

PHASE 9 DC Alternators



PHASE 9 SERIES - LOW VOLTAGE DC ALTERNATORS - GENERAL TECHNICAL SPECIFICATIONS	4
PHASE 9 - 2 POLES ALTERNATORS (FROM 2700 TO 3600 RPM) - 24 / 48 VDC	6
PHASE 9 - 4 POLES ALTERNATORS (FROM 1300 TO 2100 rpm) - 24/ 48 VDC	7
APPLICATIONS AND USES	8
KEY FEATURES	9
DIMENSIONS	10



Arcole, Verona, Italy

THE COMPANY

LINZ ELECTRIC S.p.A., part of the Pedrollo Group of companies, is specialized in the production of alternators and rotating welders. It was founded in 2002 and became in few years one of the major players in the sector. The knowledge and long experience of its designers together with the strong propensity for innovation and a natural tendency for investment has quickly led to the development of a full range of products whose high quality standards are recognized and appreciated worldwide by the most important gen-sets manufacturers. In accordance with its deep values the main focus of Linz Electric has always been the Customer Satisfaction by controlling the key points of the production through a strong vertical integration, a constant focus on the Product Quality and a quick and complete Service.

LINZ ELECTRIC lands in the States, with a new subsidiary, LINZ ELECTRIC INC. based in Northbrook, Illinois. It is an important step for the company, which will offer to US customers an optimized pre- and after-sales service, quick deliveries and customer support, thanks to the proximity to the market and to the competence that always distinguishes Linz Electric and its people.

Northbrook, IL, USA



PHASE 9 SERIES LOW VOLTAGE DC ALTERNATORS

General technical specifications

The PHASE 9 series is made up of low voltage direct current generators consisting of synchronous brushless alternators with 9-phase windings able to guarantee residual AC current (Ripple) of less than 1% without batteries. The AC output is converted to DC by means of rectifiers mounted into the control boxes located on top of the machines and provided with built-in fans. This product range offers a comprehensive line of direct current alternators for use in hybrid systems covering various applications, and for charging all types of battery available on the market.

Available voltages

The standard range is 24 or 48 Vdc; if requested, versions can be provided with different voltages or higher current ratings which in certain cases, for reasons of size, must be equipped with rectifiers located externally of the control box.

Voltage regulation

Voltage regulators designed especially for alternators of the PHASE 9 series allow a wide range of control over the output voltage.

Our DC alternators can be equipped with two types of regulators, depending on the type of system with which these machines are associated.

PHASE 9 alternators can be used with an external BMS (Battery Management System) for use in battery charging applications, or with a constant voltage control system:

1) WITH EXTERNAL CONTROL SYSTEM (BMS)

For optimal management of battery charging, the alternator can be used in conjunction with an external controller commonly known as the Battery Management System (BMS).

In this instance the machine can be controlled by the BMS, with the user able to select and set the parameters needed to manage the charging process best suited to the type of battery.

2) CONSTANT VOLTAGE SYSTEM

In the constant voltage configuration, the machine will supply a steady voltage under both full load and no load, whereas the charging current will depend on the battery charge status. To safeguard and prolong battery life, accordingly, the current output must be limited in terms of intensity and over time. If the system is not provided with an external control device, then a current limiter (CL) must be used. This is available on request.

The electronic regulator (AVR) provides:

- › precision of voltage output to $\pm 0.5\%$
- › protection against over-excitation
- › protection against low frequency

Operating speed

Our DC systems are not limited to a synchronous speed, but can be used at fixed speed, at two speeds, or at variable speed within a predetermined range.





Direction of rotation

Both directions of rotation are permissible.

Mechanical specifications

The casing and end shields are made of vibration-resistant aluminium alloy. The shaft is high strength steel. A rotor of particularly robust construction is able to withstand drive motor overspeed, and is provided with a damping cage. The top control box, likewise robustly constructed, provides ease of access to components and is equipped with additional cooling fans, as well as special output terminals to ensure simple, secure and durable connections.

Protection

IP 23 standard.

Ventilation

Axial flow fan with air intake on the side opposite to the coupling.

