



EMERSON[™]
Industrial Automation



1860...2500 kVA - 50 Hz
2235...3000 kVA - 60 Hz

4164 en - 2012.01 / e



PARTNER ALTERNATORS

LSA 51.2 - 4 pole

Electrical and mechanical data

SPECIALY ADAPTED FOR GENSET APPLICATIONS

The LSA 51.2 alternator is designed to be suitable for typical generator set applications, such as: backup, base production, cogeneration, marine applications, rental, telecommunications, etc.

COMPLIANT WITH INTERNATIONAL STANDARDS

The LSA 51.2 alternator conforms to the main international standards and regulations:

IEC 60034, NEMA MG 1.22, ISO 8528/3, CSA, UL 1446, UL 1004B on request, marine regulations, etc.

It can be integrated into a CE marked generator.

The LSA 51.2 is designed, manufactured and marketed in an ISO 9001 and ISO 14001 environment. ≤

TOP OF THE RANGE ELECTRICAL PERFORMANCE

- Class H insulation.
- Standard 6-wire winding, 2/3 pitch, type no. 6S.
- Voltage range 50 Hz : 380V - 400V - 415V - 440 V.
- Voltage range 60 Hz : 380V - 416V - 440V - 480V.
- Ability to reconnect : 50 Hz : 220V - 230V - 240V / 60 Hz : 220 V - 240 V : consult factory.
- Other voltages are possible with optional adapted windings :
 - 50 Hz : 440 V (no. 7S), 500 V (no. 9S), 600 V (no. 22S or 23S), 690 V (no. 10S or 52S)
 - 60 Hz : 380 V and 416 V (no. 8S), 600 V (no. 9S).
- High efficiency and motor starting capacity.
- Total harmonic content < 3,5 %.
- R 791 interference suppression conforming to standard EN 55011 group 1 class B standard for the European zone (CE marking).

EXCITATION AND REGULATION SYSTEM SUITED TO THE APPLICATION

The LSA 51.2 can be supplied with AREP or PMG excitation system, according to the alternator specification.

Standard excitation system is AREP with R 449 A.V.R.

Excitation system			Regulation options				
Volage regulator	AREP	PMG	C.T. Current transformer for paralleling	R 726 Mains paralleling	R 731 3 Phase sensing	R 734 3 Phase sensing for unbalanced mains paralleling	P Remote voltage potentiometer
R 449	Std	Option	√	√	√	√	√
D 510	Option	Option	√	included	included	consult factory	√

Voltage regulator accuracy ± 0.5%. - √ : adaptation possible

PROTECTION SYSTEM SUITED TO THE ENVIRONMENT

- The LSA 51.2 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 8%.
 - Winding protections for harsh environments and relative humidity greater than 95%.
 - Space heaters.
 - Thermal RTD protection for winding.

REINFORCED MECHANICAL STRUCTURE USING FINITE ELEMENT MODELLING

- Compact and rigid assembly to better withstand genset or engine vibrations.
- Steel frame.
- Cast iron flanges and shields.
- Twin-bearing and single-bearing versions designed to be suitable for most engines on the market.
- Half-key balancing.
- Regreasable bearings.

ACCESSIBLE TERMINAL BOX PROPORTIONED FOR OPTIONAL EQUIPMENT

- Easy access to the voltage regulator and to the connections.
- Possible incorporation of accessories for paralleling, protection and measurement.

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Common data

Insulation class	H	Excitation system	A R E P + PMI or PMG
Winding pitch	2/3 (n° 6S)	A.V.R. model	R 449
Terminals	6	Voltage regulation (*)	± 0,5 %
Drip proof	IP 23	Sustained short-circuit current	300% (3 IN) : 10s
Altitude	≤1000 m	Total Harmonic Distortion (THD) (**)	< 3.5 %
Overspeed	2250 min-1	Waveform : NEMA = TIF - (* *)	< 50
Air flow	1,8 m³/s (50 Hz) - 2,2 m³/s (60 Hz)		

(*) Steady state duty. (**) 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								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	440V	380V	400V	415V	440V	380V	400V	415V	440V	380V	400V	415V	440V
Δ*		220V	230V	240V		220V	230V	240V		220V	230V	240V		220V	230V	240V	
LSA 51.2 S55	kVA	1860	1690			1700	1540			1955	1792			2045	1860		
	kW	1488	1352			1360	1232			1564	1433			1636	1488		
LSA 51.2 M60	kVA	2050	1864			1870	1700			2155	1975			2255	2050		
	kW	1640	1491			1496	1360			1724	1580			1804	1640		
LSA 51.2 L70	kVA	2200	2000			2005	1825			2330	2120			2420	2200		
	kW	1760	1600			1604	1460			1864	1696			1936	1760		
LSA 51.2 VL90	kVA	2360	2145			2150	1955			2500	2275			2595	2360		
	kW	1888	1716			1720	1564			2000	1820			2076	1888		
LSA 51.2 VL 95	kVA	2500	2250			2280	2052			2650	2385			2750	2475		
	kW	2000	1800			1824	1642			2120	1908			2200	1980		

