



PLSES 4500 IMfinity® Platform



LEROY-SOMER™

IP23 high-speed induction motors
Industrial refrigeration
Variable speed
Frame size 225 to 315
100 to 480 kW

Nidec
— All for dreams

PLSES 4500

The answer to the highly demanding cold storage sector

Companies that use industrial refrigeration equipment have long been aware of the impact that the power consumption of a refrigeration installation can have both on energy bills and on the environment. The cold compressor, at the heart of the system, remains the most energy-consuming element, and can represent up to 80% of total consumption.

OEMs or integrators seek to reduce drastically the power consumption of their machines while maintaining maximum levels of reliability. The use of high-efficiency motors combined with speed variation is an efficient solution for machine regulation under partial load conditions, and for improving the COP⁽¹⁾. This process can reduce power consumption and operating cost by up to 30%.

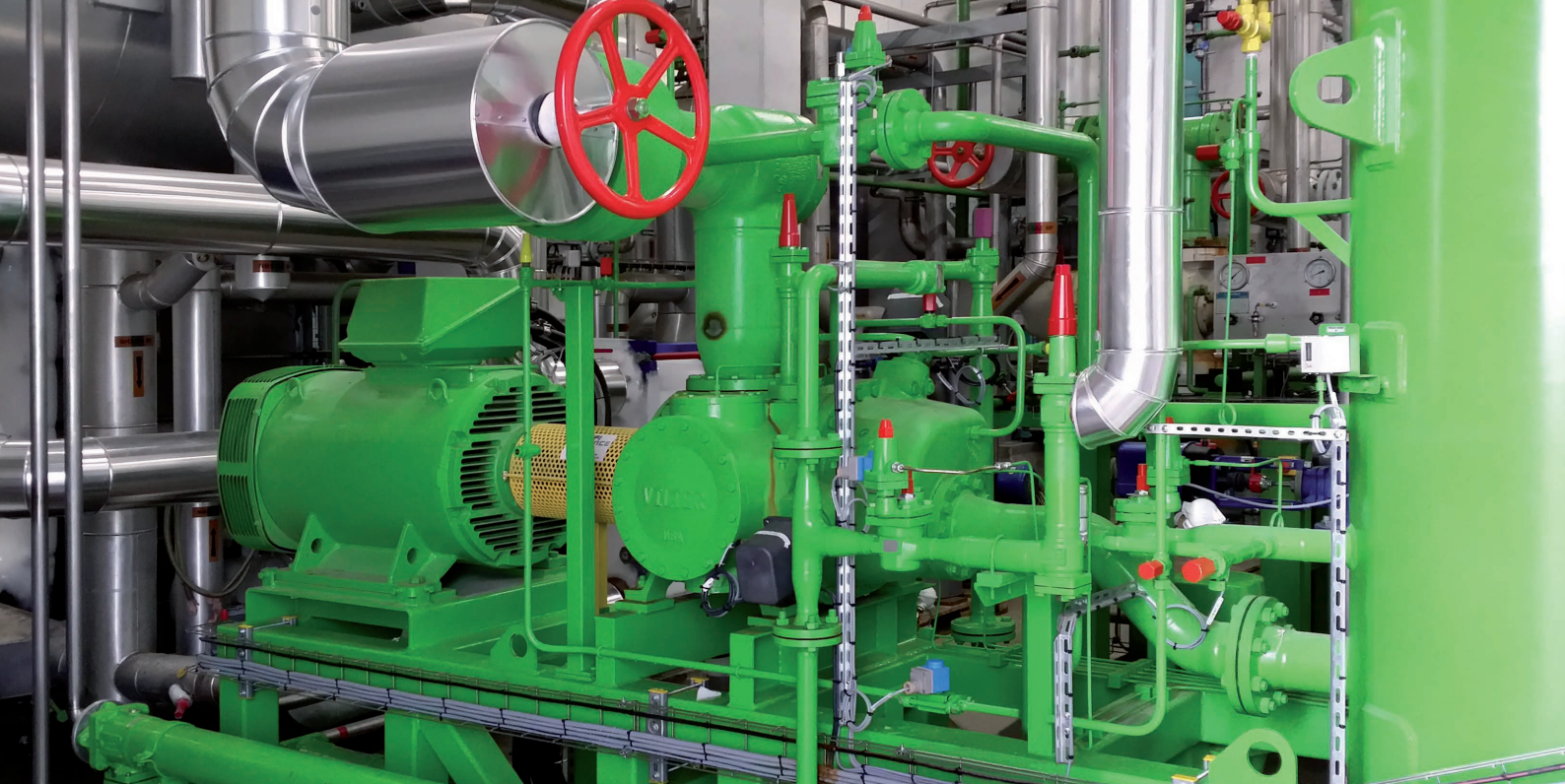
Cutting-edge technologies and technical expertise have made it possible to create new opportunities on the cold compressor market, with the development of a solution that offers even better performance, incorporating a high-speed motor controlled by a frequency inverter. This solution considerably improves compression and generates greater power at the compressor output, and has a direct impact on the size of the machine, by increasing its power-to-weight ratio.

