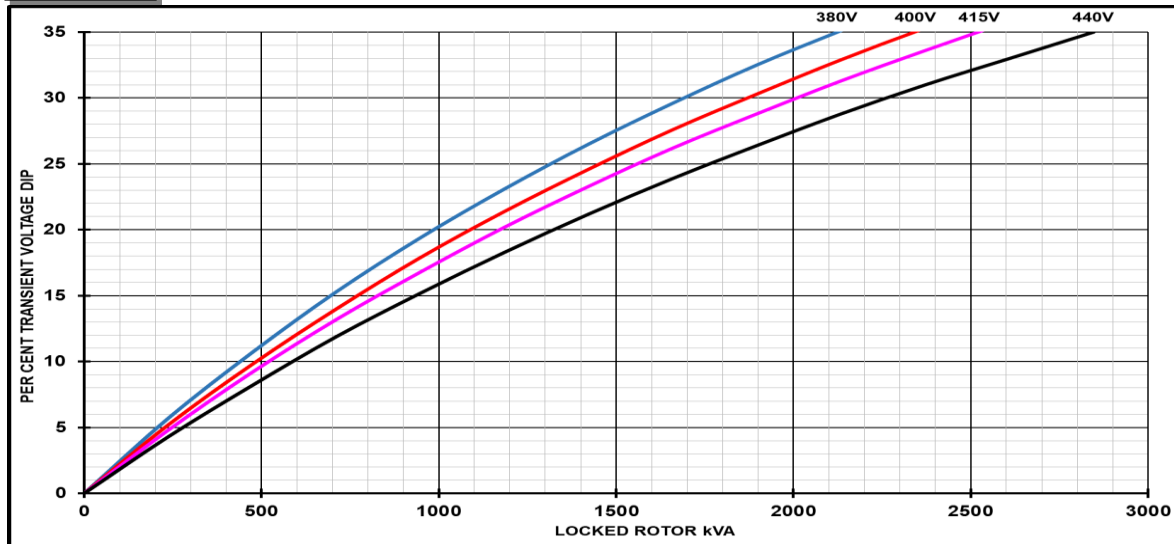


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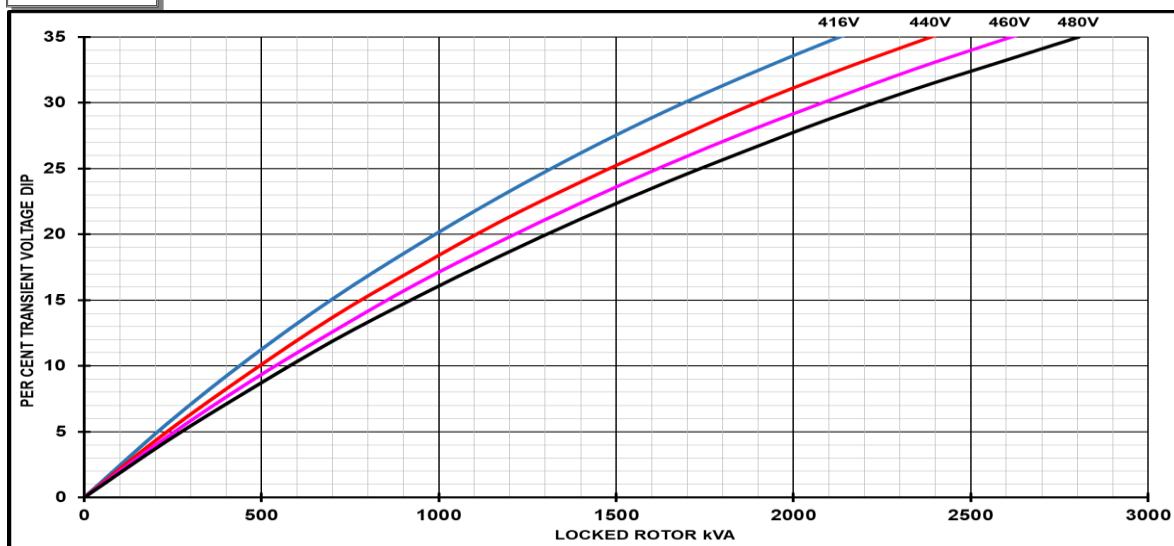
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## Locked Rotor Motor Starting Curves - Separately Excited