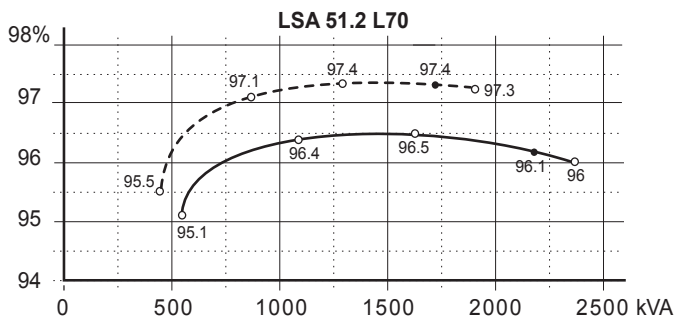
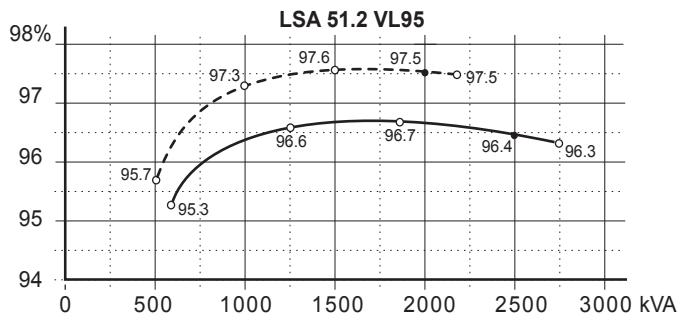
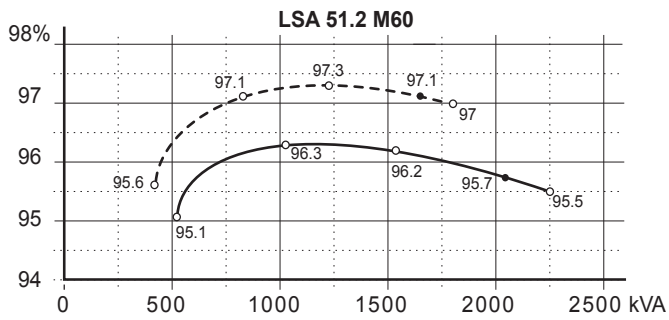
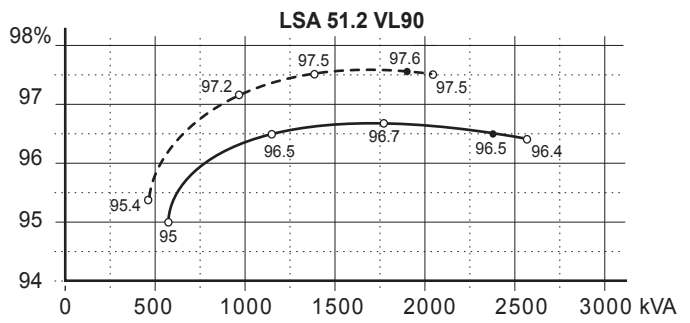
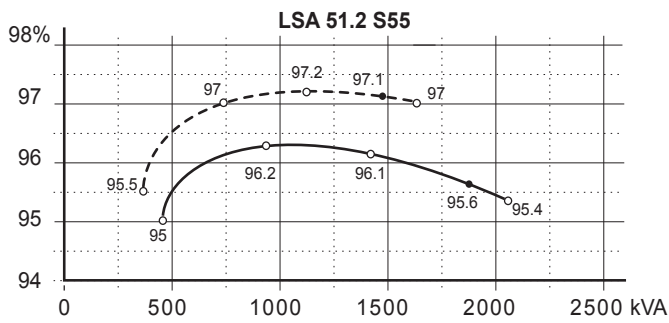
Δ* : Consult factory

Ratings 60 Hz - 1800 R.P.M.

kVA / kW - P.F. = 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		
LSA 51.2 S55	kVA	1860	2030	2150	2235	1695	1850	1960	2035	1955	2150	2280	2365	2045	2235	2365	2455
	kW	1488	1624	1720	1788	1356	1480	1568	1628	1564	1720	1824	1892	1636	1788	1892	1964
LSA 51.2 M60	kVA	2050	2240	2375	2460	1870	2045	2165	2250	2155	2375	2520	2608	2255	2465	2615	2705
	kW	1640	1792	1900	1968	1496	1636	1732	1800	1724	1900	2016	2086	1804	1972	2092	2164
LSA 51.2 L70	kVA	2200	2400	2545	2640	2005	2190	2320	2410	2330	2545	2700	2800	2420	2640	2800	2905
	kW	1760	1920	2036	2112	1604	1752	1856	1928	1864	2036	2160	2240	1936	2112	2240	2324
LSA 51.2 VL90	kVA	2360	2575	2730	2835	2150	2350	2490	2583	2500	2730	2895	3000	2595	2835	3005	3115
	kW	1888	2060	2184	2268	1720	1880	1992	2066	2000	2184	2316	2400	2076	2268	2404	2492
LSA 51.2 VL95	kVA	2500	2713	2870	3000	2280	2474	2617	2736	2650	2876	3042	3180	2750	2984	3157	3300
	kW	2000	2170	2296	2400	1824	1979	2093	2189	2120	2300	2433	2544	2200	2387	2525	2640

