EMERSON™
Industrial Automation


LEROY SOMER®

# PARTNER ALTERNATORS

## LSA 51.2 - 4 pole

Electrical and mechanical data

4164 en - 2012.01 / e

**SPECIALLY 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.

## 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

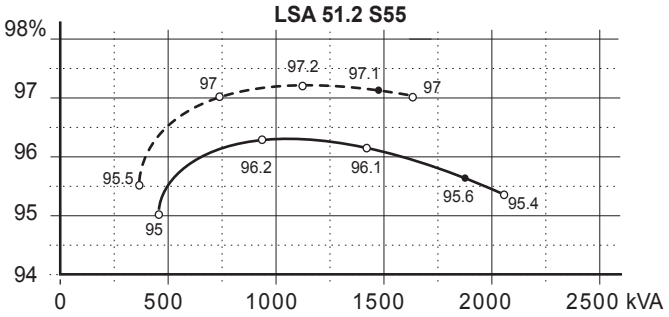
## Ratings 60 Hz - 1800 R.P.M.

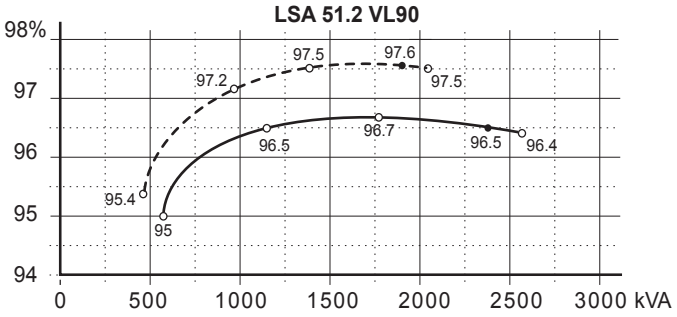
**kVA / kW - P.F. = 0,8**

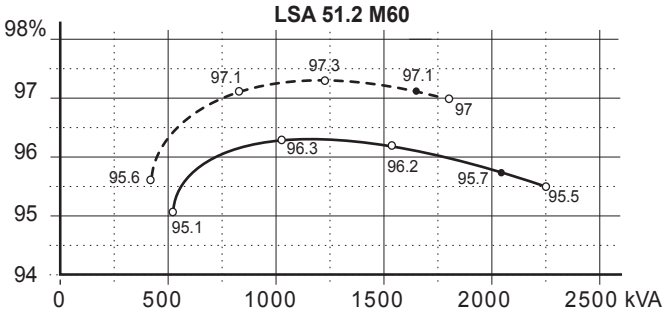
| Duty / T° C | | Continuous duty / 40 °C | | | | | | | | Stand-by / 40 °C | | | | Stand-by / 27 °C | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Class / T° K** | | **H / 125° K** | | | | **F / 105° K** | | | | **H / 150° K** | | | | **H / 163° K** | | | |
| Phase | | 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* |

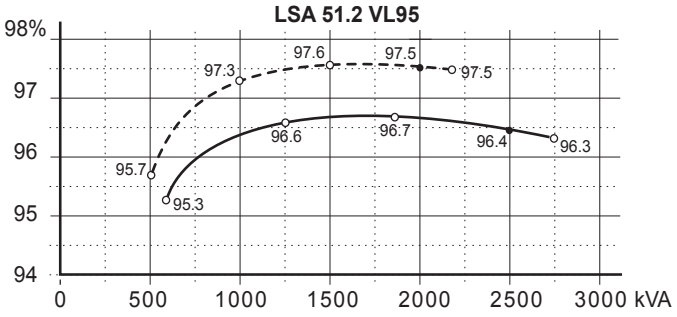
Δ* : Consult factory

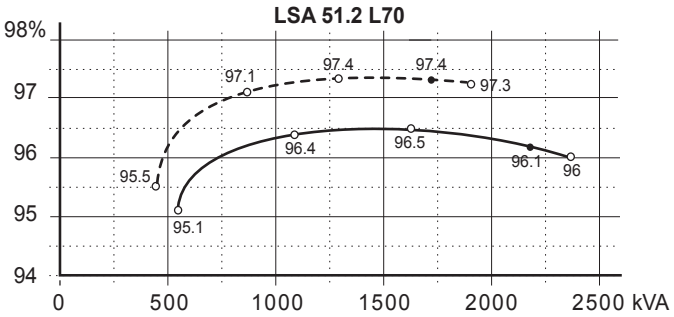
## Efficiencies 50 Hz - P.F. : 1 - - - - / P.F. : 0,8 ———



