GE Fanuc Automation

Computer Numerical Control Products

Alpha Series AC Spindle Motor

Descriptions Manual

GFZ-65152E/03 *October 1998*

Warnings, Cautions, and Notes as Used in this Publication

Warning

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use.

In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

Caution

Caution notices are used where equipment might be damaged if care is not taken.

Note

Notes merely call attention to information that is especially significant to understanding and operating the equipment.

This document is based on information available at the time of its publication. While efforts have been made to be accurate, the information contained herein does not purport to cover all details or variations in hardware or software, nor to provide for every possible contingency in connection with installation, operation, or maintenance. Features may be described herein which are not present in all hardware and software systems. GE Fanuc Automation assumes no obligation of notice to holders of this document with respect to changes subsequently made.

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SAFETY PRECAUTIONS

This manual describes the safety precautions relating to the use of FANUC control motors (servo motors and spindle motors). Read this manual carefully before attempting to use any of these motors.
Users should also read the relevant Descriptions to become fully familiar with the functions of the motor. (For the built–in spindle motor α series, the assembly and operation procedures are given in the relevant Descriptions.)
In principle, operators must not attempt any operation other than those described in this manual. If such an operation is unavoidable, contact FANUC.

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1 DEFINITION OF WARNING, CAUTION, AND NOTE

This manual provides safety precautions for protecting the operator from injury and preventing damage to the machine. The descriptions of these precautions are entitled WARNING or CAUTION according to their bearing on safety. Any supplementary information is given under the heading NOTE. Read each WARNING, CAUTION, and NOTE thoroughly before attempting to use the motor.

⚠ WARNING

Applied when there is a danger of the user being injured or when there is a danger of both the user being injured and the equipment being damaged if the approved procedure is not observed.

⚠ CAUTION

Applied when there is a danger of the equipment being damaged, if the approved procedure is not observed.

NOTE

Information given as a NOTE is supplementary and not classifiable as either a WARNING or CAUTION.

* For built–in spindle motors, all references to “motor” in the manual imply all related components, including the stator, rotor, and sensor.

❍ **Read this manual carefully, and store it in a safe place.**

2 WARNING

⚠ WARNING

- **Wear protective clothing whenever handling the motor.**

  The motor has sharp edges and projections which present a danger of injury, as well as electrical circuits which may subject the operator to the danger of electric shock. Protective gloves and shoes must be worn.

- **Use a crane or other lifting equipment to move the motor.**

  The motor is heavy. A suitable crane or other lifting equipment must be used to move the motor. (The weight of the motor is given in the Descriptions.) When moving the motor using a crane or other lifting equipment, fit a hanging bolt if the motor is provided with a tapped hole for this purpose. Otherwise, use a rope, such as a fiber rope. If, however, the motor has been mounted in a machine or other equipment, do not use a hanging bolt to move the motor. In such a case, attempting to use a hanging bolt to move the motor may result in damage to the hanging bolt or motor. Do not apply force to the windings while moving the motor. Otherwise, the windings may break or their insulation may be damaged.

- **Do not touch the motor with wet hands.**

  Touching the motor with wet hands is extremely dangerous and may result in electric shock.

- **Ensure that the power to the motor is turned off before attempting to perform wiring work.**

  Performing wiring work while the power to the motor is turned on is extremely dangerous and may result in electric shock.

- **Keep hazardous substances well away from the motor.**

  The motor is connected to the power magnetic circuit. Also, the motor generates heat while operating. Operating the motor in the proximity of any inflammable substance is therefore extremely dangerous, as there is a danger of combustion, ignition, or explosion.

- **Ground the motor.**

  To prevent electric shock, ensure that the ground terminal in the terminal box is securely connected to the machine ground.

⚠ WARNING

- **Do not short–circuit the motor power lines with ground or with each other.**

  Short–circuiting of the motor power lines presents the danger of electric shock, and may cause the motor windings to burn out.

  * Some motors require special connection, such as the switching of windings. For details, see the Descriptions for each motor.

- **Power lines must be mechanically secure.**

  Loose connections may cause a terminal to become disconnected, causing a ground fault or short–circuit, and possibly resulting in electric shock.

- **Ensure that no terminal is exposed, before attempting to turn on the power to the motor.**

  An exposed terminal presents the danger of electric shock if touched by the operator or any conductive material.

- **While the motor is operating, stand well clear. Do not attempt to touch the rotating parts of the motor.**

  The rotating parts of the motor may trap the operator's clothes or fingers. Also, before starting the motor, ensure that anything which may be trapped or scattered by the motor, such as a key, is not placed in the proximity of the motor.

- **Turn off the power to the motor before attempting to touch the motor.**

  Touching the motor while the power is turned on is dangerous because voltage is present at the terminals even if the motor is not operating. In particular, the power connection section presents an extreme danger of electric shock. If the operator must touch the power connection section, protective measures must be applied.

- **After turning off the power to the motor, wait at least five minutes before touching the terminals.**

  A high voltage remains at the power terminals for a while even after power–off. Therefore, do not attempt to touch the terminals or connect the motor to another device before sufficient time (at least five minutes) has elapsed after power–off. Otherwise, there is the danger of electric shock or damage to the motor.

- **Use only the specified amplifiers and parameters to drive the motor.**

  Driving the motor with other than the approved combinations of amplifier and parameters is dangerous because the motor may perform an unexpected operation. There is also the danger of the motor being damaged.

3 CAUTION

⚠ CAUTION

- **Do not touch the motor while it is operating, or immediately after it stops.**

  The motor becomes very hot while operating, thus presenting the danger of burning to the operator or any bystanders. Do not attempt to touch the motor before it has cooled down sufficiently.

- **Be careful to prevent hair or clothing being trapped by the fan.**

  For models fitted with a fan, be careful to prevent hair or clothing being trapped by the fan, particularly when the fan is drawing in air. Note that, even while the motor is not operating, the fan will continue to rotate provided power is applied to the amplifier.

- **FANUC motors are designed for use with machine tools. Never use these motors for any other purpose.**

  Using the motor in an unapproved way may result in substandard performance or unpredictable problems. If the motor must be used for any application other than that for which it was originally intended, contact FANUC.

- **Ensure that the motor mounting is adequate.**

  The motor is heavy. Substandard mounting may result in problems such as low precision.

- **Ensure that the motor and peripheral parts are mounted securely.**

  It is dangerous if the motor is operated while it or any peripheral part is displaced or disconnected.

- **Ensure that all cables are connected correctly.**

  Faulty cable connections may cause the motor to operate at an abnormally high temperature or malfunction, with the ultimate failure of the motor. Also, ensure that cables of the specified ratings (sizes) are used. For details of cable connection, refer to the Descriptions.

CAUTION

- **For models requiring forced cooling, ensure that the cooling is adequate and operating normally.**

  Any abnormality in the cooling system may cause the motor to operate abnormally or malfunction. In the case of forced–air cooling, ensure that the fan is not clogged with dust or chips. In the case of liquid cooling, ensure that the coolant level is normal and that the pipes are not clogged. In both cases, clean and inspect the cooling system periodically.

- **When mounting a source of inertia, such as a pulley, on the shaft, minimize imbalance.**

  A large imbalance may cause the motor to vibrate abnormally, ultimately resulting in damage to the motor.

- **A motor having a keyed shaft must always be used with the key.**

  If the motor has a keyed shaft, operating the motor without the key may result in the motor torque being degraded or in an imbalance being generated, resulting in failure of the motor.

4 NOTE

NOTE

- **Do not step or sit on the motor.**

  Stepping or sitting on the motor is likely to damage the motor. Also, do not stack uncrated motors on top of each other.

- **Store the motor in a dry (non–condensing) atmosphere at room temperature (0 to 40 °C).**

  If the motor is stored in a location which does not satisfy the above conditions, its components are likely to be damaged or deteriorate. Store the motor with its shaft level and its terminal box facing up.

- **Do not remove the nameplate.**

  If the nameplate becomes detached for any reason, store it in a safe place. If the nameplate is lost, it will become impossible to determine the model, such that appropriate maintenance cannot be performed. For a built–in spindle motor, the nameplate must always be attached to the spindle.

- **Protect the motor from impact and physical damage.**

  Any impact to the motor, or physical damage, may adversely affect the motor components, thus preventing normal operation. Be particularly careful when handling the plastic parts, sensor, or windings, all of which are relatively fragile. Never attempt to move the motor by gripping a plastic part, winding, or power cable.

- **Do not perform a dielectric strength or insulation test (megger test) on the detector.**

  Performing such a test on the detector is likely to damage the elements.

- **Observe IEC34 conditions when testing the motor (wiring resistance, insulation resistance, etc.).**

  Testing the motor under conditions other than those specified in IEC34 may result in damage to the motor.

- **Do not disassemble the motor.**

  Disassembling the motor may cause the motor to operate abnormally or malfunction. If the motor must be disassembled, such as for maintenance, contact your FANUC service representative.

NOTE

- **Do not attempt to modify the motor.**

  Do not modify the motor unless requested by FANUC. Otherwise, the motor may operate abnormally or malfunction.

- **Use the motor under the specified conditions in an appropriate environment.**

  Using the motor under other than the specified conditions, or in an unsuitable environment, may cause the motor to malfunction or even result in an accident. Refer to the Descriptions for details of the operating environment and conditions.

- **Do not connect the motor directly to the commercial power supply.**

  Connecting the motor directly to the commercial power supply may result in the windings burning out. Power must only be supplied via the specified amplifier.

- **For a model having a terminal box, prepare a conduit hole only at a specified location.**

  When making a conduit hole, be careful not to crack or damage other than the specified location. For details, refer to the Descriptions.

- **Ensure that the winding resistance and insulation resistance are normal, before attempting to use the motor.**

  Always measure the winding resistance and insulation resistance, particularly when the motor has been in storage for a long time. The motor may have deteriorated depending on the conditions and duration of the storage. For details of the winding resistance, refer to the Descriptions or contact FANUC. For details of the insulation resistance, see the table given below.

- **Perform periodic maintenance and inspection (including measurement of the winding resistance and insulation resistance) to ensure the safe operation of the motor and prolong its service life.**

  Note, however, that certain types of inspection such as dielectric strength testing may damage the windings. For details of the winding resistance, refer to the Descriptions or contact FANUC. For details of the insulation resistance, see the table given below.

Measuring the insulation resistance of the motor

Measure the insulation resistance between the windings and frame, using a megohmmeter (500 VDC). Determine the state from the following table:

Insulation resistance	Judgment
Greater than 100 MΩ	Satisfactory
10 to 100 MΩ	The motor has started to deteriorate. Performance is not affected but periodic inspection is required.
1 to 10 MΩ	The motor has deteriorated to a degree where performance may be adversely affected. Periodic inspection is required.
Less than 1 MΩ	Defective. Replace the motor.

PREFACE

This manual describes the following series and their models are as follows:

Name of series	Name of models
α series	α 0.5, α 1, α 1.5, α 2, α 3, α 6, α 8, α 12, α 15, α 18, α 22, α 30, α 40 High speed models: α 1/15000, α 2/15000, α 3/12000, α 6/12000, α 8/8000, α 12/8000, α 15/8000, α 18/8000, α 22/8000, α 30/6000 IP55 models: α 1 (IP55), α 1.5(IP55), α 2(IP55), α 3(IP55)
α P series	α P8, α P12, α P15, α P18, α P22, α P30, α P40, α P50, α P60 High speed models: α P8/8000, α P12/8000, α P15/8000, α P18/8000, α P22/8000, α P30/6000, α P40/6000
α (HV) series	α 6HV, α 8HV, α 12HV, α 15HV, α 18HV, α 22HV, α 30HV, α 40HV, α 60HV
α C series	α C1, α C1.5, α C2, α C3, α C6, α C8, α C12, α C15, α C18, α C22

Related manuals

The following six kinds of manuals are available for FANUC CONTROL MOTOR α series. In the table, this manual is marked with an asterisk (*).

Document name	Document number	Major contents	Major usage	
FANUC AC SERVO MOTOR α series DESCRIPTIONS	B–65142E	● Specification ● Characteristics ● External dimensions ● Connections	● Selection of motor ● Connection of motor	
FANUC AC SPINDLE MOTOR α series DESCRIPTIONS	B–65152E	● Specification ● Characteristics ● External dimensions ● Connections		*
FANUC SERVO AMPLIFIER α series DESCRIPTIONS	B–65162E	● Specifications and functions ● Installation ● External dimensions and maintenance area ● Connections	● Selection of amplifier ● Connection of amplifier	
FANUC CONTROL MOTOR α series MAINTENANCE MANUAL	B–65165E	● Start up procedure ● Troubleshooting ● Maintenance of motor	● Start up the system (Hardware) ● Troubleshooting ● Maintenance of motor	
FANUC AC SERVO MOTOR α series PARAMETER MANUAL	B–65150E	● Initial setting ● Setting parameters ● Description of parameters	● Start up the system (Software) ● Turning the system (Parameters)	
FANUC AC SPINDLE MOTOR α series PARAMETER MANUAL	B–65160E	● Initial setting ● Setting parameters ● Description of parameters		

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I. DESCRIPTIONS FOR THE α series

1 GENERAL

The FANUC AC Spindle Motor α series, which is a spindle motor series for CNC machine tools, has been used in many machine tool applications and provides the following outstanding features based on technology FANUC has accumulated over the years :

Features

- From among a wide variety of motor series, the user can choose the motor ideal for his or her specific requirements. Also, the motors of each series are compatible ; that is, they can be freely interchanged.
- By employing a unique stator cooling system that directly air–cools the electromagnetic steel sheet, the series has easily achieved high power output and high speed rotation with a compact design.
- The series has achieved a vibration within V5 at high–speed rotation by accurate rotor balance adjustment. (V10 for some models)
- By reducing the rotor inertia, a shorter acceleration/deceleration time has been achieved.
- The user can easily select the air flow direction (either front or rear) of the fan motor to minimize the thermal deformation of the machine.
- Motors are available which have a built–in position coder required for synchronizing spindle feed with motion along the Z–axis and for rigid tapping.
- This series employ waterproof and pressure–proof design conforming to the international standard (IEC).

2 CONFIGURATION OF THE α series

The FANUC AC Spindle Motor α series consists of the series listed below with their features.

- α series
  Standard motors for machine–tool spindles
- α P series
  Motors with constant output over a wide range, which require no reduction units
- α (HV) series
  Motors can be connected with a 400/460 VAC power supply directly without using a power transformer.
- α C series
  Economical motors

3 MOTOR TYPES

Each model has the following types, allowing the user to select the ideal motor for the machine tool being used.
See the ordering list (B–65151E) for available motors.

Item	Type	Use	Remarks
Mounting types	Flange mounting type	Connected to spindle via a gear Directly connected to a spindle Connected to spindle via a belt	The motor can be positioned accurately.
	Foot mounting type	Connected to a spindle with a belt	
Built–in detector (The αC series has no detector.)	M sensor	Orientation, rigid tapping, etc.	For a detailed explanation, refer to the following descriptions: For system configurations and position coders: B–65162 For spindle BZ sensors: B–65202EN
	MZ sensor	Orientation, rigid tapping, and Cs contouring control	
Key	With a key	Connected to a pulley or another item with a keyway	At speeds higher than 4500 min^{-1}, the use of a motor with no key is recommended.
	With no key	Connected to a pulley or another item with no keyway	
Cooling air exhaust direction	Exhaust from side opposite the output shaft (Rearward exhaust)	When the machine is positioned at the output shaft side	Direct the exhaust out and away from the machine.
	Exhaust from the output shaft side (Forward exhaust)	When the machine is positioned at the side opposite the output shaft	
Output shaft seal	Oil seal	Gear connection, direct connection, and belt connection	Used in flange mounting type standard–speed models.
	Labyrinth	Belt driving and direct connection (Only when no lubricant splashes onto the flange surface of the motor)	Used in flange mounting type high–speed models. (Some high–speed models have an oil seal.)
	No seal	Belt driving (Only when no lubricant splashes onto the flange surface of the motor)	Foot–mounting type models have no output shaft seal, but can be changed to a model with an oil seal or labyrinth. For the models that can be changed, refer to "Order List" (B–65151E).
Maximum speed	Standard–speed model	–	Consider the maximum speed of each model and select a model accordingly.
	High–speed model	–	

The following main functions require the motor(s) listed below:

- Spindle orientation by a position coder
  - Motor with a built–in M sensor + spindle α position coder
  - Motor with a built–in M sensor + spindle BZ sensor
  - Motor with a built–in MZ sensor

NOTE
For the resolution of each motor with a built–in MZ sensor, refer to the related series specifications.

- Spindle orientation by an external one–rotation signal
  - Motor with a built–in MZ sensor + external one–rotation signal switch
- Spindle orientation by a magnetic sensor
  - Motor with a built–in M sensor + spindle magnetic sensor
- Rigid tapping
  - Motor with a built–in M sensor + spindle α position coder
  - Motor with a built–in MZ sensor
- Cs contour control
  - Motor with a built–in MZ sensor + spindle BZ sensor
  - Motor with a built–in MZ sensor + spindle α position coder S
- Spindle synchronization
  - Motor with a built–in M sensor + spindle α position coder

NOTE
The αC series spindle motors can also support spindle orientation by a position coder, rigid tapping, and spindle synchronization.
For details, refer to SERVO AMPLIFIER α series DESCRIPTIONS (B–65162E).

4 NOTES ON INSTALLATION

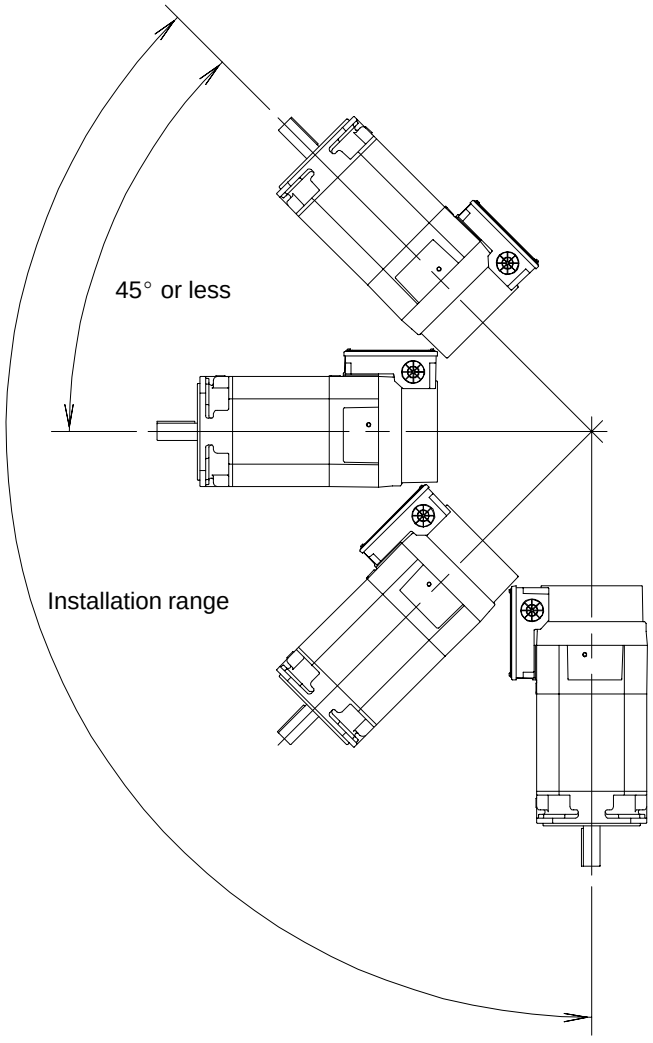
4.1 COMMON

WARNING

When connecting a metal conduit to the plastic terminal box, put the conduit to earth on the side of the machine.

CAUTION

1 Mount the motor so that the output shaft points in a direction ranging within 45° degrees above the horizontal to vertically downwards. When the motor needs to be pointed to more than 45° degrees above the horizontal, consult you FANUC representative. The terminal box can be installed at any angle.



CAUTION

2 Use the eyebolt of the motor to lift only a single motor, (gear and pulley may be attached).

3 Place a cover over an air–cooled motor to prevent the motor from being exposed to coolant.

4 Limit the vibration acceleration at the rear bracket of the motor to 0.5 G (4.9 m/s^2) to ensure the long–term reliability of each part of the motor. In particular, to limit the acceleration in the case of direct connection to 0.5 G, carefully perform centering with the mating spindle and make the motor shaft parallel with the spindle.

Details of the measuring method

Measuring instrument:

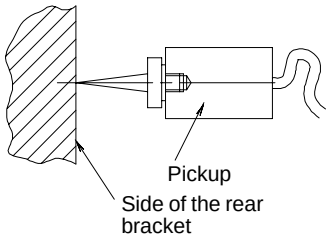
Equivalent to the VM–3314A or VM–3304 manufactured by IMV CORPORATION.

Condition: Measurement frequency range with no load at the highest speed: 10 to 1000 Hz

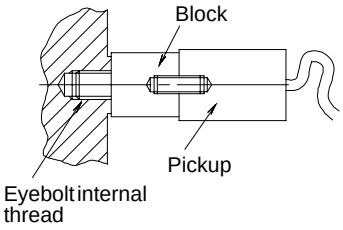
Criteria: 0.5 G (4.9 m/s^2) or less at the rear bracket

1. Using a pickup

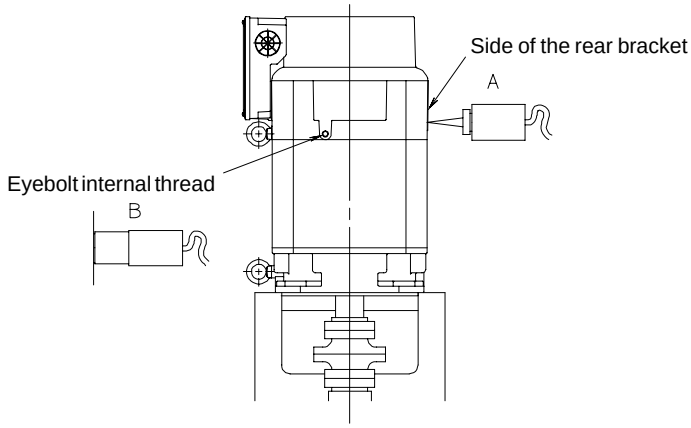
A. Pressing a pickup against the side of the rear bracket



B. Screwing a block into the eyebolt internal thread on the rear bracket, then screwing a pickup into the block



2. Vibration measurement position (rear bracket)



CAUTION

5 Dynamic balance

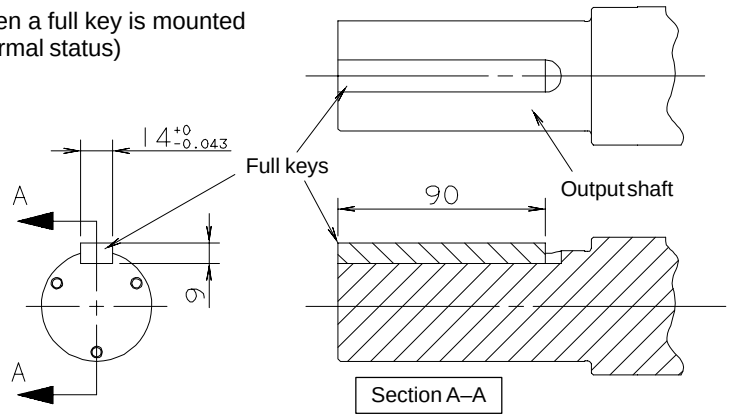
During high–speed operation, a small imbalance may cause a large vibration, resulting in an unusual sound, premature bearing damage, or some other abnormality. Therefore, reduce the amount of the imbalance with the dynamic balance of the other rotation shafts, as well as the gear and pulley mounted on the output shaft of the motor, as much as possible.

(1) Correction for the motor itself

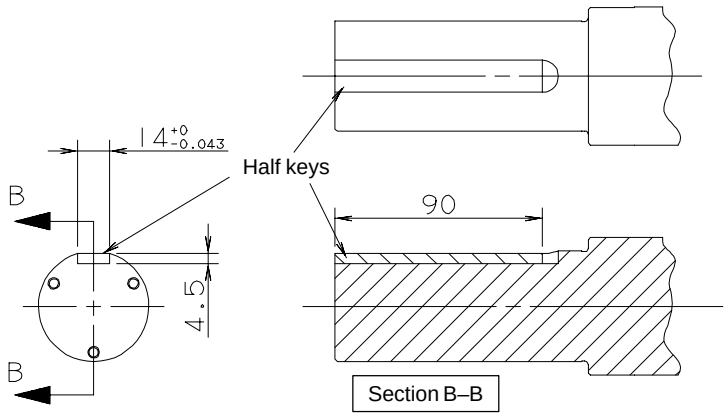
For the rotors of all motors with a key, the imbalance of the dynamic balance has been corrected by mounting a half key having half the thickness of a full key, as shown in the outside dimension diagram. (For motors with no key, the imbalance has been corrected using no key.)

Example) For model α12 with a key

When a full key is mounted
(Normal status)



When a half key is mounted
(The imbalance of the rotor has been corrected in this status.)



CAUTION

(2) Correction with a pulley mounted

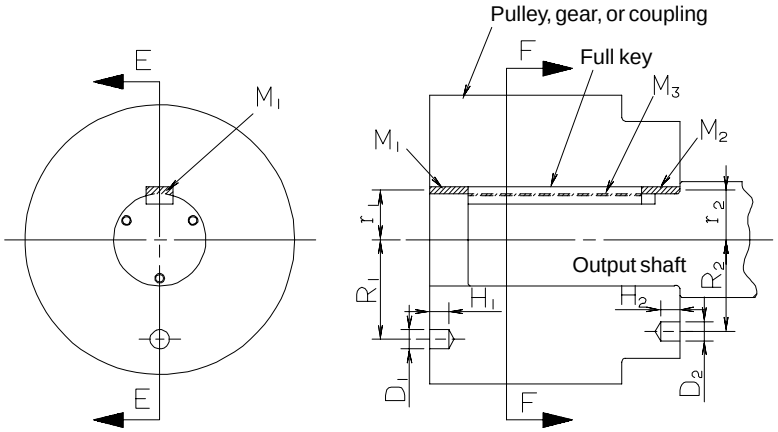
(a) When the pulley is longer than the key

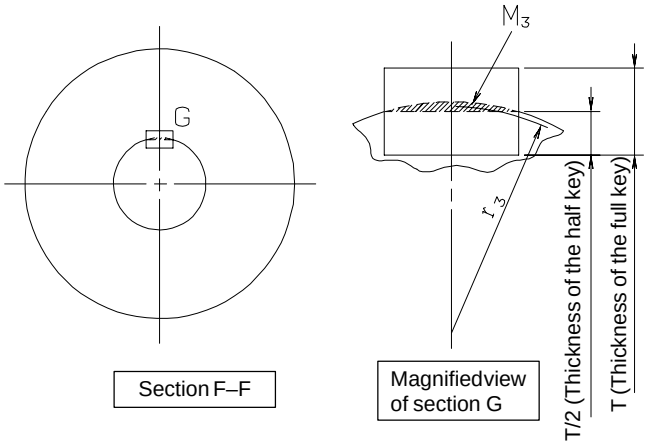
When the pulley is longer than the key, M_1 and M_2 in the keyway and M_3 in the full key imbalance section may cause an imbalance. To satisfy the following equations, drill holes D_1 and D_2 in advance:

$\pi(D_1/2)^2 \times H_1 \times \rho \times R_1 = M_1 \times r_1 - (M_3/2) \times r_3$

$\pi(D_2/2)^2 \times H_2 \times \rho \times R_2 = M_2 \times r_2 - (M_3/2) \times r_3$

D_1 and D_2 : Diameter of each correction hole (cm)
H_1 and H_2 : Depth of each correction hole (cm)
ρ : Specific gravity of the pulley (kgf/cm^3)
R_1 and R_2 : Distance from the center line to each correction hole (cm)
M_1 and M_2 : Weight based on the pulley material (kgf)
M_3 : Weight of the imbalance section of the full key (kgf)
(Perform calculation with the specific gravity assumed to be 7.8 x 10^{-3} kgf/cm^3.)
r_1, r_2, and r_3: Distance from the center line to M_1, M_2, or M_3 (cm)





NOTE

1 The same correction method is used for the gear, coupling, and so on as well as the pulley.
2 This correction is not required for a motor having no key.
3 When a motor is to be used at a speed higher than 4500 min^{-1}, the use of a motor having no key is recommended.
4 This correction does not result in the fully balanced status.
If correction is still required, perform correction (c).

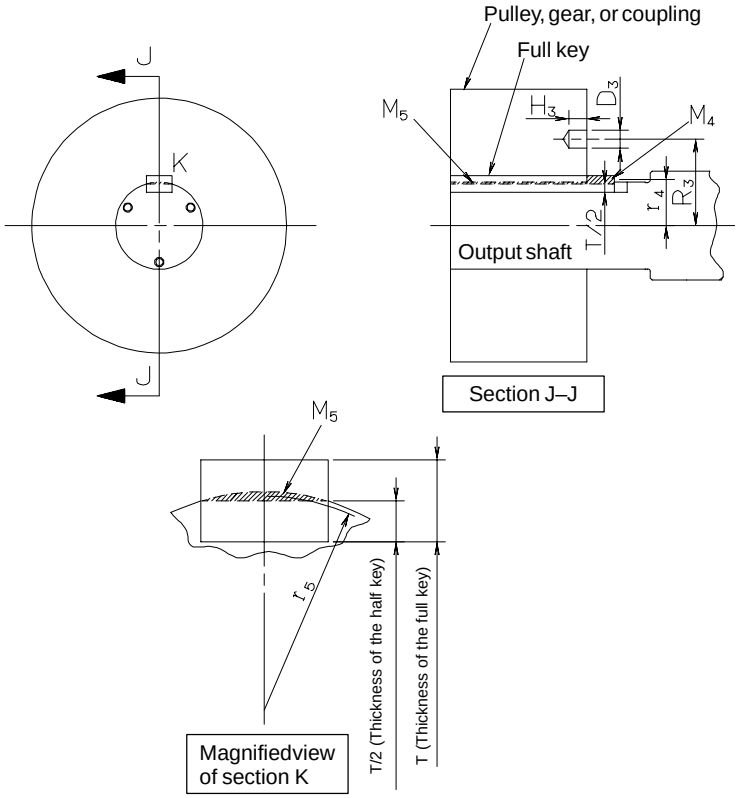
CAUTION

(b) When the pulley is shorter than the key

When the pulley is shorter than the key, M_4 and M_5 in the full key imbalance section may cause an imbalance. To satisfy the following equations, drill hole D_3 in advance:

$\pi(D_3/2)^2 \times H_3 \times \rho \times R_3 = M_4 \times r_4 + M_5 \times r_5$

D_3 : Diameter of the correction hole (cm)
H_3 : Depth of the correction hole (cm)
ρ : Specific gravity of the pulley (kgf/cm^3)
R_3 : Distance from the center line to the correction hole (cm)
M_4 and M_5 : Weight of the key in section M_4 or M_5 (kgf)
(For the calculation, assume the specific gravity to be 7.8 x 10^{-3} kgf/cm^3.)
r_4 and r_5 : Distance from the center line to M_4 or M_5 (cm)



NOTE

1 The same correction method is used for the gear, coupling, and so on as well as the pulley.
2 This correction is not required for a motor having no key.
3 When a motor is to be used at a speed higher than 4500 min^{-1}, the use of a motor with no key is recommended.
4 This correction does not result in the fully balanced status.
If correction is still required, perform correction (c).

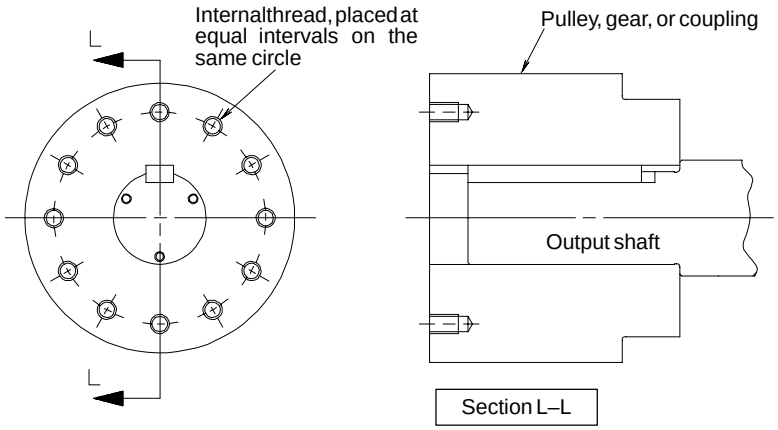
CAUTION

(c) More effective correction method

If correction (a) or (b) proves unsatisfactory or if the motor being used has no key, the imbalance can be corrected by inserting a set screw into an internal thread.

For correction, a machine equivalent to the following field balancing machine is required. For the correction method, refer to the operator's manual of the field balancing machine to be used.

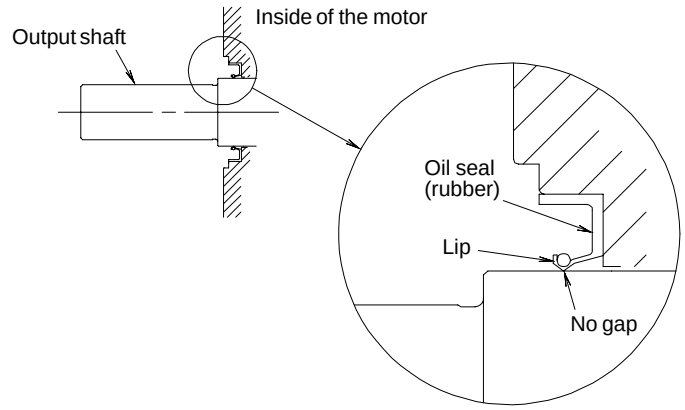
Field balancing machine : DEP–F manufactured by AKASHI.
VIBROBALANCER 41 manufactured by SCHENCK



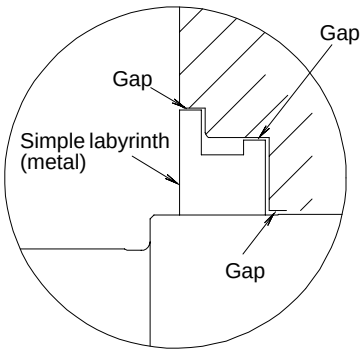
CAUTION

6 Output shaft seal

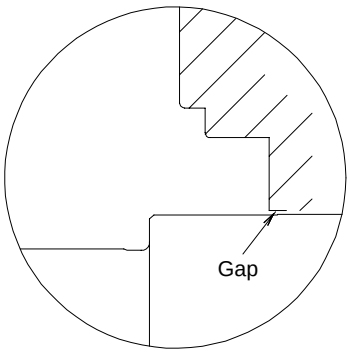
To prevent cutting lubricant or dust from penetrating inside the motor, one of the following output shaft seals is provided on the output shaft. (For the use and applicable motors, see Chapter 3, “Selecting a Motor.”)



With an oil seal



With a simple labyrinth



No seal

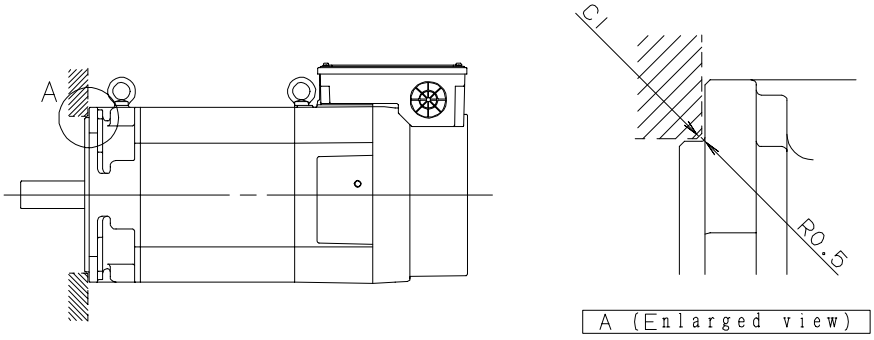
For those models with an oil seal, ensure that the surface of the lubricant is below the lip of the oil seal.

If a simple labyrinth is used as the output shaft seal (high–speed model) or if no seal is provided (foot mounting type), ensure that lubricant does not splash onto the flange surface. (If such a motor is directly mounted on a gear box, the lubricant may gradually penetrate inside the motor even when no lubricant splashes on flange surface, thus resulting in motor failure. Therefore, do not mount such a motor on a gear box directly.

