



300kW~6,300kW(400HP~8500HP)

21-L series : Combining over 100 years experience with innovative new technology makes the **21-L** series the right choice for the demanding needs of today's industry.

Superior electrical performance benefits, unsurpassed reliability :

The 21-L series three-phase high-voltage motors are at the leading edge of motor technology.

-Designs up to 6,300kW (8,500HP)

-Wide variety of enclosures

-Rugged, high quality fabricated steel construction

-Frame sizes from 150-50M~190-63L

-Designed to meet worldwide standards

Features / Benefits :

Excellent electrical performance

-Higher efficiency -Higher power factor -Superior starting characteristics

Unique Modular Construction

-Easy motor enclosure conversion DP, WP1, WP2, CACA (TEAAC), CACW (TEWAC)

Variety Selections of Thrust Bearings

Angular Contact ball bearings Spherical roller thrust bearings Tilting pad thrust bearings

New compact design derived through

-Extensive electrical magnetic field analysis -Heat transfer analysis -Improved ventilation

Lower noise & lower vibration

-Advanced techniques in core / frame construction

Advanced VPI insulation system

-Higher surge withstanding capability

Excellent Quality Control

-Low operating and maintenance costs -High reliability -Extended re-greasing intervals

Design for all applications and industries Compatible on Variable Frequency Drive applications Fabricated copper bar rotor construction

Features of 21-L Series Vertical Motors

Reliability & Easy Operation / Maintenance



Modular arrangement for accessory connections allows flexibility with standardized mechanical construction.

NEMA WP II top-hood construction prevents intrusion of water and foreign materials. IP44 protection is standard for TEAAC (CACA) and TEWAC (CACW)type.

Bearing

Variety selection thrust bearings is covering from low to special high load thrust. And best economical selection for individual

Stator coil

Utilizes highly reliable, vacuum pressured impregnation (VPI) insulation system which provides firm fixing of coil ends and ability to

Rotor bar

Copper rotor bars are shaped to provide excellent torque characteristics and mechanical strength and are retained firmly

Air housing

Enclosures of 21-L Series Motors

Drip Proof Type (DP)

A drip proof type motor (IP22, IC01) is a common choice for a well ventilated room. Cooling air intake and hot air exhaust windows are located at air housing mounted on the side of the motor. The ducts are windows provide with separate braid at inside and screens at outside to prevent intrusion of water drips and other foreign materials into the motor inside (NEMA WP-I requirements).

NEMA Weather-protected Type-II (WP-II)

The open-outdoor type motor (IP24W, IC01) is a motor use for outdoor that incorporates an air housing in accordance with NEMA WPII. It includes three right angled turns for air inlet and inlet air duct has a section where wind velocity falls below 3 m/sec (600ft/min.), dripping water, dust, and foreign materials. A section is provided in which air may blow through without being forced into the motor.

Totally-enclosed air to air cooled Type (TEAAC) (CACA)

In an environment containing corrosive or harmful gas, a totally-enclosed air to air cooled. motor (IP44, IC611) is generally used. The external fan mounted on the opposite drive end directs fresh air into the pipes of the air housing located on the side part of the motor. The pipes constitute a heat exchanger in which fresh air passing through the pipes cools motor inside hot air.



caused by water leakage.



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Totally-enclosed Water to air cooled (TEWAC) (CACW)

This type of motor (IP44, IC81W) is especially useful in a location where low noise operation is required or where it is desired to remove heat from the motor ambient. The motor accommodates a air-to-water heat exchanger in the air housing mounted on the side part of the motor. A drain in the air housing protects the motor from damage

Fundamental

- IC01, IC61 and IC81W per IEC Standard constructions are available by changing hood construction, in addition to the four types where described here.
- Main terminal box can be changed every 90 degree angle. Main terminal box size is large enough to connect cable easily. And also provided shaft current protection insulator at none drive end bearing portion.