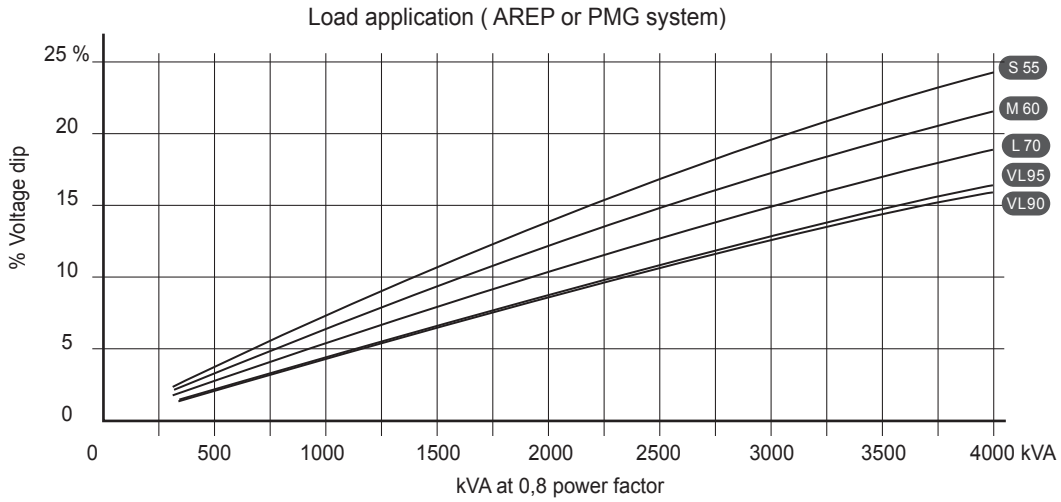

## Reactances (%) . Time constants (ms) - Class H / 400 V

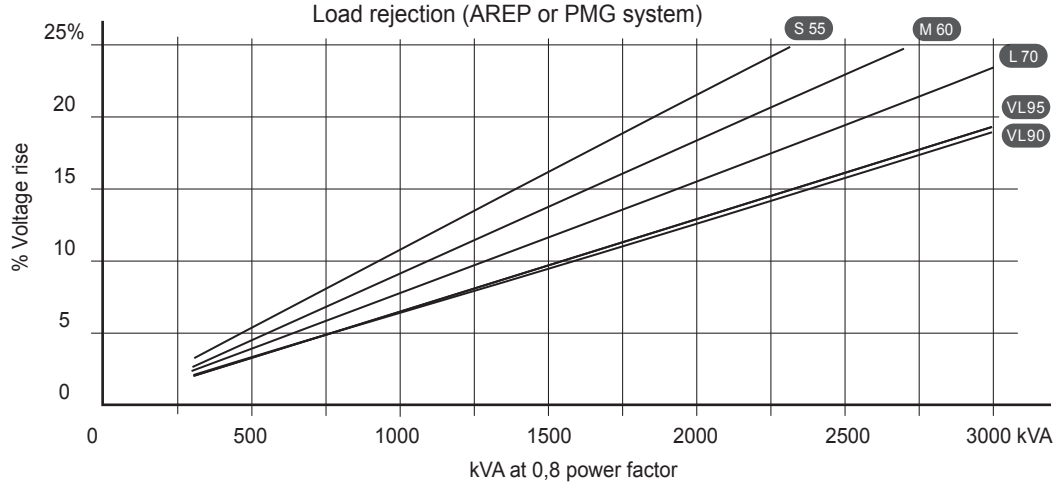
| | | S55 | M60 | L70 | VL90 | VL95 |
|---|---|---|---|---|---|---|
| Kcc | Short-circuit ratio | 0,33 | 0,36 | 0,39 | 0,44 | 0,39 |
| Xd | Direct axis synchro.reactance unsaturated | 367 | 350 | 321 | 287 | 311 |
| Xq | Quadra. axis synchr.reactance unsaturated | 220 | 210 | 193 | 172 | 187 |
| T'do | 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 |

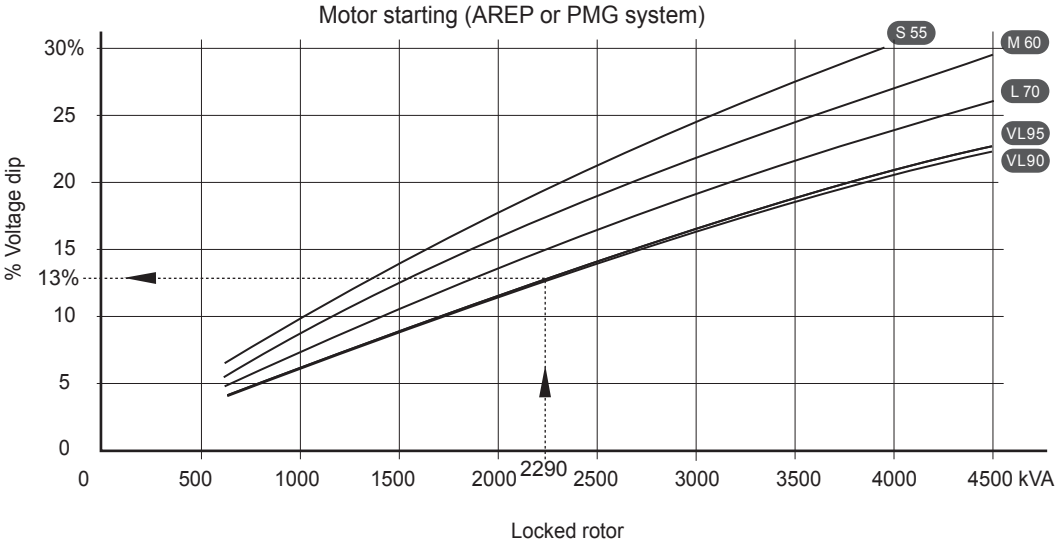
## Other data - Class H / 400 V

| | | | | | | |
|---|---|---|---|---|---|---|
| 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 (Δ U = 20 % trans.) | 700 | 700 | 700 | 700 | 700 |
| kVA | Motor start. (Δ U = 20% sust.) or (Δ 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



