NEGRA
GENERATORS

A.R.K4ES DATA SHEET

SPECIFICATIONS &OPTIONS

Standards

- A.R.K series alternator conforms to the major international standards and specifications, including:
  -IEC60034, GB755, BS5000, VDE0530, NEMA, MG1-22, C22.2-100, CSA, AS1359 standard, etc.
- A.R.K series alterantor is certified by ISO9001 quality system.
- A.R.K series alterantor can be used for the generator set of CE mark.
- Other standards and certification can be based on customer requirements.

Electrical characteristics

- Insualtion & Impregnating

  Class H insulation.
  All wound components are impregnated with meterial and processes designed specially to provide protection against harsh enviroments encountered in generator application. Resin based meterials are selected and developed to provide the high build required for static windings and the high mechanical strength required for rotating components.
- 3-phase reconnectable with12 ends brought out to the terminals.
- 2/3 pitch ，can eliminates triple (3rd, 9th, 15th …) harmonics on the voltage waveform and is found to be the optimumdesign for trouble-free supply of non-linear loads.
- Telephone interference

  THF(as defined by IEC 60034-1) is less than 2%, TIF(as defined by NEMA MG1-32) is less than 50.
- Radio interference

  Brushless device and the high quality AVR ensure low levels of interference with radio transmissions.RFI suppression module may be installed if required.
- High efficiency and motor startup capability.

Mechanical properties

- Steel structure.
- Cast aluminum for front and rear cover.
- Rigid assembly, effectively reduces the vibration during running.
- All rotors are dynamically balanced to conform with BS6861.
- Half key dynamic balance is applied in double bearing structure.
- Non-maintenance sealed-for-life ball bearing.
- 120% overspeed ability.

Standard

Protection grade

- A.R.K series alternator protection level is IP23.
- Suitable for environment with 95% relative humidity.
- optional
  - -Inlet and filter, power reduced by 5%.
  - -Inlet and outlet filter, power reduced by 10% (IP44)
  - -Anti-condensation heater.
  - -Stator winding, bearing overheating protection.
  - -Outlet line design of outlet box.
  - -Center height can be customized according to requirements.

Excitation and voltage regulation system

MODEL	16 series	18 series	22 series	27 series	4 series	5 series	6 series	7 series
AVR								
SX460	Standard	Standard	Standard	Standard				
AS440(parallel optional)	Optional	Optional	Optional	Optional				
SX440(parallel optional)			Optional	Optional	Standard	Standard		
MX341(with PMG)			Optional	Optional	Optional	Optional		
MX321(with PMG)							Standard	Standard

With the self-excited system, the main stator provides power via the automatic voltage regulator(AVR) to the exciter stator. The high efficency AVR ensures the voltage maintaining at the rated level.

The exciter rotor output is fed to the main rotor through a three phase full wave bridge rectifier. The rectifier is protected by surge suppressor from voltage spikes of short circuit or phase mismatching.

Application

Prime power, rental, telecom, mobile power station, lighting tower, railway, refrigeration and standby power.

Quality assurance

A.R.K series alterantors are manufactured using production procedures having a quality assurance level to ISO 9001.

Note: Continuous development of our products entitles usto change specification details without notice, thereforethey must not be regarded as binding.

A.R.K4ES
Parameters (WINDING 311)

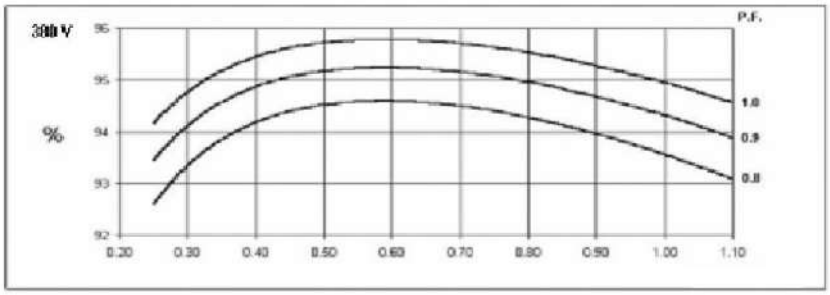
CONTROL SYSTEM	SELF EXCITED
A.V.R.	MX341 WITH PMG
VOLTAGE REGULATION	± 1.0 %
SUSTAINED SHORT CIRCUIT	>300% OF RATED CURRENT

