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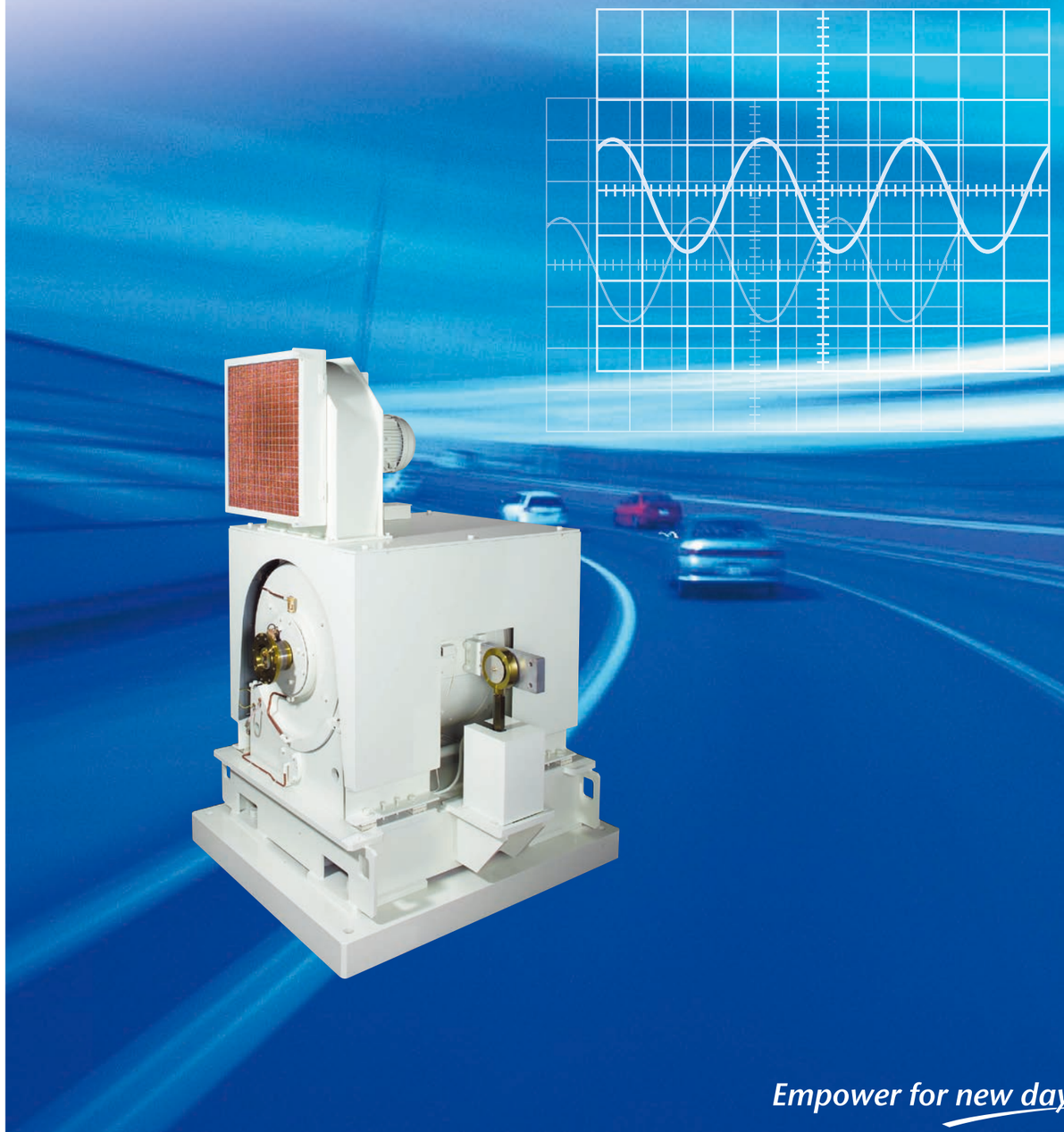
MEIDEN

FREC Dynamometer



Empower for new days

FREC Dynamometer

The Meiden FREC Dynamometer is a new series of AC dynamometer, developed based on dynamometer and induction motor technologies accumulated over many years, combined with the latest in inverter control technology.
Inverter control ensures high performance and low sound noise by adopting an IGBT in the main circuit and by means of all-digital sine wave PMW control.