21-L Series in detail



OUTLINE OF 21-L VERTICAL MOTOR SERIES

21-L series

Output	: Up to 6,300kW(8,500HP) (Refer to the output graph.)
Frame size	: 150-50M ~ 190-63L [※]
Voltage	: Up to 13.8kV
Frequency	: 50/60Hz (Variable speed drived by inverter is applicable.)
Insulation	: F class (B class temperature rise)
Locked rotor	: Less than 550%
current	
Enclosure	: Totally enclosed air to air cooled (TEAAC) (CACA)
	Totally enclosed water to air cooled (TEWAC) (CACW)
	Drip-proof (DP), NEMA Weather protected type I, II (WP-I, II)
Mounting	: Vertical Flange
Rotor	: Cage (Fabricated Copper bar construction)
Bearing	: Angular contact ball bearing (Grease Lub. : Self cooled)
	Spherical roller bearing
	(Oil lub. : Self cooled, Air cooled by shaft mounted fan, Water cooled)
	Tilting pad thrust bearing (Oil lub. : Air cooled by shaft mounted fan, Water cooled)
Explosion proof	: Non - sparking, Increased safety (Ex-e), Pressurized (Ex-p)
Standards	: JEC. JIS. IEC. NEMA. BS. AS. API-541
	Other standards are also available.
Noise	: Refer to the standard noise table.
	Low noise design is applicable.
	All of the motors noise is 80dB(A) or less with standard silencer.
*Explanation	of Frame size
ex. 150 ⁽¹	¹⁾ -50 ⁽²⁾ L ⁽³⁾
(1) 0:	

(1) : Size of flange bolts pitch diameter. (1/10 of "A"(mm) dimension in Page 10 and 11.)

(2) : Size of frame. (1/10 of center height of same size horizontal motor.)

(3) : Motor Height. (L: longer frame size, M: shorter frame size)

STANDARD NOISE TABLE (Without Silencer)

dB(A) NO-LOAD										
Enclosure	Pole	81	Ρ	10	Р	12	Р	14P		
LICIOSULE	Frame	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	
Drin Proof	150-50	78	83	76	77	74	77	74	75	
Dhp1100	170-56	80	84	77	79	75	79	74	77	
	190-63	82	86	79	81	77	80	76	79	
	150-50	77	81	75	76	74	76	73	74	
	170-56	79	82	76	78	75	78	73	76	
	190-63	81	85	78	80	76	79	75	78	
CACA	150-50	80	83	79	80	77	79	75	77	
	170-56	82	85	81	83	78	80	76	79	
	190-63	84	87	83	85	80	83	79	80	
CACW	150-50	77	78	76	77	75	76	74	75	
	170-56	78	79	77	78	76	77	75	76	
	190-63	80	81	78	79	77	78	76	77	





OUTLINES AND DIMENSIONS

TYPE:DRIP-PROOF

21-L series

TYPE:TOTALLY-ENCLOSED AIR TO AIR COOLED (TEAAC)



															UN	IT:(inch)	1U	VIT:(lbs
	MOTOR										SHAFT			TERMINAL BOX			TOTAL	ROTOF
FRAIVIE NO.	Α	В	С	D	E	F	G	н	L	М	R	Q	S	KL	KE	KG	MASS	MASS
150 5014	1500	1150	1600	695	1500	1390	40	1480	2730	28	400	350	160	1365	1115	815	8,900	2,200
150-50101	(59.1)	(45.3)	(63.0)	(27.4)	(59.1)	(54.7)	(1.6)	(58.3)	(107.5)	(1.1)	(15.7)	(13.8)	(6.25)	(53.7)	(43.9)	(32.1)	(19,700)	(4,900
150 501	1500	1150	1600	695	1500	1390	40	1480	2980	28	460	410	180	1365	1115	1055	10,450	2,650
150-50L	(59.1)	(45.3)	(63.0)	(27.4)	(59.1)	(54.7)	(1.6)	(58.3)	(117.3)	(1.1)	(18.1)	(16.1)	(7.00)	(53.7)	(43.9)	(41.5)	(23,100)	(5,900
170 56M	1700	1300	1800	780	1700	1560	45	1655	2890	28	460	410	180	1450	1200	965	11,200	2,850
170-50101	(66.9)	(51.2)	(70.9)	(30.7)	(66.9)	(61.4)	(1.8)	(65.2)	(113.8)	(1.1)	(18.1)	(16.1)	(7.00)	(57.1)	(47.2)	(38.0)	(24,700)	(6,300
170 561	1700	1300	1800	780	1700	1560	45	1655	3140	28	520	470	200	1450	1200	1185	12,500	3,300
170-56L	(66.9)	(51.2)	(70.9)	(30.7)	(66.9)	(61.4)	(1.8)	(65.2)	(123.6)	(1.1)	(20.5)	(18.5)	(7.75)	(57.1)	(47.2)	(46.7)	(27,600)	(7,300
100.62M	1900	1450	2000	865	1950	1730	45	1825	3005	35	520	470	200	1535	1285	1025	14,050	3,650
190-03101	(74.8)	(57.1)	(78.7)	(34.1)	(76.8)	(68.1)	(1.8)	(71.9)	(118.3)	(1.4)	(20.5)	(18.5)	(7.75)	(60.4)	(50.6)	(40.4)	(31,000)	(8,100
100 621	1900	1450	2000	865	1950	1730	45	1825	3255	35	580	530	220	1535	1285	1295	16,100	4,350
190-03L	(74.8)	(57.1)	(78.7)	(34.1)	(76.8)	(68.1)	(1.8)	(71.9)	(128.1)	(1.4)	(22.8)	(20.9)	(8.50)	(60.4)	(50.6)	(51.0)	(35,500)	(9,600

