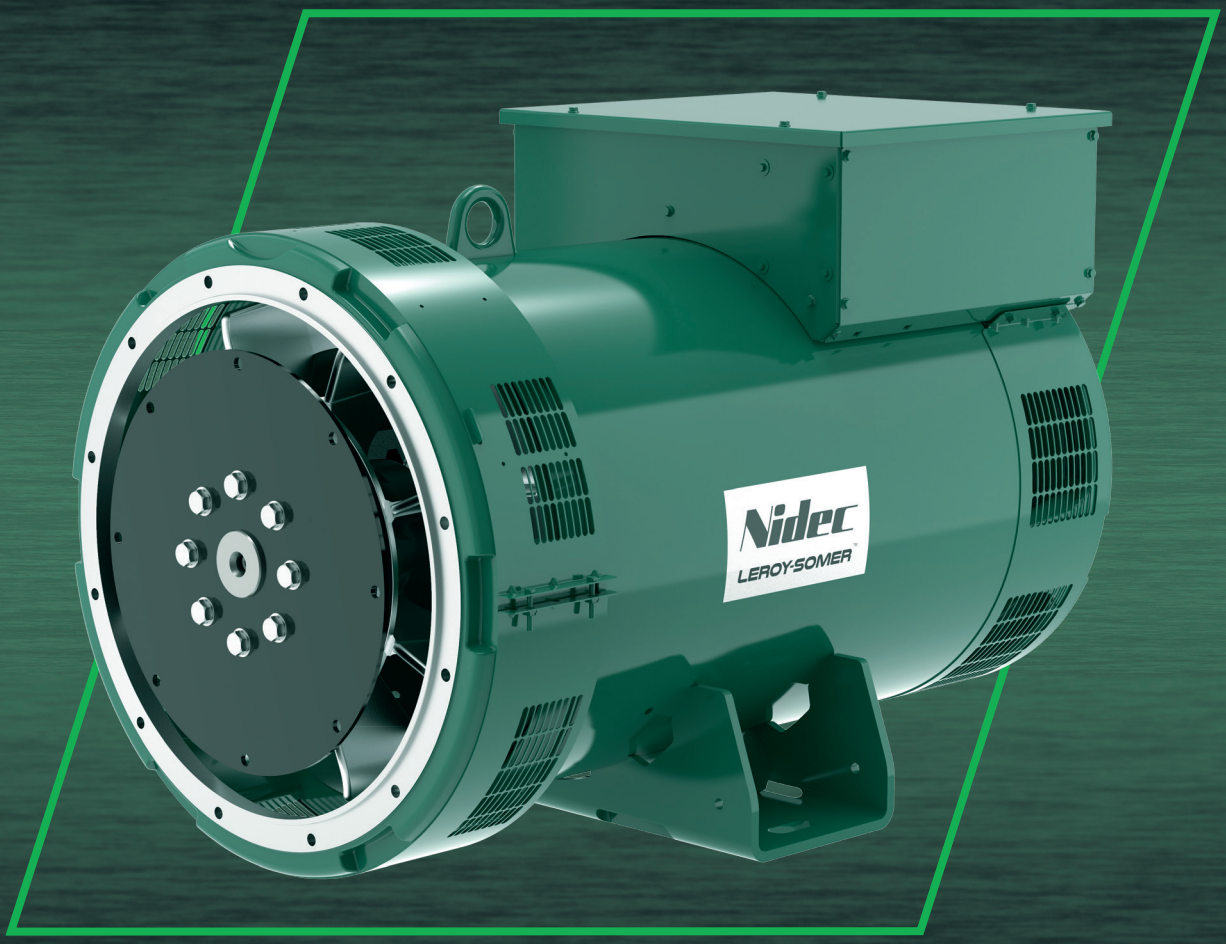
Nidec

Power



LSA 47.3

Low Voltage Alternator - 4 poles

410 to 660 kVA - 50 Hz / 510 to 825 kVA - 60 Hz

Electrical and mechanical data

LEROY-SOMER™

The best of performance

The Leroy-Somer™ LSA 47.3 alternator has been designed to offer you the best power generation performances. With its meticulous design and optimized architecture, the LSA 47.3 strikes the perfect balance between compactness, reliability, performance and longevity.
Whatever your application, the Leroy-Somer™ LSA 47.3 alternator will meet your needs and will adapt to all situations.

Standards

The Leroy-Somer™ LSA 47.3 alternator meets all key international standards and regulations such as IEC 60034, NEMA MG 1.32-33, ISO 8528-3, CSA C22.2 n°100-14, UL 1446, UL 1004-1 and UL 1004-4.
EC, UKCA, CMIM, CSA, UL 1446, UL recognized and UL listed declarations and certifications are available for the LSA 47.3.
The standards IEC 61000-6-2, IEC 61000-6-3, IEC 61000-6-4, VDE 0875G, VDE 0875N and EN 55011 allow compliance with group 1 class A for the European zone.
The Leroy-Somer™ LSA 47.3 alternator is designed, manufactured and marketed in an ISO 9001 and ISO 14001 quality assurance environment.

Electrical characteristics and performances

- Class H insulation
- 2/3 pitch winding, standard 12-wire (6) reconnectable
- Voltage range:
  - 50 Hz: 220V - 240V and 380V - 415V (440V)
  - 60 Hz: 208V - 240V and 380V - 480V
- High efficiency and motor starting capacity
- Other voltages are possible with optional adapted windings:
  - 50 Hz: 440V (no. 7), 500V (no. 9), 550V (no. 22 or 23), 600V (no. 22 or 23), 690V (no. 10 or 52)
  - 60 Hz: 380V and 416V (no. 8), 600V (no. 9), 690V (no. 22 or 23)

Excitation and regulation system

Excitation system				Regulation options		
AVR	**SHUNT**	**AREP** (option)	**PMG** (option)	**C.T. Current transformer for paralleling**	**Mains paralleling**	**Remote voltage potentiometer**
R250	Standard					√
D350	Option	Standard	Standard	√*		√
D550	Option	Option	Option	√*	√	√

*: only with AREP or PMG

3-phase sensing is included as a standard with digital regulators.

Protection system and options

- Degree of protection: IP 23
- Complete 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%
  - Reinforced winding protection for harsh environments and relative humidity greater than 95%
  - Space heater
  - Thermal protection for stator windings and shields

Mechanical construction

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

Terminal box design

- Easy access to the voltage regulator and to the connections
- Possible inclusion of accessories for paralleling, protection and measurement
- 9-way terminal block for voltage reconnection

General characteristics

Insulation class	H
Winding pitch	2/3 (wind. 6)
Number of wires	12
Protection	IP 23
Altitude	≤ 1 000 m
Overspeed	2 250 R.P.M.
Air flow	0.9 m³/s (50 Hz) / 1.1 m³/s (60 Hz)

Excitation system	SHUNT	AREP / PMG
AVR type	R250	D350
Voltage regulation (*)	± 0.5%	± 0.25%
Short-circuit current	-	300% (3 IN) : 10s
Total Harmonic Distortion THD (**)	no load < 2.5% - on load < 2%	
Waveform: NEMA = TIF (**)	< 50	
Waveform: I.E.C. = THF (**)	< 2%	

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

Ratings 50 Hz - 1 500 R.P.M.

