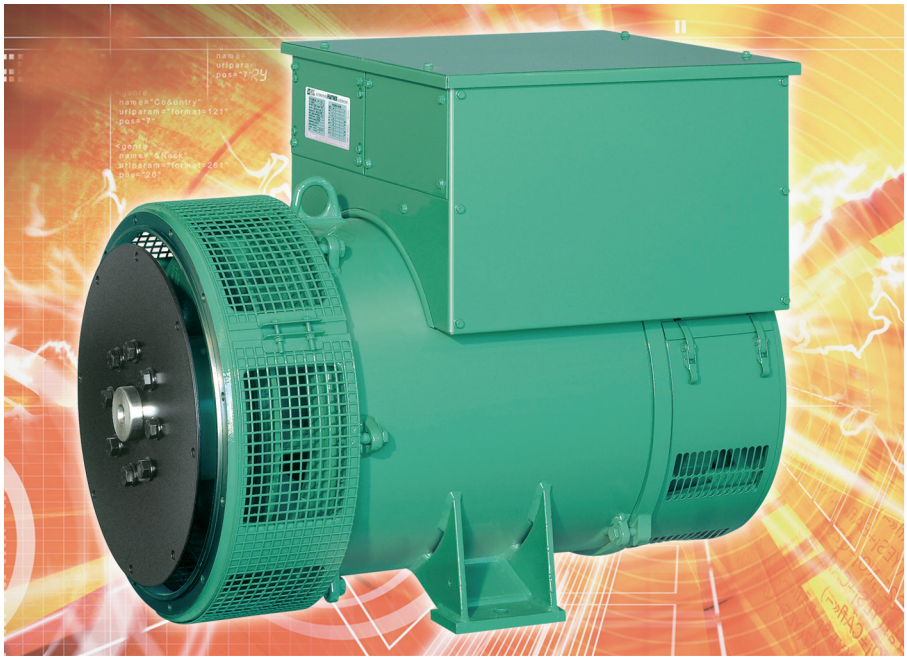
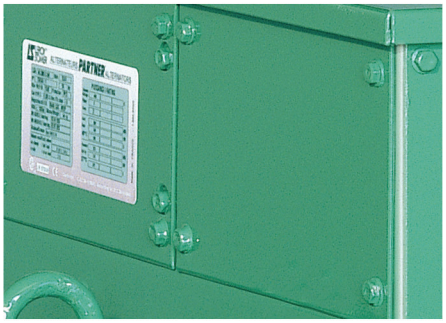
EMERSON.
Industrial Automation





LEROY SOMER

Low Voltage alternators - 4 pole
LSA 46.2

180 to 315 kVA - 50 Hz / 228 to 381 kVA - 60 Hz

Electrical and mechanical data

3790 en - 2012.11 / h

LSA 46.2 - 4 Pole

SPECIALLY ADAPTED FOR APPLICATIONS

The LSA 46.2 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 46.2 alternator conforms to the main international standards and regulations:
IEC 60034, NEMA MG 1.22, ISO 8528, CSA/UL on request, marine regulations, etc.
It can be integrated into a CE marked generator.
The LSA 46.2 is designed, manufactured and marketed in an ISO 9001 and ISO 14001 environment.

TOP OF THE RANGE ELECTRICAL PERFORMANCE

- Class H insulation.
- Standard 12-wire re-connectable winding, 2/3 pitch, type no. 6 .
- Voltage range: 220 V - 240 V and 380 V - 415 V (440 V) - 50 Hz / 208 V - 240 V and 380 V - 480 V - 60 Hz.
- High efficiency and motor starting capacity.
- Other voltages are possible with optional adapted windings:
  - 50 Hz: 440 V (no. 7), 500 V (no. 9), 550 V (no. 22), 600 V (no. 23), 690 V (no. 10 or 52)
  - 60 Hz: 380 V and 416 V (no. 8), 600 V (no. 9).
- THD Total harmonic distortion < 2,5% (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	**SHUNT**	**AREP**	**PMG**	**T.I.** Current transformer for paralleling	**R 726** Mains paralleling	**R 731** 3-phase sensing	**R 734** 3-phase sensing on mains paralleling unbalanced	**P** Remote voltage potentiometer
R 250	**Std**	**-**	**-**	**-**	**-**	**-**	**-**	√
R 450	**optional**	**Std**	**Std**	√	√	√	√	√
D 510C	**optional**	**optional**	**optional**	√	**included**	**included**	**contact factory**	√

Voltage regulator accuracy +/- 0.5%. √ : possible mounting

PROTECTION SYSTEM SUITED TO THE ENVIRONMENT

- The LSA 46. 2 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 windings and shields.

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.
- Greased for life bearings (regreasable bearings optional).

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.
- 12 way terminal block for reconnecting voltage reconnection.

Common data

Insulation class	H	Excitation system	SHUNT	A R E P or PMG
Winding pitch	2/3 (N° 6)	A.V.R. model	R 250	R 450
Terminals	12	Voltage regulation (*)	± 0,5 %	± 0,5 %
Drip proof	IP 23	Sustained short-circuit current	-	300% (3 IN) : 10s
Altitude	≤ 1000 m	Totale Harmonic distortion THD (**)	at no load < 2,5 % - on load < 2,5 %	
Overspeed	2250 min-1	Waveform : NEMA = TIF (**)	< 50	
Air flow	0,43 m3/s (50Hz)/ 0,51 (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.				1 ph.	3 ph.				1 ph.	3 ph.				1 ph.	3 ph.				1 ph.
Y		380V	400V	415V	440V	Δ Δ	380V	400V	415V	440V	Δ Δ	380V	400V	415V	440V	Δ Δ	380V	400V	415V	440V	Δ Δ
Δ		220V	230V	240V		230V	220V	230V	240V		230V	220V	230V	240V		230V	220V	230V	240V		230V
YY					220V					220V					220V					220V	
46.2 M3	kVA	180	**180**	180	160	104	168	**168**	168	146	97	195	**195**	195	175	110	203	**203**	203	180	114
	kW	***144***	***144***	***144***	***128***	***83***	***134***	***134***	***134***	***116***	***78***	***156***	***156***	***156***	***140***	***88***	***162***	***162***	162	***144***	***91***
46.2 M5	kVA	200	**200**	200	175	116	184	**184**	184	160	108	214	**214**	214	190	123	223	**223**	223	200	127
	kW	160	***160***	***160***	***140***	***93***	***147***	***147***	***147***	***128***	***86***	***171***	***171***	***171***	***152***	***98***	***178***	***178***	***178***	***160***	***102***
46.2 L6	kVA	250	**250**	240	205	141	217	**217**	217	190	131	254	**260**	254	225	150	266	**275**	266	237	156
	kW	200	***200***	***192***	***164***	***113***	***174***	***174***	***174***	***152***	***105***	***203***	***208***	***203***	***180***	***120***	***213***	***220***	***213***	***190***	***125***
46.2 L9	kVA	280	**280**	280	215	154	250	**250**	250	195	142	290	**290**	290	240	165	300	**300**	300	250	170
	kW	224	***224***	***224***	***172***	***123***	***200***	***200***	***200***	***156***	***114***	***232***	***232***	***232***	***192***	***132***	***240***	***240***	***240***	***200***	***136***
46.2 VL12	kVA	315	**315**	300	260	187	276	**276**	260	230	170	327	**327**	310	285	200	341	**341**	325	300	208
	kW	252	***252***	***240***	***208***	***150***	***221***	***221***	***208***	***184***	***136***	***262***	***262***	***248***	***228***	***160***	***273***	***273***	260	240	***166***

