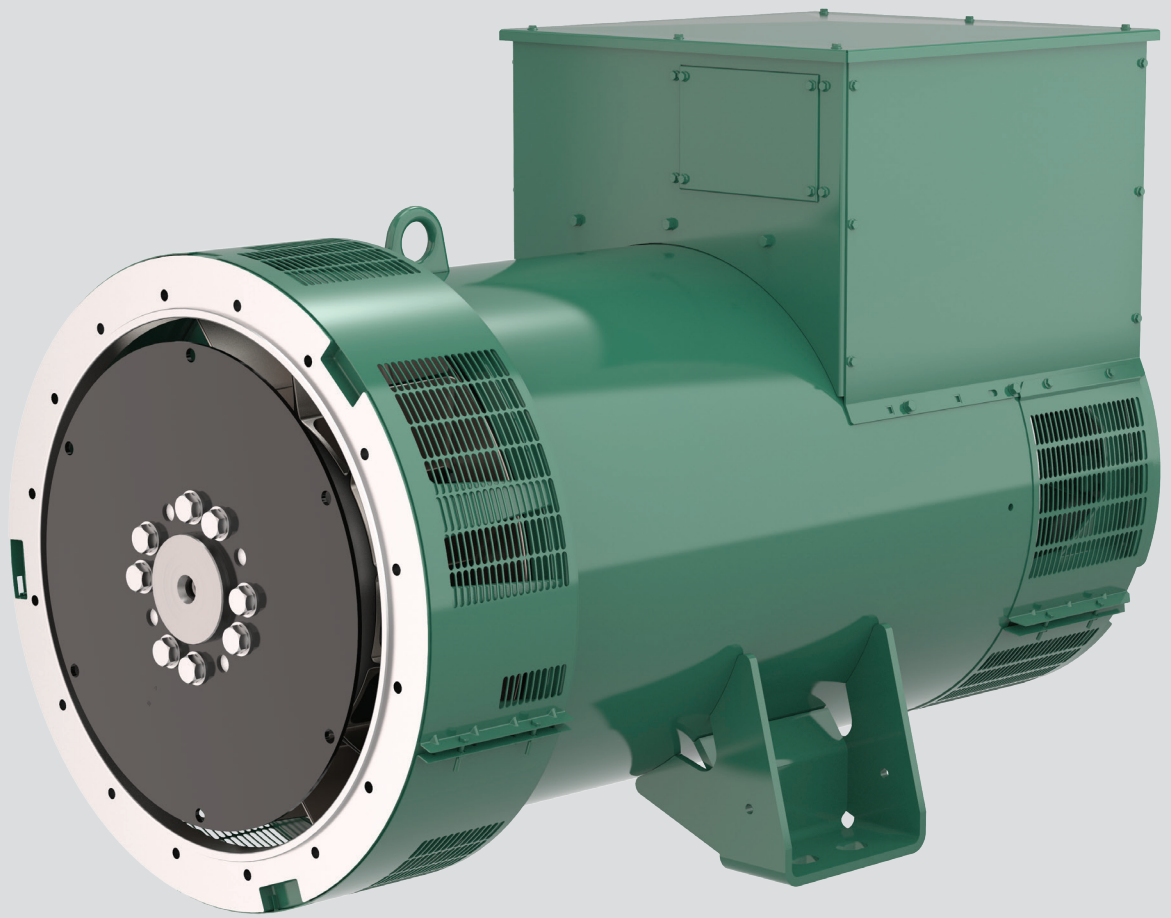




# LSA 49.3

## Low Voltage Alternator - 4 pole

660 to 1000 kVA - 50 Hz / 825 to 1250 kVA - 60 Hz  
Electrical and mechanical data

**LEROY-SOMER**™

***Nidec***  
All for dreams

## Specially adapted to applications

The LSA 49.3 alternator is designed to be suitable for typical generator applications, such as: backup, prime power, cogeneration, marine applications, rental, telecommunications, etc.

## Compliant with international standards

The LSA 49.3 alternator conforms to the main international standards and regulations: IEC 60034, NEMA MG 1.32-33, ISO 8528-3, CSA C22.2 n°100-14, UL 1446 (UL 1004 on request), marine regulations, etc.

It can be integrated into a EC marked generator.

The LSA 49.3 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 re-connectable winding, 2/3 pitch, type no. 6S (12 wire on request)
- Voltage range 50 Hz: 380V - 400V - 415V and 220V - 230V - 240V
- Voltage range 60 Hz: 380V - 416V - 440V - 480V and 220V - 240V
- High efficiency and motor starting capacity
- Other voltages are possible with optional adapted windings:
  - 50 Hz : 440 V (n° 7), 500 V (n° 9), 600 V (n° 22 or 23), 690 V (n° 10 or 52)
  - 60 Hz : 380 V and 416 V (n° 8), 600 V (n° 9)
- Complies with EN 61000-6-3, EN 61000-6-2, EN 55011, group 1 class B for European zone (EC marking)

## Excitation and regulation system suited to the application

| Excitation system |          |              | Regulation options                          |                   |                 |                              |
|-------------------|----------|--------------|---------------------------------------------|-------------------|-----------------|------------------------------|
| Voltage regulator | AREP     | PMG (option) | C.T.<br>Current transformer for paralleling | Mains paralleling | 3-phase sensing | Remote voltage potentiometer |
| D350              | Standard | Standard     | √                                           | -                 | √               | √                            |
| D550              | Option   | Option       | √                                           | √                 | √               | √                            |

√ : Possible option

## Protection system suited to the environment

- The LSA 49.3 is IP 23
- Standard winding protection for clean environments with relative humidity  $\leq 95\%$ , 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 winding 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
- Sealed for life ball bearings, regreasable bearings (optional)
- Standard direction of rotation: clockwise when looking at the drive end view (for anti-clockwise, derate the machine by 5%)

## Accessible terminal box proportioned for optional equipment

- Easy access to the voltage regulator and to the connections
- Possible inclusion of accessories for paralleling, protection and measurement
- Connection bar for reconnecting voltage

## General characteristics

|                  |                                                           |                                    |                                |
|------------------|-----------------------------------------------------------|------------------------------------|--------------------------------|
| Insulation class | H                                                         | Excitation system                  | AREP / PMG                     |
| Winding pitch    | 2/3 (winding 6S)                                          | AVR type                           | D350                           |
| Number of wires  | 6 (12 option)                                             | Voltage regulation (*)             | ± 0.25%                        |
| Protection       | IP 23                                                     | Short-circuit current              | 300% (3 IN) : 10s              |
| Altitude         | ≤ 1000 m                                                  | Total Harmonic distortion THD (**) | at no load < 4% - on load < 4% |
| Overspeed        | 2250 min <sup>-1</sup>                                    | Waveform: NEMA = TIF (**)          | < 50                           |
| Air flow         | 1 m <sup>3</sup> /s (50Hz) / 1.2 m <sup>3</sup> /s (60Hz) | Waveform: IEC = THF (**)           | < 2%                           |

