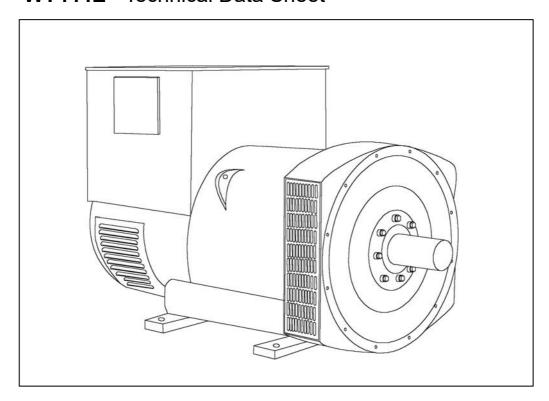


WT444E - Technical Data Sheet





SPECIFICATIONS & OPTIONS

STANDARDS

WINTPOWER industrial generators meet the requirements of BS EN 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC34, CSA C22.2-100, AS1359. Other standards and certifications can be considered on request.

VOLTAGE REGULATORS

AS440 AVR - STANDARD

With this self-excited system the main stator provides power via the Automatic Voltage Regulator (AVR) to the exciter stator. The high efficiency semi-conductors of the AVR ensure positive build-up from initial low levels of residual voltage.

The exciter rotor output is fed to the main rotor through a three-phase full-wave bridge rectifier. The rectifier is protected by a surge suppressor against surges caused, for example, by short circuit or out-of-phase paralleling. The AS440 will support a range of electronic accessories, including a 'droop' Current Transformer (CT) to permit parallel operation with other ac generators.

MX341 AVR

This sophisticated AVR is incorporated into the Wintpower Permanent Magnet Generator (PMG) control system.

The PMG provides power via the AVR to the main exciter, giving a source of constant excitation power independent of generator output. The main exciter output is then fed to the main rotor, through a full wave bridge, protected by a surge suppressor. The AVR has in-built protection against sustained over-excitation, caused by internal or external faults. This de-excites the machine after a minimum of 5 seconds.

An engine relief load acceptance feature can enable full load to be applied to the generator in a single step.

If three-phase sensing is required with the PMG system the MX321 AVR must be used.

We recommend three-phase sensing for applications with greatly unbalanced or highly non-linear loads.

MX321 AVR

The most sophisticated of all our AVRs combines all the features of the MX341 with, additionally, three-phase rms sensing, for improved regulation and performance. Over voltage protection is built-in and short circuit current level adjustments is an optional facility.

WINDINGS & ELECTRICAL PERFORMANCE

All generator stators are wound to 2/3 pitch. This eliminates triplen (3rd, 9th, 15th ...) harmonics on the voltage waveform and is found to be the optimum design for trouble-free supply of non-linear loads. The 2/3 pitch design avoids excessive neutral currents sometimes seen with higher winding pitches, when in parallel with the mains. A fully connected damper winding reduces oscillations during paralleling. This winding, with the 2/3 pitch and carefully selected pole and tooth designs, ensures very low waveform distortion.

TERMINALS & TERMINAL BOX

Standard generators are 3-phase reconnectable with 12 ends brought out to the terminals, which are mounted on a cover at the non-drive end of the generator. A sheet steel terminal box contains the AVR and provides ample space for the customers' wiring and gland arrangements. It has removable panels for easy access.

SHAFT & KEYS

All generator 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.

INSULATION/IMPREGNATION

The insulation system is class 'H'.

All wound components are impregnated with materials and processes designed specifically to provide the high build required for static windings and the high mechanical strength required for rotating components.

QUALITY ASSURANCE

Generators are manufactured using production procedures having a quality assurance level to BS EN ISO 9001.

The stated voltage regulation may not be maintained in the presence of certain radio transmitted signals. Any change in performance will fall within the limits of Criteria 'B' of EN 61000-6-2:2001. At no time will the steady-state voltage regulation exceed 2%.

NB Continuous development of our products entitles us to change specification details without notice, therefore they must not be regarded as binding.

Front cover drawing typical of product range.