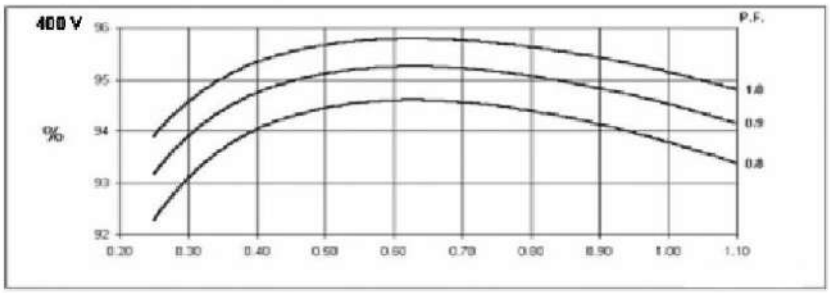
INSULATION SYSTEM	H							
RATED POWER FACTOR	0.8							
PROTECTION	IP23							
STATOR WINDING	DOUBLE LAYER							
ROTOR WINDING	WITH DAMPING CAGE							
WINDING LEADS	12							
STATOR WDG. RESISTANCE	0.009 Ohms PER PHASE AT 22°C SERIES STAR CONNECTED							
ROTOR WDG. RESISTANCE	1.19 Ohms at 22°C							
R.F.I. 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%							
MAXIMUM OVERSPEED	2250 Rev/Min							
BEARING DRIVE END	BALL. 6317 (ISO)							
BEARING NON-DRIVE END	BALL. 6314 (ISO)							
	1 BEARING				2 BEARING			
WEIGHT COMP. GENERATOR	1024 kg				1030 kg			
WEIGHT WOUND STATOR	470kg				470kg			
WEIGHT WOUND ROTOR	400kg				377kg			
WR² INERTIA	4.6331 kgm2				4.4343 kgm2			
SHIPPING WEIGHTS in a crate	1095 kg				1090 kg			
PACKING CRATE SIZE	155 x 87 x 107(cm)				156 x 87 x 107(cm)			
	50HZ				60HZ			
TELEPHONE INTERFERENCE	THF<2%				TIF<50			
COOLING AIR	0.486 m3/sec 1030 cfm				0.580 m3/sec 1240 cfm			
VOLTAGE SERIES STAR	380/220	400/231	415/240	440/254	416/240	440/254	460/266	480/277
VOLTAGE PARALLEL STAR	190/110	200/115	208/120	220/127	208/120	220/127	230/133	240/138
VOLTAGE SERIES DELTA	220/110	230/115	240/120	254/127	240/120	254/127	266/133	277/138
kVA BASE RATING FOR REACTANCE VALUES	313	313	313	325	375	394	419	419
Xd DIR. AXIS SYNCHRONOUS	2.79	2.52	2.34	2.08	3.33	3.08	2.9	2.75
X'd DIR. AXIS TRANSIENT	0.19	0.17	0.16	0.14	0.2	0.18	0.17	0.17
X"d DIR. AXIS SUBTRANSIENT	0.13	0.12	0.11	0.1	0.14	0.13	0.12	0.12
Xq QUAD. AXIS REACTANCE	2.4	2.16	2.01	1.79	2.8	2.59	2.44	2.31
X"q QUAD. AXIS SUBTRANSIENT	0.33	0.3	0.28	0.25	0.39	0.36	0.34	0.32
X L LEAKAGE REACTANCE	0.07	0.06	0.06	0.05	0.08	0.07	0.07	0.07
X 2 NEGATIVE SEQUENCE	0.23	0.2	0.19	0.17	0.27	0.25	0.24	0.22
X 0 ZERO SEQUENCE	0.08	0.08	0.07	0.06	0.1	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.	0.019 s							
T'do O.C. FIELD TIME CONST.	1.7s							
Ta ARMATURE TIME CONST.	0.018s							
SHORT CIRCUIT RATIO	1/Xd							