TYPE:TOTALLY-ENCLOSED WATER TO AIR COOLED (TEWAC)



															UN UN	IT:mm IT:(inch)	UI U	NIT:kg NIT:(lbs)
		MOTOR										SHAFT		TERMINAL BOX			TOTAL	ROTOR
FRAIVIE NO.	Α	В	С	D	E	F	G	н	L	М	R	Q	S	KL	KE	KG	MASS	MASS
150 5014	1500	1150	1600	695	1450	1390	40	1480	2180	28	400	350	160	1365	1115	815	8,150	2,050
150-50101	(59.1)	(45.3)	(63.0)	(27.4)	(57.1)	(54.7)	(1.6)	(58.3)	(85.8)	(1.1)	(15.7)	(13.8)	(6.25)	(53.7)	(43.9)	(32.1)	(18,000)	(4,600
150 501	1500	1150	1600	695	1450	1390	40	1480	2430	28	460	410	180	1365	1115	1055	9,600	2,550
150-50L	(59.1)	(45.3)	(63.0)	(27.4)	(57.1)	(54.7)	(1.6)	(58.3)	(95.7)	(1.1)	(18.1)	(16.1)	(7.00)	(53.7)	(43.9)	(41.5)	(21,200)	(5,700
170 56M	1700	1300	1800	780	1540	1560	45	1655	2350	28	460	410	180	1450	1200	965	10,300	2,700
170-3000	(66.9)	(51.2)	(70.9)	(30.7)	(60.6)	(61.4)	(1.8)	(65.2)	(92.5)	(1.1)	(18.1)	(16.1)	(7.00)	(57.1)	(47.2)	(38.0)	(22,800)	(6,000
170 561	1700	1300	1800	780	1540	1560	45	1655	2600	28	520	470	200	1450	1200	1185	11,550	3,200
170-30L	(66.9)	(51.2)	(70.9)	(30.7)	(60.6)	(61.4)	(1.8)	(65.2)	(102.4)	(1.1)	(20.5)	(18.5)	(7.75)	(57.1)	(47.2)	(46.7)	(25,500)	(7,100
100.62M	1900	1450	2000	865	1630	1730	45	1825	2460	35	520	470	200	1535	1285	1025	12,850	3,500
190-03101	(74.8)	(57.1)	(78.7)	(34.1)	(64.2)	(68.1)	(1.8)	(71.9)	(96.9)	(1.4)	(20.5)	(18.5)	(7.75)	(60.4)	(50.6)	(40.4)	(28,400)	(7,800
100 621	1900	1450	2000	865	1630	1730	45	1825	2710	35	580	530	220	1535	1285	1295	14,800	4,200
190-03L	(74.8)	(57.1)	(78.7)	(34.1)	(64.2)	(68.1)	(1.8)	(71.9)	(106.7)	(1.4)	(22.8)	(20.9)	(8.50)	(60.4)	(50.6)	(51.0)	(32,700)	(9,300