kVA / kW - P.F. = 0.8

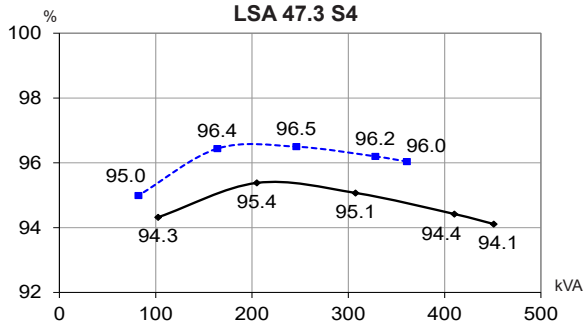
Duty / T° C		Continuous / 40 °C				Continuous / 40 °C				Stand-by / 40 °C				Stand-by / 27 °C			
Class / T° K		H / 125° K				F / 105° K				H / 150° K				H / 163° K			
Phase		3 ph.				3 ph.				3 ph.				3 ph.			
Y		380V	**400V**	415V	440V	380V	**400V**	415V	440V	380V	**400V**	415V	440V	380V	**400V**	415V	440V
Δ		220V	**230V**	240V		220V	**230V**	240V		220V	**230V**	240V		220V	**230V**	240V	
YY			**200V**		220V		**200V**		220V		**200V**		220V		**200V**		220V
LSA 47.3 S4	kVA	410	**410**	410	400	375	**375**	375	364	435	**435**	435	424	450	**450**	450	440
	kW	*328*	***328***	*328*	*320*	*300*	***300***	*300*	*291*	*348*	***348***	*348*	*339*	*360*	***360***	*360*	*352*
LSA 47.3 S5	kVA	455	**455**	455	445	415	**415**	415	405	480	**480**	480	472	500	**500**	500	490
	kW	*364*	***364***	*364*	*356*	*332*	***332***	*332*	*324*	*384*	***384***	*384*	*378*	*400*	***400***	*400*	*392*
LSA 47.3 M7	kVA	500	**500**	500	490	465	**465**	465	449	550	**550**	550	519	570	**570**	570	539
	kW	*400*	***400***	*400*	*392*	*372*	***372***	*372*	*359*	*440*	***440***	*440*	*415*	*456*	***456***	*456*	*431*
LSA 47.3 M8	kVA	550	**550**	550	540	500	**500**	500	491	585	**585**	585	572	600	**600**	600	594
	kW	*440*	***440***	*440*	*432*	*400*	***400***	*400*	*393*	*468*	***468***	*468*	*458*	*480*	***480***	*480*	*475*
LSA 47.3 L9	kVA	600	**600**	600	500	545	**545**	545	455	635	**635**	635	530	660	**660**	660	550
	kW	*480*	***480***	*480*	*400*	*436*	***436***	*436*	*364*	*508*	***508***	*508*	*424*	*528*	***528***	*528*	*440*
LSA 47.3 L10	kVA	645	**660**	660	630	587	**600**	600	573	684	**730**	730	668	710	**745**	745	693
	kW	*516*	***528***	*528*	*504*	*470*	***480***	*480*	*458*	*547*	***584***	*584*	*534*	*568*	***596***	*596*	*554*

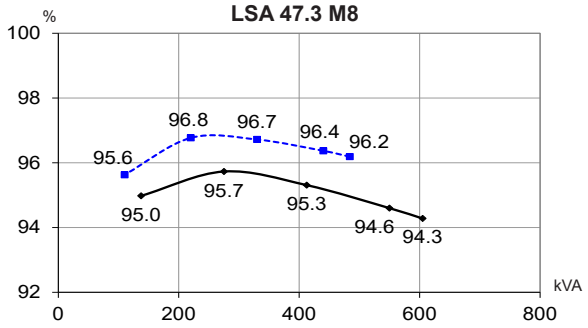
Ratings 60 Hz - 1 800 R.P.M.

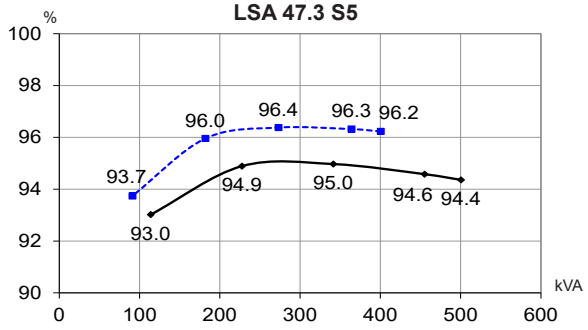
kVA / kW - P.F. = 0.8

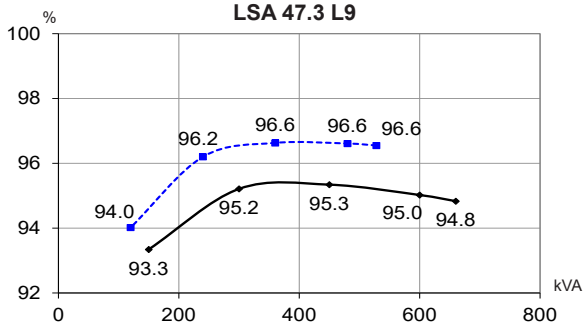
Duty / T° C		Continuous / 40 °C				Continuous / 40 °C				Stand-by / 40 °C				Stand-by / 27 °C			
Class / T° K		H / 125° K				F / 105° K				H / 150° K				H / 163° K			
Phase		3 ph.				3 ph.				3 ph.				3 ph.			
Y		380V	416V	440V	**480V**	380V	416V	440V	**480V**	380V	416V	440V	**480V**	380V	416V	440V	**480V**
Δ		220V	240V			220V	240V			220V	240V			220V	240V		
YY			208V	220V	**240V**		208V	220V	**240V**		208V	220V	**240V**		208V	220V	**240V**
LSA 47.3 S4	kVA	450	480	500	**512**	410	442	455	**465**	475	513	533	**550**	500	530	550	**581**
	kW	*360*	*384*	*400*	***410***	*328*	*354*	*364*	***372***	*380*	*410*	*426*	***440***	*400*	*424*	*440*	***465***
LSA 47.3 S5	kVA	475	510	531	**570**	441	473	493	**520**	505	543	566	**605**	527	562	585	**625**
	kW	*380*	*408*	*425*	***456***	*353*	*378*	*394*	***416***	*404*	*434*	*453*	***484***	*422*	*450*	*468*	***500***
LSA 47.3 M7	kVA	562	610	625	**625**	523	566	581	**590**	600	651	669	**680**	625	668	690	**700**
	kW	*450*	*488*	*500*	***500***	*418*	*453*	*465*	***472***	*480*	*521*	*535*	***544***	*500*	*534*	*552*	***560***
LSA 47.3 M8	kVA	562	610	630	**690**	523	566	587	**632**	600	651	672	**730**	625	671	705	**750**
	kW	*450*	*488*	*504*	***552***	*418*	*453*	*470*	***506***	*480*	*521*	*538*	***584***	*500*	*537*	*564*	***600***
LSA 47.3 L9	kVA	602	661	685	**750**	556	609	634	**685**	643	707	734	**795**	667	728	763	**825**
	kW	*482*	*529*	*548*	***600***	*445*	*487*	*507*	***548***	*514*	*566*	*587*	***636***	*534*	*582*	*610*	***660***
LSA 47.3 L10	kVA	650	715	755	**825**	590	650	685	**750**	690	760	800	**875**	720	785	830	**910**
	kW	*520*	*572*	*604*	***660***	*472*	*520*	*548*	***600***	*552*	*608*	*640*	***700***	*576*	*628*	*664*	***728***