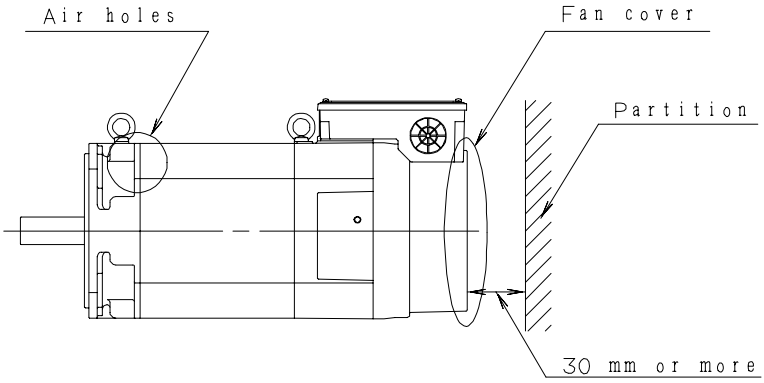
CAUTION

7 Mounting the lid on the terminal box
The lid of the terminal box is provided with rubber gasket to make it waterproof. Check that the lid has this gasket, then mount it on the terminal box.

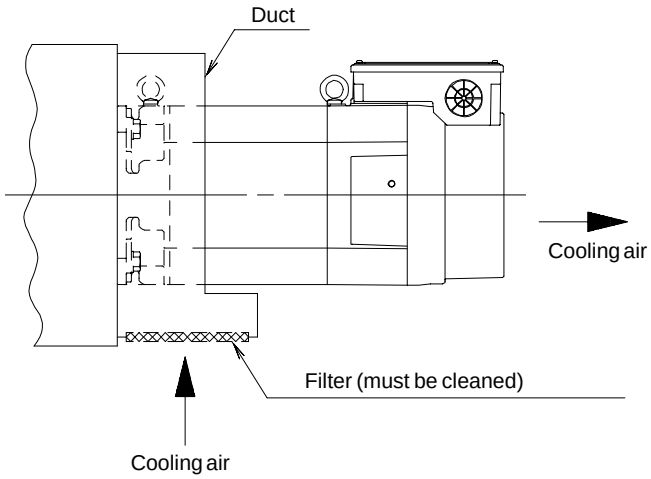
8 The edge of the fauset joint to mount the motor should be chamfered about C1.



9 Please space 30 mm or more between the fan cover and the partition to keep the cooling ability well.
We recommend to take a structure such as you can clean air holes and the fan cover easily.



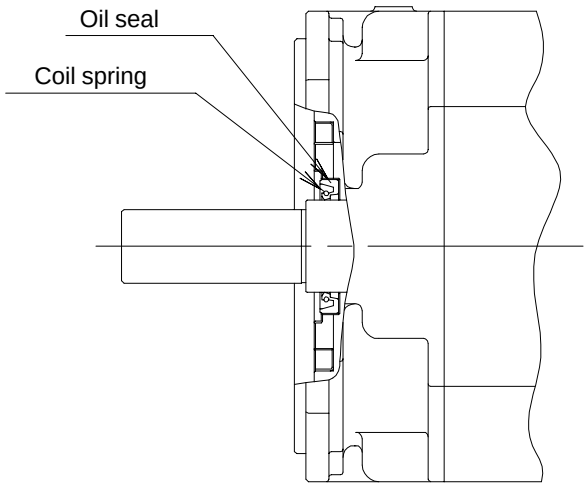
10 If much oil mist, dust, or other foreign matter settles on the motor, the cooling performance is degraded, resulting in degraded performance of the motor. Design the machine such that only clean cooling air is drawn into the motor.
Example) When a duct with a filter is installed on a flange mounting type motor with a rearward exhaust slot
(The filter requires periodic cleaning.)



NOTE

1 A foot mounting type motor has no oil seal. When an oil seal is required, add #0002 to the drawing number of the motor. An oil seal cannot be attached to any high–speed model, however. For details, refer to “Order List” (B–65151E).
Example) The drawing number of 12 A06B–0856–B200 with an oil seal is A06B–0856–B200#0002.

2 When the oil seal is not exposed to lubricant, remove the coil spring of the oil seal to decrease the friction between the lip and shaft. This operation does not adversely affect the dustproofness of the motor.



Oil seal section

NOTE

3 Cable wiring

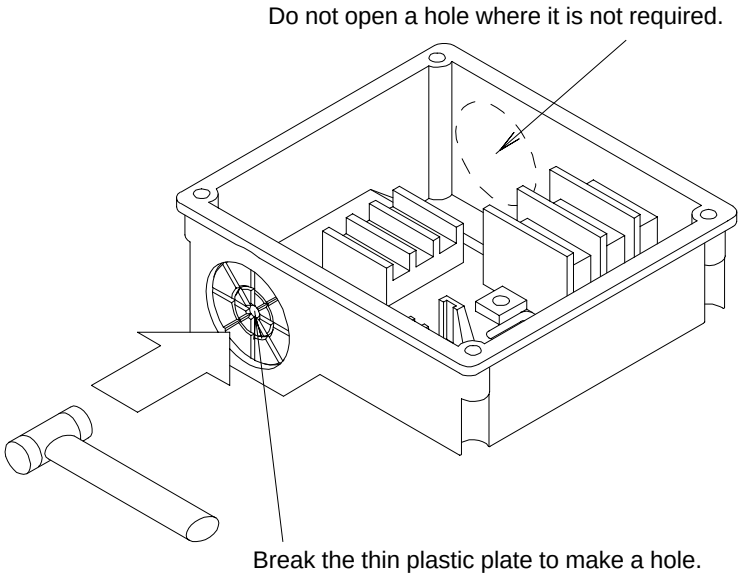
Follow the procedure below to install the cable.

(1) Use a hammer to strike the portion for the cable hole on the terminal box and open the hole.
This time, pay attention not to break the other place except hole.
(In some models, it is not necessary to make a hole.)

(2) Thread the cable through a conduit . Connect the conduit with the connector.

(3) Tighten the connector at the cable hole of the terminal box using a nut.

(4) Connect each terminal appropriately in the terminal box with screws.



When a hole once made is not used, purchase the following rubber bushing and mount it at the hole.

Model	Ordering number
α 1 to α 15, α P8 to α P22, α 6HV to α 15HV, α C1 to α C15	A06B–0754–K001
α 18, α 22, α P30, α P40, α P50, α 18HV, α 22HV, α C18, α C22	A06B–0731–K001

High speed models are same as above.

4.2 WHEN A MOTOR IS CONNECTED TO A SPINDLE VIA A BELT

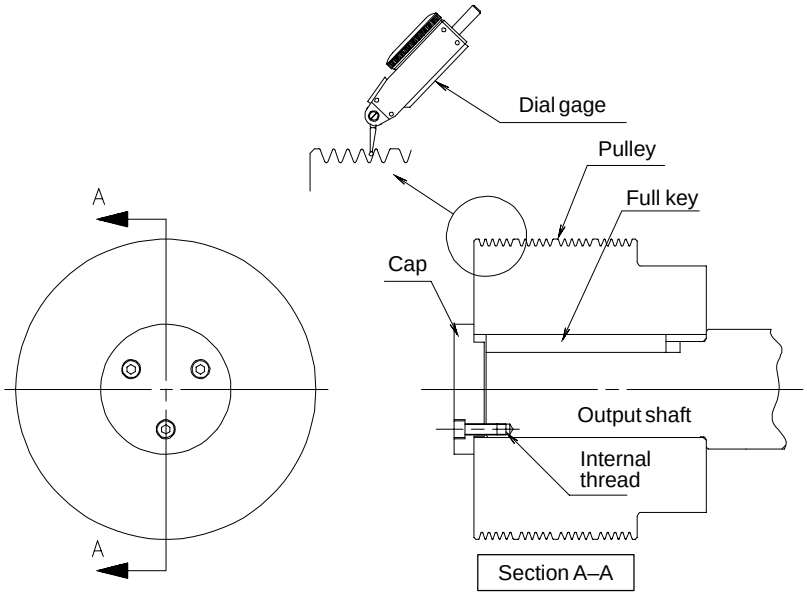
CAUTION

1 When using a motor with a key

– The gap between the inner surface of the motor pulley and output shaft should be 10μm or less. If the gap is large, fretting produced at the gap causes a large vibration, resulting in damage to the motor bearing.
To reduce the gap to 0, the pulley can be shrunk–fit by heating it to 100°C or so, but maintenance will be difficult in this case. Therefore, the use of a motor having no key is recommended.

– Perform adjustment so that the runout of the belt slot is 20μm or less when the pulley is rotated through one turn.

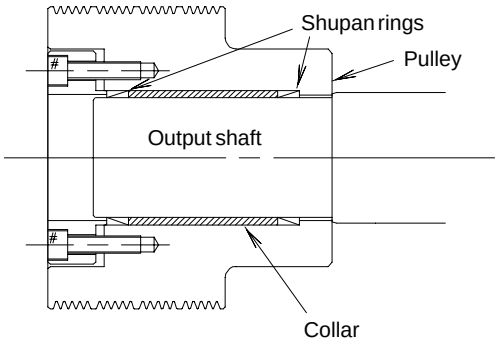
– Use the internal thread at the end of the motor output shaft to fix the pulley.



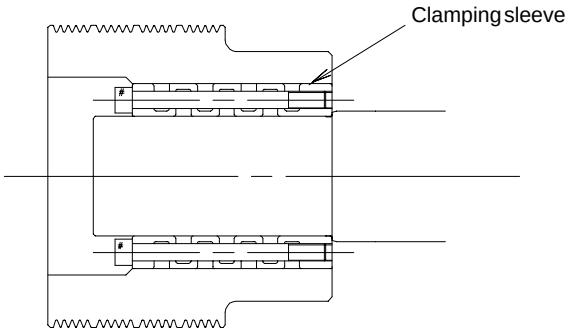
CAUTION

2 When using a motor with no key
- In the same way as when using a motor with a key, use a pulley having the shape shown in the figure below. This makes fretting less likely to occur.
- In the same way as when using a motor with a key, perform adjustment so that the runout of the belt slot is 20μm or less when the pulley is rotated through one turn.

Example 1 Two sets of shupan ring RfN8006 are used.
The collar is pinched at two points by the two sets.



Example 2 Clamping sleeve DSM is used.



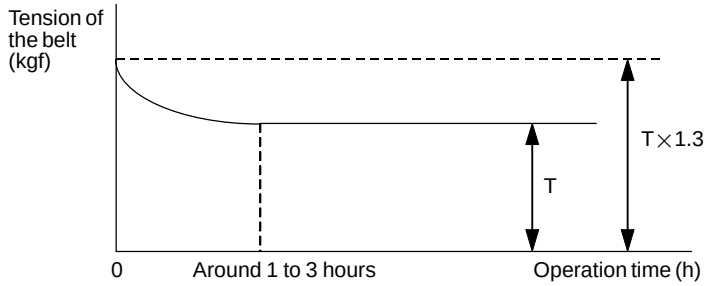
NOTE
Shupan ring RfN8006 and clamping sleeve DSM are manufactured by RINGFEDER.

3 Before the pulley is mounted on the motor and the belt is looped, FANUC recommends that the dynamic balance (field balance) be corrected.

4 Limit the radial load applied to the motor output shaft by the tension of the belt to the allowable value described in the manual for each series. If the allowable value is exceeded, the bearing may fail prematurely.

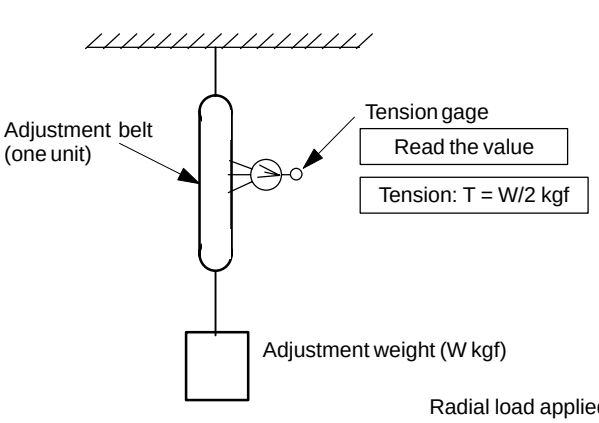
CAUTION

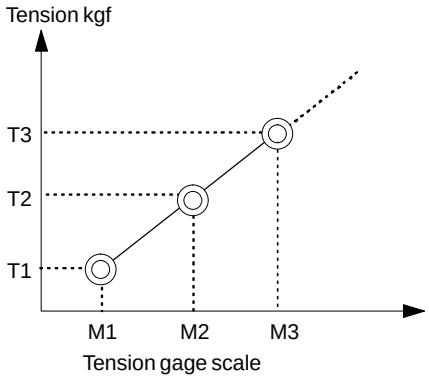
5 The tension of the belt is reduced as a result of abrasion during the initial several hours of operation. To transfer torque normally after this reduction in tension, the initial tension before operation should be set to a value 1.3 times the actually required tension T.



Recommended belts: Liveace manufactured by BANDO.
Livestar manufactured by MITSUBOSHI.

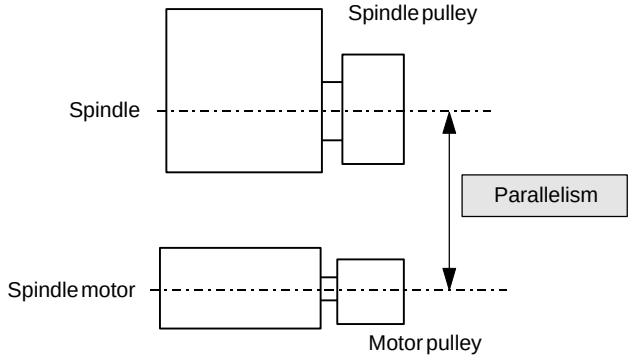
6 Use an appropriate tension gage to tension the belt.
Examples Sonic type: U–305 series manufactured by UNITTA.
Mechanical type: BT–33 series manufactured by Borroughs of the United States
A mechanical type tension gage may give a false reading depending on the belt's number of peaks and length. To overcome this problem, hang an object of a known weight on the belt, read the tension value, then adjust the tension gage.

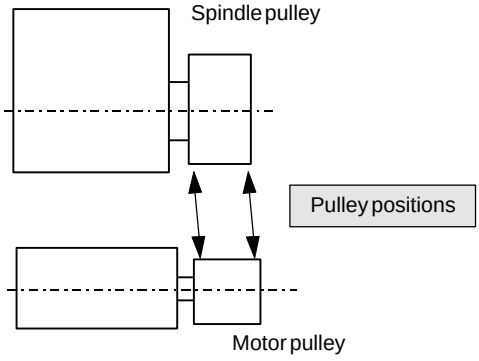




Radial load applied to the motor shaft (kgf) = tension (T kgf) x 2 x number of belts

7 Reduce the deviation between the positions of the motor and machine pulleys in the shaft direction as much as possible and ensure that the center lines of the shafts are as parallel as possible.





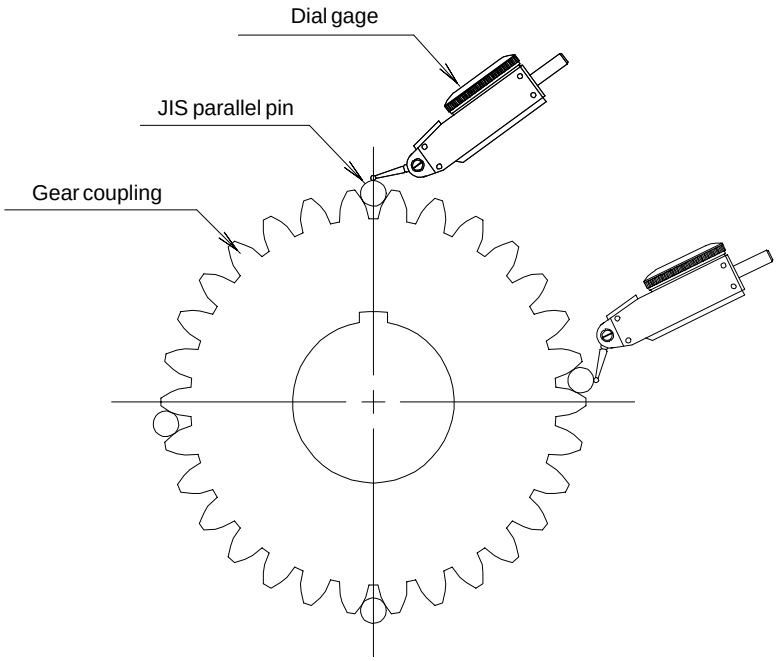
4.3 WHEN A MOTOR IS CONNECTED TO A SPINDLE VIA A GEAR

CAUTION

1 Do not use a helical gear which applies a load in the motor axial direction.

2 To prevent unusual gear sounds, apply the following precautions:

(1) The deviation of the gear tooth surface should indicate the proper value.
(Tip) Measuring the deviation of a gear tooth surface



(2) The correct backlash should be provided.

(3) The perpendicularity of the motor flange mounting surface to the machine shaft should indicate the proper value.

3 Mount the motor on the machine so that the vibration acceleration is 0.5 G or less when it is measured using the method described in **CAUTION** 4 of Section 4.1.

4.4 WHEN A MOTOR IS DIRECTLY CONNECTED TO A SPINDLE VIA A COUPLING

CAUTION

1 Use a coupling which can absorb thermal expansion in the axial direction of the motor mating shaft so that no load is applied in the motor axial direction.
(Examples)
– Diaphragm coupling (EAGLE INDUSTRY CO., LTD.)
– Oldham's coupling
– Gear coupling

2 Set the torsional rigidity of the coupling to an appropriate high value.
If the torsional rigidity is low, vibration may be produced during orientation.

3 It is important to perform centering and obtain parallelism to avoid having to recourse to the flexibility of the coupling.
At high speeds, any eccentricity may cause the bearing to fail prematurely.

4 Check all machines before shipping to confirm that the vibration acceleration is 0.5 G or less when measured using the method described in **CAUTION** 4 of Section 4.1.

5 NOTES ON OPERATION

WARNING

1 Securing earthing
When supplying voltage to the main motor or the fan motor, ensure that the earth cable is connected to the earth terminal and secure that the main motor is put to earth certainly.

2 After a continuous and long operation, the temperature of model α 0.5 and α series IP55 models may rise higher than other motors because they have no fan motor. So please treat them carefully.

CAUTION

1 Sound and vibration
Check that there is no abnormal sound or vibration.

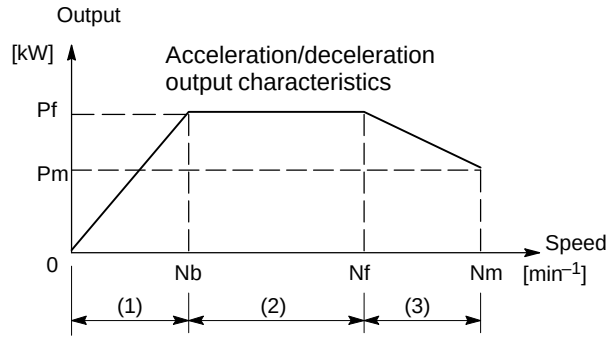
2 Cooling
Clean the cooling–air inlet and outlet every year to ensure good ventilation.
Check that the fan motor rotates in the direction indicated by the arrow on the fan housing. Also check that cooling air flows in the correct direction.

NOTE

Breaking in a motor
To increase the operating lifetime of a motor of these series, break in the motor. As a guideline, increase the speed of the motor from 1000 min^{-1} to its maximum speed in 1000 min^{-1} increments, and operate the motor at each speed for about 5 minutes.

6 DETERMINING THE ACCELERATION TIME

The time required for each acceleration for the acceleration/deceleration output characteristics shown below can be obtained from the following equation.
Since machine load torque is not taken into consideration, the actual time is slightly longer than the calculated time.



J_L : Load inertia converted for the motor shaft [kg·m·s^2]
Jm : Motor inertia [kg·m·s^2]
Pf, Pm : Output [kW]
Nb, Nf, Nm : Speed [min^{-1}]

NOTE
The target output during acceleration/deceleration is 1.2 times the 30–minute rated output of each model (10– or 15–minute rated output for some models). When an αC series motor is used or if the machine load torque is high, use the 30–minute rated output as is.

- Acceleration time (t_1) in the constant–torque range (0 to Nb)

$$t_1 = 0.10754 \times \frac{(J_L + J_m) \times Nb^2}{Pf \times 1000} \quad [s]$$

- Acceleration time (t_2) in the constant–output range (Nb to Nf)

$$t_2 = 0.10754 \times \frac{(J_L + J_m) \times (Nf^2 - Nb^2)}{2 \times Pf \times 1000} \quad [s]$$

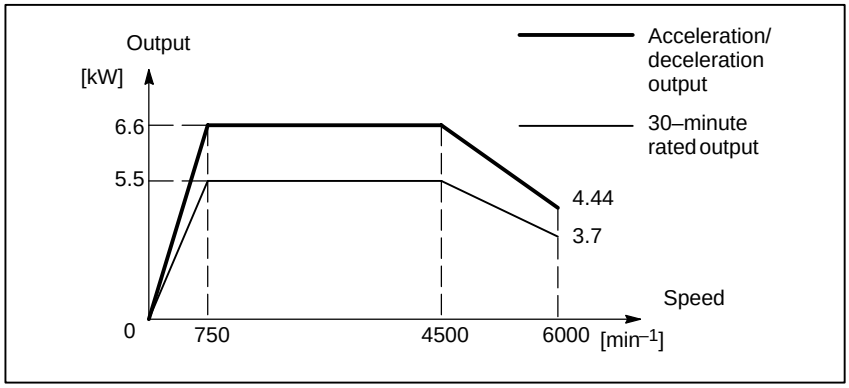
- Acceleration time (t_3) in the decreasing–output range (Nf to Nm)

$$t_3 = 0.10754 \times \frac{(J_L + J_m) \times (Nm–Nf)}{(Pm–Pf) \times 1000} \times \{(Nm–Nf) – \frac{PfNm–PmNf}{Pm–Pf} \times Ln(Pm/Pf)\} \quad [s]$$

The total time (t) required for acceleration in the range from 0 to Nm is $t_1+t_2+t_3$ [s]
Deceleration can be controlled so that the time required for deceleration is nearly equal to that for acceleration. When the power voltage is high, or the impedance of the power is high, the time required for deceleration may not be made equal to that for acceleration.

Calculation example

Model αP8 has the acceleration/deceleration output characteristics shown below.



In this case, the variables have the following values.
Jm : 0.0028 [kg·m·s^2]

NOTE
The rotor inertia is 0.28 [kgf·cm·s^2] in the αP8 specifications. When the unit is changed for calculation, the rotor inertia is 0.28 [kgf·cm·s^2]/100 = 0.0028

Pf : 5.5×1.2=6.6 [kW] (Note 1)
Pm : 3.7×1.2=4.44 [kW] (Note 1)
Nb : 750 [min^{-1}]
Nf : 4500 [min^{-1}]
Nm : 6000 [min^{-1}]

NOTE
For all models, these are not guaranteed values but guidelines. In case of α C series, use 30 min rated output for Pf and Pm (10 min or 15 min rated output for some models), and acc/dec time constant parameter (refer to technical report B–65160E/01–04) must be adjusted.

Suppose that J_L is 0.0056 [kg m s^2]. Then the acceleration times are as follows:

- Acceleration time (t_1) in the constant–torque range (0 to 750 min^{-1})

$$t_1 = 0.10754 \times \frac{(0.0056 + 0.0028) \times 750^2}{6.6 \times 1000} = 0.0770 \ [s]$$

- Acceleration time (t_2) in the constant–output range (750 to 4500 min^{-1})

$$t_2 = 0.10754 \times \frac{(0.0056 + 0.0028) \times (4500^2 - 750^2)}{2 \times 6.6 \times 1000} = 1.3473 \ [s]$$

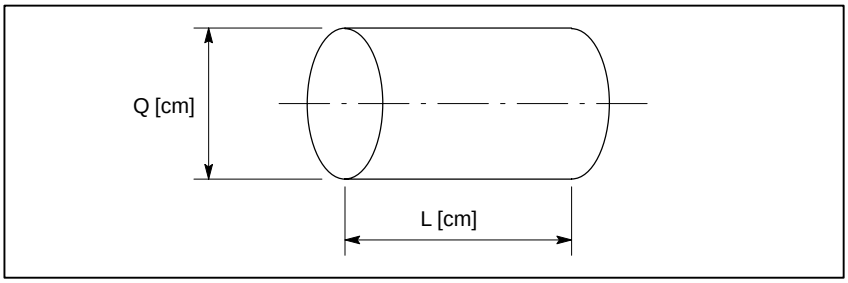
- Acceleration time (t_3) in the decreasing–output range (4500 to 6000 min^{-1})

$$t_3 = 0.10754 \times \frac{(0.0056 + 0.0028) \times (6000 - 4500)}{(4.44 - 6.6) \times 1000} \times \left\{(6000 - 4500) - \frac{6.6 \times 6000 - 4.44 \times 4500}{4.44 - 6.6} \times Ln(4.44/6.6)\right\} = 1.3178 \ [s]$$

The total time required for acceleration in the range from 0 to 6000 min^{-1} is $t_1+t_2+t_3$=2.742 [s]

Reference 1

When a cylinder rotates about its center axis, its inertia can be obtained from the following equation. The inertia of a gear can be obtained in a similar way.



$$J = \frac{\pi\gamma}{32 \times 980} Q^4 L \quad [kg \cdot cm \cdot s^2]$$

When steel ($\gamma = 7.8 \times 10^{-3}$ kg/cm^3) is used, the approximate inertia is obtained from the following equation.

$$J = 0.78 \times 10^{-6} Q^4 L \quad [kg \cdot cm \cdot s^2]$$

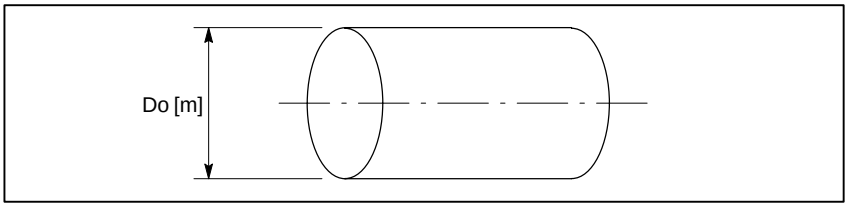
When the unit for J is changed.

$$J = 0.78 \times 10^{-8} Q^4 L \quad [kg \cdot m \cdot s^2]$$

Reference 2

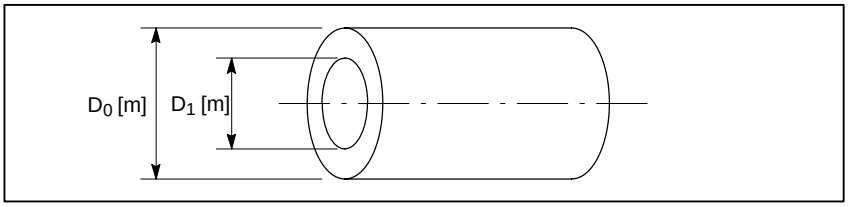
To obtain the value GD^2 [kg·m^2] for cylinder, get the value of G from its weight in kilograms and use the following equation to get the value of D^2.

- **Solid cylinder**



$$D^2 = D_0^{\,2}/2$$

- **Hollow cylinder**



$$D^2 = (D_0^{\,2} + D_1^{\,2})/2$$

Use the following equiation to convert GD^2 to J [kg · cm · s^2]

$$J[kgf \cdot cm \cdot s^2] = GD^2\ [kgf \cdot m^2]/4/g \times 100$$
$$= GD^2\ [kgf \cdot m^2]/4/9.80665 \times 100$$
$$= GD^2\ [kgf \cdot m^2] \times 2.55$$

NOTE
g indicates the acceleration of gravity: 9.80665 [m/s^2].

Reference 3

Note the following relationship between the value of inertia I [kg·m^2] in SI units and the value of GD^2 [kgf·m^2]:

$$I[kg \cdot m^2] = GD^2[kgf \cdot m^2]/4$$

Therefore, to convert I [kg·m^2] to J [kgf·cm·s^2], use the following equation:

$$J[kgfVcmVs^2] = GD^2[kgfVm^2]/4/g \times 100$$
$$= \mathbf{I}[kgVm^2]/g \times 100$$
$$= \mathbf{I}[kgVm^2]/9.80665 \times 100$$
$$= \mathbf{I}[kgVm^2] \times 10.2$$

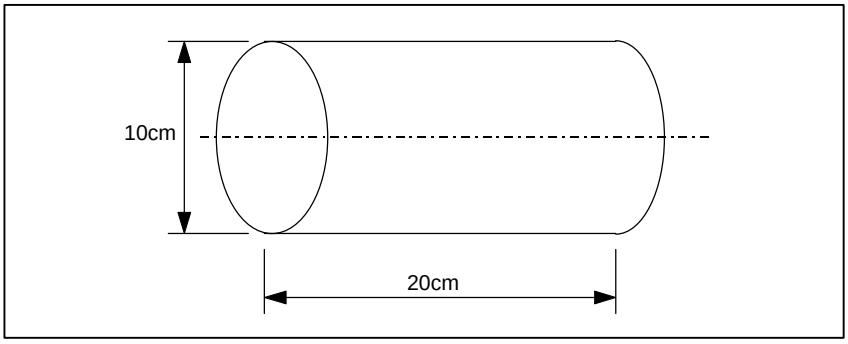
NOTE
g indicates the acceleration of gravity: 9.80665 [m/s^2].

Reference 4

Difference of inertia

Calculate the inertia of the solid steel cylinder shown in the following figure.

- **Solid cylinder**



(1) Calculating J [kgf·cm·s^2]

$J = \pi\gamma/(32\times980)\times Q^4\times L$

$= \pi\times7.8\times10^{-3}/(32\times980)\times10^4\times20$

$= 0.156$[kgf·cm·s^2]

(2) Calculating GD^2 [kgf·m^2]

$G = \pi/4\times10^2\times20\times\gamma$

$= \pi/4\times10^2\times20\times7.8\times10^{-3}$

$= 12.25$[kgf]

$D^2 = D_0^2/2$

$= 0.1^2/2$

$= 0.005$[m^2]

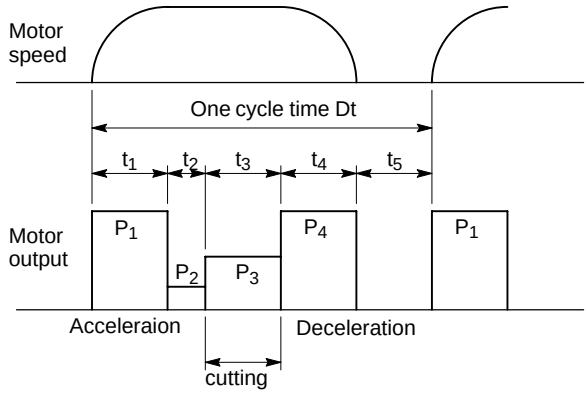
$GD^2 = 12.25\times0.005$

$= 0.0613$[kgf·m^2]

7 DETERMINING THE ALLOWABLE DUTY CYCLE

When machining requires the spindle to accelerate and decelerate frequently, the average output per cycle must not exceed the continuous rated output.
The allowable duty cycle for a typical AC spindle motor can be obtained as shown below.

Duty cycle and average output



P_1, P_4: Acceleration/deceleration output [kW] = 30 min rated output at const. output power range × 1.2
Note 1) 10 min rated output at const. output power range × 1.2 or 15 min rated output at const. output power range ×1.2 apply for some models.
2) This is not a guaranteed value but a guideline.
P_2 : Output with no load [kW] (P_2=0)
P_3 : Cutting output [kW]

Average output $$Pav = \sqrt{\frac{P_1^2 t_1 + P_2^2 t_2 + P_3^2 t_3 + P_4^2 t_4}{Dt}}$$

NOTE
This is not a guaranteed value but a guideline.

NOTE
1 Cutting output P_3 at motor speed N which is lower than base speed Nb shall be calculated by the following equation.

$P_3=P_C \times Nb/N$ [kW] (P_C: Actual cutting output)

NOTE
2 In case that P_3 is calculated by the load indicator voltage, use the following equation.

$P_3=P_1 \times L_3/10$ [kW] (L_3: Load indicator voltage in cutting [V])

Allowable duty cycle time Dt

From the equation for getting the value of Pav.

$$Dt = \frac{1}{Pav^2} \times (P_1^2 t_1 + P_2^2 t_2 + P_3^2 t_3 + P_4^2 t_4)$$

Substitute the continuous rated output of the used AC spindle motor for Pav [kW] in the equation above.

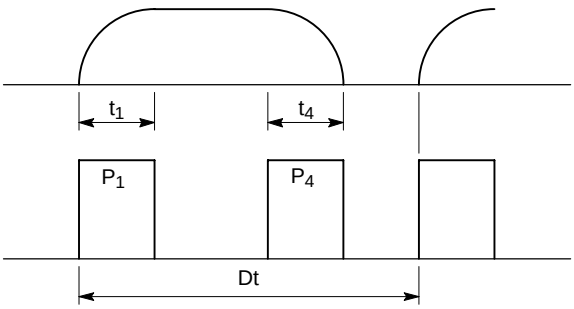
Example) To obtain the allowable duty cycle when model α3 accelerates and decelerates repeatedly without load ($P_2=P_3=0$).

- Continuous rated output Pav=Pcont=3.7kW
- Acceleration/deceleration output
  $P_1=P_4=5.5\text{kW} \times 1.2=6.6\text{kW}$
  (This is not a guaranteed value but a guideline.)
- Acceleration time t_1=3s, deceleration time t_4=3s

$$Dt = \frac{1}{3.7^2} \times (6.6^2 \times 3 + 6.6^2 \times 3) = \frac{6.6^2}{3.7^2} \times (2 \times 3) = 19.08\ s$$

As shown above, when model α 3 accelerates and decelerates repeatedly, the allowable duty cycle is 3.18 times the sum of the acceleration time and deceleration time.

Allowable duty cycle time Dt for repeated acceleration/deceleration



$$Dt = \frac{1}{P_{cont}^2} \times (P_{30min} \times 1.2)^2 \times (t_1 + t_4)$$

P_{cont} : Continuous rated output
P_{30min} : 30–minute rated output
(10 min or 15 min rated output apply for some models.)
t_1+t_4 : Sum of the acceleration and deceleration time

II. FANUC AC SPINDLE MOTOR
α series

1 GENERAL

The FANUC AC spindle motor αseries is ideal for CNC machine tool spindles.

Features

- The motor is compact, light–weight and furnished with digital control for much higher performance.
- The motor inertia of the AC spindle motor is made smaller to shorten the acceleration/ deceleration speed. Further, optimum control enables highly efficient cutting.
- The motor incorporating a position coder required for synchronous feed of the spindle and Z axis, so rigid tapping can be used.
- Improvement in machining of the motor housing enhances the accuracy of the mounting part.
- Waterproof and pressure–proof design conforming to the international standard (IEC) is employed to improve reliability and make it resistant to most environments.