Leroy-Somer has been active in the industrial refrigeration sector for more than 40 years. Drawing on this experience, its IP23 high-efficiency and high-speed PLSSES 4500 induction motors have been specifically designed to meet the requirements of refrigeration compressors.

Reliability you can depend on

The PLSSES 4500 drip-proof motor, based on the IMfinity® platform, combines tried-and-tested induction motor technology with Leroy-Somer's recognised drive systems expertise. These motors, cornerstones of the refrigeration system, whose robust design perfectly meets or even exceeds the industrial refrigeration requirements in terms of reliability, are compliant with the latest European standards.

⁽¹⁾ Coefficient of performance = cooling power / power consumption



Dedicated to high speed

- **Tested and qualified**

Designed to operate at variable speed, the PLSES 4500 has been tested and qualified with Leroy-Somer Powerdrive MD2 high-power variable speed drives, guaranteeing optimum electrical and mechanical performance, obtained thanks to the use of components selected to work together.

- **Rated torque across the entire continuous duty speed range**

PLSES 4500 motors deliver their rated torque over a range from 1000 to 4500 rpm, offering notable power gains at the refrigeration compressor output.

- **Quality of the rotating components**

The choice of robust rotating components, featuring insulated bearings and grounding ring as standard, offers maximum protection to the motor and the driven machine against the circulation of shaft currents, a particularly common phenomenon in high-power applications.

- **Easy connection**

The terminal box is laid out in such a way as to facilitate the connection of thick shielded cables. It also has a set of grounding braids that contribute to the good product immunity to high-frequency electromagnetic interference.

High-efficiency technology

The PLSES 4500 motor benefits from the technological advances of the IMfinity® platform, and offers IE3 efficiency according to IEC 60034-30-2 standard, which defines efficiency classes for variable speed AC motors.

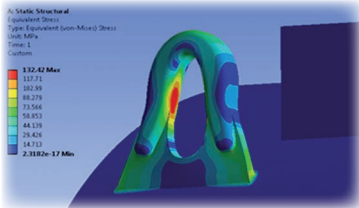
This efficiency level, associated with the undeniable benefits of variable speed control, contributes considerably to reducing the energy bill generated by the refrigeration unit, as well as improving the coefficient of performance (COP).

PLSES 4500

Major assets

Robust mechanics

- Robust design based on simulations and tests
- Machining of complete stator on mandrel for perfect concentricity from magnetic motor axis
- Rigorous balancing for reduced vibration levels (class A across the entire speed range)