WINDING 311

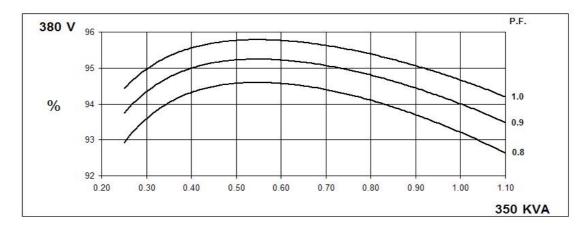
AV.R. MX321 MX341 VOLTAGE REGULATION	CONTROL SYSTEM SEPARATELY EXCITED BY P.M.G.											
VOLTAGE REGULATION												
SUSTAINED SHORT CIRCUIT REFER TO SHORT CIRCUIT DECREMENT CURVES (page 7)												
SELF EXCITED												
AVR. AS440 VOLTAGE REGULATION ± 1.0% WITH 4% ENGINE GOVERNING SUSTAINED SHORT CIRCUIT WILL NOT SUSTAIN A SHORT CIRCUIT INSULATION SYSTEM PROTECTION IP23 RATED POWER FACTOR STATOR WINDING DOUBLE LAYER LAP TWO THIRDS WINDING PITCH TWO THIRDS WINDING LEADS STATOR WID. RESISTANCE 0.009 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED ROTOR WIG. RESISTANCE EXCITER STATOR RESISTANCE EXCITER ROTOR RESISTANCE STATOR WIDSTAINCE EXCITER ROTOR RESISTANCE STATOR WISTORIUM WAVEFORM DISTORTION MAXIMUM OVERSPEED BEARING NON-DISTORTING BALANCED LINEAR LOAD < 5.0% WEIGHT COMP. GENERATOR WEIGHT COMP. GENERATOR WEIGHT WOUND STATOR WEIGHT WOUND STATOR WEIGHT WOUND STATOR WEIGHT WOUND STATOR ### NERTIA ### AS31 kgm² ** A4343 kgm² ** A434	SUSTAINED SHORT CIRCUIT REFER TO SHORT CIRCUIT DECREMENT CURVES (page /)											
VOLTAGE REGULATION ± 1.0 % With 4% ENGINE GOVERNING	ONTROL SYSTEM SELF EXCITED											
SUSTAINED SHORT CIRCUIT WILL NOT SUSTAIN A SHORT CIRCUIT	A.V.R.	AS440										
INSULATION SYSTEM	VOLTAGE REGULATION	± 1.0 % With 4% ENGINE GOVERNING										
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WINDING LEADS 12												
STATOR WDG. RESISTANCE												
ROTOR WDG. RESISTANCE			2 222 21	555 511								
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WAVEFORM DISTORTION	EXCITER ROTOR RESISTANCE			0.068	Ohms PER	PHASE AT	22°C					
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The color of the	BEARING DRIVE END				BALL. 63	317 (ISO)						
WEIGHT COMP. GENERATOR	BEARING NON-DRIVE END				BALL. 63	314 (ISO)						
WEIGHT WOUND STATOR ### 470 kg WEIGHT WOUND ROTOR ### 400 kg ### 1095 kg ### 1100 kg ###			1 BEA	RING			2 BEA	ARING				
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REACTANCE VALUES 350 350 350 350 400 420 440 440 Xd DIR. AXIS SYNCHRONOUS 3.01 2.71 2.52 2.24 3.47 3.26 3.12 2.87 X'd DIR. AXIS TRANSIENT 0.20 0.18 0.17 0.15 0.21 0.20 0.19 0.17 X"d DIR. AXIS SUBTRANSIENT 0.14 0.13 0.12 0.11 0.15 0.14 0.13 0.12 Xq QUAD. AXIS REACTANCE 2.58 2.33 2.16 1.92 2.92 2.74 2.63 2.41 X"q QUAD. AXIS SUBTRANSIENT 0.36 