Electrical specifications

The AC alternator is a 9 phase machine with exciter and auxiliary winding supplying the AVR and fans, plus thermal overload cutouts protecting the stator winding and rectifier. Insulation components are manufactured using class H materials, for both stator and rotor. The windings are tropicalized.

Overloads

The adoption of oversized electrical devices ensures that the machine can withstand overloads of +15% for a few minutes.

Power ratings

Power ratings are referred to the following conditions: ambient temperature no higher than 40 °C, altitude no higher than 1000 m a.s.l.

Applicable standards

Products of the PHASE 9 series are manufactured in compliance with standards EN 60034-1, EN 60204-1, EN61000-6-2, EN61000-6-4, EN55014-1, EN 55011 and directives 2006/42/EC, 2014/35/EU, 2014/30/EU.



PHASE 9 - 2 POLES ALTERNATORS (from 2700 to 3600 rpm)

- Output voltage: 24Vdc or 48Vdc
- 9 phases brushless AC alternator source
- Electronic regulation with $\pm 0.5\%$ of voltage accuracy
- Range of voltage regulation: 24 - 30 Vdc or 48 - 59 Vdc
- Integrated rectifier with forced ventilation for current over 200Adc
- Ripple: < 1% without battery
- Service cycle: S1

PHASE 9 24VDC

TYPE	from 2700 to 3600 rpm		Efficiency 28Vdc 3000rpm		Weight (lb)	J (Kgm ²)	Air volume (m ³ /min)
	ADC	POWER @28	3/4	4/4			
ESA2-24/200	200	5.6 kW	76.8	78.7	174.17	0.055	4.2
ESB2-24/250	250	7 kW	78.6	79.4	187.39	0.060	4.8

PHASE 9 48VDC

TYPE	from 2700 to 3600 rpm		Efficiency 56Vdc 3000rpm		Weight (lb)	J (Kgm ²)	Air volume (m ³ /min)
	ADC	POWER @56	3/4	4/4			
ESA2-48/125*	125	7 kW	80.9	82.1	169.76	0.055	4.2
ESB2-48/175*	175	10 kW	82.5	82.8	182.98	0.060	4.8
ESC2-48/200	200	11.2 kW	83.4	83.9	203.93	0.067	5.4
EMD2-48/250	250	14 kW	84.4	85.4	244.71	0.082	6.0

ES 2 or 4 poles



SM 4 poles



PM 4 poles



PHASE 9 - 4 POLES ALTERNATORS (from 1300 to 2100 rpm)

- Output voltage: 24Vdc or 48Vdc
- 9 phases brushless AC alternator source
- Electronic regulation with $\pm 0.5\%$ of voltage accuracy
- Range of voltage regulation: 24 - 30 Vdc or 48 - 59 Vdc
- Integrated rectifier with forced ventilation for current over 200Adc
- Ripple: < 1% without battery
- Service cycle: S1

PHASE 9 24VDC

TYPE	from 1300 to 2100 rpm		Efficiency 28Vdc 1500rpm		Weight (lb)	J (Kgm ²)	Air volume (m ³ /min)
	ADC	POWER @28	3/4	4/4			
ESA4-24/120*	120	3.3 kW	77	78.8	167.55	0.060	3.2
ESB4-24/200	200	5.6 kW	78.7	80.2	187.39	0.066	4.2
SMC4-24/250	250	7 kW	80.1	81.8	295.43	0.189	5.6
PSA4-24/300	300	8.4 kW	81	82	335.1	0.188	5.7
PSA4-24/380	380	11 kW	81.9	82.6	335.1	0.188	5.9
PMA4-24/500	500	14 kW	82.4	83.4	352.74	0.189	6.1
PMB4-24/600	600	17 kW	81	81.8	384.91	0.219	8.3

PHASE 9 48VDC

TYPE	from 1300 to 2100 rpm		Efficiency 56Vdc 1500rpm		Weight (lb)	J (Kgm ²)	Air volume (m ³ /min)
	ADC	POWER @56	3/4	4/4			
ESB4-48/120*	120	6.7 kW	83.6	83.6	182.98	0.066	4.3
EME4-48/200	200	11 kW	85.1	86	249.12	0.091	4.8
SMC4-48/250	250	14 kW	85.9	85.6	295.42	0.189	5.6
PSA4-48/300	300	17 kW	85.3	86.2	335.1	0.188	5.7
PSB4-48/380	380	21.5 kW	86.5	86.5	365.97	0.218	6.5
PMC4-48/500	500	28 kW	83.4	87	414.47	0.252	7.1
PMD4-48/650	650	36.5 kW	88.1	88.5	451.95	0.285	8.3