**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		

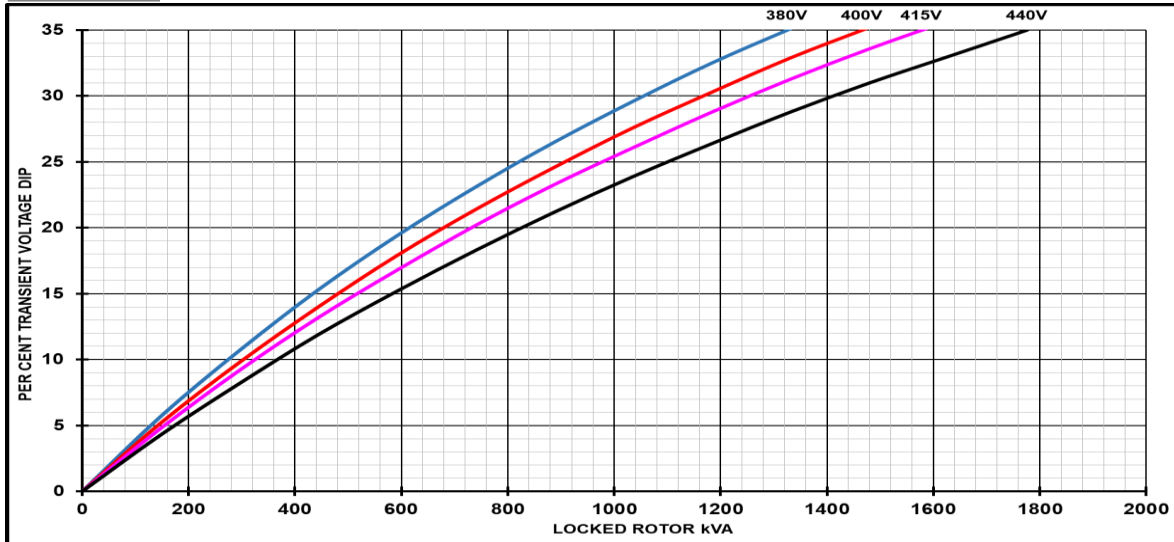
Note: To determine % Transient Voltage Dip or Voltage Rise at various PF, multiply the % Voltage Dip from the curve directly by the Scaling Factor.

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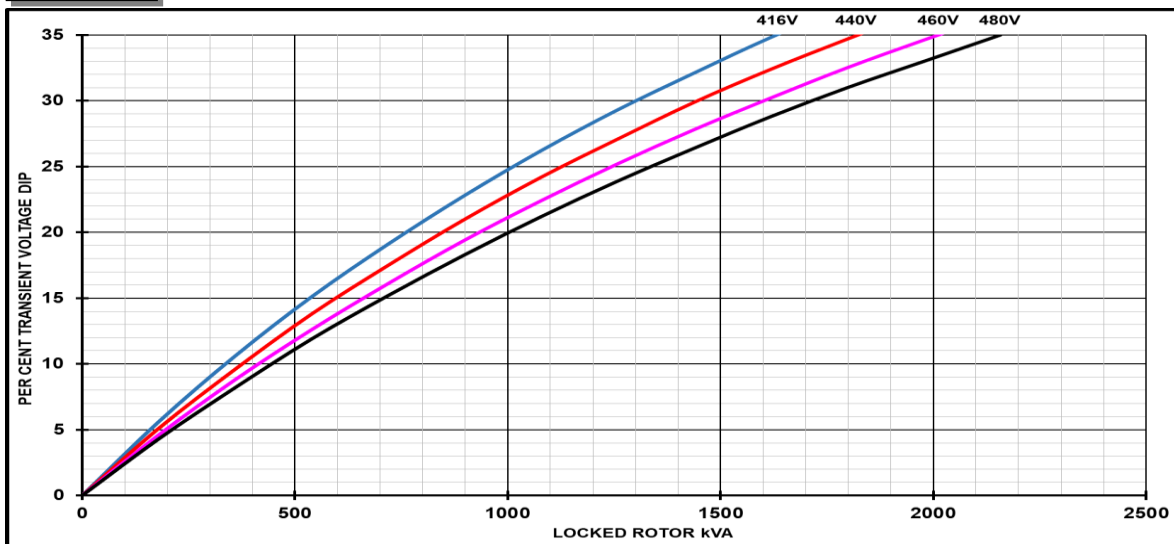
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### Locked Rotor Motor Starting Curves - Self Excited

