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A7L1D-H6 Wdg.412 - Technical Data Sheet

Standards

STAMFORD | AvK 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	DECS150	DECS100	DM110		
Voltage Regulation	± 0.25%	± 0.25%	± 0.25%		with 4% Engine Governing
AVR Power	PMG	PMG	PMG		

No Load Excitation Voltage (V)	24.10 - 32.01
No Load Excitation Current (A)	1.16 - 1.21
Full Load Excitation Voltage (V)	94
Full Load Excitation Current (A)	3.6
Exciter Time Constant (seconds)	0.251

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Electrical Data								
Insulation System	H							
Stator Winding	Double Layer Concentric							
Winding Pitch	5/6							
Winding Leads	6							
Winding Number	412							
Number of Poles	6							
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	28.07							
	50 Hz				60 Hz			
Telephone Interference	THF<2%				TIF<50			
Cooling Air Flow	2.07 m³/sec				2.48 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)	1550	1600	1600	1450	1663	1763	1838	1919
Saturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	1.81	1.68	1.56	1.26	1.94	1.84	1.75	1.68
X'd Dir. Axis Transient	0.16	0.15	0.13	0.11	0.17	0.16	0.15	0.14
X"d Dir. Axis Subtransient	0.12	0.12	0.11	0.09	0.13	0.13	0.12	0.12
Xq Quad. Axis Reactance	1.73	1.62	1.50	1.21	1.86	1.77	1.68	1.62
X"q Quad. Axis Subtransient	0.25	0.23	0.21	0.17	0.27	0.25	0.24	0.23
XL Stator Leakage Reactance	0.20	0.19	0.17	0.14	0.21	0.20	0.19	0.18
X2 Negative Sequence Reactance	0.18	0.17	0.15	0.12	0.19	0.18	0.17	0.16
X0 Zero Sequence Reactance	0.11	0.11	0.10	0.08	0.12	0.12	0.11	0.11
Unsaturated Values in Per Unit at Base Ratings and Voltages								
Xd Dir. Axis Synchronous	2.17	2.02	1.88	1.51	2.33	2.21	2.10	2.02
X'd Dir. Axis Transient	0.18	0.17	0.15	0.12	0.19	0.18	0.17	0.17
X"d Dir. Axis Subtransient	0.15	0.14	0.13	0.10	0.16	0.15	0.14	0.14
Xq Quad. Axis Reactance	1.79	1.66	1.55	1.25	1.92	1.82	1.73	1.66
X"q Quad. Axis Subtransient	0.30	0.28	0.26	0.21	0.32	0.30	0.29	0.28
XL Stator Leakage Reactance	0.22	0.21	0.19	0.16	0.24	0.23	0.22	0.21
Xlr Rotor Leakage Reactance	0.13	0.12	0.11	0.09	0.14	0.14	0.13	0.12
X2 Negative Sequence Reactance	0.21	0.20	0.18	0.15	0.23	0.22	0.21	0.20
X0 Zero Sequence Reactance	0.13	0.13	0.12	0.09	0.14	0.14	0.13	0.13

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Time Constants (Seconds)		
T'd Transient Time Const.	0.119	
T''d Sub-Transient Time Const.	0.018	
T'do O.C. Field Time Const.	3.070	
Ta Armature Time Const.	0.031	
T''q Sub-Transient Time Const.	0.0210	
Resistances in Ohms (Ω) at 22^{0}C		
Stator Winding Resistance (Ra), per phase for series connected	0.00093	
Rotor Winding Resistance (Rf)	3.345	
Exciter Stator Winding Resistance	21	
Exciter Rotor Winding Resistance per phase	0.156	
PMG Phase Resistance (Rpmg) per phase	4.11	
Positive Sequence Resistance (R1)	0.0012	
Negative Sequence Resistance (R2)	0.0013	
Zero Sequence Resistance (R0)	0.0012	
Saturation Factors	400V	480V
SG1.0	0.427	0.381
SG1.2	1.65	2.071
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	SAE0,00	SAE0,00
Moment of Inertia	69.3 kgm²	67.64 kgm²
Weight Wound Stator	1173kg	1173kg
Weight Wound Rotor	1347kg	1347kg
Weight Complete Alternator	3842kg	3816kg
Shipping weight in a Crate	3894kg	3868kg
Packing Crate Size	220*105*155(cm)	220*105*155(cm)
Maximum Over Speed	1500 RPM for two minutes	
Bearing Drive End	-	BALL 6232
Bearing Non-Drive End	BALL 6319	BALL 6319

