LEROY SOMER®

3820 en - 01.2005 / b

Alternators
LSA 44.2 - 4 Pole

Electrical and mechanical data

SPECIALLY ADAPTED FOR APPLICATIONS

The LSA 44.2 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 44.2 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 44.2 is designed, manufactured and marketed in an ISO 9001 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), 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).
- Total harmonic content < 2%.
- 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**	Current transformer for paralleling	Mains paralleling **R 726**	3-phase sensing **R 731**	**R 734** mains paralleling unbalanced	Remote voltage potentiometer
R 230	**Std**	**-**	**-**	**-**	**-**	**-**	**-**	√
R 438	**-**	**Std**	**Std**	√	√	√	√	√
R 448	**optional**	**-**	**-**	√	√	√	√	√

Voltage regulator accuracy +/- 0.5%.

PROTECTION SYSTEM SUITED TO THE ENVIRONMENT

- The LSA 44. 2 is IP 23.
- Standard winding protection for clean environments with relative humidity ≤ 95 %, including indoor marine environments.

Options:
Filters on air inlet and air outlet (IP 44).
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.
- 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.
- 8 way terminal block for reconnecting voltage reconnection.

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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 230	R 438
Terminals	12	Voltage regulation (*)	± 0,5 %	± 0,5 %
Drip proof	IP 23	Sustained short-circuit current	-	300% (3 IN) : 10s
Altitude	≤ 1000 m	Total harmonic TGH / THC (**)	at no load < 2 % - on load < 2%	
Overspeed	2250 min^{-1}	Waveform : NEMA = TIF (**)	< 50	
Air flow	0,37 m^3/s (50Hz)/ 0,44 (60Hz)	Wave form : I.E.C. = THF (**)	< 2 %	

(*) Steady state duty. (**) Total harmonic 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	ΔΔ	380V	400V	415V	440V	ΔΔ	380V	400V	415V	440V	ΔΔ	380V	400V	415V	440V	ΔΔ
Δ		220V	230V	240V		230V	220V	230V	240V		230V	220V	230V	240V		230V	220V	230V	240V		230V
YY					220V					220V					220V					220V	
44.2 VS3	kVA	90	**90**	90	90	55	80	**80**	80	80	50	95	**95**	95	95	58	100	**100**	100	100	60
	kW	*72*	***72***	*72*	*72*	*44*	*64*	***64***	*64*	*64*	*40*	*76*	***76***	*76*	*76*	*46*	*80*	***80***	80	*80*	*58*
44.2 VS45	kVA	105	**105**	105	105	66	95	**95**	95	95	62	110	**110**	110	110	69	116	**116**	116	116	72
	kW	84	***84***	*84*	*84*	*53*	*76*	***76***	*76*	*76*	*50*	*88*	***88***	*88*	*88*	*55*	*93*	***93***	*93*	*93*	*58*
44.2 S7	kVA	120	**125**	120	120	73	110	**112**	110	110	65	126	**131**	126	126	77	132	**138**	132	132	82
	kW	96	***100***	*96*	*96*	*58*	*88*	***90***	*88*	*88*	*52*	*101*	***105***	*101*	*101*	*62*	*106*	***110***	*106*	*106*	*66*
44.2 S75	kVA	130	**135**	130	125	83	115	**122**	115	114	75	138	**143**	138	132	88	144	**150**	144	137	93
	kW	104	***108***	*104*	*100*	*66*	*92*	***98***	*92*	*91*	*60*	*110*	***114***	*110*	*106*	*70*	*115*	***120***	*115*	*110*	*74*
44.2 M95	kVA	150	**150**	145	125	94	135	**135**	130	114	87	156	**156**	150	132	101	165	**165**	160	137	104
	kW	120	***120***	*116*	*100*	*75*	*108*	***108***	*104*	*91*	*70*	*125*	***125***	*120*	*106*	*81*	*132*	***132***	128	110	*83*
44.2 L12	kVA	165	**165**	165	135	102	150	**150**	150	123	94	170	**170**	170	143	109	175	**175**	175	148	113
	kW	132	***132***	*132*	*110*	*82*	*120*	***120***	*120*	*98*	*75*	*136*	***136***	*136*	*114*	*87*	*140*	***140***	140	89	*90*

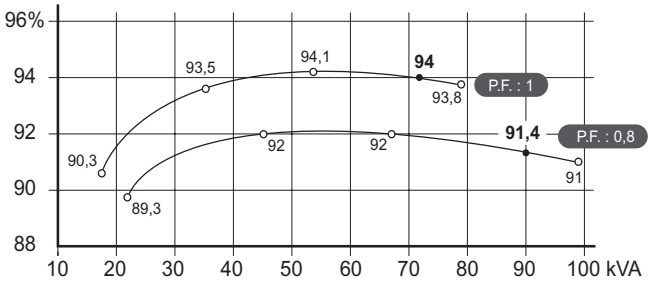
Ratings 60 Hz - 1800 R.P.M.

kVA / kW - Power factor = 0,8

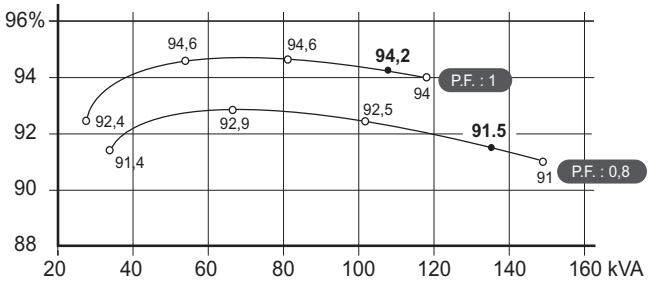
Duty T°C		Continuous duty 40°C					Continuous duty 40°C					Stand-by / 40 °C					Stand-by / 27 °C				
Class / T° K		H / 125° K					F / 105° K					H / 150° K					H / 163° K				
Phase		**3 ph.**				1 ph.	**3 ph.**				1 ph.	**3 ph.**				1 ph.	**3 ph.**				1 ph.
Y		380V	416V	440V	480V	ΔΔ	380V	416V	440V	480V	ΔΔ	380V	416V	440V	480V	ΔΔ	380V	416V	440V	480V	ΔΔ
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	
44.2 VS3	kVA	95	100	105	**115**	65	85	90	95	**105**	59	100	105	110	**120**	69	105	110	115	**125**	72
	kW	*76*	*80*	*84*	***92***	*52*	*68*	*72*	*76*	***84***	*47*	*80*	*84*	*88*	***96***	*55*	*84*	*88*	92	***100***	*58*
44.2 VS45	kVA	109	117	123	**131**	74	101	108	113	**122**	68	117	125	131	**138**	79	120	129	135	**144**	81
	kW	*87*	*94*	*98*	***105***	*59*	*81*	*86*	*90*	***98***	*54*	*94*	*100*	*105*	***110***	*63*	*96*	*103*	*108*	***115***	*65*
44.2 S7	kVA	126	137	144	**155**	83	115	123	130	**140**	77	133	143	151	**163**	89	139	151	158	**170**	92
	kW	*99*	*106*	*111*	***120***	*66*	*92*	*98*	*104*	***112***	*62*	*106*	*114*	*120*	***130***	*71*	*110*	*118*	*123*	***132***	*74*
44.2 S75	kVA	136	146	155	**169**	95	122	132	139	**152**	85	143	154	163	**178**	100	150	162	172	**187**	105
	kW	*109*	*117*	*124*	***135***	*76*	*98*	*106*	*111*	***122***	*68*	*114*	*123*	*130*	***142***	*80*	*120*	*130*	*138*	***150***	*84*
44.2 M95	kVA	156	167	174	**188**	104	144	154	160	**167**	96	167	179	186	**196**	110	173	185	194	**206**	115
	kW	*125*	*134*	*139*	***150***	*83*	*115*	*123*	*128*	***134***	*77*	*134*	*143*	*149*	***157***	*88*	*138*	*148*	155	**165**	*92*
44.2 L12	kVA	169	180	190	**206**	110	155	165	171	**185**	102	181	193	200	**215**	118	187	201	209	**225**	123
	kW	*135*	*144*	*152*	***165***	*88*	*124*	*132*	*137*	***148***	*82*	*145*	*154*	*160*	***172***	*94*	*150*	*161*	167	**180**	*98*