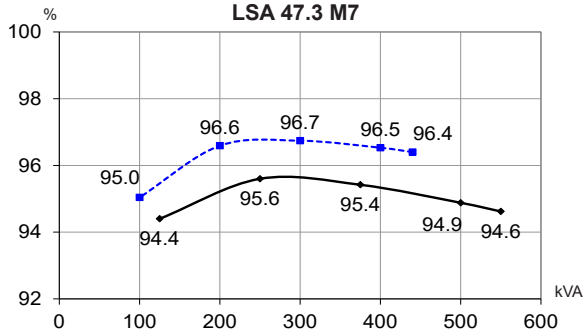
Efficiencies 400V - 50 Hz (— P.F.: 0.8) (--- P.F.: 1)

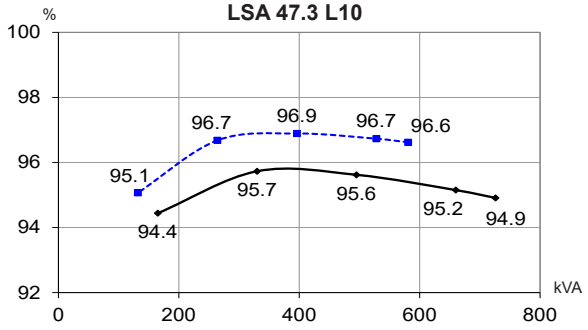








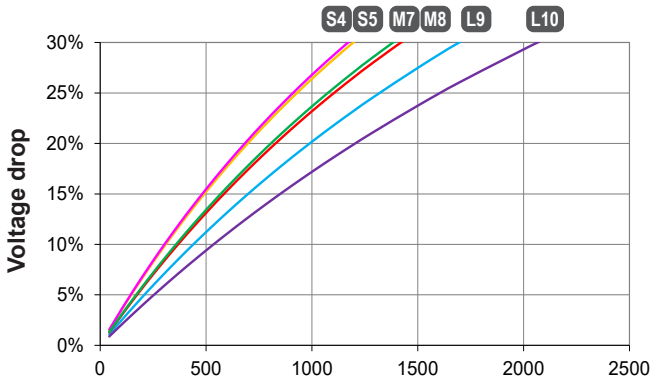




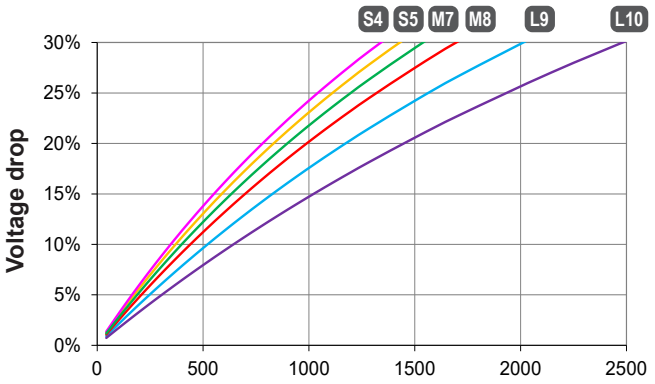
Reactances (%). Time constants (ms) - Class H / 400 V

		S4	S5	M7	M8	L9	L10
Kcc	Short-circuit ratio	0.29	0.51	0.35	0.27	0.55	0.41
Xd	Direct-axis synchronous reactance unsaturated	402	302	366	432	294	343
Xq	Quadrature-axis synchronous reactance unsaturated	205	154	187	220	150	175
T'do	No-load transient time constant	2 068	2 030	1 968	1 931	1 881	1 857
X'd	Direct-axis transient reactance saturated	19.4	14.8	18.6	22.3	15.6	18.5
T'd	Short-circuit transient time constant	100	100	100	100	100	100
X"d	Direct-axis subtransient reactance saturated	11.2	8.5	10.7	12.8	9	10.6
T"d	Subtransient time constant	10	10	10	10	10	10
X"q	Quadrature-axis subtransient reactance saturated	12.6	10.1	13.6	17	12.5	15.2
Xo	Zero sequence reactance	0.81	0.62	0.77	0.93	0.65	0.77
X2	Negative sequence reactance saturated	11.93	9.34	12.17	14.96	10.78	12.92
Ta	Armature time constant	15	15	15	15	15	15
Other class H / 400 V data							
io (A)	No-load excitation current (SHUNT / AREP)	0.68	1.07	0.79	0.68	1.13	0.92
ic (A)	On-load excitation current (SHUNT / AREP)	3.1	3.36	3.21	3.34	3.48	3.44
uc (V)	On-load excitation voltage (SHUNT / AREP)	32.4	35	33.5	34.8	36.1	35.6
ms	Response time (ΔU = 20% transient)	500	500	500	500	500	500
kVA	Start (ΔU = 20% cont. or 30% trans.) SHUNT	1 055	1 178	1 240	1 237	1 480	1 615
kVA	Start (ΔU = 20% cont. or 30% trans.) AREP	1 269	1 443	1 490	1 486	1 805	1 968
%	Transient ΔU (on-load 4/4) SHUNT - P.F.: 0.8_{LAG}	12.8	10.3	15.5	14.3	15.7	12.1
%	Transient ΔU (on-load 4/4) AREP - P.F.: 0.8_{LAG}	11	8.9	13.9	12.2	14.3	10.3
W	No-load losses	4 011	5 871	4 911	4 544	7 414	6 486
W	Heat dissipation	19 374	20 840	21 557	25 084	25 152	26 900

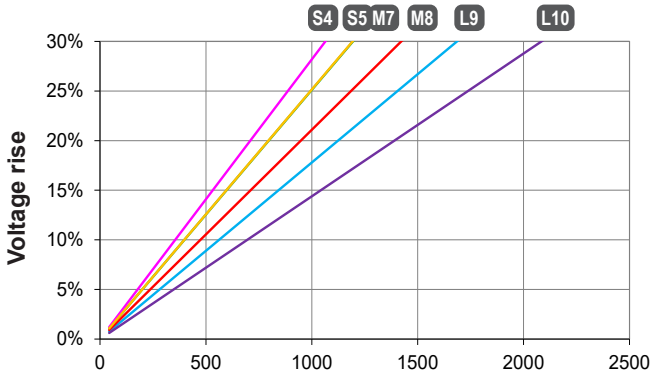
Transient voltage variation 400 V - 50 Hz



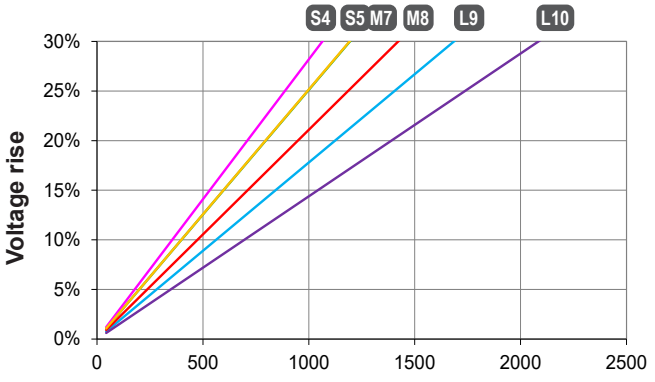
Phase loading (SHUNT) - kVA at P.F. = 0.8



