EMERSON
Industrial Automation

3867 en - 2011.03 / g

LEROY SOMER®

PARTNER ALTERNATORS

LSA 49.1 - 4 Pole

Electrical and mechanical data

SPECIALLY ADAPTED FOR APPLICATIONS

The LSA 49.1 alternator is designed to be suitable for typical generator applications, such as: backup, standard production, cogeneration, 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 1.22, ISO 8528, CSA, CSA/UL, 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.

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).
- THD Total harmonic distortion < 4% (full load).
- 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				
Voltage regulator	**AREP**	**PMG**	Current transformer for paralleling	**R 726** Mains paralleling	**R 731** 3-phase sensing	**R 734** 3-phase sensing mains paralleling unbalanced	Remote voltage potentiometer
R 450	**Std**	**Option**	√	√	√	√	√
D 510	**Optional**	**Optional**	√	Included	Included	**contact factory**	√

Voltage regulator accuracy +/- 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 ≤ 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

- Standard direction of rotation : clockwise when looking at the drive end view (engine side).
- 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 clusion of accessories for paralleling, protection and measurement.
- Connection bar for reconnecting voltage .

Common data

Insulation class	H	Excitation system	A R E P or PMG
Winding pitch	2/3 (N° 6S)	A.V.R. model	R 450
Terminals	6	Voltage regulation (*)	± 0,5 %
Drip proof	IP 23	Sustained short-circuit current	300% (3 IN) : 10s
Altitude	≤ 1000 m	Totale Harmonic distortion THD (**)	at no load < 4 % - on load < 4%
Overspeed	2250 min^{-1}	Waveform : NEMA = TIF (**)	< 50
Air flow except L11	1 m^3/s (50Hz) / 1,2 (60Hz)		
Air flow L11	1.2 m^3/s (50Hz) / 1,4 m^3/s (60Hz)		

(*) Steady state duty. (**) Total harmonic distortion content line to line, at no load or full rated linear and balanced load.

Ratings 50 Hz - 1500 R.P.M.

kVA / kW - Power factor = 0,8

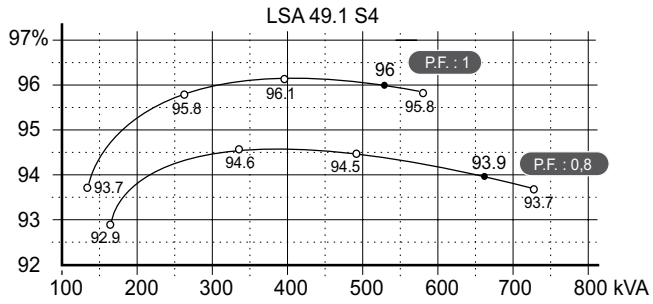
Duty T° C		Continuous duty / 40 °C			Continuous duty / 40 °C			Stand-by / 40 °C			Stand-by / 27 °C		
Class / T° K		H / 125° K			F / 105° K			H / 150° K			H / 163° K		
Phase		3 ph.			3 ph.			3 ph.			3 ph.		
Y		380V	400V	415V	380V	400V	415V	380V	400V	415V	380V	400V	415V
Δ		220V	230V	240V	220V	230V	240V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

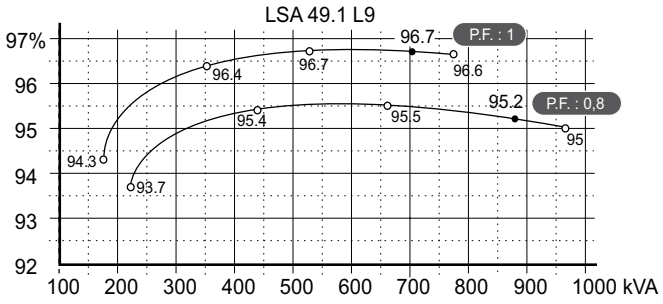
Ratings 60 Hz - 1800 R.P.M.

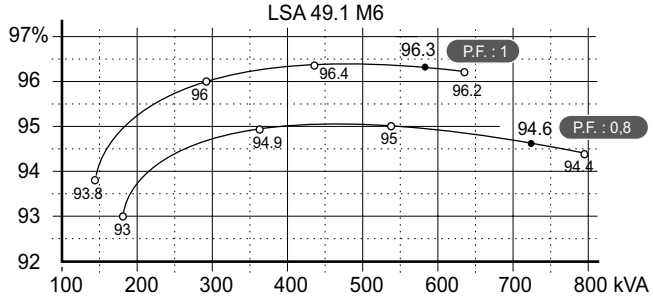
kVA / kW - PF = 0,8

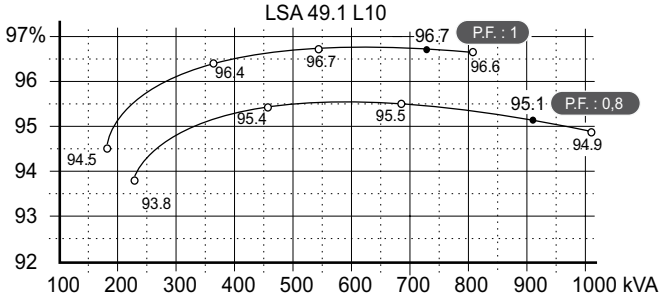
Duty / T° C		Continuous duty / 40 °C								Stand-by / 40 °C				Stand-by / 27 °C			
Class / T° K		H / 125° K				F / 105° K				H / 150° K				H / 163° K			
Phase		3 ph.				3 ph.				3 ph.				3 ph.			
Y		380V	416V	440V	480V	380V	416V	440V	480V	380V	416V	440V	480V	380V	416V	440V	480V
Δ		220V	240V			220V	240V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