0.32 0.30 0.27 0.41 0.38 0.37 0.34 XL LEAKAGE REACTANCE 0.07 0.06 0.06 0.05 0.08 0.08 0.07 0.07 Xo ZERO SEQUENCE 0.24 0.22 0.20 0.18 0.28 0.26 0.25 0.23 Xo ZERO SEQUENCE 0.10 0.09 0.08 0.07 0.10 0.09 <td>VOLTAGE SERIES DELTA</td> <td>220/110</td> <td>230/115</td> <td>240/120</td> <td>254/127</td> <td>240/120</td> <td>254/127</td> <td>266/133</td> <td>277/138</td>	VOLTAGE SERIES DELTA	220/110	230/115	240/120	254/127	240/120	254/127	266/133	277/138			
Xd DIR. AXIS SYNCHRONOUS 3.01 2.71 2.52 2.24 3.47 3.26 3.12 2.87 X'd DIR. AXIS TRANSIENT 0.20 0.18 0.17 0.15 0.21 0.20 0.19 0.17 X"d DIR. AXIS SUBTRANSIENT 0.14 0.13 0.12 0.11 0.15 0.14 0.13 0.12 Xq QUAD. AXIS REACTANCE 2.58 2.33 2.16 1.92 2.92 2.74 2.63 2.41 X"q QUAD. AXIS SUBTRANSIENT 0.36 0.32 0.30 0.27 0.41 0.38 0.37 0.34 XL LEAKAGE REACTANCE 0.07 0.06 0.06 0.05 0.08 0.08 0.07 0.07 X2 NEGATIVE SEQUENCE 0.24 0.22 0.20 0.18 0.28 0.26 0.25 0.23 X0 ZERO SEQUENCE 0.10 0.09 0.08 0.07 0.10 0.09 0.08 T"d TRANSIENT TIME CONST. 0.019s 0.019s 0.019s 0.019s T'do		350	350	350	350	400	420	440	440			
X"d DIR. AXIS SUBTRANSIENT 0.14 0.13 0.12 0.11 0.15 0.14 0.13 0.12 Xq QUAD. AXIS REACTANCE 2.58 2.33 2.16 1.92 2.92 2.74 2.63 2.41 X"q QUAD. AXIS SUBTRANSIENT 0.36 0.32 0.30 0.27 0.41 0.38 0.37 0.34 XL LEAKAGE REACTANCE 0.07 0.06 0.06 0.05 0.08 0.08 0.07 0.07 X2 NEGATIVE SEQUENCE 0.24 0.22 0.20 0.18 0.28 0.26 0.25 0.23 X0 ZERO SEQUENCE 0.10 0.09 0.08 0.07 0.10 0.09 0.08 REACTANCES ARE SATURATED VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED T'd TRANSIENT TIME CONST. 0.08s T'd SUB-TRANSTIME CONST. 0.019s T'do O.C. FIELD TIME CONST. 1.7s Ta ARMATURE TIME CONST. 0.018s	Xd DIR. AXIS SYNCHRONOUS	3.01	2.71	2.52	2.24	3.47	3.26	3.12	2.87			
Xq QUAD. AXIS REACTANCE 2.58 2.33 2.16 1.92 2.92 2.74 2.63 2.41 X"q QUAD. AXIS SUBTRANSIENT 0.36 0.32 0.30 0.27 0.41 0.38 0.37 0.34 XL LEAKAGE REACTANCE 0.07 0.06 0.06 0.05 0.08 0.08 0.07 0.07 X2 NEGATIVE SEQUENCE 0.24 0.22 0.20 0.18 0.28 0.26 0.25 0.23 X0 ZERO SEQUENCE 0.10 0.09 0.08 0.07 0.10 0.09 0.08 REACTANCES ARE SATURATED VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED T'd TRANSIENT TIME CONST. 0.08s T'd SUB-TRANSTIME CONST. 0.019s T'do O.C. FIELD TIME CONST. 1.7s Ta ARMATURE TIME CONST. 0.018s	X'd DIR. AXIS TRANSIENT				0.15				0.17			