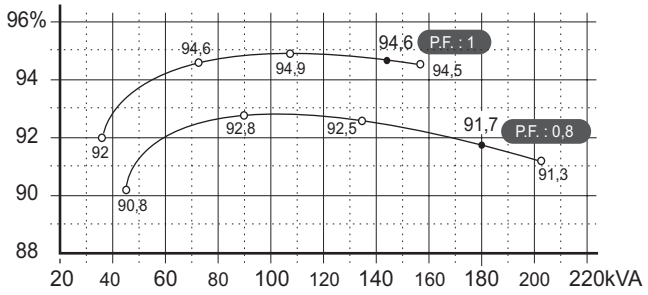
Ratings 60 Hz - 1800 R.P.M.

kVA / kW - Power factor = 0,8

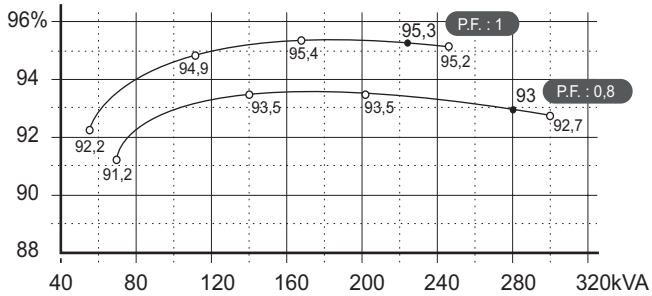
Duty	T° C	Continuous duty 40°C					Continuous duty 40°C					Stand-by / 40 °C					Stand-by / 27 °C				
Class / T° K		H / 125° K					F / 105° K					H / 150° K					H / 163° K				
Phase		3 ph.				1 ph.	3 ph.				1 ph.	3 ph.				1 ph.	3 ph.				1 ph.
Y		380V	416V	440V	480V	Δ Δ	380V	416V	440V	480V	Δ Δ	380V	416V	440V	480V	Δ Δ	380V	416V	440V	480V	Δ Δ
Δ		220V	240V			240V	220V	240V			240V	220V	240V			240V	220V	240V			240V
YY			208V	220V	240V			208V	220V	240V			208V	220V	240V			208V	220V	240V	
46.2 M3	kVA	192	205	220	**228**	128	177	189	198	**210**	119	203	219	228	**244**	136	211	225	237	**255**	141
	kW	***154***	***164***	***176***	***182***	***102***	***142***	***151***	***158***	***168***	***95***	***162***	***175***	***182***	***195***	***109***	***169***	***180***	190	***204***	***113***
46.2 M5	kVA	205	219	230	**250**	136	190	203	211	**225**	126	219	235	245	**262**	145	227	242	252	**273**	151
	kW	***164***	***175***	***184***	***200***	***109***	***152***	***162***	***169***	***180***	***101***	***175***	***188***	***196***	***210***	***116***	***182***	***194***	***202***	***218***	***121***
46.2 L6	kVA	257	276	289	**300**	173	239	255	265	**278**	160	276	295	308	**324**	184	285	304	317	**337**	192
	kW	***206***	***221***	***231***	***240***	***138***	***191***	***204***	***212***	***222***	***128***	***221***	***236***	***246***	***259***	***147***	***228***	***243***	***254***	***270***	***154***
46.2 L9	kVA	296	316	328	**344**	197	273	291	302	**302**	182	313	338	351	**357**	209	326	348	366	**375**	220
	kW	***237***	***253***	***262***	***275***	***158***	***218***	***233***	***242***	***242***	***146***	***250***	***270***	***281***	***286***	***167***	***261***	***278***	***293***	***300***	***176***
46.2 VL12	kVA	333	357	372	**381**	220	309	329	341	**347**	200	359	383	397	**412**	235	370	399	415	**429**	243
	kW	***266***	***286***	***298***	***305***	***176***	***247***	***263***	***273***	***278***	***160***	***287***	***306***	***318***	***330***	***188***	***296***	***319***	332	***343***	***194***