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

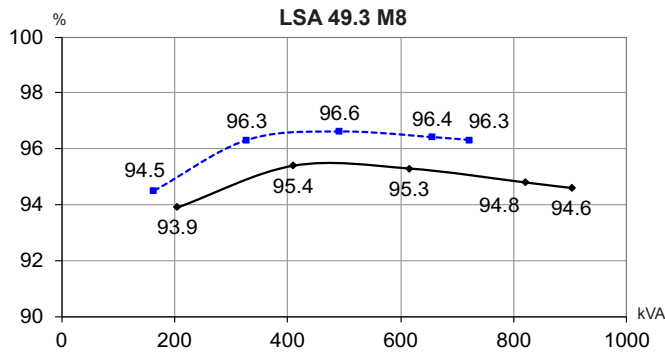
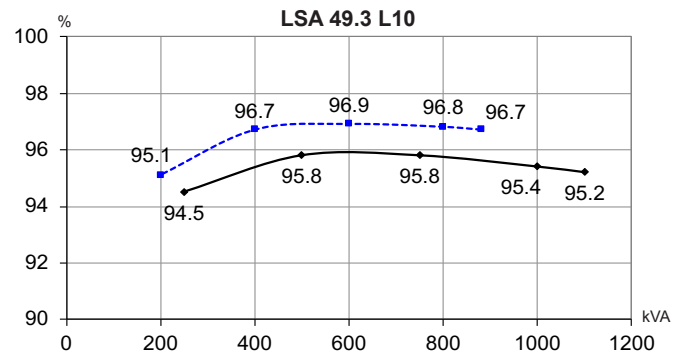
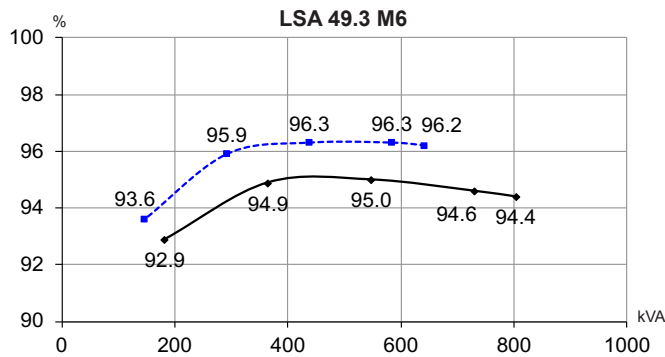
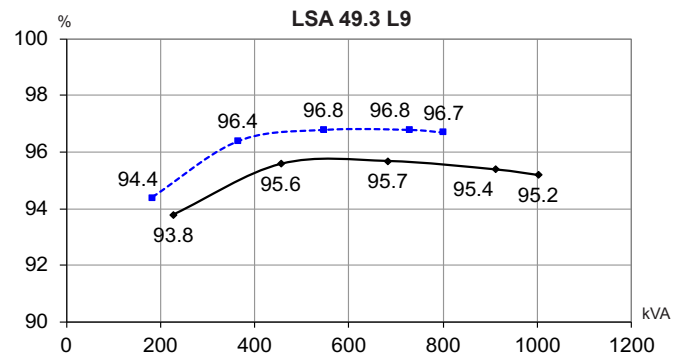
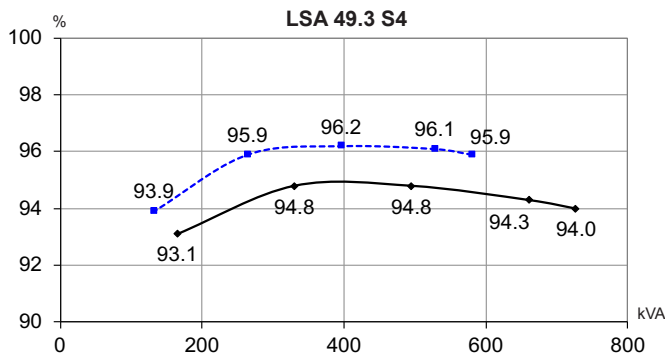
## Ratings 50 Hz - 1500 R.P.M.

| kVA / kW - P.F. = 0.8 |     |                      |      |      |      |                      |      |      |      |               |      |      |      |               |      |      |      |
|-----------------------|-----|----------------------|------|------|------|----------------------|------|------|------|---------------|------|------|------|---------------|------|------|------|
| Duty/T°C              |     | Continuous duty/40°C |      |      |      | 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 |      |
| YY                    |     | 220V                 |      |      |      | 220V                 |      |      |      | 220V          |      |      |      | 220V          |      |      |      |
| LSA 49.3 S4           | kVA | 660                  | 660  | 660  | 620  | 595                  | 595  | 595  | 560  | 725           | 725  | 725  | 685  | 745           | 745  | 745  | 715  |
|                       | kW  | 528                  | 528  | 528  | 496  | 476                  | 476  | 476  | 448  | 580           | 580  | 580  | 548  | 596           | 596  | 596  | 572  |
| LSA 49.3 M6           | kVA | 730                  | 730  | 730  | 665  | 660                  | 660  | 660  | 600  | 780           | 780  | 780  | 730  | 810           | 810  | 810  | 765  |
|                       | kW  | 584                  | 584  | 584  | 532  | 528                  | 528  | 528  | 480  | 624           | 624  | 624  | 584  | 648           | 648  | 648  | 612  |
| LSA 49.3 M8           | kVA | 820                  | 820  | 820  | 810  | 760                  | 760  | 760  | 710  | 910           | 910  | 910  | 885  | 945           | 945  | 945  | 925  |
|                       | kW  | 656                  | 656  | 656  | 648  | 608                  | 608  | 608  | 568  | 728           | 728  | 728  | 708  | 756           | 756  | 756  | 740  |
| LSA 49.3 L9           | kVA | 910                  | 910  | 910  | 820  | 820                  | 820  | 820  | 740  | 1000          | 1000 | 1000 | 920  | 1020          | 1020 | 1020 | 965  |
|                       | kW  | 728                  | 728  | 728  | 656  | 656                  | 656  | 656  | 592  | 800           | 800  | 800  | 736  | 816           | 816  | 816  | 772  |
| LSA 49.3 L10          | kVA | 1000                 | 1000 | 1000 | 950  | 900                  | 900  | 900  | 840  | 1085          | 1085 | 1085 | 1030 | 1130          | 1130 | 1130 | 1080 |
|                       | kW  | 800                  | 800  | 800  | 760  | 720                  | 720  | 720  | 672  | 868           | 868  | 868  | 824  | 904           | 904  | 904  | 864  |