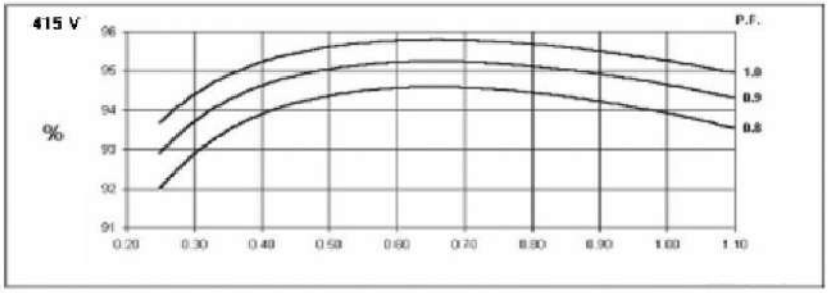
EXTATION SYSTEM	SX460	SX440	AS440	MX341	MX321
VOLTAGE REGULATION RATE	±1.5%	±1.0%	±1.0%	±1.0%	±0.5%
LOW SPEED VOLTAGE DROP PROTECTION	Standard	Standard	Standard	Standard	Standard
SHORT-CIRCUITED ELECTRIC ABILITY				300%:10S	300%:10S
PARALLEL OPERATION		Optional	Optional	Optional	Optional