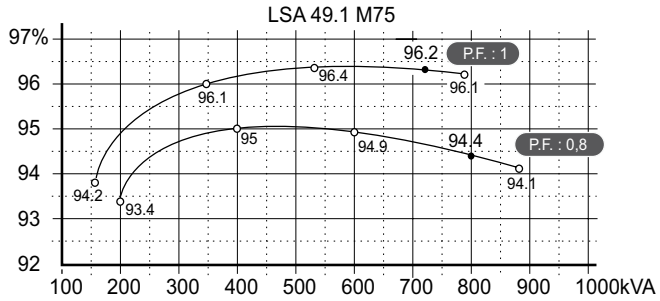
Efficiencies 50 Hz - P.F. : 1 / P.F. : 0,8

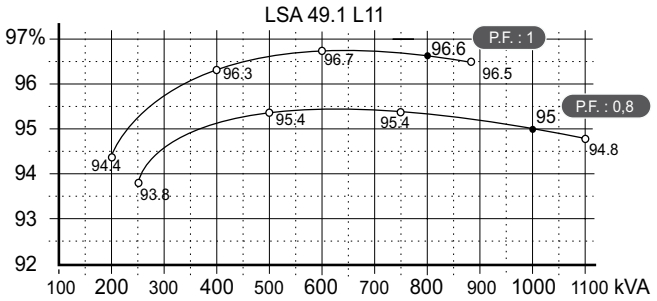












Reactances (%) . Time constants (ms) - Class H / 400 V

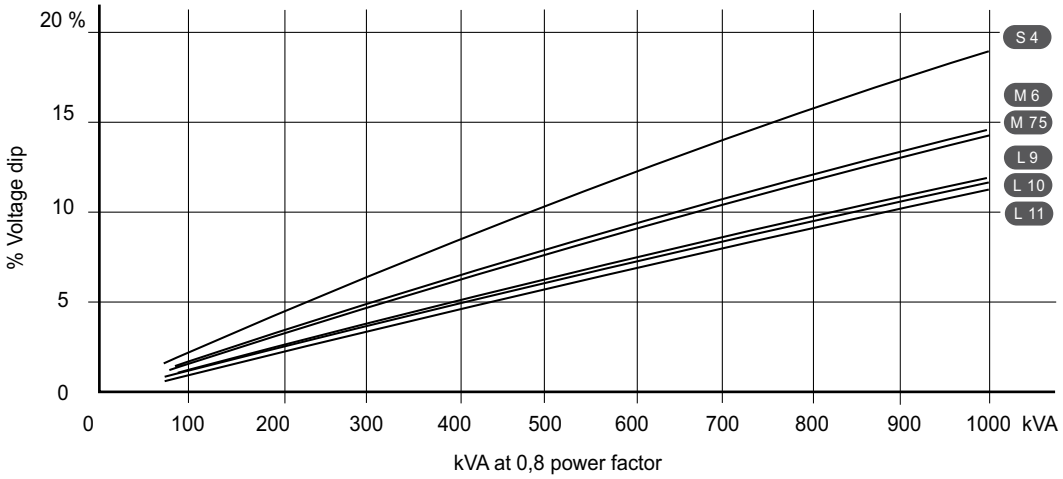
		S4	M6	M75	L9	L10	L11
Kcc	Short-circuit ratio	0,38	0,43	0,39	0,43	0,41	0.37
Xd	Direct axis synchro.reactance unsaturated	343	301	332	304	315	346
Xq	Quadra. axis synchr.reactance unsaturated	205	180	199	182	189	207
T'do	Open circuit time constant	1958	2047	2047	2111	2111	2111
X'd	Direct axis transient reactance saturated	17,5	14,7	16,2	14,4	14,9	16.4
T'd	Short-Circuit transient time constant	100	100	100	100	100	100
X"d	Direct axis subtransient reactance saturated	14	11,7	12,9	11,5	11,9	13.1
T"d	Subtransient time constant	10	10	10	10	10	10
X"q	Quadra. axis subtransient reactance saturated	16,3	13,1	14,5	12,5	13	14.3
Xo	Zero sequence reactance unsaturated	0,9	0,7	0,8	0,8	0,9	0.9
X2	Negative sequence reactance saturated	15,2	12,5	13,8	12,1	12,5	13.7
Ta	Armature time constant	15	15	15	15	15	15

Other data - Class H / 400 V

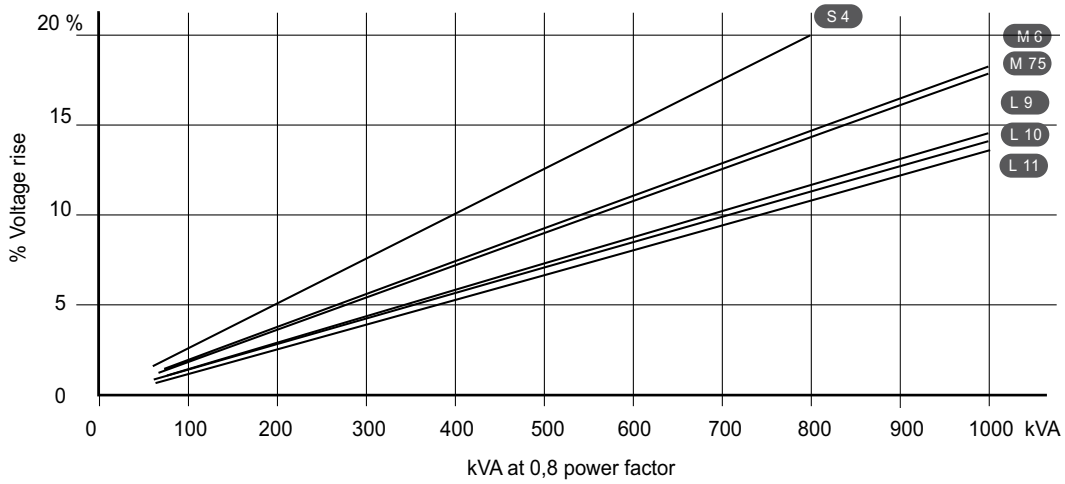
io (A)	No load excitation current	0,9	0,9	0,,9	0,9	0,9	0.8
ic (A)	Full load excitation current	3,6	3,2	3,5	3,3	3,4	3.2
uc (V)	Full load excitation voltage	43	38	41	39	40	38
ms	Recovery time (Δ = 20 % trans.)	500	500	500	500	500	500
kVA	Motor start. (Δ = 20% sust.) or (Δ = 50% trans.)	1578	1985	1985	2372	2372	2372
%	Transient dip (rated step load) - PF : 0,8 LAG	13,3	10,9	11,7	10,7	11	11.8
W	No load losses	8110	9000	9000	9860	9860	11050
W	Heat rejection	33710	32740	37700	35340	37030	41710