2 SPECIFICATIONS

SPECIFICATIONS

Series		α series												
Item \ Model		α 0.5	α 1	α 1.5	α 2	α 3	α 6	α 8	α 12	α 15	α 18	α 22	α 30	α 40 (*1)
Output (*2)	Cont. rated kW (HP)	0.55 (0.74)	1.5 (2.0)	1.1 (1.5)	2.2 (3.0)	3.7 (5.0)	5.5 (7.4)	7.5 (10)	11 (14.7)	15 (20.1)	18.5 (24.8)	22 (29.5)	30 (40.2)	37 (49.6)
	30 min rated kW [15 min, 10min] (*3) (HP)	1.1 (1.5)	2.2 (3.0)	3.7 (5.0)	3.7 (5.0)	5.5. (7.4)	7.5 (10)	11 (14.7)	15 (20.1)	18.5 (24.8)	22 (29.5)	26 (34.9)	37 (49.6)	45 (60.3)
	S3 60% kW [40%, 25%] (*4) (*5) (HP)	1.1 (1.5)	2.2 (3.0)	3.7 (5.0)	3.7 (5.0)	5.5 (7.4)	7.5 (10)	11 (4.7)	15 (20.1)	18.5 (24.8)	22 (29.5)	26 (34.9)	37 (49.6)	45 (60.3)
Rated current A (*6)	Cont. rated	7	11	13	19	23	36	44	53	74	91	105	139	170
	30 min rated (*3) S3 60% (*4)	11	13	27	27	29	44	56	65	85	102	117	164	196
Speed min^{-1}	Base speed	3000	3000	1500	1500	1500	1500	1500	1500	1500	1500	1500	1150	1500
	Max. speed	8000	8000	8000	8000	8000	8000	6000	6000	6000	6000	6000	4500	6000
Output torque N·m (Cont. rated torque at const. rated torque range) (kg·cm)		1.75 (17.9)	4.77 (48.7)	7.00 (71.4)	14.0 (143)	23.5 (240)	35.0 (357)	47.7 (487)	70.0 (714)	95.4 (974)	117.7 (1201)	140.0 (1428)	249.1 (2540)	235.5 (2402)
Rotor inertia	$kg \cdot m^2$	0.00048	0.003	0.0043	0.0078	0.0148	0.0215	0.0275	0.09	0.09	0.128	0.128	0.295	0.355
	$kgf \cdot cm \cdot s^2$	0.0048	0.03	0.04	0.08	0.15	0.22	0.28	0.93	0.93	1.29	1.29	3.0	3.6
Weight kg		7	18	24	27	46	60	80	110	110	143	143	250	290
Vibration		V5												
Noise		75 dB (A) or less												
Cooling system (*7)		TENV IC0A0	Totally enclosed and fan cooled IC0A6	Totally enclosed and fan cooled IC0A5									Totally enclosed and fan cooled IC0A6	
Cooling fan W		None	17	20					56				84	
Installation (*8)		The output shaft must be oriented in the range from 45° above the horizontal to 90° below the horizontal. IMB5, IMV1, IMB3, IMB6, IMB7, IMB8, IMV5												
Allowable overload capacity (1 min) (*9)		120 % of 30 min rated output												
Insulation		Class H												
Ambient temperature		0–40°C												
Altitude		Height above sea level not exceeding 1000m												
Painting color		Munsell system N2.5												
Detector		M sensor or MZ sensor												
Type of thermal protection (*10)		TP211												
Resolution of the MZ sensor		2048					4096							
Number of detected gear teeth per rotation		64 teeth	128 teeth				256 teeth (*11)							
Bearing lubrication		Grease												
Maximum output during acceleration		1.32	2.64	4.44	4.44	6.6	9.0	13.2	18.0	22.2	26.4	31.2	44.4	54.0
Applicable spindle amplifier		SPM–2.2		SPM–5.5			SPM–11		SPM–15	SPM–22		SPM–26	SPM–45	

NOTE

*1 The α40 differs from the conventional 40S in its outside dimensions and output characteristics.
*2 The rated output is guaranteed at the rated voltage.
(Amplifier input: 200/220/230V AC +10% –15%, 50/60 Hz ±1Hz)
If the input voltage fluctuates, it is possible that the rated output cannot be obtained even when such fluctuations are within the allowable fluctuation range.
*3 The output for α 0.5, α1 and α 2 is 15 min rated. That for α1.5 is 10 min rated.
*4 S3 40% for α 0.5 and α 30, S3 25% for α 1.5.
*5 The cycle time is 10 minutes, S3 60%: ON 6 minutes, OFF 4 minutes, S3 40%: ON 4 minutes, OFF 6 minutes and S3 25%: ON 2.5 minutes, OFF 7.5 minutes.
*6 The rated current is the maximum current for each rated output.
*7 IC code conforms to IEC 34–6. TENV means totally enclosed and non–ventilated.
*8 IM code conforms to IEC 34–7.
*9 This is not a guaranteed value but a guideline for the maximum motor output at a rated supply voltage. 120 % of 15 min rated for α 0.5, α 1 and α 2, and 120% of 10 min rated for α 1.5.
*10 Type conforms to IEC 34–11.
*11 128 teeth for motors with a high resolution magnetic pulse coder.
*12 These values are to be used only as guidance for selecting a power supply module and are not guaranteed.
*13 Degree of protection: with oil seal: IP54, without oil seal: IP40.

SPECIFICATIONS

Series		α series (High speed models)									
Item \ Model		α 1/15000	α 2 /15000	α 3 /12000	α 6 /12000	α 8 /8000	α 12 /8000	α 15 /8000	α 18 /8000	α 22 /8000	α 30/6000
Output (*1)	Cont. rated kW (HP)	1.5 (2.0)	2.2 (3.0)	3.7 (5.0)	5.5 (7.4)	7.5 (10)	11 (14.7)	15 (20.1)	18.5 (24.8)	22 (29.5)	30 (40.2)
	30 min rated kW [15 min] (*2) (HP)	2.2 (3.0)	3.7 (5.0)	5.5. (7.4)	7.5 (10)	11 (14.7)	15 (20.1)	18.5 (24.8)	22 (29.5)	26 (34.9)	37 (49.6)
	S3 60% kW [40%] (*3) (*4) (HP)	2.2 (3.0)	3.7 (5.0)	5.5 (7.4)	7.5 (10)	11 (14.7)	15 (20.1)	18.5 (24.8)	22 (29.5)	26 (34.9)	37 (49.6)
Rated current A (*5)	Cont. rated	11	20	23	36	44	53	74	91	105	139
	30 min rated (*2) S3 60% (*3)	13	26	29	44	56	65	85	102	117	164
Speed min^{-1}	Base speed	3000	3000	1500	1500	1500	1500	1500	1500	1500	1150
	Max. speed	15000	15000	12000	12000	8000	8000	8000	8000	8000	6000
Output torque N·m (Cont. rated torque at const. rated torque range) (kg·cm)		4.77 (48.7)	7.00 (71.4)	23.5 (240)	35.0 (357)	47.7 (487)	70.0 (714)	95.4 (974)	117.7 (1201)	140.0 (1428)	249.1 (2540)
Rotor inertia	$kg \cdot m^2$	0.003	0.0078	0.0148	0.0215	0.0275	0.09	0.09	0.128	0.128	0.295
	$kgf \cdot cm \cdot s^2$	0.03	0.08	0.15	0.22	0.28	0.93	0.93	1.29	1.29	3.0
Weight kg		18	27	46	60	80	110	110	143	143	250
Vibration		V5									
Noise		75 dB (A) or less									
Cooling system (*6)		Totally enclosed and fan cooled IC0A6	Totally enclosed and fan cooled IC0A5								Totally enclosed and fan cooled IC0A6
Cooling fan W		17	20				56				84
Installation (*7)		The output shaft must be oriented in the range from 45° above the horizontal to 90° below the horizontal. IMB5, IMV1									
Allowable overload capacity (1 min) (*8)		120 % of 30 min rated output									
Insulation		Class H									
Ambient temperature		0–40°C									
Altitude		Height above sea level not exceeding 1000m									
Painting color		Munsell system N2.5									
Detector		M sensor or MZ sensor									
Type of thermal protection (*9)		TP211									
Resolution of the MZ sensor		2048			4096						
Number of detected gear teeth per rotation		128 teeth				256 teeth (*9)					
Bearing lubrication		Grease									
Maximum output during acceleration (*10)		2.64	4.44	6.6	9.0	13.2	18.0	22.2	26.4	31.2	44.4
Applicable spindle amplifier		SPM–2.2	SPM–5.5		SPM–11		SPM–15	SPM–22		SPM–26	SPM–45

NOTE

*1 The rated output is guaranteed at the rated voltage.
(Amplifier input: 200/220/230V AC +10% –15%, 50/60 Hz ±1Hz)
If the input voltage fluctuates, it is possible that the rated output cannot be obtained even when such fluctuations are within the allowable fluctuation range.
*2 The output for α 1/15000 and α 2/15000 is 15 min rated.
*3 S3 40% for α 30/6000.
*4 The cycle time is 10 minutes, S3 60%: ON 6 minutes, OFF 4 minutes, S3 40%: ON 4 minutes, OFF 6 minutes.
*5 The rated current is the maximum current for each rated output.
*6 IC code conforms to IEC 34–6.
*7 IM code conforms to IEC 34–7.
*8 This is not a guaranteed value but a guideline for the maximum motor output at a rated supply voltage. 120 % of 15 min rated for α 1/15000 and α 2/15000.
*9 Type conforms to IEC 34–11.
*10 128 teeth for motors with a high resolution magnetic pulse coder.
*11 Degree of protection: α 30/6000: IP54, others: IP40.

3 OUTPUT/TORQUE CHARACTERISTICS

(Reference) Calculation for torque

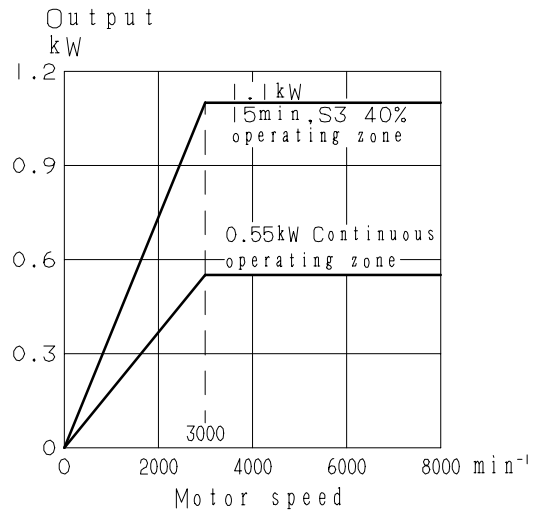
Torque T can be obtained by the following equation.

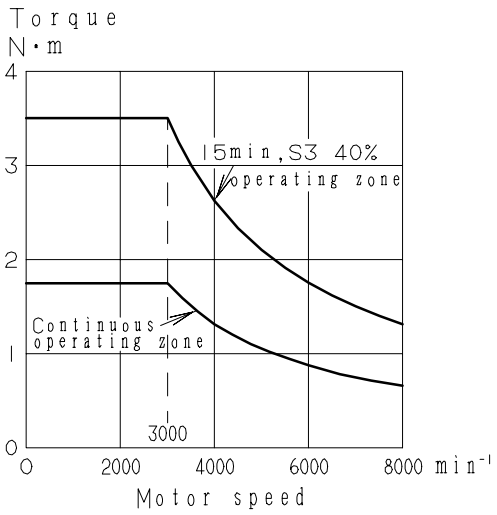
$T[N \cdot m]=P[kW] \times 1000/0.1047/N[min^{-1}]$

P[kW]: motor output
$N[min^{-1}]$: motor speed

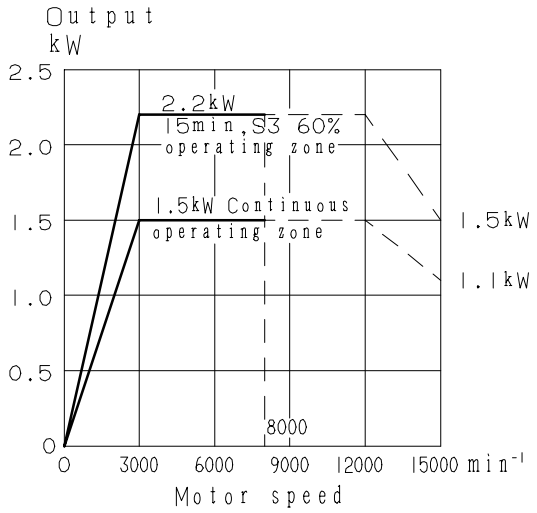
When the unit of T is $[kg \cdot m]$,
$T[kg \cdot m]=P[kW] \times 1000/1.0269/N[min^{-1}]$

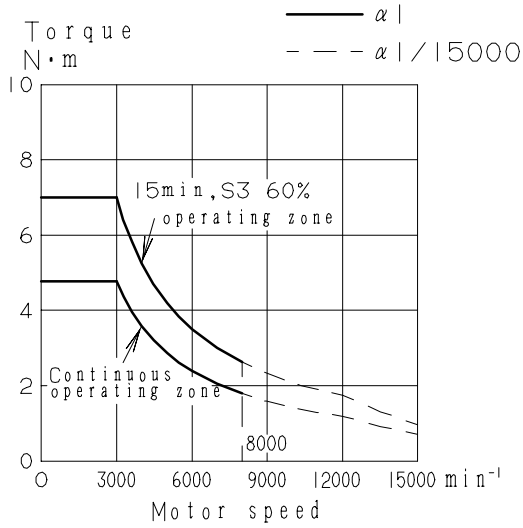
(1)Model α0.5



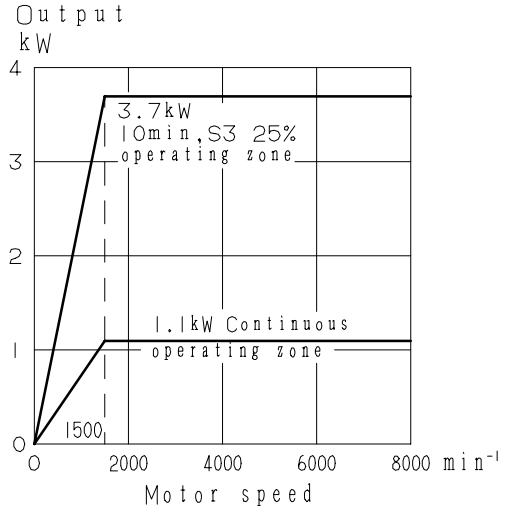


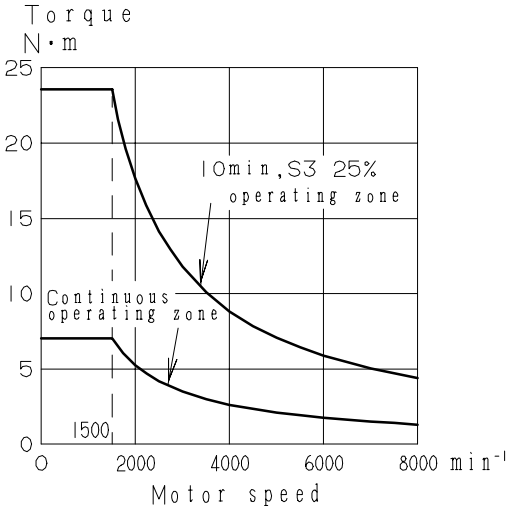
(2)Model α1,α1/15000



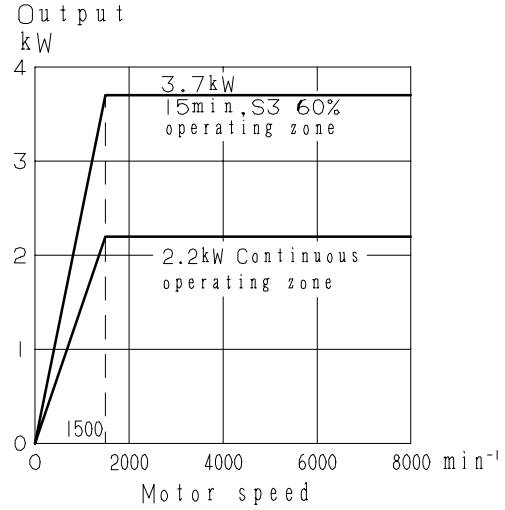


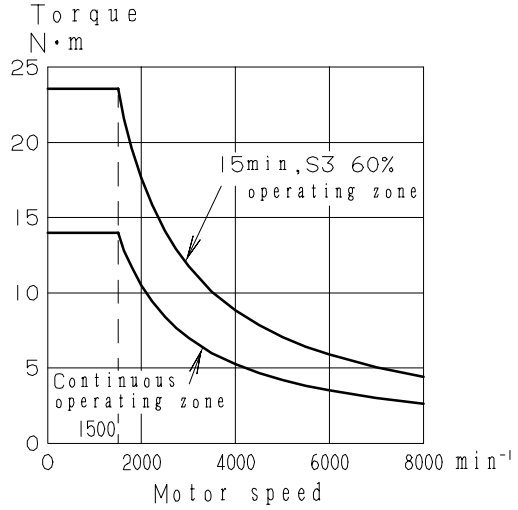
(3)Model α1.5



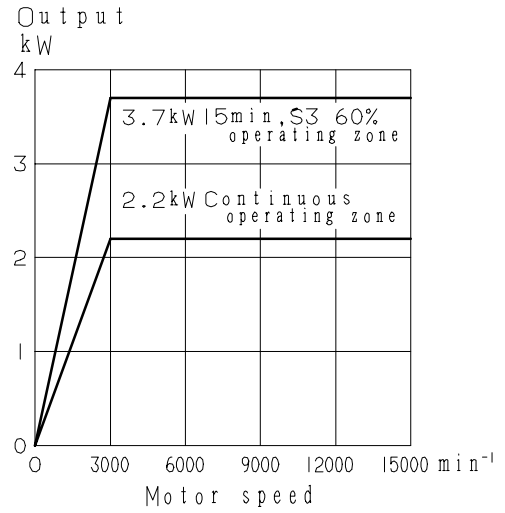


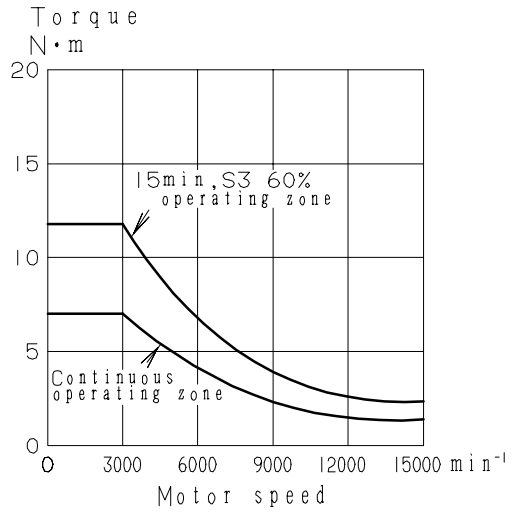
(4)Model α2



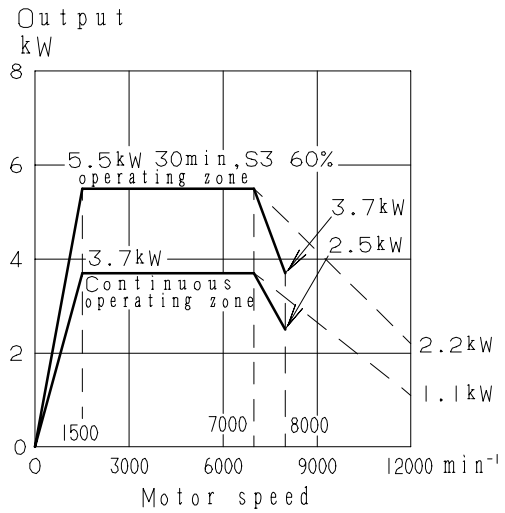


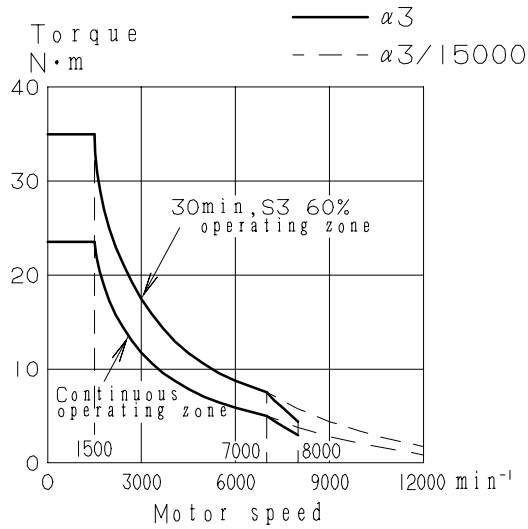
(5)Model α2/15000



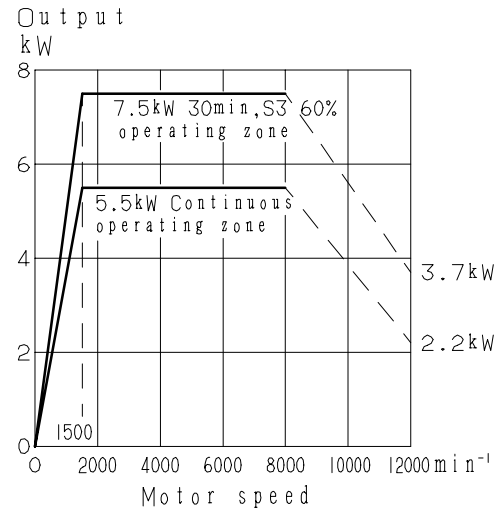


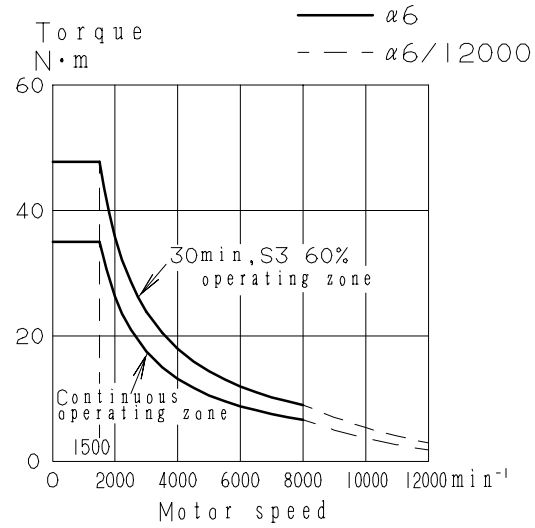
(6)Model α3,α3/12000



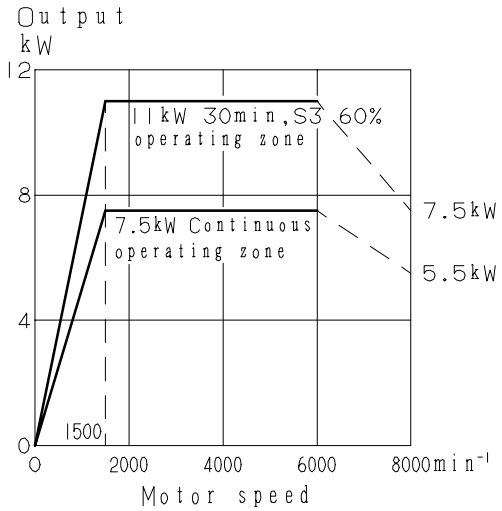


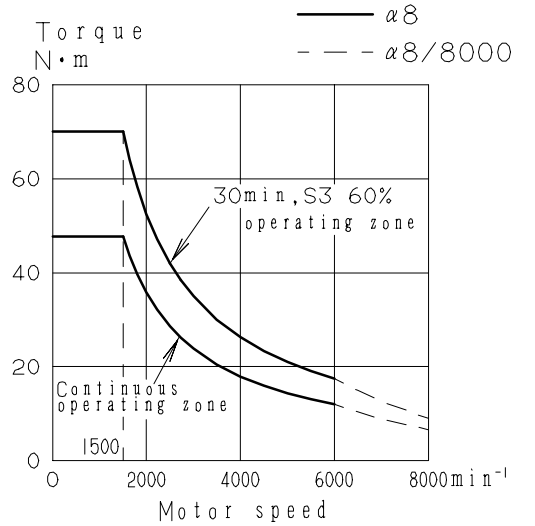
(7)Model α6, α6/12000



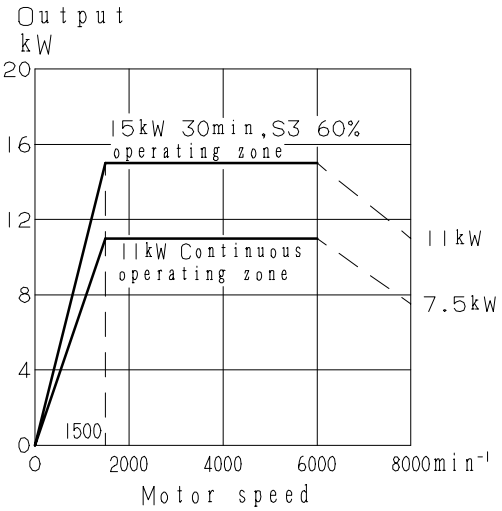


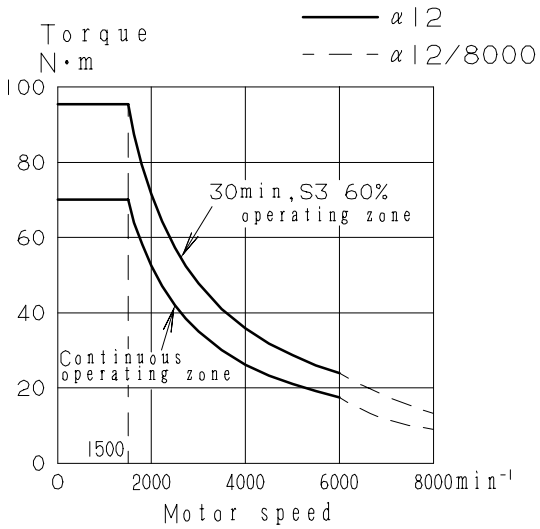
(8)Model α8, α8/8000



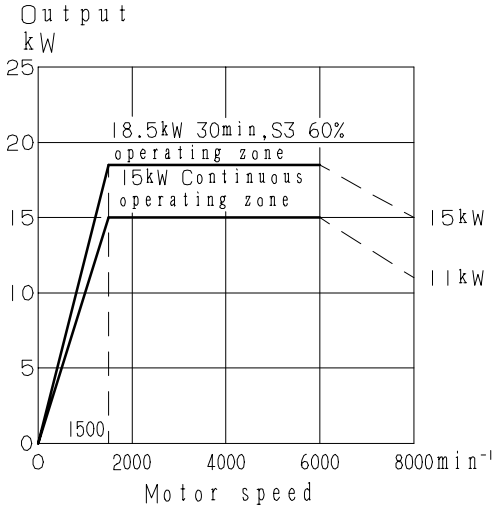


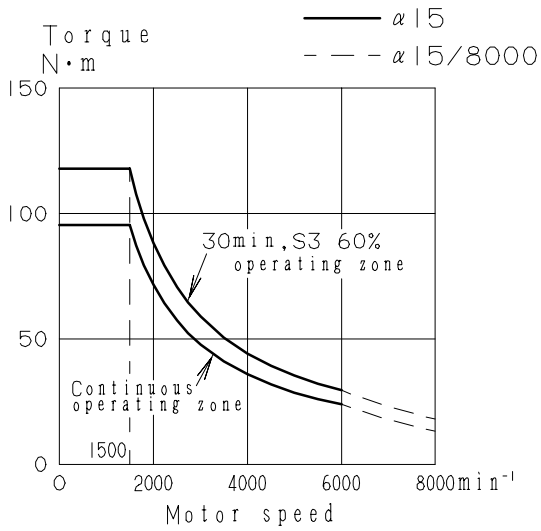
(9)Model α12, α12/8000



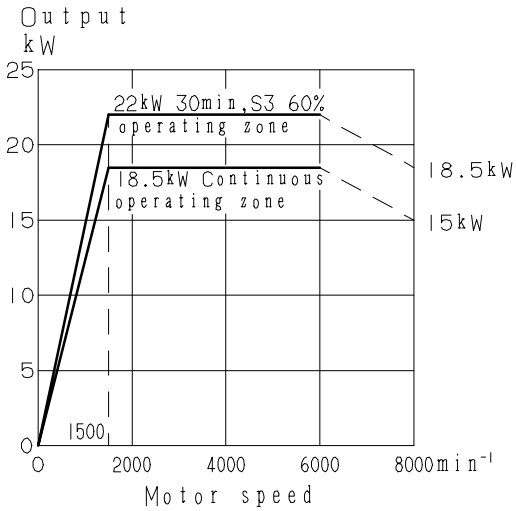


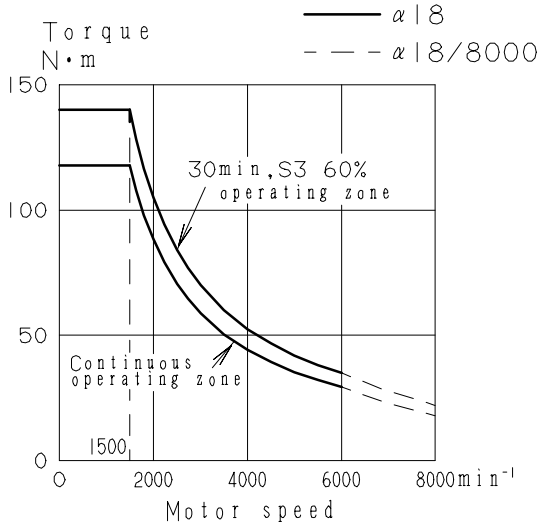
(10)Model α15, α15/8000



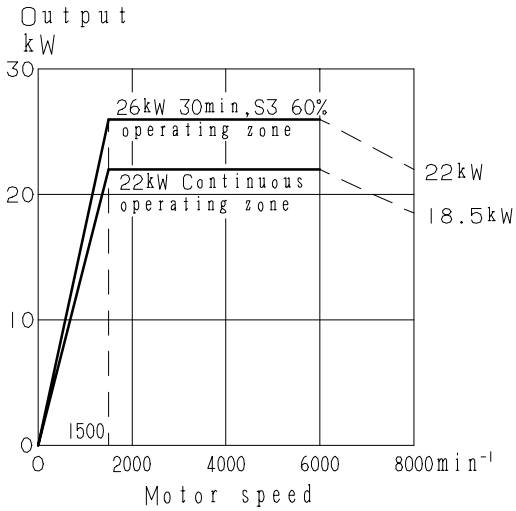


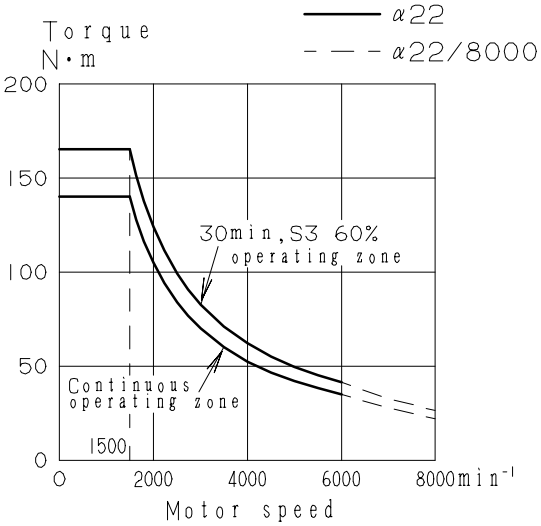
(11)Model α18, α18/8000



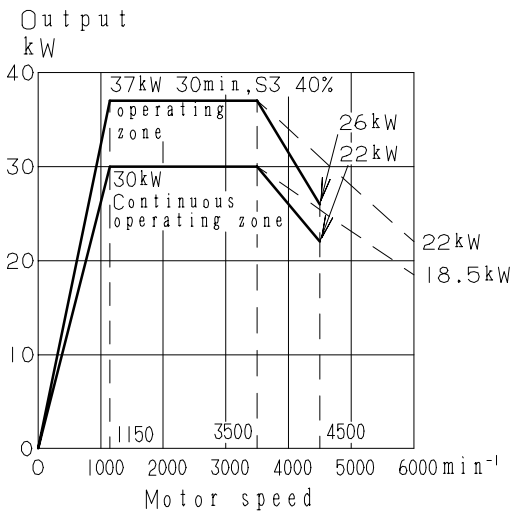


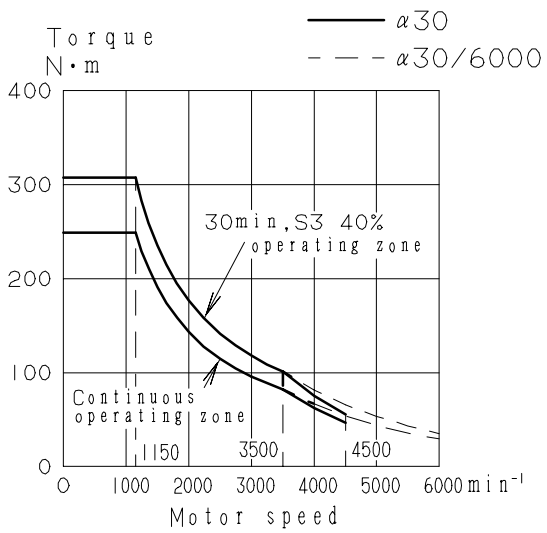
(12)Model α22, α22/8000



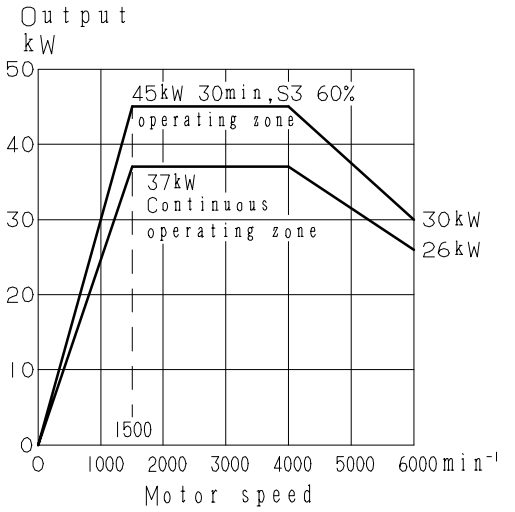


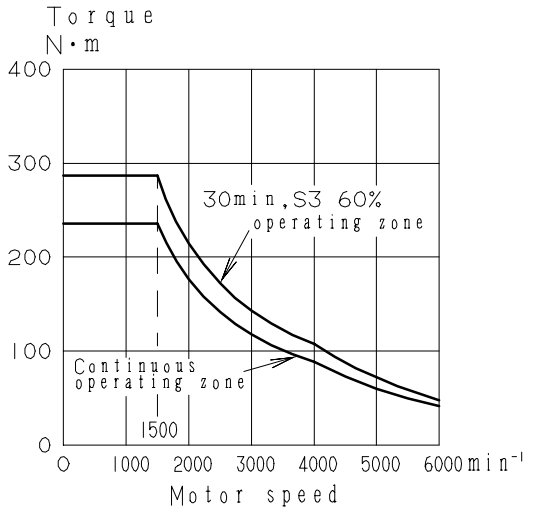
(13)Model α30, α30/6000





(14)Model α40





4 ORDERING NUMBER

(1) α series

Name		Ordering number	Remarks
Model α 0.5	Flange mounting	A06B–0866–B300	8000 min^{-1}, no key
Model α 1	Flange mounting	A06B–0850–B100 A06B–0850–B101 A06B–0850–B300 A06B–0850–B301	8000 min^{-1}, has key, exhaust rear 8000 min^{-1}, has key, exhaust front 8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0850–B200 A06B–0850–B201 A06B–0850–B400 A06B–0850–B401	8000 min^{-1}, has key, exhaust rear 8000 min^{-1}, has key, exhaust front 8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
Model α 1.5	Flange mounting	A06B–0851–B100 A06B–0851–B101 A06B–0851–B300 A06B–0851–B301	8000 min^{-1}, has key, exhaust rear 8000 min^{-1}, has key, exhaust front 8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0851–B200 A06B–0851–B201 A06B–0851–B400 A06B–0851–B401	8000 min^{-1}, has key, exhaust rear 8000 min^{-1}, has key, exhaust front 8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
Model α 2	Flange mounting	A06B–0852–B100 A06B–0852–B101 A06B–0852–B300 A06B–0852–B301	8000 min^{-1}, has key, exhaust rear 8000 min^{-1}, has key, exhaust front 8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0852–B200 A06B–0852–B201 A06B–0852–B400 A06B–0852–B401	8000 min^{-1}, has key, exhaust rear 8000 min^{-1}, has key, exhaust front 8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
Model α 3	Flange mounting	A06B–0853–B100 A06B–0853–B101 A06B–0853–B300 A06B–0853–B301	8000 min^{-1}, has key, exhaust rear 8000 min^{-1}, has key, exhaust front 8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0853–B200 A06B–0853–B201 A06B–0853–B400 A06B–0853–B401	8000 min^{-1}, has key, exhaust rear 8000 min^{-1}, has key, exhaust front 8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
Model α 6	Flange mounting	A06B–0854–B100 A06B–0854–B101 A06B–0854–B300 A06B–0854–B301	8000 min^{-1}, has key, exhaust rear 8000 min^{-1}, has key, exhaust front 8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0854–B200 A06B–0854–B201 A06B–0854–B400 A06B–0854–B401	8000 min^{-1}, has key, exhaust rear 8000 min^{-1}, has key, exhaust front 8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front

NOTE
1 The listed ordering numbers are for motors with a M sensor. The end of the ordering number for the motor, except α 0.5, with a MZ sensor is B□9□. That for α 0.5 is B□8□.
2 Refer to the ordering list (B–65151E) for available motors except above.