															UNI UNI	T:mm T:(inch)	UN UN	IT:kg IT:(lbs)
						MOTOR					SHAFT			TERMINAL BOX			TOTAL	ROTOR
FRAME NO.	Α	В	С	D	Е	F	G	Н	L	М	R	Ø	S	KL	KE	KG	MASS	MASS
150 50M	1500	1150	1600	695	1130	1390	40	1480	2180	28	400	350	160	1365	1115	815	7,800	2,050
150-50101	(59.1)	(45.3)	(63.0)	(27.4)	(44.5)	(54.7)	(1.6)	(58.3)	(85.8)	(1.1)	(15.7)	(13.8)	(6.25)	(53.7)	(43.9)	(32.1)	(17,200)	(4,600)
150 501	1500	1150	1600	695	1130	1390	40	1480	2430	28	460	410	180	1365	1115	1055	9,300	2,550
150-50L	(59.1)	(45.3)	(63.0)	(27.4)	(44.5)	(54.7)	(1.6)	(58.3)	(95.7)	(1.1)	(18.1)	(16.1)	(7.00)	(53.7)	(43.9)	(41.5)	(20,600)	(5,700)
170 56M	1700	1300	1800	780	1235	1560	45	1655	2350	28	460	410	180	1450	1200	965	9,900	2,700
170-300	(66.9)	(51.2)	(70.9)	(30.7)	(48.6)	(61.4)	(1.8)	(65.2)	(92.5)	(1.1)	(18.1)	(16.1)	(7.00)	(57.1)	(47.2)	(38.0)	(21,900)	(6,000)
170 561	1700	1300	1800	780	1235	1560	45	1655	2600	28	520	470	200	1450	1200	1185	11,100	3,200
170-50L	(66.9)	(51.2)	(70.9)	(30.7)	(48.6)	(61.4)	(1.8)	(65.2)	(102.4)	(1.1)	(20.5)	(18.5)	(7.75)	(57.1)	(47.2)	(46.7)	(24,500)	(7,100)
100.62M	1900	1450	2000	865	1345	1730	45	1825	2460	35	520	470	200	1535	1285	1025	12,350	3,500
190-03101	(74.8)	(57.1)	(78.7)	(34.1)	(53.0)	(68.1)	(1.8)	(71.9)	(96.9)	(1.4)	(20.5)	(18.5)	(7.75)	(60.4)	(50.6)	(40.4)	(27,300)	(7,800)
100 621	1900	1450	2000	865	1345	1730	45	1825	2710	35	580	530	220	1535	1285	1295	14,250	4,200
190-03L	(74.8)	(57.1)	(78.7)	(34.1)	(53.0)	(68.1)	(1.8)	(71.9)	(106.7)	(1.4)	(22.8)	(20.9)	(8.50)	(60.4)	(50.6)	(51.0)	(31,500)	(9,300)

TYPE:WEATHER-PROTECTED (NEMA WP-I)