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

LSA 44.2 VS 3



LSA 44.2 S75



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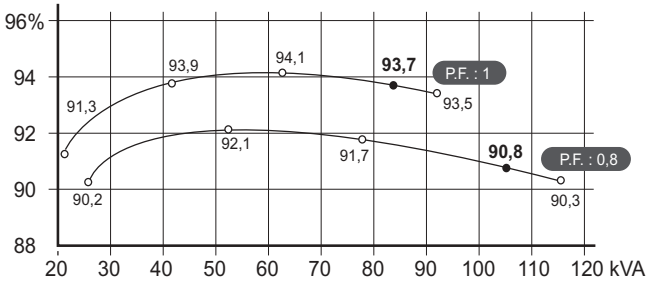
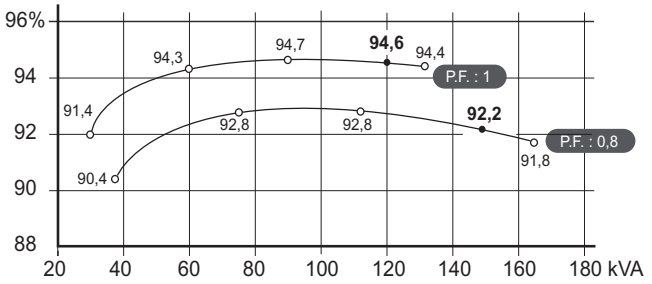
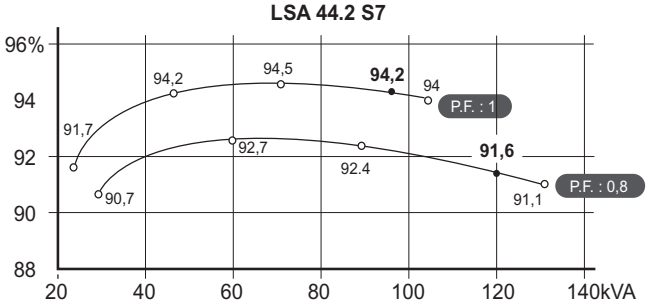


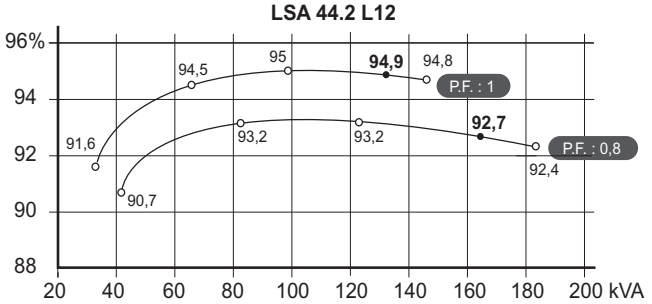
LSA 44.2 M95



LSA 44.2 S7



LSA 44.2 L12



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

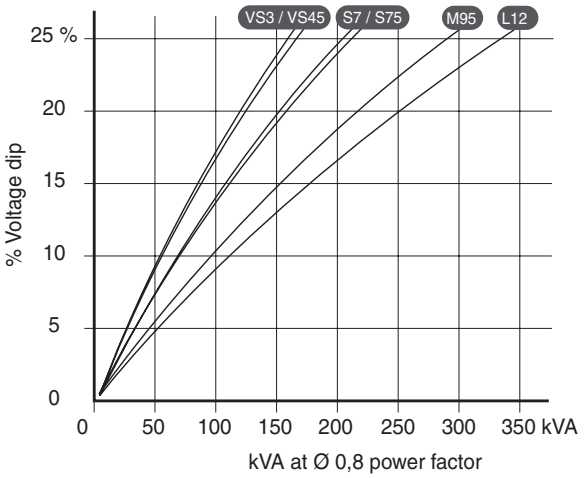
		VS3	VS45	S7	S75	M95	L12
Kcc	Short-circuit ratio	0,40	0,35	0,33	0,31	0,42	0,43
Xd	Direct axis synchro.reactance unsaturated	311	362	363	392	317	306
Xq	Quadra. axis synchr.reactance unsaturated	186	217	218	235	190	184
T'do	Open circuit time constant	2555	2555	2734	2734	2865	2966
X'd	Direct axis transient reactance saturated	12,1	14,1	13,2	14,3	11	10,3
T'd	Short-Circuit transient time constant	100	100	100	100	100	100
X"d	Direct axis subtransient reactance saturated	7,3	8,5	7,9	8,6	6,6	6,2
T"d	Subtransient time constant	10	10	10	10	10	10
X"q	Quadra. axis subtransient reactance saturated	8,9	10,4	9,6	10,3	7,8	7,2
Xo	Zero sequence reactance unsaturated	0,3	0,5	0,7	0,9	0,1	0,8
X2	Negative sequence reactance saturated	8,1	9,5	8,8	9,5	7,3	6,7
Ta	Armature time constant	15	15	15	15	15	15