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

| kVA / kW - P.F. = 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.                |      |      |      | 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 49.3 S4           | kVA | 653                  | 715  | 756  | 825  | 588                  | 644  | 681  | 743  | 693           | 758  | 802  | 875  | 718           | 787  | 832  | 908  |
|                       | kW  | 522                  | 572  | 605  | 660  | 470                  | 515  | 545  | 594  | 554           | 606  | 642  | 700  | 574           | 630  | 666  | 726  |
| LSA 49.3 M6           | kVA | 725                  | 795  | 840  | 915  | 655                  | 715  | 760  | 825  | 770           | 845  | 890  | 970  | 800           | 875  | 925  | 1005 |
|                       | kW  | 580                  | 636  | 672  | 732  | 524                  | 572  | 608  | 660  | 616           | 676  | 712  | 776  | 640           | 700  | 740  | 804  |
| LSA 49.3 M8           | kVA | 815                  | 890  | 940  | 1025 | 735                  | 805  | 850  | 925  | 865           | 945  | 1000 | 1090 | 895           | 980  | 1040 | 1130 |
|                       | kW  | 652                  | 712  | 752  | 820  | 588                  | 644  | 680  | 740  | 692           | 756  | 800  | 872  | 716           | 784  | 832  | 904  |
| LSA 49.3 L9           | kVA | 905                  | 990  | 1045 | 1140 | 815                  | 895  | 940  | 1025 | 960           | 1050 | 1110 | 1210 | 1000          | 1090 | 1155 | 1255 |
|                       | kW  | 724                  | 792  | 836  | 912  | 652                  | 716  | 752  | 820  | 768           | 840  | 888  | 968  | 800           | 872  | 924  | 1004 |
| LSA 49.3 L10          | kVA | 990                  | 1083 | 1146 | 1250 | 891                  | 975  | 1031 | 1125 | 1049          | 1148 | 1215 | 1325 | 1089          | 1192 | 1260 | 1375 |
|                       | kW  | 792                  | 866  | 917  | 1000 | 713                  | 780  | 825  | 900  | 839           | 918  | 972  | 1060 | 871           | 954  | 1008 | 1100 |

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



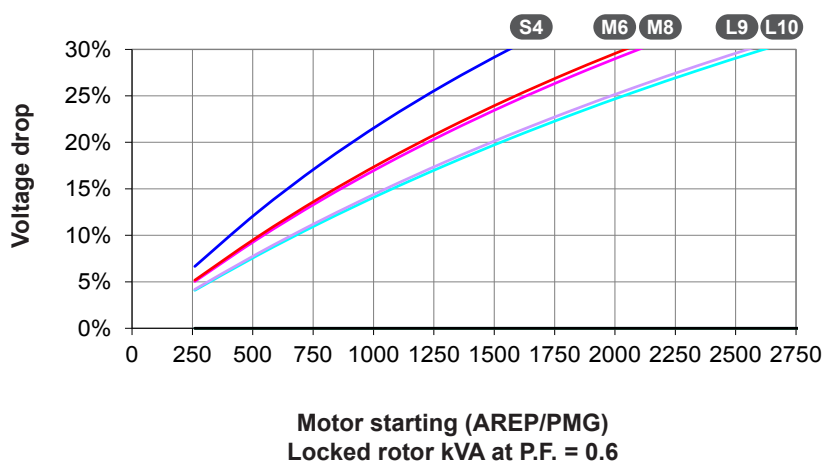
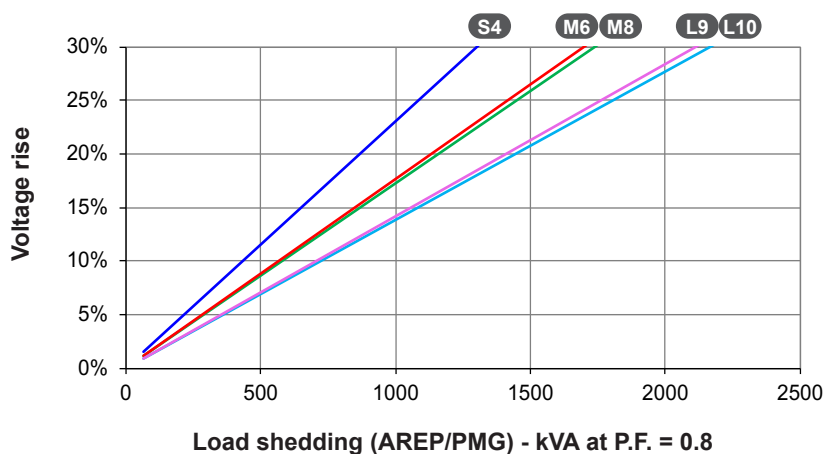
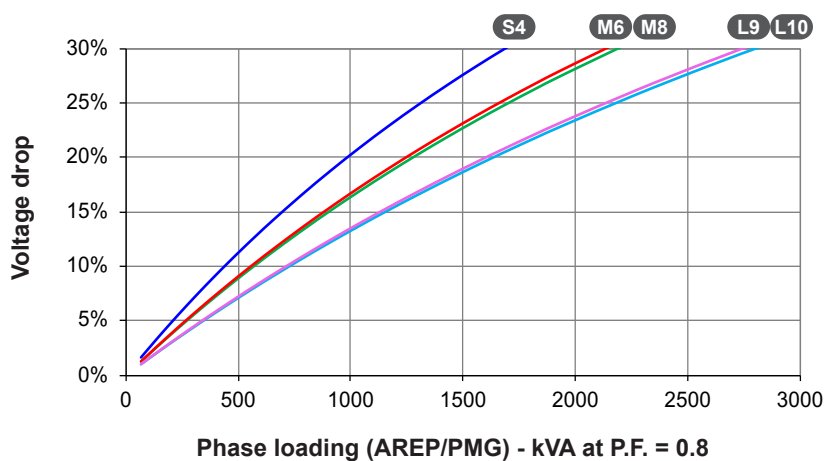
**Reactances (%). Time constants (ms) - Class H / 400 V**

