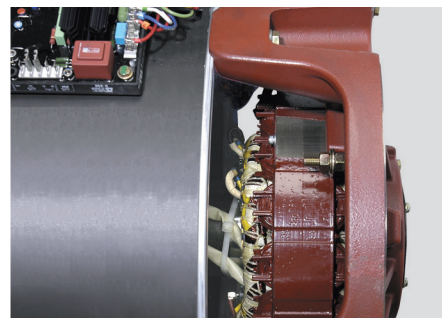
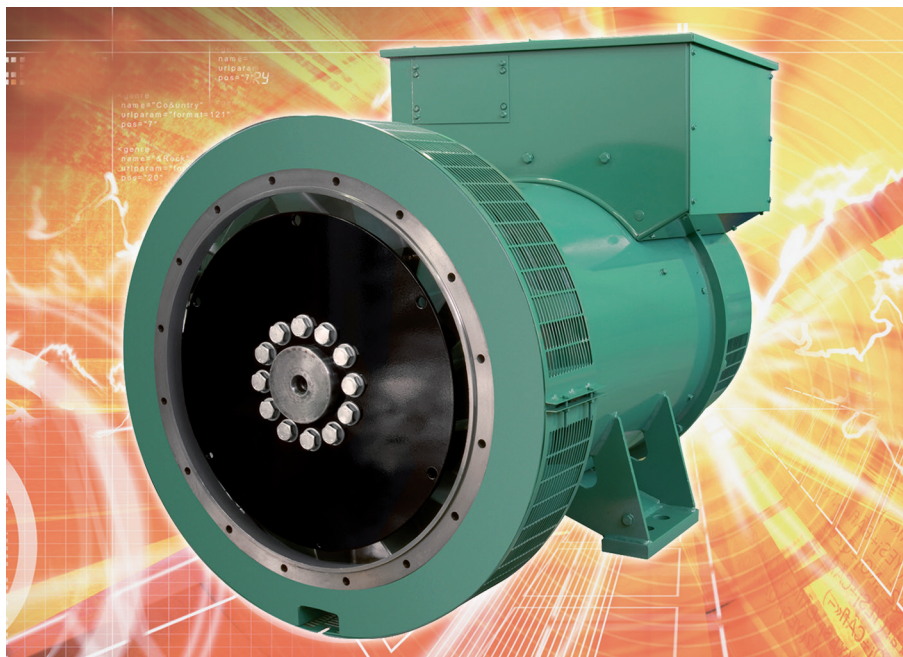




**EMERSON**<sup>™</sup>  
Industrial Automation



## Low Voltage alternators - 4 pole LSA 49.1

660 to 1000 kVA - 50 Hz / 792 to 1250 kVA - 60 Hz

Electrical and mechanical data

3867 en - 2014.05 / h

# Low Voltage alternators 4 pole 3-phase *PARTNER*

## LSA 49.1

660 to 1000 kVA - 50 Hz / 792 to 1250 kVA - 60 Hz

### SPECIALLY ADAPTED TO APPLICATIONS

The LSA 49.1 alternator is designed to be suitable for typical generator applications, such as: backup, marine applications, rental, telecommunications, etc.

### COMPLIANT WITH INTERNATIONAL STANDARDS

The LSA 49.1 alternator conforms to the main international standards and regulations:

- IEC 60034, NEMA MG 1.32-33, ISO 8528-3, CSA / UL 1446 (UL 1004 on request), marine regulations, etc.

It can be integrated into a CE marked generator.

The LSA 49.1 is designed, manufactured and marketed in an ISO 9001 environment and ISO 14001.

### TOP OF THE RANGE ELECTRICAL PERFORMANCE

- Class H insulation.
- Standard 6-wire re-connectable winding, 2/3 pitch, type no. 6.
- Voltage range 50 Hz: 380V - 400V - 415V and 220V - 230V - 240V.
- Voltage range 60 Hz: 380V - 416V - 440V - 480V and 220 V - 240 V.
- High efficiency and motor starting capacity.
- Other voltages are possible with optional adapted windings:
  - 50 Hz : 440 V (no. 7), 500 V (no. 9), 600 V (no. 22 or 23), 690 V (no. 10 or 52).
  - 60 Hz : 380 V and 416 V (no. 8), 600 V (no. 9).
- R 791 interference suppression conforming to standard EN 55011 group 1 class B standard for European zone (CE marking).

### EXCITATION AND REGULATION SYSTEM SUITED TO THE APPLICATION

Excitation system			Regulation options				
Volage regulator	AREP	PMG	Current transformer for paralleling	Mains paralleling	3-phase sensing	3-phase sensing for mains paralleling unbalanced	Remote voltage potentiometer
R450	Std	Option	C.T.	R726	R731	R734	√
D510C	Option	Option	C.T.	included	included	contact factory	√

Voltage regulator accuracy  $\pm 0.5\%$  - √ : possible mounting

### PROTECTION SYSTEM SUITED TO THE ENVIRONMENT

- The LSA 49.1 is IP 23.
- Standard winding protection for clean environments with relative humidity  $\leq 95\%$ , including indoor marine environments.
- Options :
  - Filters on air inlet : derating 5%.
    - Filters on air inlet and air outlet (IP 44) : derating 10%.
    - Winding protections for harsh environments and relative humidity greater than 95%.
    - Space heaters.
    - Thermal protection for winding.

### REINFORCED MECHANICAL STRUCTURE USING FINITE ELEMENT MODELLING

- Compact and rigid assembly to better withstand generator vibrations.
- Steel frame.
- Cast iron flanges and shields.
- Twin-bearing and single-bearing versions designed to be suitable for engines on the market.
- Half-key balancing.
- Regreasable bearings.
- Standard direction of rotation: clockwise when looking at the drive end view (for anti-clockwise, derate the machine by 5%).

### ACCESSIBLE TERMINAL BOX PROPORTIONED FOR OPTIONAL EQUIPMENT

- Easy access to the voltage regulator and to the connections.
- Possible inclusion of accessories for paralleling, protection and measurement.
- Connection bar for reconnecting voltage.