Other data - Class H / 400 V

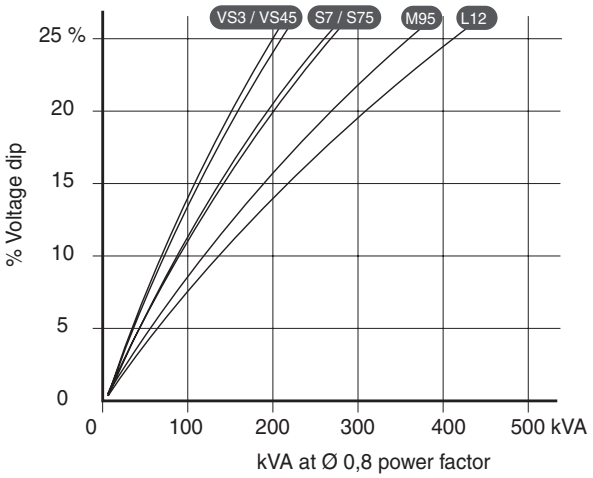
io (A)	No load excitation current (SHUNT / AREP or PMG)	0,5/1	0,5/1	0,5/1	0,5/1	0,6/1,2	0,5/1
ic (A)	Full load excitation current (SHUNT / AREP or PMG)	1,8/3,6	2,1/4,2	2/3,8	2,1/4,2	2/4	1,9/3,8
uc (V)	Full load excitation voltage (SHUNT / AREP or PMG)	33/17	38/19	36/17	38/19	36/18	34/17
ms	Recovery time (ΔU = 20 % trans.)	500	500	500	500	500	500
kVA	Motor start. (ΔU = 20% sust.) or (ΔU = 50% trans.) SHUNT	194,4	194,4	243,9	246,4	284,2	331,4
kVA	Motor start. (ΔU = 20% sust.) or (ΔU = 50% trans.) AREP	227,9	227,9	286,2	287,3	329,2	383,1
%	Transient dip (rated step load) SHUNT / PF : 0,8 LAG	15,6	17,3	16,6	17,5	14,7	14
%	Transient dip (rated step load) AREP / PF : 0,8 LAG	13	14,3	13,4	14,4	12,2	11,7
W	No load losses	1800	1800	1970	1970	2620	2830
W	Heat rejection	6760	8500	9410	9980	10150	10330

Transient voltage variation 400 V - 50 Hz

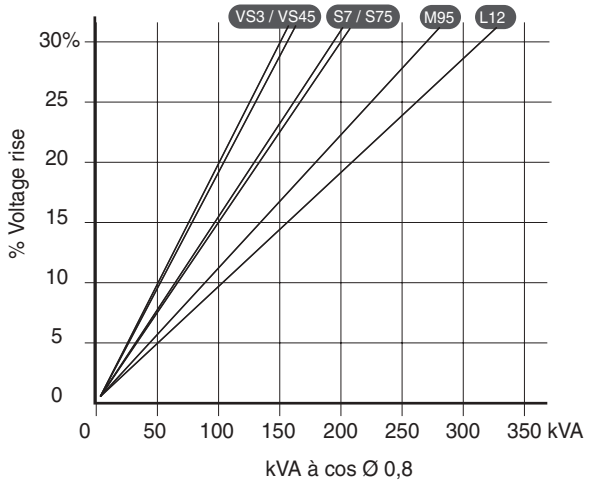
Load application (Shunt excitation)



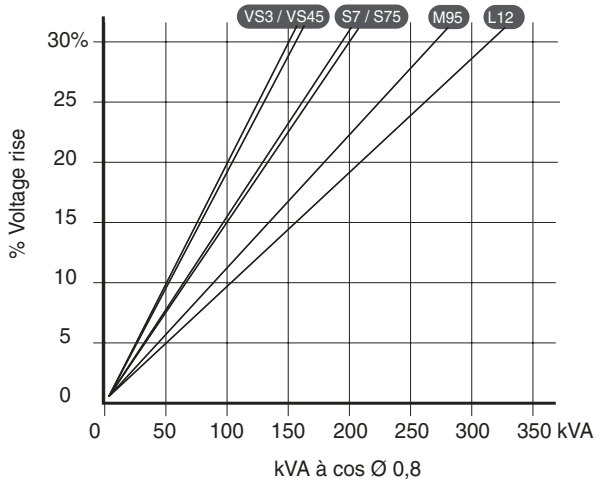
Load application (AREP ou PMG excitation)



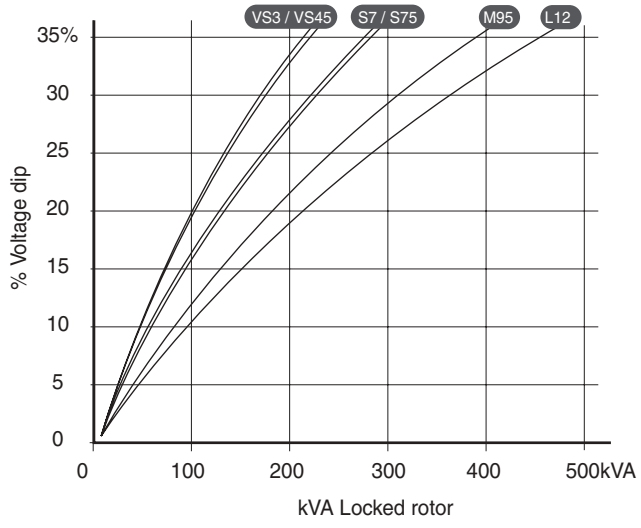
Load rejection (Shunt excitation)



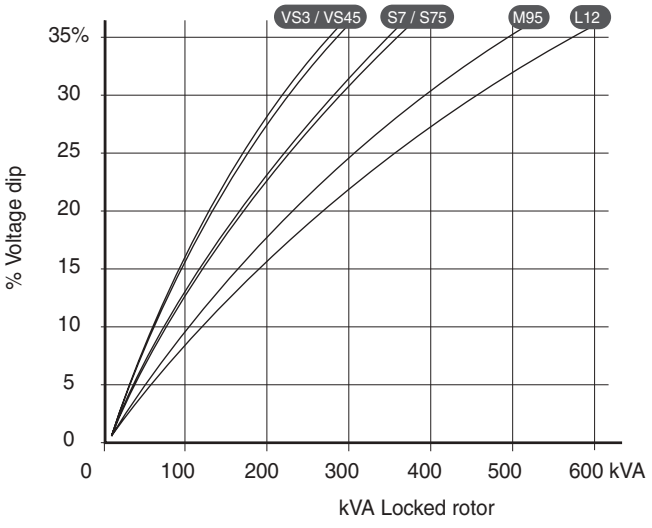
Load rejection (AREP or PMG excitation)



Motor starting (SHUNT excitation)