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

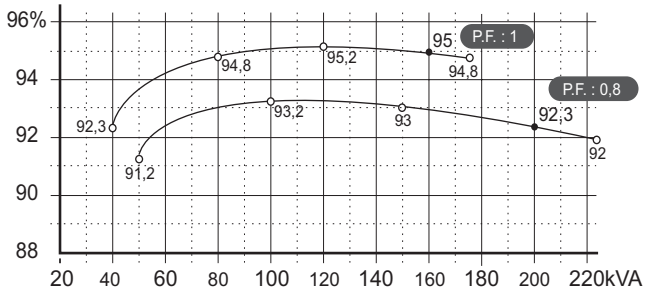
LSA 46.2 M3



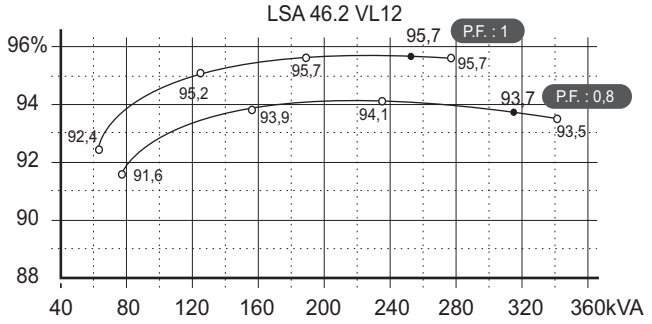
LSA 46.2 L9



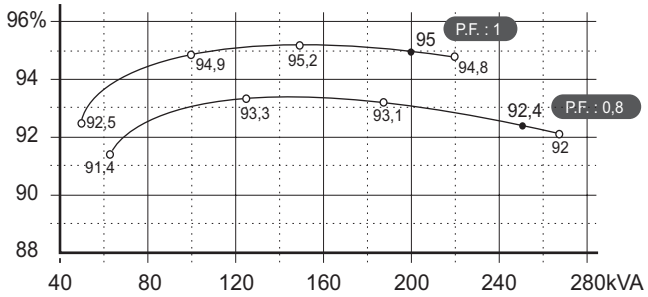
LSA 46.2 M5



LSA 46.2 VL12



LSA 46.2 L6



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

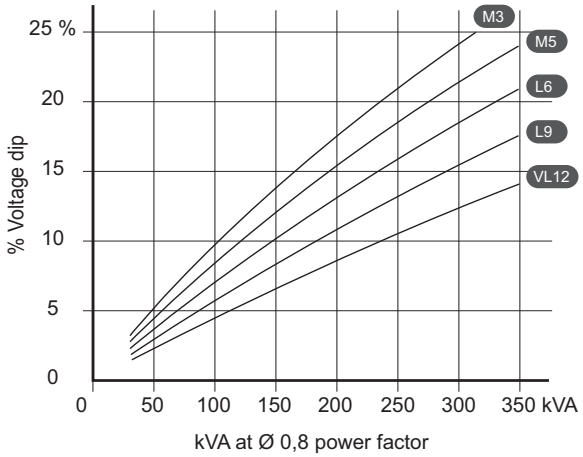
		M3	M5	L6	L9	VL12
Kcc	Short-circuit ratio	0,44	0,45	0,41	0,48	0,5
Xd	Direct axis synchro.reactance unsaturated	312	301	327	294	273
Xq	Quadra. axis synchr.reactance unsaturated	187	180	196	176	164
T'do	Open circuit time constant	1971	2042	2105	2175	2253
X'd	Direct axis transient reactance saturated	15,8	14,7	15,5	13,5	12,1
T'd	Short-Circuit transient time constant	100	100	100	100	100
X"d	Direct axis subtransient reactance saturated	9,5	8,8	9,3	8,1	7,2
T"d	Subtransient time constant	10	10	10	10	10
X"q	Quadra. axis subtransient reactance saturated	11,8	10,9	11,5	10	8,9
Xo	Zero sequence reactance unsaturated	0,5	0,8	0,7	0,7	0,5
X2	Negative sequence reactance saturated	10,6	9,9	10,4	9,1	8,1
Ta	Armature time constant	15	15	15	15	15

Other data - Class H / 400 V

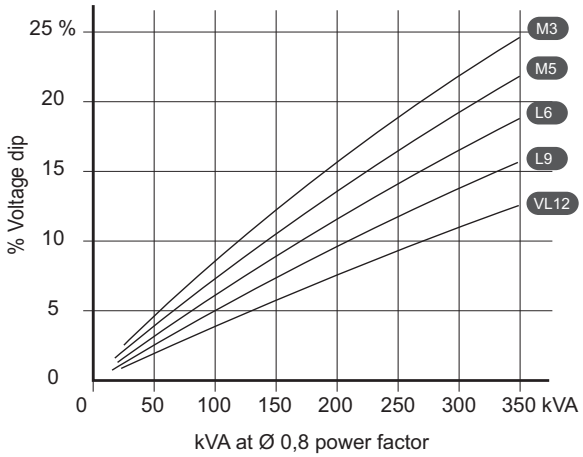
io (A)	No load excitation current (SHUNT / AREP or PMG)	1	1	1	1,1	1
ic (A)	Full load excitation current (SHUNT / AREP or PMG)	3,9	3,7	4	3,9	3,4
uc (V)	Full load excitation voltage (SHUNT / AREP or PMG)	33	32	34	33	33
ms	Recovery time (Δ = 20 % trans.)	500	500	500	500	500
kVA	Motor start. (Δ = 20% sust.) or (Δ = 50% trans.) SHUNT	340	397	462	538	694
kVA	Motor start. (Δ = 20% sust.) or (Δ = 50% trans.) AREP	371	434	504	583	760
%	Transient dip (rated step load) SHUNT / PF : 0,8 LAG	16,2	15,4	15,9	14,6	12,9
%	Transient dip (rated step load) AREP / PF : 0,8 LAG	14,3	13,7	14,1	13	11,4
W	No load losses	2810	3040	3690	4340	4800
W	Heat rejection	12900	13180	16400	16810	16730

Transient voltage variation 400 V - 50 Hz

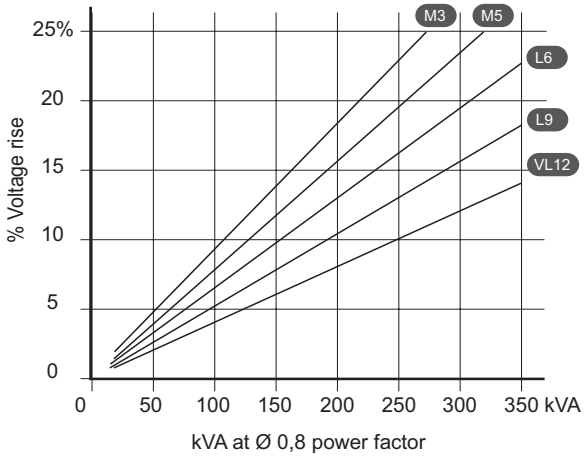
Load application (SHUNT excitation)



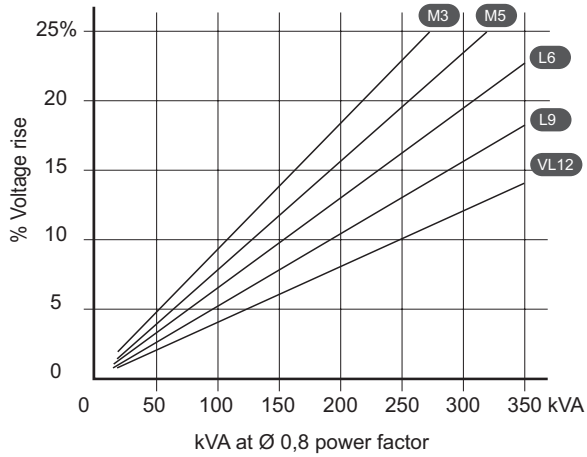
Load application (AREP or PMG excitation)