Δ* : Consult factory

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



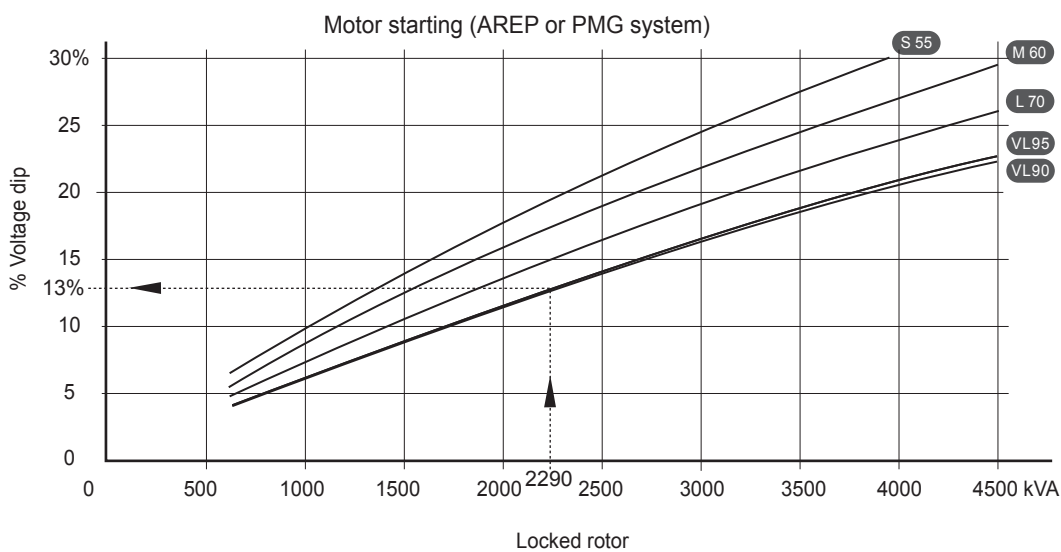
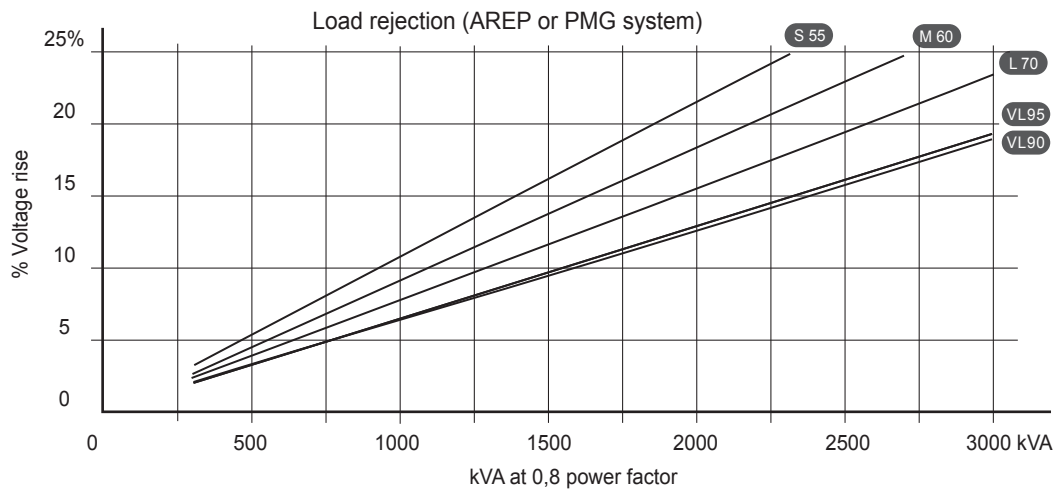
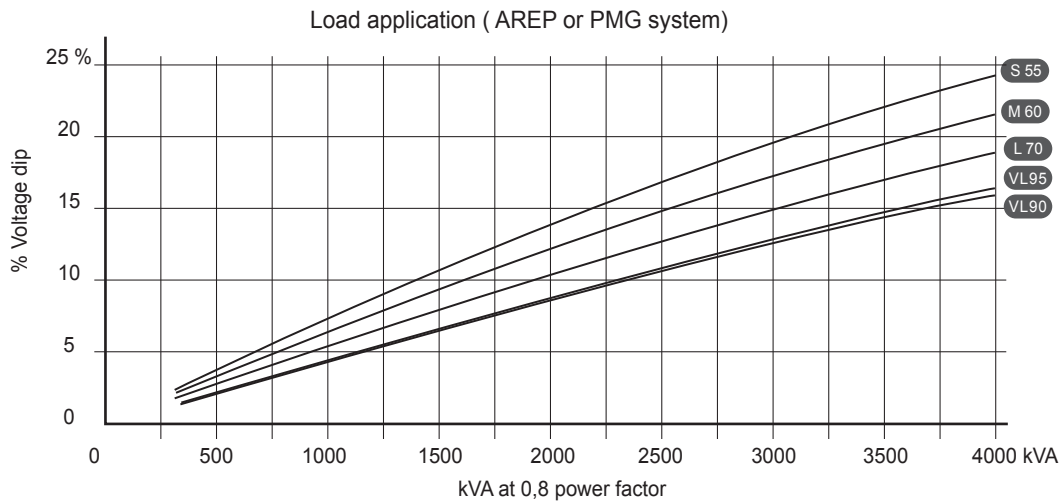
Reactances (%) . Time constants (ms) - Class H / 400 V

	S55	M60	L70	VL90	VL95
Kcc Short-circuit ratio	0,33	0,36	0,39	0,44	0,39
Xd Direct axis synchro.reactance unsaturated	367	350	321	287	311
Xq Quadra. axis synchr.reactance unsaturated	220	210	193	172	187
T'do Open circuit time constant	2950	3080	3230	3390	3410
X'd Direct axis transient reactance saturated	28,4	26,9	24,4	21,4	23,1
T'd Short-Circuit transient time constant	268	278	288	298	299
X»d Direct axis subtransient reactance saturated	14,8	13,9	12,7	11,1	12,1
T»d Subtransient time constant	22	23	24	26	26
X»q Quadra. axis subtransient reactance saturated	18,4	17,5	15,9	13,9	15,0
Xo Zero sequence reactance unsaturated	2,6	2,5	2,2	2,0	2,1
X2 Negative sequence reactance saturated	16,7	15,7	14,3	12,5	13,6
Ta Armature time constant	39	41	45	49	49

Other data - Class H / 400 V

	S55	M60	L70	VL90	VL95
io (A) No load excitation current	1,3	1,4	1,4	1,4	1,3
ic (A) Full load excitation current	5,5	5,4	5,0	4,6	4,7
uc (V) Full load excitation voltage	58	57	53	49	50
ms Recovery time ($\Delta U = 20\%$ trans.)	700	700	700	700	700
kVA Motor start. ($\Delta U = 20\%$ sust.) or ($\Delta U = 50\%$ trans.)	3720	4100	4320	4500	5000
% Transient dip (rated step load) - PF : 0,8 LAG	13,1	12,5	11,4	10,2	10,9
W No load losses	15300	16600	18200	20400	19300
W Heat rejection	68000	73000	71000	68000	75000