Transient voltage variation 400V - 50 Hz

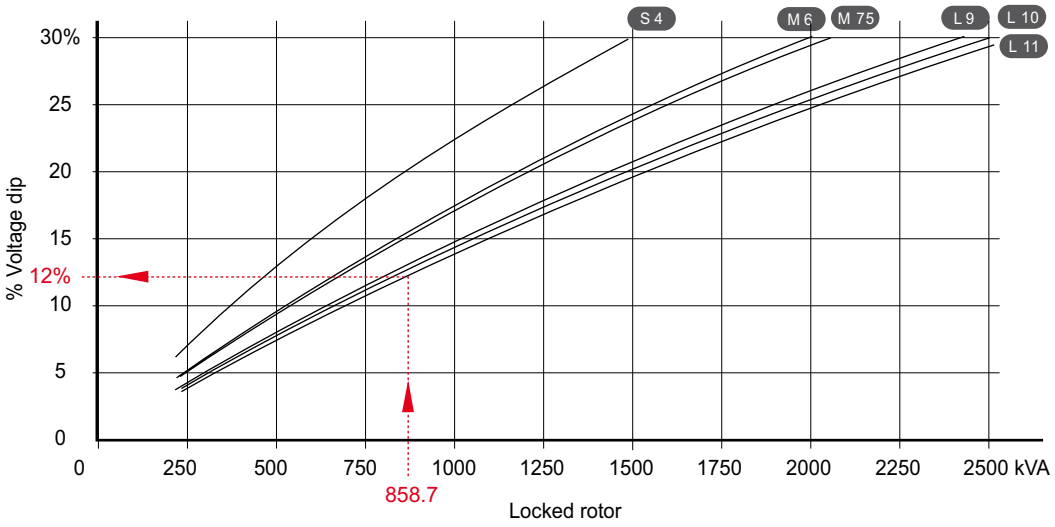
Load application (AREP or PMG system)



Load rejection (AREP or PMG system)



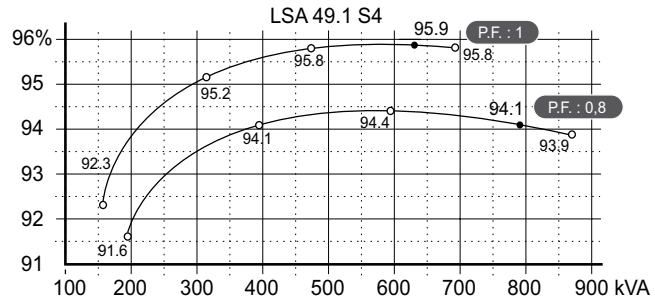
Motor starting (AREP or PMG system)

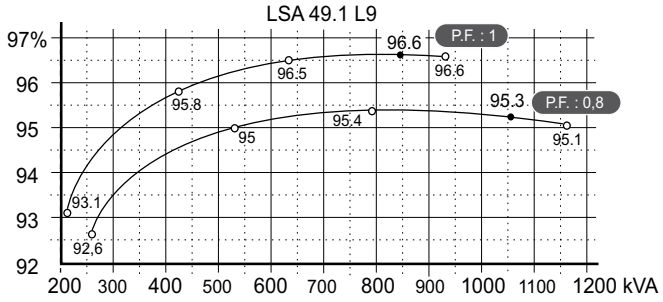


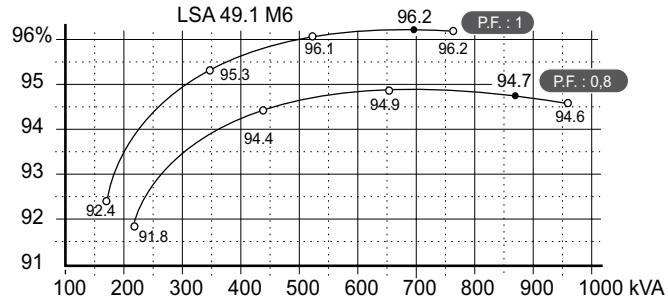
1) For a starting P.F. other than 0,6 , the starting kVA must be multiplied by K = Sine Ø /0,8
Calculation example for a different P.F. : Starter motor kVA calculated at 0.4 P.F. = 750 kVA
► Sin Ø 0,4 = 0,9165 ► K = 1,145 ► kVA corrected = 858,7 kVA ► Voltage dip corresponding to L11 = 12 %.

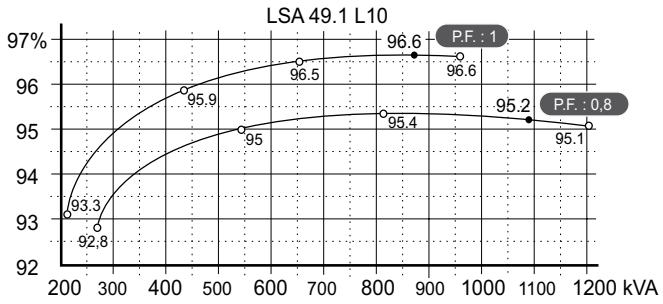
2) For voltages other than 400V (Y) , 230V (△) at 50 Hz, then kVA must be multiplied by $(400/U)^2$ or $(230/U)^2$.