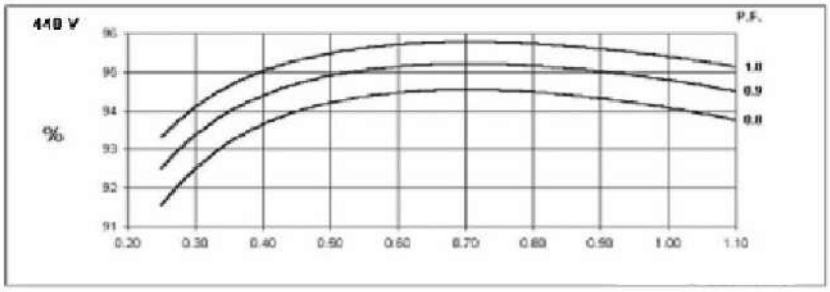
A.R.K4ES

Three Phase Efficiency Curves (WINDING 311) 50HZ



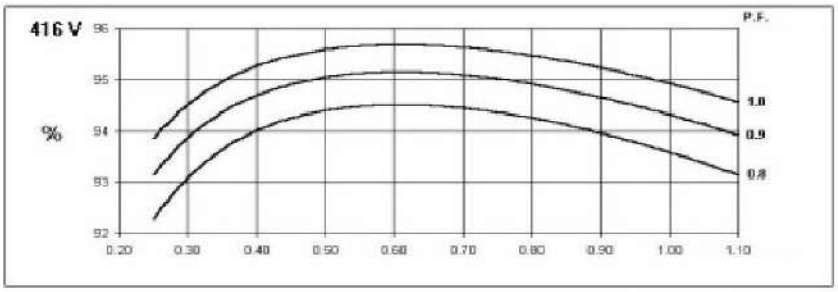


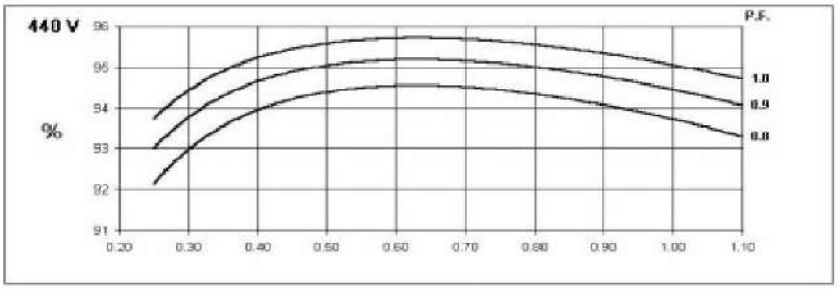


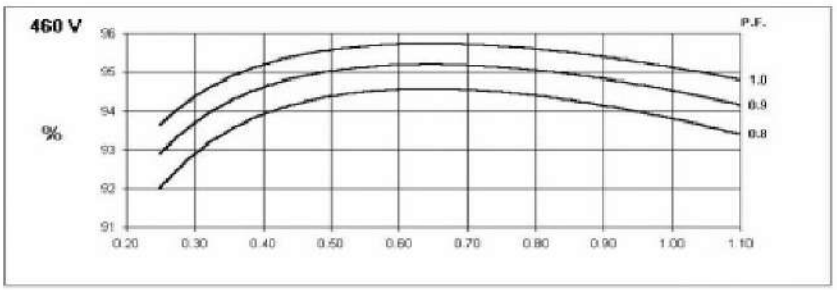


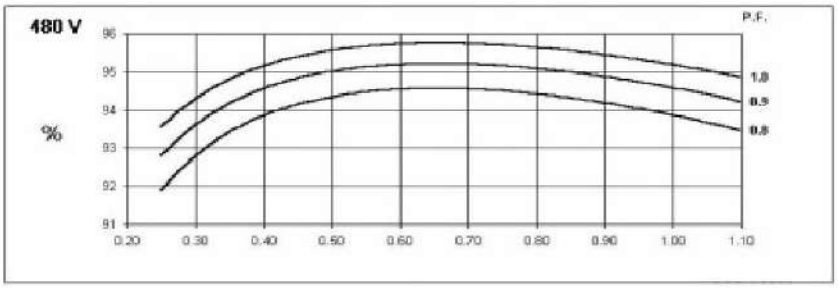
A.R.K4ES

Three Phase Efficiency Curves (WINDING 311) 60HZ





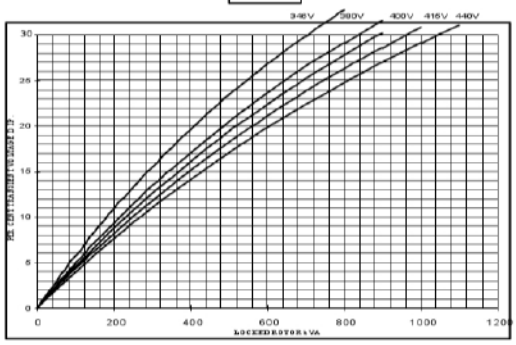




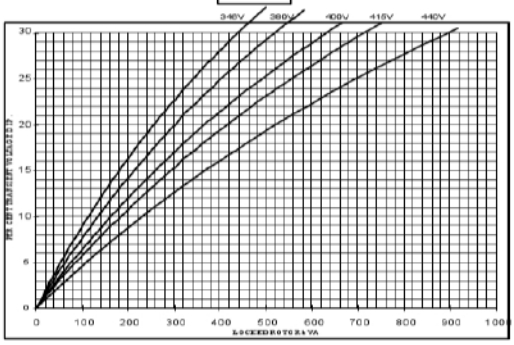
A.R.K4ES
Locked Rotor Motor Starting Curve (Winding 311)