1 Features

1 High precision torque detection
A floated frame cradle system and a gapless bearing-type load detector allows for high-precision torque detection.
Calibration accuracy: within ±0.1%/FS

2 Four-quadrant continuous operation
Continuous operation/control is possible in "power absorption ⇔ motoring" and "forward ⇔ reverse" modes.

3 Excellent safety and maintenance
Because of the brushless construction,it is safe and minimum maintenance is required.

4 Low inertia
FREC dynamometer has lower inertia compared to conventional machines.

5 Wide product selection
A wide range of products are available, from low-speed and high torque applications to high-speed applications.

6 High accuracy, high response, and wide control range
The integration of THYFREC VT330DY high-performance control equipment ensures high accuracy, high response, and wide range of control.

2 Principle

The FREC dynamometer basic configuraion is same as squirrel cage induction motor (IM). Stator of the motor is cradled and load cell is connected to this stator to measure torque. The inverter (variable-frequency power supply) can arbitrarily control the speed or torque.
The synchronous speed N_0[min^{-1}] of the IM, the revolving speed N [min^{-1}] in the loaded state, and the slip S [%] for speed regulation are given by the following expressions (1) to (3), respectively.

$$N_0\,[\mathrm{min}^{-1}] = \frac{120\times \mathrm{Frequency}\,[f:\mathrm{Hz}]}{\mathrm{No.\ of\ IM\ poles}} \quad \cdots\cdots (1)$$

$$N\,[\mathrm{min}^{-1}] = N_0\,(1-S) \quad \cdots\cdots (2)$$

$$S\,[\%] = (N_0-N)/N_0 \quad \cdots\cdots (3)$$

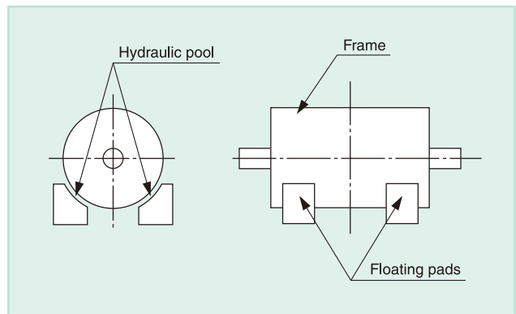
The relationship between Torque T and Slip S is given by the following expression:

$$T \fallingdotseq k\cdot I_0\cdot S \fallingdotseq k'\cdot I_0\cdot I_1 \quad \cdots\cdots (4)$$

In the above expression, I_0 is exciting current and I_1 is effective current I_0 has the same function as the field current of a DC machine. It has 90˚phase lag from the effective current. Vector control is excuted through vector calculation, in which I_0 and I_1 are controlled independently.
There are many compensation culculation to improve vector control (Proportional relationship between effective current and torque) accuracy.

3 Cradle System

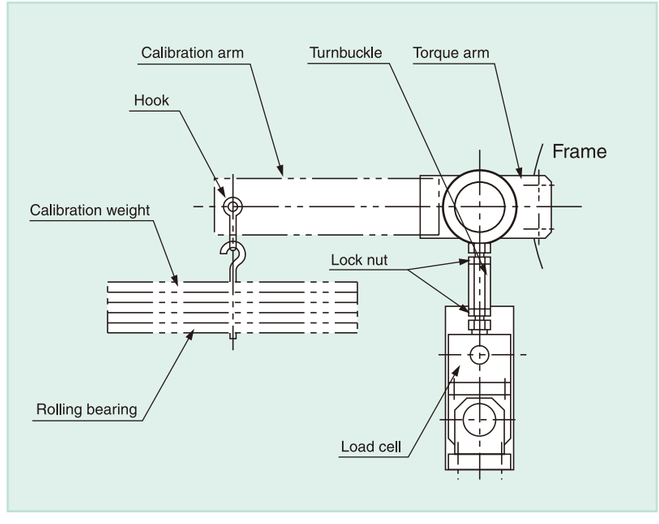
The cradle system uses hydraulic pressure to float the frame. As shown in the figure, the frame is directly supported by a hydraulic pool on the floating pads. This reduces cradle friction and ensures high accuracy torque measurement.