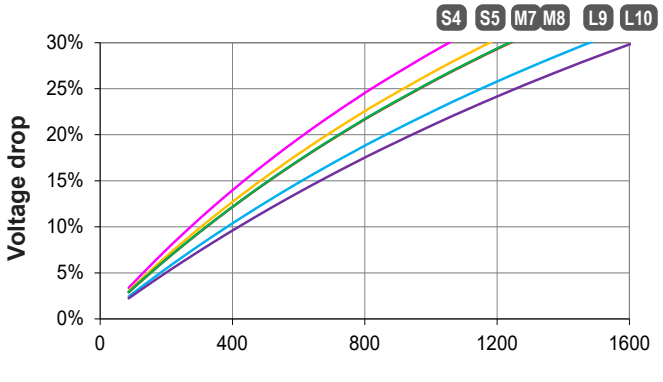
Phase loading (AREP/PMG) - kVA at P.F. = 0.8



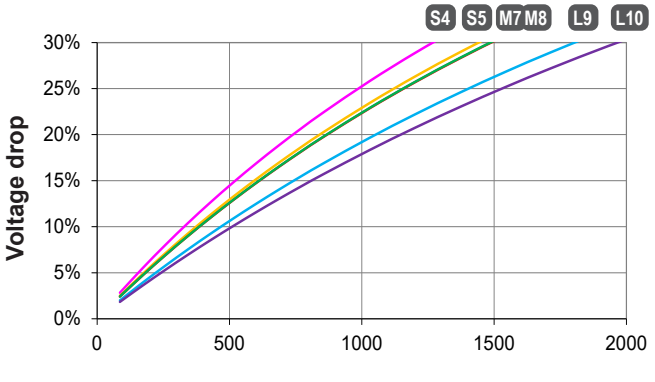
Load shedding (SHUNT) - kVA at P.F. = 0.8



Load shedding (AREP/PMG) - kVA at P.F. = 0.8



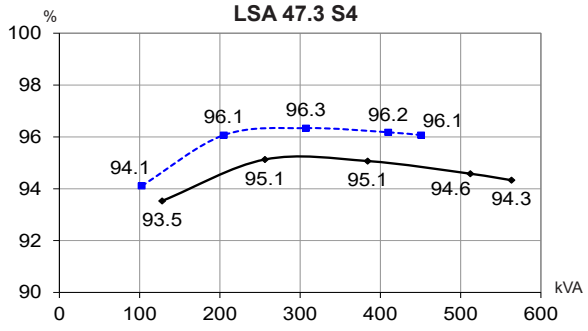
Motor starting (SHUNT)
Locked rotor kVA at P.F. = 0.6

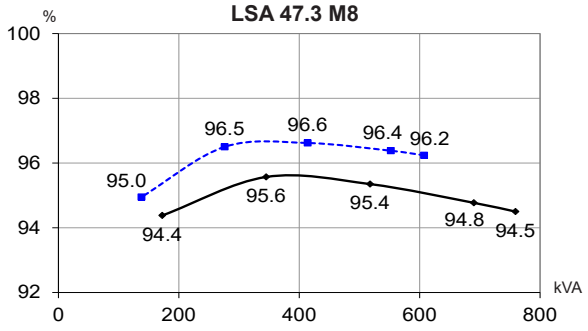


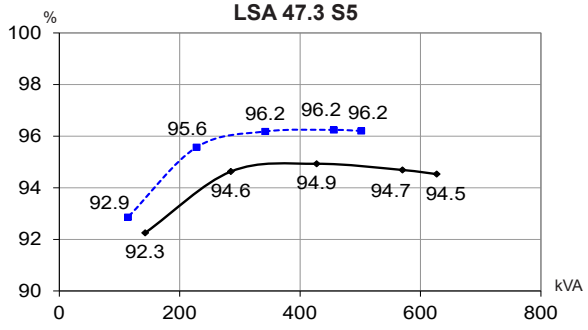
Motor starting (AREP/PMG)
Locked rotor kVA at P.F. = 0.6

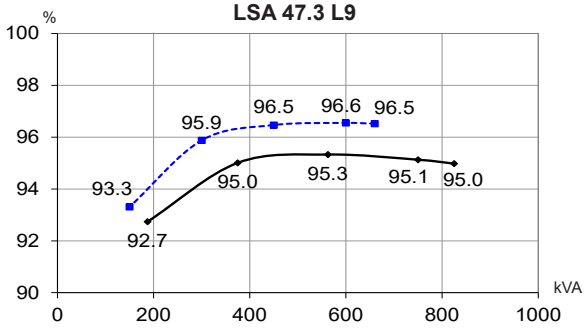
1) For a starting P.F. other than 0.6, the starting kVA must be multiplied by K = Sine P.F. / 0.8
2) For voltages other than 400V (Y), 230V (Δ) at 50 Hz, then kVA must be multiplied by $(400/U)^2$ or $(230/U)^2$.

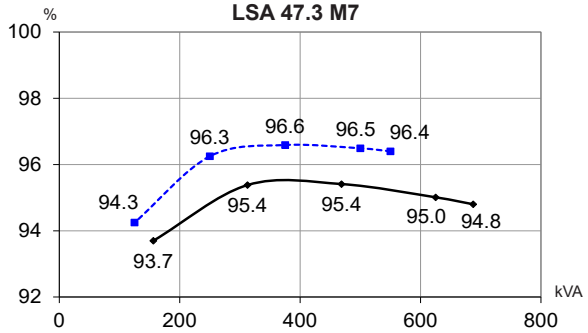
Efficiencies 480 V - 60 Hz (— P.F.: 0.8) (--- P.F.: 1)

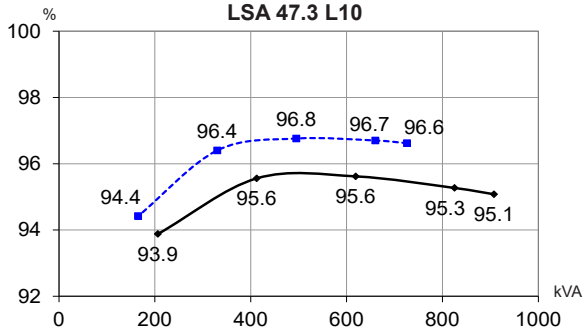








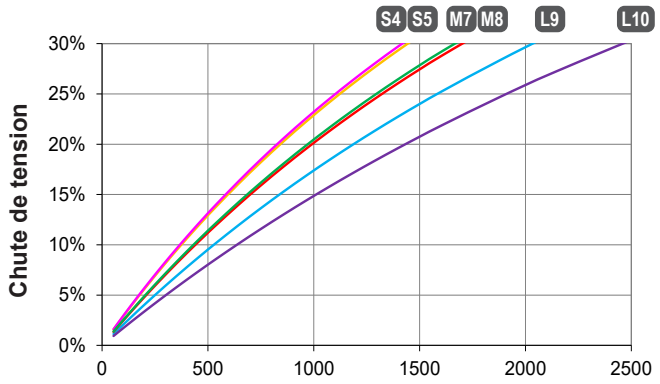




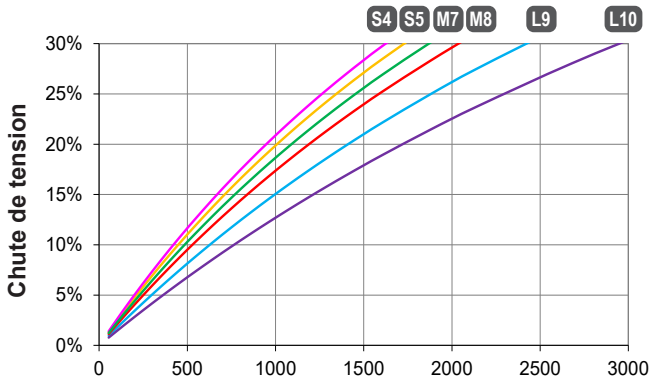
Reactances (%). Time constants (ms) - Class H / 480 V