(Continued from the previous page)

Name		Ordering number	Remarks
Model α 8	Flange mounting	A06B–0855–B100	6000 min^{-1}, has key, exhaust rear
		A06B–0855–B101	6000 min^{-1}, has key, exhaust front
		A06B–0855–B300	6000 min^{-1}, no key, exhaust rear
		A06B–0855–B301	6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0855–B200	6000 min^{-1}, has key, exhaust rear
		A06B–0855–B201	6000 min^{-1}, has key, exhaust front
		A06B–0855–B400	6000 min^{-1}, no key, exhaust rear
		A06B–0855–B401	6000 min^{-1}, no key, exhaust front
Model α 12	Flange mounting	A06B–0856–B100	6000 min^{-1}, has key, exhaust rear
		A06B–0856–B101	6000 min^{-1}, has key, exhaust front
		A06B–0856–B300	6000 min^{-1}, no key, exhaust rear
		A06B–0856–B301	6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0856–B200	6000 min^{-1}, has key, exhaust rear
		A06B–0856–B201	6000 min^{-1}, has key, exhaust front
		A06B–0856–B400	6000 min^{-1}, no key, exhaust rear
		A06B–0856–B401	6000 min^{-1}, no key, exhaust front
Model α 15	Flange mounting	A06B–0857–B100	6000 min^{-1}, has key, exhaust rear
		A06B–0857–B101	6000 min^{-1}, has key, exhaust front
		A06B–0857–B300	6000 min^{-1}, no key, exhaust rear
		A06B–0857–B301	6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0857–B200	6000 min^{-1}, has key, exhaust rear
		A06B–0857–B201	6000 min^{-1}, has key, exhaust front
		A06B–0857–B400	6000 min^{-1}, no key, exhaust rear
		A06B–0857–B401	6000 min^{-1}, no key, exhaust front
Model α 18	Flange mounting	A06B–0858–B100	6000 min^{-1}, has key, exhaust rear
		A06B–0858–B101	6000 min^{-1}, has key, exhaust front
		A06B–0858–B300	6000 min^{-1}, no key, exhaust rear
		A06B–0858–B301	6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0858–B200	6000 min^{-1}, has key, exhaust rear
		A06B–0858–B201	6000 min^{-1}, has key, exhaust front
		A06B–0858–B400	6000 min^{-1}, no key, exhaust rear
		A06B–0858–B401	6000 min^{-1}, no key, exhaust front
Model α 22	Flange mounting	A06B–0859–B100	6000 min^{-1}, has key, exhaust rear
		A06B–0859–B101	6000 min^{-1}, has key, exhaust front
		A06B–0859–B300	6000 min^{-1}, no key, exhaust rear
		A06B–0859–B301	6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0859–B200	6000 min^{-1}, has key, exhaust rear
		A06B–0859–B201	6000 min^{-1}, has key, exhaust front
		A06B–0859–B400	6000 min^{-1}, no key, exhaust rear
		A06B–0859–B401	6000 min^{-1}, no key, exhaust front

NOTE
1 The listed ordering numbers are for motors with a M sensor. The end of the ordering number for the motor, except α 0.5, with a MZ sensor is B□9□. That for α 0.5 is B□8□.
2 Refer to the ordering list (B–65151E) for available motors except above.

(Continued from the previous page)

Name		Ordering number	Remarks
Model α 30	Flange mounting	A06B–0860–B100 A06B–0860–B101 A06B–0860–B300 A06B–0860–B301	4500 min^{-1}, has key, exhaust rear 4500 min^{-1}, has key, exhaust front 4500 min^{-1}, no key, exhaust rear 4500 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0860–B200 A06B–0860–B201 A06B–0860–B400 A06B–0860–B401	4500 min^{-1}, has key, exhaust rear 4500 min^{-1}, has key, exhaust front 4500 min^{-1}, no key, exhaust rear 4500 min^{-1}, no key, exhaust front
Model α 40	Flange mounting	A06B–0868–B100 A06B–0868–B101 A06B–0868–B300 A06B–0868–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0868–B200 A06B–0868–B201 A06B–0868–B400 A06B–0868–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front

NOTE
1 The listed ordering numbers are for motors with a M sensor. The end of the ordering number for the motor, except α 0.5, with a MZ sensor is B□9□. That for α 0.5 is B□8□.
2 Refer to the ordering list (B–65151E) for available motors except above.

(2) α series high speed models

Name		Ordering number	Remarks
Model α 1/15000	Flange mounting	A06B–0850–B304 A06B–0850–B305	15000 min^{-1}, no key, exhaust rear 15000 min^{-1}, no key, exhaust front
Model α 2/15000	Flange mounting	A06B–0852–B304 A06B–0852–B305	15000 min^{-1}, no key, exhaust rear 15000 min^{-1}, no key, exhaust front
Model α 3/12000	Flange mounting	A06B–0853–B304 A06B–0853–B305	12000 min^{-1}, no key, exhaust rear 12000 min^{-1}, no key, exhaust front
Model α 6/12000	Flange mounting	A06B–0854–B302 A06B–0854–B303	12000 min^{-1}, no key, exhaust rear 12000 min^{-1}, no key, exhaust front
Model α 8/8000	Flange mounting	A06B–0855–B302 A06B–0855–B303	8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
Model α 12/8000	Flange mounting	A06B–0856–B302 A06B–0856–B303	8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
Model α 15/8000	Flange mounting	A06B–0857–B302 A06B–0857–B303	8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
Model α 18/8000	Flange mounting	A06B–0858–B302 A06B–0858–B303	8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
Model α 22/8000	Flange mounting	A06B–0859–B302 A06B–0859–B303	8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
Model α 30/6000	Flange mounting	A06B–0860–B302 A06B–0860–B303	6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front

NOTE
1 The listed ordering numbers are for motors with a M sensor. The end of the ordering number for the motor with a MZ sensor is B□9□.
2 Refer to the ordering list (B–65151E) for available motors except above.

5 CONNECTIONS

5.1 MODEL α0.5

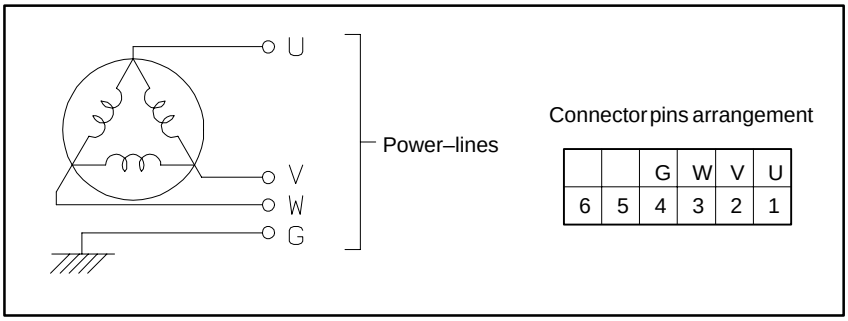
The power–line and signal line are connected with the connector. Please use the shield cable for the connection.
Please refer to FANUC SERVO AMPLIFIER α series (B–65162E) for other respects in the connection.

Connection of power–line

Connector parts related to cable side

	FANUC purchase specification	NIHON–AMP specification
Connector (*1) (*2)	A63L–0001–0428/CT	176346–6
Contact	A63L–0001–0456/AS	1–175218–2
Contact crimp tool	A97L–0200–0979/L	914596–3
Contact pulling out tool	A97L–0200–0980/D3	914677–1

NOTE
*1 Six contacts are contained.
*2 Order specification (A06B–6050–K121) is prepared as a connector kit.

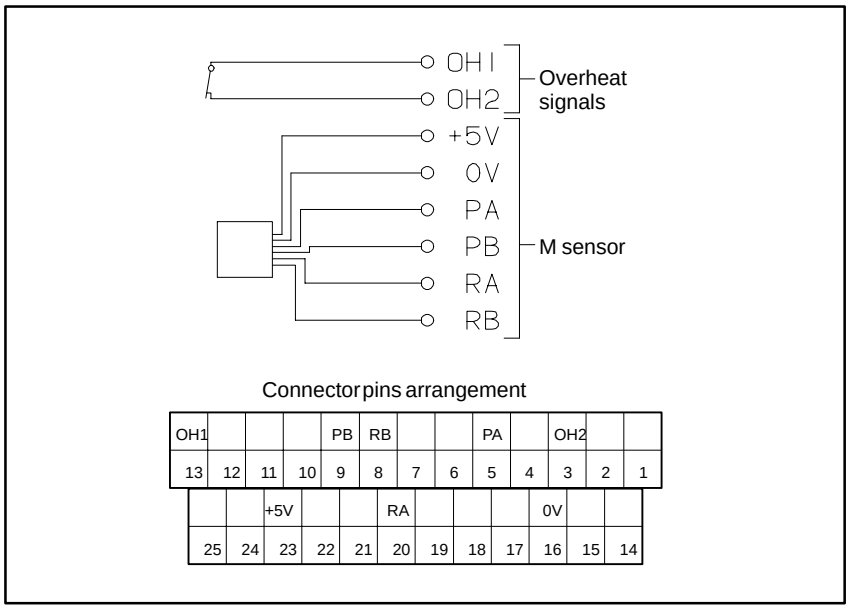


Connection of signal–line For type with M sensor

Connector parts related to cable side

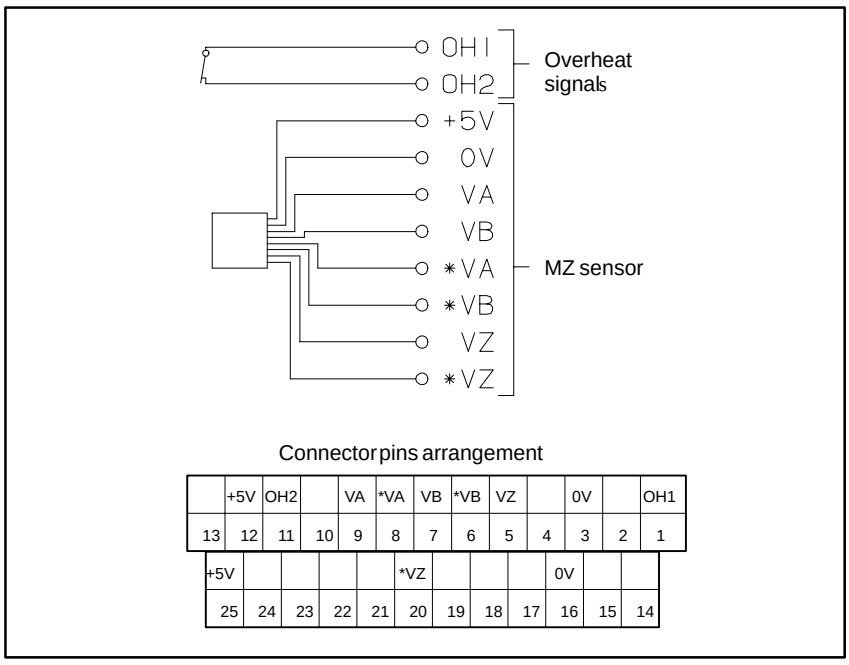
	FANUC purchase specification	Hirose specification
Connector (*1)	A63L–0001–0434/BB25SN0	HDBB–25S
Connector cover (*1)	A63L–0001–0442	HDBW–25–CV

NOTE
*1 Order specification (A06B–6050–K110) is prepared as a connector kit.



For type with MZ sensor

Connector parts related to cable side are the same in the case of the type with the M sensor.



CONDITIONS FOR APPROVAL RELATED TO THE IEC34 STANDARD

Sections 8.2.3 of IEC204–1 (EN60204–1), which must be met to acquire CE marking approval, stipulates that all exposed live conductors of electric equipment and machines be connected to a protection link circuit.

WARNING

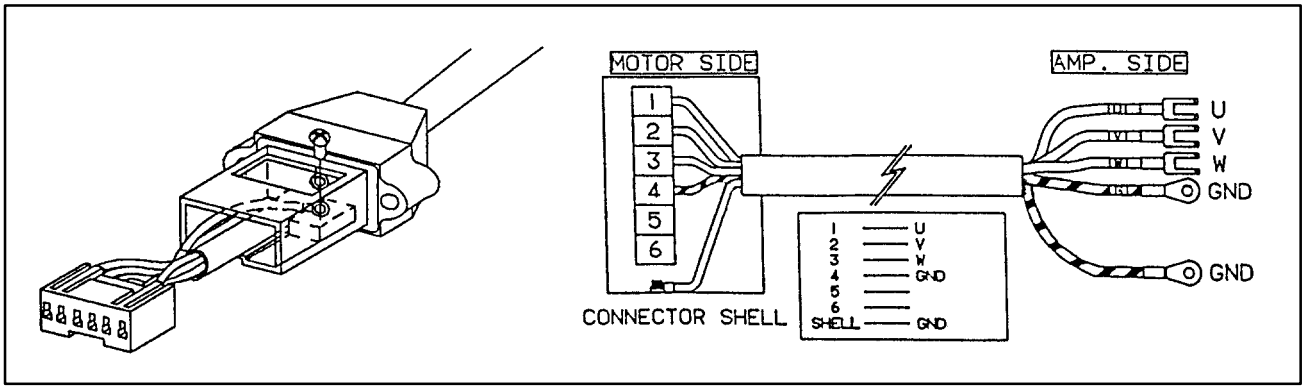
If the connector portion of a motor is exposed to the outside, its metal portion should be covered with a non–moving insulation, or the metal shell should be connected to a protection link circuit using the following connector kit.

- Connector kit: A06B–6050–K121 [FANUC specification]

CAUTION

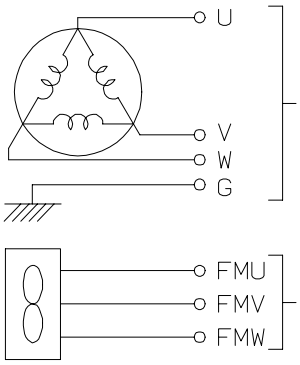
1 Cables with an external size of 9.9 to 10.9 mm should be used to provide a sufficient waterproof performance related to cable clamps.
The number of cable conductors is 1 greater than the conventional U/V/W/G to provide for the connector shell protection link circuit, that is 5 conductors.

2 The motor grounding wire (at terminal 4) and connector shell grounding wire should be bundled with one crimping terminal and connected to the grounding terminal of the amplifier. The grounding lines must be indicated in yellow/green.



5.2 MODELS α1–α40

Cables of primary winding and fan motor are connected to the terminal block.
M sensor (or built in sensor) and the over heat signal use a connector manufactured by AMP.
The connector housing and the connector are attached to the motor.

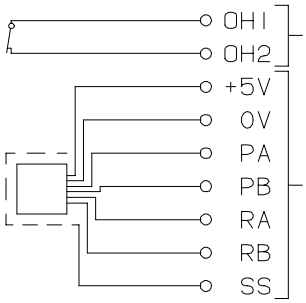


Type of screws used in the terminal block

Motor model \ Terminal name	U, V, W, G	FMU~FMW
α1~α15	M5	M4
α18, α22	M8	M4
α30, α40	M10	M3.5

NOTE1 Screws of high speed models are same as above.
2 Refer to FANUC SERVO AMPLIFIER α series DESCRIPTIONS (B–65162E) for specifications of connection cables.

When M sensor is provided



Pin assignment in the connector

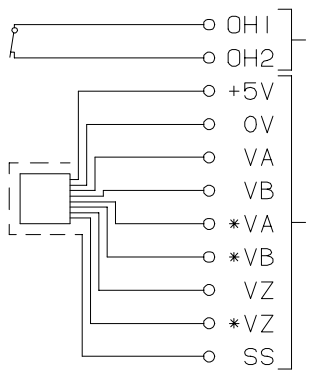
Number	B1	B2	B3	B4	B5	B6
Color		Green	White		Yellow	
Signal		RA	RB		0V	OH2
Number	A1	A2	A3	A4	A5	A6
Color	Red	Black	Blue		No color	
Signal	+5V	PA	PB		SS	OH1

Connector: Manufactured by D–3000 series

	Motor side		Cable side	
	FANUC purchase specification	AMP specification	FANUC purchase specification	AMP specification
Housing	A63L–0001–0535/121KDF	178964–6	A63L–0001–0460/121KD	178289–6
Contact	A63L–0001–0456/ASMT	175288-2	A63L–0001–0456/ASM	1–175217–2

Crimping tool : 919601–1
Extractor : 914677–1

When MZ sensor is provided



Pin assignment in the connector

Number	B1	B2	B3	B4	B5	B6
Color		Blue	White–orange	White–purple	Orange	
Signal		*VA	*VB	*VZ	0V	OH2
Number	A1	A2	A3	A4	A5	A6
Color	Red	Black	Green	Gray	No color	
Signal	+5V	VA	VB	VZ	SS	OH1

Connector, Crimping tool and Extractor are same as above case of M sensor.

6 ALLOWABLE RADIAL LOAD

Use the motor output shaft below the allowable radial loads shown in the table below.

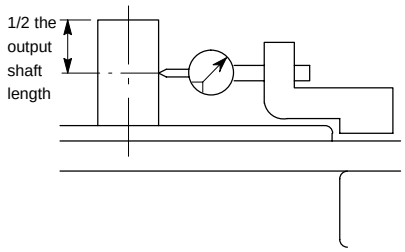
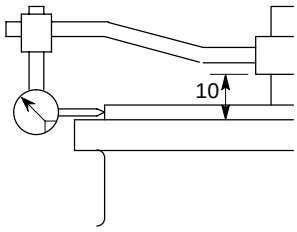
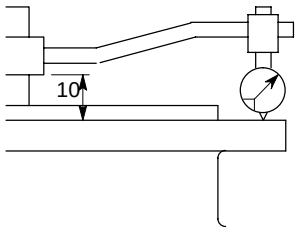
Model	Allowable radial load (kg)	
	At output shaft end	At output shaft center
α 0.5	30	33
α 1	40	45
α 1.5	90	100
α 2	90	102
α 3	150	164
α 6	200	225
α 8	300	344
α 12, α 15	300	348
α 18, α 22	450	509
α 30	550	626
α 40	550	618
α 1/15000	40	45
α 2/15000	50	57
α 3/12000	100	109
α 6/12000	150	169
α 8/8000	200	229
α 12/8000, α 15/8000	250	290
α 18/8000, α 22/8000	300	340
α 30/6000	550	626

CAUTION

1 When using a belt, adjust the tension so the allowable loads indicated above are not exceeded. If an excessive load is applied, consider the use of a support bearing on the machine side to maintain the long–term reliability of the motor. (If an excessive load is applied, it is possible that an abnormal sound may occur.)
2 When the belt tension is maximized at a point outside the output shaft end, the allowable loads are less than those at the output shaft end.
3 If a thrust load is applied when a helical gear is used, the shaft moves in the direction of the thrust. So, as a general rule, never apply a thrust load.

7 ASSEMBLING ACCURACY (T.I.R Total Indicator Reading)

Conform to JEM 1401

Item \ Model	α0.5 to α22	α30, α40	Measuring method
Vibration at the end of the output shaft	20μm or less		
Vibration of the faucet joint for mounting the flange against the core of the shaft (Only for flange type)	40μm or less	60μm or less	
Vibration of the flange mounting surface against the core of the shaft (Only for flange type)	80μm or less	100μm or less	

NOTE
Assembling accuracy of high speed models are same as above.

8 EXTERNAL DIMENSIONS

Refer to the following pages.

Model name		Number of figure
Model	Type	
Model α 0.5	Flange mounting type	Fig.8 (a)
Model α 1	Flange mounting type	Fig.8 (b)
	Foot mounting type	Fig.8 (c)
Model α 1.5	Flange mounting type	Fig.8 (d)
	Foot mounting type	Fig.8 (e)
Model α 2	Flange mounting type	Fig.8 (f)
	Foot mounting type	Fig.8 (g)
Model α 3	Flange mounting type	Fig.8 (h)
	Foot mounting type	Fig.8 (i)
Model α 6	Flange mounting type	Fig.8 (j)
	Foot mounting type	Fig.8 (k)
Model α 8	Flange mounting type	Fig.8 (l)
	Foot mounting type	Fig.8 (m)
Model α 12, α 15	Flange mounting type	Fig.8 (n)
	Foot mounting type	Fig.8 (o)
Model α 18, α 22	Flange mounting type	Fig.8 (p)
	Foot mounting type	Fig.8 (q)
Model α 30	Flange mounting type	Fig.8 (r)
	Foot mounting type	Fig. (s)
Model α 40	Flange mounting type	Fig.8 (t)
	Foot mounting type	Fig.8 (u)
Model α 1/15000	Flange mounting type	Fig.8 (v)
Model α 2/15000	Flange mounting type	Fig.8 (w)
Model α 3/12000	Flange mounting type	Fig.8 (x)
Model α 6/12000	Flange mounting type	Fig. 7 (y)
Model α 8/8000	Flange mounting type	Fig.8 (z)
Model α 12/8000, α 15/8000	Flange mounting type	Fig.8 (aa)
Model α 18/8000, α 22/8000	Flange mounting type	Fig.8 (ab)
Model α 30/6000	Flange mounting type	Fig.8 (ac)

NOTE
High speed models of α series are limited to the flange mounting and key–less type. And the shaft end seal is not a oil–seal but a simplified labyrinth. (In case of α 30/6000, that is an oil–seal.)

Fig.8 (a) Model α 0.5 (Flange mounting type)

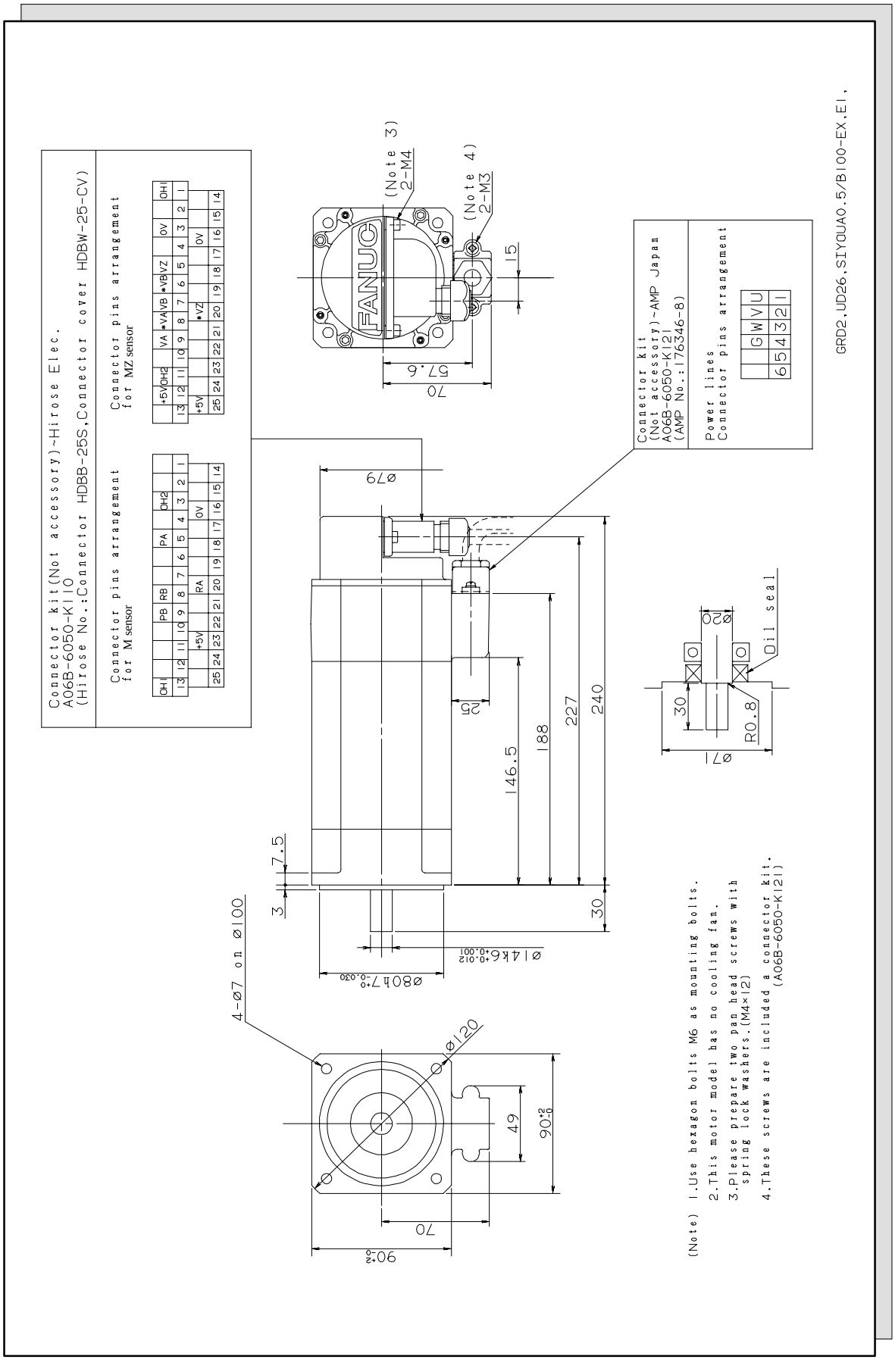


Fig.8(b) Model α1 (Flange mounting type)

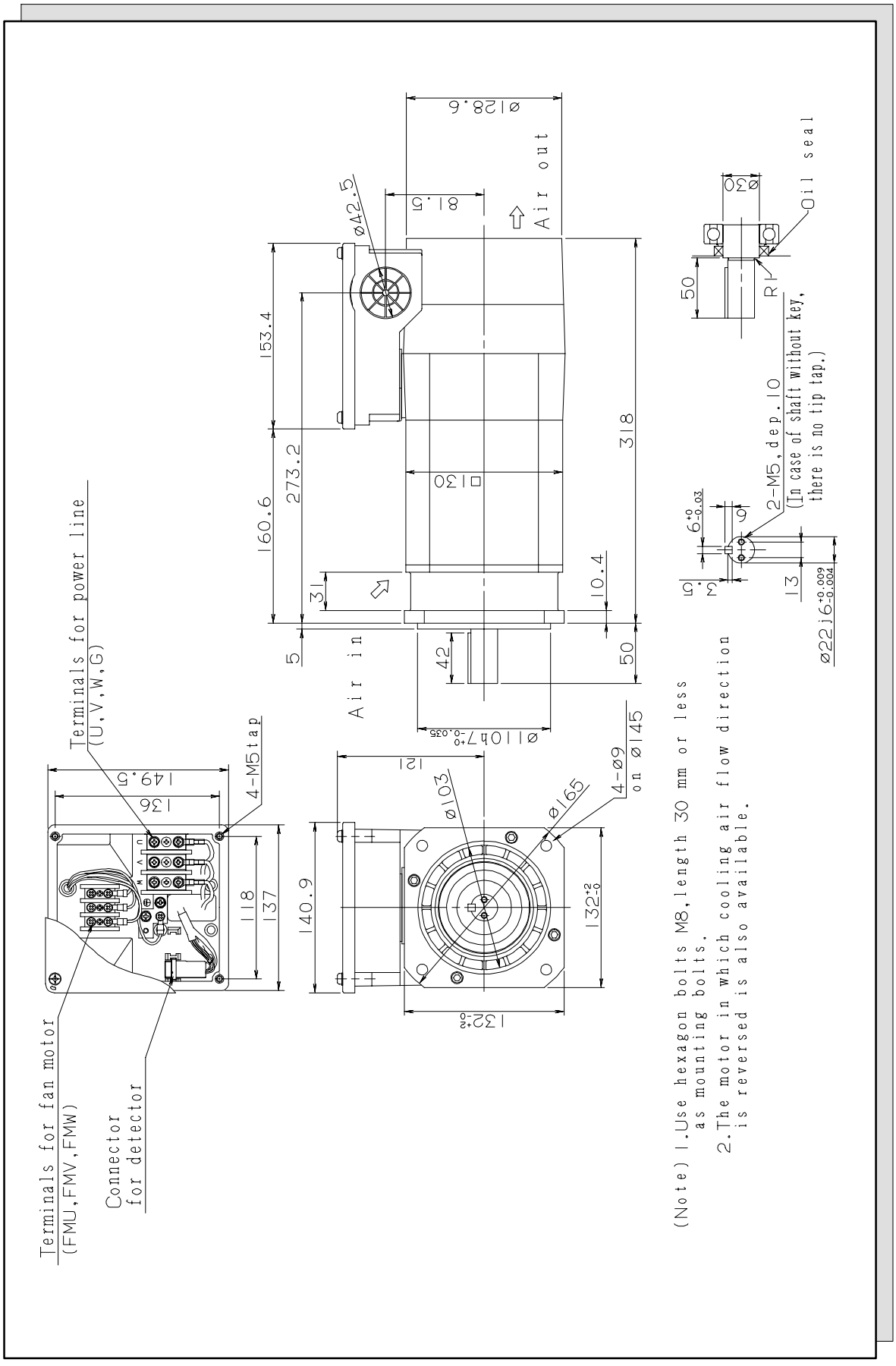


Fig.8(c) Model α 1 (Foot mounting type)

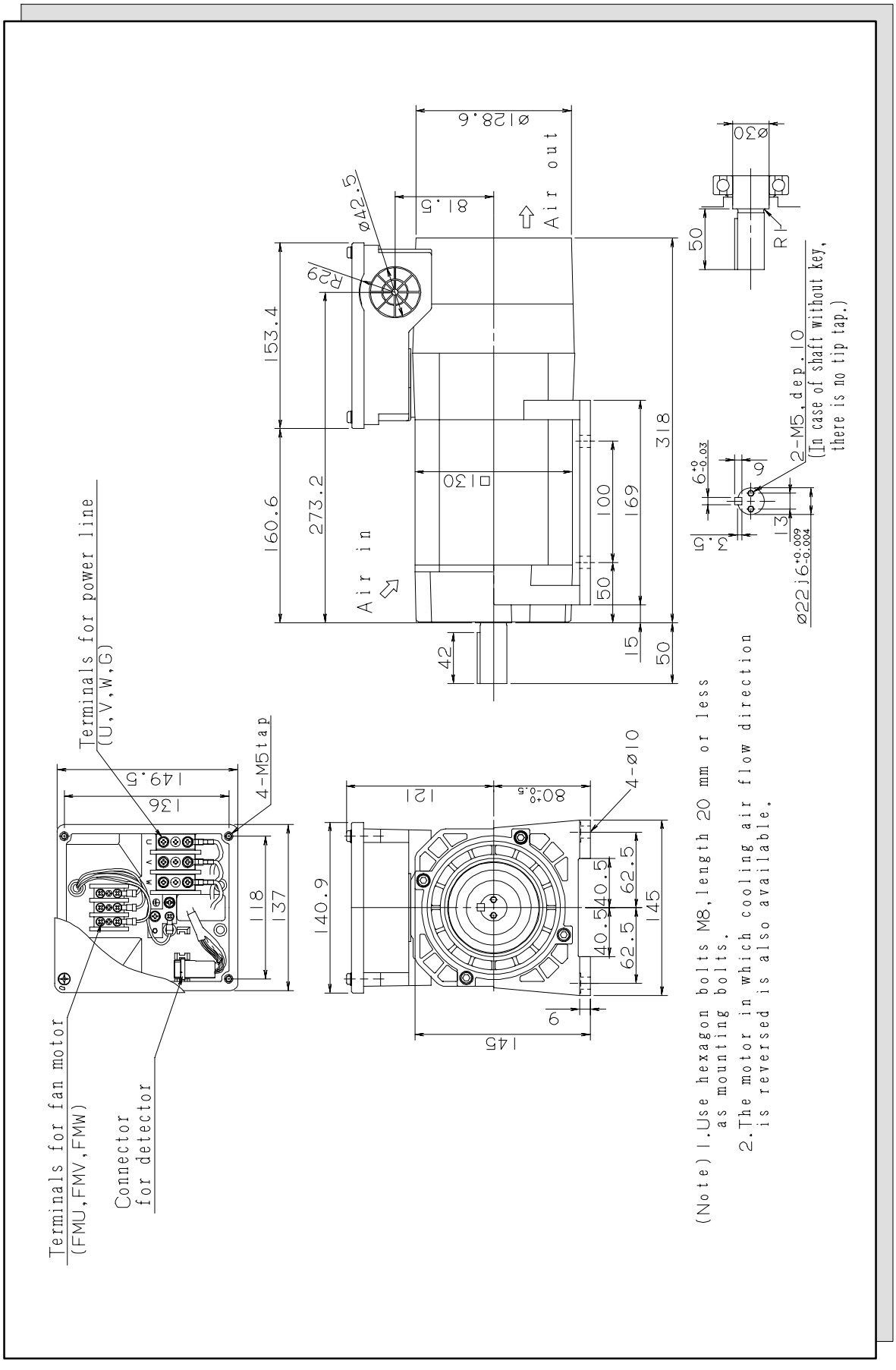


Fig.8(d) Model α 1.5 (Flange mounting type)

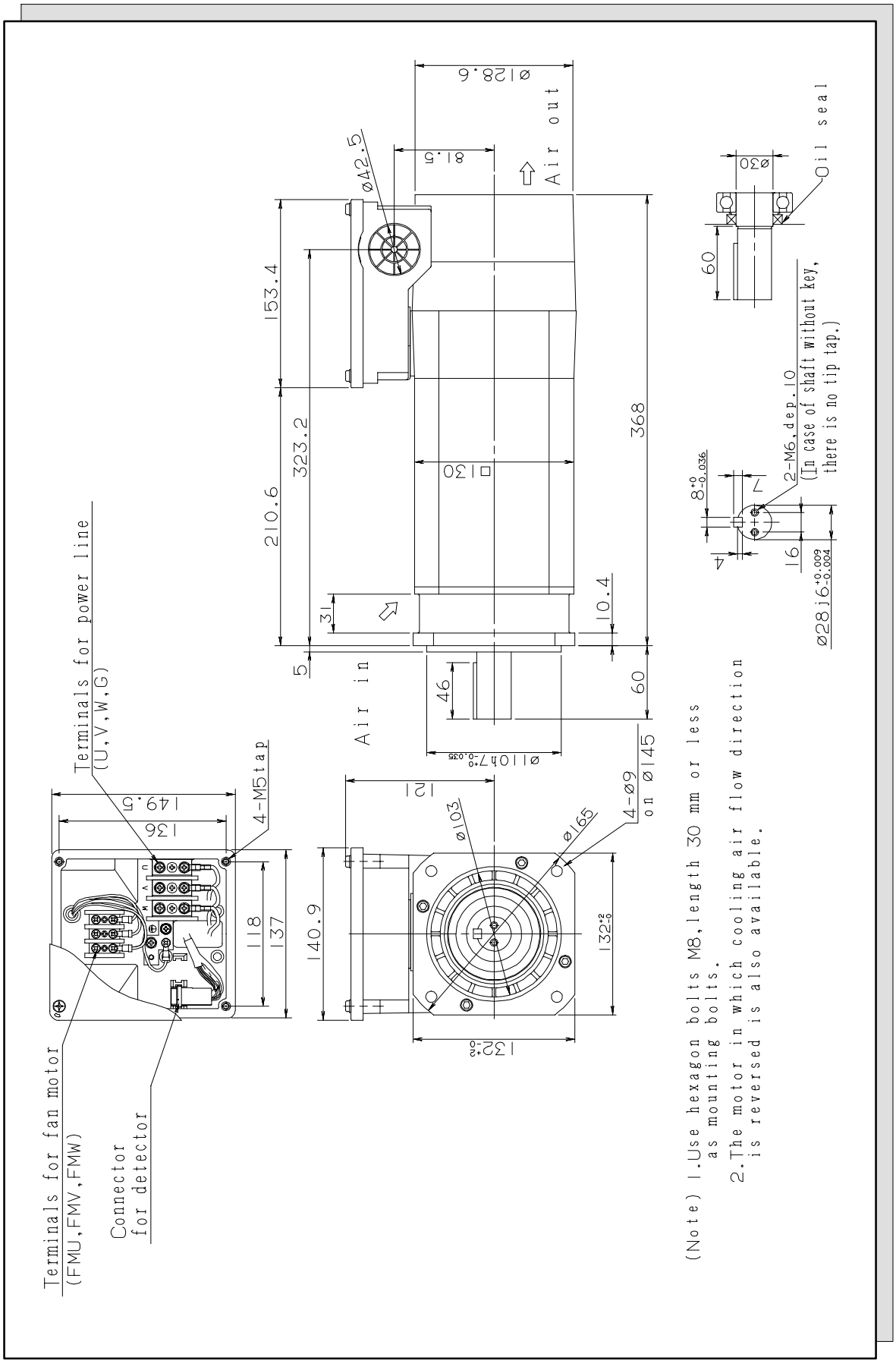


Fig.8(e) Model α 1.5 (Foot mounting type)