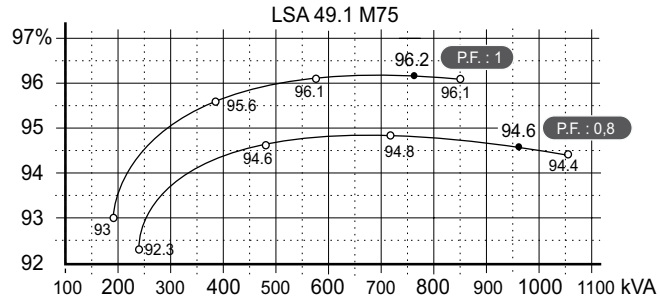
Efficiencies 60 Hz - P.F. : 1 / P.F. : 0,8

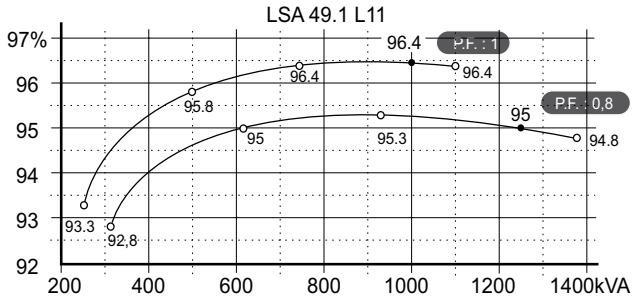












Reactances (%) . Time constants (ms) - Class H / 480 V

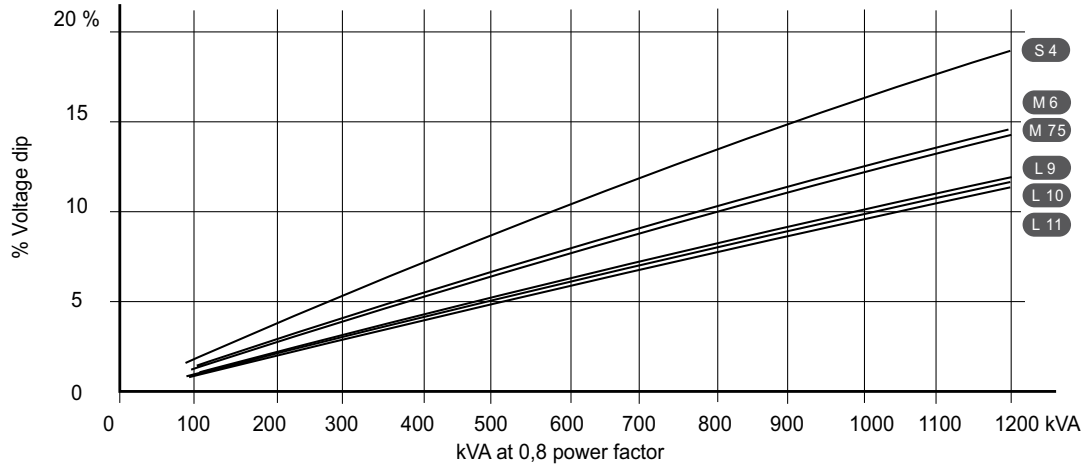
		S4	M6	M75	L9	L10	L11
Kcc	Short-circuit ratio	0,38	0,43	0,39	0,43	0,41	0.36
Xd	Direct axis synchro.reactance unsaturated	343	301	332	304	315	360
Xq	Quadra. axis synchr.reactance unsaturated	205	180	199	182	189	216
T'do	Open circuit time constant	1958	2047	2047	2111	2111	2111
X'd	Direct axis transient reactance saturated	17,5	14,7	16,2	14,4	14,9	17
T'd	Short circuit transient time constant	100	100	100	100	100	100
X"d	Direct axis subtransient reactance saturated	14	11,7	12,9	11,5	11,9	13.6
T"d	Subtransient time constant	10	10	10	10	10	10
X"q	Quadra. axis subtransient reactance saturated	16,3	13,1	14,5	12,5	13	14.9
Xo	Zero sequence reactance unsaturated	0,9	0,7	0,8	0,8	0,9	0.9
X2	Negative sequence reactance saturated	15,2	12,5	13,8	12,1	12,5	14.3
Ta	Armature time constant	15	15	15	15	15	15

Other data - Class H / 480 V

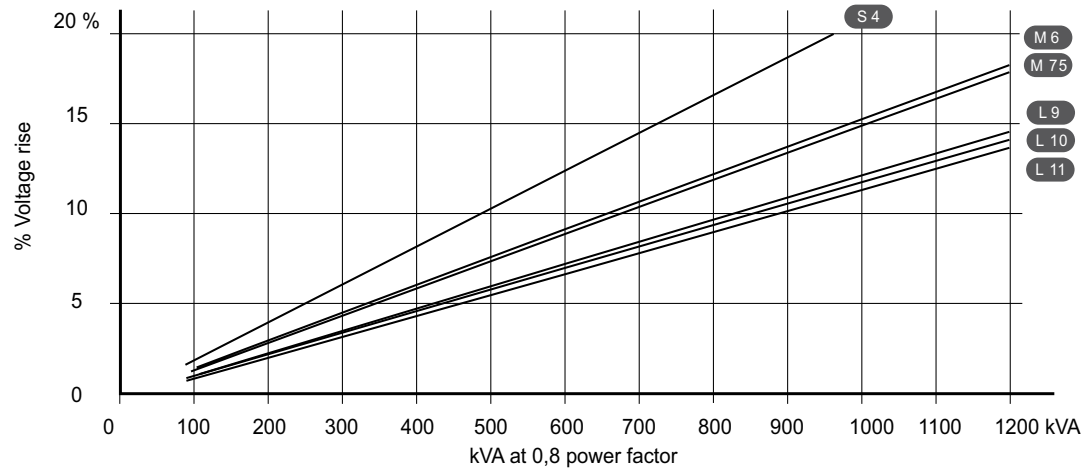
io (A)	No load excitation current	0,9	0,9	0,9	0,9	0,9	0.8
ic (A)	Full load excitation current	3,6	3,2	3,5	3,2	3,3	3.2
uc (V)	Full load excitation voltage	42	38	41	38	39	38
ms	Recovery time (Δ = 20 % trans.)	500	500	500	500	500	500
kVA	Motor start. (Δ = 20% sust.) or (Δ = 50% trans.)	1950	2482	2482	2972	2972	2972
%	Transient dip (rated step load) - PF : 0,8 LAG	13,3	10,9	11,7	10,7	11	12.2
W	No load losses	12570	13820	13820	15030	15030	17160
W	Heat rejection	39100	38520	43730	41600	43380	51950