50Hz

MX

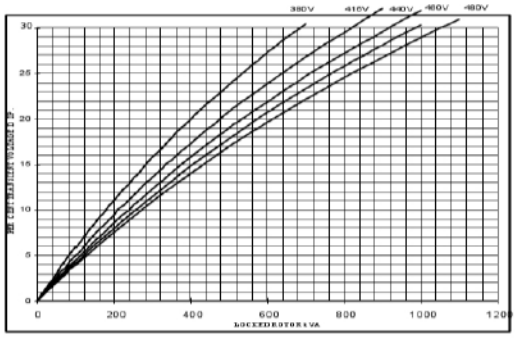


SX

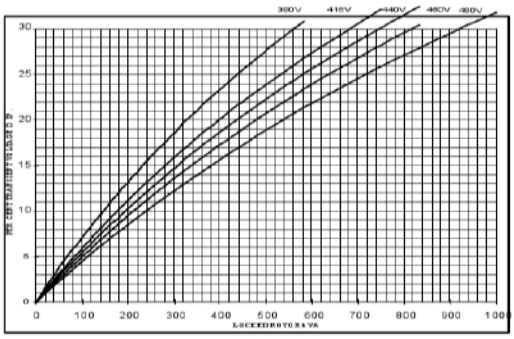


60Hz

MX



SX

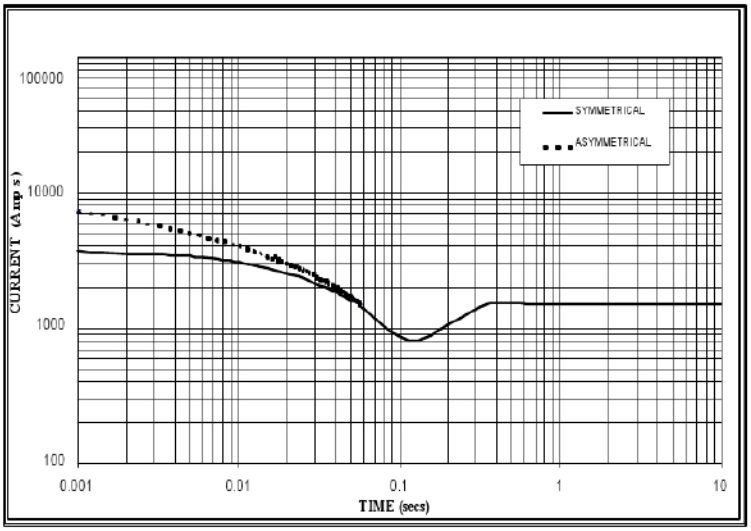


A.R.K4ES

Three-phase Short Circuit Decrement Curve. No-load Excitation at Rated Speed

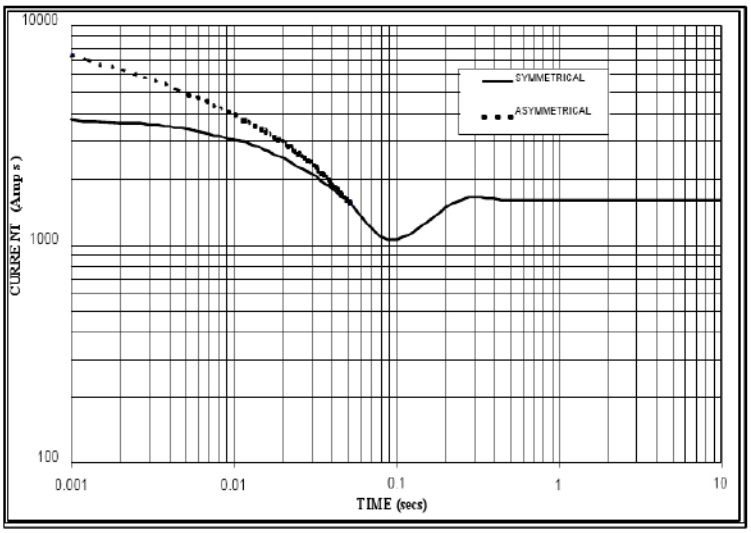
Based on star (wye) connection.

50 Hz



Sustained Short Circuit = 1,500 Amps

60 Hz



Sustained Short Circuit = 1,600 Amps

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

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

3.Curves are drawn for Star (Wye) connected machines.

For other connection the following multipliers should be applied to current values as shown :