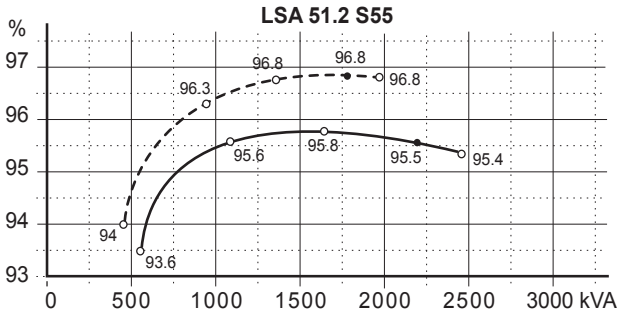



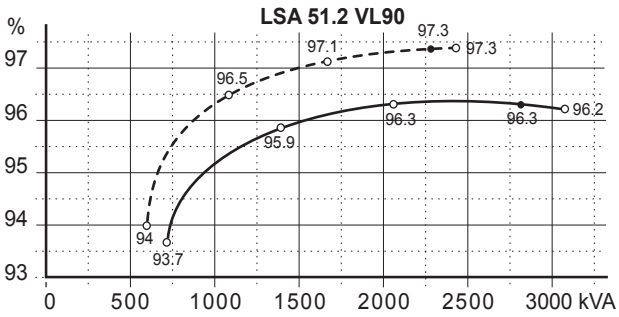



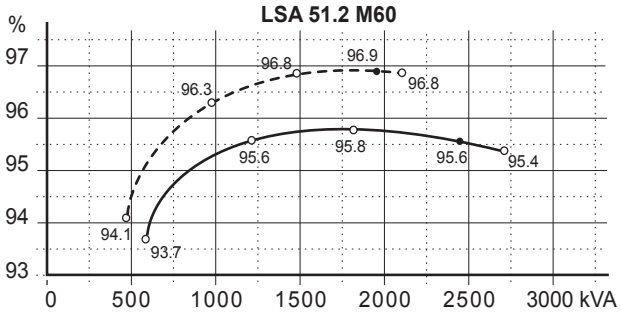

1) For a starting P.F. other than 0,6 , the starting kVA must be multiplied by K = Sine Ø /0,8
Calculation example for a different P.F. : Starter motor kVA calculated at 0.4 P.F. = 2000 kVA
► Sin Ø 0,4 = 0,9165 ► K = 1,145 ► kVA corrected = 2290 kVA ► Voltage dip corresponding to VL90 = 13 %.

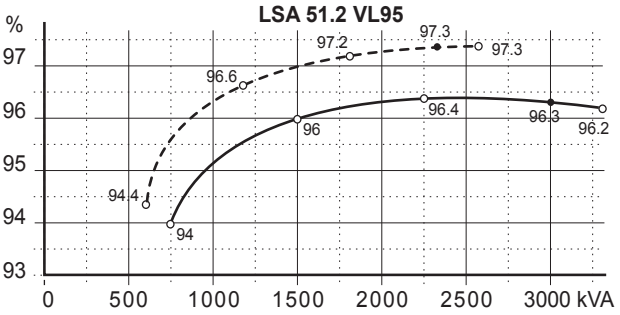
2) For voltages other than 400V (Y) , 230V (△) at 50 Hz, then kVA must be multiplied by $(400/U)^2$ or $(230/U)^2$.

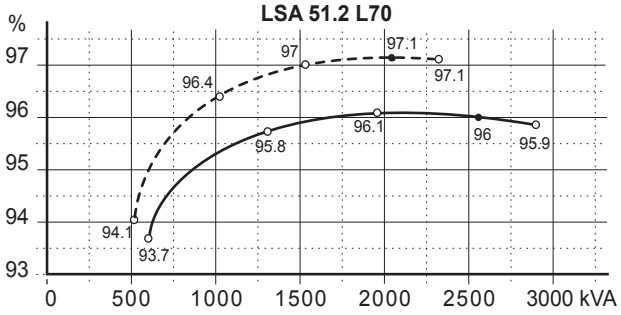
## Efficiencies 60 Hz - P.F. : 1 - - - - / P.F. : 0,8 ———



