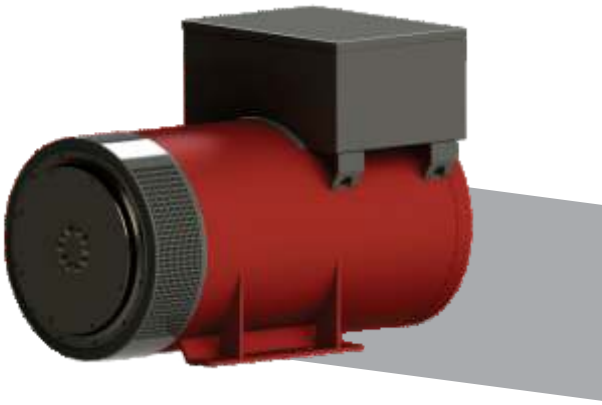
Application and Standard

The 4-pole generator is suitable for matching with a reciprocating internal combustion engine (commonly called a diesel engine) to form a generator set, which can be used as a fixed power supply or backup power supply for national defense, post and telecommunications, airports, hospitals, buildings, oil exploration, industrial and mining enterprises and other departments. Potenza Alternators are in compliance to the main domestic and international standards and regulations.



Electrical features

Automatic voltage regulators: Potenza 4 Pole Alternators are fitted with reliable and performant AVR, adapted to excitation systems, powered by transistors and fulfilling perfect regulation.

Short circuit capacity: Potenza propose two choices of excitation systems to meet different customer requirements:

A) Self-Excition system, without short-circuit capacity.
B) Other excitation systems, negotiable.

Transient features: Transient voltage dip for 60% rated current at 0.4 power factor is less than 15%.
Recovery time for a 15% transient voltage dip is less than 1.5s.

Parallel operation: All 4 pole alternators can operate in parallel with other alternators or with the mains, when they are equipped with the appropriate devices (AVR, current transformer...).

Overload acceptance: 4 pole alternators can be overloaded according to NEMA.

Single-phase operation: F1-20 series 4 pole alternators can be connected for single phase use. The single phase rating is given in the various alternator data sheets. F1-20 series alternators can be supplied with a dedicated single phase winding (D51/D61).

Waveform: Total harmonic distortion (THD), at no load or linear load is less than 5% according to IEC.
Telephone influence factor(TIF) according to NEMA is less than 50.

Frequency: 4 pole alternators may operate either 50Hz or 60Hz. The standard winding (B31, B32) is suitable both for 50Hz and 60Hz.

Power factor: 4 pole alternators are designed to operate between 0.8 and 1.0 power factor.
A derating is necessary below 0.8 power factor (see derating table).

Mechanical features

Forms: 4 pole alternators can be provided in single bearing or double bearing configurations according to customer's requirements, as well as Engine adaptors and coupling discs which are fit for the major engines.

Balancing: All the rotors are dynamically balanced according to ISO1940. Double bearing rotors are balanced with a half key.

Insulation and protection: 4 pole alternators are class H insulated. The standard winding protection can accept up to 95% relative humidity and is suitable in the cabins. Specific added coatings can be proposed for harsh environments.

Enclosure: Standard enclosure is IP23.

Direction of rotation: F1-20 series can operate in both directions.

Terminal box and connectors: 4 pole alternators have a terminal box which allows easy access for connection of AVR or reconnection.
Current transformers or other optional modules can be fitted within the box.

Bearings: Sealed for life bearings up to all Potenza 4 pole alternator.

Overspeed: The maximum overspeed is 2250 RPM for the 4 pole alternator (1.25 times the 60Hz rated speed).

Mechanical structure: Steel frame. Aluminium, cast iron or steel housing and flanges depending on models.

General Parameters

Ambient temperature	40°C	Temperature rise	125K	Short circuit current multiple	/
Altitude	1000m	Voltage Regulation	±1%	Cooling method	IC01
Insulation class	Class H	Exciter method	Brushless self-excitation	Direction of rotation	Clockwise
Duty type	S1	Winding pitch	2/3	Maximum speed	2250 rpm
Phases	3	Power factor	0.8	Protection grade	IP23
Number of poles	4	TIF	<50	Frequency	50/60Hz
AVR model	SX460	THF	<2%	THD	1.2%~2.5%