		S4	S5	M7	M8	L9	L10
Kcc	Short-circuit ratio	0.28	0.49	0.33	0.26	0.51	0.39
Xd	Direct-axis synchronous reactance unsaturated	417	315	382	452	309	361
Xq	Quadrature-axis synchronous reactance unsaturated	212	160	194	230	157	184
T'do	No-load transient time constant	2 068	2 030	1 968	1 931	1 881	1 857
X'd	Direct-axis transient reactance saturated	20.1	15.5	19.4	23.4	16.4	19.4
T'd	Short-circuit transient time constant	100	100	100	100	100	100
X"d	Direct-axis subtransient reactance saturated	11.5	8.9	11.1	13.4	9.4	11.1
T"d	Subtransient time constant	10	10	10	10	10	10
X"q	Quadrature-axis subtransient reactance saturated	13.1	10.5	14.2	17.8	13.2	15.9
Xo	Zero sequence reactance	0.84	0.64	0.8	0.97	0.68	0.81
X2	Negative sequence reactance saturated	12.35	9.75	12.68	15.64	11.33	13.58
Ta	Armature time constant	15	15	15	15	15	15
Other class H / 480 V data							
io (A)	No-load excitation current (SHUNT / AREP)	0.68	1.07	0.79	0.68	1.11	0.91
ic (A)	On-load excitation current (SHUNT / AREP)	3.17	3.42	3.28	3.43	3.51	3.49
uc (V)	On-load excitation voltage (SHUNT / AREP)	33.2	35.8	34.3	35.8	36.6	36.3
ms	Response time (ΔU = 20% transient)	500	500	500	500	500	500
kVA	Start (ΔU = 20% cont. or 30% trans.) SHUNT	1 268	1 456	1 495	1 482	1 849	2 015
kVA	Start (ΔU = 20% cont. or 30% trans.) AREP	1 526	1 791	1 783	1 780	2 262	2 460
%	Transient ΔU (on-load 4/4) SHUNT - P.F.: 0.8_{LAG}	13.2	10.7	15.9	14.8	16.2	12.6
%	Transient ΔU (on-load 4/4) AREP - P.F.: 0.8_{LAG}	11.3	9.2	14.2	12.7	14.7	10.7
W	No-load losses	6 196	8 711	7 429	6 931	10 718	9 520
W	Heat dissipation	23 456	25 534	26 224	30 403	30 686	32 721

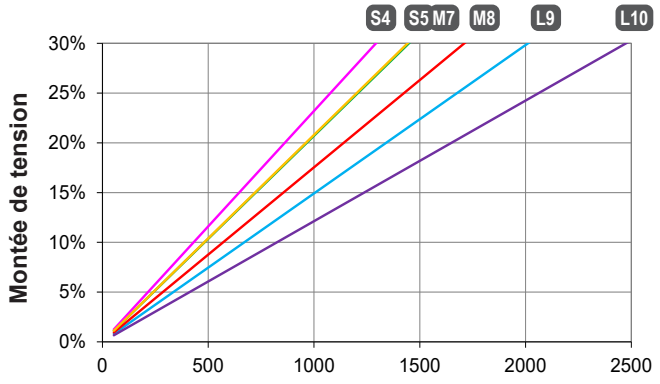
Transient voltage variation 480 V - 60 Hz



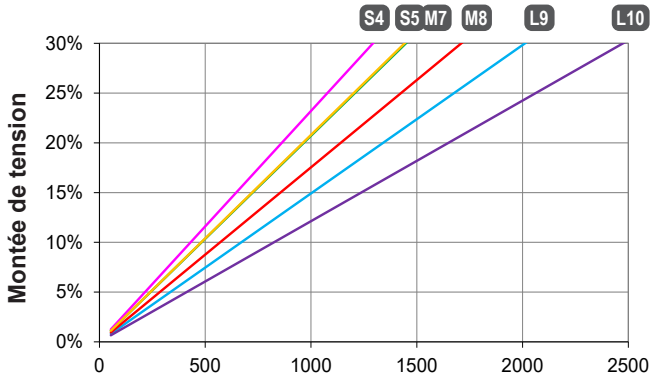
Mise en charge (SHUNT) - kVA à Cos Φ 0.8



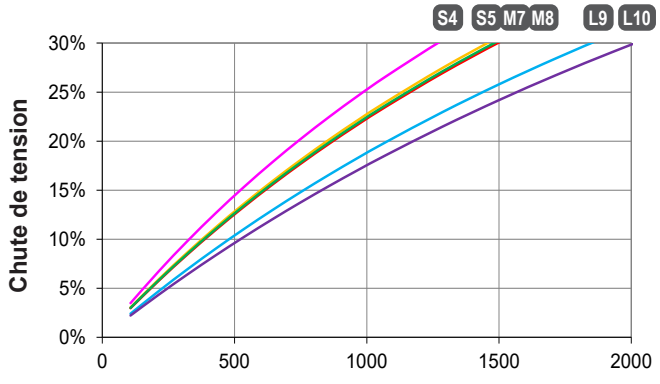
Mise en charge (AREP/PMG) - kVA à Cos Φ 0.8