|                                                              | S4    | M6   | M8    | L9    | L10   |
|--------------------------------------------------------------|-------|------|-------|-------|-------|
| <b>Kcc</b> Short-circuit ratio                               | 0.33  | 0.42 | 0.34  | 0.41  | 0.34  |
| <b>Xd</b> Direct-axis synchro. reactance unsaturated         | 350   | 294  | 348   | 303   | 348   |
| <b>Xq</b> Quadrature-axis synchro. reactance unsaturated     | 178   | 150  | 177   | 154   | 177   |
| <b>T'do</b> No-load transient time constant                  | 2002  | 2074 | 2094  | 2138  | 2153  |
| <b>X'd</b> Direct-axis transient reactance saturated         | 17.5  | 14.2 | 16.6  | 14.1  | 16.1  |
| <b>T'd</b> Short-circuit transient time constant             | 100   | 100  | 100   | 100   | 100   |
| <b>X''d</b> Direct-axis subtransient reactance saturated     | 14    | 11.3 | 13.3  | 11.3  | 12.9  |
| <b>T''d</b> Subtransient time constant                       | 10    | 10   | 10    | 10    | 10    |
| <b>X''q</b> Quadrature-axis subtransient reactance saturated | 16.3  | 12.8 | 14.9  | 12.4  | 14.1  |
| <b>Xo</b> Zero sequence reactance                            | 0.72  | 0.59 | 0.69  | 0.59  | 0.67  |
| <b>X2</b> Negative sequence reactance saturated              | 15.17 | 12.1 | 14.11 | 11.92 | 13.53 |
| <b>Ta</b> Armature time constant                             | 15    | 15   | 15    | 15    | 15    |

**Other class H / 400 V data**

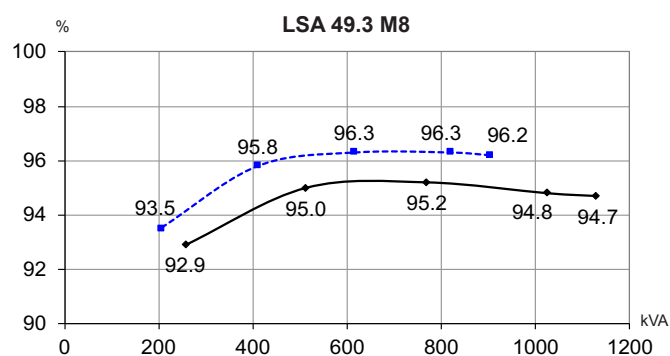
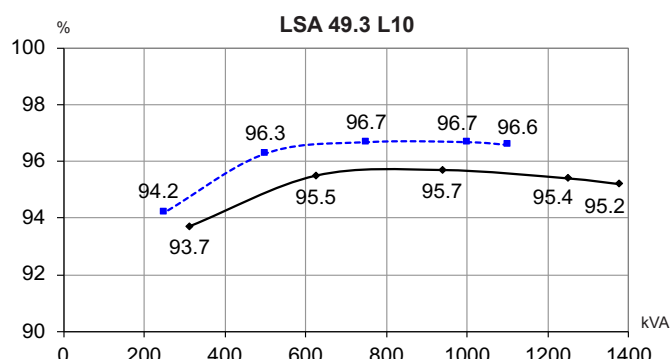
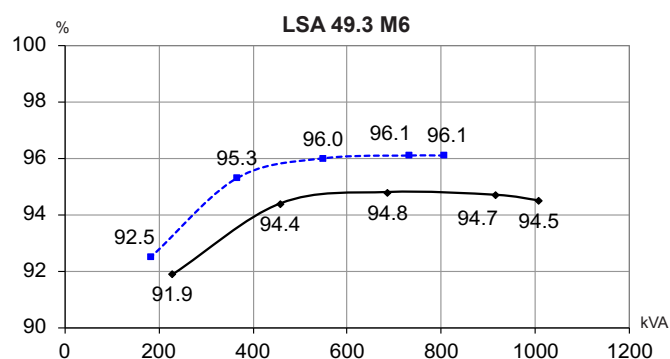
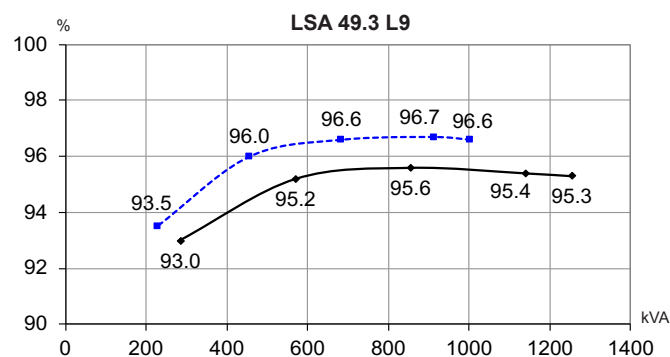
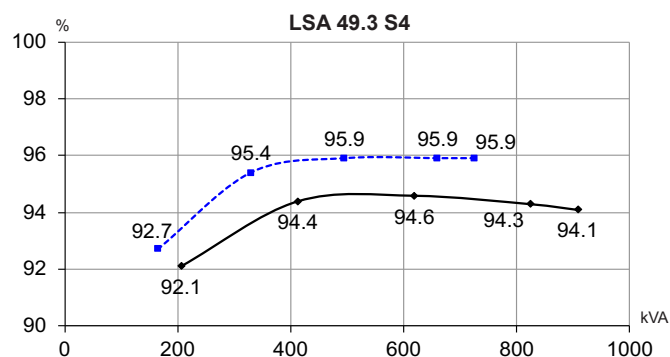
|                                                                        |       |       |       |       |       |
|------------------------------------------------------------------------|-------|-------|-------|-------|-------|
| <b>io (A)</b> No-load excitation current                               | 0.99  | 1.11  | 0.87  | 0.99  | 0.9   |
| <b>ic (A)</b> On-load excitation current                               | 4.04  | 3.8   | 3.52  | 3.46  | 3.62  |
| <b>uc (V)</b> On-load excitation voltage                               | 46    | 43.2  | 39.9  | 39.1  | 40.9  |
| <b>ms</b> Response time ( $\Delta U = 20\%$ transient)                 | 500   | 500   | 500   | 500   | 500   |
| <b>kVA</b> Start ( $\Delta U = 20\%$ cont. or 30% trans.)              | 1560  | 2050  | 2050  | 2600  | 2600  |
| <b>%</b> Transient $\Delta U$ (on-load 4/4) - P.F.: 0.8 <sub>LAG</sub> | 14.4  | 12.6  | 14.2  | 12.2  | 13.6  |
| <b>W</b> No-load losses                                                | 7968  | 9374  | 8753  | 10104 | 9556  |
| <b>W</b> Heat dissipation                                              | 31765 | 32819 | 35599 | 34562 | 38447 |

## Transient voltage variation 400V - 50 Hz



- 1) For a starting P.F. other than 0.6, the starting kVA must be multiplied by  $K = \text{Sine P.F.} / 0.8$
- 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 480V - 60 Hz (..... P.F.: 1) (— P.F.: 0.8)