Transient voltage variation 480V - 60 Hz

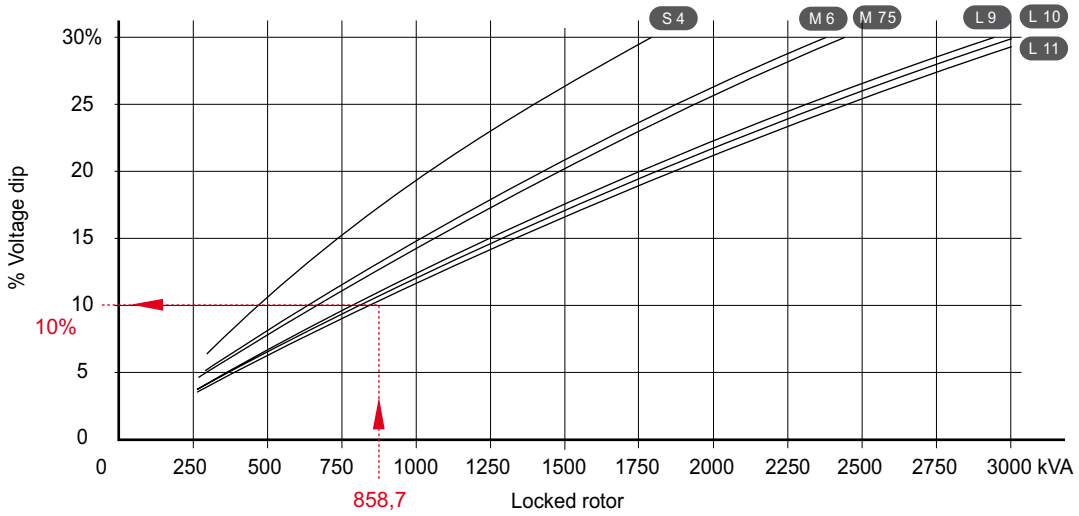
Load application (AREP or PMG system)



Load rejection (AREP or PMG system)



Motor starting (AREP or PMG system)



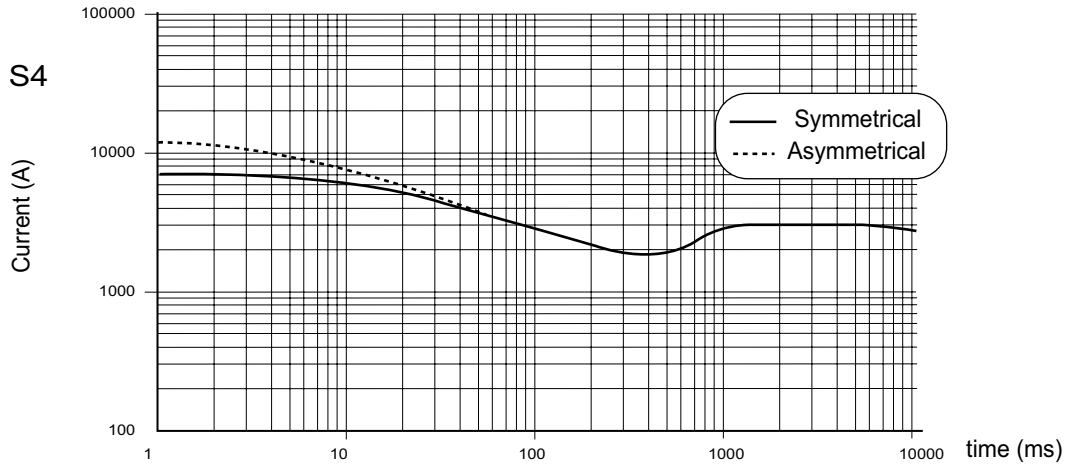
1) For a starting P.F. other than 0,6 , the starting kVA must be multiplied by K = Sine Ø /0,8
Calculation example for a different P.F. : Starter motor kVA calculated at 0.4 P.F. = 750 kVA
► Sin Ø 0,4 = 0,9165 ► K = 1,145 ► kVA corrected = 858,7 kVA ► Voltage dip corresponding to L11 = 10 %.

2) For voltages other than 480V (Y), 277V (△), 240V (YY) at 60 Hz ,

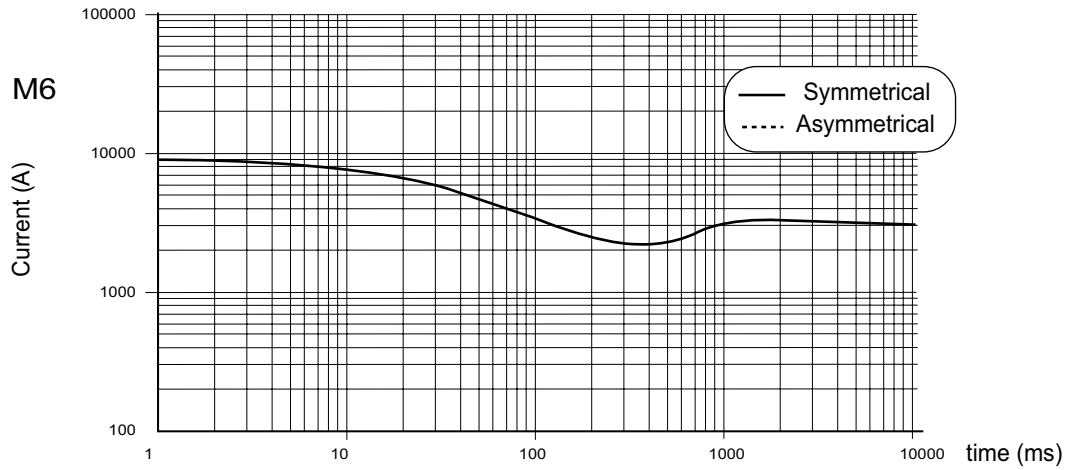
then kVA must be multiplied by $(480/U)^2$ or $(277/U)^2$ or $(240/U)^2$.