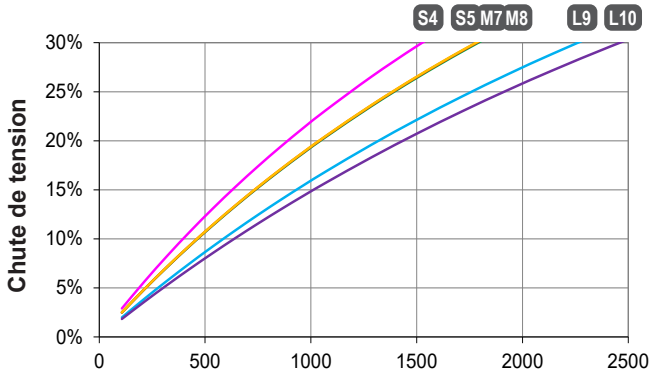
Délestage (SHUNT) - kVA à Cos Φ 0.8



Délestage (AREP/PMG) - kVA à Cos Φ 0.8



Démarrage des moteurs (SHUNT)
kVA rotor bloqué à Cos Φ 0.6



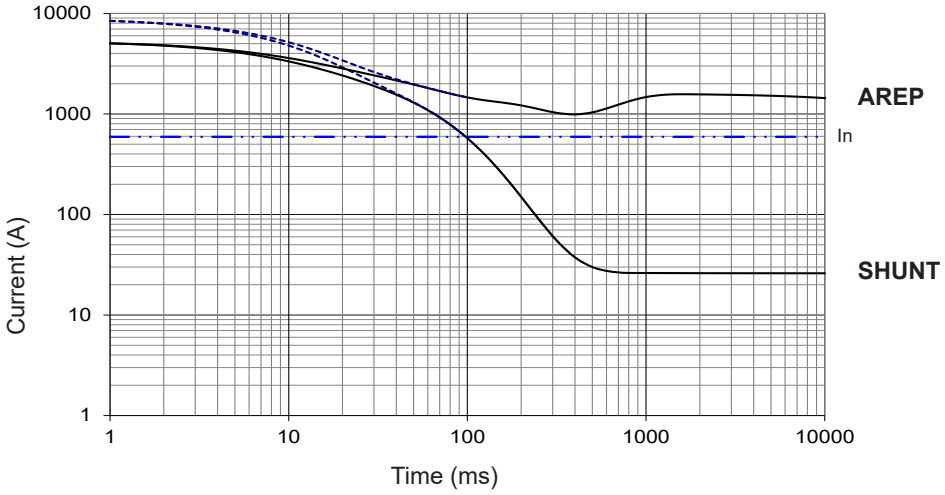
Démarrage des moteurs (AREP/PMG)
kVA rotor bloqué à Cos Φ 0.6

1) For a starting P.F. other than 0.6, the starting kVA must be multiplied by K = Sine P.F. / 0.8
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)

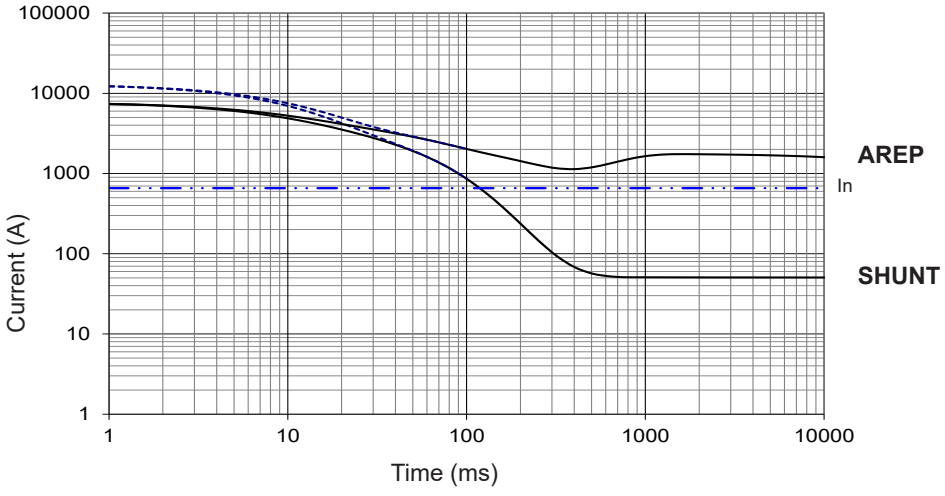
LSA 47.3 S4

Symmetrical ——
Asymmetrical - - -



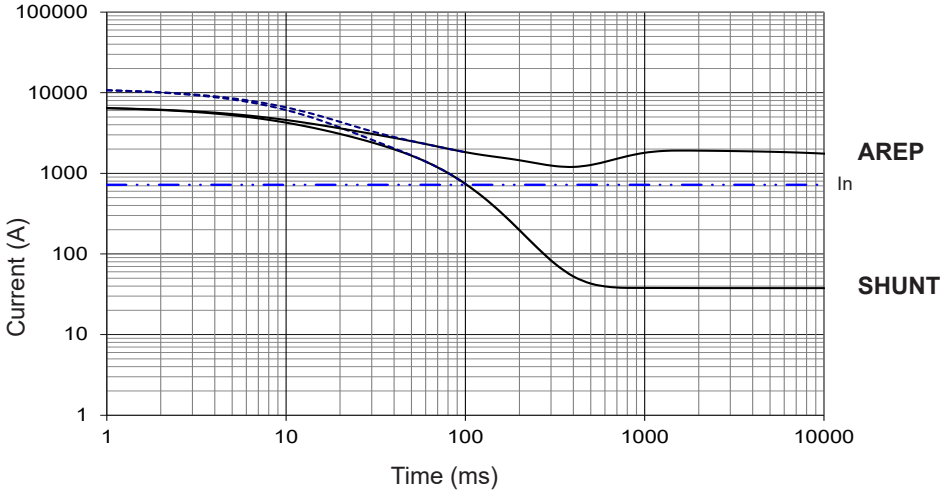
LSA 47.3 S5

Symmetrical ——
Asymmetrical - - -



LSA 47.3 M7

Symmetrical ——
Asymmetrical - - -

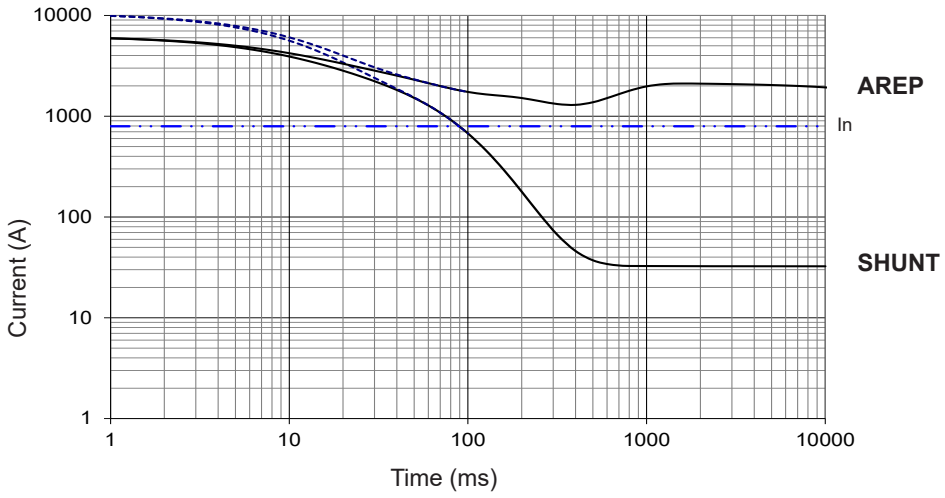


Influence due to connection
Curves shown are for star (Y) connection.
For other connections, use the following multiplication factors:
- Series delta : current value x 1.732 - Parallel star : current value x 2