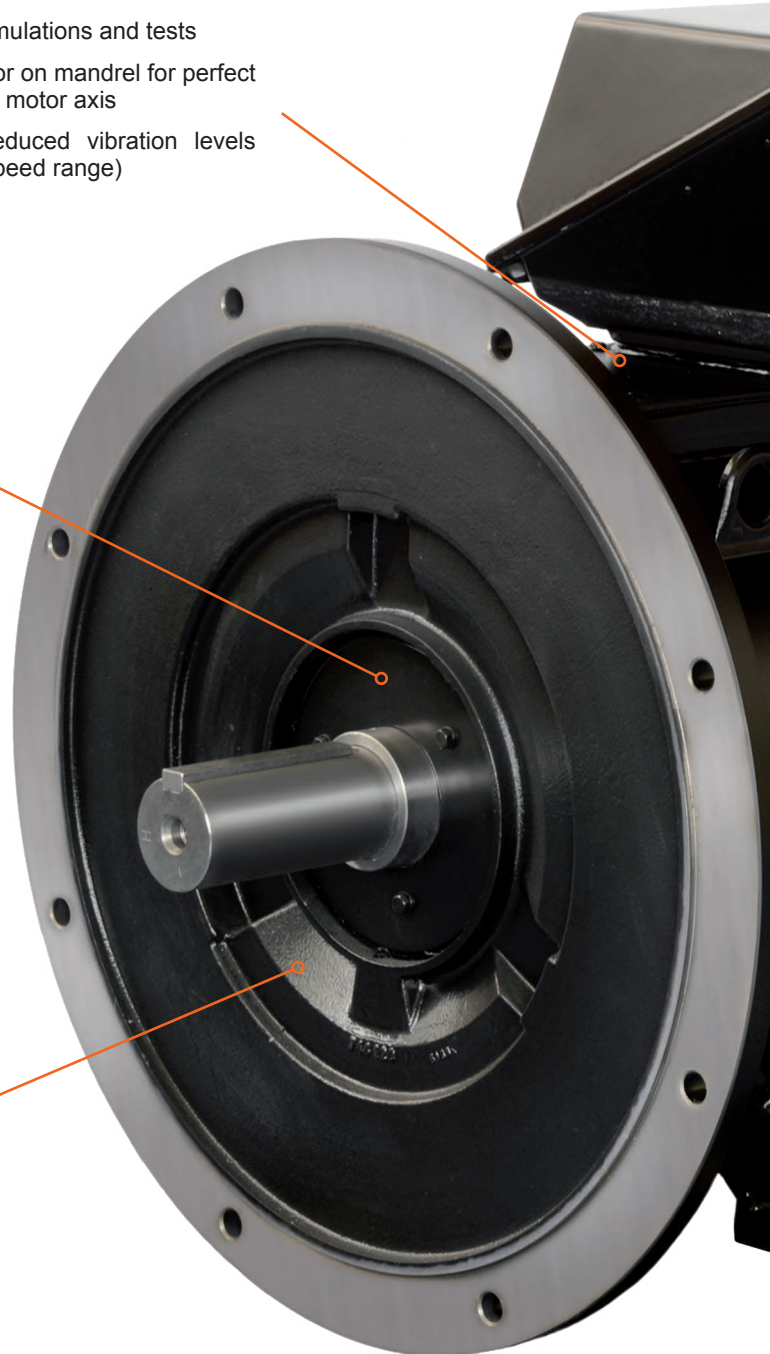
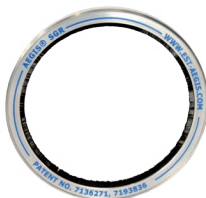
Bearings suited to variable speed

- Insulated non-drive end bearing (NDE) to avoid shaft currents (insulated DE bearing optional)
- Longer service life and lubrication intervals



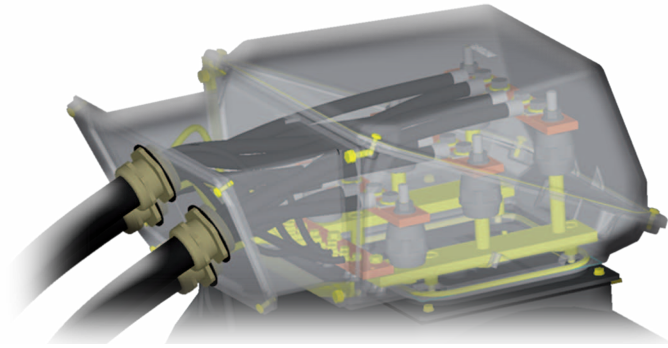
Rotating components protection

- Grounding ring as standard for redirecting shaft currents
- High protection of the motor and driven machine bearings



Easy wiring

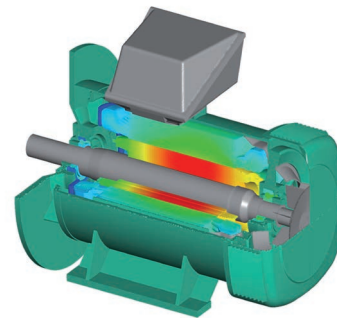
- Large terminal box for easier access and safer connections
- Connecting bar and grounding braids in terminal box for eliminating HF interference



Improved cooling

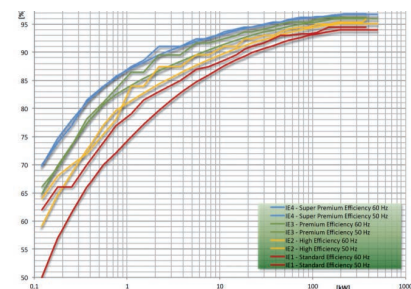
Complete optimisation of the motor cooling system to:

- reduce losses
- prevent hot spots and excessively high temperatures in the bearings
- minimise noise levels



Optimised characteristics

- Electric core designed and characterised to work with a speed drive
- Magnetic circuit optimised to reach IE3 efficiency class