															UNI	T:(inch)	UN	IT:(lbs)
	MOTOR										SHAFT		TERMINAL BOX			TOTAL	ROTOR	
FRANCE NO.	Α	В	С	D	Е	F	G	н	L	М	R	Q	S	KL	KE	KG	MASS	MASS
150 50M	1500	1150	1600	695	1860	1390	40	1480	2180	28	400	350	160	1365	1115	815	8,050	2,050
150-50101	(59.1)	(45.3)	(63.0)	(27.4)	(73.2)	(54.7)	(1.6)	(58.3)	(85.8)	(1.1)	(15.7)	(13.8)	(6.25)	(53.7)	(43.9)	(32.1)	(17,800)	(4,600)
150 501	1500	1150	1600	695	1860	1390	40	1480	2430	28	460	410	180	1365	1115	1055	9,550	2,550
150-50L	(59.1)	(45.3)	(63.0)	(27.4)	(73.2)	(54.7)	(1.6)	(58.3)	(95.7)	(1.1)	(18.1)	(16.1)	(7.00)	(53.7)	(43.9)	(41.5)	(21,100)	(5,700)
170 56M	1700	1300	1800	780	2040	1560	45	1655	2350	28	460	410	180	1450	1200	965	10,100	2,700
170-300	(66.9)	(51.2)	(70.9)	(30.7)	(80.3)	(61.4)	(1.8)	(65.2)	(92.5)	(1.1)	(18.1)	(16.1)	(7.00)	(57.1)	(47.2)	(38.0)	(22,300)	(6,000)
170-561	1700	1300	1800	780	2040	1560	45	1655	2600	28	520	470	200	1450	1200	1185	11,350	3,200
170-302	(66.9)	(51.2)	(70.9)	(30.7)	(80.3)	(61.4)	(1.8)	(65.2)	(102.4)	(1.1)	(20.5)	(18.5)	(7.75)	(57.1)	(47.2)	(46.7)	(25,100)	(7,100)
100.62M	1900	1450	2000	865	2330	1730	45	1825	2460	35	520	470	200	1535	1285	1025	12,550	3,500
190-0310	(74.8)	(57.1)	(78.7)	(34.1)	(91.7)	(68.1)	(1.8)	(71.9)	(96.9)	(1.4)	(20.5)	(18.5)	(7.75)	(60.4)	(50.6)	(40.4)	(27,700)	(7,800)
100-631	1900	1450	2000	865	2330	1730	45	1825	2710	35	580	530	220	1535	1285	1295	14,500	4,200
130-03L	(74.8)	(57.1)	(78.7)	(34.1)	(91.7)	(68.1)	(1.8)	(71.9)	(106.7)	(1.4)	(22.8)	(20.9)	(8.50)	(60.4)	(50.6)	(51.0)	(32,000)	(9,300)

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COOLING WATER OUTLET FLANGE JIS 10K (ANSI 150LBS)

> COOLING WATER INLET FLANGE JIS 10K (ANSI 150LBS)

BEARING CONSTRUCTIONS

VARIETY SELECTION OF THRUST BEARINGS (Serve the best selection for the individual situation)



Angular contact ball bearing

21-L series

- Lubricant : Lithium grease - Cooling system : Self cooled
- : Use for NONE or low down thrust

Over 35,000 hours as L10 life and 3,000 hours re-greasing interval are achieved using large sized bearing.



Spherical roller thrust bearing

- Lubricant : Turbine oil(VG46) - Cooling system : Self cooled : Air cooled (by shaft mounted fan) : Water cooled : Use for medium to high down thrust

Improved cooling method without water cool are provided under high thrust requirement.



Tilting pad thrust bearing

- Lubricant : Turbine oil(VG46) - Cooling system : Water cooled : Air cooled (by shaft mounted fan)
- : Use for high to super high down thrust

Improved cooling method without water cool are provided under high thrust requirement.

GUIDE LINE OF THRUST BEARING SELECTION



- to page 10 and 11)
- * Allowable maximum momentary (up to 30 seconds) down thrust is 1.5 times of continuous down thrust.

LOWER BEARING CONSTRUCTION



Main terminal box

21-L series

Accessories

Drawing



Auxiliary terminal box





Large-sized main terminal box

21-L series



For space heater













NON REVERSE RATCHET

- The following non reverse ratchet will be provided as an option if required this function on to motor side.
- High reliability
- Higher torque capacity
- Long lifetime against frequent^{*} reverse torque (* over 10,000 times)