# Low Voltage alternators 4 pole 3-phase **PARTNER**

LSA 49.1

660 to 1000 kVA - 50 Hz / 792 to 1250 kVA - 60 Hz

## General characteristics

Insulation class	H	Air flow L11	1.2 m <sup>3</sup> /s (50 Hz) - 1.4 m <sup>3</sup> /s (60 Hz)
Winding pitch	2/3 (n° 6S)	Excitation system	AREP or PMG
Number of wires	6	AVR type	R 450
Protection	IP 23	Voltage regulation (*)	± 0.5 %
Altitude	≤ 1000 m	Short-circuit current	300% (3 IN) : 10s
Overspeed	2250 min <sup>-1</sup>	Totale Harmonic distortion THD (**)	at no load < 4 % - on load < 4 %
Air flow except L11	1 m <sup>3</sup> /s (50 Hz) - 1.2 m <sup>3</sup> /s (60 Hz)	Waveform: NEMA = TIF (**)	< 50

(\*) Steady state. (\*\*) Total harmonic distortion between phases, no-load or on-load (non-distorting)

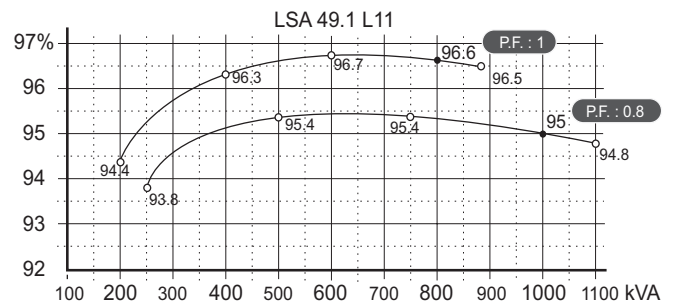
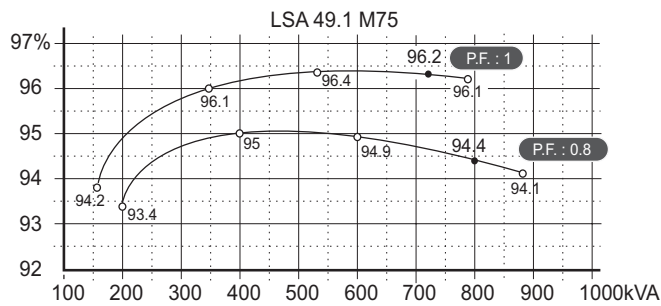
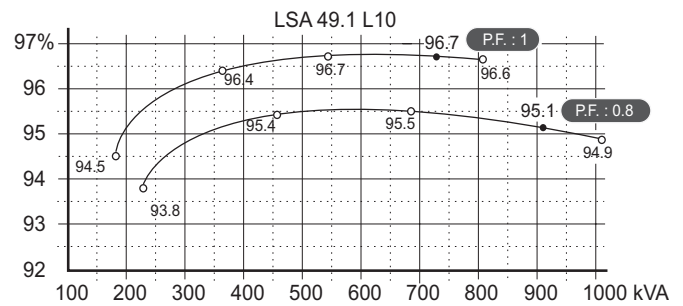
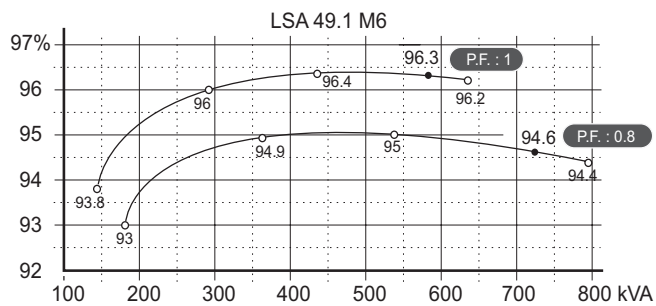
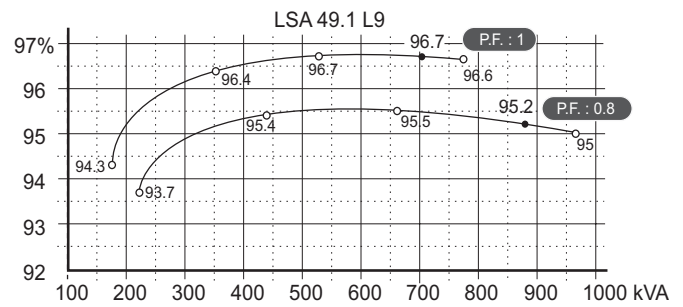
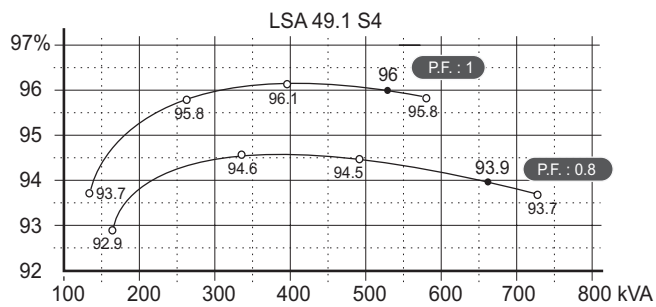
## Ratings 50 Hz - 1500 R.P.M.

kVA / kW - P.F. = 0.8															
Duty/T°C		Continuous duty/40°C				Continuous duty/40°C				Stand-by/40°C			Stand-by/27°C		
Class/T°K		H/125°K				F/105°K				H/150°K			H/163°K		
Phase		3 ph.				3 ph.				3 ph.			3 ph.		
Y		380V	400V	415V		380V	400V	415V		380V	400V	415V	380V	400V	415V
Δ		220V	230V	240V		220V	230V	240V		220V	230V	240V	220V	230V	240V
<b>LSA 49.1 S4</b>	kVA	660	<b>660</b>	660		594	594	594		693	693	693	725	<b>725</b>	725
	kW	528	<b>528</b>	528		475	475	475		554	554	554	580	<b>580</b>	580
<b>LSA 49.1 M6</b>	kVA	725	<b>725</b>	725		653	653	653		760	760	760	800	<b>800</b>	800
	kW	580	<b>580</b>	580		522	522	522		608	608	608	640	<b>640</b>	640
<b>LSA 49.1 M75</b>	kVA	775	<b>800</b>	775		698	720	698		810	840	810	850	<b>880</b>	850
	kW	620	<b>640</b>	620		558	576	558		648	672	648	680	<b>704</b>	680
<b>LSA 49.1 L9</b>	kVA	880	<b>880</b>	880		792	792	792		920	920	920	960	<b>960</b>	960
	kW	704	<b>704</b>	704		634	634	634		736	736	736	768	<b>768</b>	768
<b>LSA 49.1 L10</b>	kVA	890	<b>910</b>	890		800	820	800		934	955	934	979	<b>1000</b>	979
	kW	712	<b>728</b>	712		640	656	640		747	764	747	783	<b>800</b>	783
<b>LSA 49.1 L11</b>	kVA	1000	<b>1000</b>	1000		910	910	910		1050	1050	1050	1100	<b>1100</b>	1100
	kW	800	<b>800</b>	800		728	728	728		840	840	840	880	<b>880</b>	880