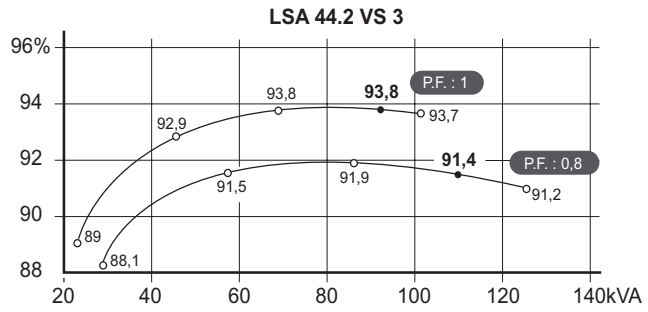
Motor starting (AREP or PMG excitation)

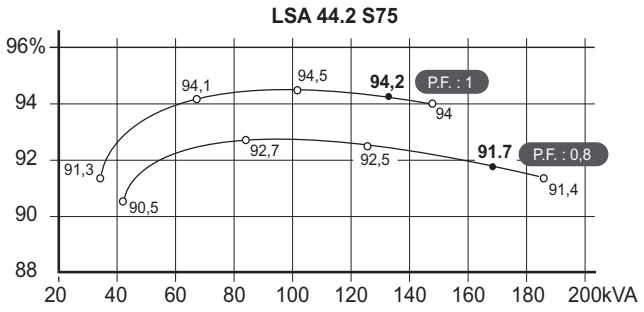


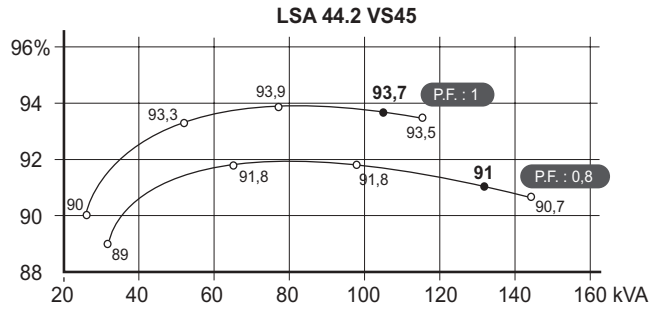
1) For a starting P.F. differing from 0,6 , the starting kVA must be multiplied by (Sine Ø /0,8)

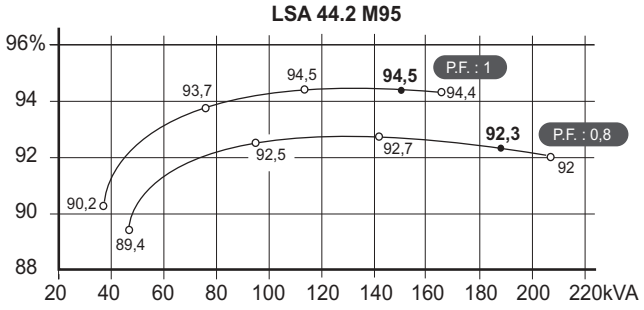
2) For voltages other than 400V(Y) , 230V() at 50 Hz, then kVA must be multiplied by $(400/U)^2$ or $(230/U)^2$.

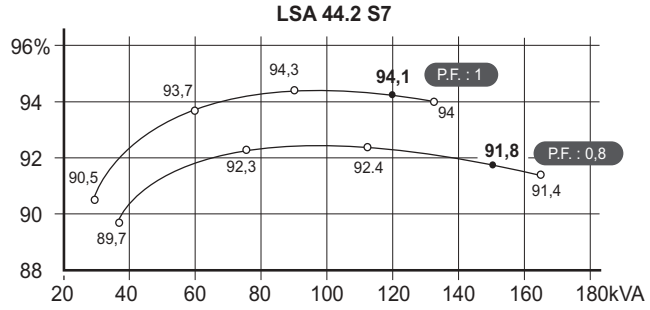
Efficiencies 60 Hz - P.F. :1 / P.F. : 0,8

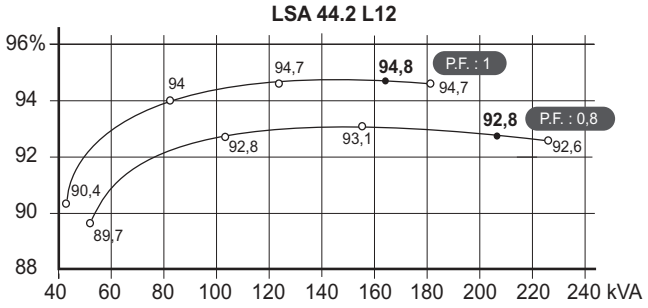












Reactances Class H / 480 V - Time constants (ms)

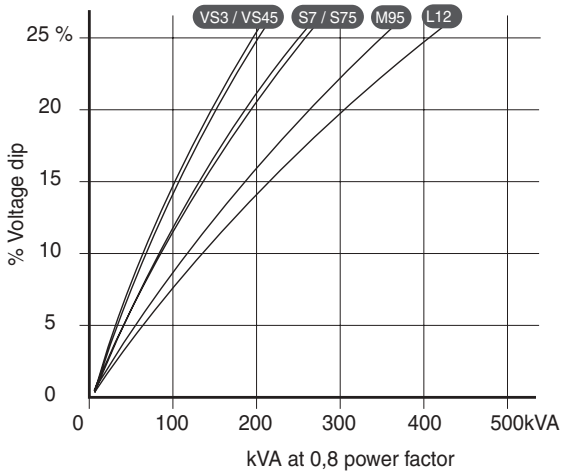
		VS3	VS45	S7	S75	M95	L12
Kcc	Short-circuit ratio	0,38	0,33	0,33	0,29	0,41	0,41
Xd	Direct axis synchro.reactance unsaturated	331	377	363	409	331	319
Xq	Quadra. axis synchr.reactance unsaturated	198	226	218	245	198	191
T'do	Open circuit time constant	2555	2555	2734	2734	2865	2966
X'd	Direct axis transient reactance saturated	12,9	14,7	13,2	14,9	11,5	10,7
T'd	Short circuit transient time constant	100	100	100	100	100	100
X"d	Direct axis subtransient reactance saturated	7,7	8,8	7,9	8,9	6,9	6,4
T"d	Subtransient time constant	10	10	10	10	10	10
X"q	Quadra. axis subtransient reactance saturated	9,5	10,8	9,6	10,8	8,2	7,5
Xo	Zero sequence reactance unsaturated	0,6	0,9	0,7	0,5	0,2	0,5
X2	Negative sequence reactance saturated	8,7	9,9	8,8	9,9	7,6	7
Ta	Armature time constant	15	15	15	15	15	15