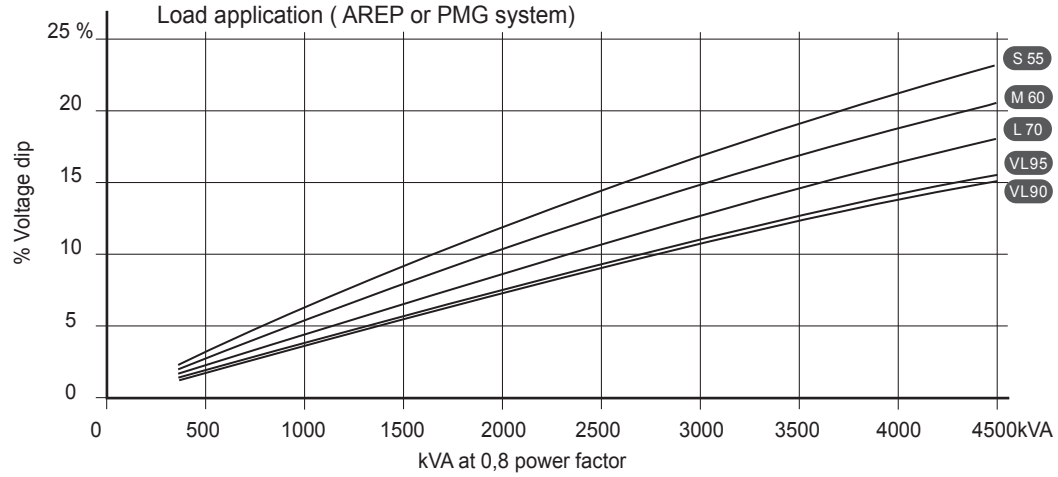

## Reactances (%) . Time constants (ms) - Class H / 480 V

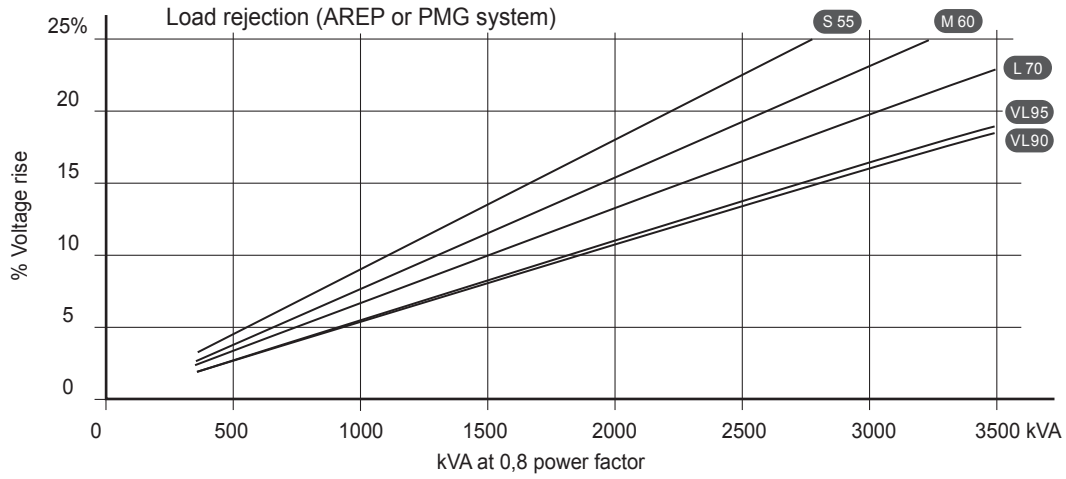
| | | S55 | M60 | L70 | VL90 | VL95 |
|---|---|---|---|---|---|---|
| Kcc | Short-circuit ratio | 0,33 | 0,36 | 0,39 | 0,44 | 0,39 |
| Xd | Direct axis synchro.reactance unsaturated | 368 | 350 | 321 | 287 | 311 |
| Xq | Quadra. axis synchr.reactance unsaturated | 221 | 210 | 193 | 172 | 187 |
| T'do | 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 |

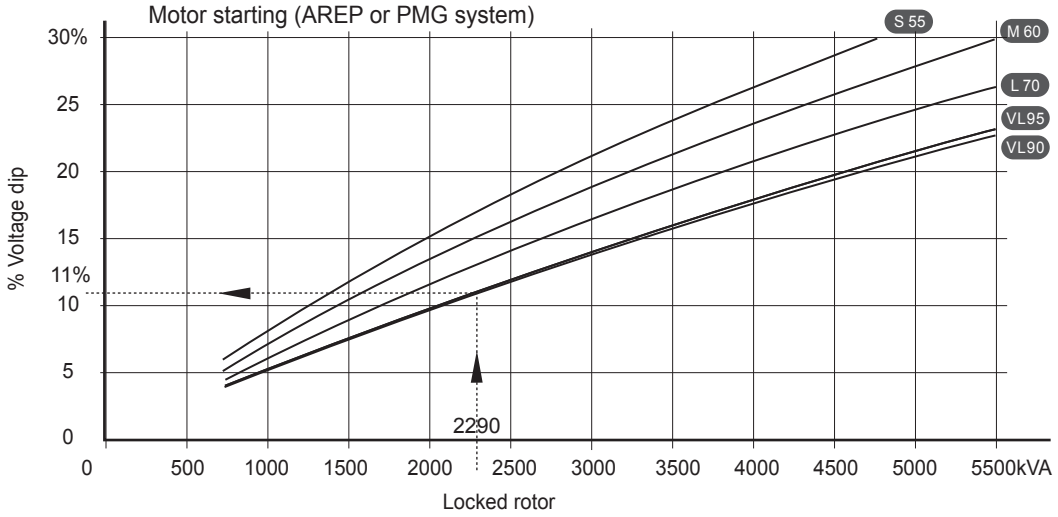
## Other characteristics - Class H / 480 V