## Ratings 60 Hz - 1800 R.P.M.

kVA / kW - P.F. = 0.8																	
Duty/T°C		Continuous duty/40°C				Continuous duty/40°C				Stand-by/40°C				Stand-by/27°C			
Class/T°K		H/125°K				F/105°K				H/150°K				H/163°K			
Phase		3 ph.				3 ph.				3 ph.				3 ph.			
Y		380V	416V	440V	480V	380V	416V	440V	480V	380V	416V	440V	480V	380V	416V	440V	480V
Δ		220V	240V			220V	240V			220V	240V			220V	240V		
<b>LSA 49.1 S4</b>	kVA	710	710	725	<b>792</b>	639	639	652	712	745	745	760	830	781	781	798	<b>871</b>
	kW	568	568	580	<b>634</b>	511	511	522	570	596	596	608	664	625	625	638	<b>697</b>
<b>LSA 49.1 M6</b>	kVA	780	780	800	<b>870</b>	702	702	720	783	819	819	840	913	858	858	880	<b>957</b>
	kW	624	624	640	<b>696</b>	562	562	576	626	655	655	672	730	686	686	704	<b>766</b>
<b>LSA 49.1 M75</b>	kVA	866	936	960	<b>960</b>	780	842	865	865	910	983	1008	1008	953	1030	1056	<b>1056</b>
	kW	693	749	768	<b>768</b>	624	674	692	692	728	786	806	806	762	824	845	<b>845</b>
<b>LSA 49.1 L9</b>	kVA	910	980	1010	<b>1056</b>	819	882	909	950	955	1029	1060	1108	1000	1078	1111	<b>1162</b>
	kW	728	784	808	<b>845</b>	655	706	727	760	764	823	848	886	800	862	889	<b>930</b>
<b>LSA 49.1 L10</b>	kVA	958	1020	1050	<b>1092</b>	862	918	945	983	1006	1071	1102	1146	1054	1122	1155	<b>1200</b>
	kW	766	816	840	<b>874</b>	690	734	756	786	805	857	882	917	843	898	924	<b>960</b>
<b>LSA 49.1 L11</b>	kVA	1000	1080	1145	<b>1250</b>	900	980	1040	1140	1040	1135	1200	1310	1090	1190	1260	<b>1375</b>
	kW	800	864	916	<b>1000</b>	720	784	832	912	832	908	960	1048	872	952	1008	<b>1100</b>

### Efficiencies 50 Hz - P.F.: 1 / P.F.: 0.8



### Reactances (%). Time constants (ms) - Class H / 400 V

	S4	M6	M75	L9	L10	L11
<b>Kcc</b> Short-circuit ratio	0.38	0.43	0.39	0.43	0.41	0.37
<b>Xd</b> Direct-axis synchro. reactance unsaturated	343	301	332	304	315	346
<b>Xq</b> Quadrature-axis synchro. reactance unsaturated	205	180	199	182	189	207
<b>T'do</b> No-load transient time constant	1958	2047	2047	2111	2111	2111
<b>X'd</b> Direct-axis transient reactance saturated	17.5	14.7	16.2	14.4	14.9	16.4
<b>T'd</b> Short-circuit transient time constant	100	100	100	100	100	100
<b>X''d</b> Direct-axis subtransient reactance saturated	14	11.7	12.9	11.5	11.9	13.1
<b>T''d</b> Subtransient time constant	10	10	10	10	10	10
<b>X''q</b> Quadrature-axis subtransient reactance saturated	16.3	13.1	14.5	12.5	13	14.3
<b>Xo</b> Zero sequence reactance unsaturated	0.9	0.7	0.8	0.8	0.9	0.9
<b>X2</b> Negative sequence reactance saturated	15.2	12.5	13.8	12.1	12.5	13.7
<b>Ta</b> Armature time constant	15	15	15	15	15	15

### Other class H/400 V data

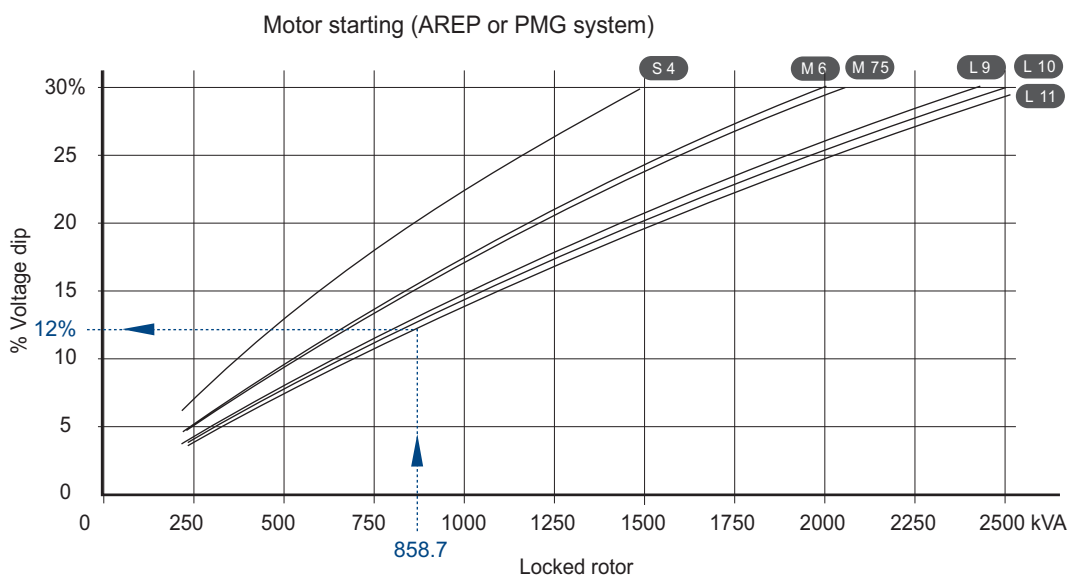
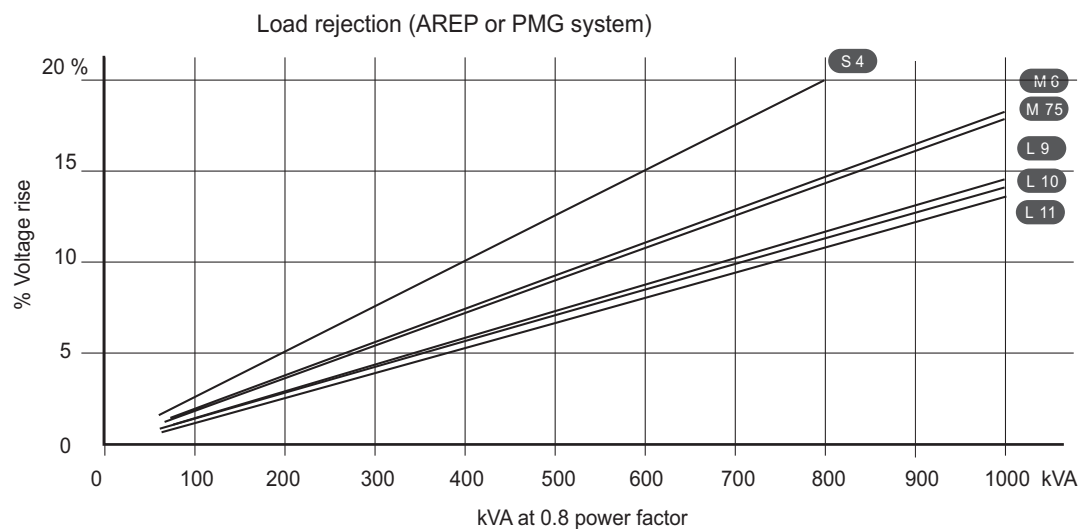
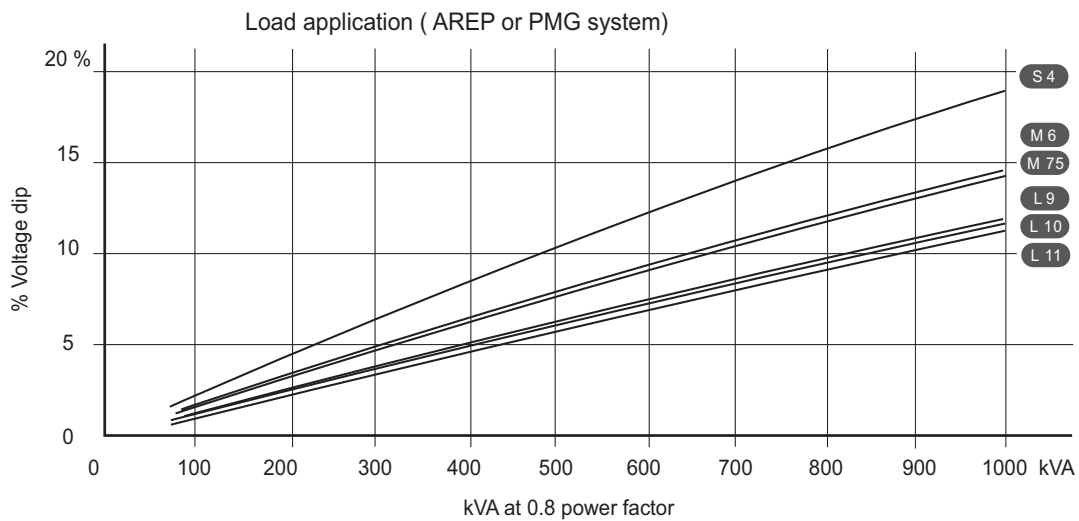
	S4	M6	M75	L9	L10	L11
<b>io (A)</b> No-load excitation current	0.9	0.9	0.9	0.9	0.9	0.8
<b>ic (A)</b> On-load excitation current	3.6	3.2	3.5	3.3	3.4	3.2
<b>uc (V)</b> On-load excitation voltage	43	38	41	39	40	38
<b>ms</b> Response time ( $\Delta U = 20\%$ transient)	500	500	500	500	500	500
<b>kVA</b> Start ( $\Delta U = 20\%$ cont. or 50% trans.)	1578	1985	1985	2372	2372	2372
<b>%</b> Transient $\Delta U$ (on-load 4/4) - P.F.: 0.8 <sub>LAG</sub>	13.3	10.9	11.7	10.7	11	11.8
<b>W</b> No-load losses	8110	9000	9000	9860	9860	11050
<b>W</b> Heat dissipation	33710	32740	37700	35340	37030	41710