X"q QUAD. AXIS SUBTRANSIENT 0.36 0.32 0.30 0.27 0.41 0.38 0.37 0.34 XL LEAKAGE REACTANCE 0.07 0.06 0.06 0.05 0.08 0.08 0.07 0.07 X2 NEGATIVE SEQUENCE 0.24 0.22 0.20 0.18 0.28 0.26 0.25 0.23 X0 ZERO SEQUENCE 0.10 0.09 0.08 0.07 0.10 0.09 0.09 0.08 REACTANCES ARE SATURATED VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED T'd TRANSIENT TIME CONST. 0.08s 0.019s T'd SUB-TRANSTIME CONST. 0.019s 1.7s Ta ARMATURE TIME CONST. 0.018s	X"d DIR. AXIS SUBTRANSIENT	0.14	0.13	0.12	0.11	0.15	0.14	0.13	0.12			
XL LEAKAGE REACTANCE 0.07 0.06 0.06 0.05 0.08 0.08 0.07 0.07 X2 NEGATIVE SEQUENCE 0.24 0.22 0.20 0.18 0.28 0.26 0.25 0.23 X0 ZERO SEQUENCE 0.10 0.09 0.08 0.07 0.10 0.09 0.09 0.08 REACTANCES ARE SATURATED VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED T'd TRANSIENT TIME CONST. 0.08s T''d SUB-TRANSTIME CONST. 0.019s 0.019s T'do O.C. FIELD TIME CONST. 1.7s Ta ARMATURE TIME CONST. 0.018s	Xq QUAD. AXIS REACTANCE	2.58	2.33	2.16	1.92	2.92	2.74	2.63	2.41			
X2 NEGATIVE SEQUENCE 0.24 0.22 0.20 0.18 0.28 0.26 0.25 0.23 X0 ZERO SEQUENCE 0.10 0.09 0.08 0.07 0.10 0.09 0.09 0.08 REACTANCES ARE SATURATED VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED T'd TRANSIENT TIME CONST. 0.08s T''d SUB-TRANSTIME CONST. 0.019s T''do O.C. FIELD TIME CONST. 1.7s Ta ARMATURE TIME CONST. 0.018s	X"q QUAD. AXIS SUBTRANSIENT	0.36	0.32	0.30	0.27	0.41	0.38	0.37	0.34			
Xo ZERO SEQUENCE 0.10 0.09 0.08 0.07 0.10 0.09 0.09 0.08 REACTANCES ARE SATURATED VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED T'd TRANSIENT TIME CONST. 0.08s T'd SUB-TRANSTIME CONST. 0.019s T'do O.C. FIELD TIME CONST. 1.7s Ta ARMATURE TIME CONST. 0.018s	XLLEAKAGE REACTANCE	0.07	0.06	0.06	0.05	0.08	0.08	0.07	0.07			
REACTANCES ARE SATURATED VALUES ARE PER UNIT AT RATING AND VOLTAGE INDICATED T'd TRANSIENT TIME CONST. 0.08s T"d SUB-TRANSTIME CONST. 0.019s T'do O.C. FIELD TIME CONST. 1.7s Ta ARMATURE TIME CONST. 0.018s	X2 NEGATIVE SEQUENCE	0.24	0.22	0.20	0.18	0.28	0.26	0.25	0.23			
T'd TRANSIENT TIME CONST. 0.08s T"d SUB-TRANSTIME CONST. 0.019s T'do O.C. FIELD TIME CONST. 1.7s Ta ARMATURE TIME CONST. 0.018s	X ₀ ZERO SEQUENCE											
T''d SUB-TRANSTIME CONST. 0.019s T'do O.C. FIELD TIME CONST. 1.7s Ta ARMATURE TIME CONST. 0.018s		TED	VAL	UES ARE F			ND VOLTA	GE INDICAT	ED			
T'do O.C. FIELD TIME CONST. 1.7s Ta ARMATURE TIME CONST. 0.018s												
Ta ARMATURE TIME CONST. 0.018s												
SHORT CIRCUIT RATIO 1/Xd												
	SHORT CIRCUIT RATIO				1/	Xd						