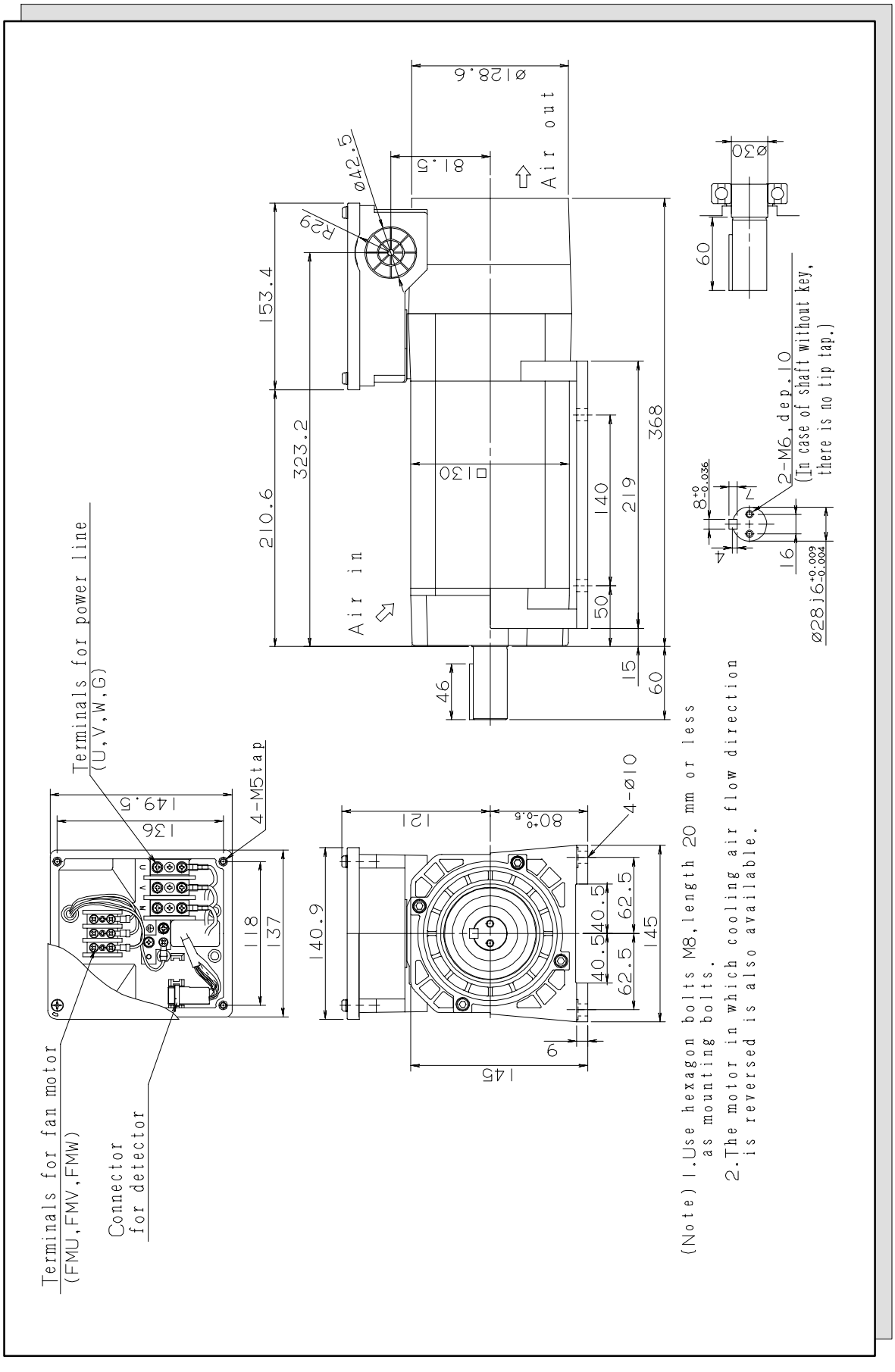


Fig.8(f) Model α 2(Flange mounting type)

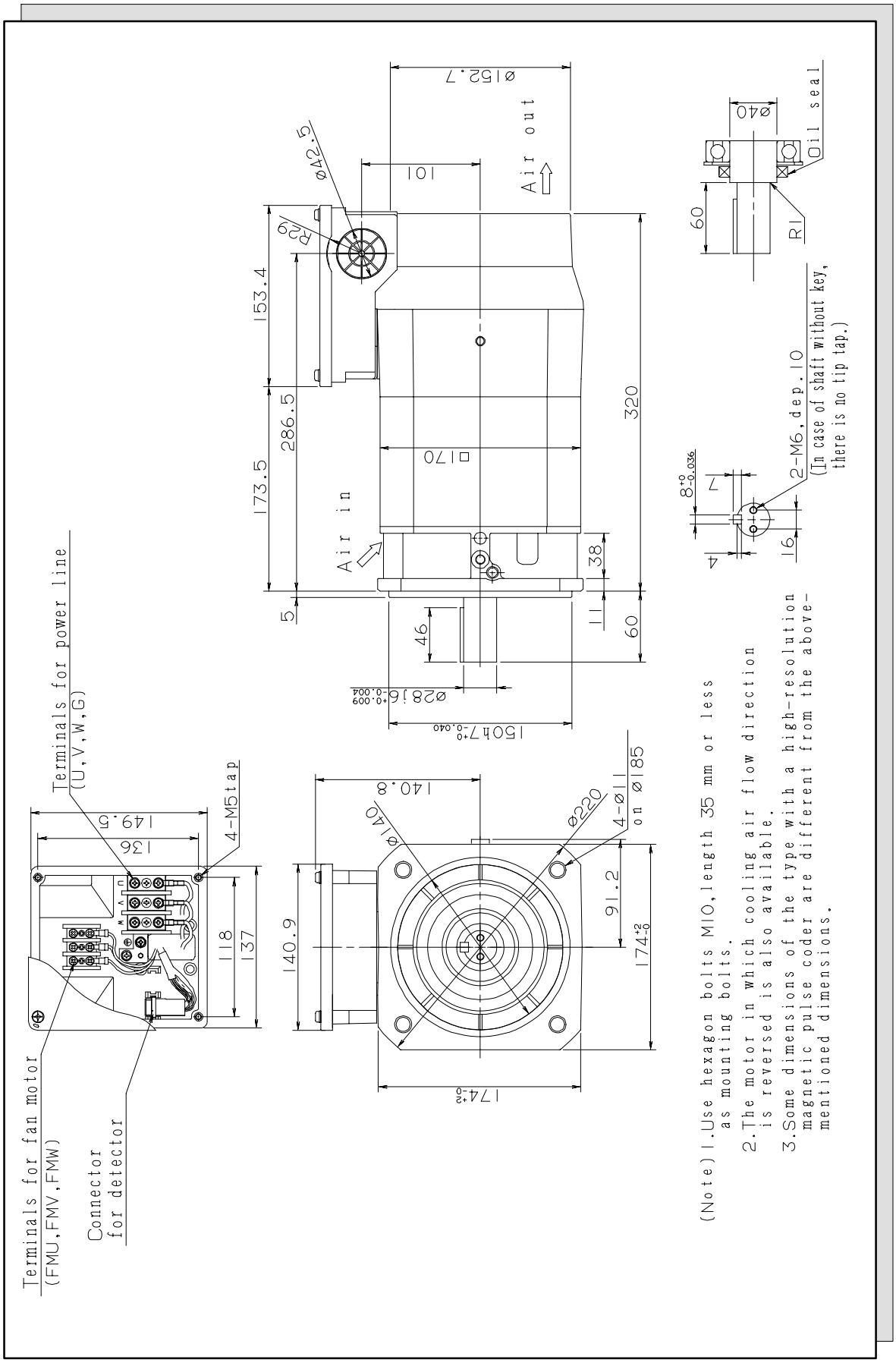


Fig.8(g) Modelα 2(Foot mounting type)

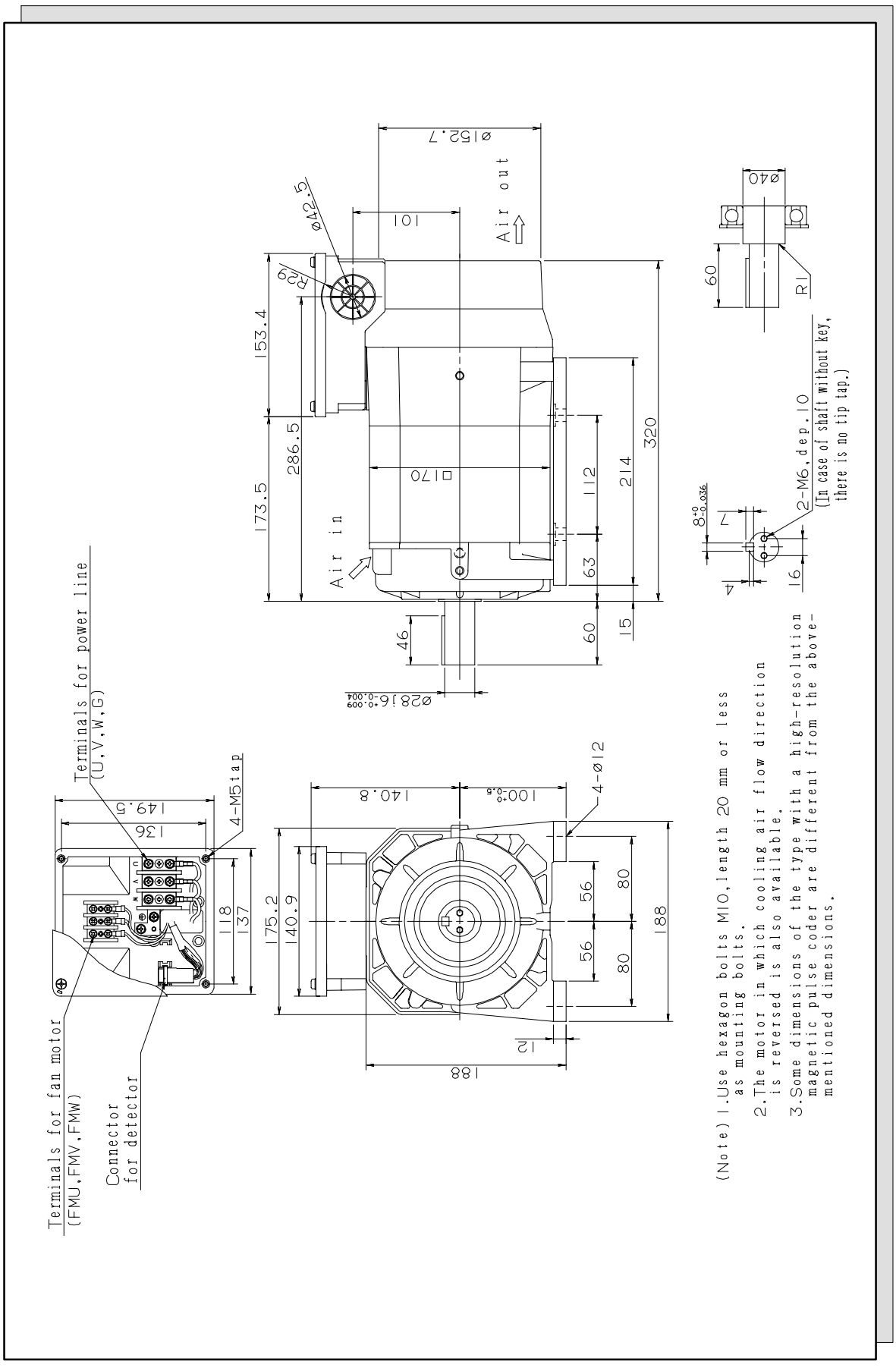


Fig.8(h) Model α 3(Flange mounting type)

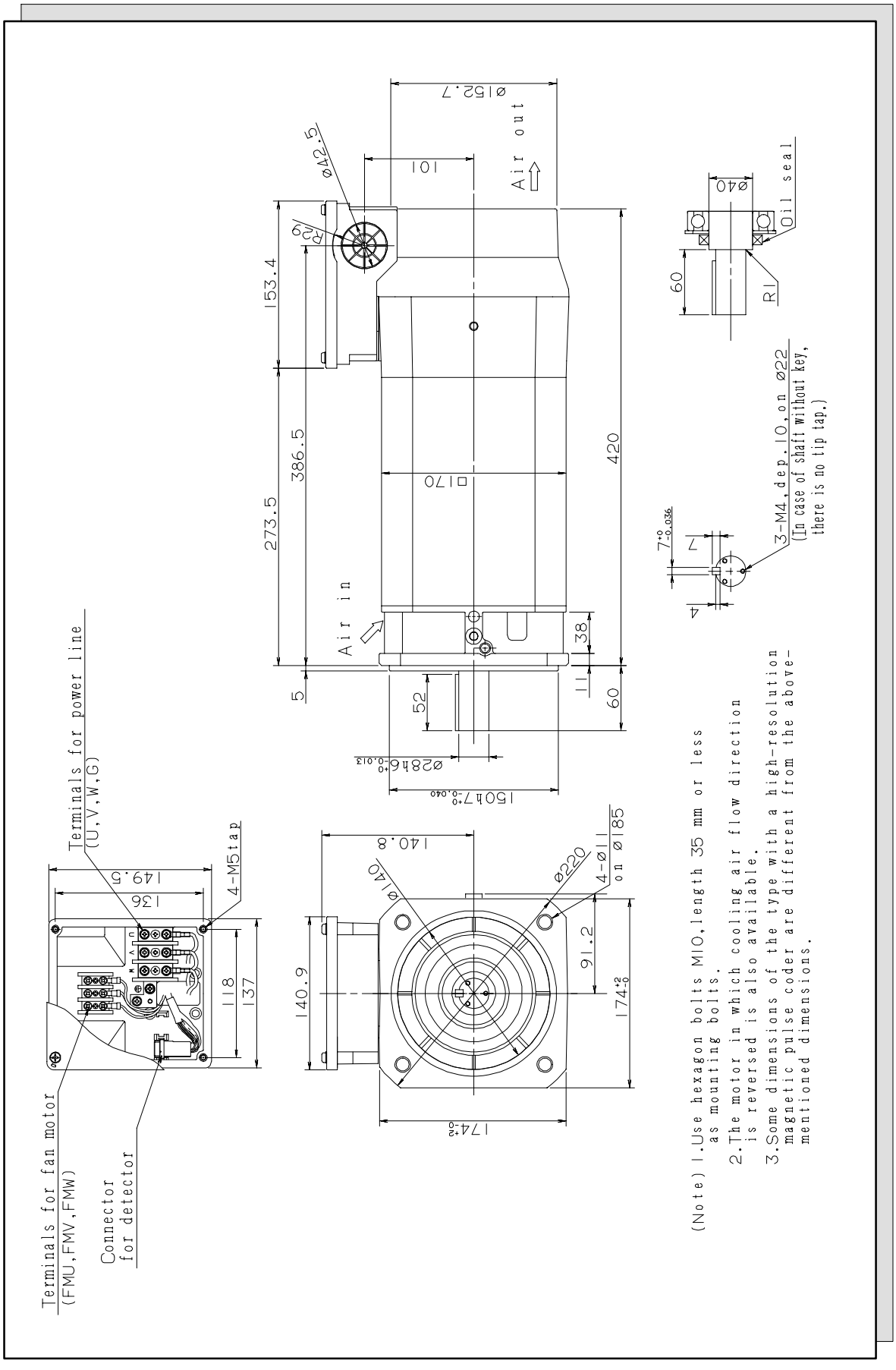
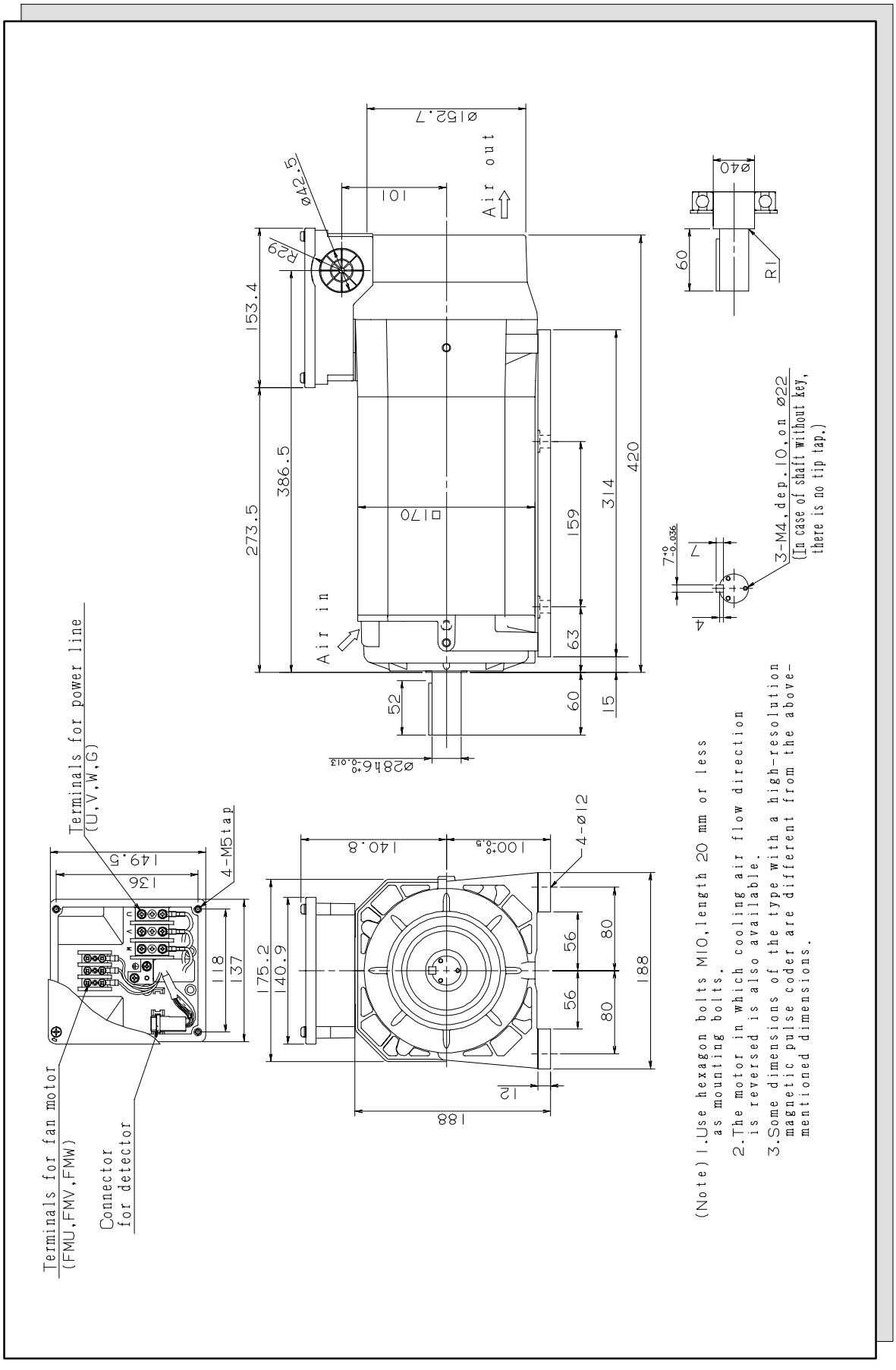


Fig.8(i) Model α 3 (Foot mounting type)



(Note) 1.Use hexagon bolts M10, length 20 mm or less as mounting bolts.
2.The motor in which cooling air flow direction is reversed is also available.
3.Some dimensions of the type with a high-resolution magnetic pulse coder are different from the above-mentioned dimensions.

Fig. 8(j) Model α6 (Flange mounting type)

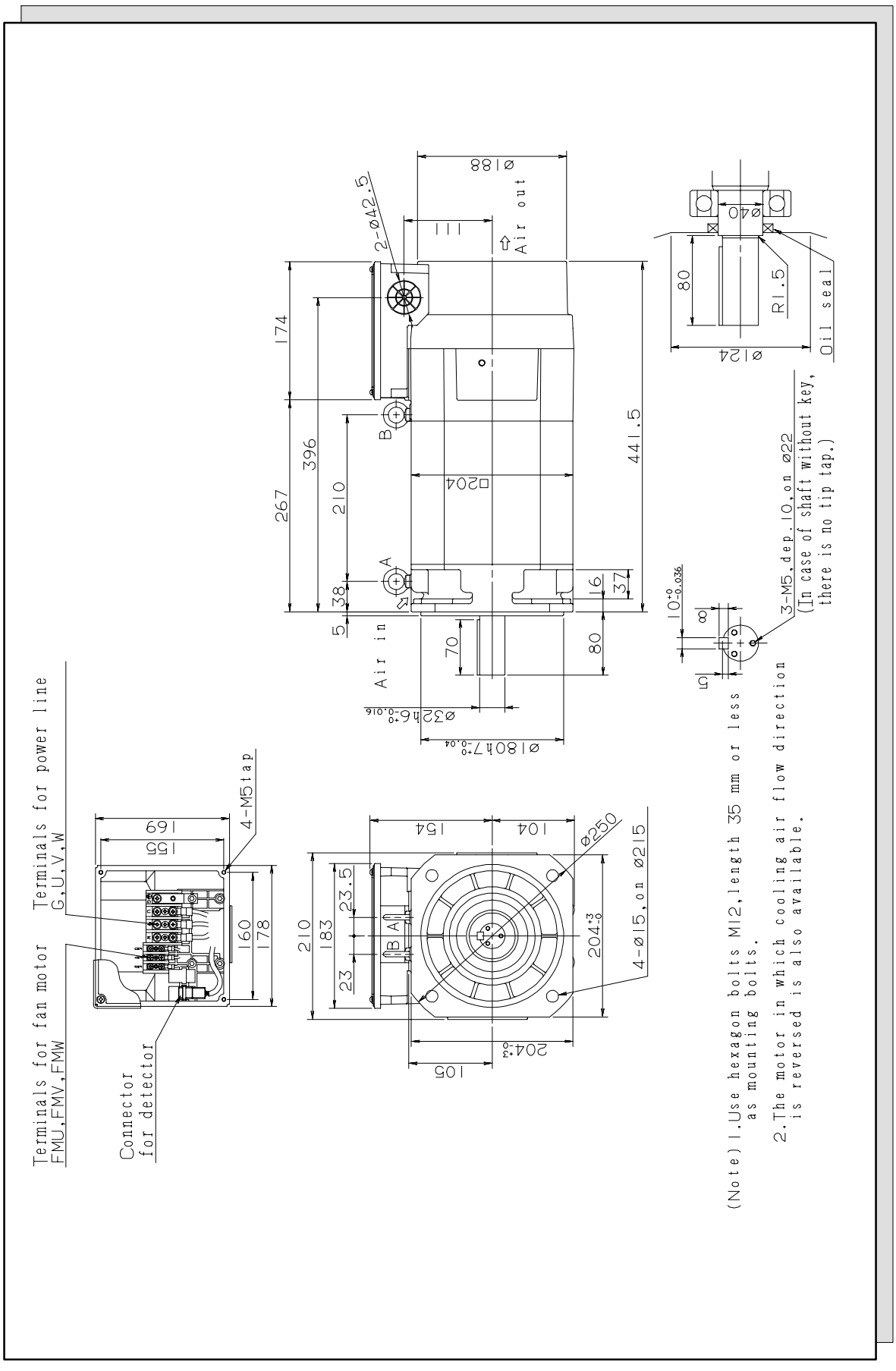
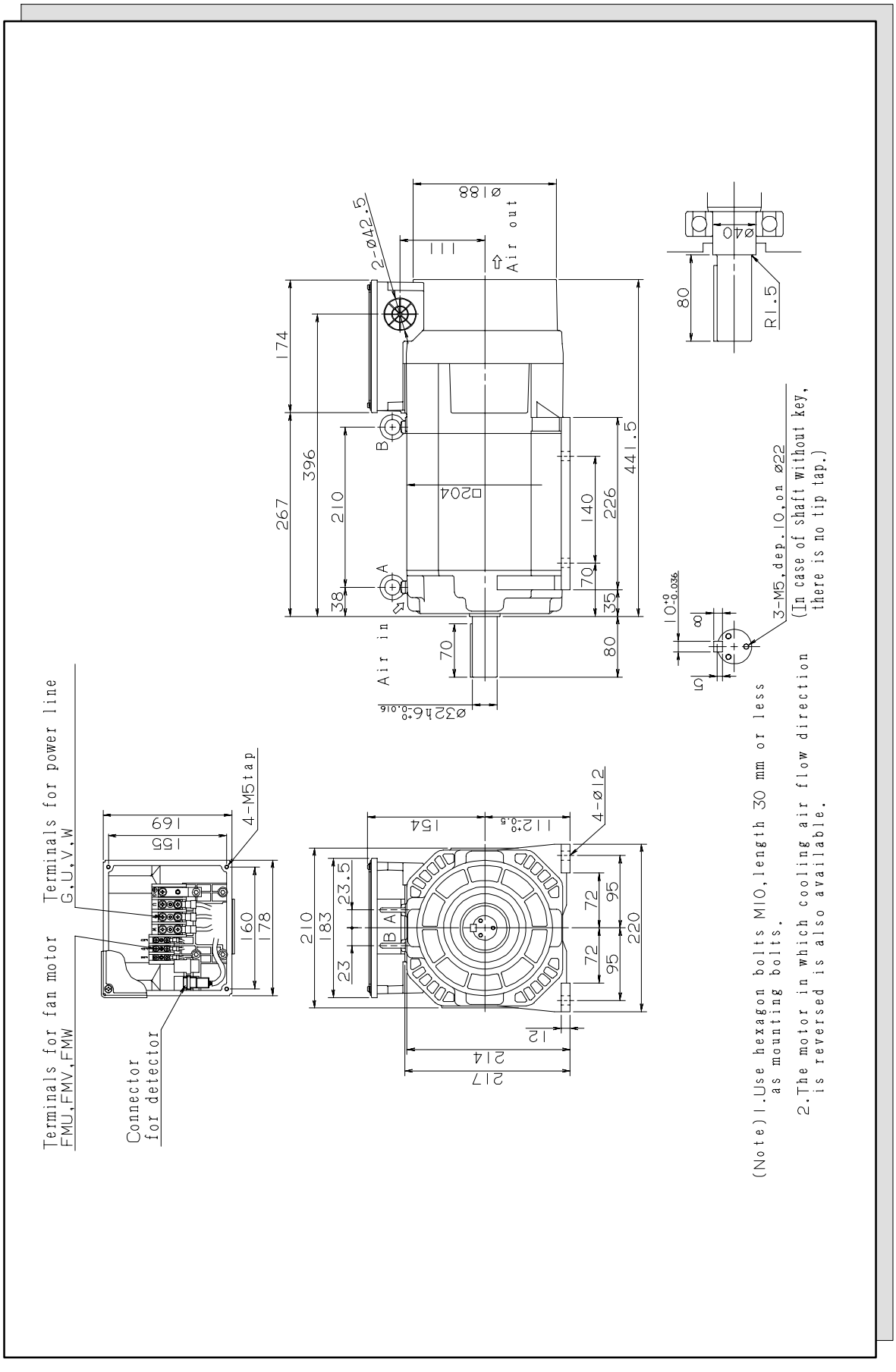


Fig. 8(k) Model α6 (Foot mounting type)



(Note) 1. Use hexagon bolts M10, length 30 mm or less as mounting bolts.
2. The motor in which cooling air flow direction is reversed is also available.

Fig. 8(l) Model α 8 (Flange mounting type)

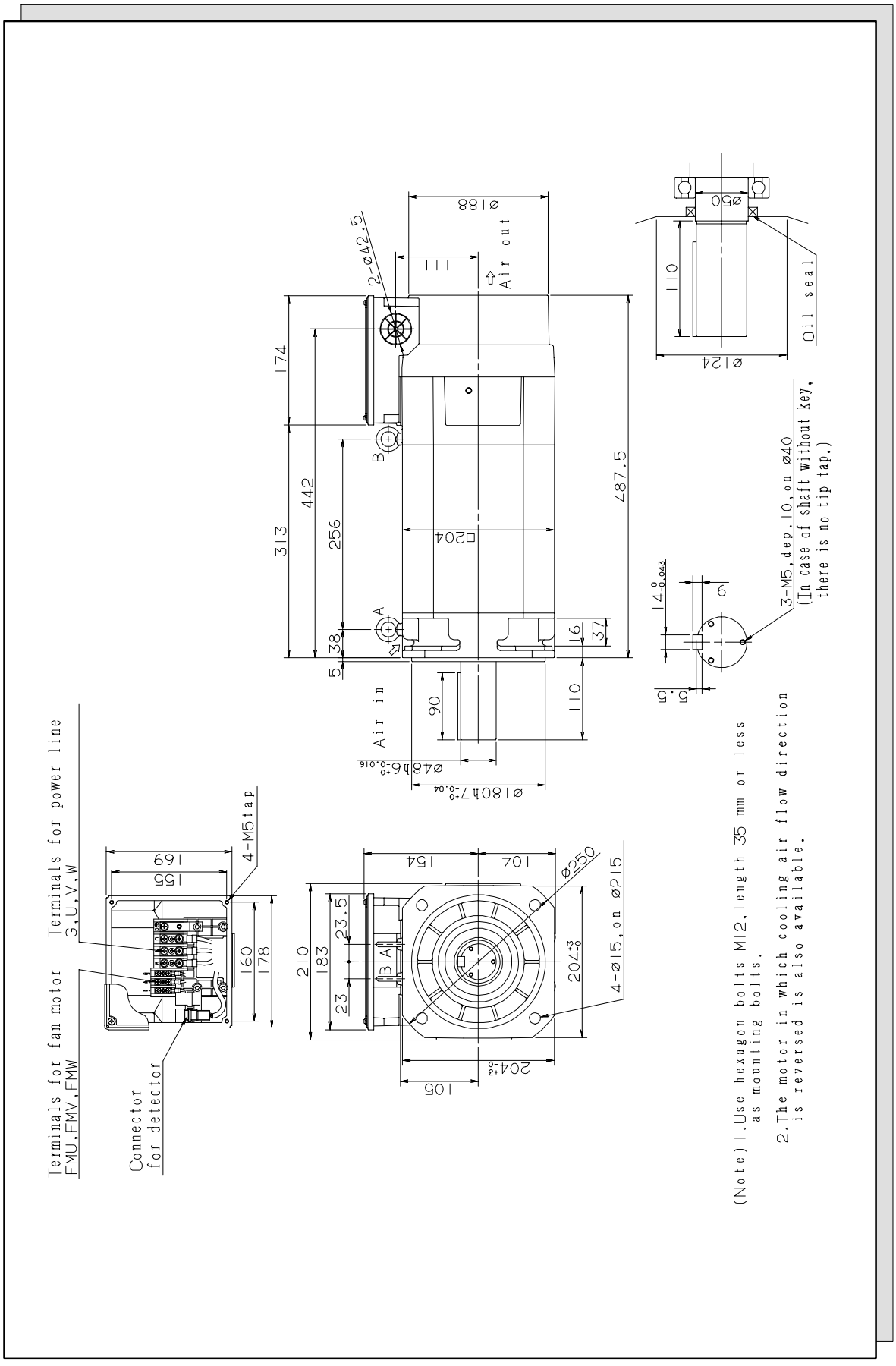


Fig. 8(m) Model α 8 (Foot mounting type)

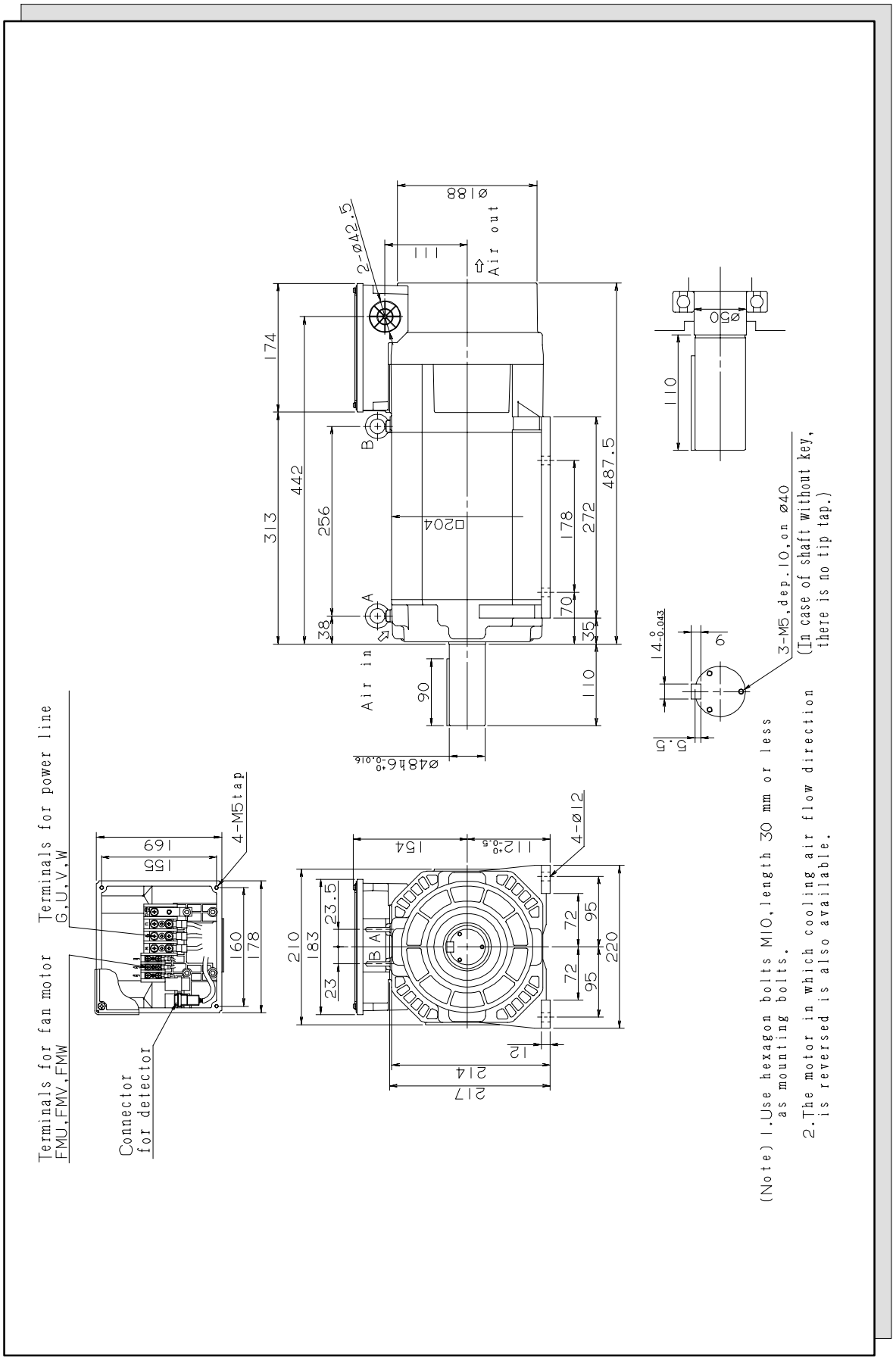


Fig. 8(n) **Model α 12, α 15 (Flange mounting type)**

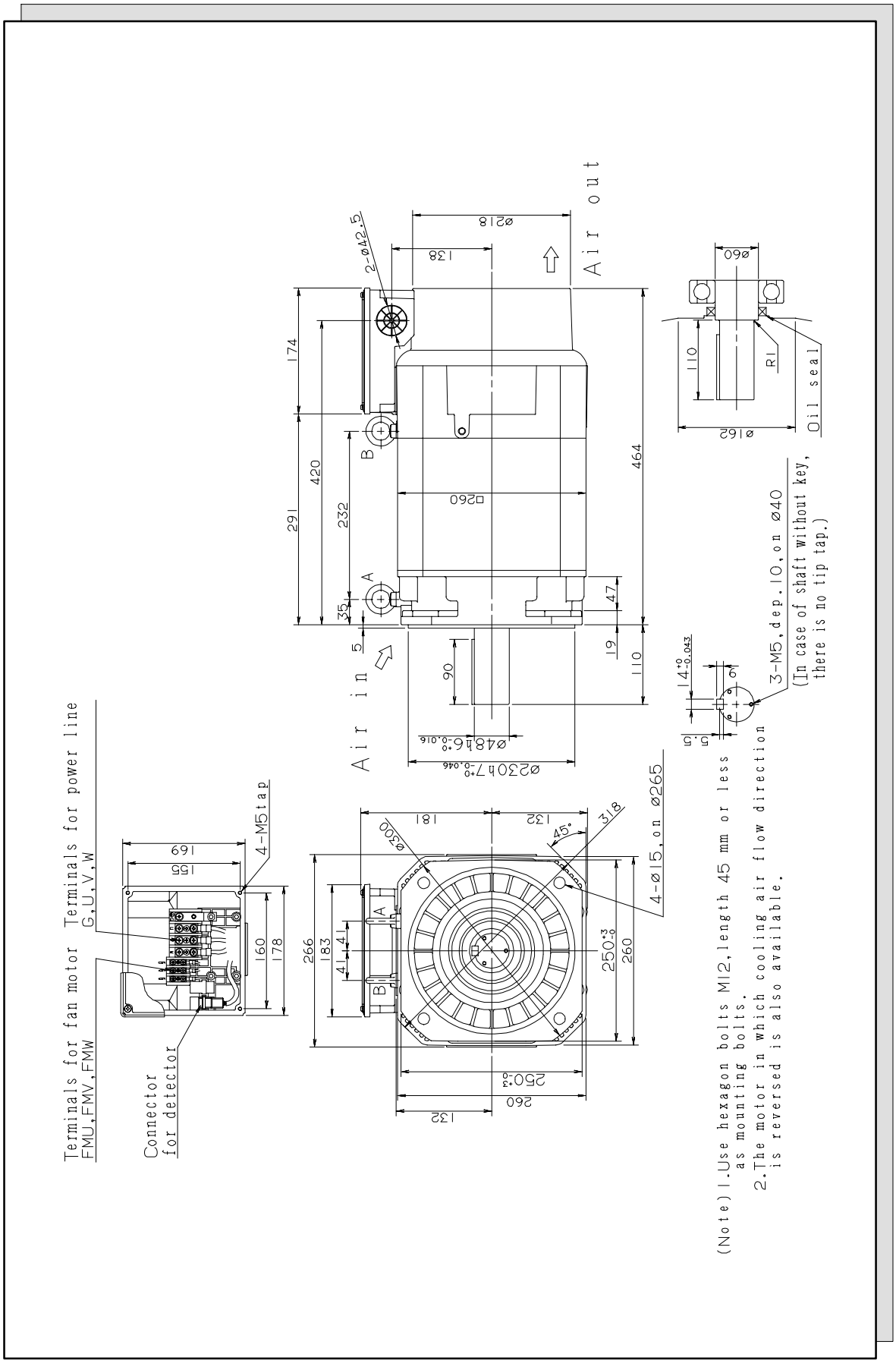


Fig. 8(o) Model α 12, α 15 (Foot mounting type)