Thermal and mechanical protection

- PTC sensors included in winding as standard. Other sensor models available on request (PT100, PT1000, etc.)
- Machining of vibration sensors as standard (located at 12 o'clock and 3 o'clock on the rear bearing, sensors not supplied)

PLSES 4500

Rated torque from 1000 to 4500 rpm

Electric specifications of motor and associated speed drive

The PLSES 4500 high-speed induction motor associated with the ready-to-use variable speed drive Powerdrive MD2 is a perfect solution for the refrigeration sector. The motor and drive performances have been validated by our technical services, and benefit from all the Leroy-Somer expertise, in terms of both electric motor and frequency inverter.

Power supply: 400V three phase, 50 Hz - Speed drive switching frequency: 2.5 kHz; Ambient temperature: $\leq 40^{\circ}\text{C}$

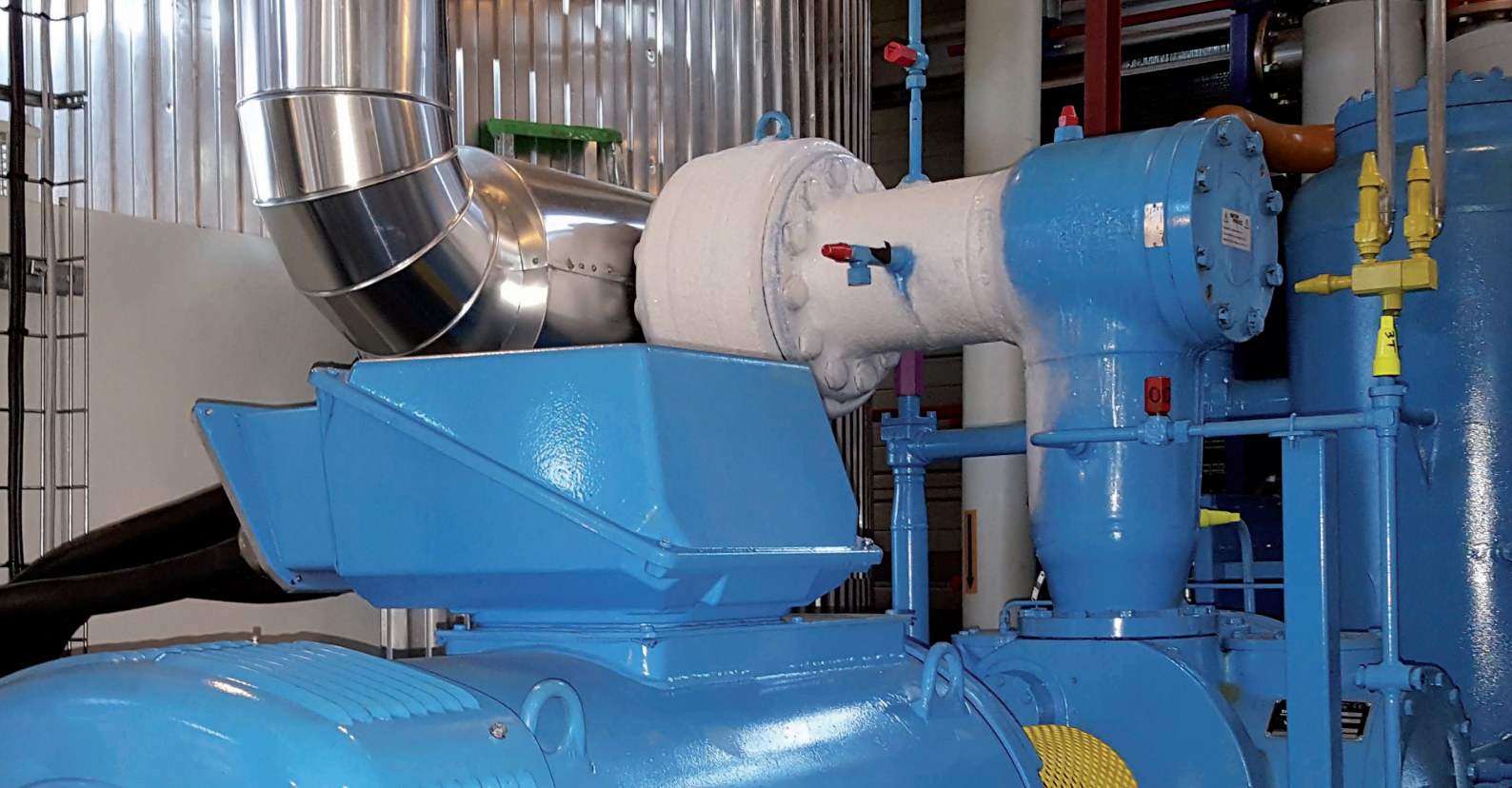
Motor type PLSES 4500	Rated power @ 4500 rpm	Rated torque	Rated current	Efficiency ⁽¹⁾	Power factor	Noise level (Lp) @ 4500 rpm	Weight (IM 2001)	Powerdrive MD2 model ⁽²⁾
	kW	N.m	A	η (4/4)	$\cos \varphi$ (4/4)	dBA	Kg	
PLSES 225 MG	100	212	187	93.9	0.9	91	395	MD2MS 120T
PLSES 250 SF	135	286	251	94.3	0.91	91	476	MD2MS 180T
PLSES 250 MF	170	361	315	94.6	0.91	92	511	MD2MS 220T
PLSES 280 MD	200	424	369	94.7	0.9	95	546	MD2MS 220T
PLSES 315 SU	240	509	453	95	0.89	97	747	MD2MS 270T
PLSES 315 M	260	552	481	95.2	0.91	97	767	MD2S 340T
PLSES 315 L	290	615	552	95.1	0.88	97	837	MD2S 340T
PLSES 315 LD ⁽³⁾	330	700	602	95.6	0.92	97	897	MD2S 400T
PLSES 315 LD ⁽³⁾	370	785	666	95.8	0.93	97	947	MD2S 470T
PLSES 315 LU ⁽³⁾	420	891	772	95.8	0.91	97	997	MD2S 470T
PLSES 315 LU ^{(3) (4)}	480	1019	871	95.6	0.91	89	1077	MD2S 570T