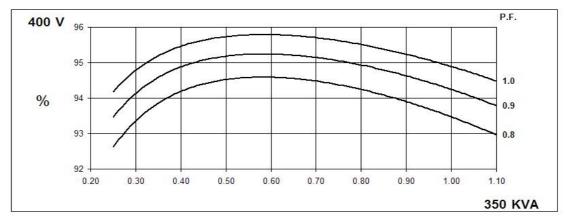
50 Hz

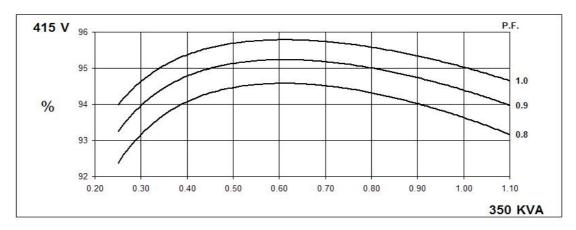
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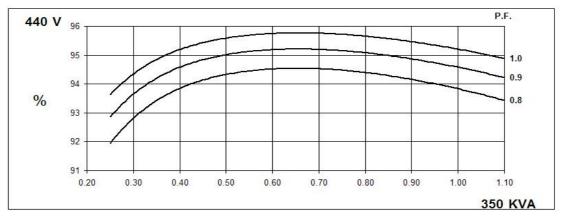


THREE PHASE EFFICIENCY CURVES







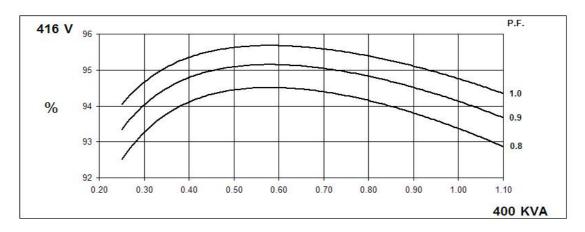


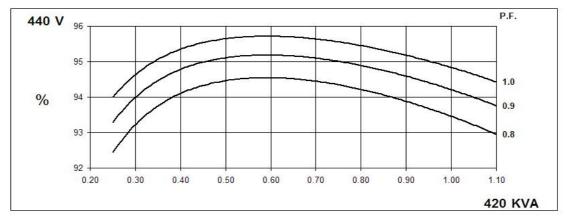
60 Hz

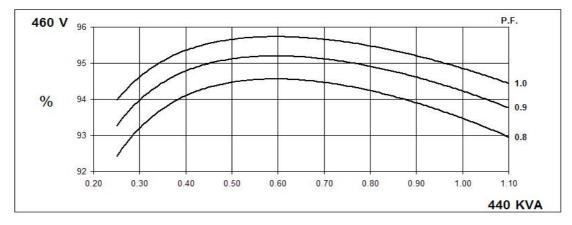
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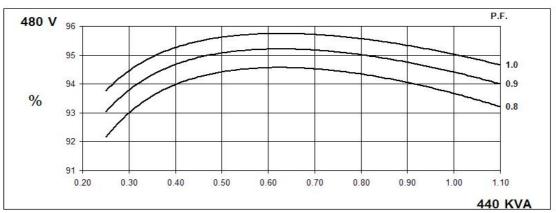