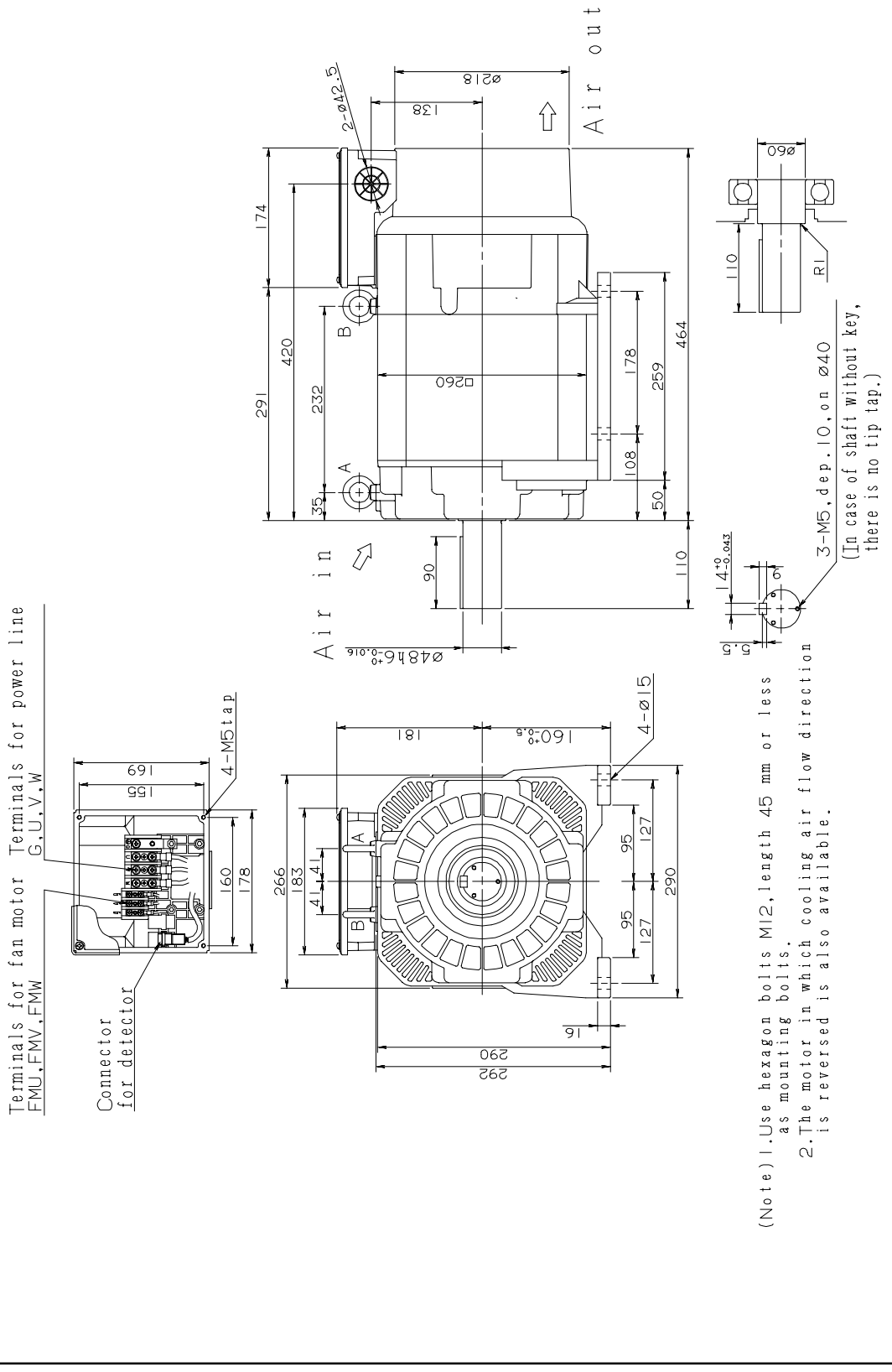


Fig. 8(p) Model α18, α22 (Flange mounting type)

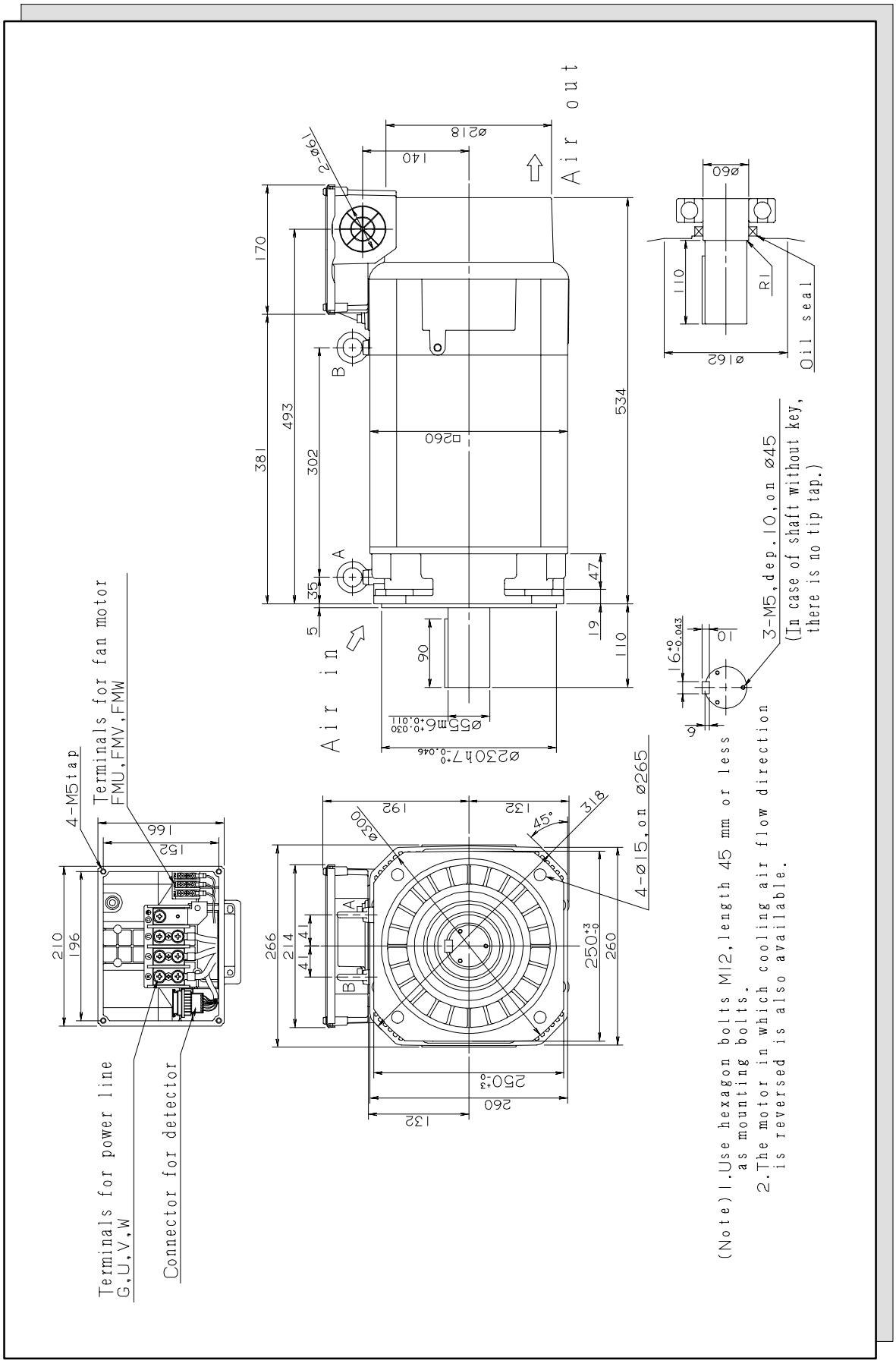


Fig. 8(q) **Model α18, α 22 (Foot mounting type)**

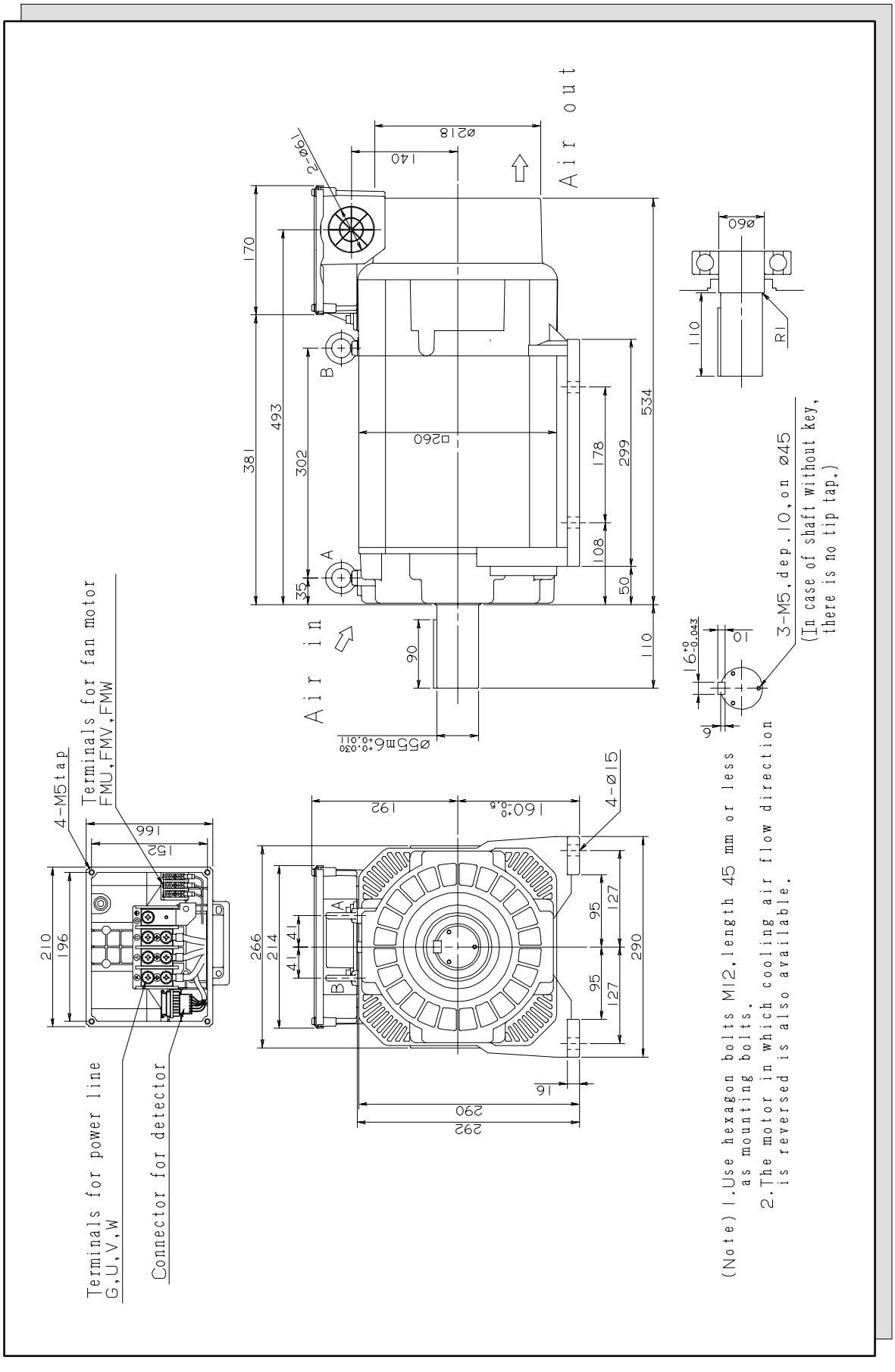


Fig. 8(r) Model α 30 (Flange mounting type)

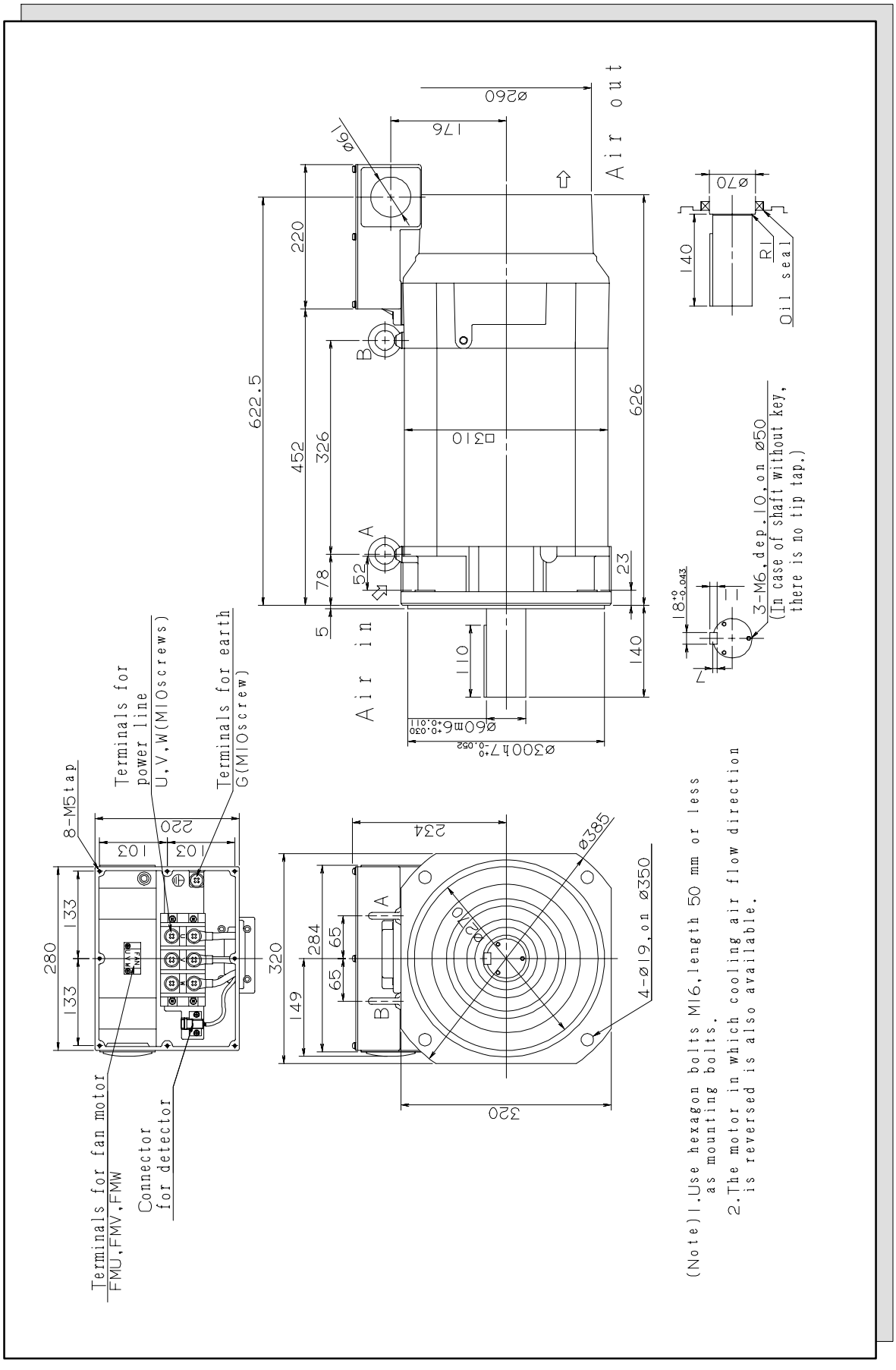


Fig. 8(s) Model α 30 (Foot mounting type)

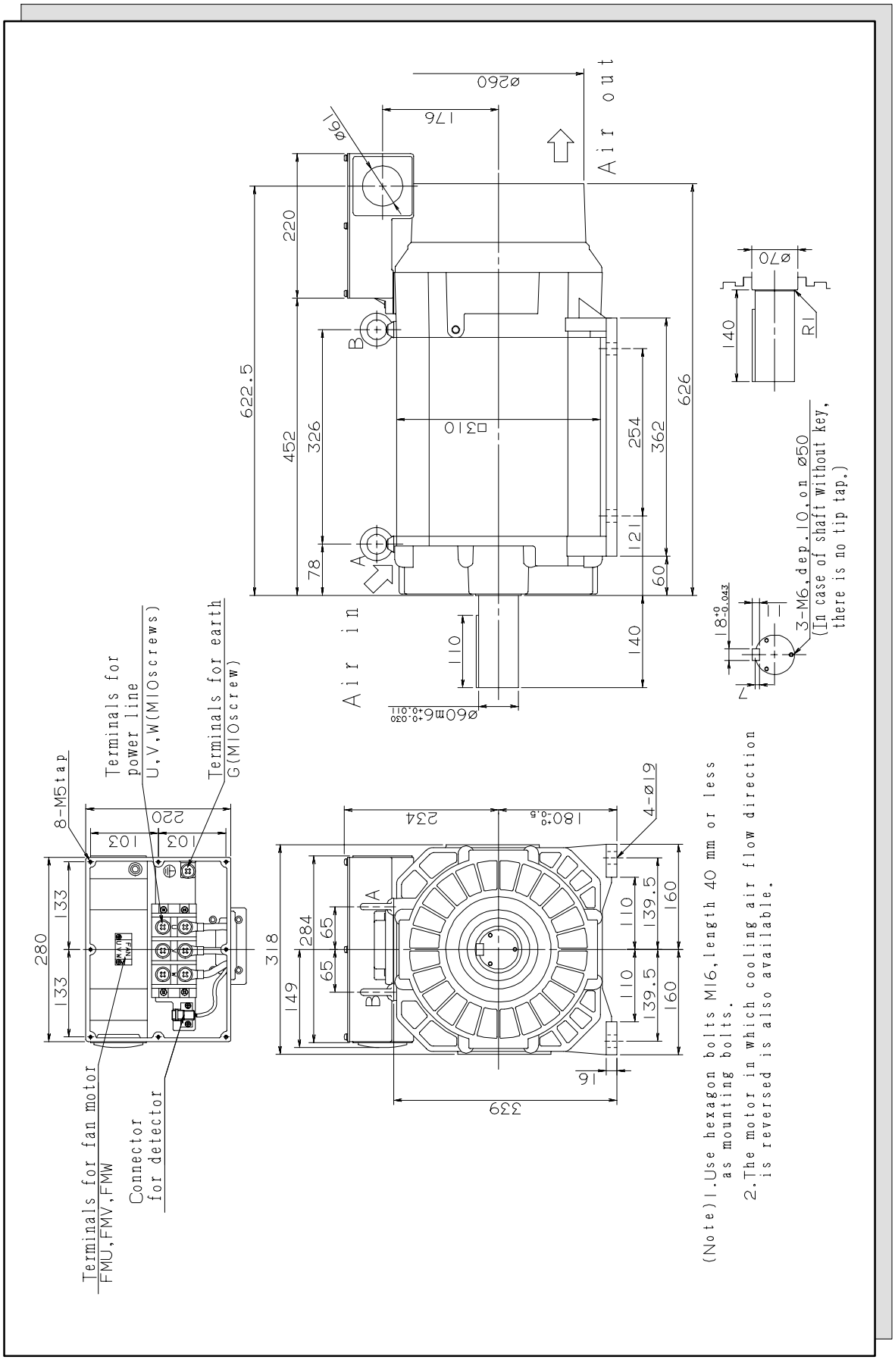


Fig. 8(t) Model α 40 (Flange mounting type)

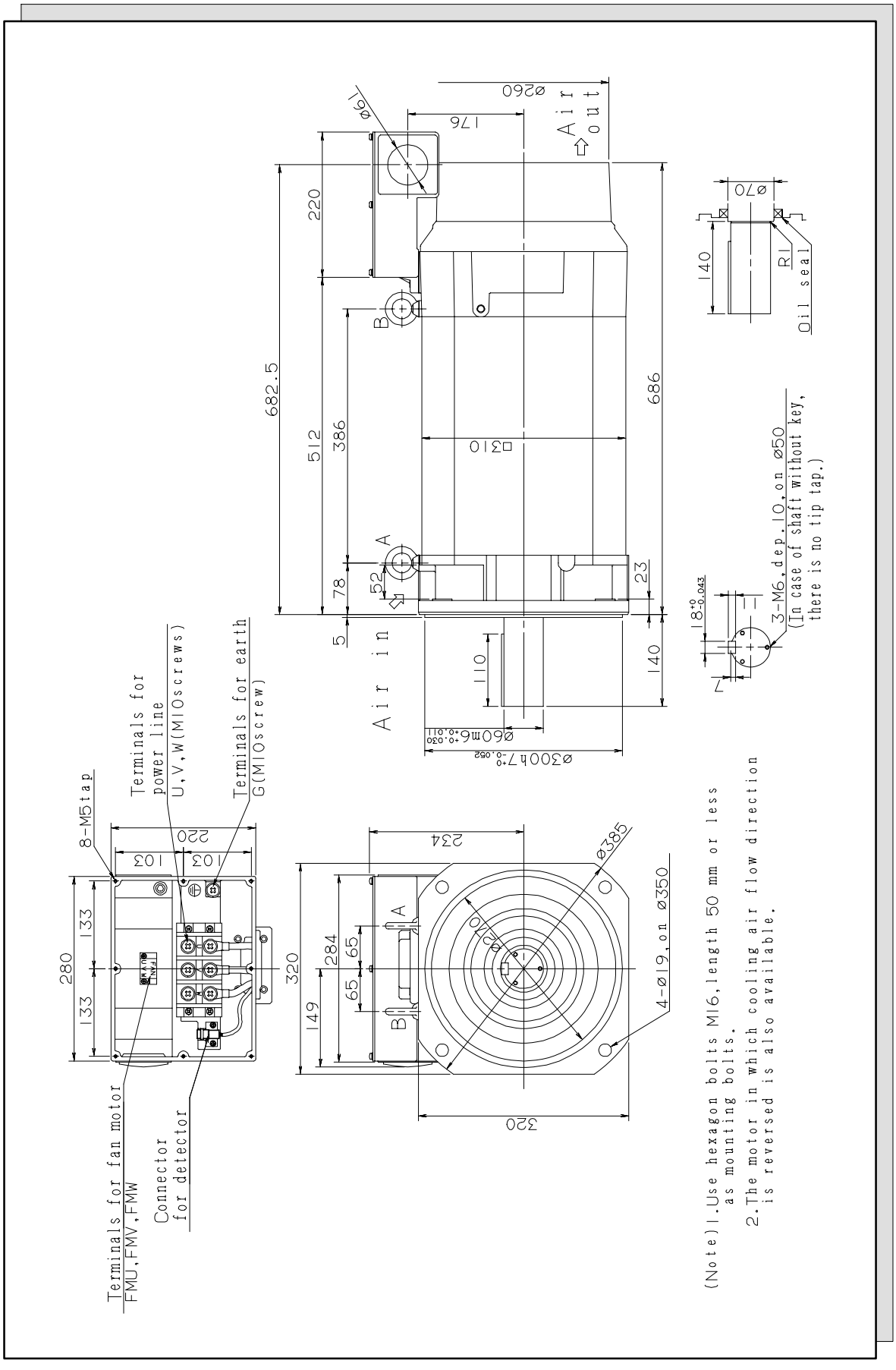


Fig. 8(u) Model α 40 (Foot mounting type)

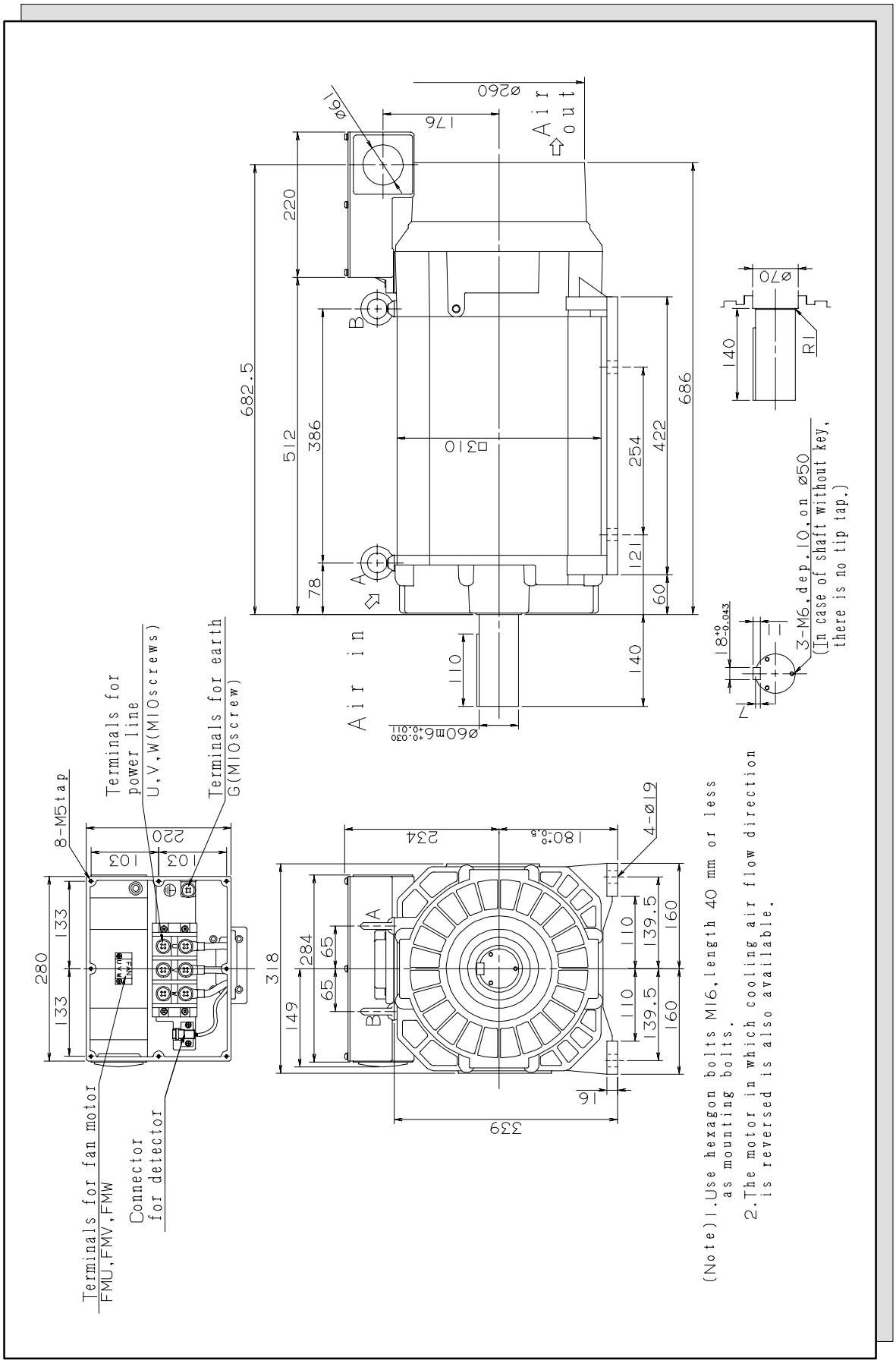


Fig. 8(v) Model α 1/15000 (Flange mounting type)

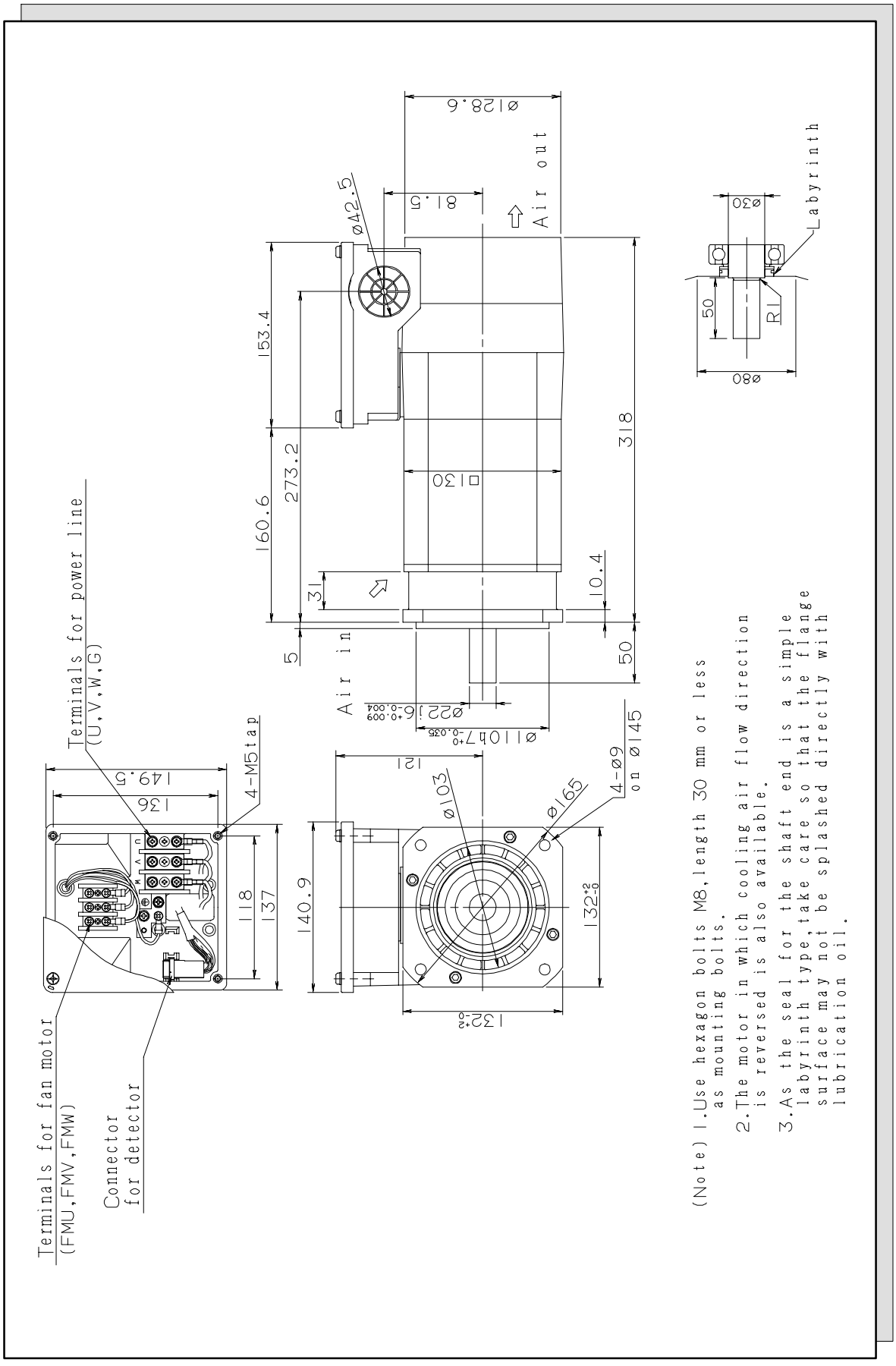


Fig. 8(w) Model α 2/15000 (Flange mounting type)