**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		

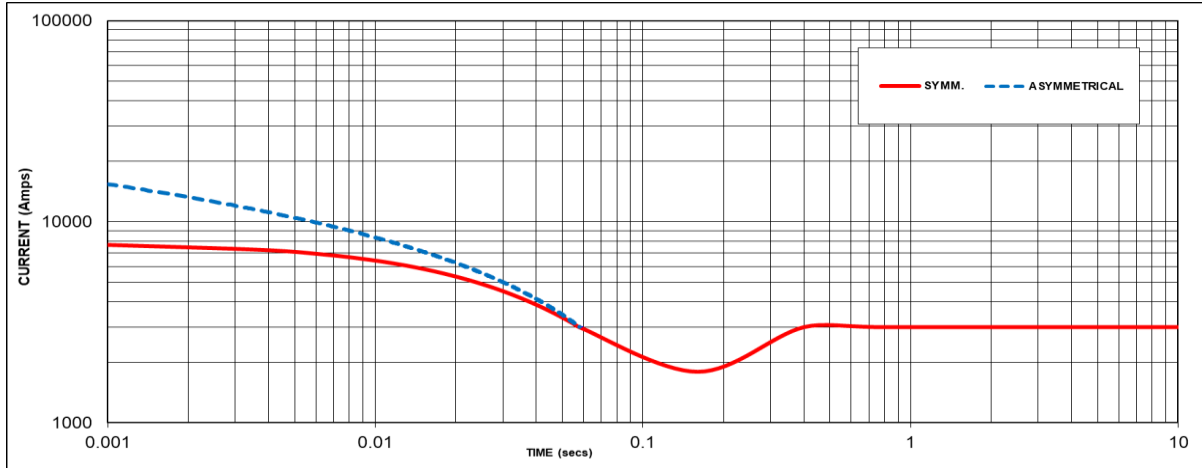
**Note:** To determine % Transient Voltage Dip or Voltage Rise at various PF, multiply the % Voltage Dip from the curve directly by the Scaling Factor.

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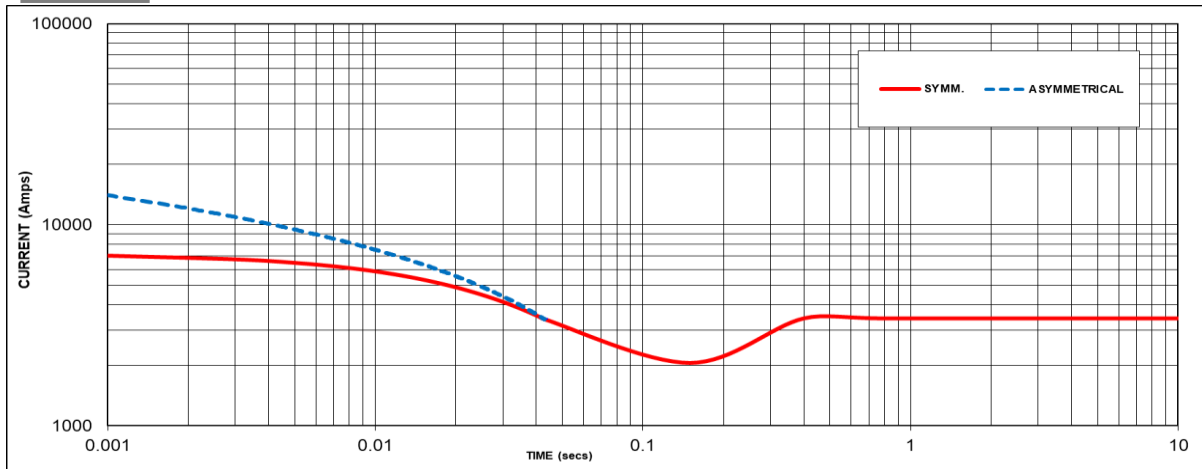
### Three-phase Short Circuit Decrement Curve - Separately Excited