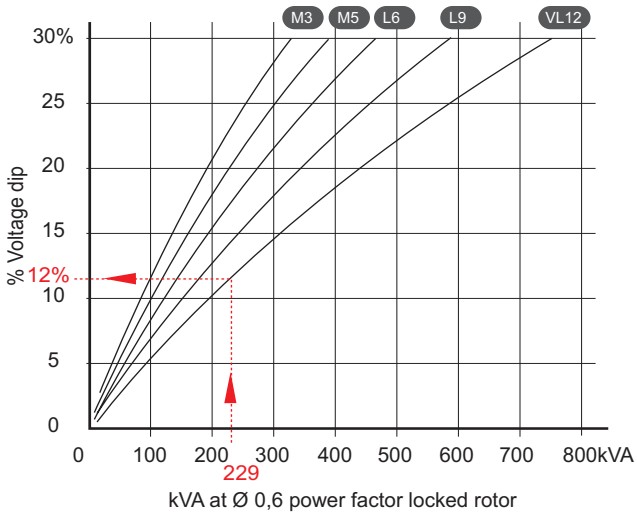
Load rejection (SHUNT excitation)



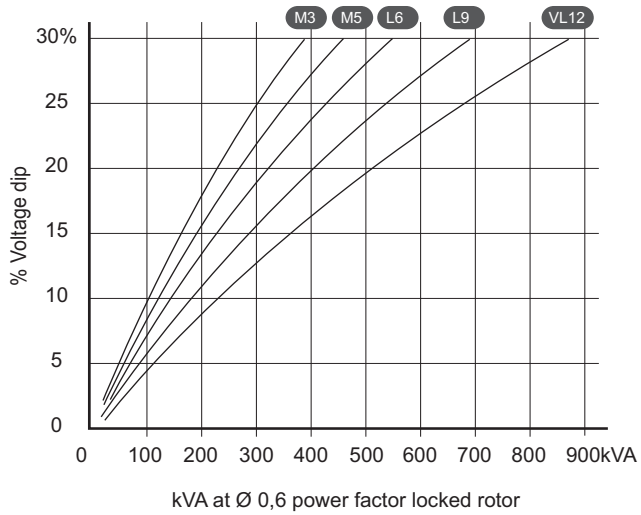
Load rejection (AREP or PMG excitation)



Motor starting (SHUNT excitation)



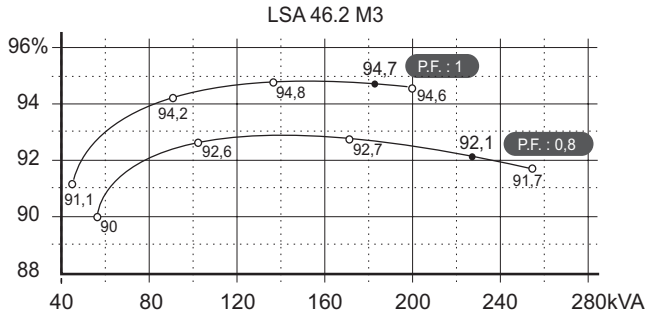
Motor starting (AREP or PMG excitation)

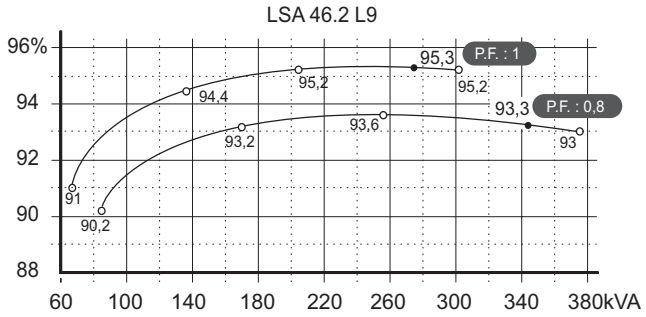


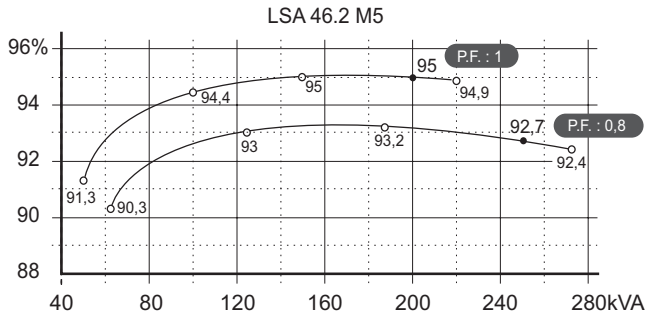
1) For a starting P.F. other than 0,6 , the starting kVA must be multiplied by K = Sine P.F. /0,8
Calculation example for a different P.F. : Starter motor kVA calculated at 0.4 P.F. = 200 kVA
► Sin P.F. 0,4 = 0,9165 ► K = 1,145 ► kVA corrected = 229 kVA ► Voltage dip corresponding to VL12 = 12 %.

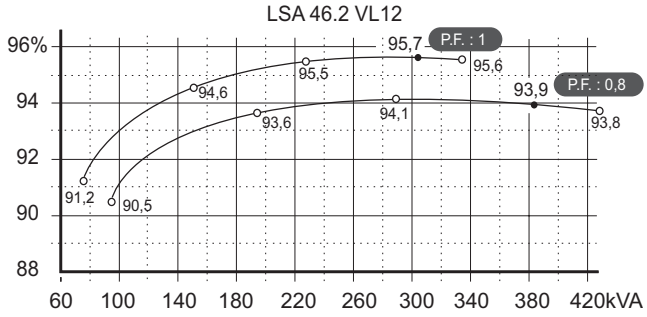
2) For voltages other than 400V (Y) , 230V (△) at 50 Hz, then kVA must be multiplied by $(400/U)^2$ or $(230/U)^2$.

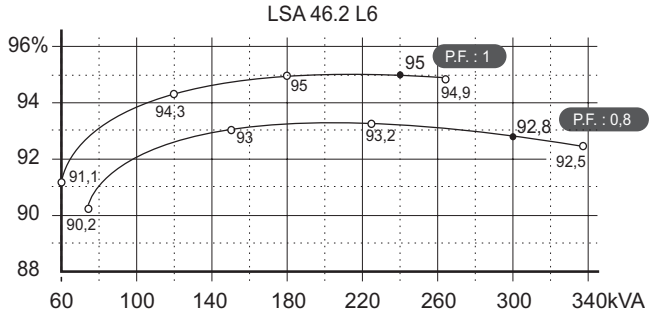
Efficiencies 60 Hz - P.F. :1 / P.F. : 0,8