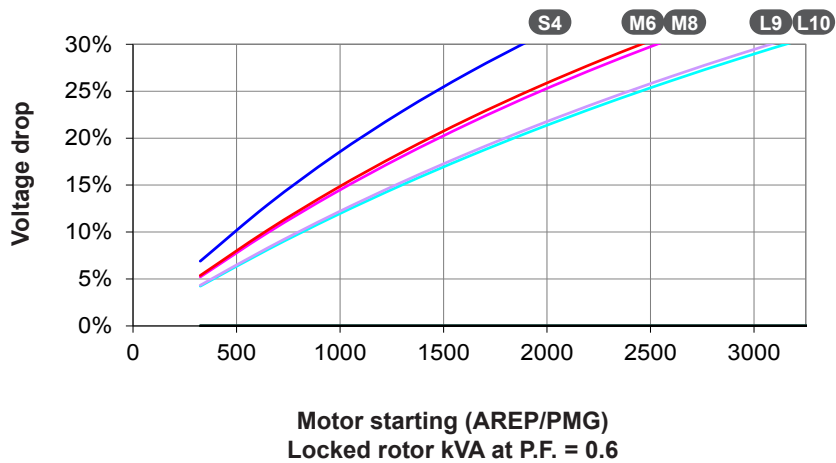
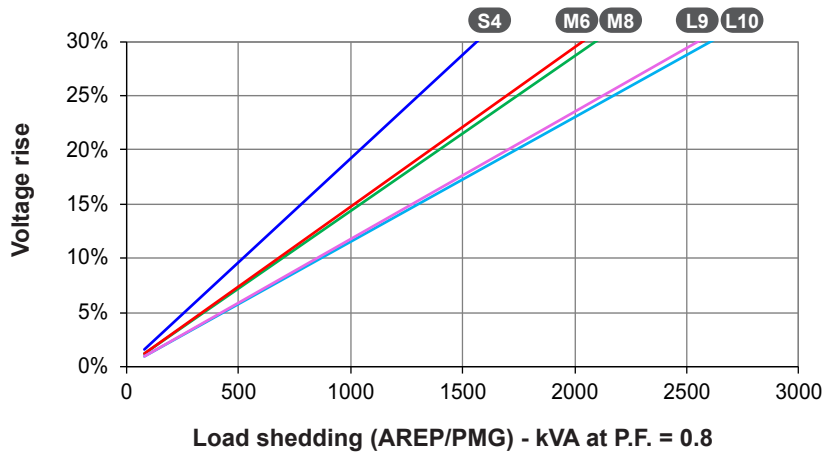
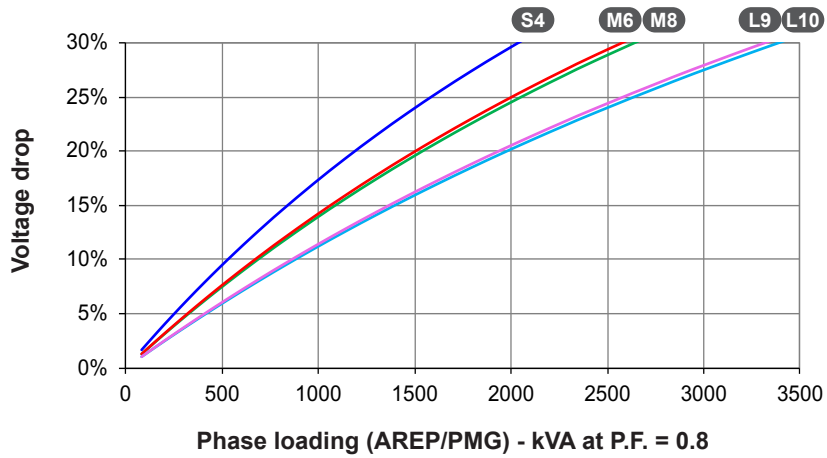
## Reactances (%). Time constants (ms) - Class H / 480 V

|                                                              | S4   | M6    | M8   | L9    | L10  |
|--------------------------------------------------------------|------|-------|------|-------|------|
| <b>Kcc</b> Short-circuit ratio                               | 0.32 | 0.4   | 0.32 | 0.4   | 0.33 |
| <b>Xd</b> Direct-axis synchro. reactance unsaturated         | 365  | 307   | 362  | 317   | 363  |
| <b>Xq</b> Quadrature-axis synchro. reactance unsaturated     | 186  | 156   | 185  | 161   | 185  |
| <b>T'do</b> No-load transient time constant                  | 2002 | 2074  | 2094 | 2138  | 2153 |
| <b>X'd</b> Direct-axis transient reactance saturated         | 18.2 | 14.8  | 17.3 | 14.8  | 16.8 |
| <b>T'd</b> Short-circuit transient time constant             | 100  | 100   | 100  | 100   | 100  |
| <b>X''d</b> Direct-axis subtransient reactance saturated     | 14.5 | 11.8  | 13.8 | 11.8  | 13.4 |
| <b>T''d</b> Subtransient time constant                       | 10   | 10    | 10   | 10    | 10   |
| <b>X''q</b> Quadrature-axis subtransient reactance saturated | 17   | 13.4  | 15.5 | 13    | 14.7 |
| <b>Xo</b> Zero sequence reactance                            | 0.76 | 0.61  | 0.72 | 0.61  | 0.7  |
| <b>X2</b> Negative sequence reactance saturated              | 15.8 | 12.64 | 14.7 | 12.44 | 14.1 |
| <b>Ta</b> Armature time constant                             | 15   | 15    | 15   | 15    | 15   |

### Other class H / 480 V data

|                                                                        |       |       |       |       |       |
|------------------------------------------------------------------------|-------|-------|-------|-------|-------|
| <b>io (A)</b> No-load excitation current                               | 0.99  | 1.11  | 0.87  | 0.99  | 0.9   |
| <b>ic (A)</b> On-load excitation current                               | 4.14  | 3.89  | 3.6   | 3.53  | 3.69  |
| <b>uc (V)</b> On-load excitation voltage                               | 47.3  | 44.4  | 41    | 40.2  | 41.9  |
| <b>ms</b> Response time ( $\Delta U = 20\%$ transient)                 | 500   | 500   | 500   | 500   | 500   |
| <b>kVA</b> Start ( $\Delta U = 20\%$ cont. or 30% trans.)              | 1950  | 2565  | 2565  | 3250  | 3250  |
| <b>%</b> Transient $\Delta U$ (on-load 4/4) - P.F.: 0.8 <sub>LAG</sub> | 14.9  | 13    | 14.7  | 12.7  | 14    |
| <b>W</b> No-load losses                                                | 12441 | 14387 | 13586 | 15384 | 14640 |
| <b>W</b> Heat dissipation                                              | 39236 | 40967 | 44074 | 43239 | 47530 |