Electrical parameters

50Hz/1500RPM		Standard winding / Power factor 0.8								Special winding	
Duty type / temp rise / ambient temp		Cont. / 125K / 40°C				Standby / 163K / 27°C				Cont. / 125K / 40°C	
Phase		**3 Phases**				**3 Phases**				**Single-phase**	
Voltage	Y	380V	400V	415V	440V	380V	**400V**	415V	440V	220V / 230V / 240V	
	Δ	220V	230V	240V		220V	230V	240V		Power factor	
	YY				220V				220V	0.8	1.0
PO9	KVA	8.1	8.1	8.1	7.7	9.1	**9.1**	9.1	8.5	5.5	6.5
	KW	*6.5*	*6.5*	*6.5*	*6.2*	*7.3*	*7.3*	*7.3*	*6.8*	*4.4*	*6.5*
PO12	KVA	11	11	11	10.5	12.5	**12.5**	12.5	11.5	7.5	8.8
	KW	*8.8*	*8.8*	*8.8*	*8.4*	*9.9*	*9.9*	*9.9*	*9.2*	*6.0*	*8.8*
PO15	KVA	13.5	13.5	13.5	12.8	15.1	**15.1**	15.1	14.1	9.2	10.8
	KW	*10.8*	*10.8*	*10.8*	*10.3*	*12.1*	*12.1*	*12.1*	*11.3*	*7.3*	*10.8*
PO18	KVA	16	16	16	15.2	18.0	**18.0**	18.0	16.7	10.9	12.8
	KW	*12.8*	*12.8*	*12.8*	*12.2*	*14.4*	*14.4*	*14.4*	*13.4*	*8.7*	*12.8*
PO20	KVA	17.5	17.5	17.5	16.6	20.1	**20.1**	20.1	18.3	11.9	14.0
	KW	*14*	*14*	*14*	*13.3*	*16.1*	*16.1*	*16.1*	*14.6*	*9.5*	*14.0*

* Consult factory for other voltages

Electrical Parameters

60Hz/1800RPM		Standard winding / Power factor 0.8								Special winding	
Duty type / temp rise / ambient temp		Cont. / 125K / 40°C				Standby / 163K / 27°C				Cont. / 125K / 40°C	
Phase		3 Phases				3 Phases				Single-phase	
Voltage	Y	416V	440V	460V	480V	416V	**440V**	460V	480V	220V / 230V / 240V	
	Δ	240V				240V				Power factor	
	YY	208V	220V	230V	240V	208V	220V	230V	240V	0.8	1.0
PO9	KVA	8.7	9.3	10.0	10.0	9.6	**10.3**	11.2	11.2	6.2	7.3
	KW	*7.0*	*7.5*	*8.0*	*8.0*	*7.7*	*8.2*	*8.9*	*8.9*	*5.0*	*7.3*
PO12	KVA	11.8	12.7	13.8	13.8	13.0	**13.9**	15.1	15.1	8.4	9.9
	KW	*9.5*	*10.1*	*11.0*	*11.0*	*10.4*	*11.1*	*12.1*	*12.1*	*6.7*	*9.9*
PO15	KVA	14.5	15.5	16.9	16.9	16.0	**17.1**	18.6	18.6	10.3	12.2
	KW	*11.6*	*12.4*	*13.5*	*13.5*	*12.8*	*13.7*	*14.9*	*14.9*	*8.3*	*12.2*
PO18	KVA	17.2	18.4	20.0	20.0	18.9	**20.2**	22.0	22.0	12.2	14.4
	KW	*13.8*	*14.7*	*16.0*	*16.0*	*15.1*	*16.2*	*17.6*	*17.6*	*9.8*	*14.4*
PO20	KVA	18.8	20.1	21.9	21.9	20.7	**22.1**	24.1	24.1	13.4	15.8
	KW	*15*	*16.1*	*17.5*	*17.5*	*16.6*	*17.7*	*19.3*	*19.3*	*10.7*	*15.8*

Moment of Inertia & Efficiency

Model	F1-20	PO9	PO12	PO15	PO18	PO20
Moment of Inertia (single-bearing).J	kgm^2	0.091	0.102	0.113	0.120	0.129
50Hz 400V Efficiency (100% Load)	%	78.8	80.2	81.4	82.0	82.4
60Hz 440V Efficiency (100% Load)	%	79.6	81.5	82.5	83.1	83.4