Transient voltage variation 400V - 50 Hz



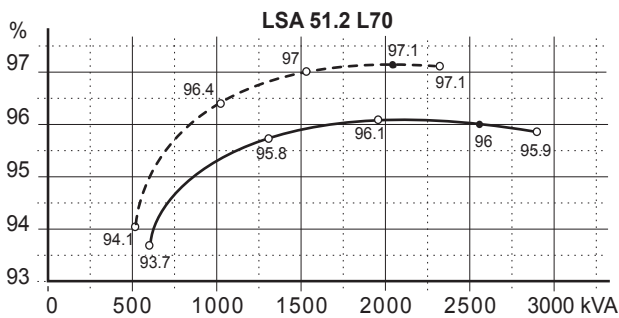
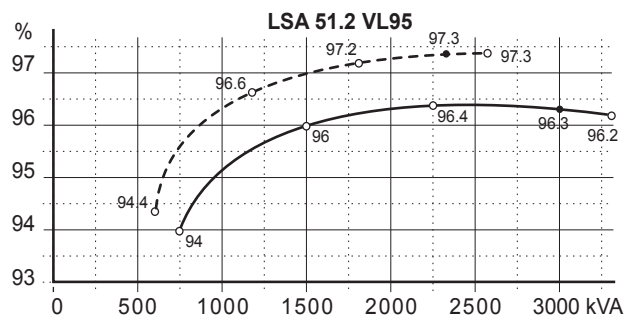
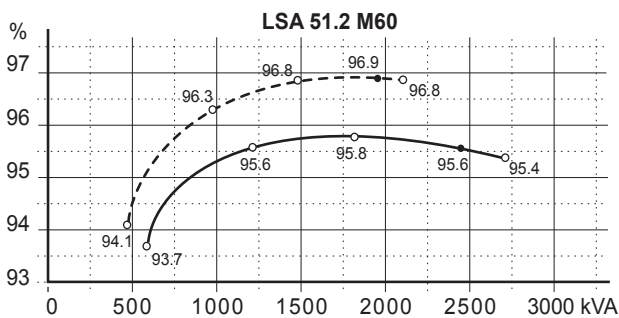
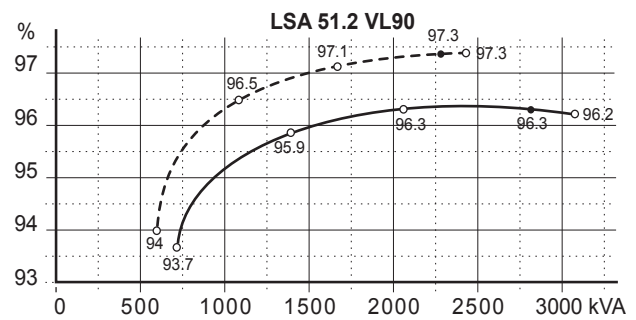
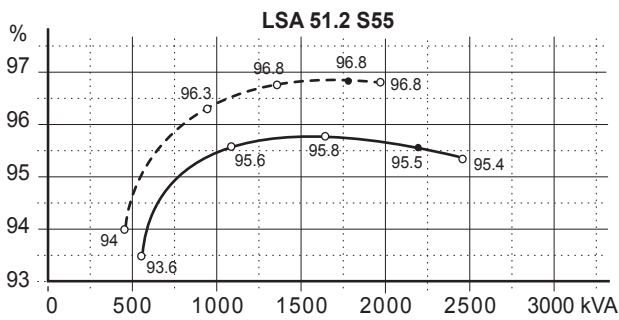
1) For a starting P.F. other than 0,6 , the starting kVA must be multiplied by $K = \text{Sine } \varnothing / 0,8$

Calculation example for a different P.F. : Starter motor kVA calculated at 0.4 P.F. = 2000 kVA

► $\text{Sin } \varnothing 0,4 = 0,9165$ ► $K = 1,145$ ► kVA corrected = 2290 kVA ► Voltage dip corresponding to VL90 = 13 %.

2) For voltages other than 400V (Y) , 230V (Δ) 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 ———



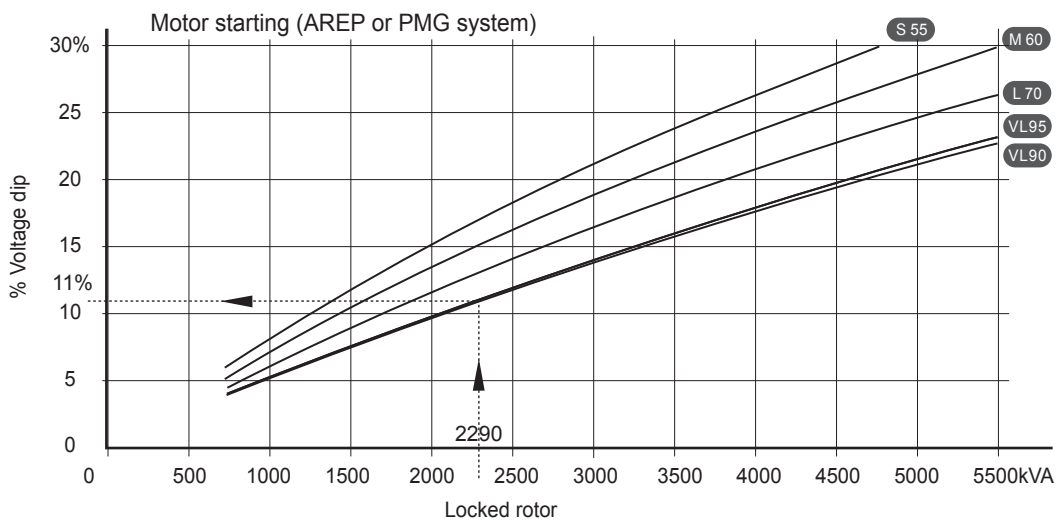
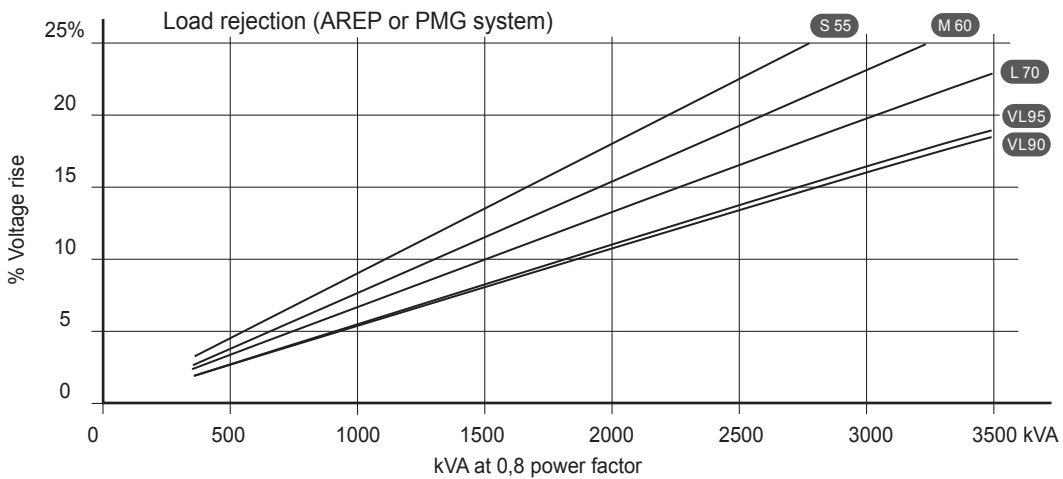
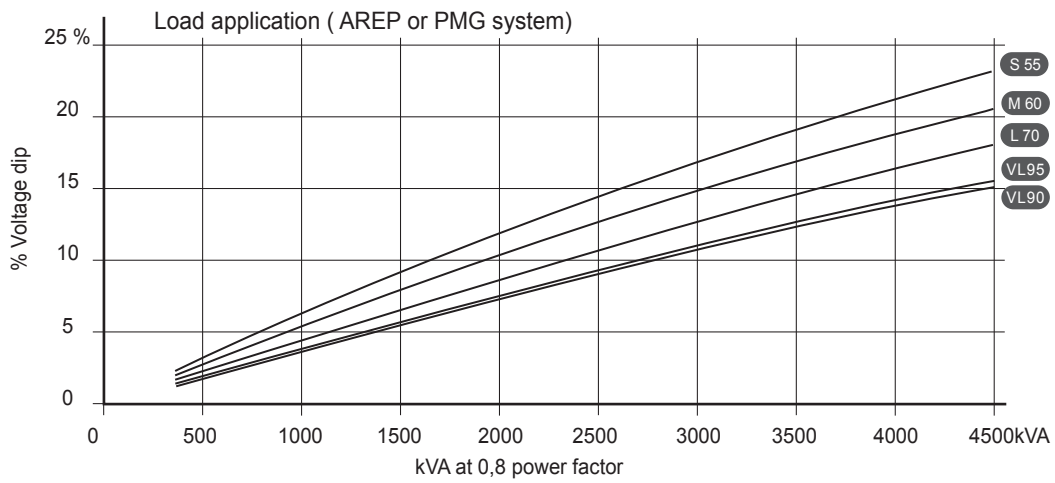
Reactances (%) . Time constants (ms) - Class H / 480 V