## Transient voltage variation 480V - 60 Hz

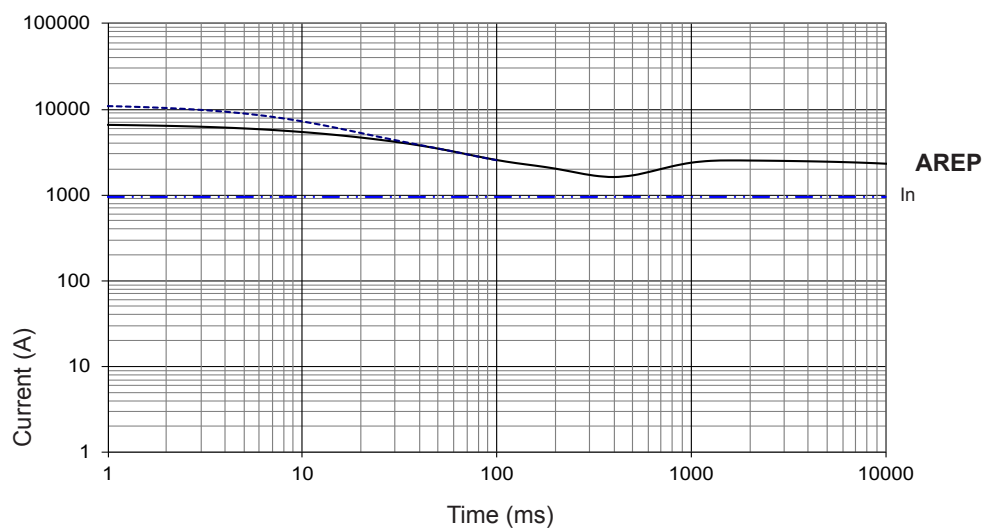


- 1) For a starting P.F. other than 0.6, the starting kVA must be multiplied by  $K = \text{Sine P.F.} / 0.8$
- 2) For voltages other than 480V (Y), 277V ( $\Delta$ ), 240V (YY) at 60 Hz, then kVA must be multiplied by  $(480/U)^2$  or  $(277/U)^2$  or  $(240/U)^2$ .

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

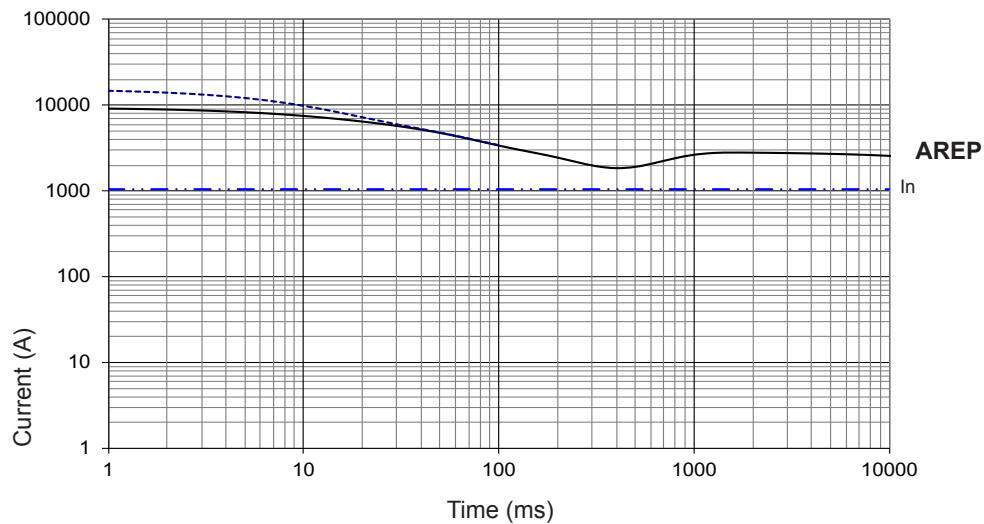
#### LSA 49.3 S4

Symmetrical —  
Asymmetrical - - -



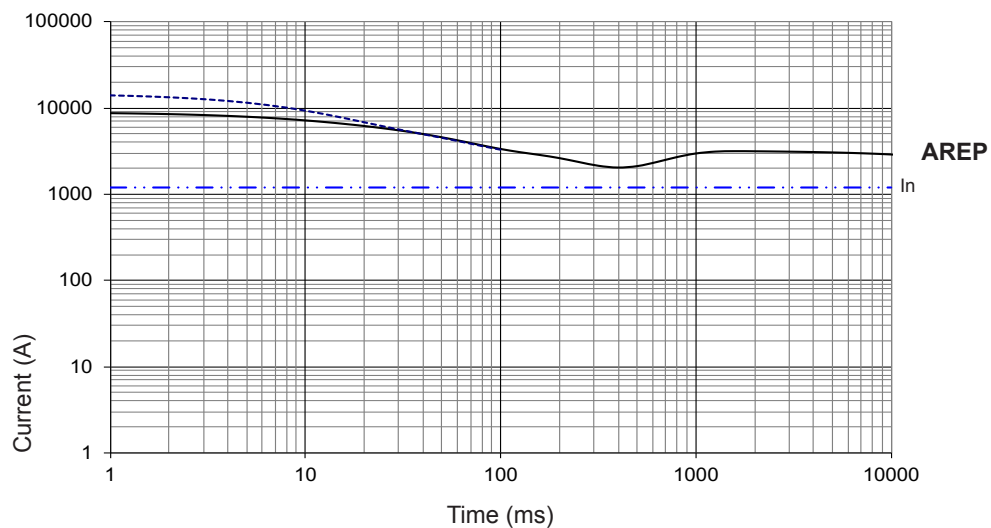
#### LSA 49.3 M6

Symmetrical —  
Asymmetrical - - -



#### LSA 49.3 M8

Symmetrical —  
Asymmetrical - - -



#### Influence due to connection

Curves shown are for star (Y) connection.