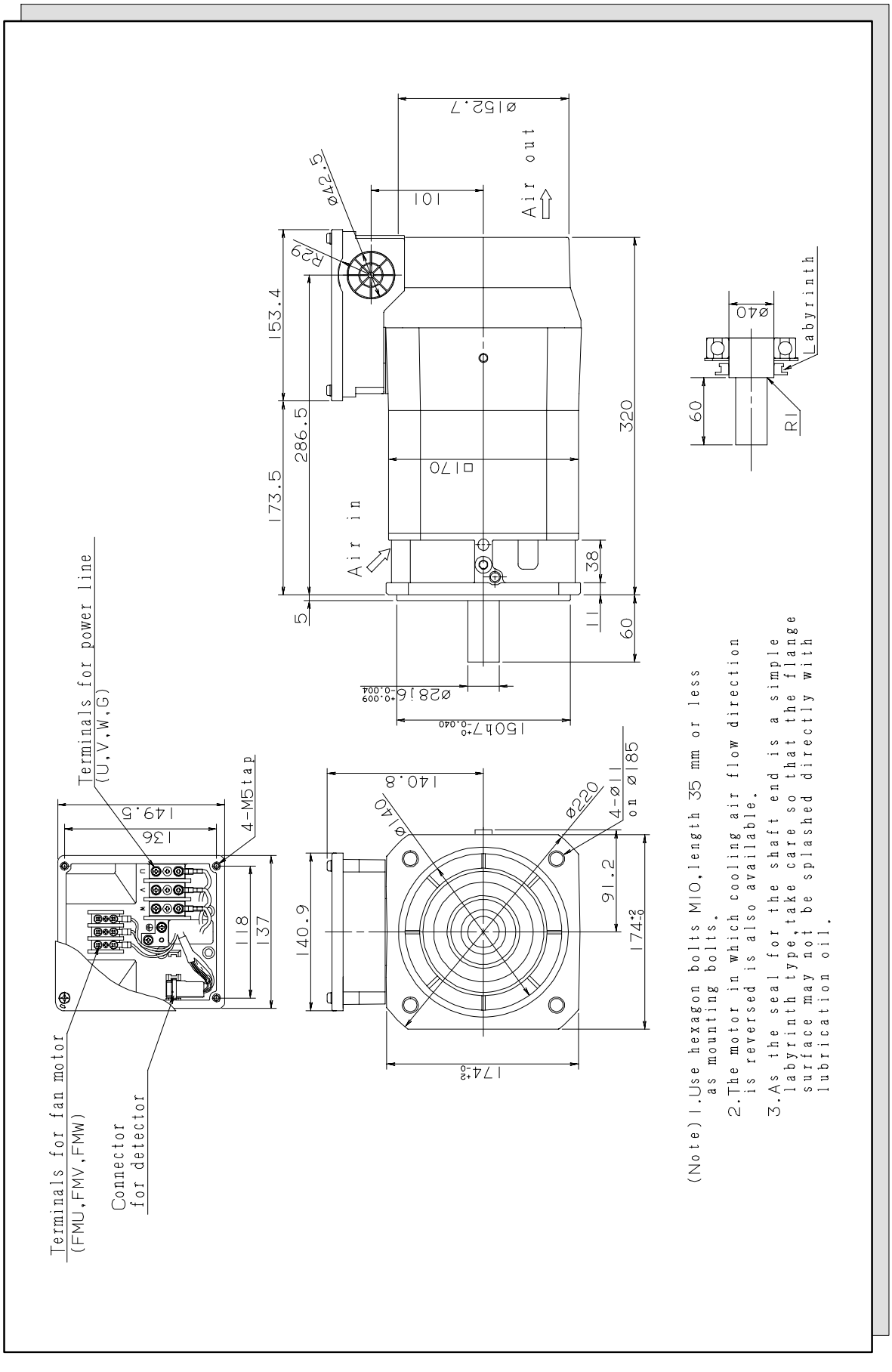
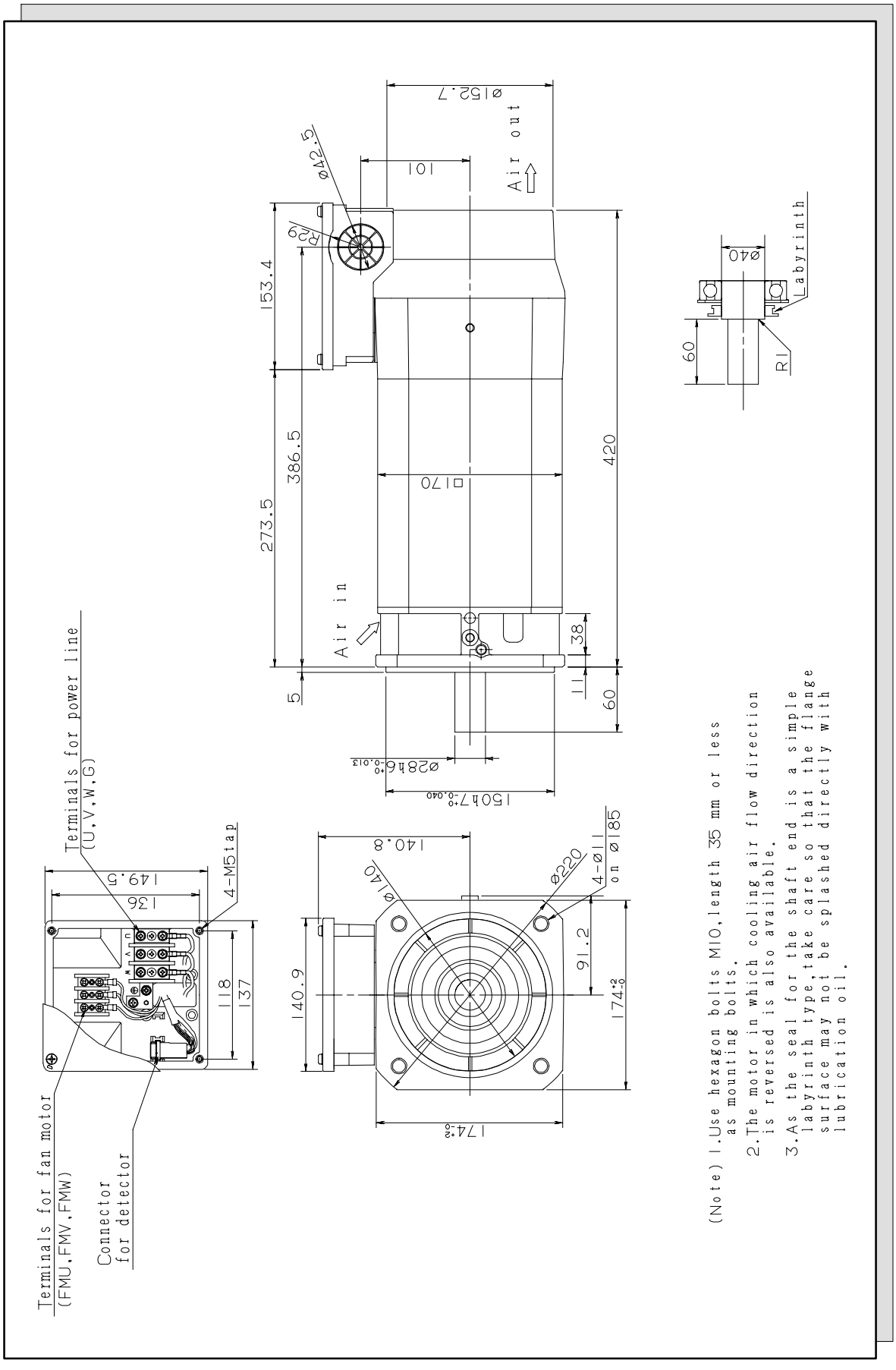
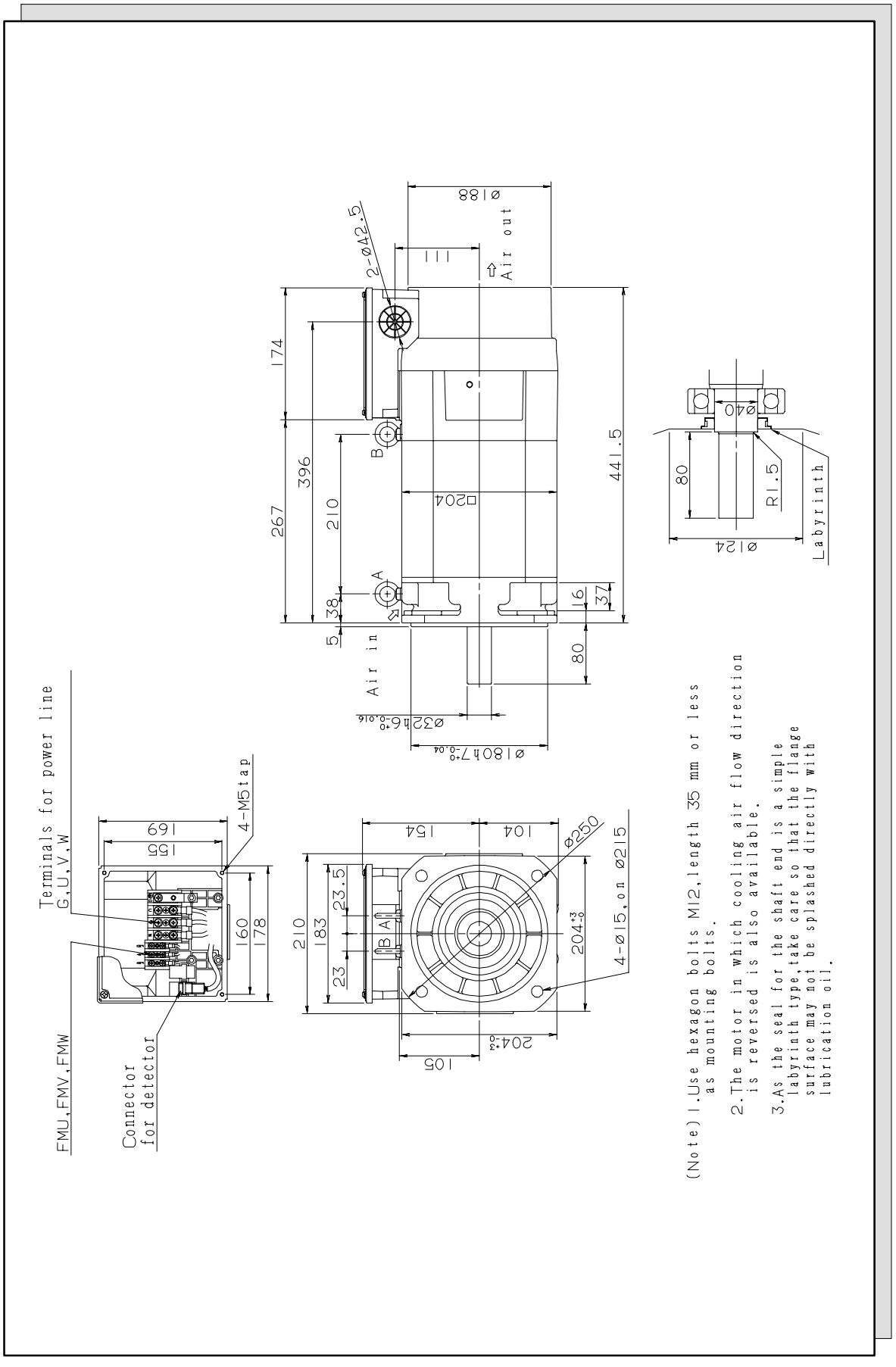


Fig. 8(x) Model α 3/12000 (Flange mounting type)



(Note) 1.Use hexagon bolts M10,length 35 mm or less as mounting bolts.
2.The motor in which cooling air flow direction is reversed is also available.
3.As the seal for the shaft end is a simple labyrinth type,take care so that the flange surface may not be splashed directly with lubrication oil.

Fig. 8(y) Model α6/12000 (Flange mounting type)



(Note) 1.Use hexagon bolts M12, length 35 mm or less as mounting bolts.
2.The motor in which cooling air flow direction is reversed is also available.
3.As the seal for the shaft end is a simple labyrinth type, take care so that the flange surface may not be splashed directly with lubrication oil.

Fig. 8(z) Model α8/8000 (Flange mounting type)

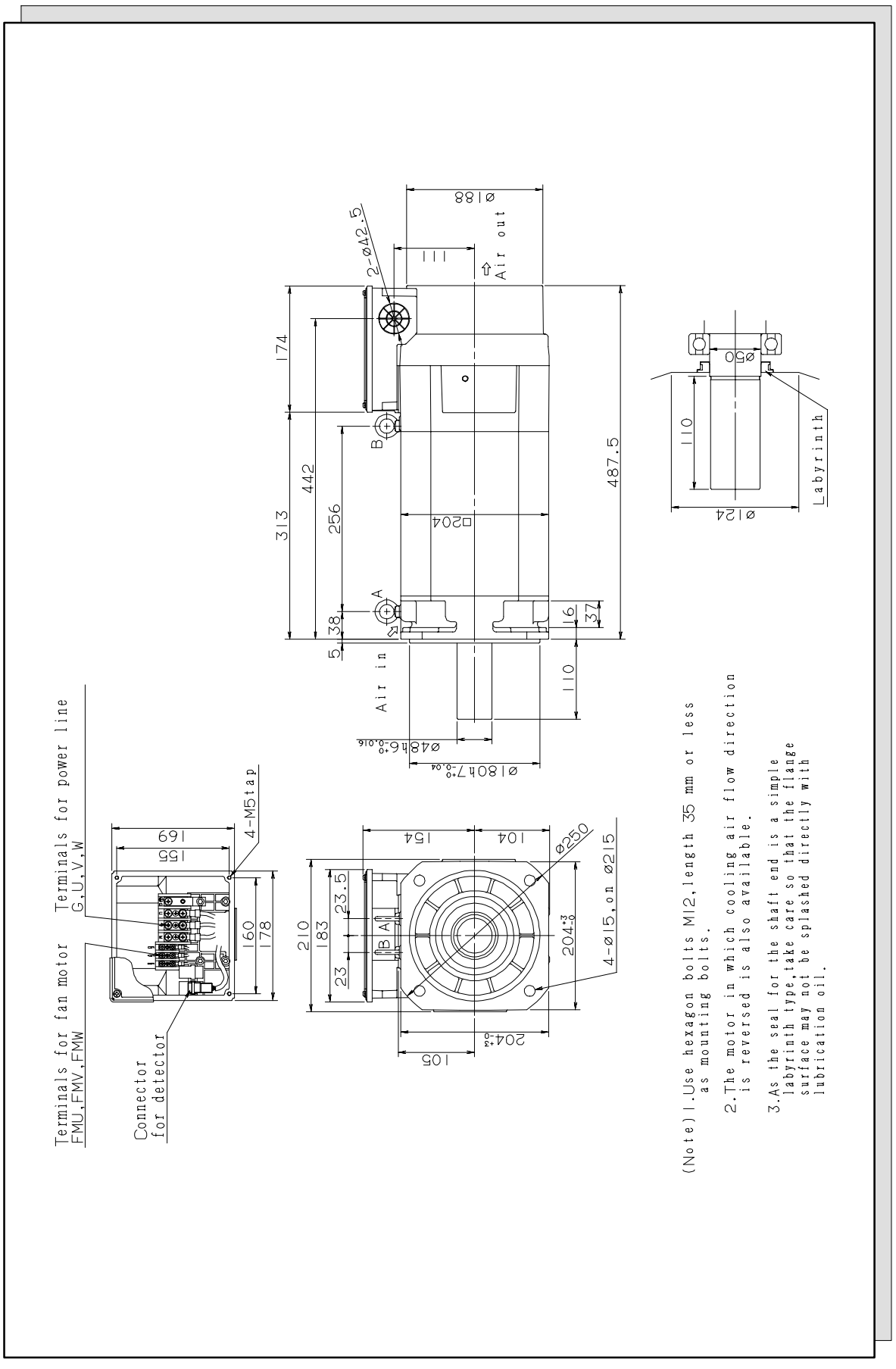


Fig. 8(aa) Model α12/8000, α15/8000 (Flange mounting type)

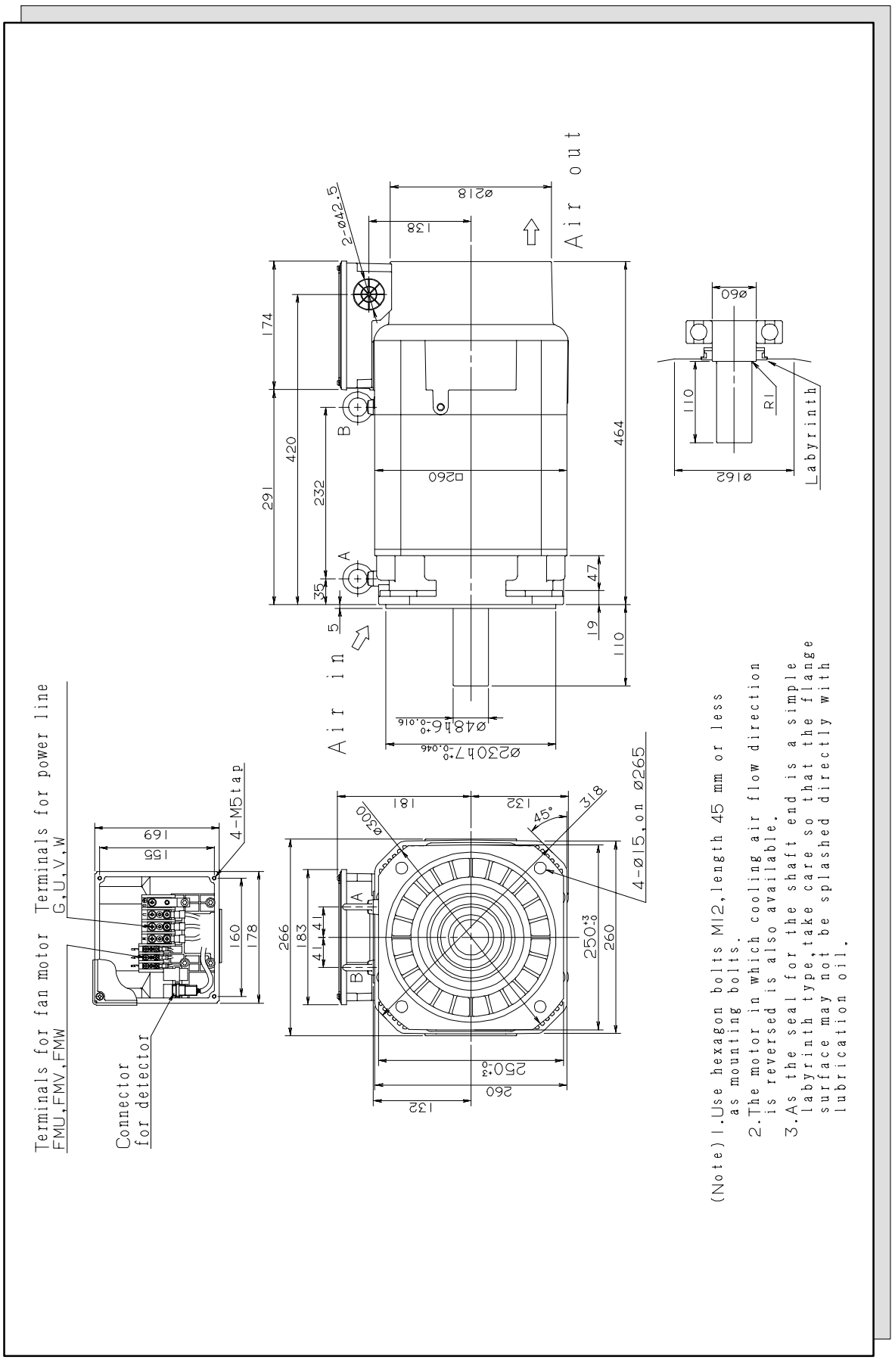


Fig. 8(ab) Model α18/8000, α22/8000 (Flange mounting type)

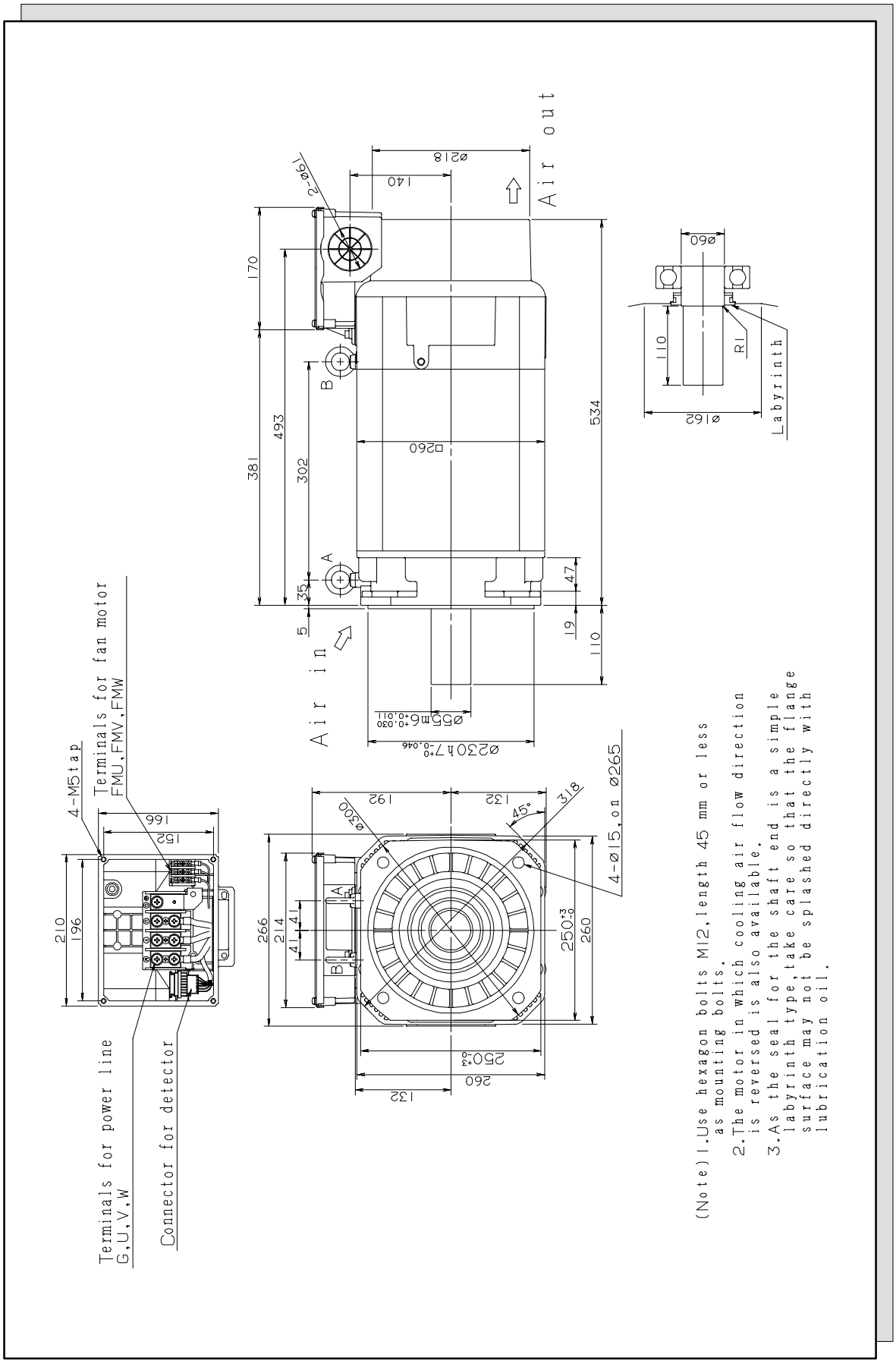
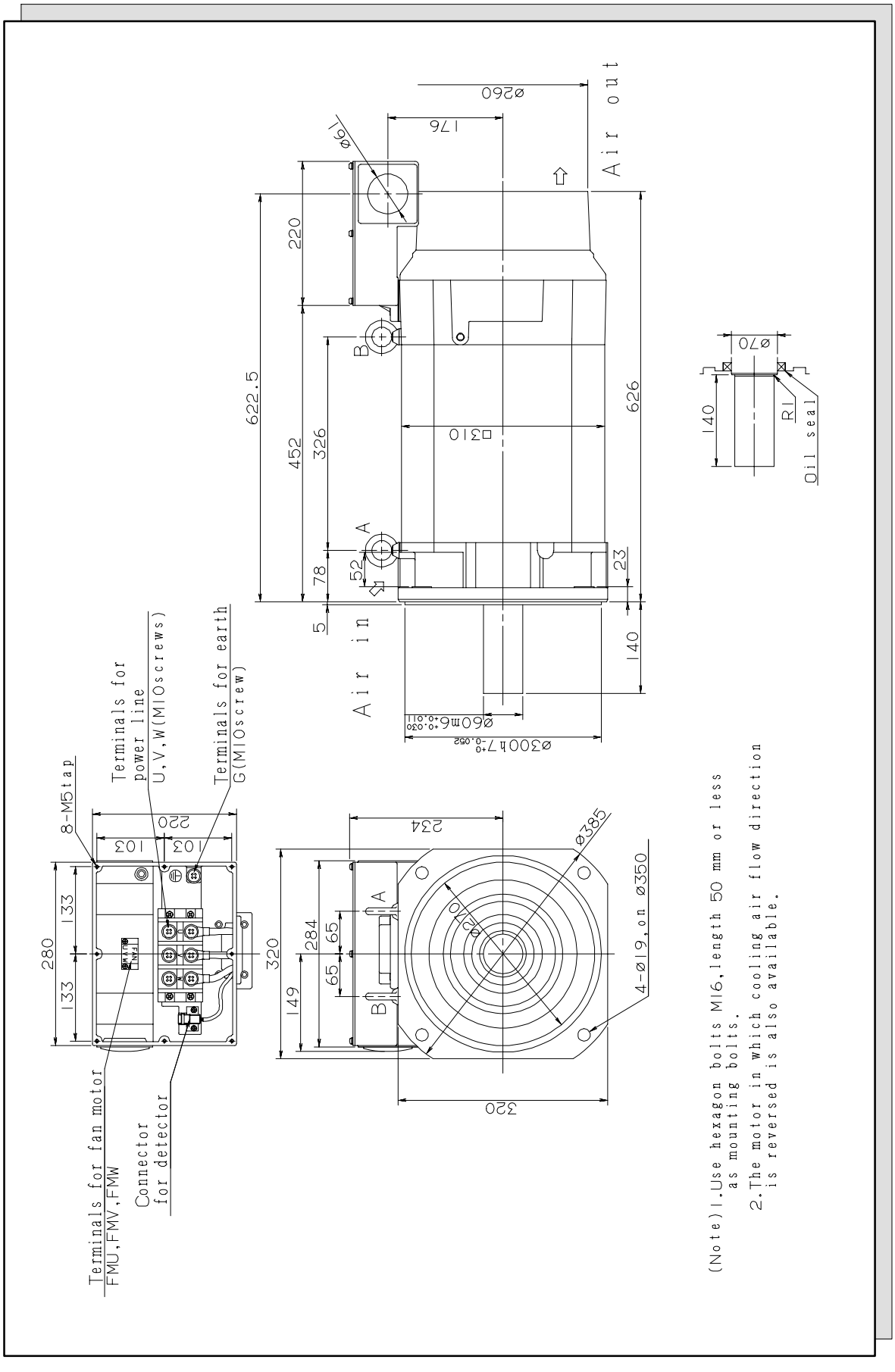


Fig. 8(ac) Model α 30/6000 (Flange mounting type)



III. FANUC AC SPINDLE MOTOR
α P series

1 GENERAL

FANUC AC spindle motor αP series is suitable for structural simplification by eliminating the machine spindle gear box.

Features

- As the rated output range is wide from 1:6 to 1:8 , a gear box structure for speed change is not required, thereby allowing the structure of the machine to be simplified.
  Accordingly, vibration and noise caused by the gear box structure is also eliminated.
- Improvement in efficiency of construction equipment
  Unnecessary use of time is reduced because it is not necessary to stop the spindle when switching the gear.
- Despite a compact configuration, a large low–speed torque can be obtained.
- The method of fan exhaust can be selected from either a exhaust front type or exhaust rear type, thus preventing heat deformation of the machine.
- Waterproof and pressure–proof design conforming to the international standard (IEC) is employed to improve reliability and make it resistant to most environments.

2 SPECIFICATIONS

SPECIFICATIONS

Series		α P series									
Item \ Model		α P8	α P12	α P15	α P18	α P22	α P30	α P40	α P50	α P60 (*1)	
										Low speed winding	High speed winding
Output (*2)	Cont. rated kW (HP)	3.7 (5.0)	5.5 (7.4)	7.5 (10)	9 (12)	11 (14.7)	15 (20.1)	18.5 (24.8)	22 (29.5)	18.5 (24.8)	22 (29.5)
	30 min rated kW [15 min, 10min] (HP)	5.5 (7.4)	7.5 (10)	9 (12)	11 (14.7)	15 (20.1)	18.5 (24.8)	22 (29.5)	30 (40.2)	30 (40.2)	30 (40.2)
	S3 60% kW [25%] (*3) (*4) (HP)	5.5 (7.4)	7.5 (10)	9 (12)	11 (14.7)	15 (20.1)	18.5 (24.8)	22 (29.5)	30 (40.2)	30 (40.2)	30 (40.2)
Rated current A (*5)	Cont. rated	28	34	50	55	70	86	108	105	88	106
	30 min rated S3 60% (*3)	37	42	57	63	86	101	123	133	134	131
Speed min^{-1}	Base speed	750	750	750	750	750	575	575	575	400	750
	Max. speed	6000	6000	6000	6000	6000	4500	4500	4500	1500	4500
Output torque N·m (Cont. rated torque at const. rated torque range) (kg·cm)		47.1 (480)	70 (714)	95.5 (974)	114.6 (1169)	140 (1428)	249 (2540)	307 (3133)	365 (3726)	442 (4504)	280 (2850)
Rotor inertia	$kg \cdot m^2$	0.0275	0.09	0.09	0.128	0.128	0.295	0.295	0.49	0.49	
	$kgf \cdot cm \cdot s^2$	0.28	0.93	0.93	1.29	1.29	3.0	3.0	5.0	5.0	
Weight kg		80	110	110	143	143	250	250	460	468	
Vibration		V5							V10		
Noise		75 dB (A) or less							80 dB (A) or less		
Cooling system (*6)		Totally enclosed and fan cooled IC0A5					Totally enclosed and fan cooled IC0A6				
Cooling fan W		20	56				84		90		
Installation (*7)		The output shaft must be oriented in the range from 45° above the horizontal to 90° below the horizontal. IMB5, IMV1, IMB3, IMB6, IMB7, IMB8, IMV5									
Allowable overload capacity (1 min) (*8)		120 % of 30 min rated output									
Insulation		Class H									
Ambient temperature		0–40°C									
Altitude		Height above sea level not exceeding 1000m									
Painting color		Munsell system N2.5									
Detector		M sensor, MZ sensor									
Type of thermal protection (*9)		TP211									
Resolution of the MZ sensor		4096									
Number of detected gear teeth per rotation		256 teeth (*10)									
Bearing lubrication		Grease									
Maximum output during acceleration (*11) kw		8.3	12.3	13.5	15.1	20.0	25.0	29.0	35.4	36.0	
Applicable spindle amplifier		SPM–11		SPM–15		SPM–22		SPM–26		SPM–30	

NOTE

*1 Optional speed range switching control (Y–Δ switching) is necessary for α P60.
*2 The rated output is guaranteed at the rated voltage. (Amplifier input: AC 200/220/230V +10% –15%, 50/60Hz ± 1Hz) If the input voltage fluctuates, it is possible that the rated output cannot be obtained even when such fluctuations are within the allowable fluctuation range.
*3 S3 25% for low speed winding of α P60.
*4 The cycle time is 10 minutes, S3 60%: ON 6 minutes, OFF 4 minutes and S3 25%: ON 2.5 minutes, OFF 7.5 minutes.
*5 The rated current is the maximum current for each rated output.
*6 IC code conforms to IEC 34–6.
*7 IM code conforms to IEC 34–7.
*8 This is not a guaranteed value but a guideline for the maximum motor output at a rated supply voltage.
*9 Type conforms to IEC 34–11.
*10 128 teeth for motors with a high resolution magnetic pulse coder.
*11 These values are to be used only as guidance for selecting a power supply module and are not guaranteed.
*12 Degree of protection: with oil seal: IP54, without oil seal: IP40.

SPECIFICATIONS

Series		α P series (High speed models)						
Item \ Model		α P8/8000	α P12/8000	α P15/8000	α P18/8000	α P22/8000	α P30/6000	α P40/6000
Output (*1)	Cont. rated kW (HP)	3.7 (5.0)	5.5 (7.4)	7.5 (10)	9 (12)	11 (14.7)	15 (20.1)	18.5 (24.8)
	30 min rated kW (HP)	5.5 (7.4)	7.5 (10)	9 (12)	11 (14.7)	15 (20.1)	18.5 (24.8)	22 (29.5)
	S3 60% kW (*2) (HP)	5.5 (7.4)	7.5 (10)	9 (12)	11 (14.7)	15 (20.1)	18.5 (24.8)	22 (29.5)
Rated current A (*3)	Cont. rated	28	34	50	55	70	86	108
	30 min rated S3 60%	37	42	57	63	86	101	123
Speed min^{-1}	Base speed	750	750	750	750	750	575	575
	Max. speed	8000	8000	8000	8000	8000	6000	6000
Output torque N·m (Cont. rated torque at const. rated torque range) (kg·cm)		47.1 (480)	70 (714)	95.5 (974)	114.6 (1169)	140 (1428)	249 (2540)	307 (3133)
GD^2 $kg \cdot m^2$		0.11	0.36	0.36	0.51	0.51	1.18	1.18
Rotor inertia	$kg \cdot m^2$	0.0275	0.09	0.09	0.128	0.128	0.295	0.295
	$kgf \cdot cm \cdot s^2$	0.28	0.93	0.93	1.29	1.29	3.0	3.0
Rotor inertia $N \cdot m \cdot s^2$ ($kg \cdot cm \cdot s^2$)		0.027 (0.28)	0.091 (0.93)	0.091 (0.93)	0.126 (1.29)	0.126 (1.29)	0.29 (3.0)	0.29 (3.0)
Weight kg		80	110	110	143	143	250	250
Vibration		V5						
Noise		75 dB (A) or less						
Cooling system (*4)		Totally enclosed and fan cooled IC0A5					Totally enclosed and fan cooled IC0A6	
Cooling fan W		20	56				84	
Installation (*5)		The output shaft must be oriented in the range from 45° above the horizontal to 90° below the horizontal. IMB5, IMV1						
Allowable overload capacity (1 min) (*6)		120 % of 30 min rated output						
Insulation		Class H						
Ambient temperature		0–40°C						
Altitude		Height above sea level not exceeding 1000m						
Painting color		Munsell system N2.5						
Detector		M sensor or MZ sensor						
Type of thermal protection (*7)		TP211						
Resolution of the MZ sensor		4096						
Number of detected gear teeth per rotation		256 teeth						
Bearing lubrication		Grease						
Maximum output during acceleration (*8) kw		8.3	12.3	13.5	15.1	20.0	25.0	29.0
Applicable spindle amplifier		SPM–11		SPM–15		SPM–22		SPM–26

NOTE

*1 The rated output is guaranteed at the rated voltage. (Amplifier input: AC 200/220/230V +10% –15%, 50/60Hz ±1Hz) If the input voltage fluctuates, it is possible that the rated output cannot be obtained even when such fluctuations are within the allowable fluctuation range.
*2 The cycle time is 10 minutes, S3 60% : ON 6 minutes, OFF 4 minutes.
*3 The rated current is the maximum current for each rated output.
*4 IC code conforms to IEC 34–6.
*5 IM code conforms to IEC 34–7.
*6 This in not a guaranteed value but a guideline for the maximum motor output at a rated supply voltage.
*7 Type conforms to IEC 34–11.
*8 These values are to be used only as guidance for selecting a power supply module and are not guaranteed.
*9 Degree of protection: α P30/6000, α P40/6000: IP54, others : IP40

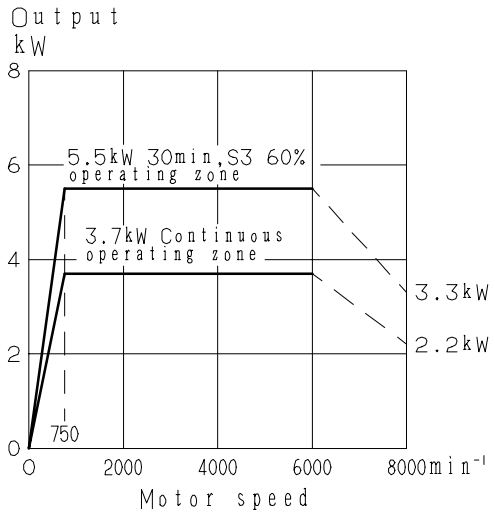
3 OUTPUT/TORQUE CHARACTERISTICS

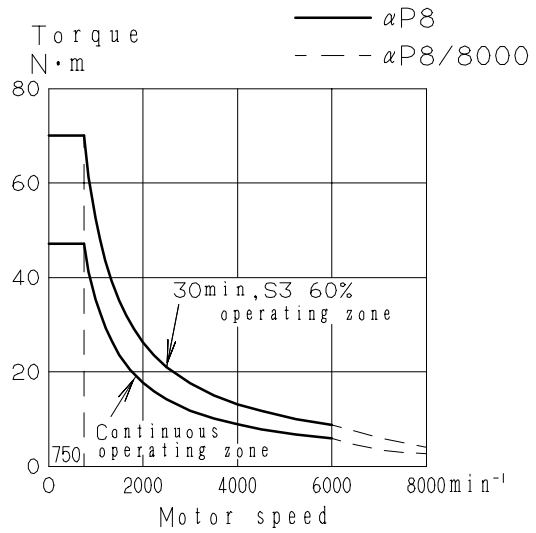
(Reference) Calculation for torque

Torque T can be obtained by the following equation.
$T[N \cdot m]=P[kW] \times 1000/0.1047/N[min^{-1}]$
P[kW]: motor output
$N[min^{-1}]$: motor speed

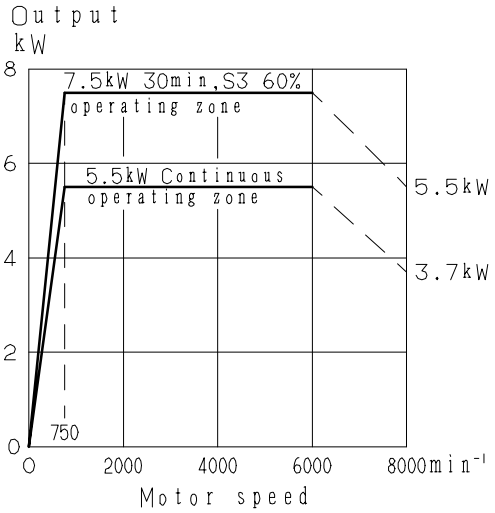
When the unit of T is $[kg \cdot m]$,
$T[kg \cdot m]=P[kW] \times 1000/1.0269/N[min^{-1}]$