Other data - Class H / 480 V

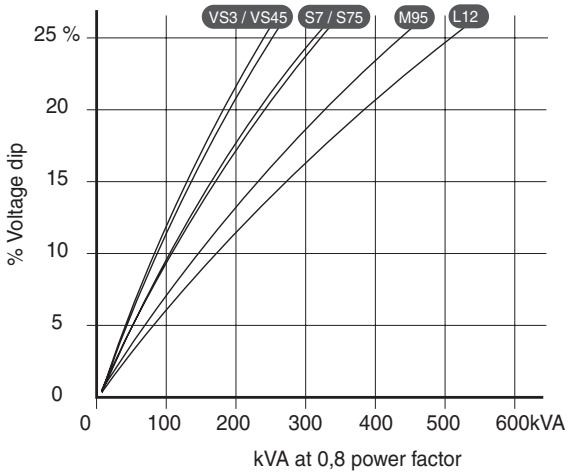
io (A)	No load excitation current (SHUNT / AREP or PMG)	0,5/1	0,5/1	0,5/1	0,5/1	0,6/1,2	0,5/1
ic (A)	Full load excitation current (SHUNT / AREP or PMG)	1,8/3,6	2,1/4,2	1,9/3,8	2,1/4,2	2/4	1,9/3,8
uc (V)	Full load excitation voltage (SHUNT / AREP or PMG)	34/17	38/19	36/18	40/20	38/19	36/18
ms	Recovery time (ΔU = 20 % trans.)	500	500	500	500	500	500
kVA	Motor start. (ΔU = 20% sust.) or (ΔU = 50% trans.) SHUNT	238,2	238,2	300,7	301,6	349,9	408,8
kVA	Motor start. (ΔU = 20% sust.) or (ΔU = 50% trans.) AREP	280,4	280,4	351,8	352,8	407,1	478,2
%	Transient dip (rated step load) SHUNT / PF : 0,8 LAG	16,3	17,8	16,6	18	15,1	14,4
%	Transient dip (rated step load) AREP / PF : 0,8 LAG	13,5	14,7	13,7	14,8	12,5	12
W	No load losses	2720	2720	2960	2960	3870	4170
W	Heat rejection	8550	10250	10680	12070	12440	12680

Transient voltage variation - 480 V - 60 Hz

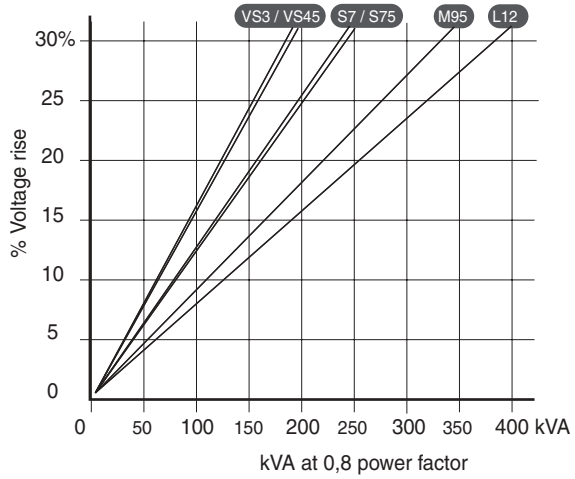
Load application (SHUNT excitation)



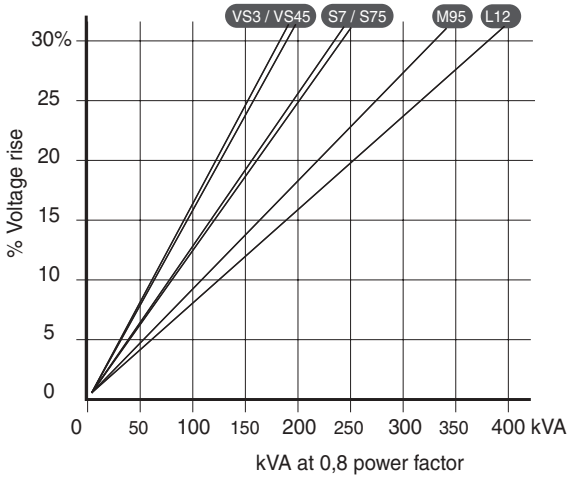
Load application (AREP or PMG excitation)



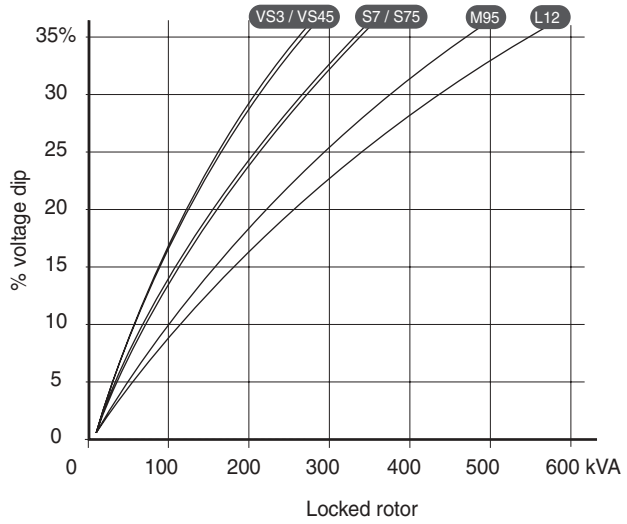
Load rejection (SHUNT excitation)



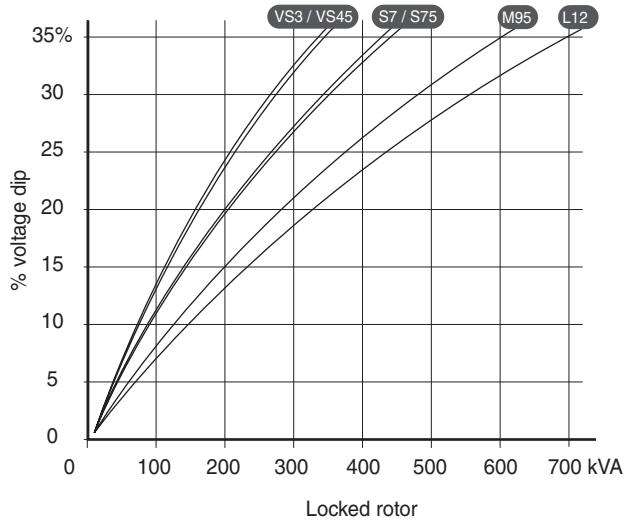
Load rejection (AREP or PMG excitation)



Motor starting (SHUNT excitation)