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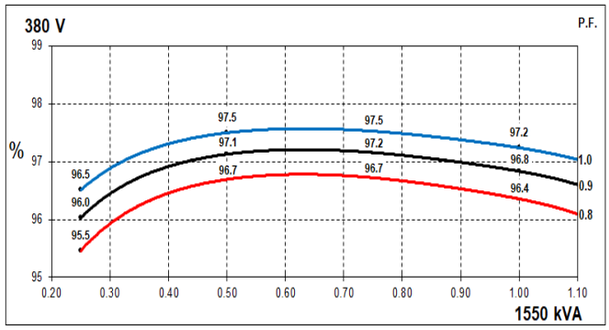
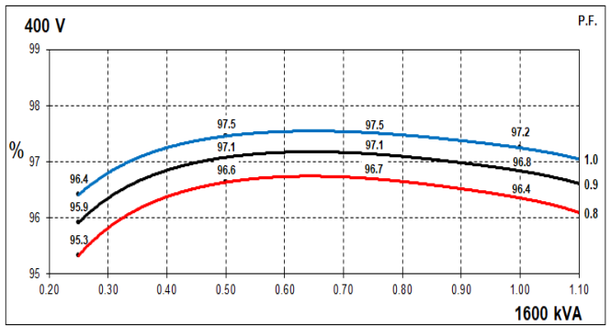
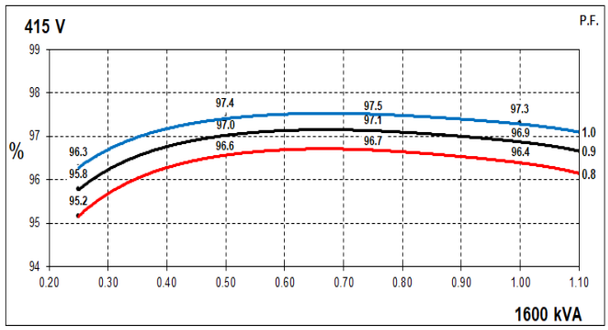
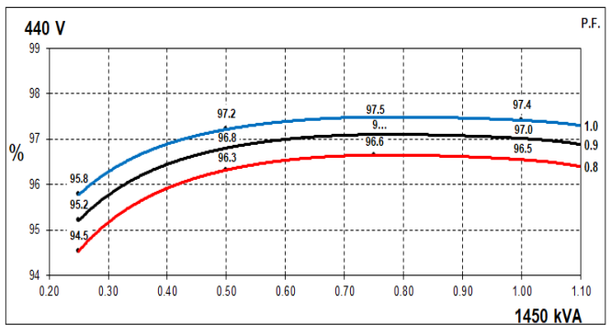
THREE PHASE EFFICIENCY CURVES