**50Hz**



**60Hz**

Sustained Short Circuit = 3000 Amps



Sustained Short Circuit = 3420 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

If MX322 or digital AVR is used, the sustained short-circuit current value is to be multiplied by a factor of 1.1.

**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**

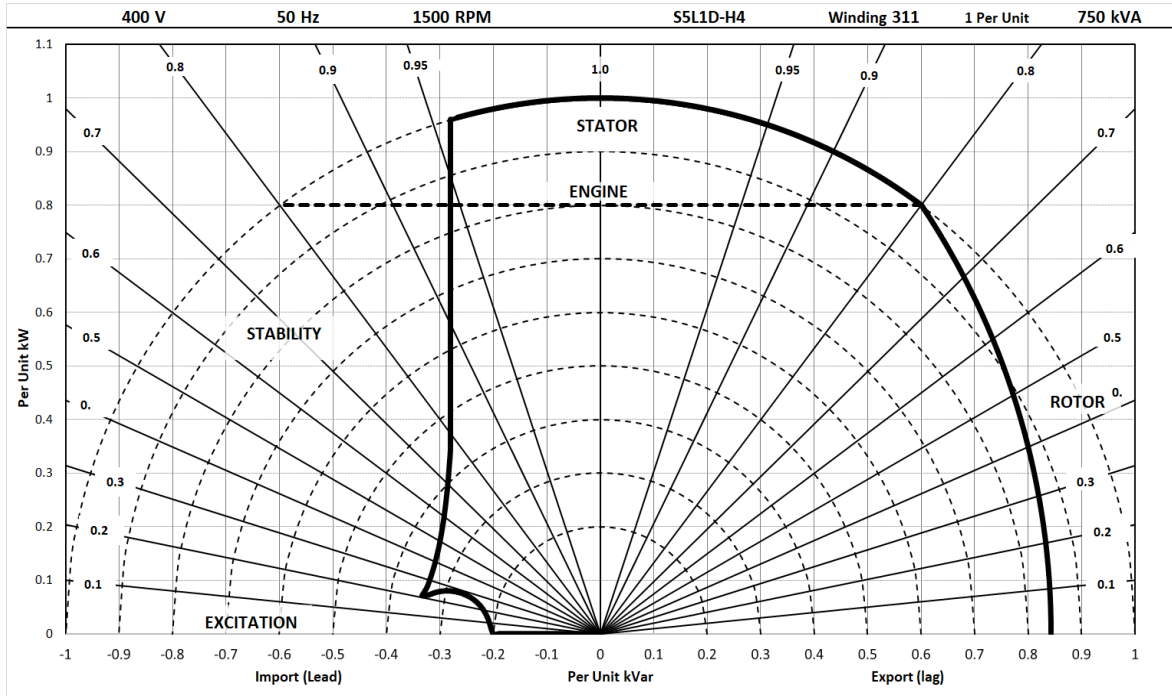
All other times are unchanged  
 Curves are drawn for Star connections under no-load excitation at rated speeds. For other connection (where applicable) the following multipliers should be applied to current values as shown :  
 Parallel Star = Curve current value X 2  
 Series Delta = Curve current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