| | | | | | | |
|---|---|---|---|---|---|---|
| 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 (ΔU = 20 % trans.) | 700 | 700 | 700 | 700 | 700 |
| kVA | Motor start. (ΔU = 20% sust.) or (ΔU = 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



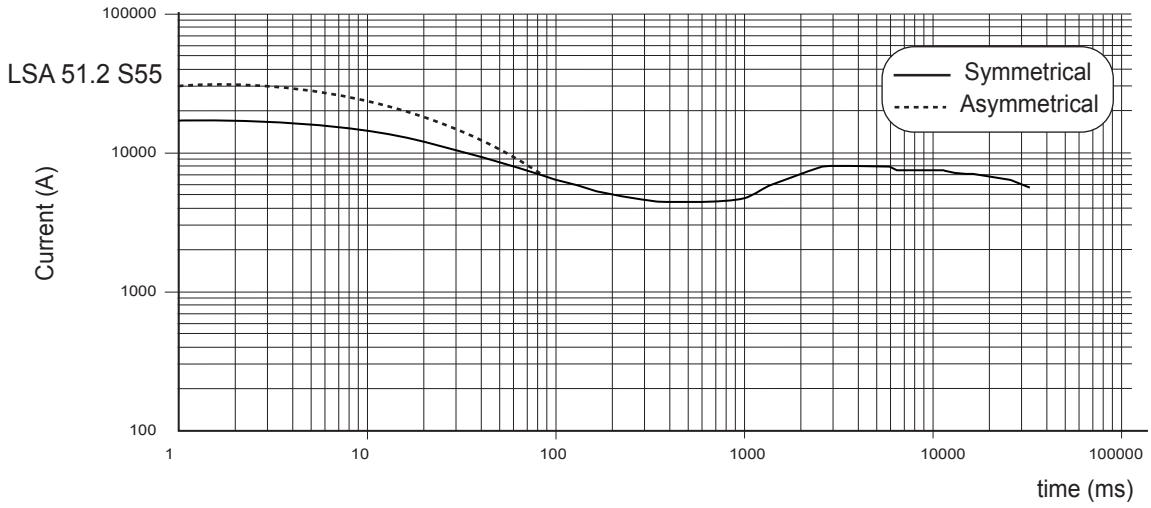



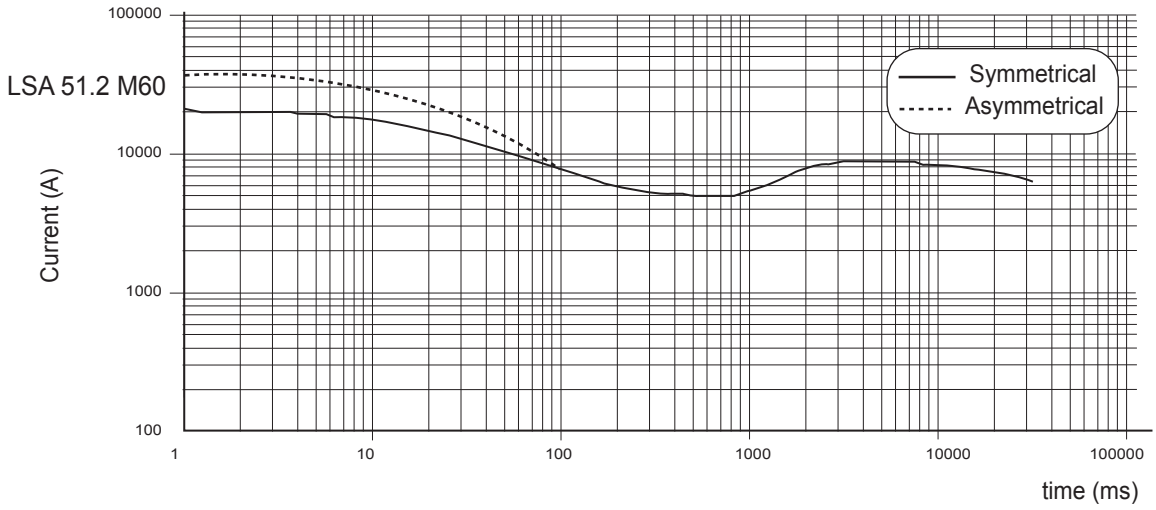



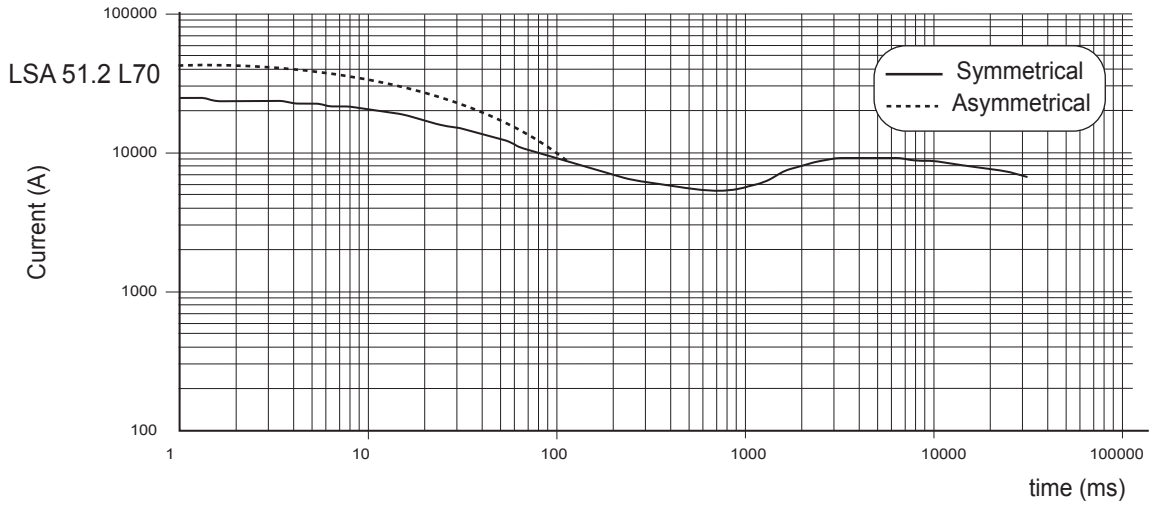

1) For a starting P.F. other than 0,6 , the starting kVA must be multiplied by K = Sine Ø /0,8
Calculation example for a different P.F. : Starter motor kVA calculated at 0.4 P.F. = 2000 kVA
► Sin Ø 0,4 = 0,9165 ► K = 1,145 ► kVA corrected = 2290 kVA ► Voltage dip corresponding to VL90 = 11 %.

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)