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

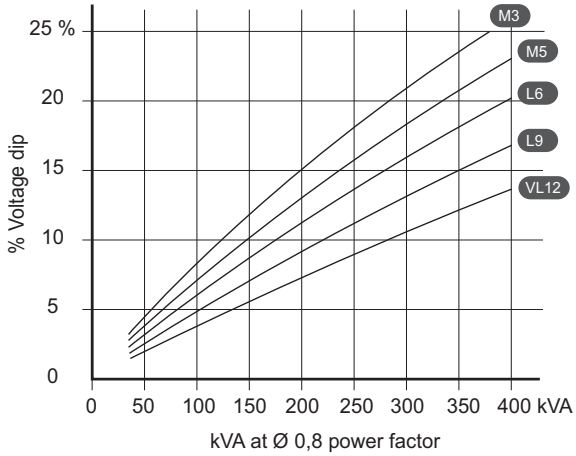
		M3	M5	L6	L9	VL12
Kcc	Short-circuit ratio	0,41	0,43	0,41	0,47	0,5
Xd	Direct axis synchro.reactance unsaturated	329	314	327	300	275
Xq	Quadra. axis synchr.reactance unsaturated	197	188	196	180	165
T'do	Open circuit time constant	1971	2042	2105	2175	2253
X'd	Direct axis transient reactance saturated	16,7	15,3	15,5	13,8	12,2
T'd	Short circuit transient time constant	100	100	100	100	100
X"d	Direct axis subtransient reactance saturated	10	9,2	9,3	8,2	7,3
T"d	Subtransient time constant	10	10	10	10	10
X"q	Quadra. axis subtransient reactance saturated	12,4	11,4	11,5	10,2	9
Xo	Zero sequence reactance unsaturated	0,5	0,5	0,6	0,4	0,4
X2	Negative sequence reactance saturated	11,2	10,3	10,4	9,3	8,2
Ta	Armature time constant	15	15	15	15	15

Other data - Class H / 480 V

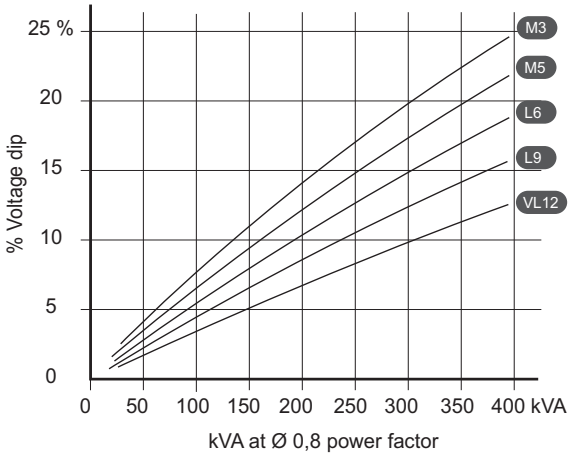
io (A)	No load excitation current (SHUNT / AREP or PMG)	1	1	1	1,1	1
ic (A)	Full load excitation current (SHUNT / AREP or PMG)	4	3,8	3,9	3,8	3,4
uc (V)	Full load excitation voltage (SHUNT / AREP or PMG)	34	32	33	33	33
ms	Recovery time (Δ = 20 % trans.)	500	500	500	500	500
kVA	Motor start. (Δ = 20% sust.) or (Δ = 50% trans.) SHUNT	420	496	575	673	867
kVA	Motor start. (Δ = 20% sust.) or (Δ = 50% trans.) AREP	461	540	629	732	953
%	Transient dip (rated step load) SHUNT / PF : 0,8 LAG	16,7	15,8	15,9	14,8	13
%	Transient dip (rated step load) AREP / PF : 0,8 LAG	14,8	14,1	14,1	13,1	11,5
W	No load losses	4180	4500	5530	6430	7090
W	Heat rejection	15570	15680	18500	19690	19510

Transient voltage variation - 480 V - 60 Hz

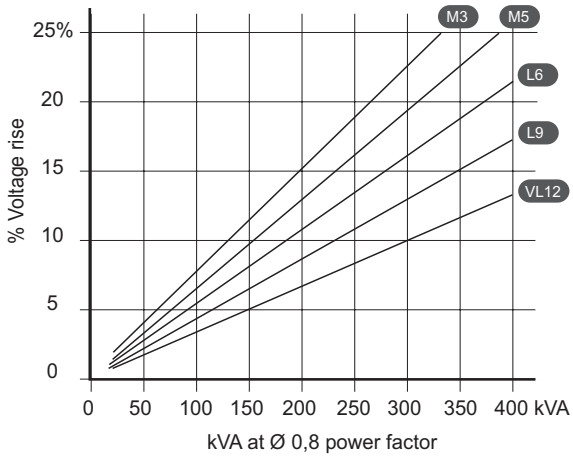
Load application (SHUNT excitation)



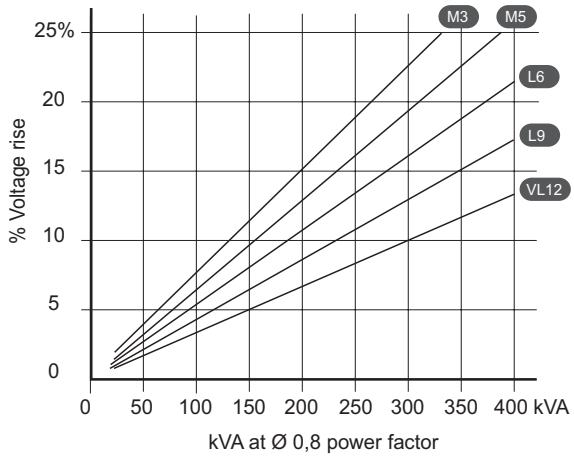
Load application (AREP or PMG excitation)



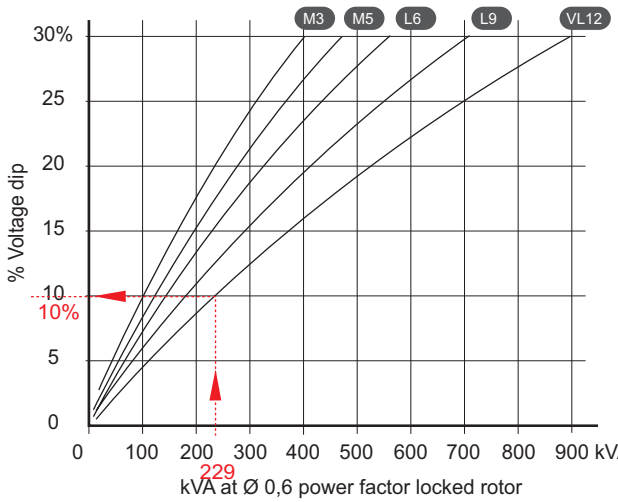
Load rejection (SHUNT excitation)