Parallel Star = Curve current value X 2

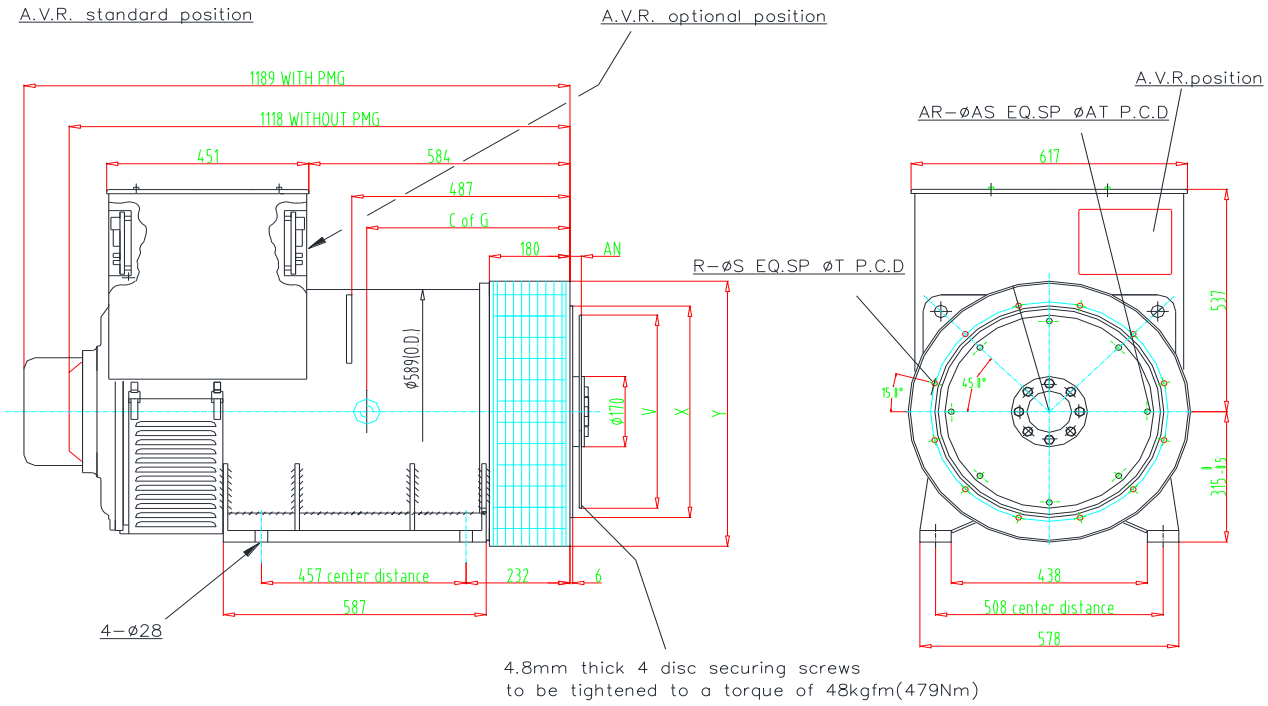
Series Delta = Curve current value X 1.732

A.R.K4ES
Winding 311 / 0.8 Power Factor
RATINGS

	Class - Temp Rise	Cont. F - 105/40°C				Cont. H - 125/40°C				Standby - 150/40°C				Standby - 163/27°C			
50HZ	Series Star (V)	380	400	415	440	380	400	415	440	380	400	415	440	380	400	415	440
	Parallel S tar (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	300	300	300	300	313	313	313	325	340	340	340	340	344	344	344	344
	kW	240	240	240	240	250	250	250	260	272	272	272	272	275.2	275.2	275.2	275.2
	Efficiency (%)	93.9	94.1	94.2	94.3	93.2	93.5	93.6	94.1	93.3	93.5	93.7	93.9	93.1	93.4	93.5	93.7

	Class - Temp Rise	Cont. F - 105/40°C				Cont. H - 125/40°C				Standby - 150/40°C				Standby - 163/27°C			
60HZ	Series Star (V)	416	440	460	480	416	440	460	480	416	440	460	480	416	440	460	480
	Parallel S tar (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	350	363	375	381	375	394	419	419	406	419	431	444	419	431	444	456
	kW	280	290	300	305	300	315	335	335	325	35	345	355	335	345	355	365
	Efficiency (%)	93.9	94	94.1	94.2	93.3	93.5	93.7	93.9	93.3	93.5	93.6	93.6	93.1	93.3	93.4	93.5

DIMENSIONS



MODEL	CofG	(Kg)
4ES	463	880
4FS	483	1010
4F	530	1105
4FG	530	1125

ADAPTOR					
S.A.E No.	R	S	T	X	Y
0	12	14	679.5	647.6	711
1/2	12	14	619.1	584.1	680
1	12	12,7	530,2	511,1	617
2	12	11	466,7	447,6	617
3	12	11	428,6	409,5	617

COUPLING DISC					
S.A.E No.	AN	AR	AS	AT	V
11,5	39,68	8	11	333,3	352,3
14	25,40	8	13,5	438,2	466,6
18	15.87	8	16.7	543.0	571.1