⁽¹⁾ Efficiency class: IE3 as per IEC 60034-30-2.

⁽²⁾ Powerdrive MD2MS: wall-mounting speed drive; Powerdrive MD2S: free-standing speed drive cabinet.

⁽³⁾ Terminal box with inclined extension feed as standard.

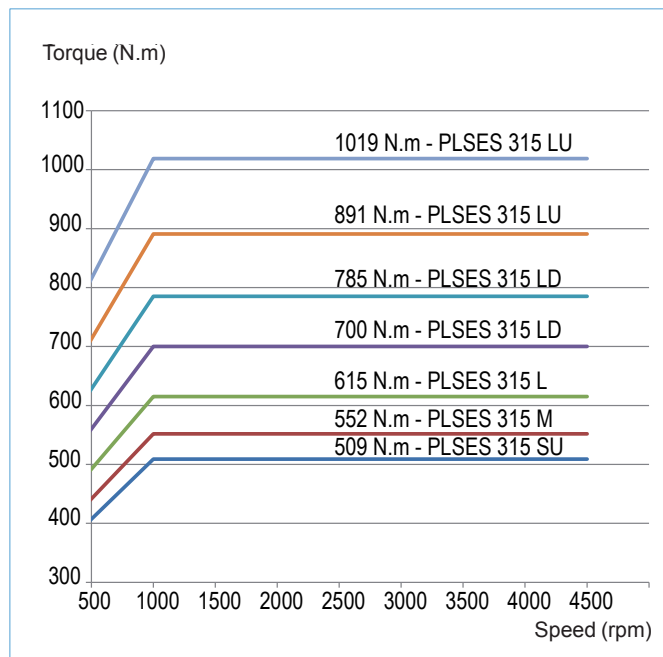
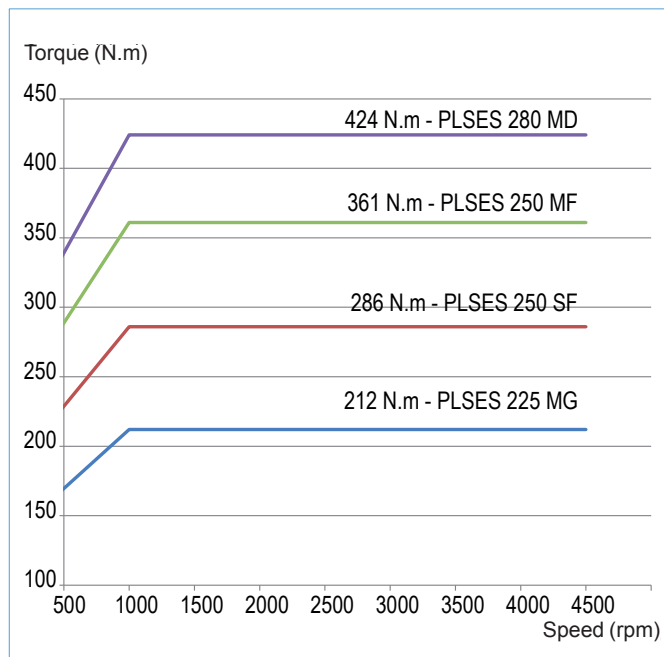
⁽⁴⁾ Forced radial ventilation as standard.