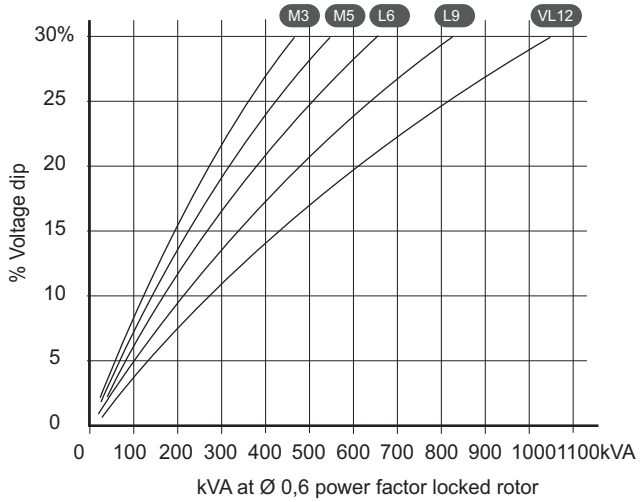
Load rejection (AREP or PMG excitation)



Motor starting (SHUNT excitation)



Motor starting (AREP or PMG excitation)

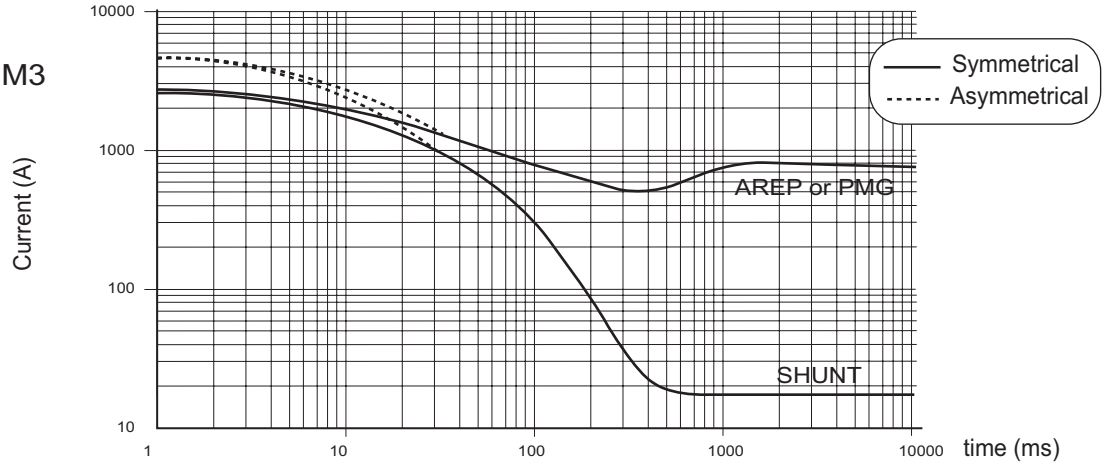


1) For a starting P.F. other than 0,6 , the starting kVA must be multiplied by K = Sine P.F. /0,8
Calculation example for a different P.F. : Starter motor kVA calculated at 0.4 P.F. = 200 kVA
► Sin P.F. 0,4 = 0,9165 ► K = 1,145 ► kVA corrected = 229 kVA ► Voltage dip corresponding to VL12 = 10 %.

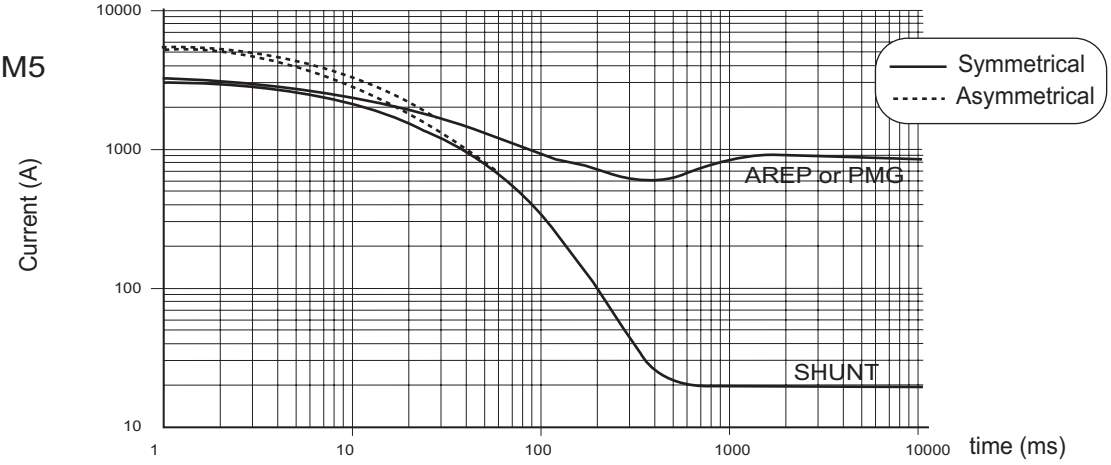
2) For voltages other than 480V (Y), 277V (△), 240V (YY) at 60 Hz ,
then kVA must be multiplied by $(480/U)^2$ or $(277/U)^2$ or $(240/U)^2$.