50Hz

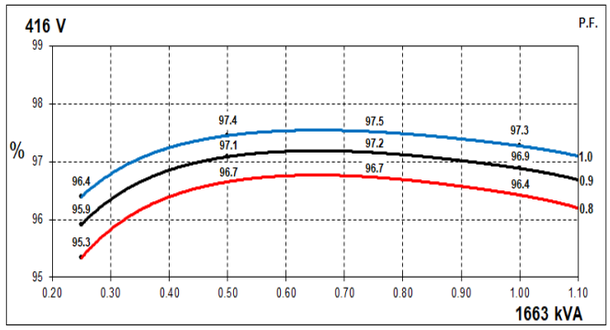


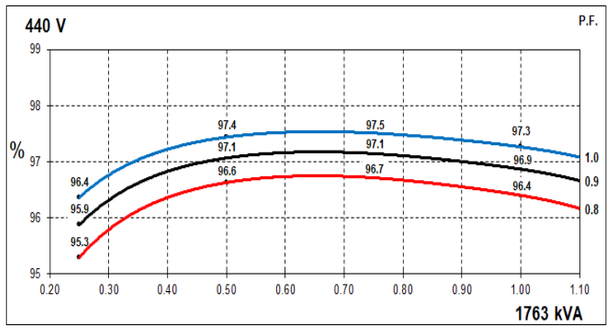


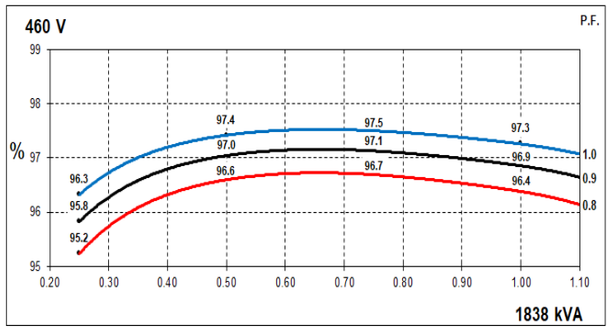


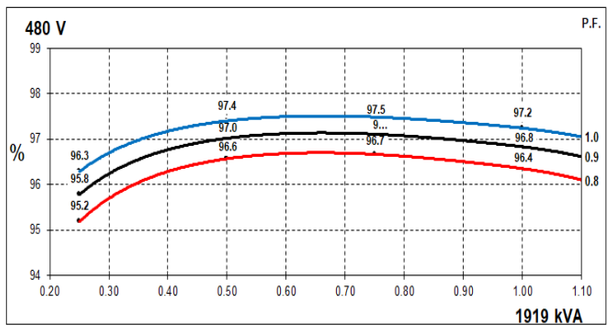


60Hz









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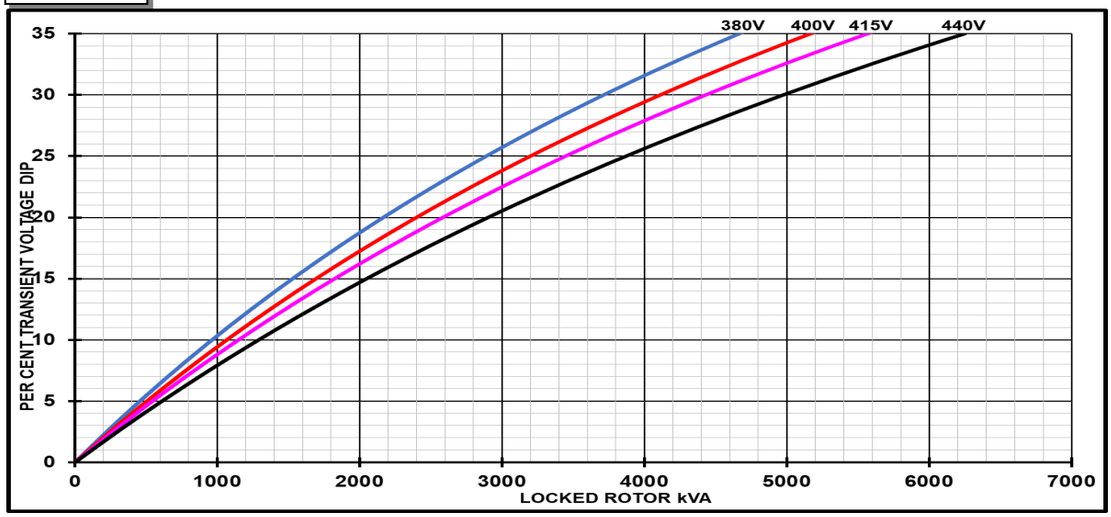
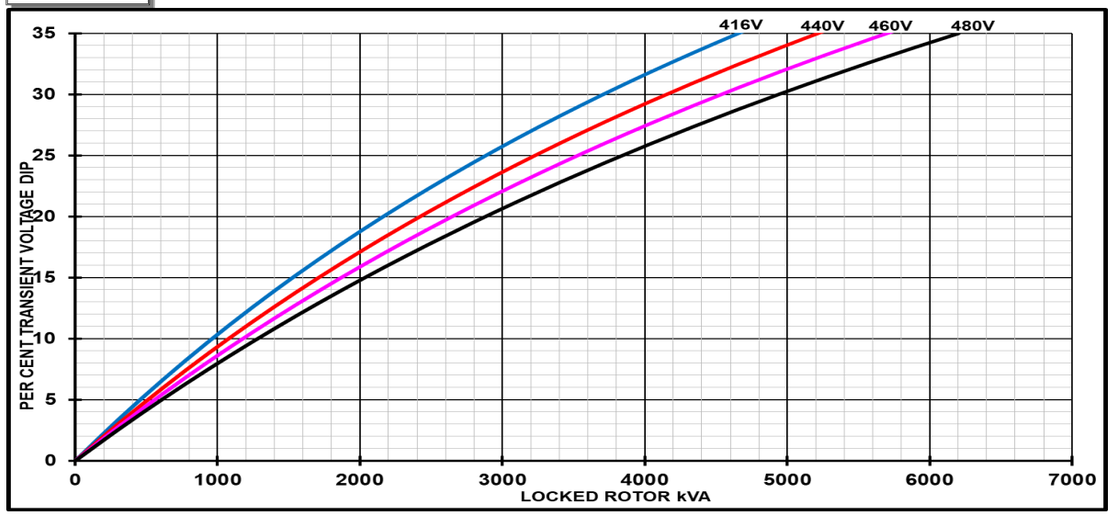