* without rectifier ventilation

APPLICATIONS AND USES

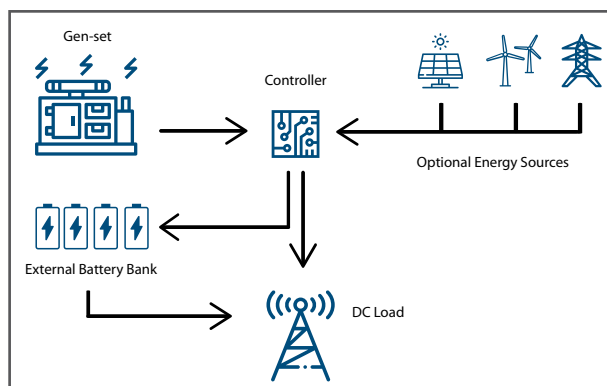
The standard range of 24Vdc and 48 Vdc covers the voltages utilized most widely in various applications such as telecoms, backup units for hybrid systems, low voltage light towers, battery charge systems or APUs.

• **Battery chargers** (12 and 24 Vdc): products of the PHASE 9 series offer flexible solutions to guarantee optimal charging of any battery type. More exactly, the options include a constant voltage version with current limiter, and a version with voltage regular allowing control by a battery management system (BMS), which is recommended in particular for use in systems using batteries of the latest generation (LFE – Li-Ion). In addition to the standard 24 Vdc range, there are also 12 Vdc models available on request.

• **Telecoms and hybrid systems** (48Vdc): these are the main applications for alternators of the PHASE 9 series.

The electronic voltage regulator was developed to allow the management of key variables — time, voltage, current, temperature — and activation/deactivation of the DC current output by an external controller or by a BMS, to the end of achieving an optimized charging process for any type of battery, and enabling the supply of power simultaneously to batteries and to DC loads. In effect, thanks to the low ripple obtained with the 9-phase winding, power can be supplied directly to any DC load.

The ruggedness of our machines and the brushless technology used in their manufacture are also factors that render PHASE 9 alternators ideal for telecom towers, which require a power source rated for continuous duty.



Other Applications:

- **Low voltage light towers (48Vdc)**
- **Starter systems for Aircraft and Industrial Vehicles (24-28Vdc high current levels)**
- **APUs**
- **Electric cranes (220Vdc)**
- **Magnetic lifting cranes**



KEY FEATURES



• **Top dependability and durability** thanks to a simple and reliable technology that excludes the use of power switching electronics. This translates into longer working life of the product and lower operating costs.



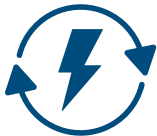
• **Optimization of the battery charging process** thanks to the accuracy of the voltage: a charging process characterized by high and enhanced performance.



• **Ultra-low ripple effect** ensured by the 9-phase winding, which means power can be supplied directly to any DC load.



• **Flexibility and adaptability to many applications**, by virtue of the different configurations available



• **High Efficiency** thanks to the manufacturing technologies employed and to painstaking design, which have enabled the achievement of efficiency levels among the highest on record in the category of alternators for hybrid applications.



• **Variable speed** capability means that systems can be utilized setting a speed that will allow a more efficient saving of fuel.