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

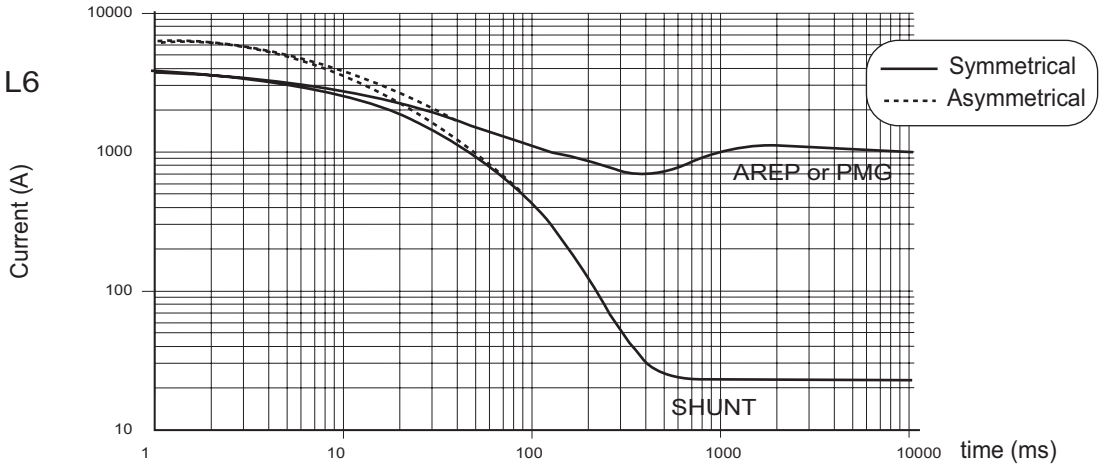
LSA 46.2 M3



LSA 46.2 M5



LSA 46.2 L6



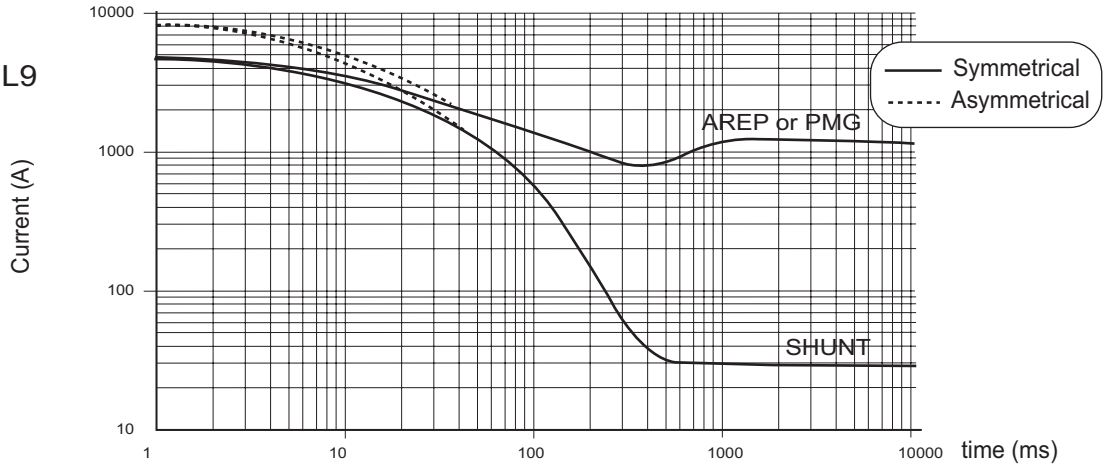
Influence due to connexion.

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

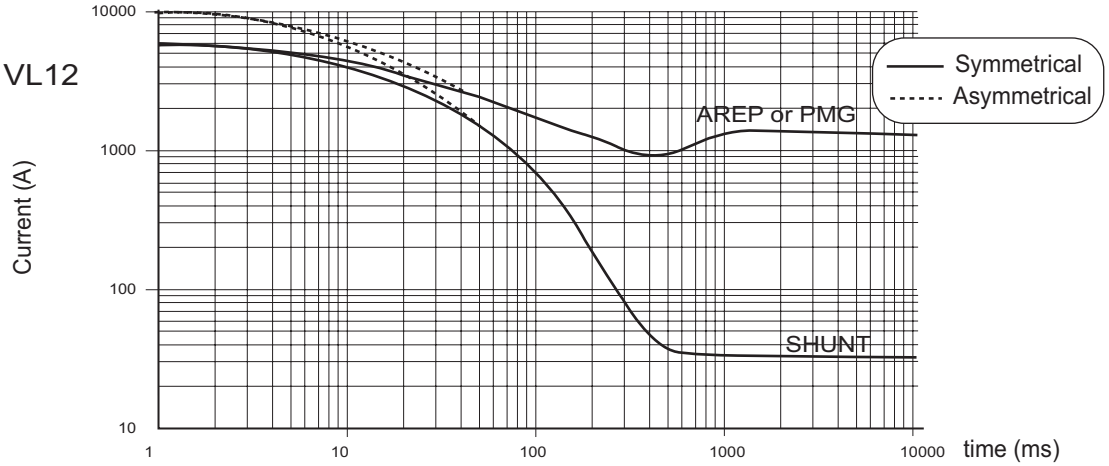
- Series delta : Current value x 1,732
- Parallel star : Current value x 2

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

LSA 46.2 L9



LSA 46.2 VL12



Influence due to short-circuit.

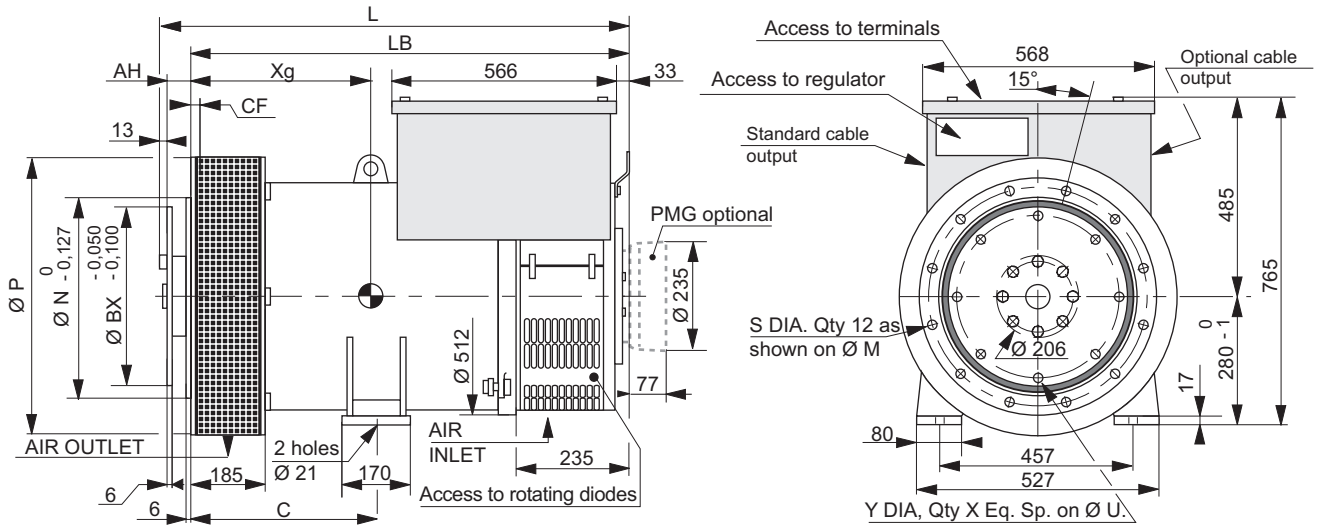
Curves are based on a three-phase short-circuit.

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.