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

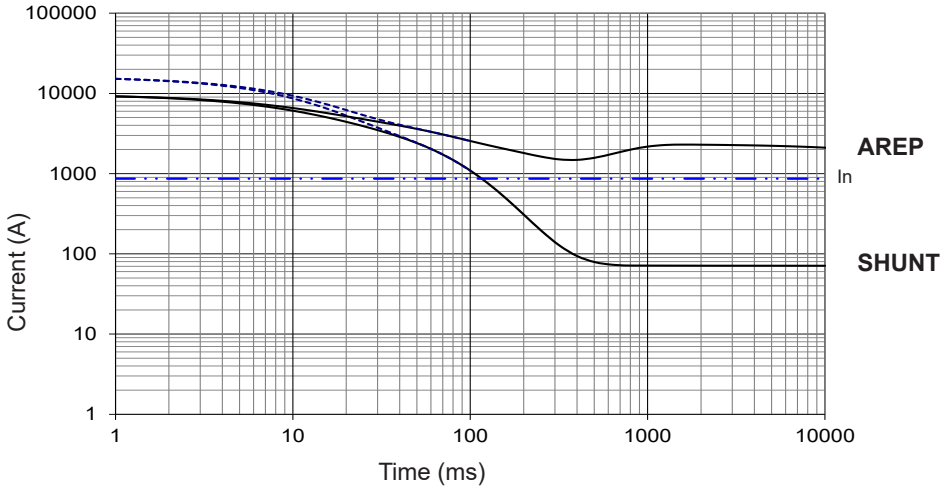
LSA 47.3 M8

Symmetrical ——
Asymmetrical - - -



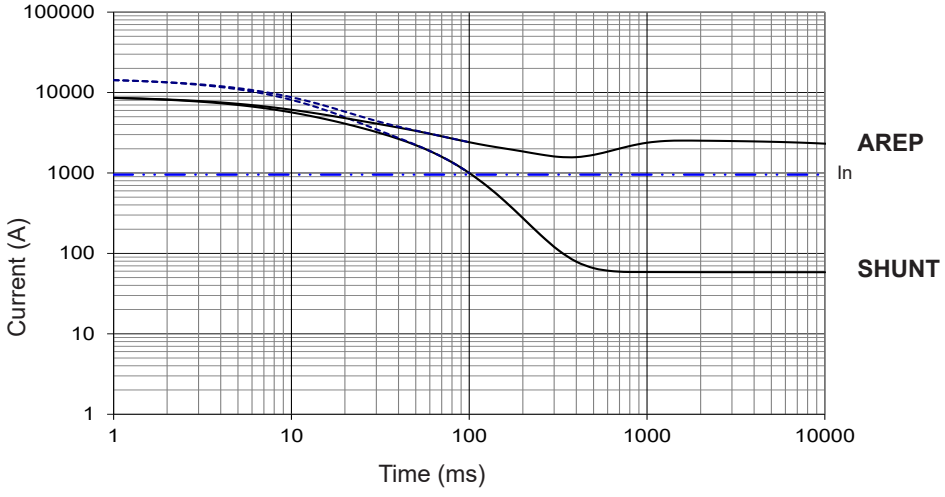
LSA 47.3 L9

Symmetrical ——
Asymmetrical - - -



LSA 47.3 L10

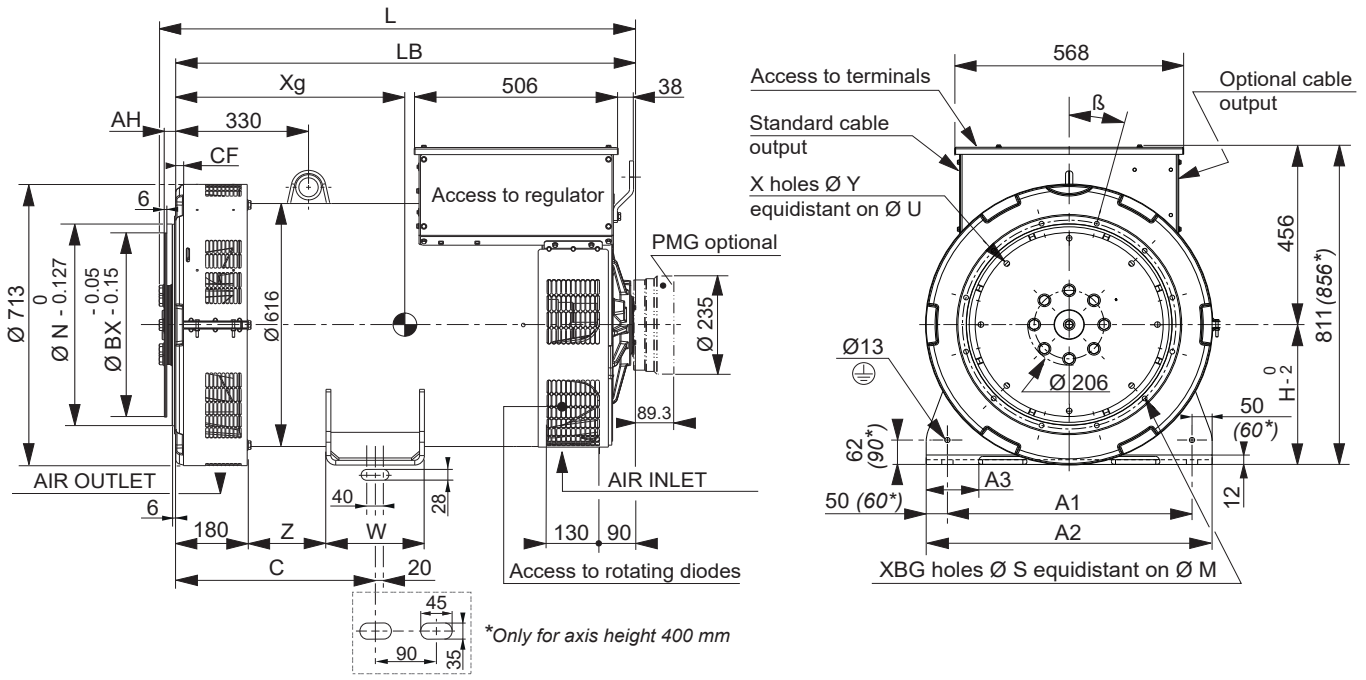
Symmetrical ——
Asymmetrical - - -



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.

Single-bearing dimensions



Dimensions (mm) and weight (kg)				
Type	L without PMG maxi*	LB	Xg	Weight
LSA 47.3 S4	1 108	1 056	479	1 110
LSA 47.3 S5	1 108	1 056	485	1 142
LSA 47.3 M7	1 208	1 156	515	1 230
LSA 47.3 M8	1 208	1 156	524	1 284
LSA 47.3 L9	1 228	1 176	543	1 366
LSA 47.3 L10	1 228	1 176	552	1 414

* L maxi = LB + AH maxi + 13

Shaft height (mm)		
	Standard	*Option**
H	**355**	*400*
C	530	*560*
A1	610	*686*
A2	710	*786*
W	244	*259*
Z	228	*295.5*
A3	-	*110*

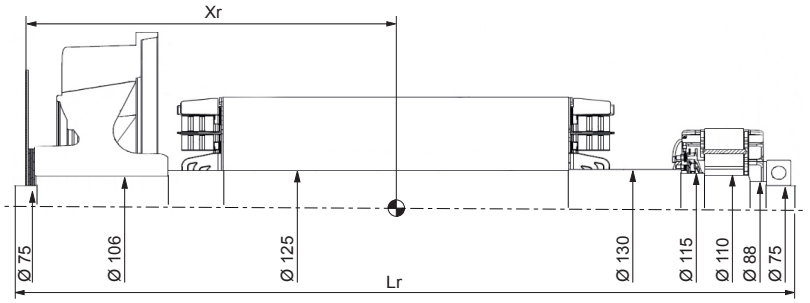
** Available only for L10*

Coupling			
Flex plate	**11 ½**	**14**	**18**
Flange S.A.E 1	X	X	
Flange S.A.E ½		X	
Flange S.A.E 0		X	X