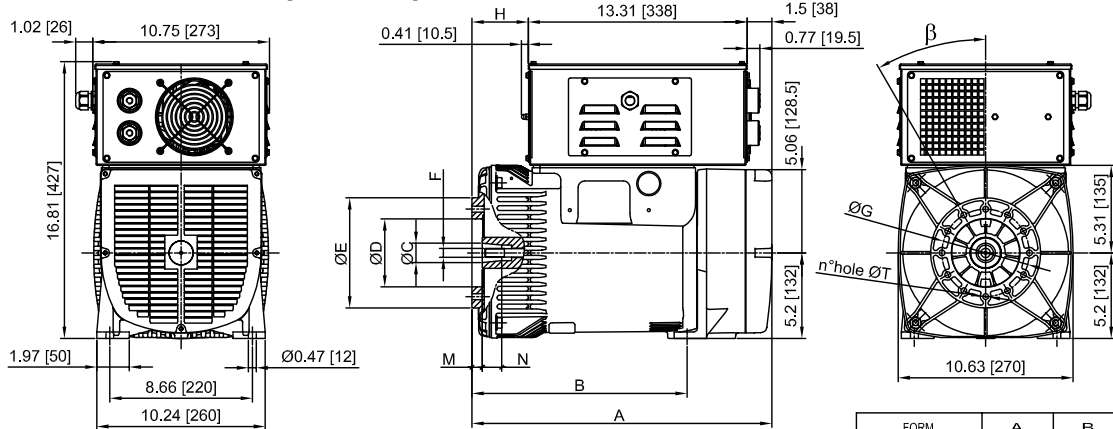


• Systems incorporating PHASE 9, alternative energy sources, battery packs and a relative BMS are able to **guarantee maximum economy** in terms of operating costs.

DIMENSIONS PHASE 9 ES

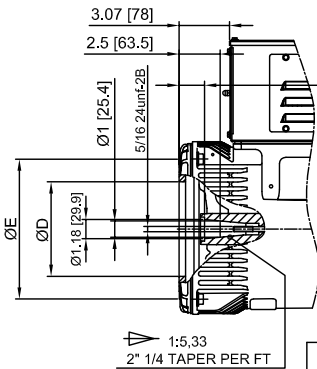
Dimensions in inches and [millimeters]

FORM B3/B9



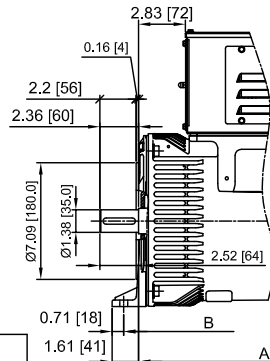
FORM	ØC	ØD	ØE	F	ØG	H	M	N	n°holes	ØT	β
cone Ø1.18 [30]	1.18 [30]	4.13 [105]	6.69 [170]	M14x1.5	5.32 [135]	3.43 [87]	0.63 [16]	1.18 [30]	12	0.35 [9]	30°
cone Ø1.49 [38]	1.49 [38]	4.92 [125]	7.28 [185]	M18x1.5	5.91 [150]	3.07 [78]	0.2 [5]	1.18 [30]	4	0.43 [11]	β/2 45°

FORM	A	B
B3B9 c. Ø1.18 [30]	18.23 [463]	13.07 [332]
B3B9 c.Ø1.49[38]-J609b	17.87 [454]	12.72 [323]
B3/B14	17.64 [448]	13.39 [340]
MD35 - LOMB. STD	19.53 [496]	14.37 [365]

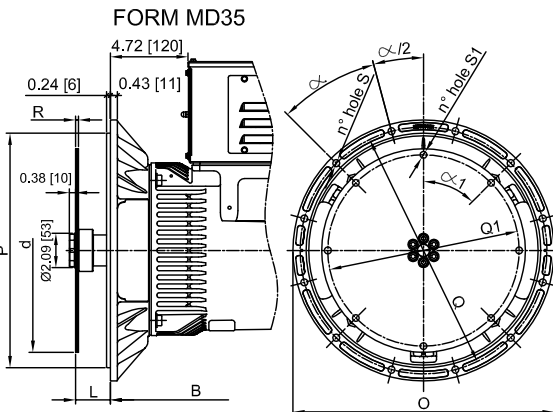


FORM J609b

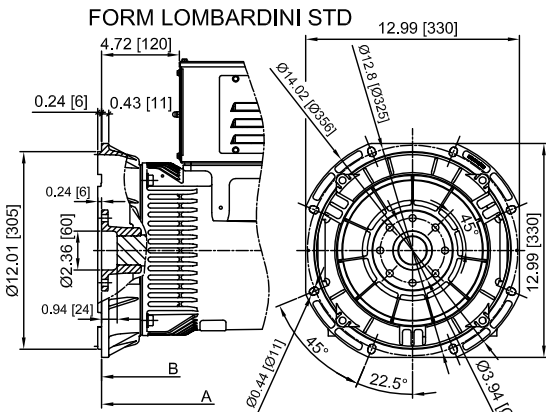
FORM	ØD	ØE	ØG
J609b	5.75 [146]	7.56 [192]	6.49 [165]
	6.44 [163.6]	8.5 [216]	7.75 [196.85]
	7 [177.8]		