	S55	M60	L70	VL90	VL95
Kcc Short-circuit ratio	0,33	0,36	0,39	0,44	0,39
Xd Direct axis synchro.reactance unsaturated	368	350	321	287	311
Xq Quadra. axis synchr.reactance unsaturated	221	210	193	172	187
T'do Open circuit time constant	2950	3080	3230	3390	3410
X'd Direct axis transient reactance saturated	28,4	26,9	24,4	21,4	23,1
T'd Short-Circuit transient time constant	268	278	288	298	299
X»d Direct axis subtransient reactance saturated	14,8	13,9	12,7	11,1	12,1
T»d Subtransient time constant	22	23	24	26	26
X»q Quadra. axis subtransient reactance saturated	18,5	17,5	15,9	13,9	15,0
Xo Zero sequence reactance unsaturated	2,6	2,5	2,2	2,0	2,1
X2 Negative sequence reactance saturated	16,7	15,7	14,3	12,6	13,6
Ta Armature time constant	39	41	45	49	49

Other characteristics - Class H / 480 V

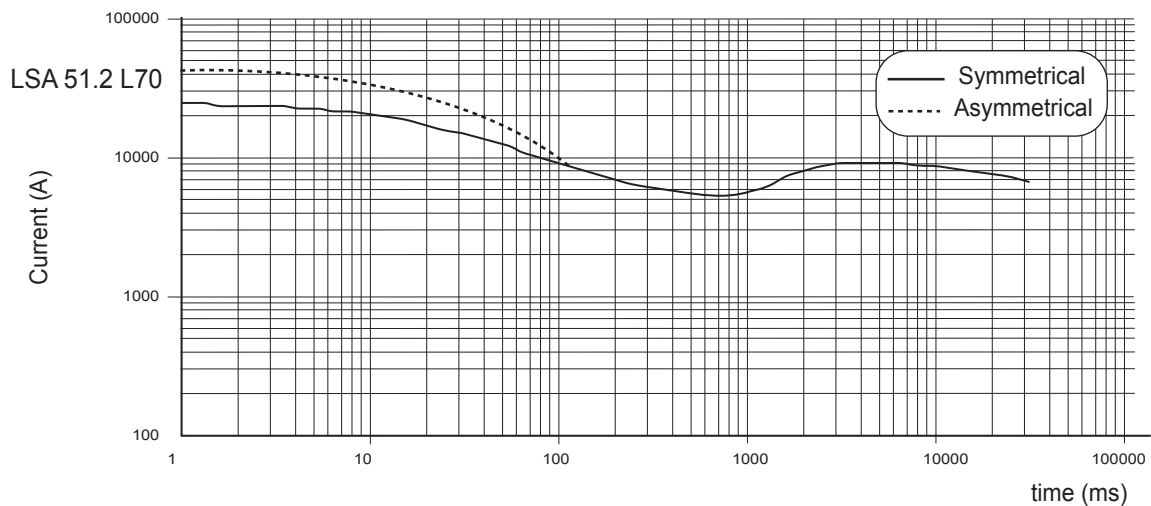
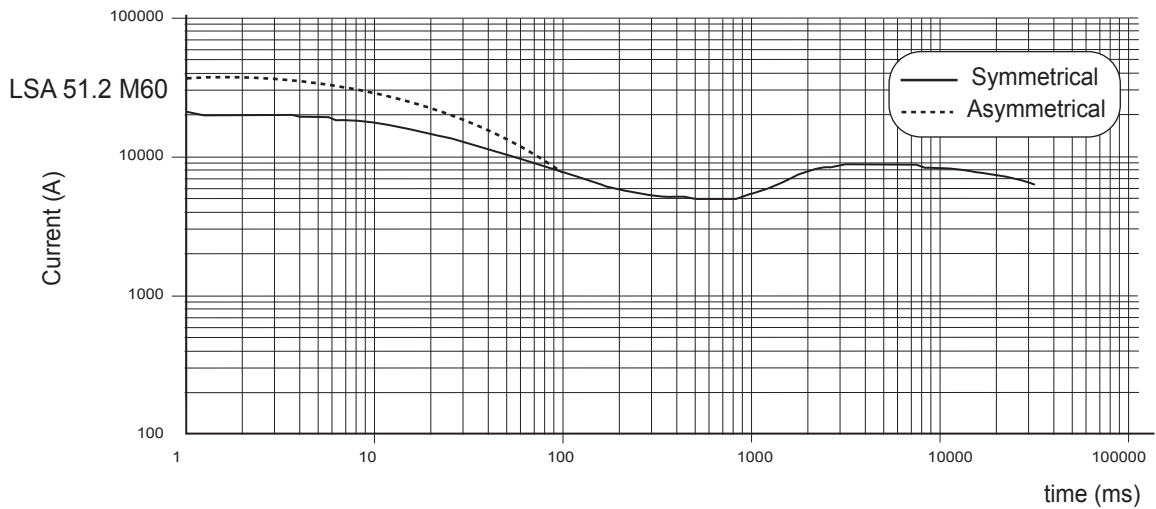
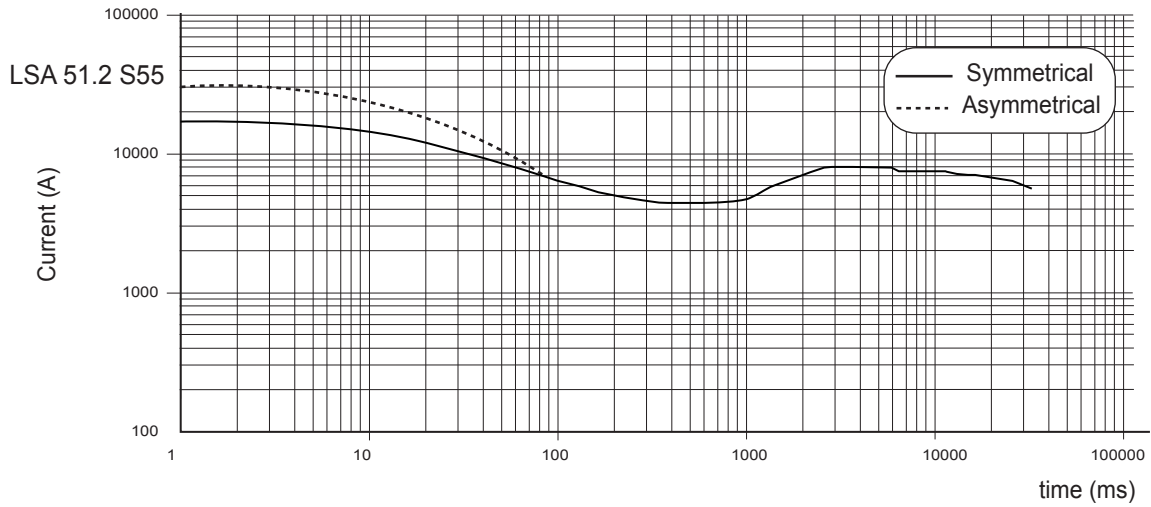
	S55	M60	L70	VL90	VL95
io (A) No load excitation current	1,3	1,4	1,4	1,4	1,3
ic (A) Full load excitation current	5,5	5,4	5,0	4,6	4,7