Rated torque from 1000 to 4500 rpm

All PLSES 4500 motors benefit from a rated torque across the 1000 to 4500 rpm speed range with no derating in continuous duty (S1).

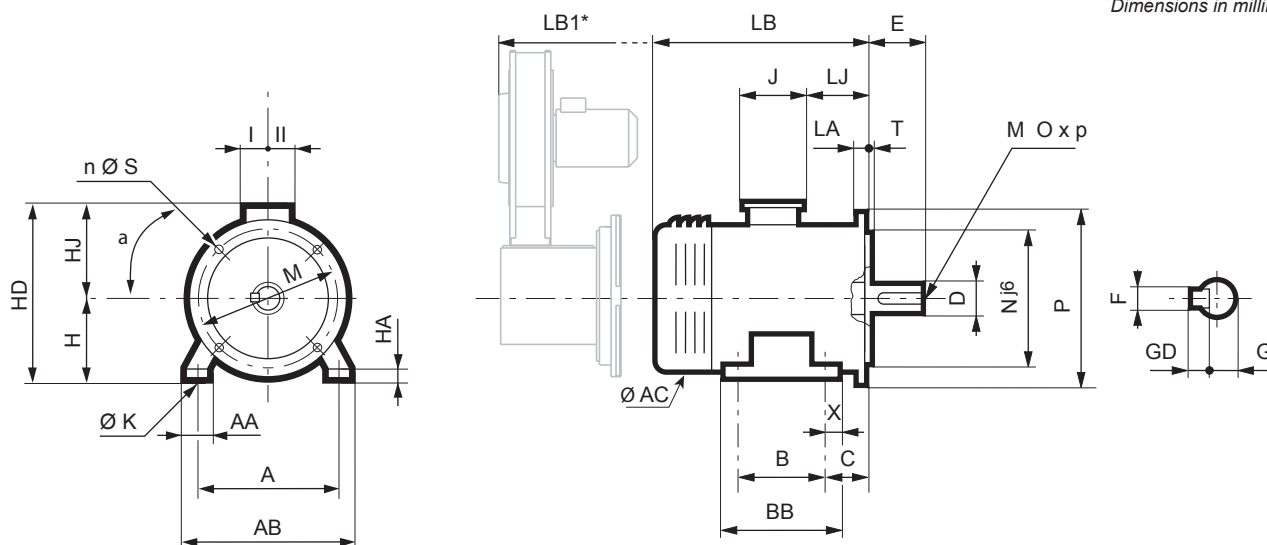
Torque curves



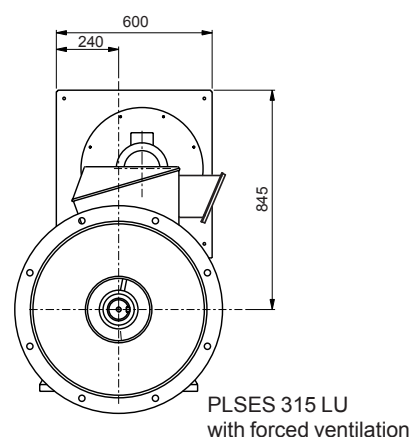
Motor sizes

Shaft end, feet and flange IM 2001 (IM B35) ⁽¹⁾

Dimensions in millimetres



Type	Main shaft end						
	F	GD	D	G	E	O	p
PLSES 225 MG	18	11	60m6	53	140	20	42
PLSES 250 SF	18	11	65m6	58	140	20	42
PLSES 250 MF	18	11	65m6	58	140	20	42
PLSES 280 MD	18	11	65m6	58	140	20	42
PLSES 315 SU	20	12	70m6	62.5	140	20	42
PLSES 315 M	20	12	70m6	62.5	140	20	42
PLSES 315 L	20	12	70m6	62.5	140	20	42
PLSES 315 LD	22	14	80m6	71	170	20	42
PLSES 315 LU	22	14	80m6	71	170	20	42