LSA 46.2 - 4 Pole

Single bearing dimensions



Frame dimensions					
TYPE	L max without PMG	LB	Xg	C	Weight (kg)
LSA 46.2 M3	973	920	460	429	585
LSA 46.2 M5	973	920	470	429	625
LSA 46.2 L6	1083	1030	460	429	710
LSA 46.2 L9	1083	1030	485	429	775
LSA 46.2 VL12	1175	1130	530	525	895

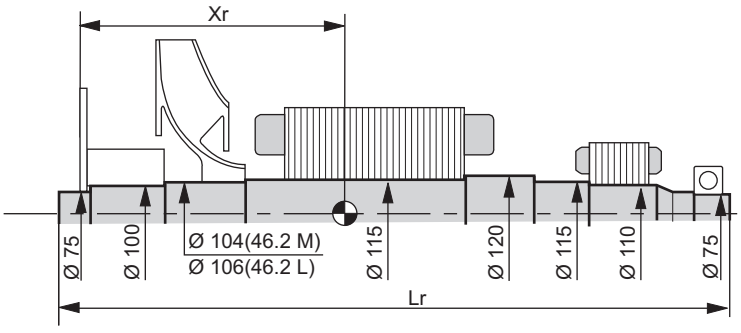
Coupling		
Flex plate	11 1/2	14
Flange S.A.E 3	X	
Flange S.A.E. 2	X	
Flange S.A.E 1	X	X
Flange S.A.E. 1/2		X

Flange (mm)						
S.A.E.	P	N	M	S	R	CF
3	575*/623	409.575	428,625	11	345*/368	24*/17
2	575*/623	447,675	466,725	11	345*/368	24*/17
1	575*/623	511,175	530,225	12	345*/368	24*/17
1/2	651	584,2	619,125	14,5	382	17

Flex plate (mm)					
S.A.E.	BX	U	X	Y	AH
11 1/2	352,42	333,38	8	11	39,6
14	466,72	438,15	8	14	25,4

* : dimensions LSA 46,2 M

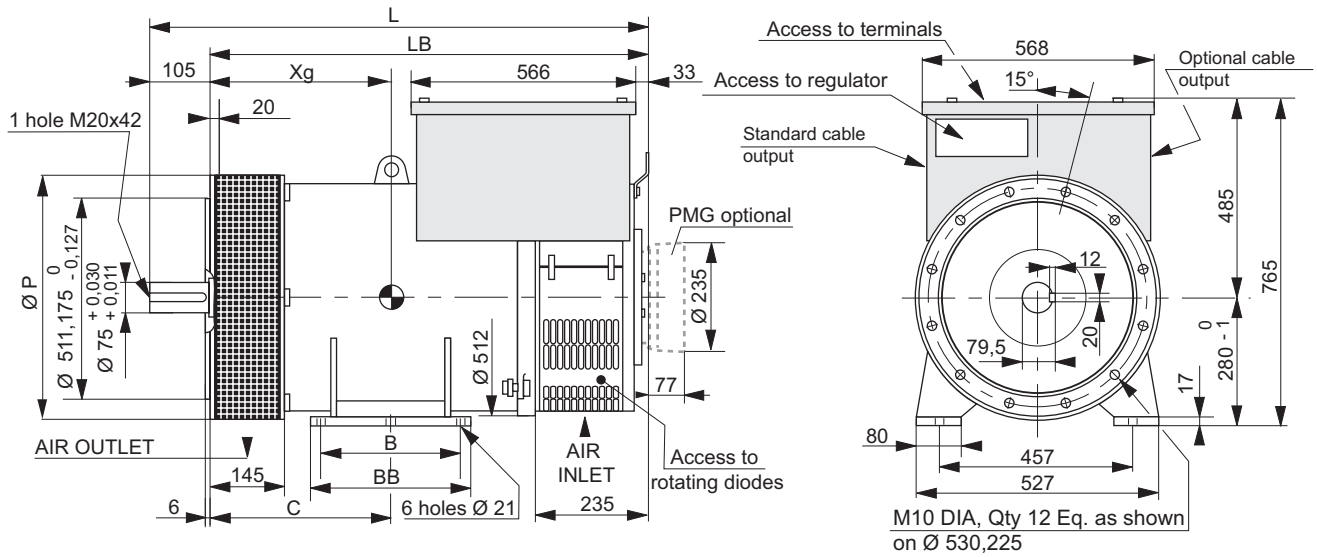
Torsional analysis data



Gravity center : Xr (mm), Rotor length Lr (mm), Weight : M (kg), Moment of inertia : J (kgm²) : (4J = MD²)								
	Flex plate S.A.E. 11 1/2				Flex plate S.A.E. 14			
TYPE	Xr	Lr	M	J	Xr	Lr	M	J
LSA 46.2 M3	422	935	229	1,78	407	935	229,4	1,909
LSA 46.2 M5	434	935	245	1,948	419	935	245,3	2,077
LSA 46.2 L6	466	1045	278	2,329	451	1045	278,8	2,458
LSA 46.2 L9	485	1045	304,3	2,605	474	1045	304,9	2,724
LSA 46.2 VL12	540	1145	357	3,1	529	1145	357,6	3,216

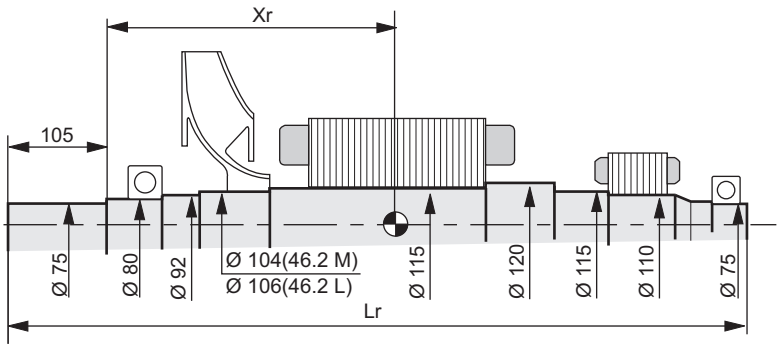
LSA 46.2 - 4 Pole

Two bearing dimensions



Frame dimensions									
TYPE	L max without PMG	LB	P	C	BB	B	R	Xg	Weight (kg)
LSA 46.2 M3	985	880	575	389	418	368	345	400	570
LSA 46.2 M5	985	880	575	389	418	368	345	410	615
LSA 46.2 L6	1095	990	623	389	418	368	368	430	705
LSA 46.2 L9	1095	990	623	389	418	368	368	455	770
LSA 46.2 VL12	1195	1090	623	485	610	560	368	500	885

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 46.2 M3	395	955	199,9	1,57
LSA 46.2 M5	404	955	215,8	1,738
LSA 46.2 L6	436	1065	247,6	2,109
LSA 46.2 L9	453	1065	273,7	2,385
LSA 46.2 VL12	502	1165	323,8	2,845

Contact

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