21-L series

STANDARD SPECIFICATIONS

21-L series

Item	Standard Specifications	Remarks
Output	Approx. 500 ~ 6300kW	
Voltage	2300V,2400V,3000V,3300V,4000V,4160V,6000V,	Recommended selection of motor terminal voltage and
	6600V,10000V,11000V,13200V,13800V	capacity.
		Table 1
		Voltage class Output
		2300V class Up to 3000kW
		3000V class Up to 4000kW
		6000V class From 1000kW to 8000kW
		11000V class Sobokvi of larger
Frequency	50Hz , 60Hz	Motor can be used for Inverter Drive and need load condition
		such as application, operation speed, constant or variable
		torque and so on.
Number of Poles	8 poles through 24 poles	The relation of the number of poles and synchronous
		speed is as follows:
		Ns=120•f/P
		Ns : Synchronous speed (min ⁻¹)
		f : frequency (Hz)
		P : Number of poles
Applicable Standards		
Performance	Basically JEC-2137 (2000)	Overseas Standards are also available such as NEMA, IEC,
	(Japan Electrical Committee Standards)	BS, AS.
Materials	JIS (Japan Industrial Standards)	Selected JIS materials are also equivalent to ANSI.
Reference ambient	Maximum : +40°C	Motors for use in hot climate (approx. 50°C) or a cold climate
temperature	Minimum : -20°C	(-50°C) can be manufactured.
Installation place and	Sea level : 1000 m or less	A motor for high altitude can be manufactured based on each
altitude		standards described rules.
Installation	Relative humidity : 95% or less	When motor is installing in tropic area then need to
environment	Environmental condition is non-hazardous.	indicate on the your requisition.
		Anti-corrosion treatment is required for use in an
		atmosphere containing corrosive gases such as H2S
Inculation class		(nydrogen sulfide). Notity the environmental condition.
	Class F Insulation	Alco E alcos rico is sucilable so request
limit		AISO F Class lise is available as request.
Service factor	Basically 1.0	If a service factor is required, designate the value and
		temperature rise limit
Noise	80 dB(A) with 3 dB(A) tolerance under the no-load	A low-noise motor can be manufactured.
	condition. (with standard silencer)	Designate the noise value up to approx 75dB(A) under the
	The average sound pressure level at four points 1	no-load condition.
	m from the motor enclosure outer surface and	
	height is 1/2 of motor total height position.	
	с	
Protection and	Totally-enclosed type : IP44, IC6, IC8	The protection and cooling methods can be selected in
cooling system	Open type : IP22, IP24W, IC0	accordance with the installation conditions or environment.
Starting duty	When starting from ambient temperature state	
	(COLD state) : Two times consecutive	
	When starting after stopping room state that does	
	not exceed the rated load temperature (HOT	
	state) : Once	

Item	Standard Specifications
Starting method	Full voltage starting method
	(Direct on line or Across the line)
Direction of rotation	Bi-directional
Shaft end	Single shaft extension is used
	A straight shaft end with parallel key way
Tube material for	Stainless tube
Totally Enclosed Fan	
cooled.	Cooling water
cooling water pipe	Water temperature : Max. 35°C
for Totally	Shutoff pressure : Max. 0.7MPa
Enclosed water	Water quality : Fresh water
to air cooled.	Cooling water tube shape :
	Single tube with plate fins.
	Cooling water tube material (Use of a tube
	for clean fresh water is standard) :
	Seamless phosphorus deoxidized copper
	tube (JIS C1220)
Finishing color	Munsell notation 2.5PB 6/2
Paint coat	For indoor : 50µm or more
thickness	For outdoor : 50µm or more
Protective devices	as required.
	ex. •Winding RTD's
	Bearing RTD's
	Dial thermometer
	Space heater
Accessories	The following items will be provided as standard
	Coupling key
	Drain plug
Other features	Bearing application
	Angular contact bearing
	spherical roller thrust bearing
	Tiling pad thrust bearing
	Starting current : 550%
	Insulated bearing at non drive end
	Flange size conform to IEC recommendation.
	Over 35,000 hours as L10 life and 3,000 hours
	re-greasing interval are achieved using large
	sized bearing.
	Non reversing device is available as request.
	Motor natural frequency is 125% or more of
	motor rotating frequency.

Remarks
Reduced voltage starting using a reactor or auto-transformer
are also possible.
Advise the permissible starting kVA.
It will be considered for designate.
When none reversing device is required and tilting pad thrust
bearing is used then rotation becomes only specified direction.
External fan for TEAAC is using bi-directional type fan.
If the fluxional torque value is large when starting or
during operation, the key way and shaft dimensions
may be changed.
When required other material then it can be
manufactured.
A double tube can be manufactured.
Depend on the water quality (polluted fresh water, sea water),
the water tube material will be changed.
Other color is also available as request.
Other thickness is also available as request.
Other thickness is also available as request.
Other device will be provided as request.
Other device will be provided as request.



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