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

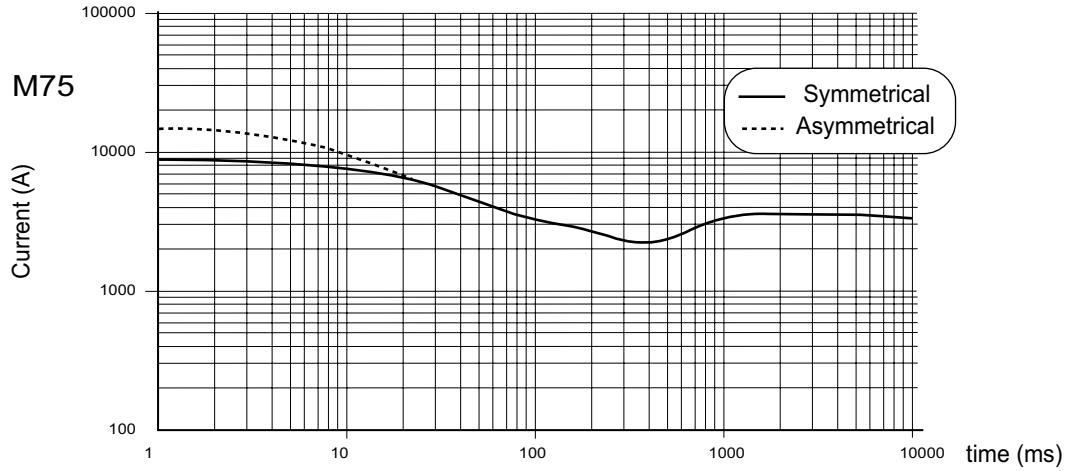
LSA 49.1 S4



LSA 49.1 M6



LSA 49.1 M75



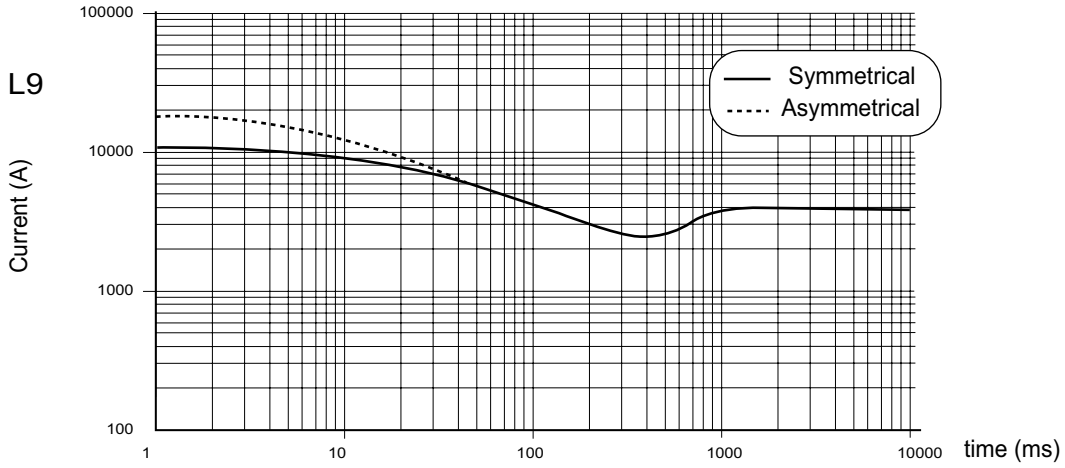
Influence due to connexion

Curves shown are for star connection (Y).
For other connections, use the following multiplication factors :

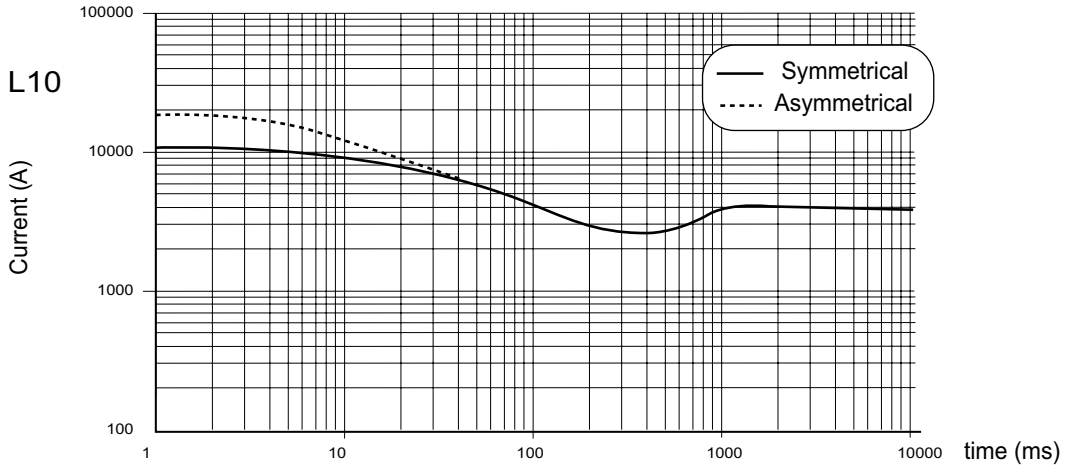
- Series delta : Current value x 1,732
- Parallel star : Current value x 2