uc (V) Full load excitation voltage	59	57	53	49	50
ms Recovery time ($\Delta U = 20\%$ trans.)	700	700	700	700	700
kVA Motor start. ($\Delta U = 20\%$ sust.) or ($\Delta U = 50\%$ trans.)	4460	4920	5180	5400	6000
% Transient dip (rated step load) - PF : 0,8 LAG	13,1	12,5	11,4	10,2	10,9
W No load losses	27100	28800	31100	34200	32000
W Heat rejection	83000	91000	89000	87000	92000

Transient voltage variation 480V - 60 Hz



- 1) For a starting P.F. other than 0,6 , the starting kVA must be multiplied by $K = \text{Sine } \varnothing / 0,8$
 Calculation example for a different P.F. : Starter motor kVA calculated at 0.4 P.F. = 2000 kVA
 $\blacktriangleright \text{Sin } \varnothing 0,4 = 0,9165 \blacktriangleright K = 1,145 \blacktriangleright \text{kVA corrected} = 2290 \text{ kVA} \blacktriangleright \text{Voltage dip corresponding to VL90} = 11 \%$
- 2) For voltages other than 480V (Y) , 277V (Δ) , 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 connexion

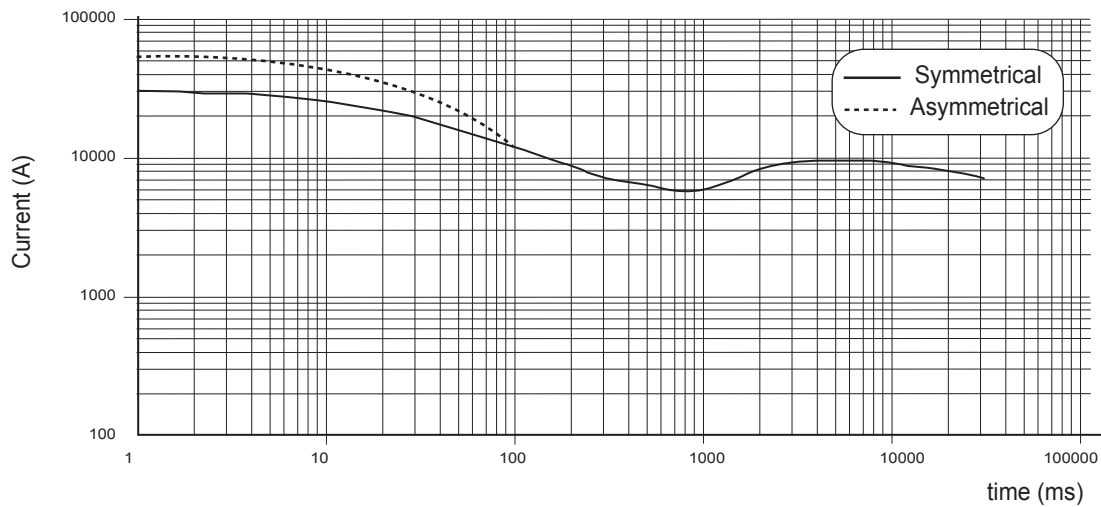
Curves shown are for star connection (Y).