Type	Main dimensions																			
	A	AB	B	BB	C	X	AA	K	HA	H	AC**	HD	HJ	LB	LB1*	LJ	J	I	II	Symb
PLSES 225 MG	356	416	311	351	149	20	60	19	26	225	469	629	404	824	-	209	292	151	181	FF 500
PLSES 250 SF	406	466	311	397	168	24	60	24	26	250	494	654	404	904	-	209	292	151	181	FF 600
PLSES 250 MF	406	466	349	397	168	24	60	24	26	250	494	654	404	904	-	209	292	151	181	FF 600
PLSES 280 MD	457	517	419	467	190	24	60	24	26	280	524	773	493	904	-	145	420	180	235	FF 600
PLSES 315 SU	508	608	406	486	216	40	100	28	26	315	600	865	550	940	-	241	420	180	235	FF 740
PLSES 315 M	508	608	457	537	216	40	100	28	26	315	600	865	550	940	-	241	420	180	235	FF 740
PLSES 315 L	508	608	508	588	216	40	100	28	26	315	600	865	550	1024	-	241	420	180	235	FF 740
PLSES 315 LD	508	608	508	588	216	40	100	28	26	315	600	865	550	1084	-	241	420	180	395	FF 740
PLSES 315 LU	508	608	508	588	216	40	100	28	26	315	600	865	550	1104	1303	241	420	180	395	FF 740

IEC Symbol	Flange dimensions							
	M	N	D	T	n	α°	S	LA
FF 500	500	450	550	5	8	22.5	18.5	18
FF 600	600	550	660	6	8	22.5	24	25
FF 740	740	680	800	6	8	22.5	24	25

⁽¹⁾ IM 2001 (IM B35) form as standard. For frame sizes ≥ 250 used in IM B5 (IM3001), please contact us.

* LB1: dimension for PLSES 315 LU 480 kW motor.

** AC: Housing diameter without lifting rings.



Drive dimensions

Powerdrive MD2MS (wall-mounting version)

Ratings MD2MS	H (mm)	W (mm)	D (mm)	Weight (kg)
120T	1383	490	654	190
180T	1883	490	654	200
220T and 270T	1883	490	654	240

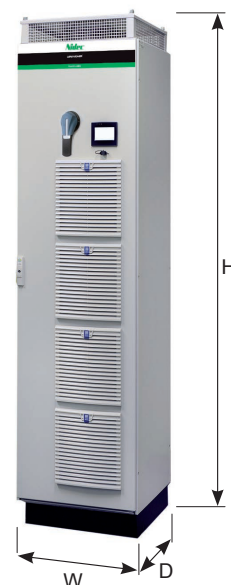
These dimensions and weights correspond to a Powerdrive MD2MS without options. The following options can be added to the Powerdrive MD2MS without altering its size: EMC filter, switch, IP54 version, heating kit, emergency stop, communication and additional input/output modules.

Powerdrive MD2S (free-standing cabinet)

Ratings MD2S	H (mm)	W (mm)	D (mm)	Weight (kg)
340T and 400T	2160	606	600	380
470T and 570 T	2160	606	600	410

These dimensions and weights correspond to a Powerdrive MD2S without options. The following options can be added to the Powerdrive MD2S without altering its size: emergency stop, communication and additional input/output modules.

For more precise information depending on the options, please use the Configurator:
<http://configureurl.s.leroy-somer.com>



PLSES 4500

For surprise-free operation

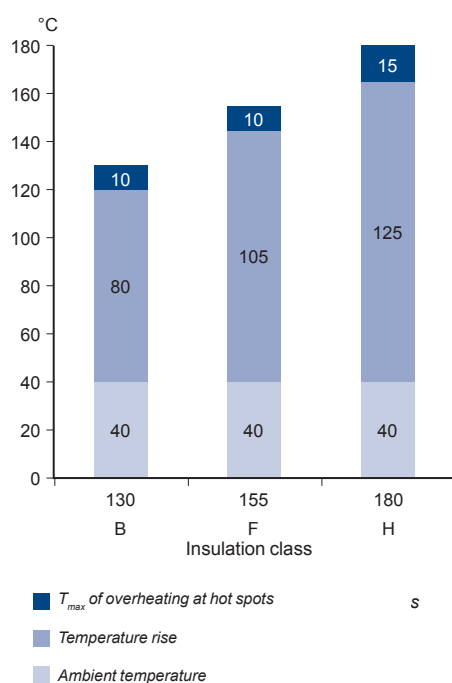
Thermal reserve across the entire speed range

Leroy-Somer machines are designed with a class F winding insulation system with a class B temperature rise.