Locked Rotor Motor Starting Curves - Separately Excited

50Hz



60Hz



Transient Voltage Dip Scaling Factor	
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.

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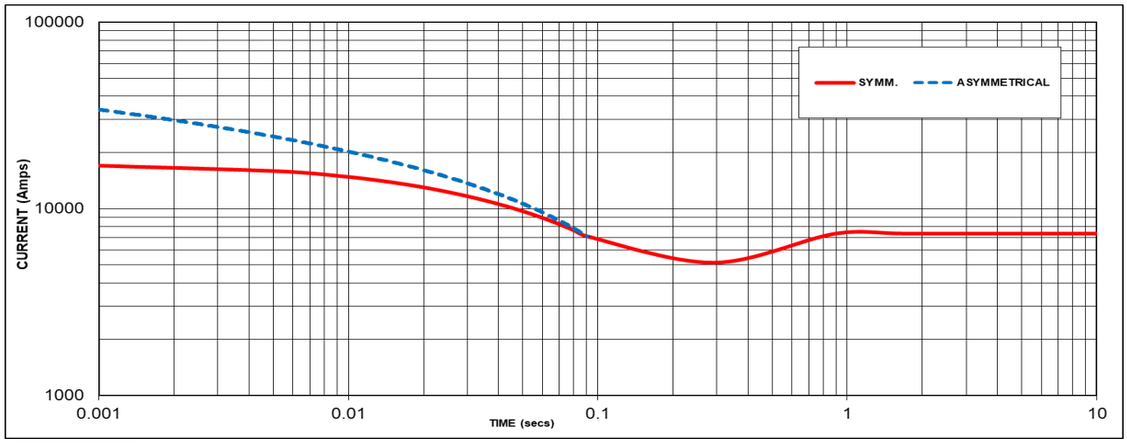
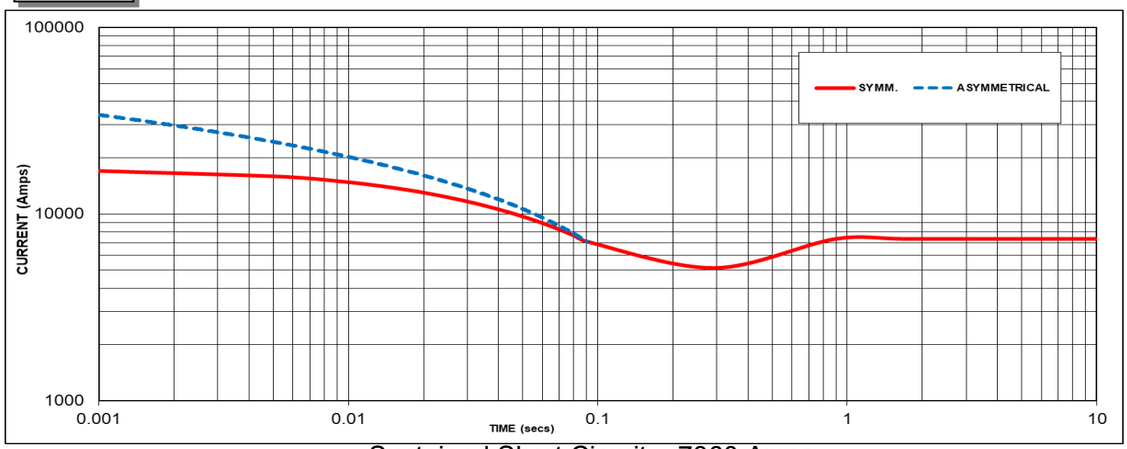
Three-phase Short Circuit Decrement Curve - Separately Excited