# Low Voltage alternators 4 pole 3-phase *PARTNER*

LSA 49.1

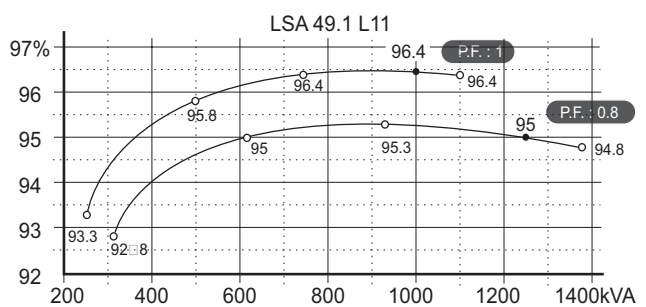
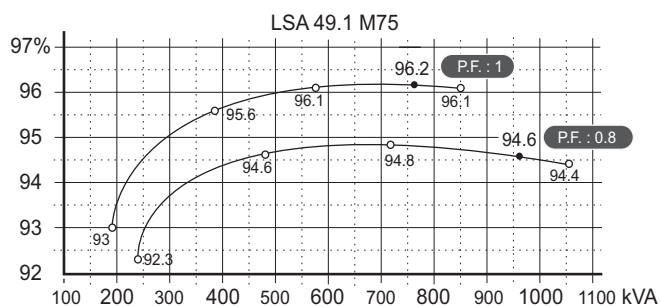
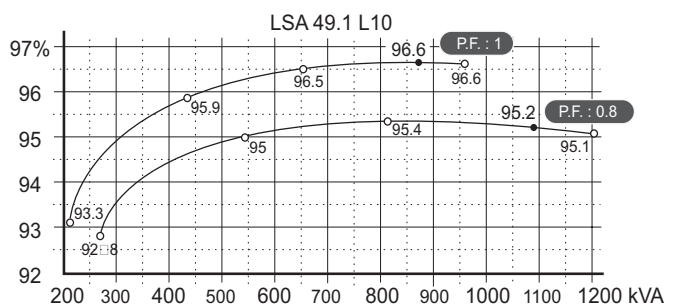
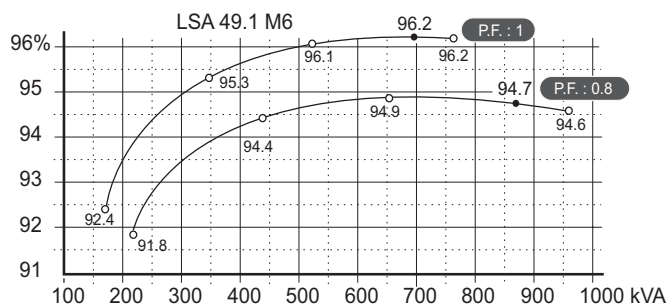
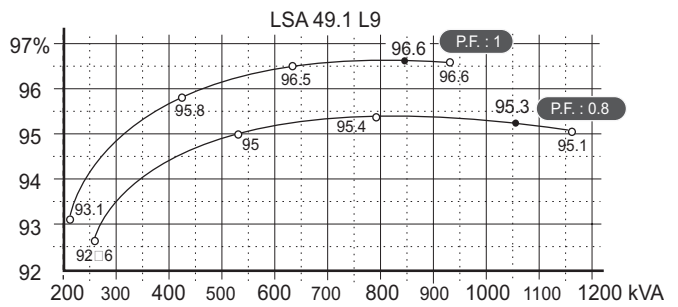
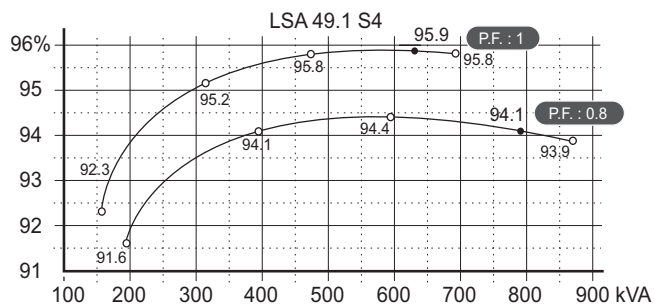
660 to 1000 kVA - 50 Hz / 792 to 1250 kVA - 60 Hz

## Transient voltage variation 400V - 50 Hz



- 1) For a starting P.F. other than 0.6, the starting kVA must be multiplied by  $K = \text{Sine } \varphi / 0.8$   
 Calculation example for a different P.F. : Starter motor kVA calculated at 0.4 P.F. = 750 kVA  
 $\blacktriangleright \text{Sin } \varphi 0.4 = 0.9165 \blacktriangleright K = 1.145 \blacktriangleright \text{kVA corrected} = 858.7 \text{ kVA} \blacktriangleright \text{Voltage dip corresponding to L11} = 12 \%$
- 2) For voltages other than 400V (Y), 230V ( $\Delta$ ) at 50 Hz, then kVA must be multiplied by  $(400/U)^2$  or  $(230/U)^2$ .