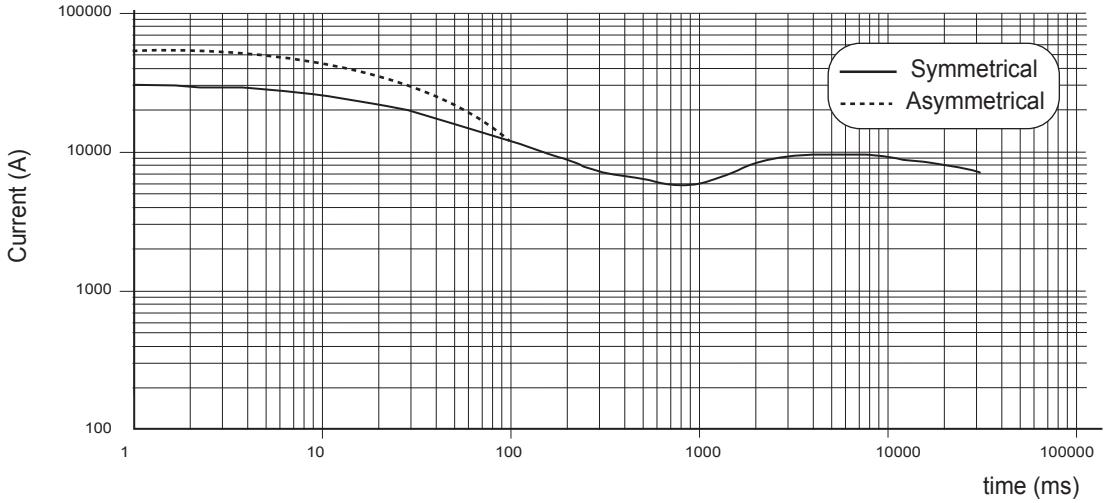




**Influence due to connexion**
Curves shown are for star connection (Y).

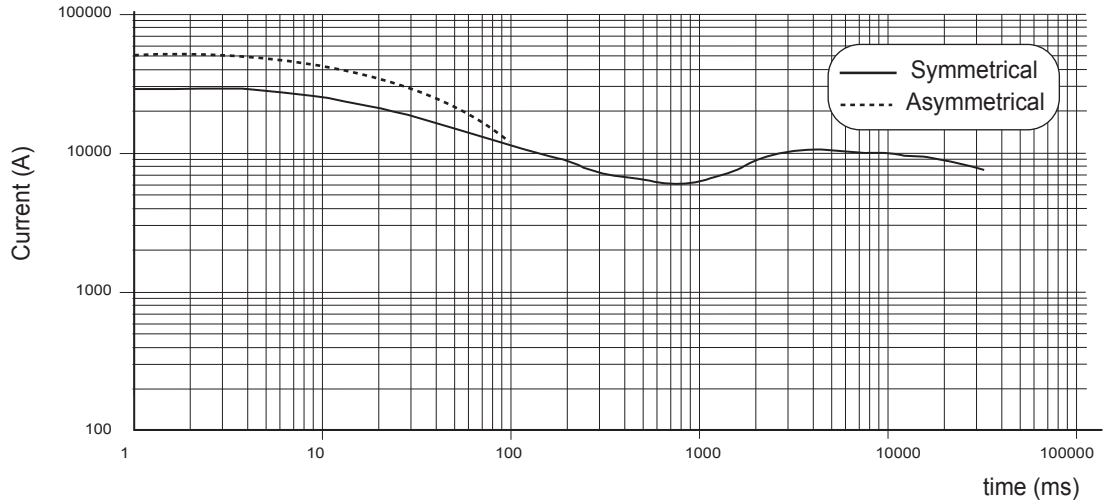
For other connections, use the following multiplication factors :
- Series delta : Current value x 1,732
- Parallel star : Current value x 2

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

**LSA 51.2 VL90**




**LSA 51.2 VL95**



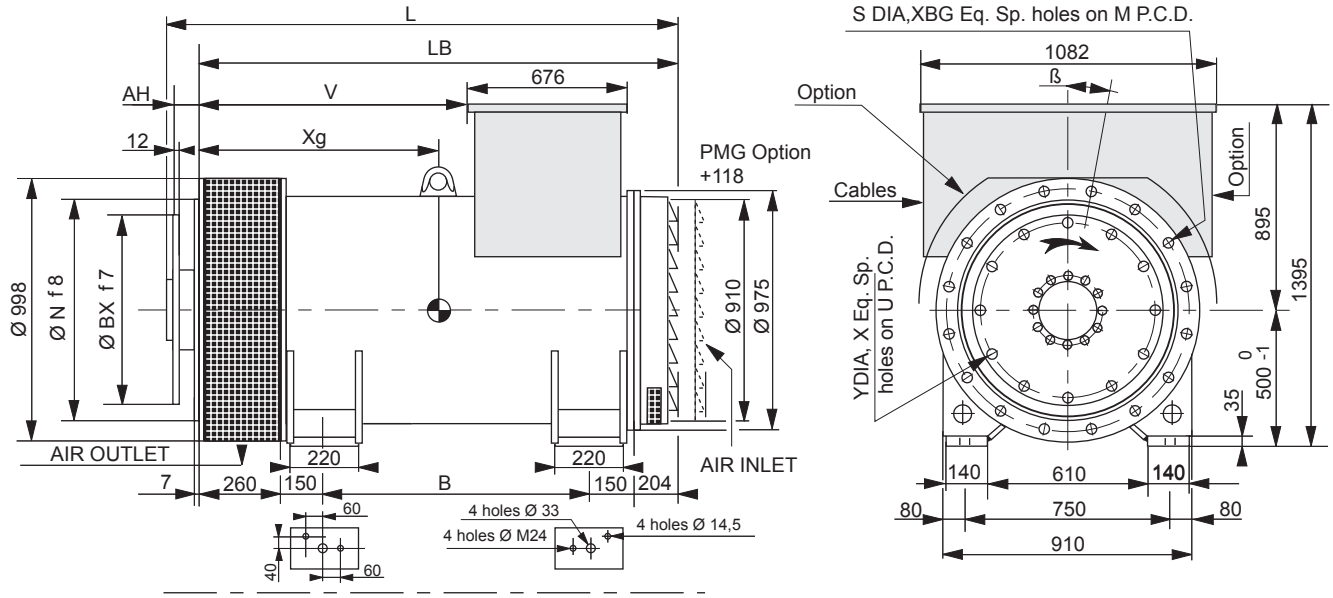

**Influence due to short-circuit.**

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



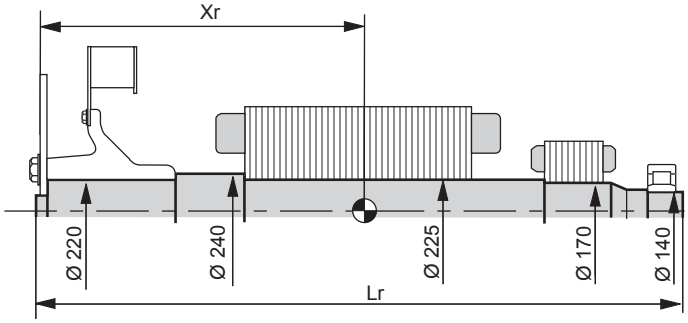

| Frame dimensions (mm) and weight (kg) | | | | | | |
|---|---|---|---|---|---|---|
| TYPE | L without PMG | LB | B | V | Xg | Weight (kg) |
| LSA 51.2 S55 | 1699 | 1677 | 900 | 744 | 735 | 3745 |
| LSA 51.2 M60 | 1799 | 1777 | 1000 | 844 | 770 | 4040 |
| LSA 51.2 L70 | 1899 | 1877 | 1100 | 944 | 825 | 4445 |
| LSA 51.2 VL90 | 1999 | 1977 | 1200 | 1044 | 885 | 4995 |
| LSA 51.2 VL95 | 1999 | 1977 | 1200 | 1044 | 890 | 5065 |

| Coupling | | |
|---|---|---|
| Flange | 0 | 00 |
| Flex plate S.A.E 24 | | X |
| Flex plate S.A.E 21 | | X |
| Flex plate S.A.E 18 | X | X |

| Flange dimensions (mm) | | | | | |
|---|---|---|---|---|---|
| S.A.E. | N | M | XBG | S | ß |
| 0 | 647.7 | 679.5 | 16 | 14 | 11°15' |
| 00 | 787.4 | 850.9 | 16 | 14 | 11° 15' |