Flange (mm)						
S.A.E.	N	M	XBG	S	β°	CF
1	511.175	530.225	12	12	15°	15
½	584.2	619.125	12	14	15°	22
0	647.7	679.45	16	14	11° 15'	42

Flex plate (mm)					
S.A.E.	BX	U	X	Y	AH
11 ½	352.42	333.38	8	11	39.6
14	466.72	438.15	8	14	25.4
18	571.5	542.92	6	17	15.7

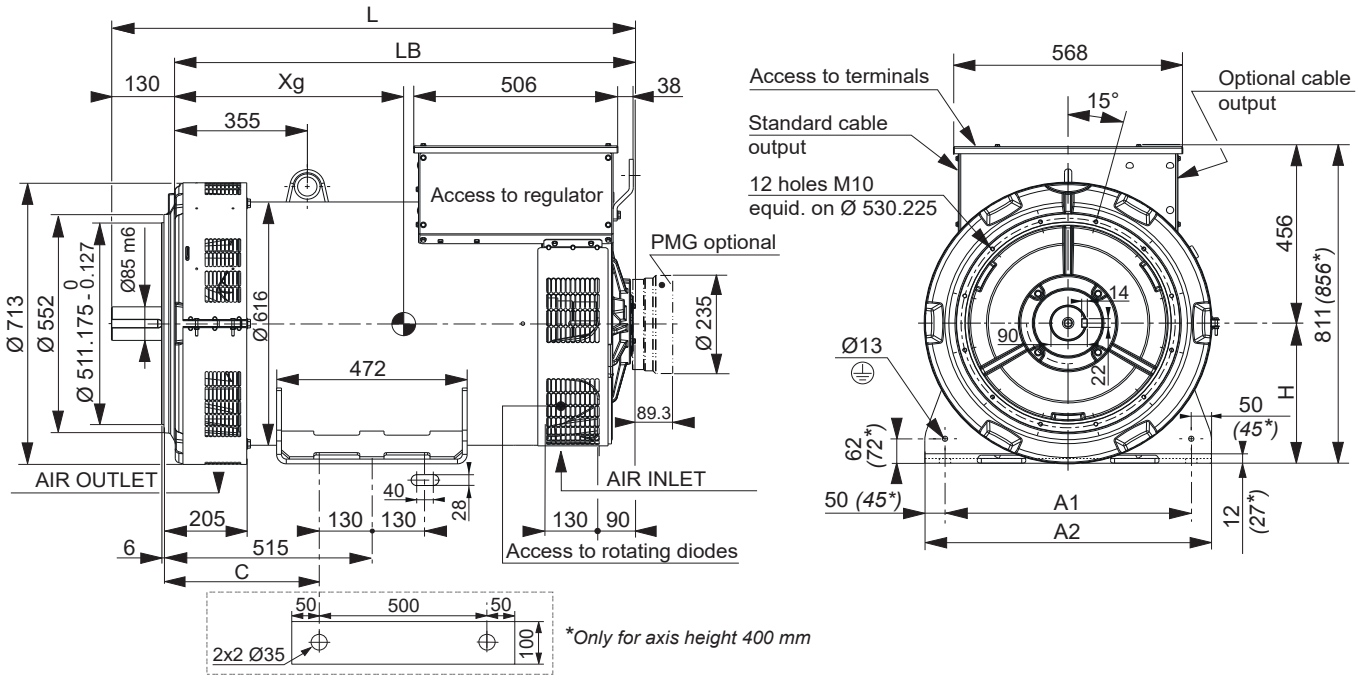
Torsional analysis data



Centre of gravity: Xr (mm), Rotor length: Lr (mm), Weight: M (kg), Moment of inertia: J (kgm²): (4J = MD²)												
Flex plate	S.A.E. 11 ½				S.A.E. 14				S.A.E. 18			
Type	Xr	Lr	M	J	Xr	Lr	M	J	Xr	Lr	M	J
LSA 47.3 S4	465	1 081	443	7.1	450	1 070	444	7.18	439	1 070	444	7.46
LSA 47.3 S5	473	1 081	456	7.3	457	1 070	456	7.41	447	1 070	457	7.68
LSA 47.3 M7	502	1 181	491	7.8	487	1 170	492	7.88	477	1 170	492	8.14
LSA 47.3 M8	512	1 181	517	8.2	498	1 170	517	8.37	487	1 170	518	8.54
LSA 47.3 L9	533	1 201	545	8.7	518	1 190	546	8.83	508	1 190	546	9.09
LSA 47.3 L10	544	1 201	563	9.1	529	1 190	564	9.18	519	1 190	564	9.44

NOTE : Dimensions are for information only and may be subject to modifications. Contractual 2D drawings can be downloaded from the Nidec Power website, 3D drawing files are available upon request.
The torsional analysis of the transmission is imperative. All values are available upon request.

Two-bearing dimensions

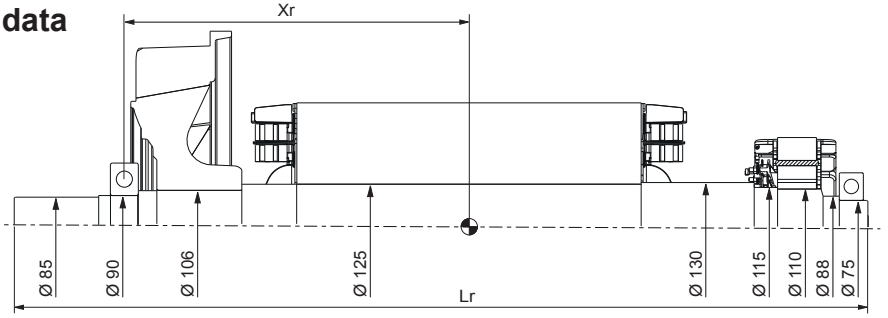


Dimensions (mm) and weight (kg)				
Type	L without PMG	LB	Xg	Weight
LSA 47.3 S4	1 211	1 081	473	1 125
LSA 47.3 S5	1 211	1 081	479	1 157
LSA 47.3 M7	1 311	1 181	510	1 245
LSA 47.3 M8	1 311	1 181	519	1 299
LSA 47.3 L9	1 331	1 201	537	1 381
LSA 47.3 L10	1 331	1 201	547	1 429

Shaft height (mm)		
	Standard	*Option**
H	**355** $^{0}_{-2}$	*400* $^{0}_{-1}$
A1	610	*686*
A2	710	*786*
C	-	*290*

** Available only for L10*

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 47.3 S4	430	1 194	422	6.80
LSA 47.3 S5	437	1 194	435	7.03
LSA 47.3 M7	466	1 294	470	7.51
LSA 47.3 M8	477	1 294	496	8
LSA 47.3 L9	497	1 314	524	8.46
LSA 47.3 L10	508	1 314	542	8.81

NOTE : Dimensions are for information only and may be subject to modifications. Contractual 2D drawings can be downloaded from the Nidec Power website, 3D drawing files are available upon request.
The torsional analysis of the transmission is imperative. All values are available upon request.

Nidec

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