### Efficiencies 60 Hz - P.F.: 1 / P.F.: 0.8



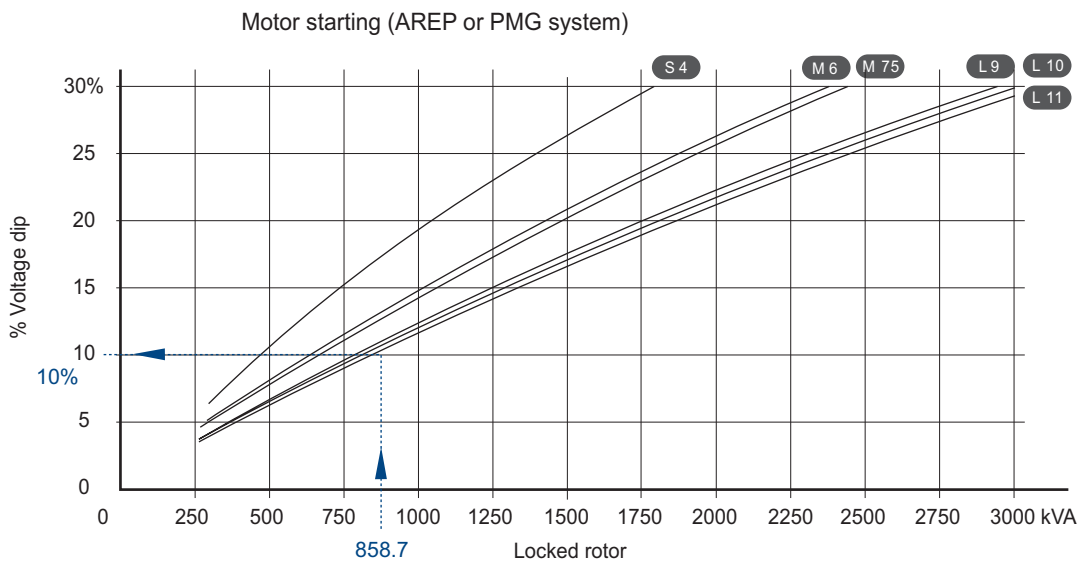
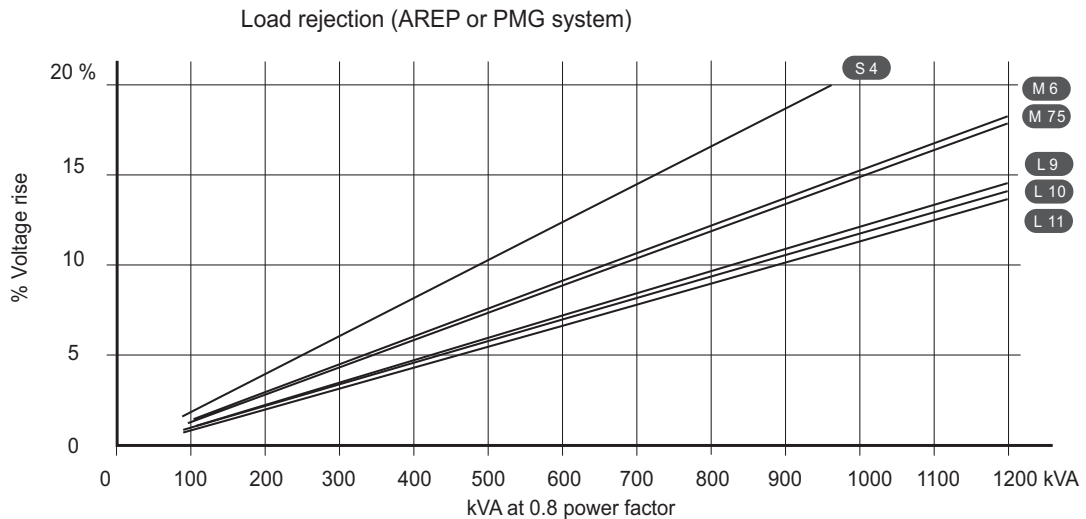
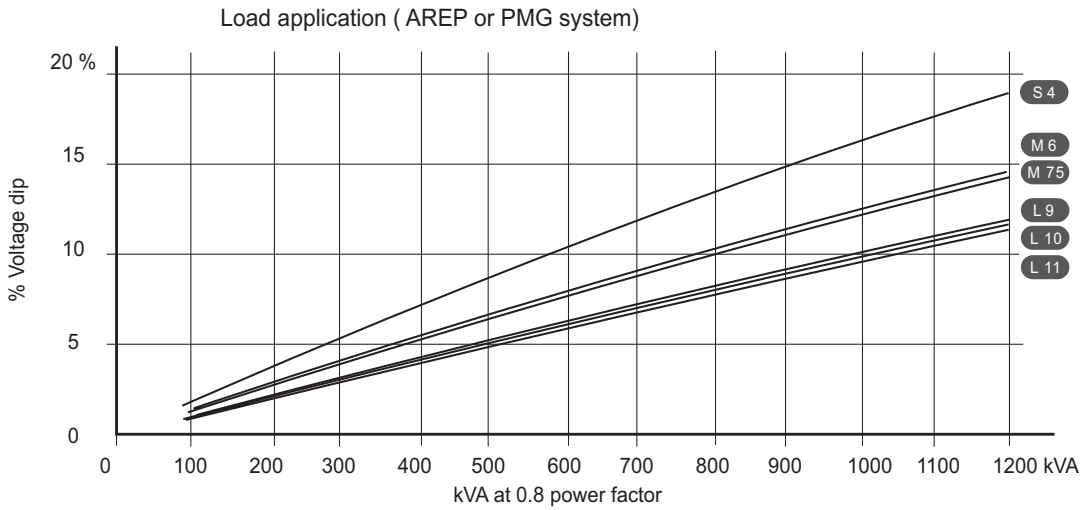
### Reactances (%). Time constants (ms) - Class H / 480 V