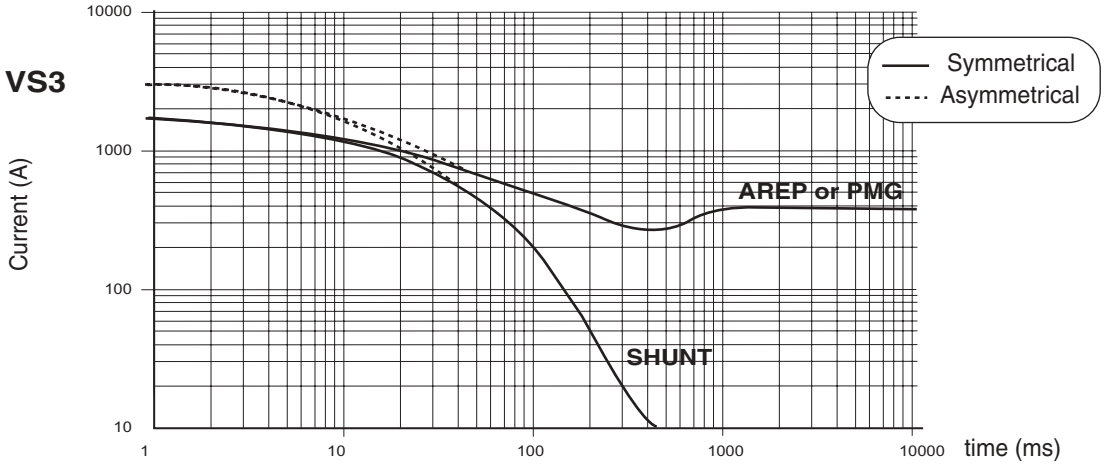
Motor starting (AREP or PMG excitation)



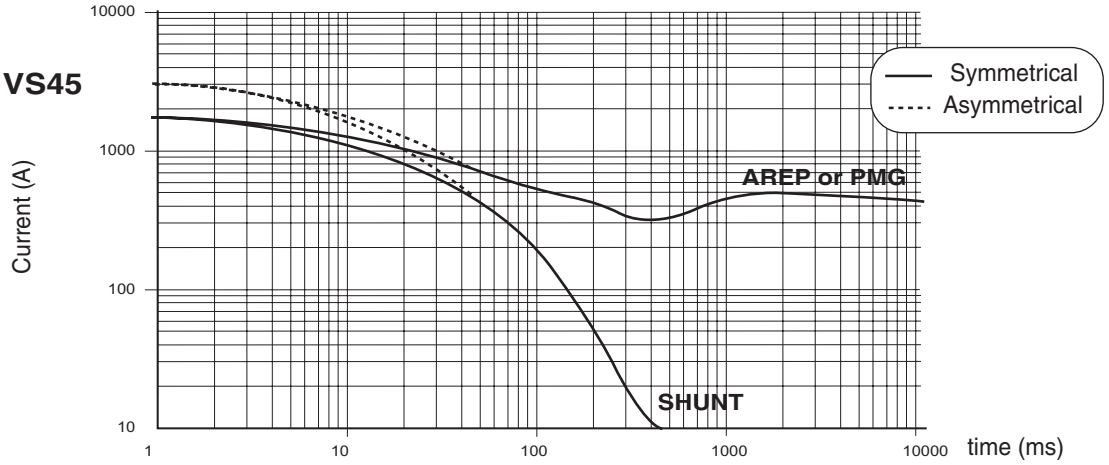
1) For a starting P.F. differing from 0,6 , the starting kVA must be multiplied by (Sine Ø /0,8)
2) For voltages other than 480V(Y), 277V(), 240V(YY) at 60 Hz, then kVA must be multiplied by $(480/U)^2$ or $(277/U)^2$ or $(240/U)^2$.

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

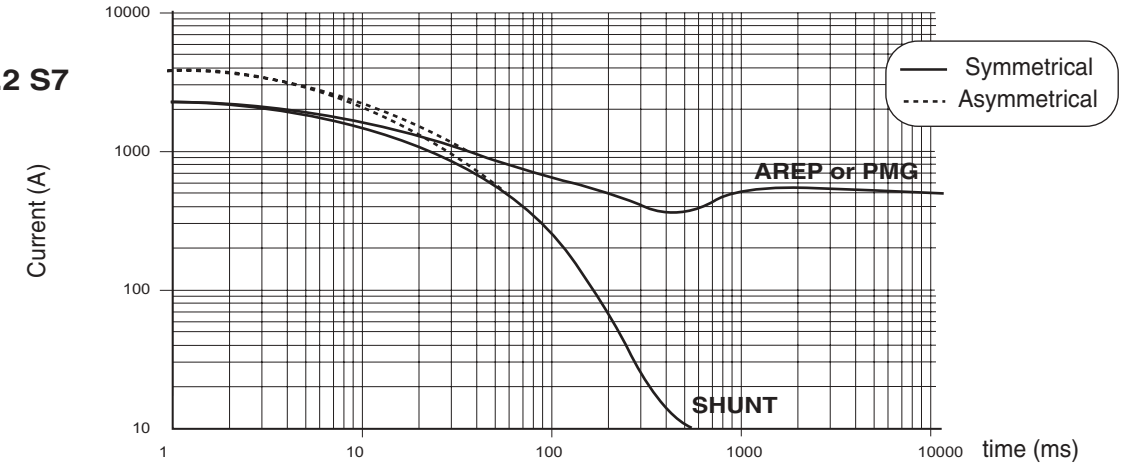
LSA 44.2 VS3



LSA 44.2 VS45



LSA 44.2 S7



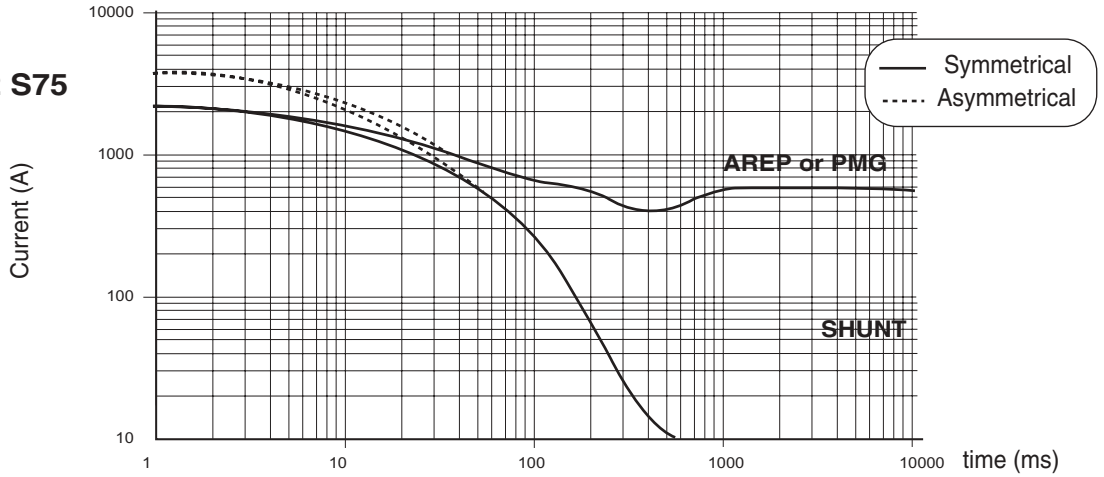
Influence due to connexion.