50Hz



Sustained Short Circuit = 6550 Amps

60Hz



Sustained Short Circuit = 7360 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 1.07	440V	X 1.06
415V	X 1.12	460V	X 1.12
440V	X 1.18	480V	X 1.17

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

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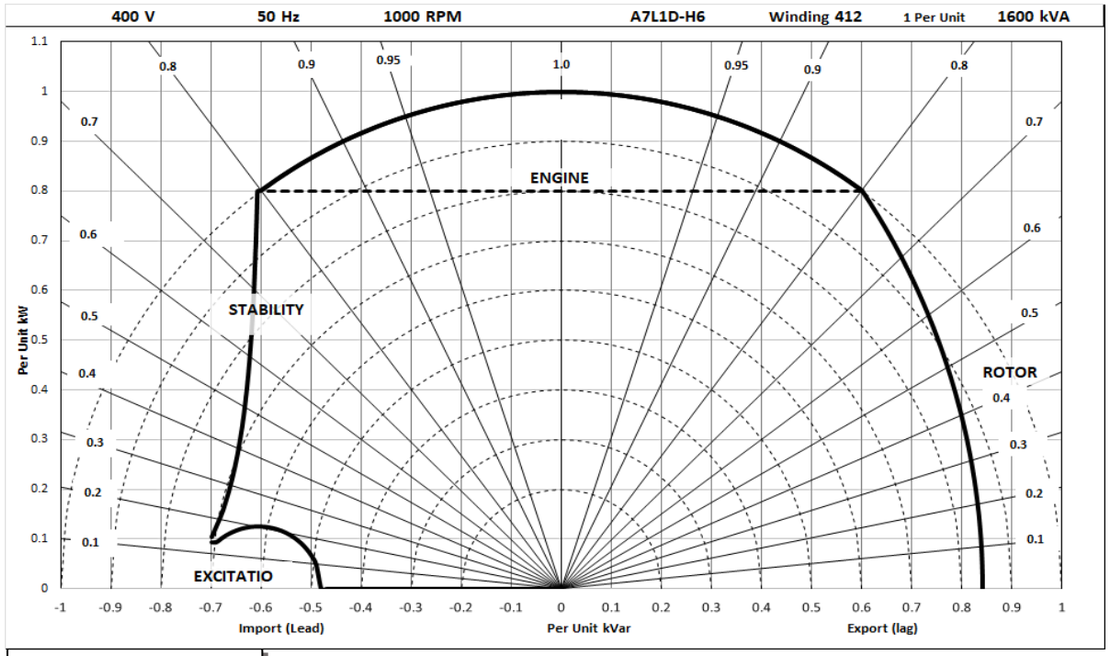
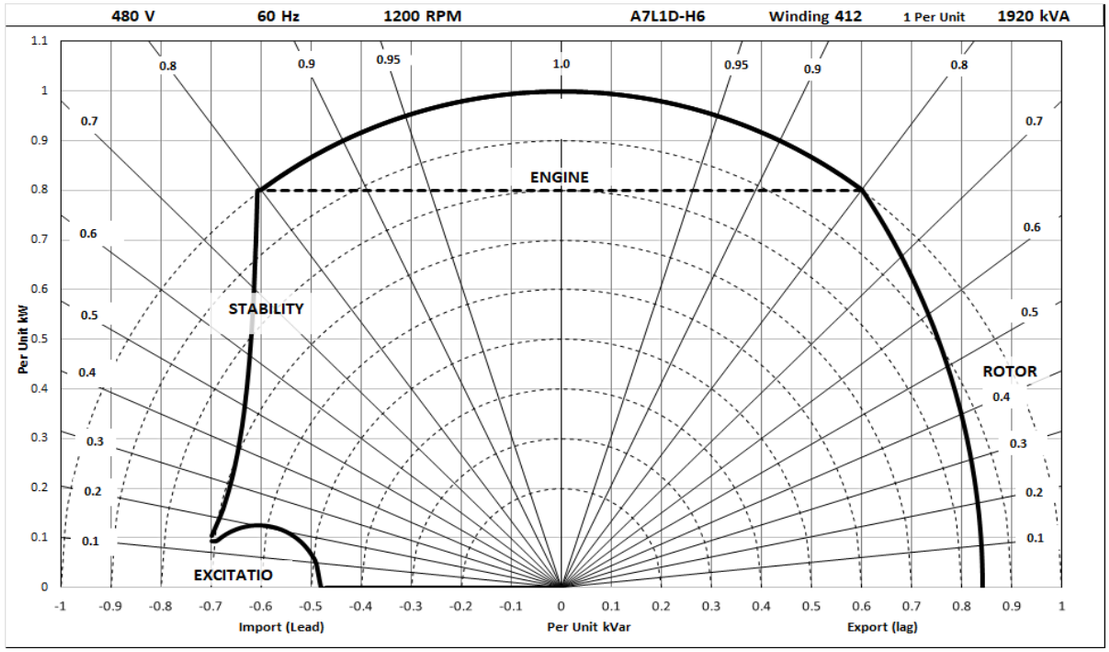
Typical Alternator Operating Charts

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	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	1665	1715	1715	1595	1615	1665	1665	1550	1550	1600	1600	1450	1395	1440	1440	1330
	kW	1332	1372	1372	1276	1292	1332	1332	1240	1240	1280	1280	1160	1116	1152	1152	1064
	Efficiency (%)	96.2	96.2	96.2	96.4	96.3	96.3	96.3	96.5	96.4	96.4	96.4	96.5	96.5	96.5	96.6	96.6
	kW Input	1385	1426	1426	1323	1342	1384	1383	1285	1287	1328	1328	1201	1156	1193	1193	1101

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	1794	1888	1969	2056	1731	1831	1919	2000	1663	1763	1838	1919	1494	1581	1656	1725
	kW	1435	1510	1575	1645	1385	1465	1535	1600	1330	1410	1470	1535	1195	1265	1325	1380
	Efficiency (%)	96.3	96.3	96.2	96.2	96.3	96.3	96.3	96.3	96.4	96.4	96.4	96.4	96.6	96.6	96.5	96.5
	kW Input	1491	1569	1637	1710	1437	1521	1594	1662	1380	1463	1526	1593	1237	1310	1372	1430

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.

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