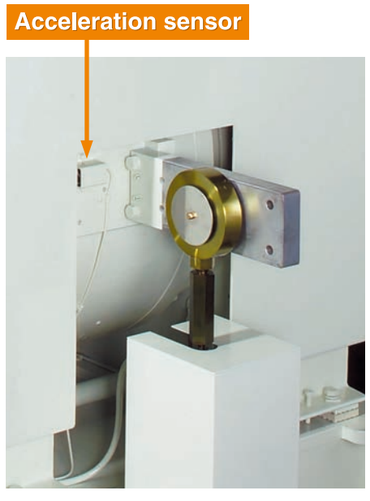


4 Torque Detection System

(1) High accuracy torque detection is realized by means of a gapless bearing-type load detector and a high accuracy load cell.

(2) An acceleration sensor compensates for the natural vibration of the frame and ensures steady torque detection.





FREC Dynamometer

5 Ratings

FREC dynamometer ratings are specified as followings;

Absorption capacity	**(kW)**
Motoring capacity	**(kW)**
Base speed / Maximum speed	**(min^{-1})**

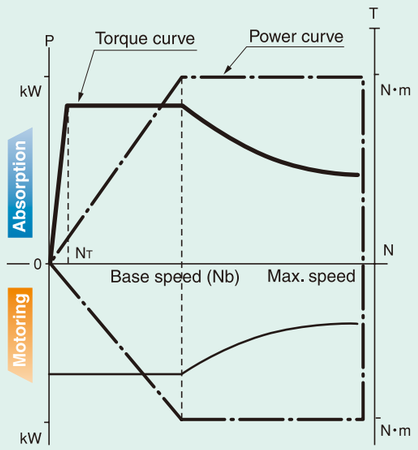
The capacity specified denotes the rated capacity (input/output value) from the base speed to the maximum speed. This speed range is called the constant output range (or constant capacity range).

Torque is obtained by the following equation

$$P(kW) = \frac{2\pi N}{60} \times T \times 10^{-3}$$

〔where T:torque(N·m)、N:speed(min^{-1})〕

From the above equation, the maximum torque lowers in inverse proportion to speed, if this speed is above the base speed. The torque is kept constant when the speed is below the base speed. This speed range is called the constant torque range.



Typical example of FREC dynamometer operating range (performance curve)