	S4	M6	M75	L9	L10	L11
<b>Kcc</b> Short-circuit ratio	0.38	0.43	0.39	0.43	0.41	0.36
<b>Xd</b> Direct-axis synchro. reactance unsaturated	343	301	332	304	315	360
<b>Xq</b> Quadrature-axis synchro. reactance unsaturated	205	180	199	182	189	216
<b>T'do</b> No-load transient time constant	1958	2047	2047	2111	2111	2111
<b>X'd</b> Direct-axis transient reactance saturated	17.5	14.7	16.2	14.4	14.9	17
<b>T'd</b> Short-circuit transient time constant	100	100	100	100	100	100
<b>X''d</b> Direct-axis subtransient reactance saturated	14	11.7	12.9	11.5	11.9	13.6
<b>T''d</b> Subtransient time constant	10	10	10	10	10	10
<b>X''q</b> Quadrature-axis subtransient reactance saturated	16.3	13.1	14.5	12.5	13	14.9
<b>Xo</b> Zero sequence reactance unsaturated	0.9	0.7	0.8	0.8	0.9	0.9
<b>X2</b> Negative sequence reactance saturated	15.2	12.5	13.8	12.1	12.5	14.3
<b>Ta</b> Armature time constant	15	15	15	15	15	15

### Other class H/480 V data

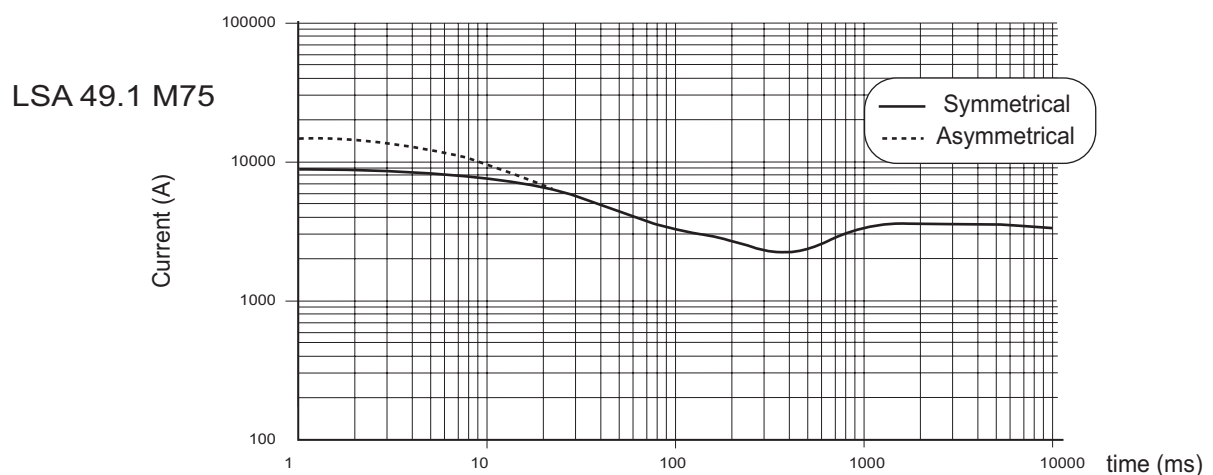
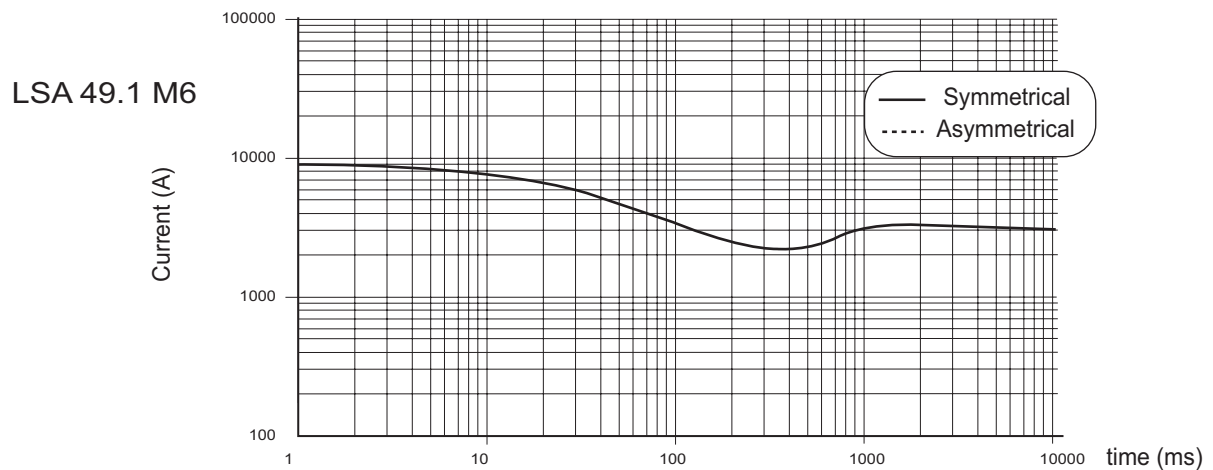
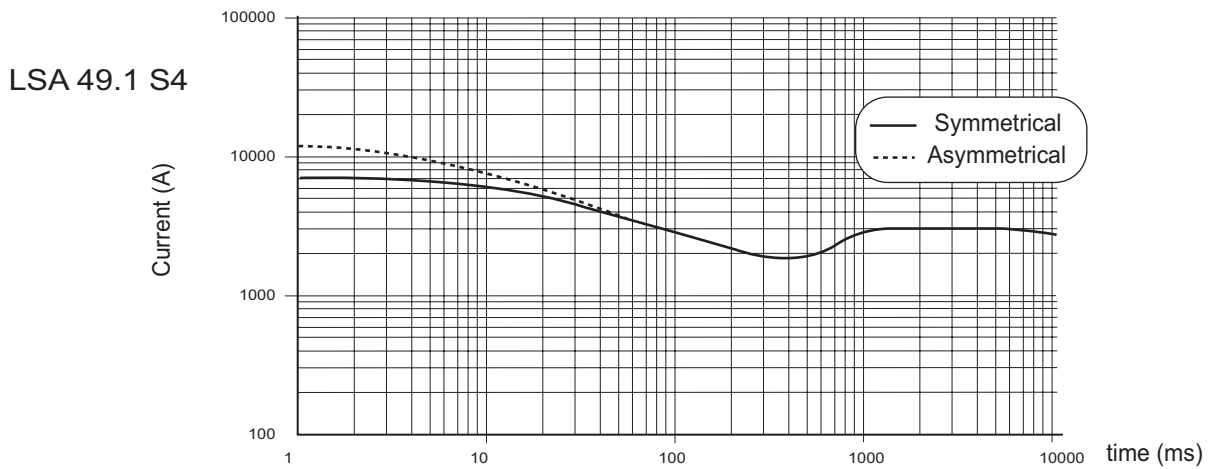
	S4	M6	M75	L9	L10	L11
<b>io (A)</b> No-load excitation current	0.9	0.9	0.9	0.9	0.9	0.8
<b>ic (A)</b> On-load excitation current	3.6	3.2	3.5	3.2	3.3	3.2
<b>uc (V)</b> On-load excitation voltage	42	38	41	38	39	38
<b>ms</b> Response time ( $\Delta U = 20\%$ transient)	500	500	500	500	500	500
<b>kVA</b> Start ( $\Delta U = 20\%$ cont. or 50% trans.)	1950	2482	2482	2972	2972	2972
<b>%</b> Transient $\Delta U$ (on-load 4/4) - P.F.: 0.8 <sub>LAG</sub>	13.3	10.9	11.7	10.7	11	12.2
<b>W</b> No-load losses	12570	13820	13820	15030	15030	17160
<b>W</b> Heat dissipation	39100	38520	43730	41600	43380	51950