FORM B3/B14



FORM MD35

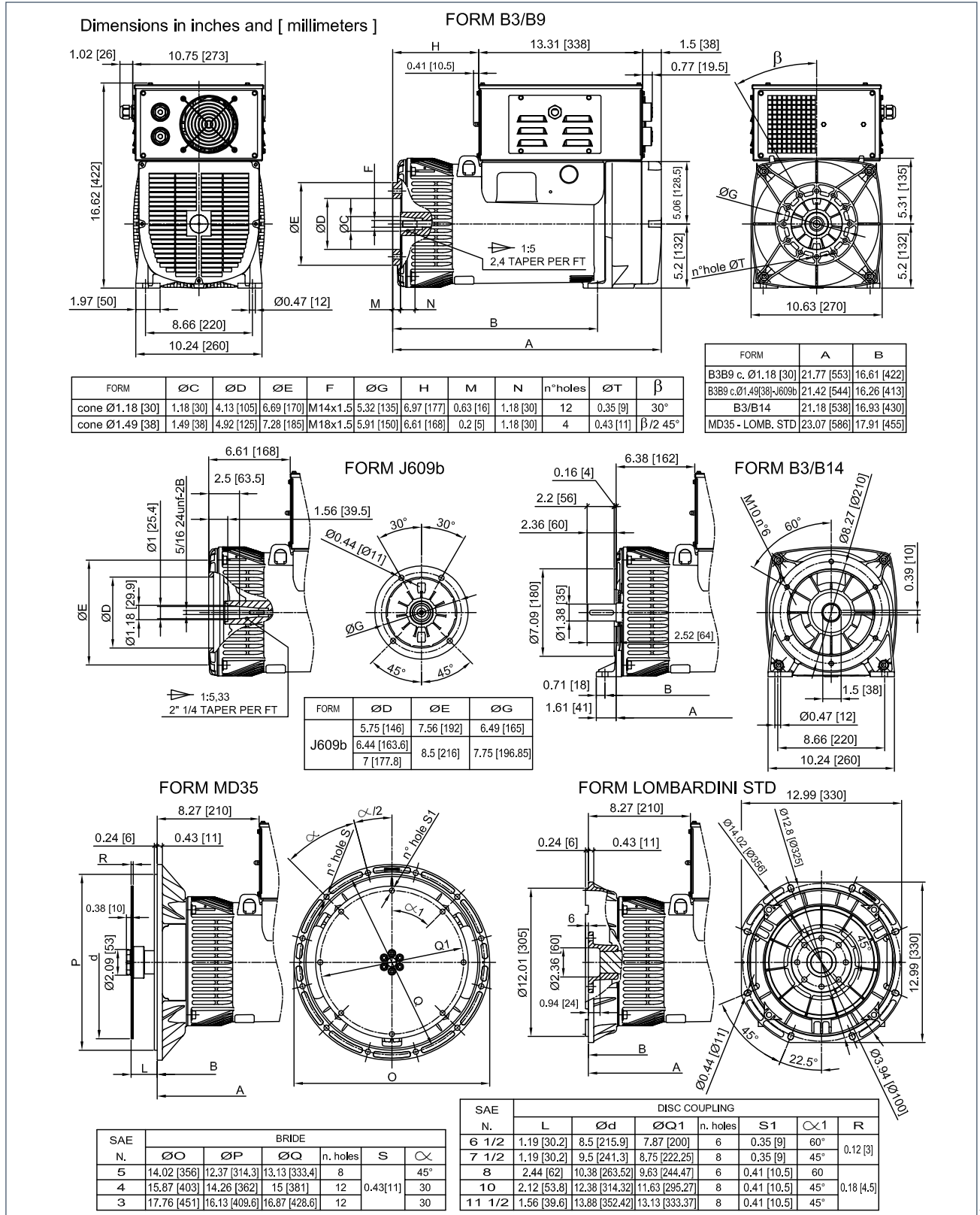


FORM LOMBARDINI STD

SAE N.	BRIDE				
	ØO	ØP	ØQ	n. holes	S
5	14.02 [356]	12.37 [314.3]	13.13 [333.4]	8	45°
4	15.87 [403]	14.26 [362]	15 [381]	12	0.43 [11]
3	17.76 [451]	16.13 [409.6]	16.87 [428.6]	12	30