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

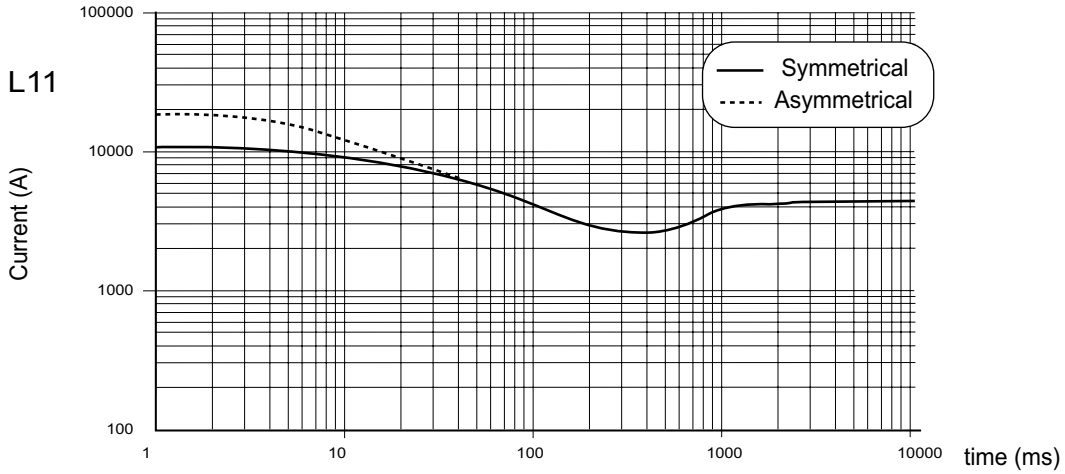
LSA 49.1 L9



LSA 49.1 L10



LSA 49.1 L11



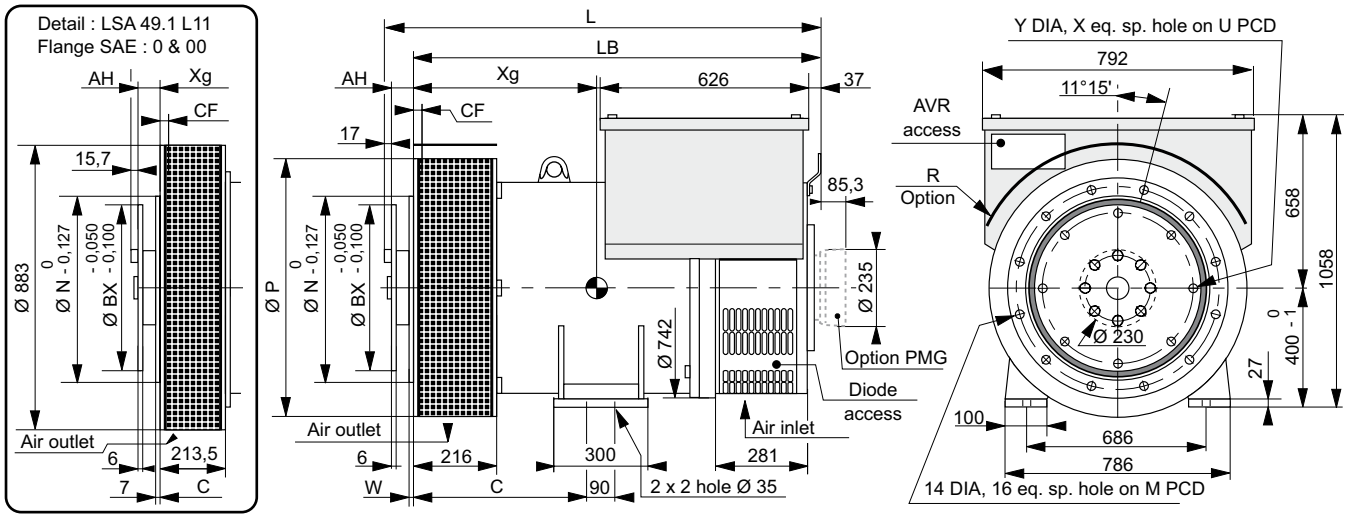
Influence due to short-circuit.

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
Sustained	1	1,5	2,2
Max sustained duration (AREP/ PMG)	10 sec.	5 sec.	2 sec.

Single bearing dimensions



Frame dimensions (mm)					
TYPE	L maxi without PMG	LB	C	Xg	Weight (kg)
LSA 49.1 S4	1315	1272	560	635	1420
LSA 49.1 M6	1415	1372	650	670	1620
LSA 49.1 M75	1415	1372	650	670	1620
LSA 49.1 L9	1515	1472	650	710	1820
LSA 49.1 L10	1515	1472	650	710	1820
LSA 49.1 L11	1480	1448	650	686	1945

Coupling		
Flex plate	14	18
Flange S.A.E. 1 *	**X**	
Flange S.A.E 1/2 *	**X**	
Flange S.A.E. 0	**X**	**X**
Flange S.A.E. 00		**X**

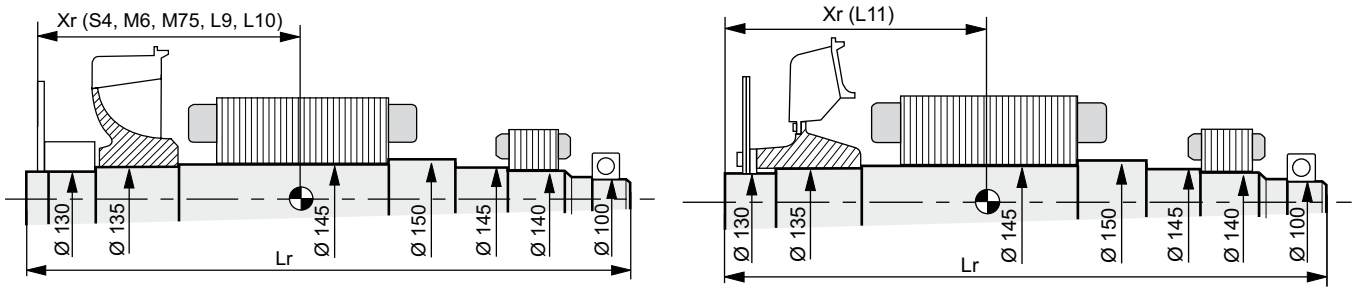
(*) : not available for LSA 49.1 L11

Flange dimensions (mm)						
S.A.E.	P	N	M	W	R	CF
1	753	511,175	530.225	7	438	17
1/2	753	584,2	619,125	6	438	17
0 *	753	647,7	679,45	7	438	17
00 *	885	787,4	850,9	6	505	15