* Consult factory for other voltages

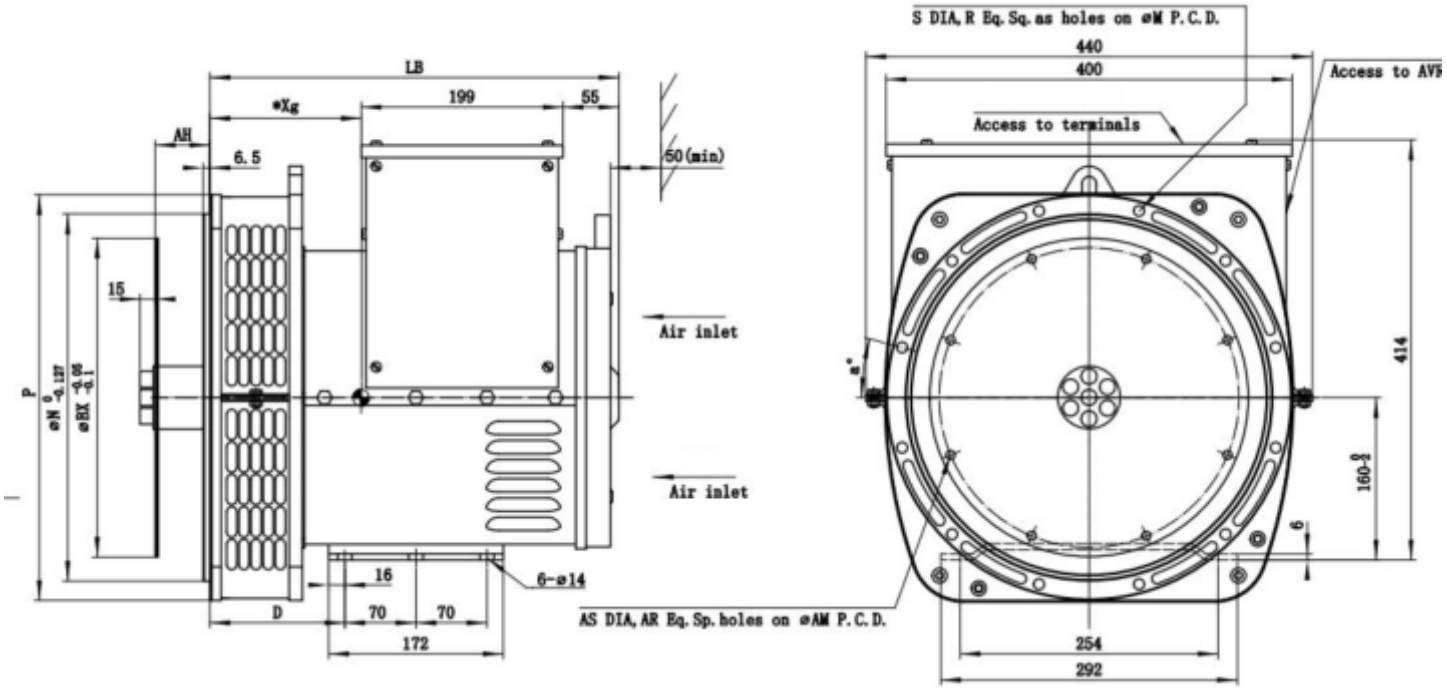
Reactance (%) - Time Constant (ms)

F1-20	50Hz @ 400V	PO9	PO12	PO15	PO18	PO20
Kcc	Short circuit ratio	0.49	0.44	0.45	0.44	0.43
Xd	Direct axis synchronous unsaturated reactance	205	226	222	229	231
X'd	Direct Axis Transient Saturation Reactance	18.6	19.4	18.3	18.5	18.4
X''d	Direct Axis Subtransient Saturation Reactance	12.7	12.7	11.6	11.6	11.3
Xq	Quadrature axis synchronous unsaturated reactance	118	130	127	131	132
X''q	Quadrature Subtransient Saturation Reactance	13.6	13.6	12.4	12.4	12.1
X2	Negative sequence saturation reactance	1.32	1.31	1.20	1.20	1.17
X0	Zero sequence unsaturated reactance	1.16	1.06	0.90	0.87	0.82
T'd	Short-circuit transient time constant	15	15	13	12	12
T''d	Subtransient time constant	19.0	18.3	16.0	15.5	14.7
T'do	Open circuit time constant	700	713	649	642	618
Ta	Armature time constant	4.2	6.1	7.2	9.4	11.0

Reactance (%) - Time Constant (ms)

F1-20	60Hz @ 440V	PO9	PO12	PO15	PO18	PO20
Kcc	Short circuit ratio	0.35	0.37	0.38	0.36	0.38
Xd	Direct axis synchronous unsaturated reactance	986	269	264	281	266
X'd	Direct Axis Transient Saturation Reactance	89.5	23.1	21.7	22.7	21.2
X''d	Direct Axis Subtransient Saturation Reactance	61.0	15.1	13.9	14.2	13.1
Xq	Quadrature axis synchronous unsaturated reactance	567	154	151	160	152
X''q	Quadrature Subtransient Saturation Reactance	65.6	16.2	14.8	15.2	13.9
X2	Negative sequence saturation reactance	6.38	1.57	1.43	1.47	1.35
X0	Zero sequence unsaturated reactance	5.58	1.27	1.08	1.06	0.94
T'd	Short-circuit transient time constant	61	15	13	13	11
T''d	Subtransient time constant	76.1	18.2	15.9	15.9	14.1
T'do	Open circuit time constant	3359	848	773	786	715
Ta	Armature time constant	8.4	6.1	7.7	9.6	10.6