SAE N.	DISC COUPLING					
	L	Ød	ØQ1	n. holes	S1	α1
6 1/2	1.19 [30.2]	8.5 [215.9]	7.87 [200]	6	0.35 [9]	60°
7 1/2	1.19 [30.2]	9.5 [241.3]	8.75 [222.25]	8	0.35 [9]	45°
8	2.44 [62]	10.38 [263.52]	9.63 [244.47]	6	0.41 [10.5]	60°
10	2.12 [53.8]	12.38 [314.32]	11.63 [295.27]	8	0.41 [10.5]	45°
11 1/2	1.56 [39.6]	13.88 [352.42]	13.13 [333.37]	8	0.41 [10.5]	45°

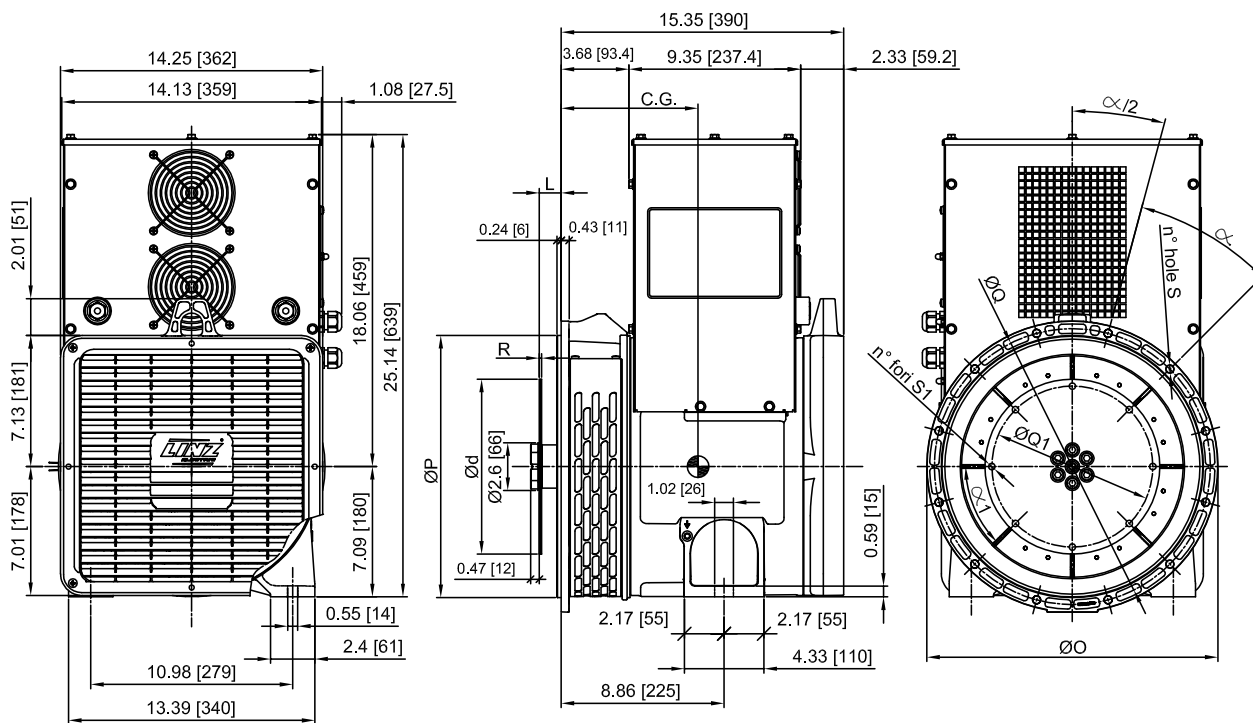
DIMENSIONS PHASE 9 EM



DIMENSIONS PHASE 9 SM

Dimensions in inches and [millimeters]