Flex plate dimensions (mm)					
S.A.E.	BX	U	X	Y	AH
14	466,7	438,15	8	14	25,4
18	571,5	542,92	6	17	15,7

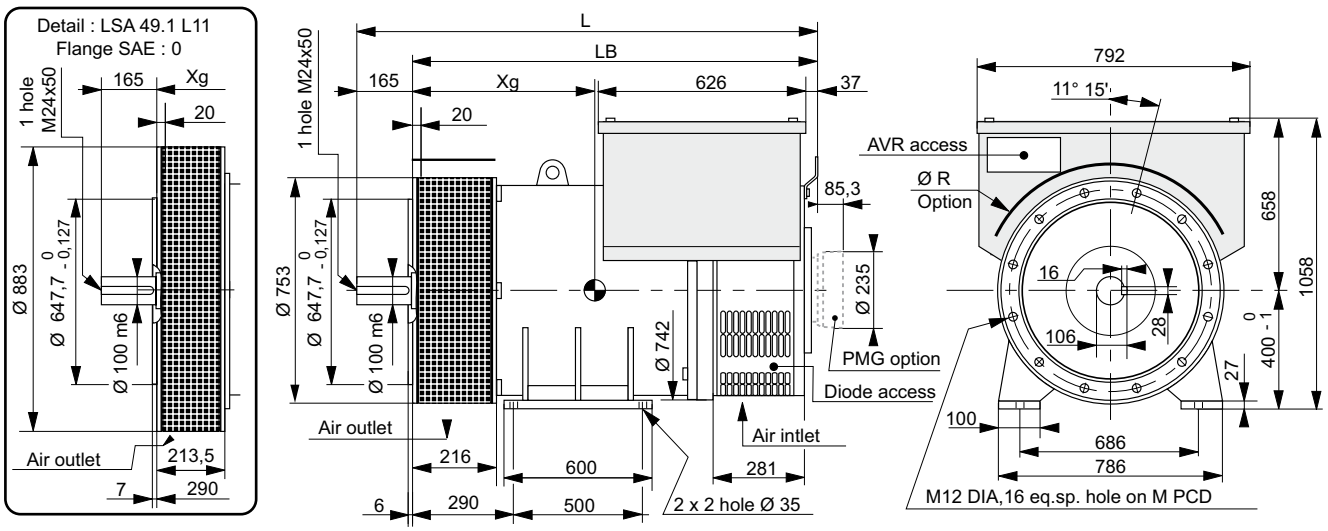
(*) : see the flange detail for LSA 49.1 L11 SAE 0 & 00.

Torsional analysis data



Gravity center : Xr (mm), Rotor length Lr (mm), Weight : M (kg), Moment of inertia : J (kgm²) : (4J = MD²)								
	Flex plate S.A.E. 14				Flex plate S.A.E. 18			
TYPE	Xr	Lr	M	J	Xr	Lr	M	J
LSA 49.1 S4	601	1280	536	8,51	591	1280	539	8,76
LSA 49.1 M6	651	1380	618	10,14	641	1380	621	10,39
LSA 49.1 M75	651	1380	618	10,14	641	1380	621	10,39
LSA 49.1 L9	701	1480	700	11,78	691	1480	703	12,03
LSA 49.1 L10	701	1480	700	11,78	691	1480	703	12,03
LSA 49.1 L11	676	1456	747	13.43	672	1456	751	13.70

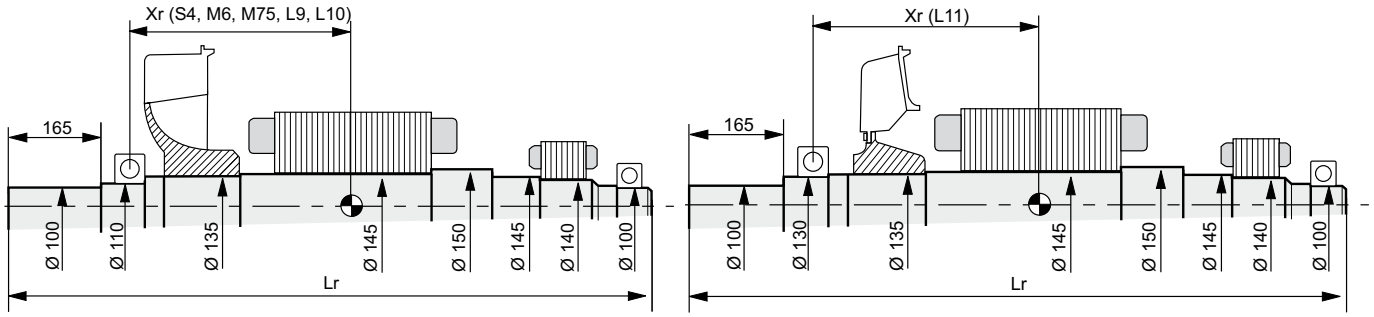
Two bearing dimensions



Frame dimensions (mm)						
TYPE	L maxi 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



Gravity center : Xr (mm), Rotor length Lr (mm), Weight : M (kg), Moment of inertia : J (kgm²) : (4J = MD²)				
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


LEROY®
SOMER