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

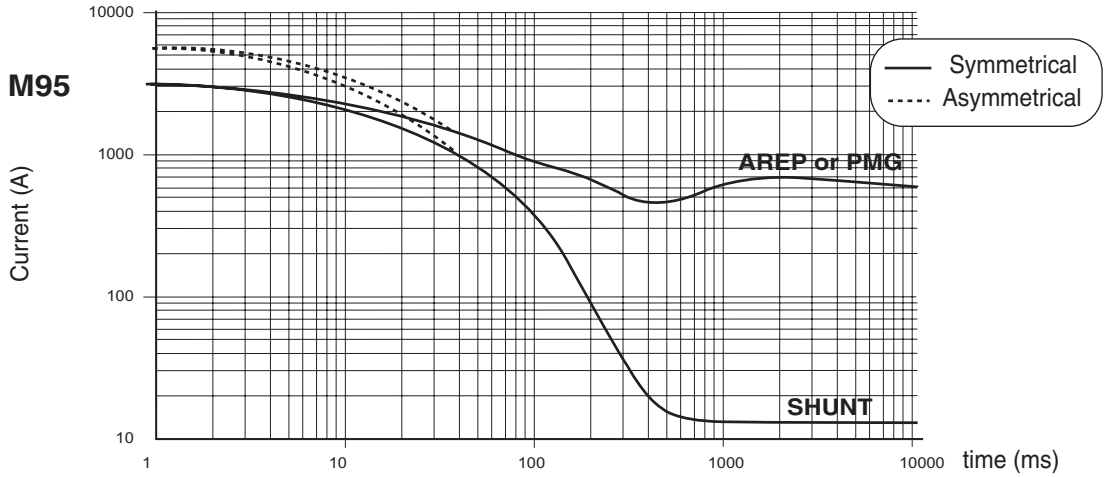
- Series delta : Current value x 1,732
- Parallel star : Current value x 2

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

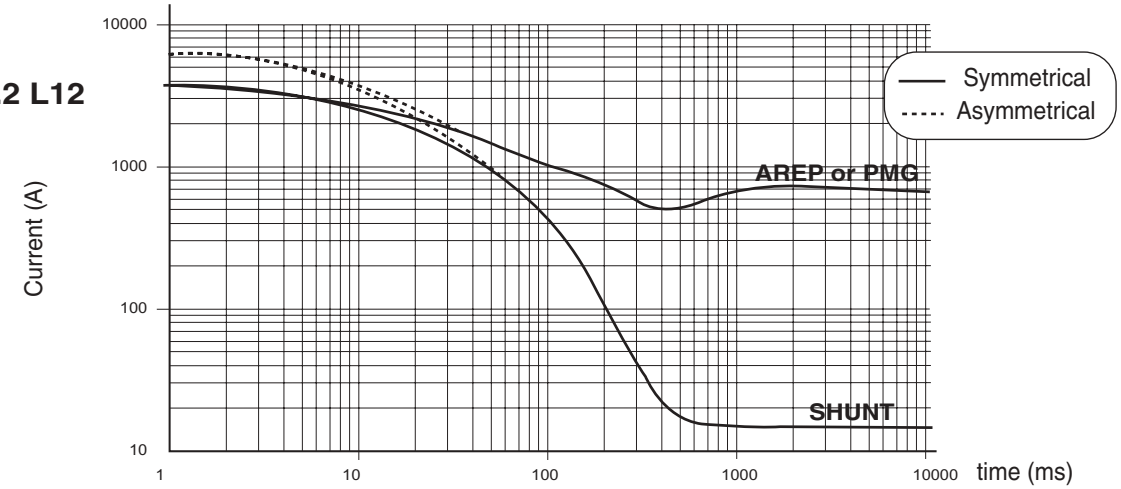
LSA 44.2 S75



LSA 44.2 M95



LSA 44.2 L12



Influence due to short-circuit.

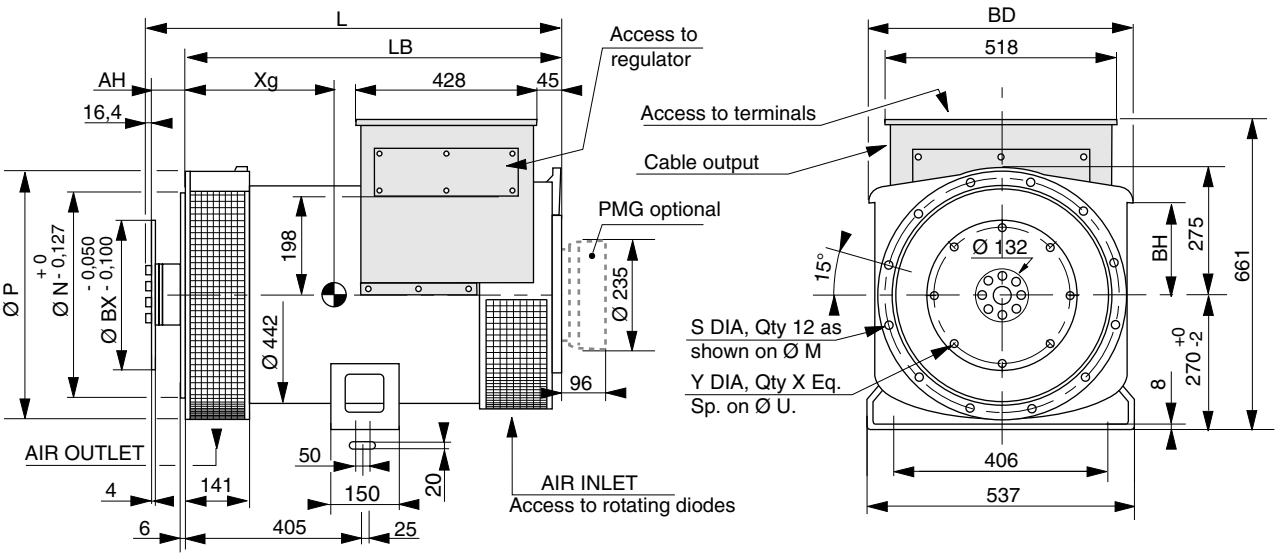
Curves are based on a three-phase short-circuit.