For other connections, use the following multiplication factors:

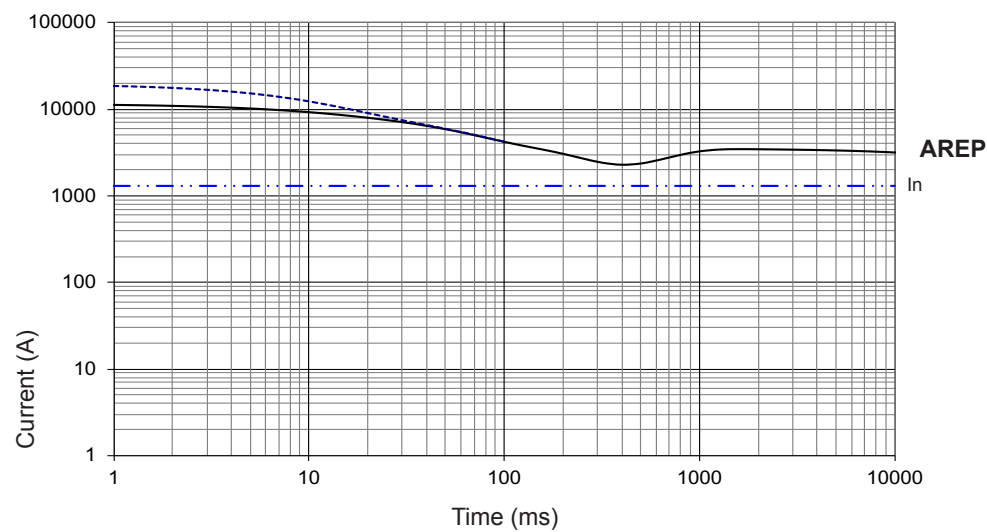
- Series delta : current value x 1.732 - Parallel star : current value x 2



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

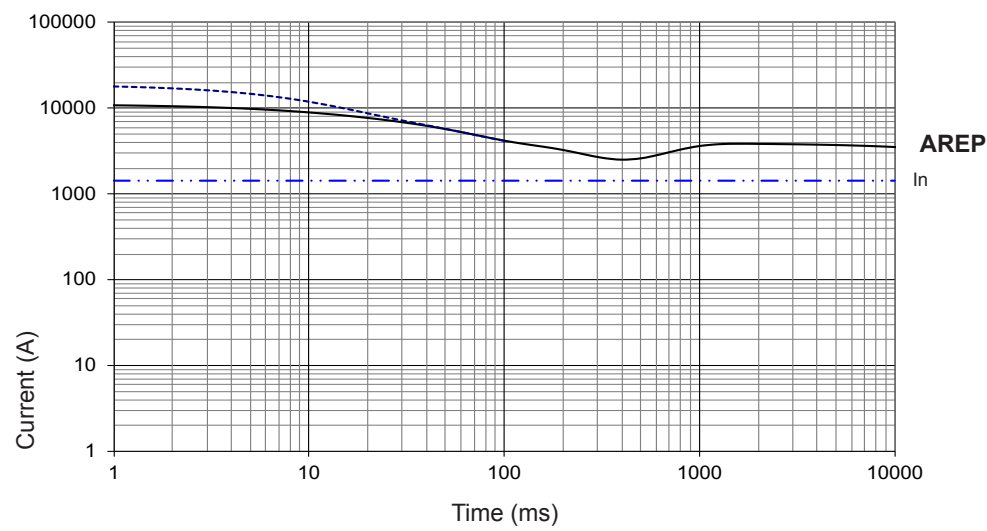
LSA 49.3 L9

Symmetrical —  
Asymmetrical - - -



LSA 49.3 L10

Symmetrical —  
Asymmetrical - - -

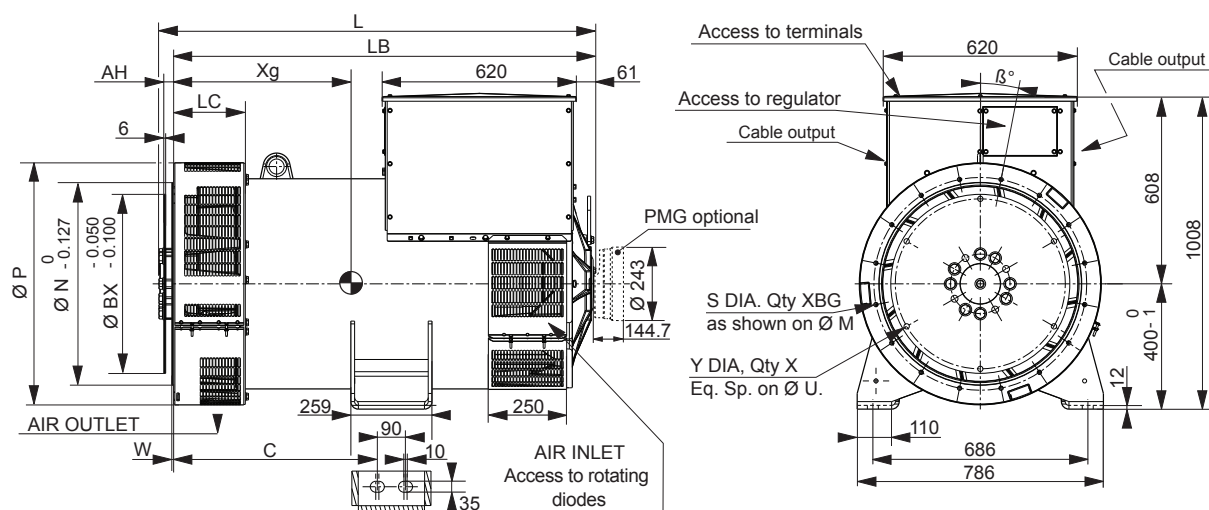


Influence due to short-circuit

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

| Type         | L without PMG maxi* | LB     | C   | Xg  | Weight (kg) |
|--------------|---------------------|--------|-----|-----|-------------|
| LSA 49.3 S4  | 1297.4              | 1256.5 | 560 | 590 | 1431        |
| LSA 49.3 M6  | 1387.4              | 1346.5 | 650 | 629 | 1578        |
| LSA 49.3 M8  | 1387.4              | 1346.5 | 650 | 636 | 1639        |
| LSA 49.3 L9  | 1477.4              | 1436.5 | 650 | 673 | 1792        |
| LSA 49.3 L10 | 1477.4              | 1436.5 | 650 | 681 | 1841        |

\* L maxi = LB + AH maxi + 15.5

### Flange (mm)

| S.A.E. | P   | N       | M       | LC    | XBG | S  | W | β°      |
|--------|-----|---------|---------|-------|-----|----|---|---------|
| 1      | 773 | 511.175 | 530.225 | 228.5 | 12  | 12 | 6 | 15°     |
| 1/2    | 773 | 584.2   | 619.125 | 228.5 | 12  | 14 | 6 | 15°     |
| 0      | 773 | 647.7   | 679.45  | 228.5 | 16  | 14 | 6 | 11° 15' |
| 00     | 883 | 787.4   | 850.9   | 245   | 16  | 14 | 7 | 11° 15' |