This results in a thermal reserve of 25 K:

- Winding lifetime doubled for a reduced ΔT of 10K
- Possible overload of 10%
- Variable speed operation without derating

Temperature rise (ΔT) and maximum temperatures at hot spots (T_{max}) according to insulation class (IEC 60034-1)



Maximising energy efficiency

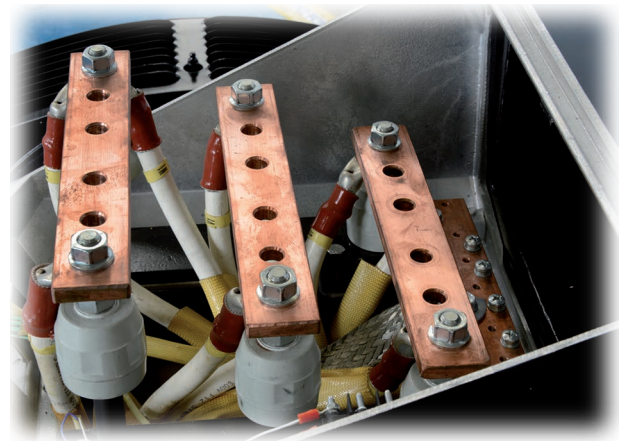
The PLSES 4500 and Powerdrive MD2 variable speed solution has a positive impact on energy bills thanks to the high level of motor drive efficiency (IE3) and an extended speed range up to 4500 rpm.

Since the absorbed power is proportional to the rotation speed of this type of constant-torque application, high-speed operation makes it possible to streamline the dimensions of the compressor (increased refrigeration capacity with a smaller compressor). Adapting the speed to load fluctuations (seasonal variations, fluctuations in activity, external temperature) offers better operating conditions and, consequently, a significant reduction in energy consumption.

Optimised connection for high power

To facilitate the commissioning and wiring, the PLSES 4500 terminal box layout and dimensions are adapted to the motor power.

- Generously-sized terminal boxes
- Connection to stepped copper bars as standard (3 levels) from 330 kW
- Accessible earthing bar and prewired grounding braids to simplify customer wiring and facilitate earthing according to best practices



Shielded motor cable recommendations

• Benefits

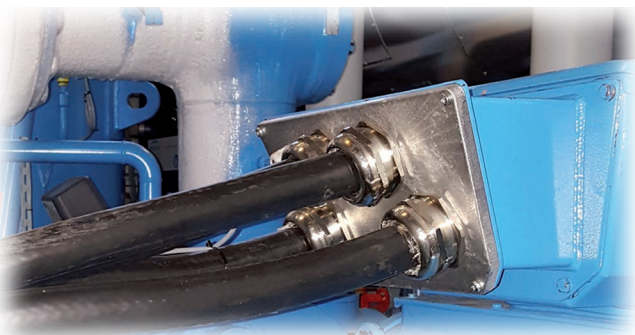
Shielding of the power conductors is a preferred method that enables the common mode currents to return to their point of origin without dispersing into other possible paths (equipotential conductors, piping, building structure, etc.). It significantly reduces the levels of electromagnetic emissions, both conducted and radiated. For this reason, it is mandatory to use shielded cables between drive and motor to ensure compliance with the EMC emission standards (IEC 61800-3, etc.). Shielded cables are also used to limit shaft voltage and the risk of damage to the bearings.

• Cable type

Shielded cables must be symmetrical multicore cables with low leakage capacity.

For higher-power motors, only use cables with 3 equipotential conductors.

The shielding must be connected at both ends: drive side and motor side, over 360°. The unshielded part of the cable must be as short as possible, and use metal cable glands (clamping on the cable shield) on the motor side.



Rotating components protection

• Insulated bearing

An insulated bearing is produced with an insulating coating or non-conducting ceramic balls. It limits or even eliminates the passage of current flow through the bearing.

In the case of a single insulated bearing being used, it must be installed at the non drive end (NDE) of the motor and must be combined with a current grounding ring, in order to efficiently cut off the circulation of current.

• Grounding ring

A grounding ring diverts shaft currents to prevent them from flowing through the bearings.

A grounding ring does not replace a good high frequency earthing between the motor and the variable speed drive as well as between the motor and its load. Indeed, if the earthing is of poor quality, common mode currents can flow through the frame, the grounding brush, the transmission shaft, the coupling and the load. The risk then lies in shifting the problem from the motor bearings to those of the load.

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