For other connections, use the following multiplication factors :

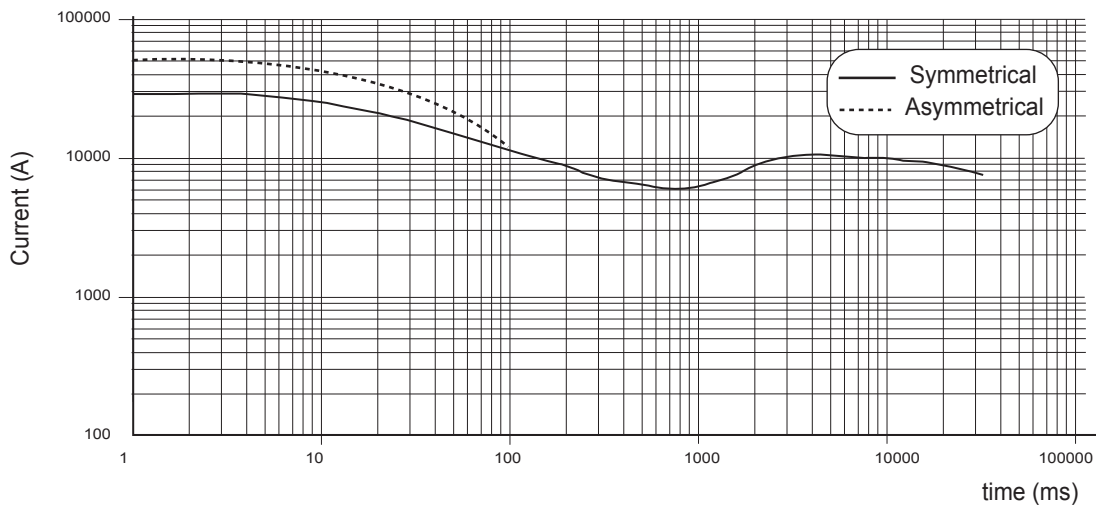
- Series delta : Current value x 1,732
- Parallel star : Current value x 2

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

LSA 51.2 VL90



LSA 51.2 VL95



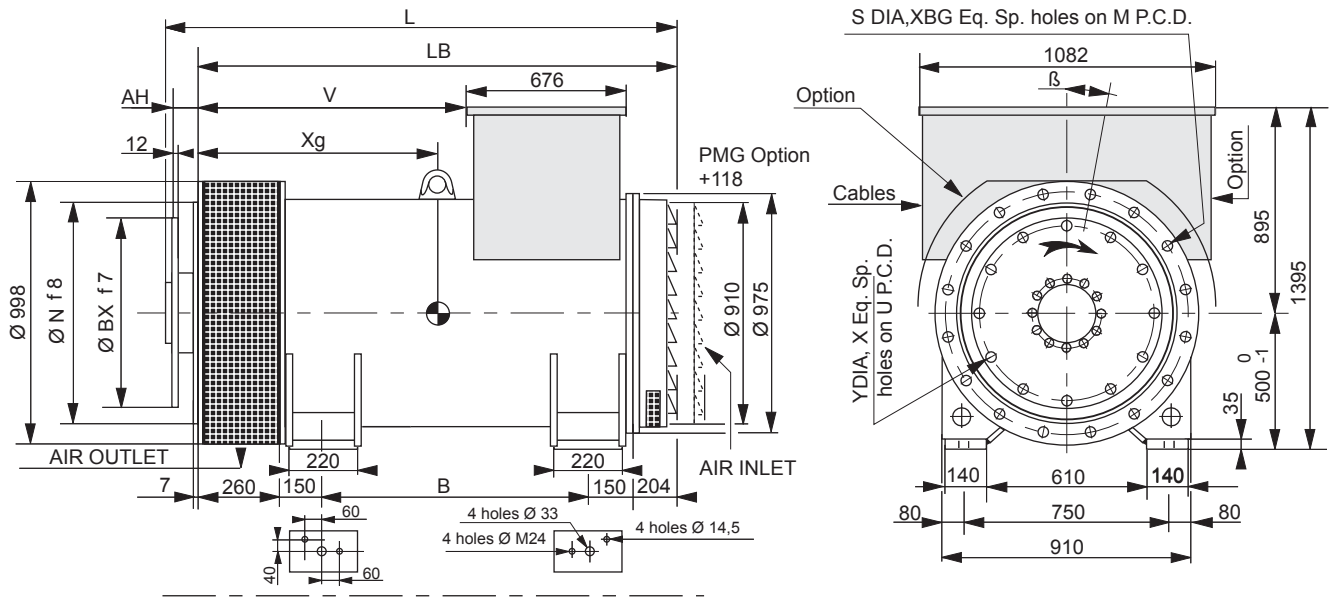
Influence due to short-circuit.

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.

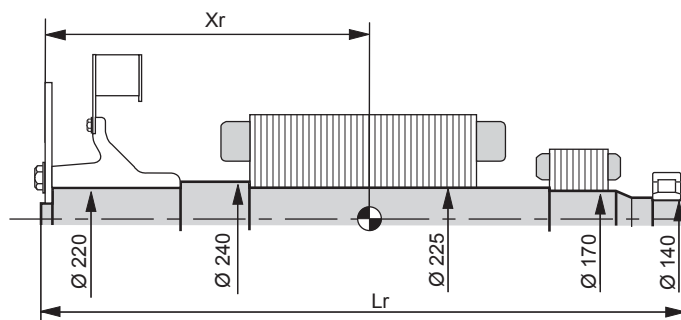
Single bearing dimensions



Frame dimensions (mm) and weight (kg)							Coupling		
TYPE	L without PMG	LB	B	V	Xg	Weight (kg)	Flange		
							0	00	
LSA 51.2 S55	1699	1677	900	744	735	3745	Flex plate S.A.E 24		X
LSA 51.2 M60	1799	1777	1000	844	770	4040	Flex plate S.A.E 21		X
LSA 51.2 L70	1899	1877	1100	944	825	4445	Flex plate S.A.E 18	X	X
LSA 51.2 VL90	1999	1977	1200	1044	885	4995			
LSA 51.2 VL95	1999	1977	1200	1044	890	5065			