## Transient voltage variation 480V - 60 Hz



- 1) For a starting P.F. other than 0.6, the starting kVA must be multiplied by  $K = \text{Sine } \phi / 0.8$   
 Calculation example for a different P.F. : Starter motor kVA calculated at 0.4 P.F. = 750 kVA  
 $\blacktriangleright \text{Sin } \phi 0.4 = 0.9165 \blacktriangleright K = 1.145 \blacktriangleright \text{kVA corrected} = 858.7 \text{ kVA} \blacktriangleright \text{Voltage dip corresponding to L11} = 10 \%$
- 2) For voltages other than 480V (Y), 277V ( $\Delta$ ), 240V (YY) at 60 Hz ,  
 then kVA must be multiplied by  $(480/U)^2$  or  $(277/U)^2$  or  $(240/U)^2$ .

### 3-phase short-circuit curves at no load and rated speed (star connection Y)



#### Influence due to connection

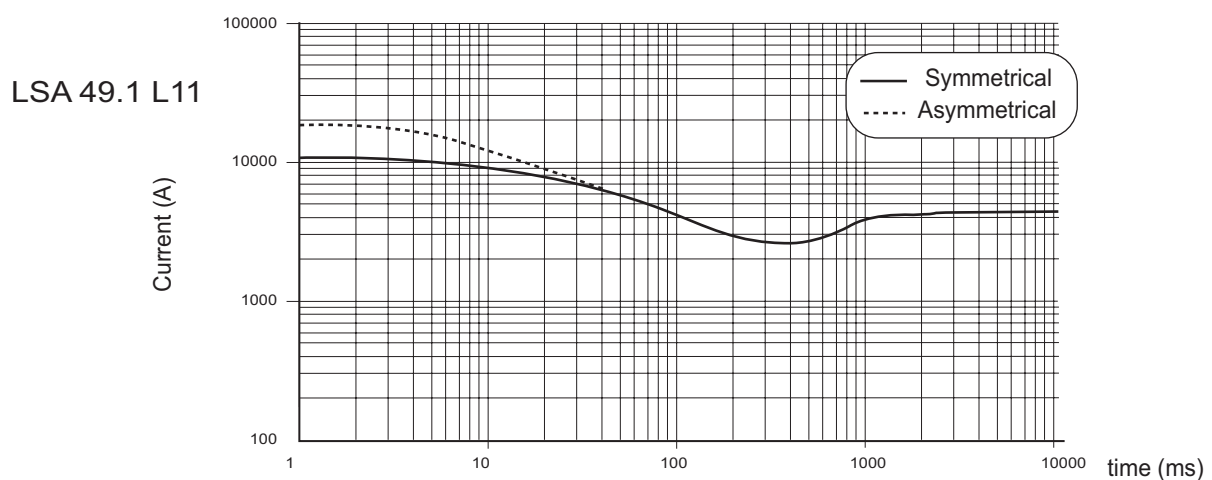
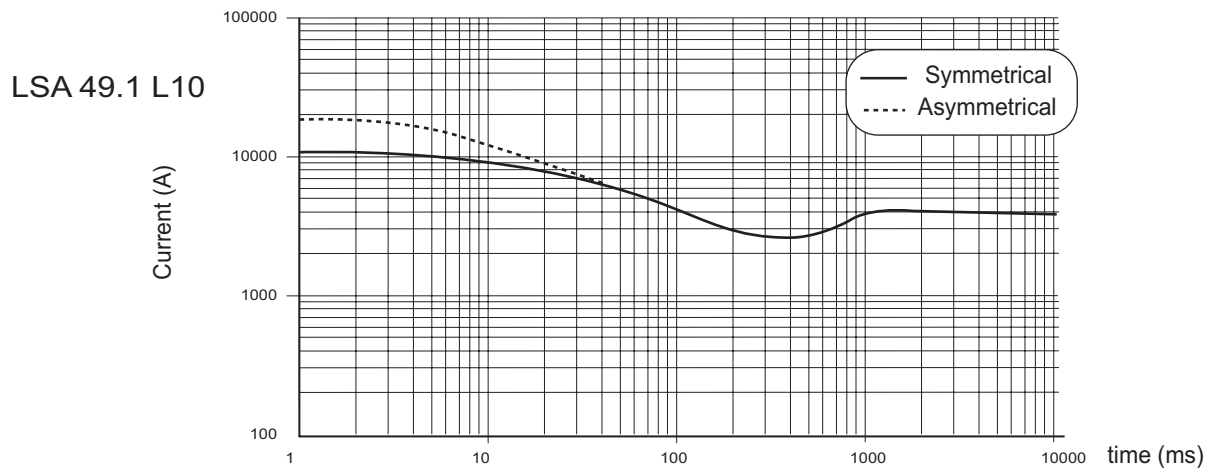
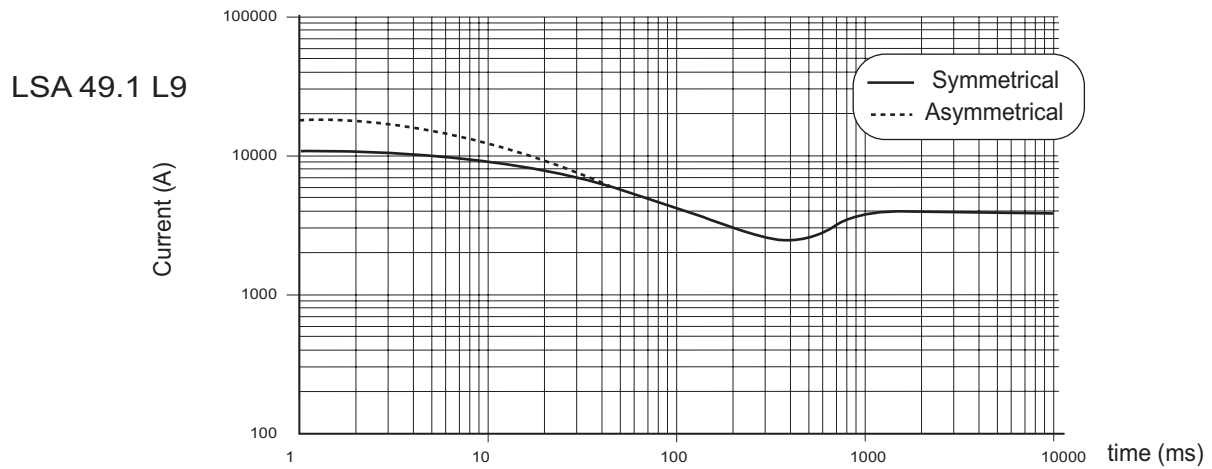
Curves shown are for star (Y) connection.