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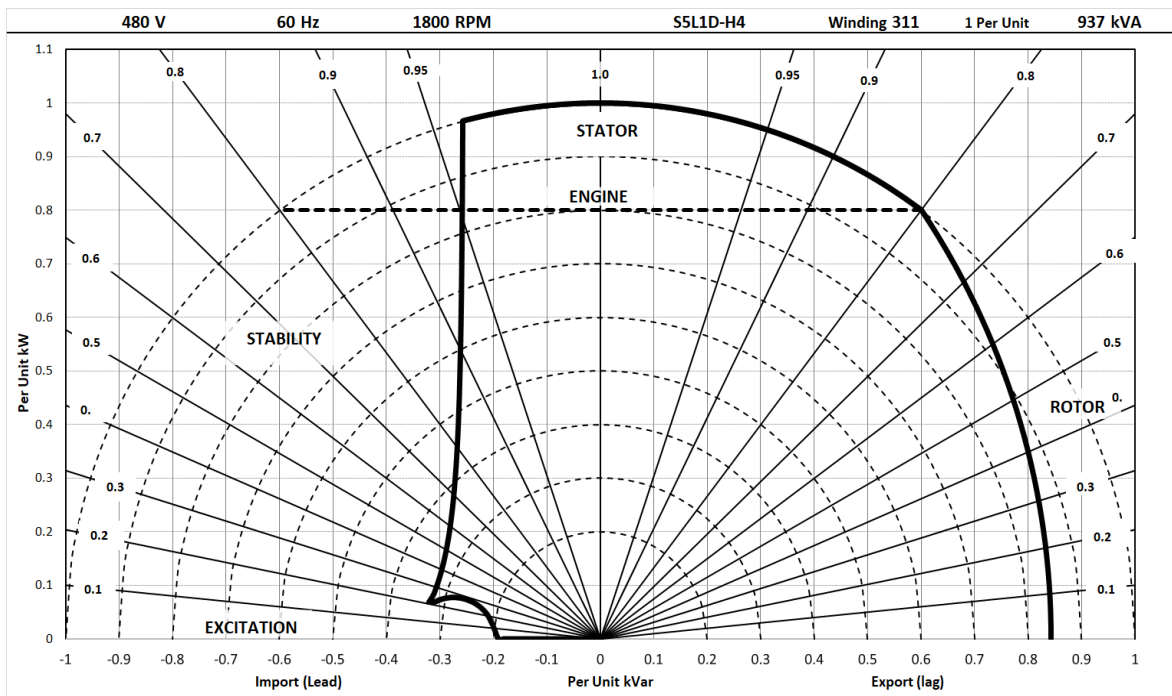
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## Typical Alternator Operating Charts

**400V/50Hz**



**480V/60Hz**





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### RATINGS AT 0.8 POWER FACTOR

Class - Temp Rise		Standby - 163/27°C				Standby - 150/40°C				Cont. H - 125/40°C				Cont. F - 105/40°C			
<b>50</b> Hz	Series Star (V)	380	400	415	440	380	400	415	440	380	400	415	440	380	400	415	440
	Parallel Star (V)	190	200	208	220	190	200	208	220	190	200	208	220	190	200	208	220
	Series Delta (V)	220	230	240	254	220	230	240	254	220	230	240	254	220	230	240	254
	kVA	780	825	825	780	755	800	800	755	710	750	750	710	650	685	685	650
	kW	624	660	660	624	604	640	640	604	568	600	600	568	520	548	548	520
	Efficiency (%)	94.2	94.2	94.4	94.8	94.4	94.4	94.5	94.9	94.6	94.6	94.7	95.0	94.9	94.9	95.0	95.2
	kW Input	662	701	699	658	640	678	677	637	600	634	633	598	548	578	577	546

<b>60</b> Hz	Series Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	Parallel Star (V)	208	220	230	240	208	220	230	240	208	220	230	240	208	220	230	240
	Series Delta (V)	240	254	266	277	240	254	266	277	240	254	266	277	240	254	266	277
	kVA	881	931	975	1013	850	894	944	981	800	844	887	937	737	775	819	844
	kW	705	745	780	810	680	715	755	785	640	675	710	750	590	620	655	675
	Efficiency (%)	94.3	94.4	94.5	94.5	94.5	94.6	94.6	94.6	94.6	94.7	94.8	94.8	94.8	94.9	94.9	95.0
	kW Input	747	789	826	858	720	756	799	830	676	713	749	791	622	653	690	711

#### 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 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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