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 44.2 - 4 Pole

Single bearing dimensions



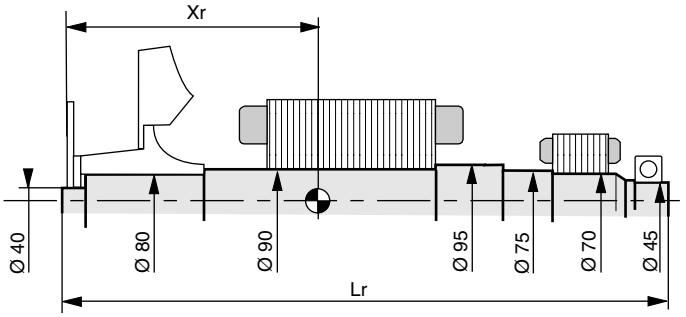
Frame dimensions				
TYPE	L max without	LB	Xg	Weight (kg)
LSA 44.2 VS3	755	685	335	385
LSA 44.2 VS45	755	685	335	385
LSA 44.2 S7	815	745	365	440
LSA 44.2 S75	815	745	365	440
LSA 44.2 M95	875	805	395	495
LSA 44.2 L12	935	865	420	550

Coupling			
Flex plate	10	11 1/2	14
Flange S.A.E 3	**X**	**X**	
Flange S.A.E 2	**X**	**X**	
Flange S.A.E 1		**X**	**X**

Flange (mm)						
S.A.E.	BD	S	BH	P	N	M
3	530	11	210	450	409,575	428,625
2	530	11	210	488	447,675	466,725
1	590	12,5	240	554	511,175	530,225

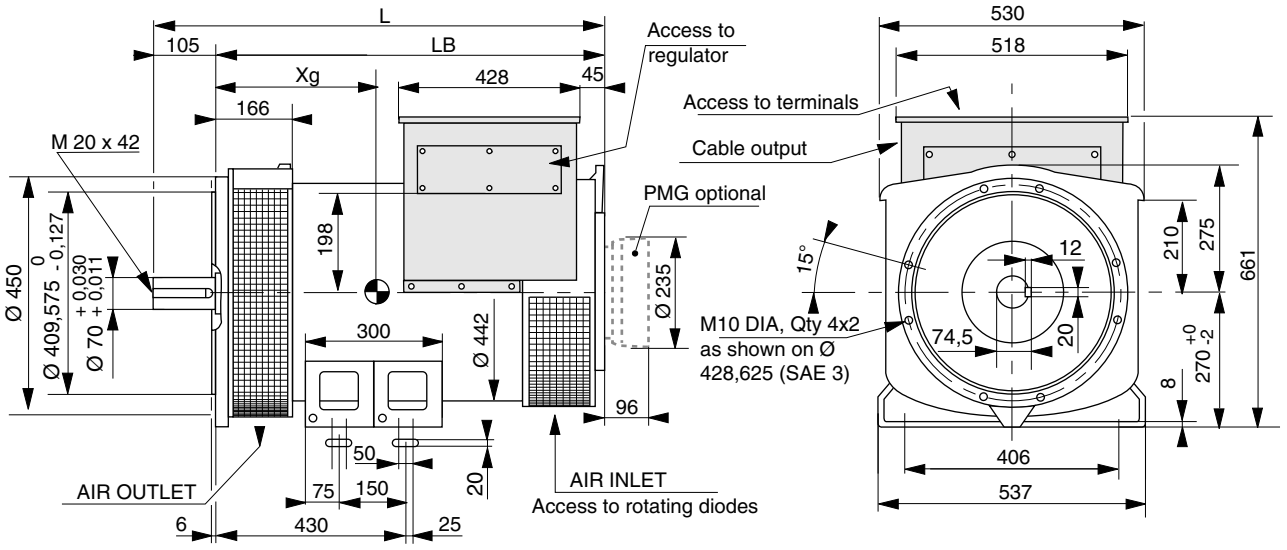
Flex plate (mm)					
S.A.E.	BX	U	X	Y	AH
14	466,72	438,15	8	14	25,4
11 1/2	352,42	333,38	8	11	39,6
10	314,32	295,28	8	11	53,8

Torsional analysis data



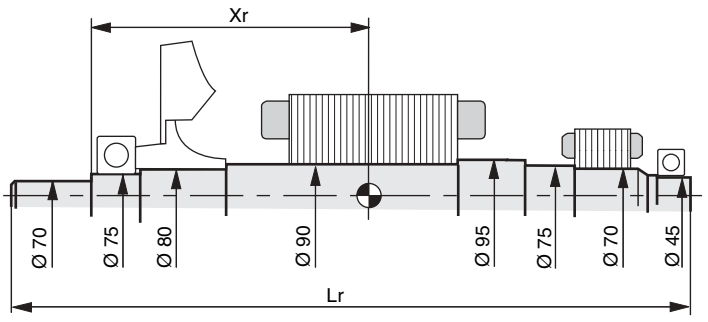
Gravity center : Xr (mm), Rotor length Lr (mm), Weight : M (kg), Moment of inertia : J (kgm²) : (4J = MD²)												
	Flex plate S.A.E. 10				Flex plate S.A.E. 11 1/2				Flex plate S.A.E. 14			
TYPE	Xr	Lr	M	J	Xr	Lr	M	J	Xr	Lr	M	J
LSA 44.2 VS3	366	731	140,4	0,8569	352	731	140	0,8689	337	731	140,7	0,9329
LSA 44.2 VS45	366	731	140,4	0,8569	352	731	140	0,8689	337	731	140,7	0,9329
LSA 44.2 S7	395	791	162,9	1,0078	382	791	163	1,0198	367	791	163,2	1,0838
LSA 44.2 S75	395	791	162,9	1,0078	382	791	163	1,0198	367	791	163,2	1,0838
LSA 44.2 M95	425	851	185,4	1,1587	412	851	185	1,1707	397	851	185,8	1,2347
LSA 44.2 L12	456	911	207,9	1,3095	443	911	208	1,3215	427	911	208,3	1,3855

Two bearing dimensions



Frame dimensions				
TYPE	L max without PMG	LB	Xg	Weight (kg)
LSA 44.2 VS3	815	710	360	405
LSA 44.2 VS45	815	710	360	405
LSA 44.2 S7	875	770	390	460
LSA 44.2 S75	875	770	390	460
LSA 44.2 M95	935	830	420	515
LSA 44.2 L12	995	890	450	570

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 44.2 VS3	341	803	137	0,8276
LSA 44.2 VS45	341	803	137	0,8276
LSA 44.2 S7	371	863	160	0,9785
LSA 44.2 S75	371	863	160	0,9765
LSA 44.2 M95	422	923	182	1,1294
LSA 44.2 L12	473	983	205	1,2803

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