For other connections, use the following multiplication factors:

- Series delta : current value x 1.732 - Parallel star : current value x 2



### 3-phase short-circuit curves at no load and rated speed (star connection Y)



#### Influence due to short-circuit

Curves are based on a three-phase short-circuit.

For other types of short-circuit, use the following multiplication factors.

	3-phase	2-phase L/L	1-phase L/N
Instantaneous (max.)	1	0.87	1.3
Continuous	1	1.5	2.2
Maximum duration (AREP/PMG)	10 sec.	5 sec.	2 sec.

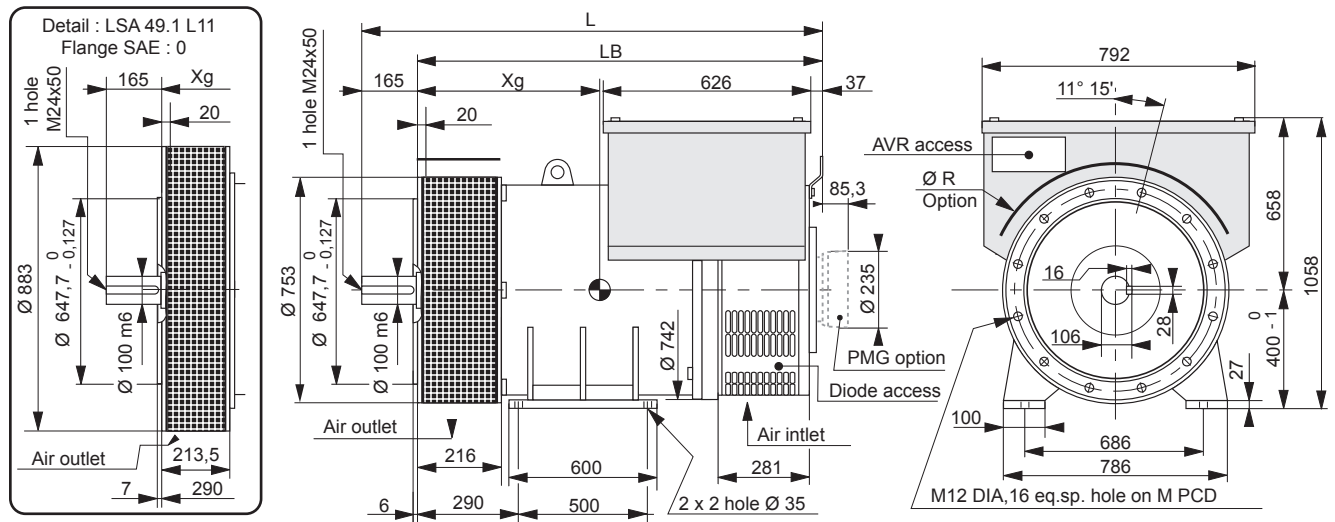


# Low Voltage alternators 4 pole 3-phase *PARTNER*

## LSA 49.1

660 to 1000 kVA - 50 Hz / 792 to 1250 kVA - 60 Hz

### Two bearing dimensions

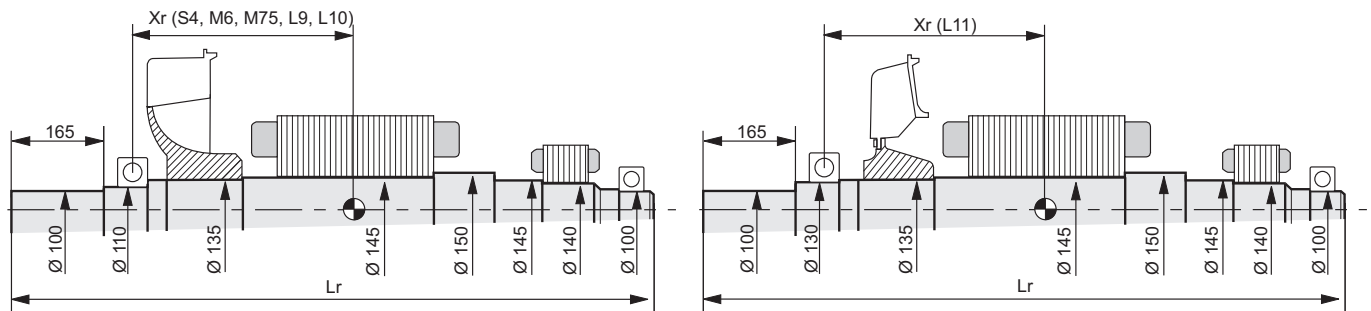


#### Dimensions (mm) and weight

Type	L without PMG	LB	M	R	Xg	Weight (kg)
LSA 49.1 S4	1419	1254	679.45	438	620	1445
LSA 49.1 M6	1519	1354	679.45	438	655	1645
LSA 49.1 M75	1519	1354	679.45	438	655	1645
LSA 49.1 L9	1619	1454	679.45	438	695	1845
LSA 49.1 L10	1619	1454	679.45	438	695	1845
LSA 49.1 L11*	1613	1452	679.45	438	670	1985

\*: see the flange detail for LSA 49.1 L11 SAE 0.

### Torsional analysis data

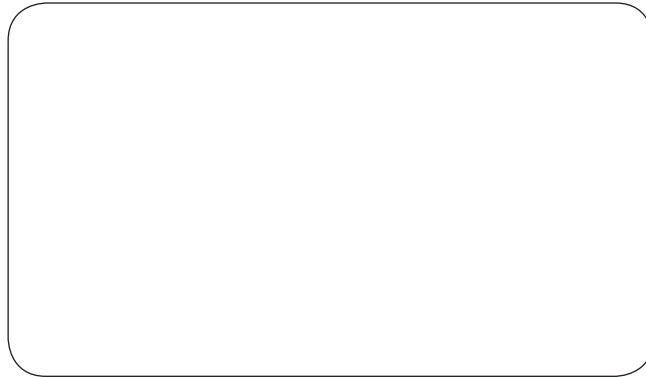


#### Centre of gravity: Xr (mm), Rotor length: Lr (mm), Weight: M (kg), Moment of inertia: J (kgm<sup>2</sup>): (4J = MD<sup>2</sup>)

Type	Xr	Lr	M	J
LSA 49.1 S4	503	1397	502	8.04
LSA 49.1 M6	553	1497	584	9.67
LSA 49.1 M75	553	1497	584	9.67
LSA 49.1 L9	603	1597	666	11.31
LSA 49.1 L10	603	1597	666	11.31
LSA 49.1 L11	601	1591	724	13

**NOTE:** dimensions are for information only and may be subject to modifications. Contractuel 2D drawings (.pdf files) can be downloaded from the Leroy-Somer site, 3D drawing files are available upon request.

## Contact



[www.leroy-somer.com](http://www.leroy-somer.com)



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