THREE PHASE EFFICIENCY CURVES





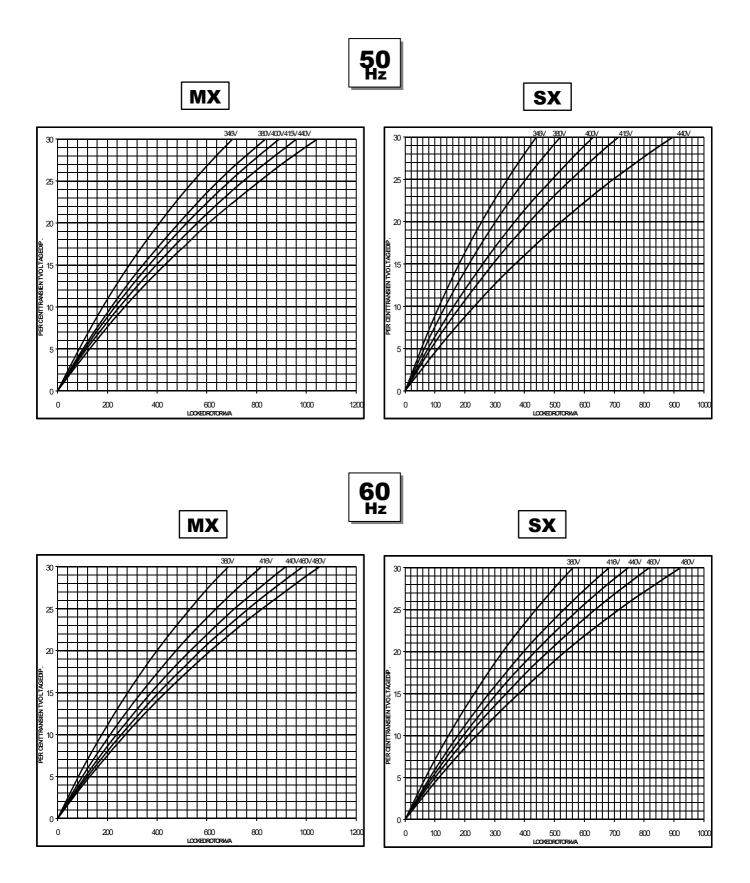






Winding 311

Locked Rotor Motor Starting Curve

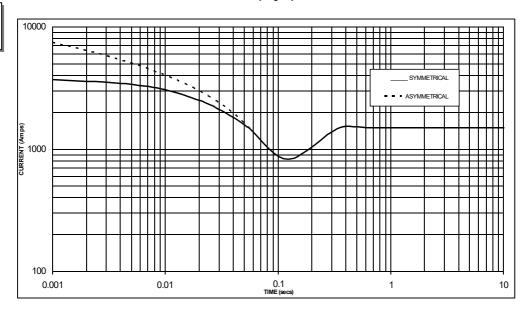




HCI434E

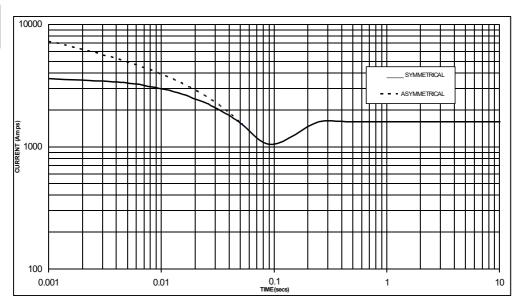
Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed Based on star (wye) connection.

50 Hz



Sustained Short Circuit = 1,500 Amps

60 Hz



Sustained Short Circuit = 1,600 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:

50	Hz	60Hz						
Voltage	Factor	Voltage	Factor					
380v	X 1.00	416v	X 1.00					
400v	X 1.05	440v	X 1.06					
415v	X 1.10	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 (Wye) connected machines. For other connection the following multipliers should be applied to current values as shown:



Winding 311 / 0.8 Power Factor

RATINGS

	Class - Temp Rise	C	ont. F	105/40	°C	С	nt. H	125/40	°C	St	andb y	150/40)°C	St	andb y	163/27	″°C
50	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
Hz	Series Delta (V)	220	230	240	254	220	230	240	254	220	230	240	254	220	230	240	254
	kVA	320	320	320	320	350	350	350	350	370	370	370	370	380	400	380	380
	kW	256	256	256	256	280	280	280	280	296	296	296	296	304	320	304	304
	Efficiency (%)	93.6	93.8	94.0	94.1	93.2	93.5	93.6	93.8	92.9	93.2	93.4	93.6	92.7	92.7	93.2	93.5
	kW Input	274	273	272	272	300	299	299	299	319	318	317	316	328	345	326	325
60	Series Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
Hz	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	365	385	400	400	400	420	440	440	420	445	460	460	435	455	475	475
	kW	292	308	320	320	320	336	352	352	336	356	368	368	348	364	380	380
	Efficiency (%)	93.8	93.8	93.9	94.0	93.4	93.5	93.5	93.7	93.1	93.2	93.2	93.5	92.9	93.0	93.1	93.3
	kW Input	311	328	341	340	343	359	376	376	361	382	395	394	375	391	408	407

DIMENSIONS