Outline Drawing (Single Bearing)

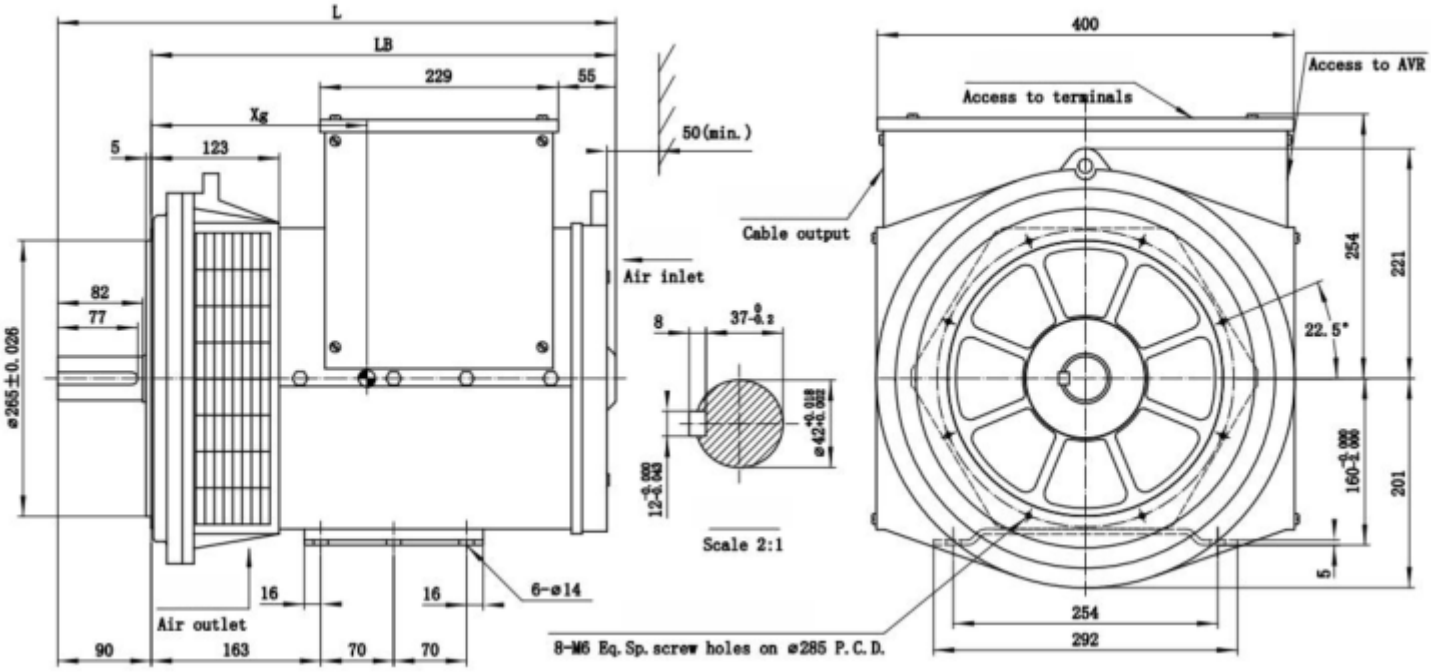


Dimension (mm)					
Model	**LB** SAE3	**LB** SAE4&5	***Xg**	**Weight**	**Package**
	mm		mm	kg	L x W x H (mm)
PO9	376	364	145	75	542*504*620
PO12	376	364	152	80	542*504*620
PO15	416	404	160	86	597*504*620
PO18	416	404	165	90	597*504*620
PO20	416	404	170	97	597*504*620

Front cover (mm)						
S.A.E	P	N	M	R-øS	W	a°
#3	451	409.575	428.625	12 - ø12	5	15°
#4	402	361.95	381	12 - ø12	5	15°
#5	356	314.325	333.375	8 - ø12	5	22.5°

Coupling (mm)				
S.A.E	BX	AM	AR-øAS	AH
#6.5	215.9	200.025	6 - ø9	30.2
#7.5	241.3	222.25	8 - ø9	30.2
#8	263.525	244.475	6 - ø11	62
#10	314.325	295.3	8 - ø11	53.8
#11.5	352.425	333.38	8 - ø11	39.6

Outline Drawing (Double Bearing)



Dimension (mm)					
Model	L	LB	*Xg	Weight	Package
	mm	mm	mm	kg	L x W x H (mm)
PO9	517	427	183	81	602*504*620
PO12	517	427	193	86	602*504*620
PO15	517	427	203	92	657*504*620
PO18	562	472	217	96	657*504*620
PO20	562	472	225	103	657*504*620