FORM SAE

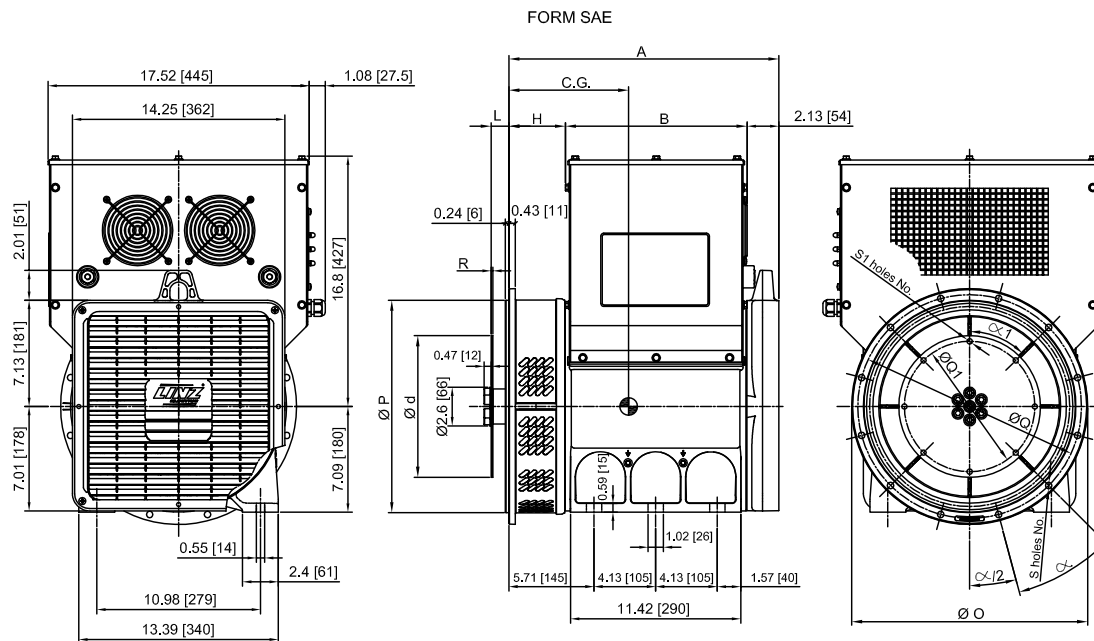
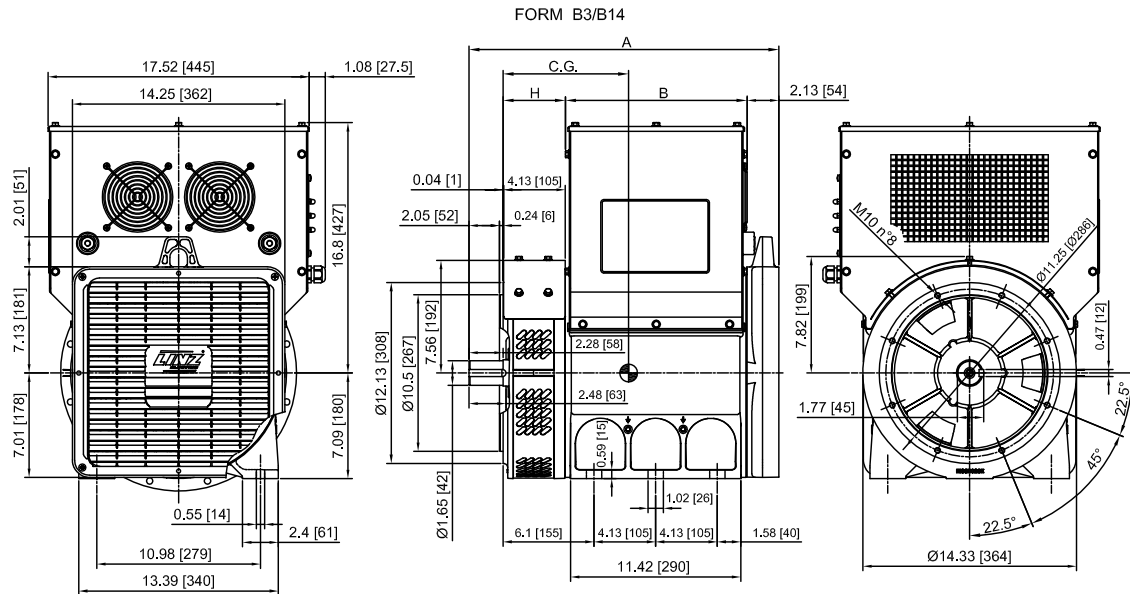