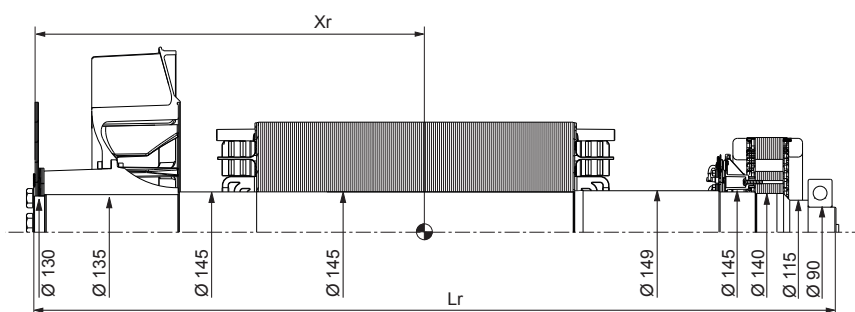
### Flex plate (mm)

| S.A.E. | BX    | U      | X | Y  | AH   |
|--------|-------|--------|---|----|------|
| 14     | 466.7 | 438.15 | 8 | 14 | 25.4 |
| 18     | 571.5 | 542.92 | 6 | 17 | 15.7 |

### Coupling

| Flex plate       | 14 | 18 |
|------------------|----|----|
| Flange S.A.E 1   | X  |    |
| Flange S.A.E 1/2 | X  |    |
| Flange S.A.E 0   | X  | X  |
| Flange S.A.E 00  |    | X  |

## Torsional analysis data



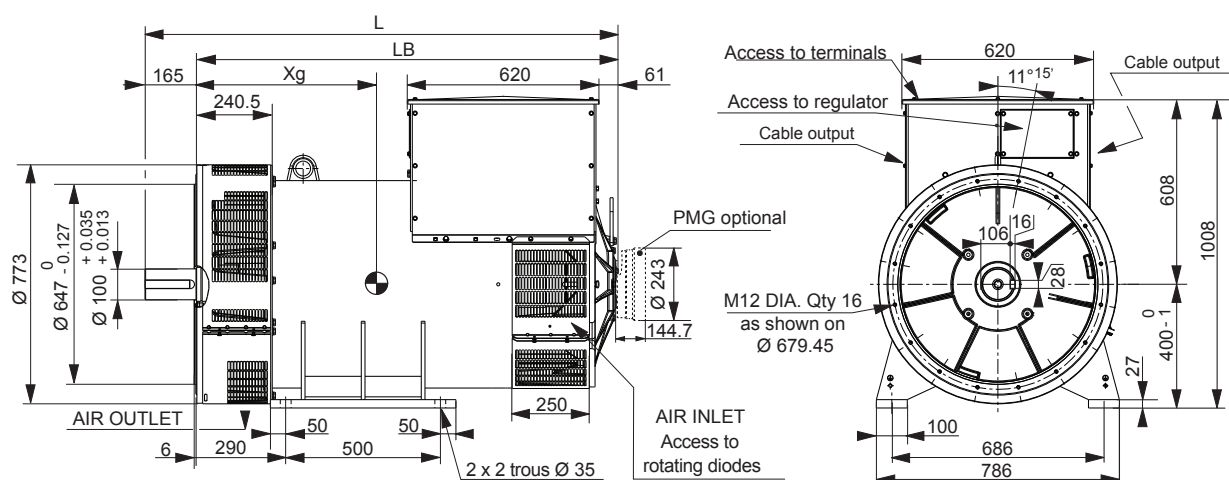
### Centre of gravity: Xr (mm), Rotor length: Lr (mm), Weight: M (kg), Moment of inertia: J (kgm²): (4J = MD²)

| Flange       | S.A.E. 14 |      |     |       | S.A.E. 18 |      |     |       |
|--------------|-----------|------|-----|-------|-----------|------|-----|-------|
| Type         | Xr        | Lr   | M   | J     | Xr        | Lr   | M   | J     |
| LSA 49.3 S4  | 584       | 1255 | 539 | 8.51  | 572       | 1255 | 541 | 8.77  |
| LSA 49.3 M6  | 626       | 1345 | 602 | 9.61  | 614       | 1345 | 604 | 9.87  |
| LSA 49.3 M8  | 634       | 1345 | 628 | 10.16 | 622       | 1345 | 630 | 10.42 |
| LSA 49.3 L9  | 671       | 1435 | 684 | 11.12 | 659       | 1435 | 686 | 11.38 |
| LSA 49.3 L10 | 681       | 1435 | 701 | 11.48 | 669       | 1435 | 703 | 11.74 |

**NOTE :** Dimensions are for information only and may be subject to modifications. Contractual 2D drawings can be downloaded from the Leroy-Somer site, 3D drawing files are available upon request.

The torsional analysis of the transmission is imperative. All values are available upon request.

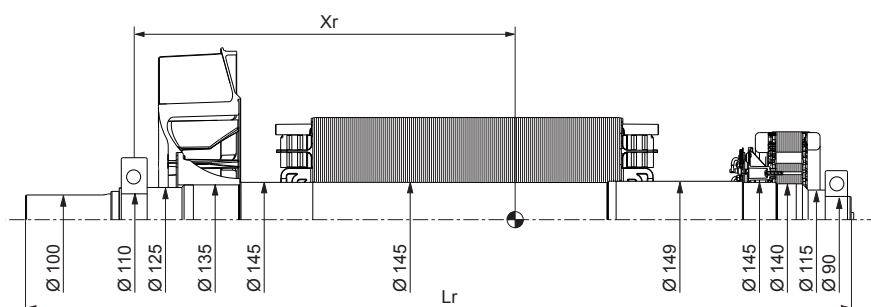
## Two bearing dimensions



Dimensions (mm) and weight

| Type         | L without PMG | LB     | Xg  | Weight (kg) |
|--------------|---------------|--------|-----|-------------|
| LSA 49.3 S4  | 1439.5        | 1274.5 | 596 | 1480        |
| LSA 49.3 M6  | 1529.5        | 1364.5 | 636 | 1622        |
| LSA 49.3 M8  | 1529.5        | 1364.5 | 643 | 1683        |
| LSA 49.3 L9  | 1619.5        | 1454.5 | 682 | 1835        |
| LSA 49.3 L10 | 1619.5        | 1454.5 | 688 | 1884        |

## 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 49.3 S4  | 545 | 1409 | 512 | 8.07  |
| LSA 49.3 M6  | 584 | 1499 | 574 | 9.18  |
| LSA 49.3 M8  | 590 | 1499 | 600 | 9.73  |
| LSA 49.3 L9  | 627 | 1589 | 656 | 10.69 |
| LSA 49.3 L10 | 634 | 1589 | 673 | 11.05 |

**NOTE :** Dimensions are for information only and may be subject to modifications. Contractual 2D drawings can be downloaded from the Leroy-Somer site, 3D drawing files are available upon request.  
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