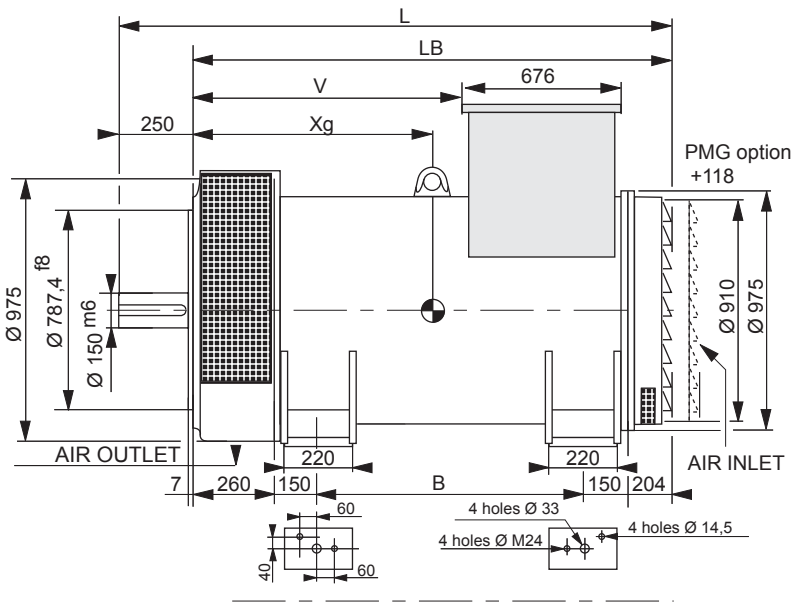
| Flex plate dimensions (mm) | | | | | |
|---|---|---|---|---|---|
| S.A.E. | BX | U | X | Y | AH |
| 24 | 733.4 | 692.1 | 12 | 21 | 0 |
| 21 | 673.1 | 641.3 | 12 | 18 | 0 |
| 18 | 571.5 | 542.9 | 6 | 18 | 15.8 |

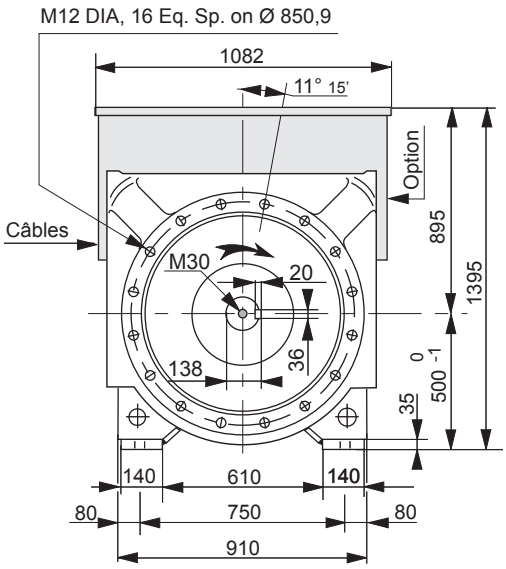
## Torsional analysis data




| Centre of gravity : Xr (mm), rotor length Lr (mm), Weight : M (kg), Moment of inertia : J (kgm²) : (4J = MD²) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Flex plate S.A.E. 18 | | | | Flex plate S.A.E. 21 | | | | Flex plate S.A.E. 24 | | | |
| TYPE | 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 |

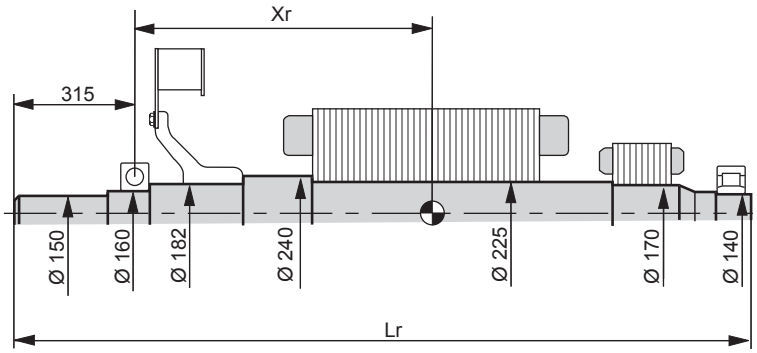
## Two bearing dimensions




| 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 |

**Contact**

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