TIPO - TYPE	C.G.
SMC	8,07 [205]

SAE	FLANGES						DISC COUPLING						
	N.	$\varnothing O$	$\varnothing P$	$\varnothing Q$	holes No.	S	α	L	$\varnothing d$	$\varnothing Q1$	n. holes	S1	$\alpha 1$
6 1/2	1.19 [30.2]	12.37 [314.3]	13.13 [333.4]	8	0.43 [11]	45°	1.19 [30.2]	8.5 [215.9]	7.87 [200]	6	0.35 [9]	60°	0.12 [3]
7 1/2	1.19 [30.2]	14.26 [362]	15 [381]	12	0.43 [11]	30°	1.19 [30.2]	9.5 [241.3]	8.75 [222.25]	8	0.35 [9]	45°	
8	2.44 [62]	10.38 [263.52]	9.63 [244.47]	6	0.41 [10.5]	60°	2.44 [62]	10.38 [263.52]	9.63 [244.47]	6	0.41 [10.5]	45°	
10	2.12 [53.8]	12.38 [314.32]	11.63 [295.27]	8	0.41 [10.5]	45°	2.12 [53.8]	12.38 [314.32]	11.63 [295.27]	8	0.41 [10.5]	45°	0.18 [4.5]
11 1/2	1.56 [39.6]	13.88 [352.42]	13.13 [333.37]	8	0.41 [10.5]	45°	1.56 [39.6]	13.88 [352.42]	13.13 [333.37]	8	0.41 [10.5]	45°	

DIMENSIONS PHASE 9 PS -PM

Dimensions in inches and [millimeters]



FORM		A	B	H
B3/B14	PS	20.79 [528]	12.17 [309]	4.21 [107]
	PM	23.54 [598]	15.08 [383]	4.06 [103]
SAE	PS	18.11 [460]	12.17 [309]	3.82 [97]
	PM	20.87 [530]	15.08 [383]	3.66 [93]

TYPE	C.G.
PSA4 B3/B14	8.9 [226]
PSB4 B3/B14	9.02 [229]
PMA4 B3/B14	9.80 [249]
PMB4 B3/B14	9.84 [250]
PMC4 B3/B14	10.04 [255]
PMD4 B3/B14	10.16 [258]

TYPE	C.G.
PSA4 SAE	8.98 [228]
PSB4 SAE	9.09 [231]
PMA4 SAE	9.88 [251]
PMB4 SAE	9.92 [252]
PMC4 SAE	10.12 [257]
PMD4 SAE	10.24 [260]

SAE N.	FLANGES					
	Ø O	Ø P	Ø Q	holes No.	S	α
5	14.02 [356]	12.37 [314.3]	13.13 [333.4]	8	0.43 [11]	45°
4	15.83 [402]	14.26 [362]	15 [381]	8		
3	17.76 [451]	16.13 [409.6]	16.87 [428.6]	12		30°
2	19.29 [490]	17.63 [447.7]	18.37 [466.7]	12		

SAE N.	COUPLING DISCS						
	L	Ø d	Ø Q1	holes No.	S1	α	R
6 1/2	1.19 [30.2]	8.5 [215.9]	7.87 [200]	6	0.35 [9]	60°	0.12 [3]
7 1/2		9.5 [241.3]	8.75 [222.25]	8		45°	
8	2.44 [62]	10.38 [263.52]	9.63 [244.47]	6	0.41 [10.5]	60°	0.18 [4.5]
10	2.12 [53.8]	12.38 [314.32]	11.63 [295.27]	8		45°	
11 1/2	1.56 [39.6]	13.88 [352.42]	13.13 [333.37]	8			