6 Standard Ratings

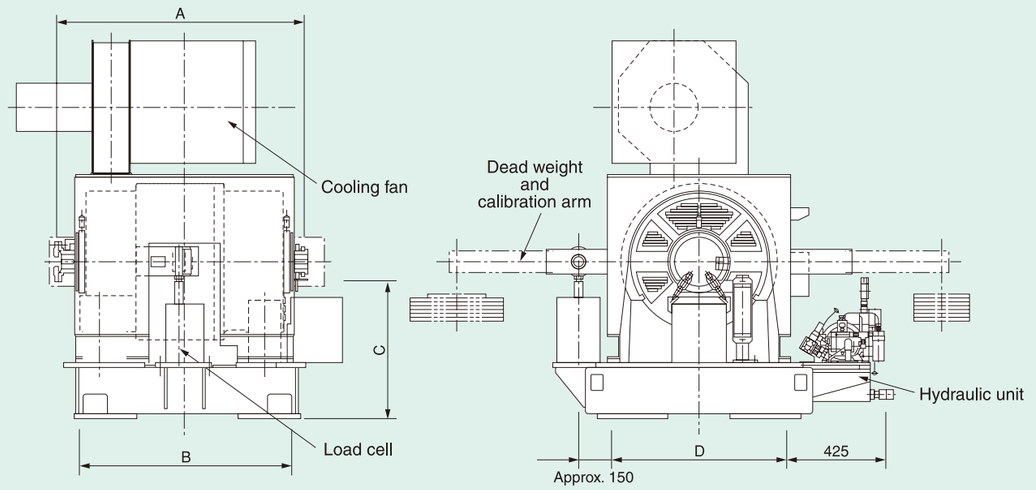
Absorption capacity (kW)	Motoring capacity (kW)	Base speed (min^{-1})										Voltage (V)
		2000		2500		3150		3550		4000		
		Frame no.	Max. speed	Frame no.	Max. speed	Frame no.	Max. speed	Frame no.	Max. speed	Frame no.	Max. speed	
75	55	250M	8000	250M	9000	250M	10,000	250M	10,000	250M	10,000	360
110	80	280M	8000	280M	9000	250M	10,000	250M	10,000	250M	10,000	
150	110	315S	8000	315S	8000	280M	10,000	280M	10,000	250M	10,000	
185	130	315M	8000	315S	8000	315S	9000	280M	9000	280M	10,000	
220	160	315L	8000	315M	8000	315S	9000	315S	9000	280M	10,000	
260	190	355M	8000	315L	8000	315M	9000	315S	9000	315S	10,000	
300	220	355L	8000	355M	8000	315M	8000	315M	9000	315S	10,000	
370	250	400S2	6000	355L	8000	355M	8000	355M	8000	315M	9000	
450	370	400L4	5000									
550	450	400L4	5000									

Specifications

Enclosure type	Protected type (IP20)
Cooling system	Separately-cooled type (IC0A6 or IC06)
Overtorque durability	120% for 1 min. (below base speed)
Overspeed durability	105% for 1 min.
Ambient temperature	0～40℃
Standard	JEC-2100

Special ratings can be manufactured. Please consult with us regarding specific needs.

7 External Dimensions of FREC Dynamometer



Frame no.	Dimensions (mm)				Allowable shaft end load (N)	Approx. mass (kg)	Moment of inertia J (kg·m^2)
	A	B	C	D			
250M	890	770	500	600	150	1100	0.33
280M	1000	840	550	700	150	1300	0.66
315S	1060	900	600	760	100	1950	0.93
315M	1160	960	600	760	150	2000	1.2
315L	1160	960	600	760	200	2450	1.3
355M	1290	1080	650	840	300	2700	2.6
355L	1350	1140	650	840	300	3100	3.0
400S2	1450	1500	700	1640	300	4500	5.7
400L4	1500	1500	700	1640	400	4500	12.5

Note: Dimensions are subject to change without notice. Detailed plan will be submitted at ordering.

FREC Dynamometer

8 Control Drive Performance (THYFREC VT330DY)

Item		Standard	Option
Capacity		55～550kW	Small type: 1.5～55 kW Large type: 600～1100 kW
DY main circuit voltage		AC360V/320V	
Circuit system	Converter	IGBT 120° current carrying control	Sine wave PWM control
	Inverter	IBGT voltage type current control	
Control system		Torque control by vector control All-digital sine wave PWM control	
Speed control (ASR)	Set resolution	Analog: 0.01%	
	Setting	Analog: 0 to 10V	
	Accuracy	±0.1%FS（25℃±10℃）	
	Max. speed	20,000min^{-1} (controller)	
Torque control (ATR)	Set resolution	Analog: 0.01%	
	Setting	Analog: −10 to 10V	
	Accuracy	±0.5% FS+accuracy of detector (25℃±10℃)	
Current control (ACR)	Set resolution	Analog and digital: 0.01%	
	Setting	Analog: −10 to 10V	Digital: Serial communication
	Response	1.5kHz	
Source power factor		0.9	1.0