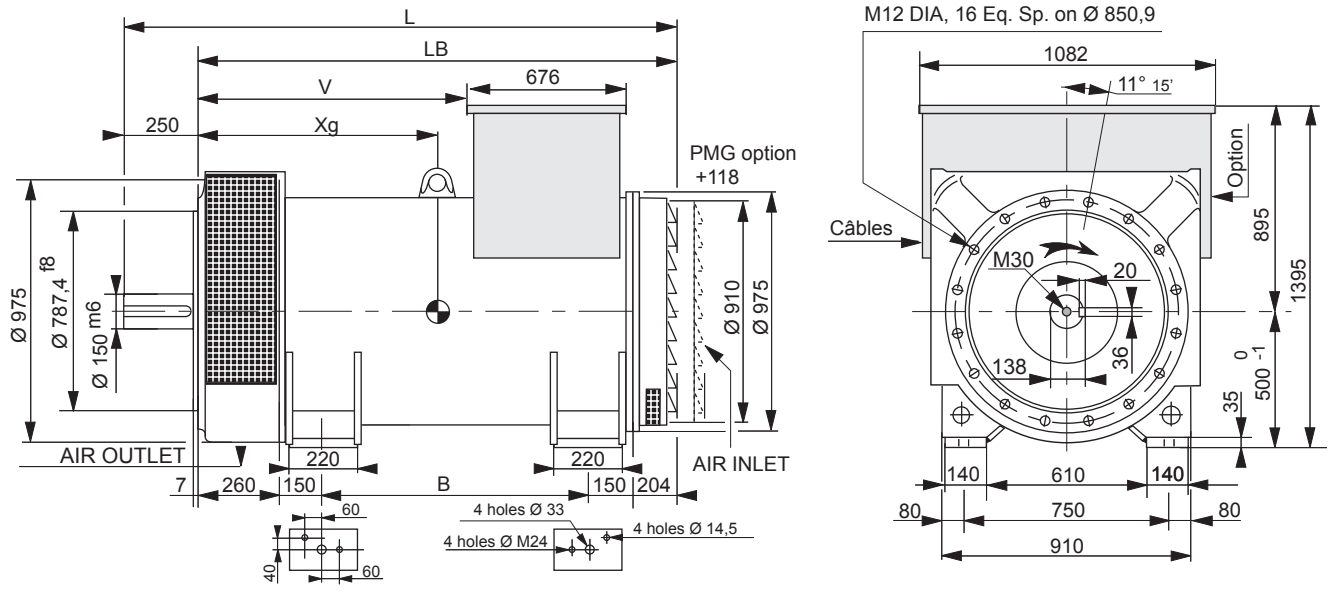
Flange dimensions (mm)						Flex plate dimensions (mm)					
S.A.E.	N	M	XBG	S	β	S.A.E.	BX	U	X	Y	AH
0	647.7	679.5	16	14	11° 15'	24	733.4	692.1	12	21	0
00	787.4	850.9	16	14	11° 15'	21	673.1	641.3	12	18	0
						18	571.5	542.9	6	18	15.8

Torsional analysis data



Centre of gravity : Xr (mm), rotor length Lr (mm), Weight : M (kg), Moment of inertia : J (kgm ²) : (4J = MD ²)												
TYPE	Flex plate S.A.E. 18				Flex plate S.A.E. 21				Flex plate S.A.E. 24			
	Xr	Lr	M	J	Xr	Lr	M	J	Xr	Lr	M	J
LSA 51.2 S55	661	1555.5	1357	41.1	643	1555.5	1359	41.9	640	1555.5	1365	42.6
LSA 51.2 M60	703	1655.5	1475	44.8	685	1655.5	1479	45.6	682	1655.5	1483	46.3
LSA 51.2 L70	754	1755.5	1630	50	736	1755.5	1632	50.8	734	1755.5	1638	51.6
LSA 51.2 VL90	819	1855.5	1833	57.2	801	1855.5	1835	58	799	1855.5	1841	58.8
LSA 51.2 VL95	821	1855.5	1854	63.7	805	1855.5	1854	64.4	802	1855.5	1860	65.2

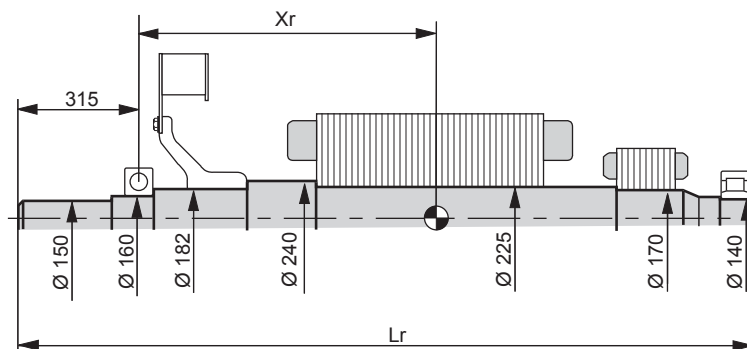
Two bearing dimensions



Frame dimensions (mm) and weight (kg)

TYPE	L without PMG	LB	B	V	Xg	Weight (kg)
LSA 51.2 S55	1905	1655	900	744	735	3725
LSA 51.2 M60	2005	1755	1000	844	770	4020
LSA 51.2 L70	2105	1855	1100	944	825	4425
LSA 51.2 VL90	2205	1955	1200	1044	885	4975
LSA 51.2 VL95	2205	1955	1200	1044	890	5045

Torsional analysis data



Centre of gravity : Xr (mm), rotor length Lr (mm), Weight : M (kg), Moment of inertia : J (kgm²) : (4J = MD²)

TYPE	Xr	Lr	M	J
LSA 51.2 S55	610.8	1783.5	1279	38.9
LSA 51.2 M60	652.6	1883.5	1396	42.6
LSA 51.2 L70	703.7	1983.5	1551	47.8
LSA 51.2 VL90	765.5	2083.5	1753	55.1
LSA 51.2 VL95	793.2	2083.5	1789	61.7