9 Control Circuit Configuration

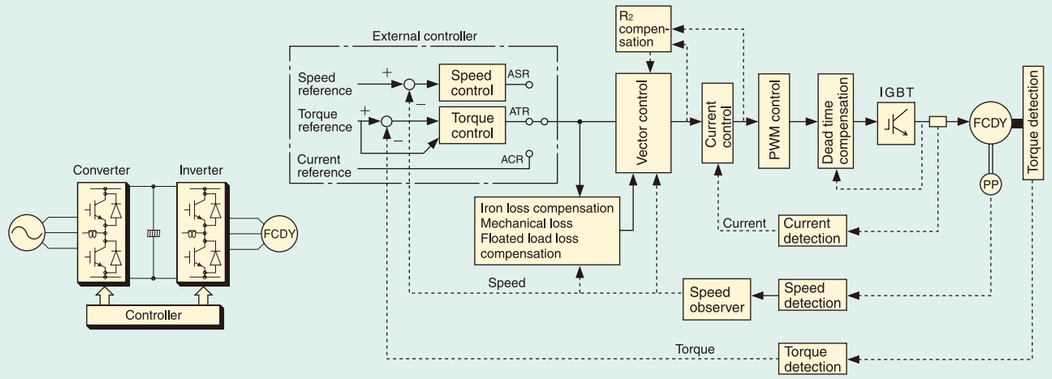


Fig. 1 Main circuit configuration (typical example)

Fig. 2 Control block (typical example)

10 External Dimensions and Capacity of Control Drive (THYFREC VT330DY)

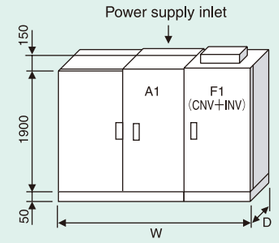


Fig. 1

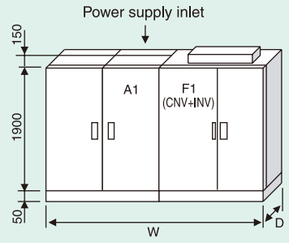


Fig. 2

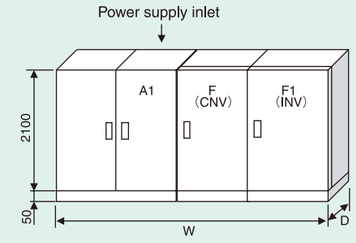


Fig. 3

Dimensions (unit: mm)

Type	Width (W)	Depth (D)	Height (H)	Independent inverter panel	Independent converter panel	Total mass (kg)	Capacity (kVA)	Output current (A)	Output voltage (V)	DY rated capacity (kW)	Fig.
H1600	1900	600	2100	+700	+700	900	160	250	360/320	90/75	1
H2450	2100	600	2100	+900	+900	1000	245	390	360/320	180/150	1
H3200	2100	600	2100	+900	+900	1000	320	510	360/320	220/180	1
H4000	2500	600	2100	+900	+900	1250	400	640	360/320	300/250	2
H4700	2500	600	2100	+900	+900	1250	470	750	360/320	330/280	2
H5600	3400	600	2150	+1100	+900	1800	560	900	360/320	370/300	3
H7000	3400	600	2150	+1100	+900	1900	700	1120	360/320	450/400	3
H8500	3400	600	2150	+1100	+900	2000	850	1350	360/320	550/450	3

Note 1: Control panel specifications are subject to change without notice to accommodate installation and application conditions. Please check the approval drawing that we will supply upon receiving your order.
Note 2: Capacities and output currents shown above are the maximum values of the control equipment. Rated capacity may change according to frame number.
Note 3: Panel dimensions differ in the case of the PWM control converter. Please consult with us separately regarding this matter.

Output filter

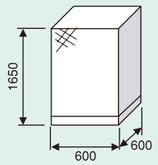


Fig. 4

Dimensions (unit: mm)

Type	Width (W)	Depth (D)	Height (H)	Mass (kg)	Remarks	Fig.
H1600～H4700	600	600	1650	250	Output ACL, ferrite core, resistance	4
H5600～H8500	600	600	1650	200	Ferrite core, resistance	4