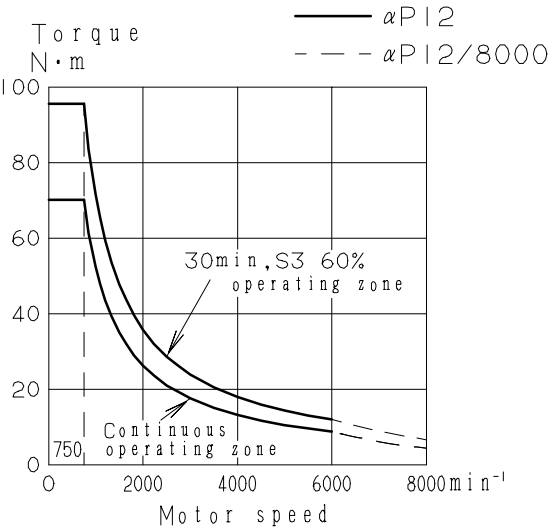
(1)Model αP8, αP8/8000



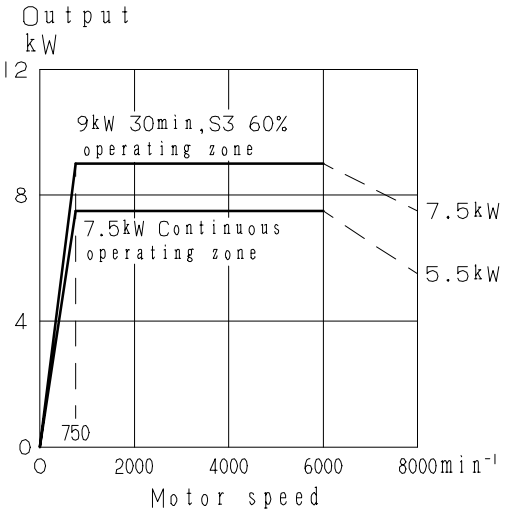


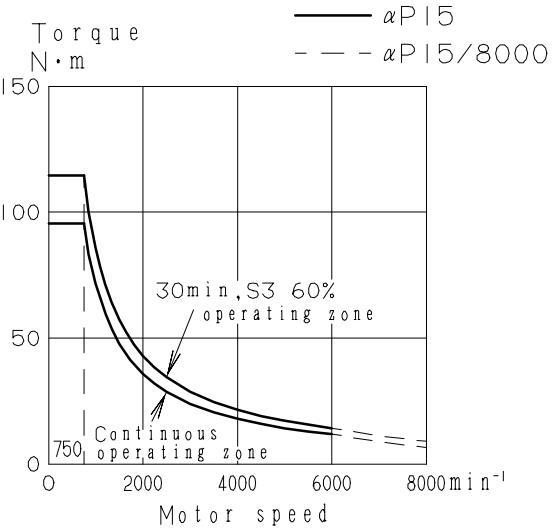
(2)Model αP12, αP12/8000



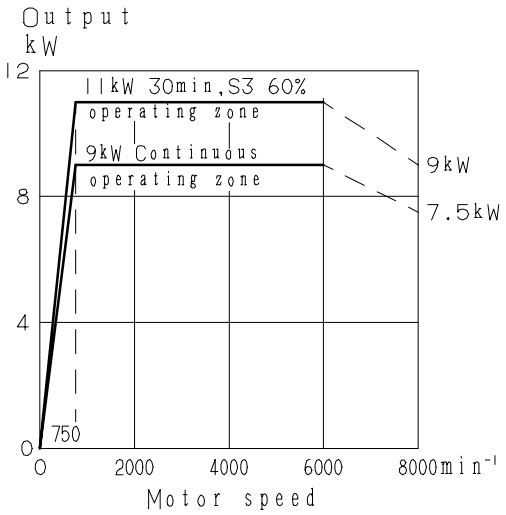


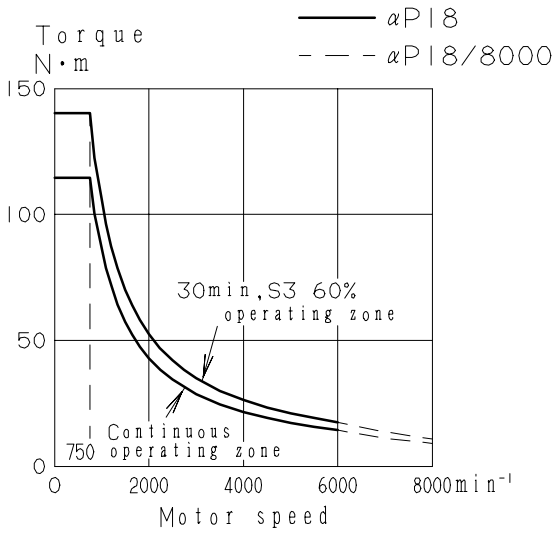
(3)Model αP15, αP15/8000



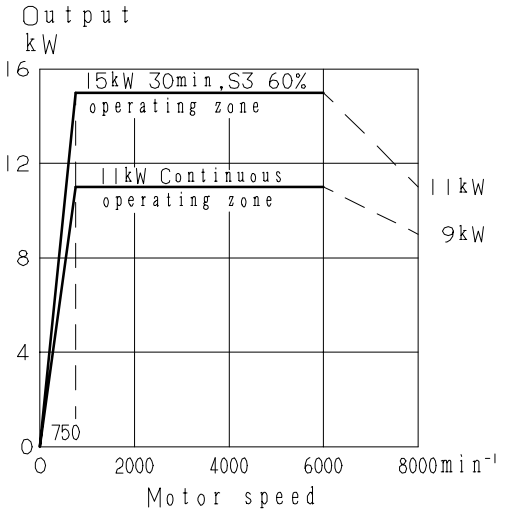


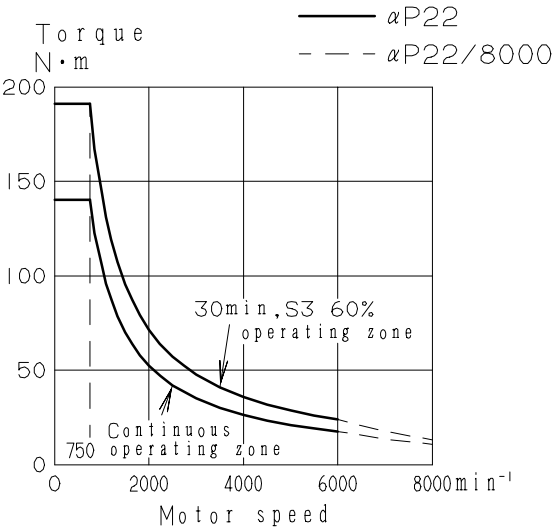
(4)Model αP18, αP18/8000



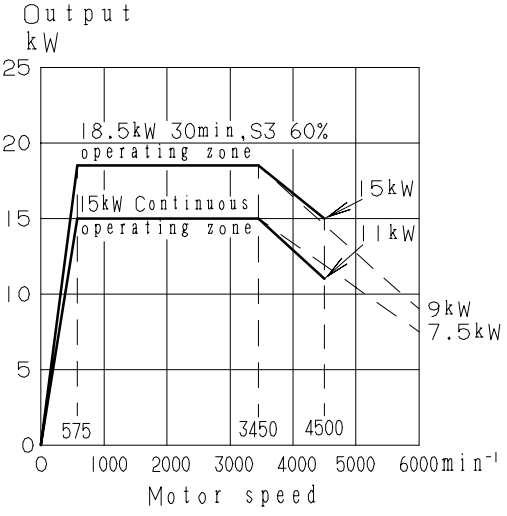


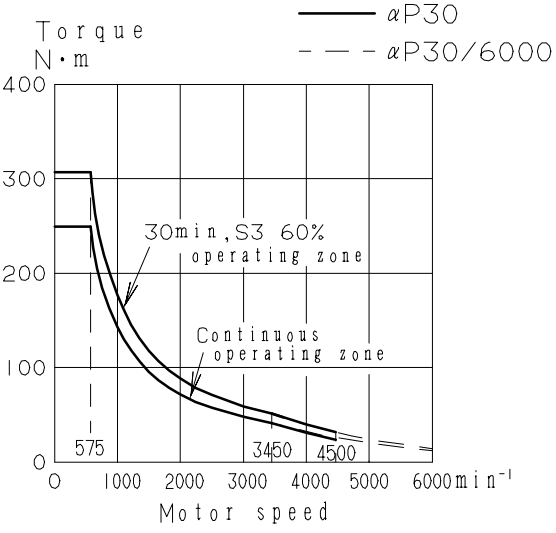
(5)Model αP22, αP22/8000



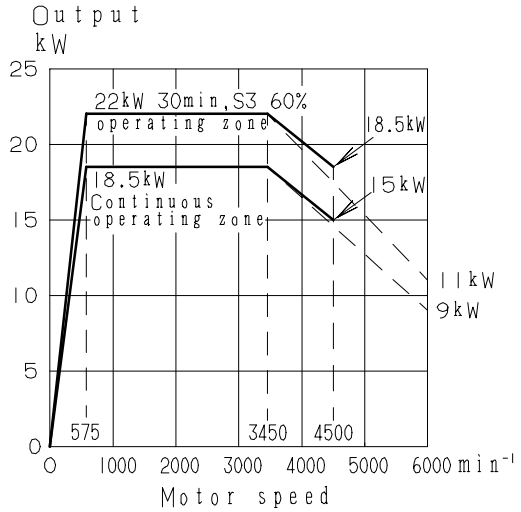


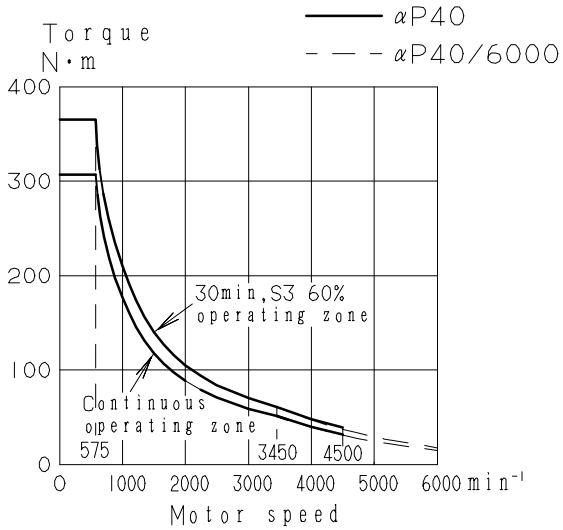
(6)Model αP30, αP30/6000



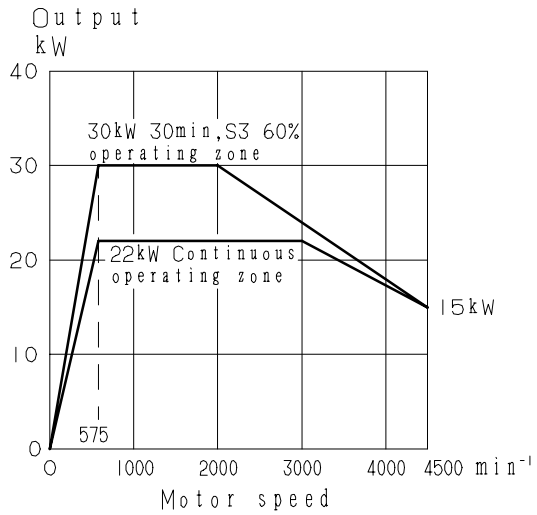


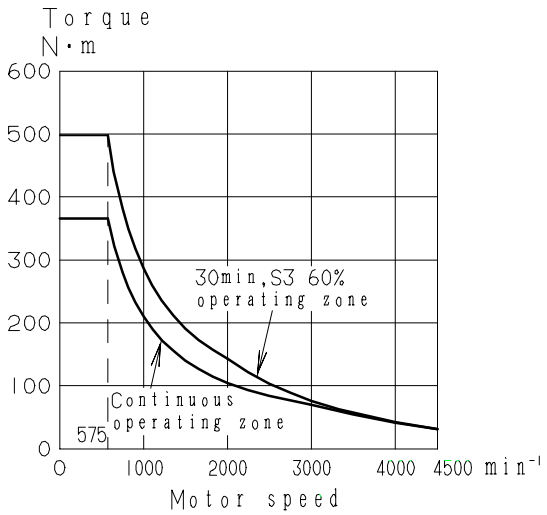
(7)Model αP40, αP40/6000



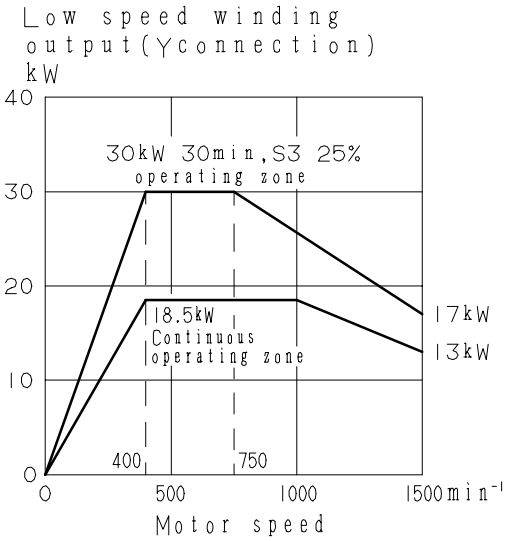


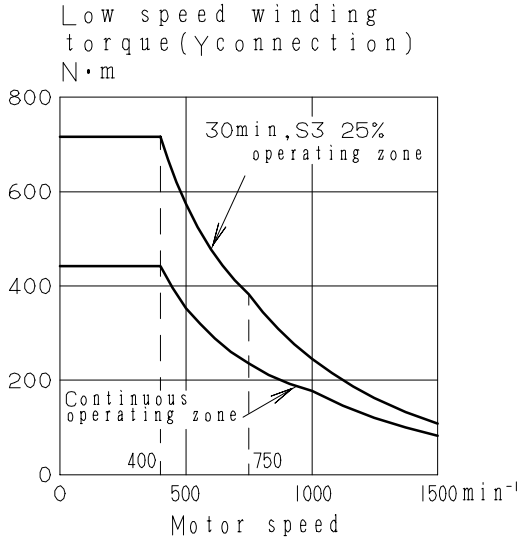
(8)Model αP50



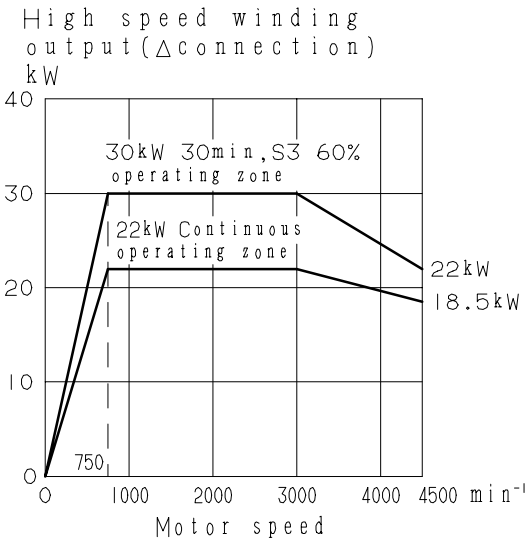


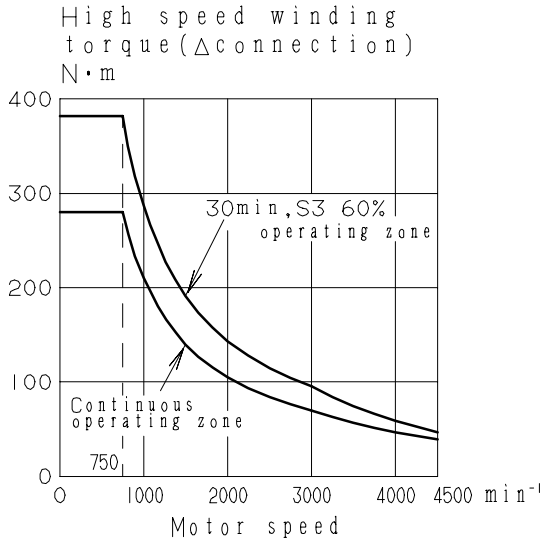
(9)Model αP60





Switching speed:750min-1





NOTE
Optional speed range switching control (Y–Δ switching) is necessary.

4 ORDERING NUMBER

(1) α P series

Name		Ordering number	Remarks
Model α P8	Flange mounting	A06B–0825–B100 A06B–0825–B101 A06B–0825–B300 A06B–0825–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0825–B200 A06B–0825–B201 A06B–0825–B400 A06B–0825–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
Model α P12	Flange mounting	A06B–0826–B100 A06B–0826–B101 A06B–0826–B300 A06B–0826–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0826–B200 A06B–0826–B201 A06B–0826–B400 A06B–0826–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
Model α P15	Flange mounting	A06B–0827–B100 A06B–0827–B101 A06B–0827–B300 A06B–0827–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0827–B200 A06B–0827–B201 A06B–0827–B400 A06B–0827–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
Model α P18	Flange mounting	A06B–0828–B100 A06B–0828–B101 A06B–0828–B300 A06B–0828–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0828–B200 A06B–0828–B201 A06B–0828–B400 A06B–0828–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
Model α P22	Flange mounting	A06B–0829–B100 A06B–0829–B101 A06B–0829–B300 A06B–0829–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0829–B200 A06B–0829–B201 A06B–0829–B400 A06B–0829–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front

NOTE
1 The listed ordering numbers are for motors with a M sensor. The end of the ordering number for the motor with a MZ sensor is B□9□.
2 Refer to the ordering list (B–65151E) for available motors except above.

(Continued from the previous page)

Name		Ordering number	Remarks
Model α P30	Flange mounting	A06B–0830–B100	4500 min^{-1}, has key, exhaust rear
		A06B–0830–B101	4500 min^{-1}, has key, exhaust front
		A06B–0830–B300	4500 min^{-1}, no key, exhaust rear
		A06B–0830–B301	4500 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0830–B200	4500 min^{-1}, has key, exhaust rear
		A06B–0830–B201	4500 min^{-1}, has key, exhaust front
		A06B–0830–B400	4500 min^{-1}, no key, exhaust rear
		A06B–0830–B401	4500 min^{-1}, no key, exhaust front
Model α P40	Flange mounting	A06B–0831–B100	4500 min^{-1}, has key, exhaust rear
		A06B–0831–B101	4500 min^{-1}, has key, exhaust front
		A06B–0831–B300	4500 min^{-1}, no key, exhaust rear
		A06B–0831–B301	4500 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0831–B200	4500 min^{-1}, has key, exhaust rear
		A06B–0831–B201	4500 min^{-1}, has key, exhaust front
		A06B–0831–B400	4500 min^{-1}, no key, exhaust rear
		A06B–0831–B401	4500 min^{-1}, no key, exhaust front
Model α P50	Flange mounting	A06B–0832–B100	4500 min^{-1}, has key, exhaust rear
		A06B–0832–B101	4500 min^{-1}, has key, exhaust front
		A06B–0832–B300	4500 min^{-1}, no key, exhaust rear
		A06B–0832–B301	4500 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0832–B200	4500 min^{-1}, has key, exhaust rear
		A06B–0832–B201	4500 min^{-1}, has key, exhaust front
		A06B–0832–B400	4500 min^{-1}, no key, exhaust rear
		A06B–0832–B401	4500 min^{-1}, no key, exhaust front
Model α P60	Flange mounting	A06B–0833–B106	4500 min^{-1}, has key, exhaust rear
		A06B–0833–B107	4500 min^{-1}, has key, exhaust front
		A06B–0833–B306	4500 min^{-1}, no key, exhaust rear
		A06B–0833–B307	4500 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0833–B206	4500 min^{-1}, has key, exhaust rear
		A06B–0833–B207	4500 min^{-1}, has key, exhaust front
		A06B–0833–B406	4500 min^{-1}, no key, exhaust rear
		A06B–0833–B407	4500 min^{-1}, no key, exhaust front

NOTE

1 The listed ordering numbers are for motors with a M sensor. The end of the ordering number for the motor with a MZ sensor is B□9□.

2 Refer to the ordering list (B–65151E) for available motors except above.

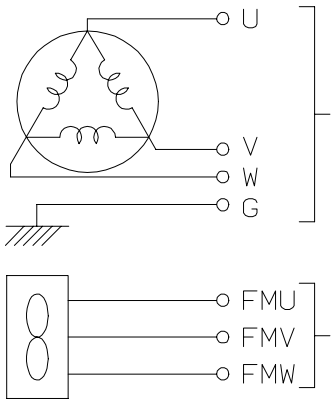
(2) α P series high speed models

Name		Ordering number	Remarks
Model α P8/8000	Flange mounting	A06B–0825–B102 A06B–0825–B103 A06B–0825–B302 A06B–0825–B303	8000 min^{-1}, has key, exhaust rear 8000 min^{-1}, has key, exhaust front 8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
Model α P12/8000	Flange mounting	A06B–0826–B102 A06B–0826–B103 A06B–0826–B302 A06B–0826–B303	8000 min^{-1}, has key, exhaust rear 8000 min^{-1}, has key, exhaust front 8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
Model α P15/8000	Flange mounting	A06B–0827–B102 A06B–0827–B103 A06B–0827–B302 A06B–0827–B303	8000 min^{-1}, has key, exhaust rear 8000 min^{-1}, has key, exhaust front 8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
Model α P18/8000	Flange mounting	A06B–0828–B102 A06B–0828–B103 A06B–0828–B302 A06B–0828–B303	8000 min^{-1}, has key, exhaust rear 8000 min^{-1}, has key, exhaust front 8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
Model α P22/8000	Flange mounting	A06B–0829–B102 A06B–0829–B103 A06B–0829–B302 A06B–0829–B303	8000 min^{-1}, has key, exhaust rear 8000 min^{-1}, has key, exhaust front 8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
Model α P30/6000	Flange mounting	A06B–0830–B102 A06B–0830–B103 A06B–0830–B302 A06B–0830–B303	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
Model α P40/6000	Flange mounting	A06B–0831–B102 A06B–0831–B103 A06B–0831–B302 A06B–0831–B303	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front

NOTE
1 The listed ordering numbers are for motors with a M sensor. The end of the ordering number for the motor with a MZ sensor is B□9□.
2 Refer to the ordering list (B–65151E) for available motors except above.

5 CONNECTIONS

Cables of power line and fan motor are connected to the terminal block. The M sensor (or MZ sensor) and overheat signals are connected to the connector manufactured by AMP.
Connector housing and connector manufactured by AMP are attached to the motor.

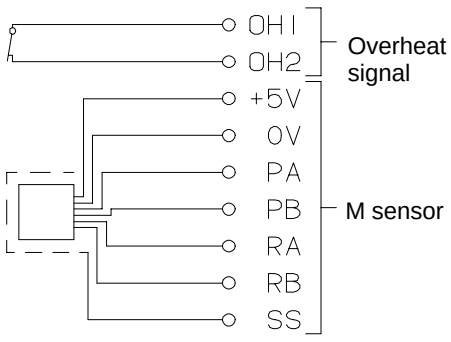


Type of screws used in the terminal block

Motor model \ Terminal name	U, V, W, G	FMU~FMW
αP8~αP22	M5	M4
αP30~αP50	M8	M4
α P60	M8	M3.5

NOTE1 Screws of high speed models are same as above.
2 Refer to FANUC SERVO AMPLIFIER α series DESCRIPTIONS (B–65162E) for specifications of connection cables.

When M sensor is provided



Pin assignment in the connector

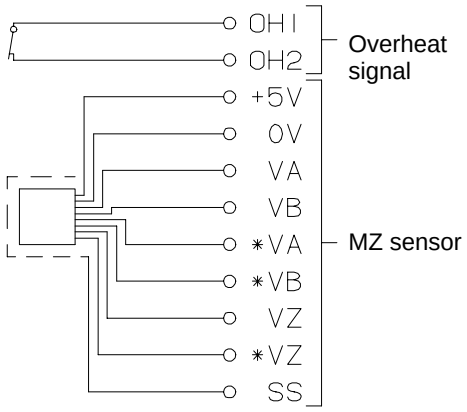
Number	B1	B2	B3	B4	B5	B6
Color		Green	White		Yellow	
Signal		RA	RB		0V	OH2
Number	A1	A2	A3	A4	A5	A6
Color	Red	Black	Blue		No color	
Signal	+5V	PA	PB		SS	OH1

Connector: Manufactured by D–3000 series

	Motor side		Cable side	
	FANUC purchase specification	AMP specification	FANUC purchase specification	AMP specification
Housing	A63L–0001–0535/121KDF	178964–6	A63L–0001–0460/121KD	178289–6
Contact	A63L–0001–0456/ASMT	175288-2	A63L–0001–0456/ASM	1–175217–2

Crimping tool : 919601–1
Extractor : 914677–1

When MZ sensor is provided



Pin assignment in the connector

Number	B1	B2	B3	B4	B5	B6
Color		Blue	White–orange	White–purple	Orange	
Signal		*VA	*VB	*VZ	0V	OH2
Number	A1	A2	A3	A4	A5	A6
Color	Red	Black	Green	Gray	No color	
Signal	+5V	VA	VB	VZ	SS	OH1

Connector, Crimping tool and Extractor are same as above case of M sensor.

6 ALLOWABLE RADIAL LOAD

Use the motor output shaft below the allowable radial loads shown in the table below.

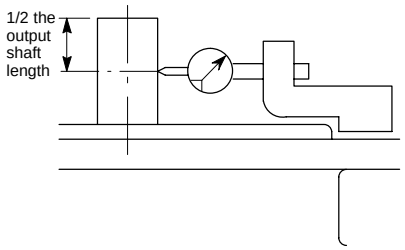
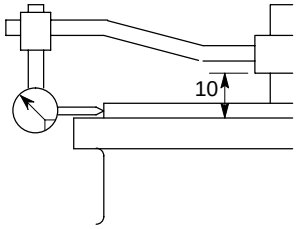
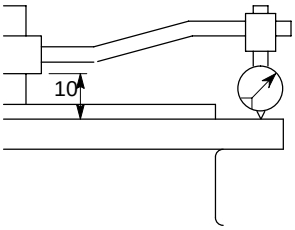
Model	Allowable radial load (kg)	
	At output shaft end	At output shaft center
α P8	300	344
α P12, α P15	300	348
α P18, α P22	450	509
α P30, α P40	550	626
α P50	1100	1255
α P60	–	2000
α P8/8000	200	229
α P12/8000, α P15/8000	250	290
α P18/8000, α P22/8000	300	340
α P30/6000, α P40/6000	550	626

CAUTION

1 When using a belt, adjust the tension so the allowable loads indicated above are not exceeded. If an excessive load is applied, consider the use of a support bearing on the machine side to maintain the long–term reliability of the motor. (If an excessive load is applied, it is possible that an abnormal sound may occur.)
2 When the belt tension is maximized at a point outside the output shaft end, the allowable loads are less than those at the output shaft end.
3 If a thrust load is applied when a helical gear is used, the shaft moves in the direction of the thrust. So, as a general rule, never apply a thrust load.

7 ASSEMBLING ACCURACY (T.I.R Total Indicator Reading)

Conform to JEM 1401

Model / Item	αP8 to αP22	αP30 to αP60	Measuring method
Vibration at the end of the output shaft	20μm or less		
Vibration of the faucet joint for mounting the flange against the core of the shaft (Only for flange type)	40μm or less	60μm or less	
Vibration of the flange mounting surface against the core of the shaft (Only for flange type)	80μm or less	100μm or less	

NOTE
Assembling accuracy of High speed models are same as above.

8 EXTERNAL DIMENSIONS

Refer to the following pages.

Model name		Number of figure
Model	**Type**	
Model αP8	Flange mounting type	Fig.8 (a)
	Foot mounting type	Fig.8 (b)
Model αP12, αP15	Flange mounting type	Fig.8 (c)
	Foot mounting type	Fig.8 (d)
Model αP18,αP22	Flange mounting type	Fig.8 (e)
	Foot mounting type	Fig.8 (f)
Model αP30, αP40	Flange mounting type	Fig.8 (g)
	Foot mounting type	Fig.8 (h)
Model αP50	Flange mounting type	Fig.8 (i)
	Foot mounting type	Fig.8 (j)
Model αP60	Flange mounting type	Fig.8 (k)
	Foot mounting type	Fig.8 (l)
Model αP8/8000	Flange mounting type	Fig.8 (m)
Model αP12/8000 αP15/8000	Flange mounting type	Fig.8 (n)
Model αP18/8000 αP22/8000	Flange mounting type	Fig.8 (o)
Model αP30/6000 αP40/6000	Flange mounting type	Fig.8 (p)

NOTE
High speed models of α P series are limited to the flange mounting and key–less type. And the shaft end seal i s not a oil–seal but a simplified labyrinth. (In case of α P30/6000 and α P40/6000, that is an oil–seal.)

Fig.8 (a) Model αP8 (Flange mounting type)

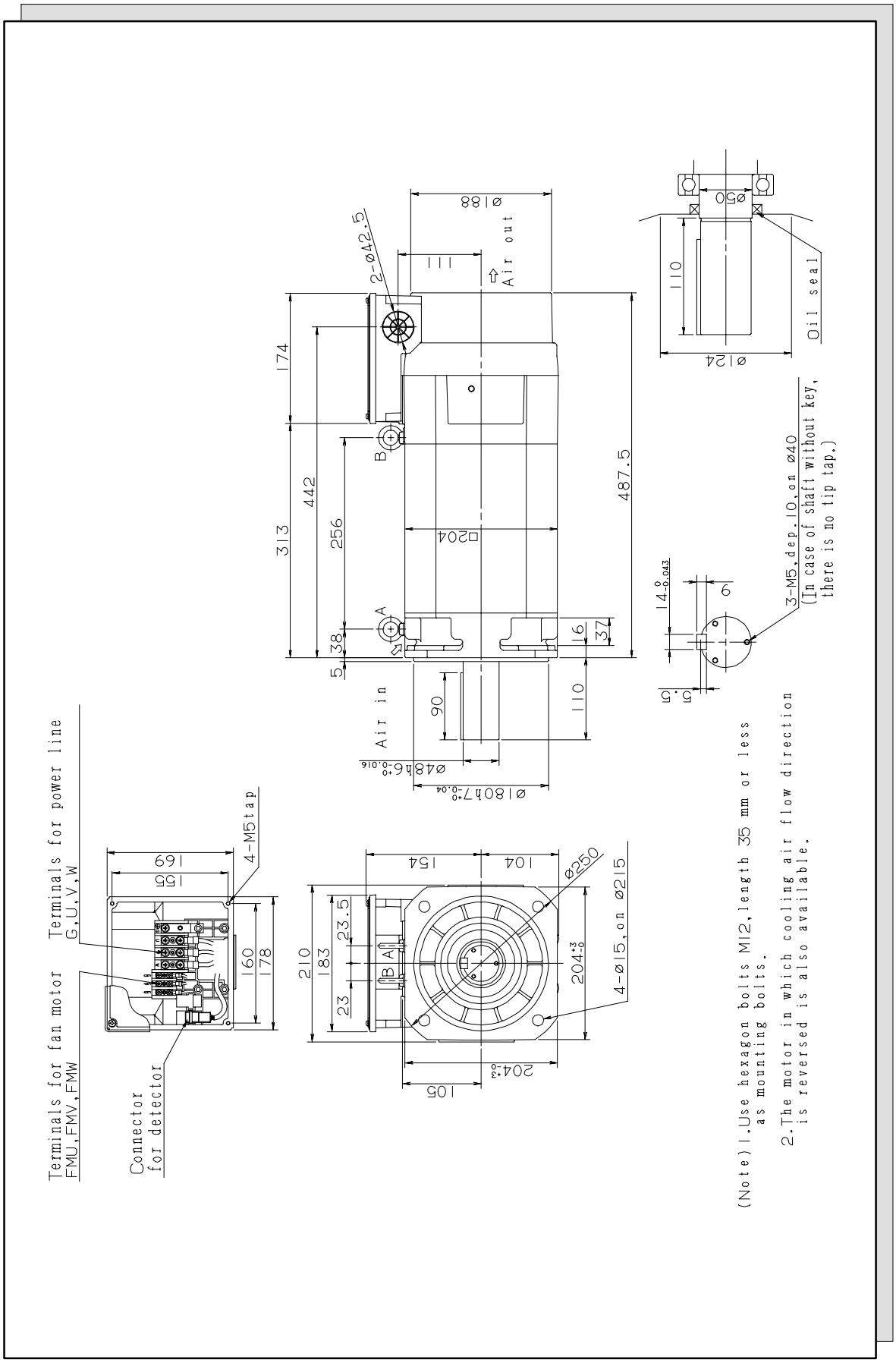


Fig. 8(b) **Model αP8 (Foot mounting type)**

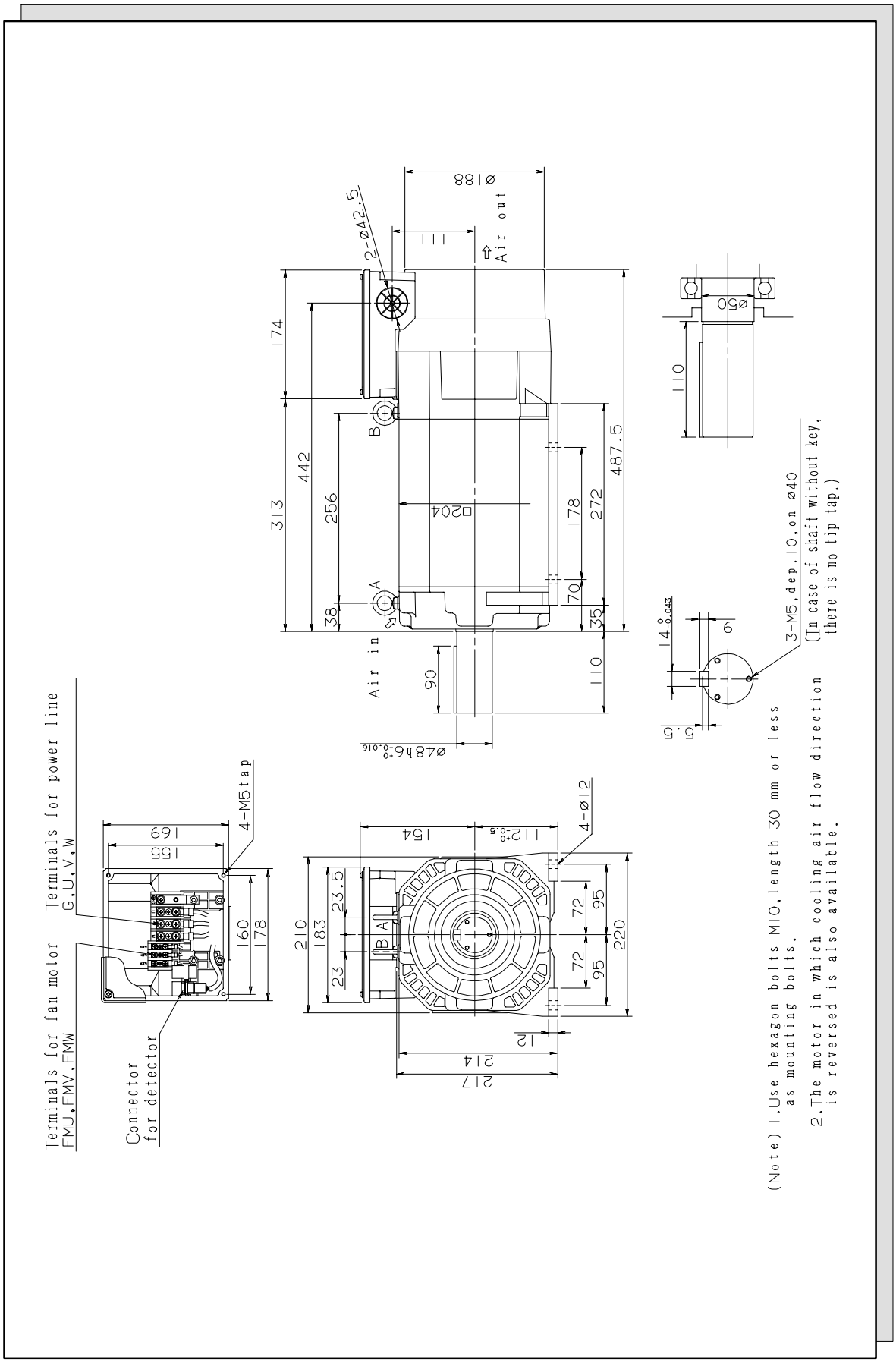


Fig.8(c) Model αP12,αP15 (Flange mounting type)

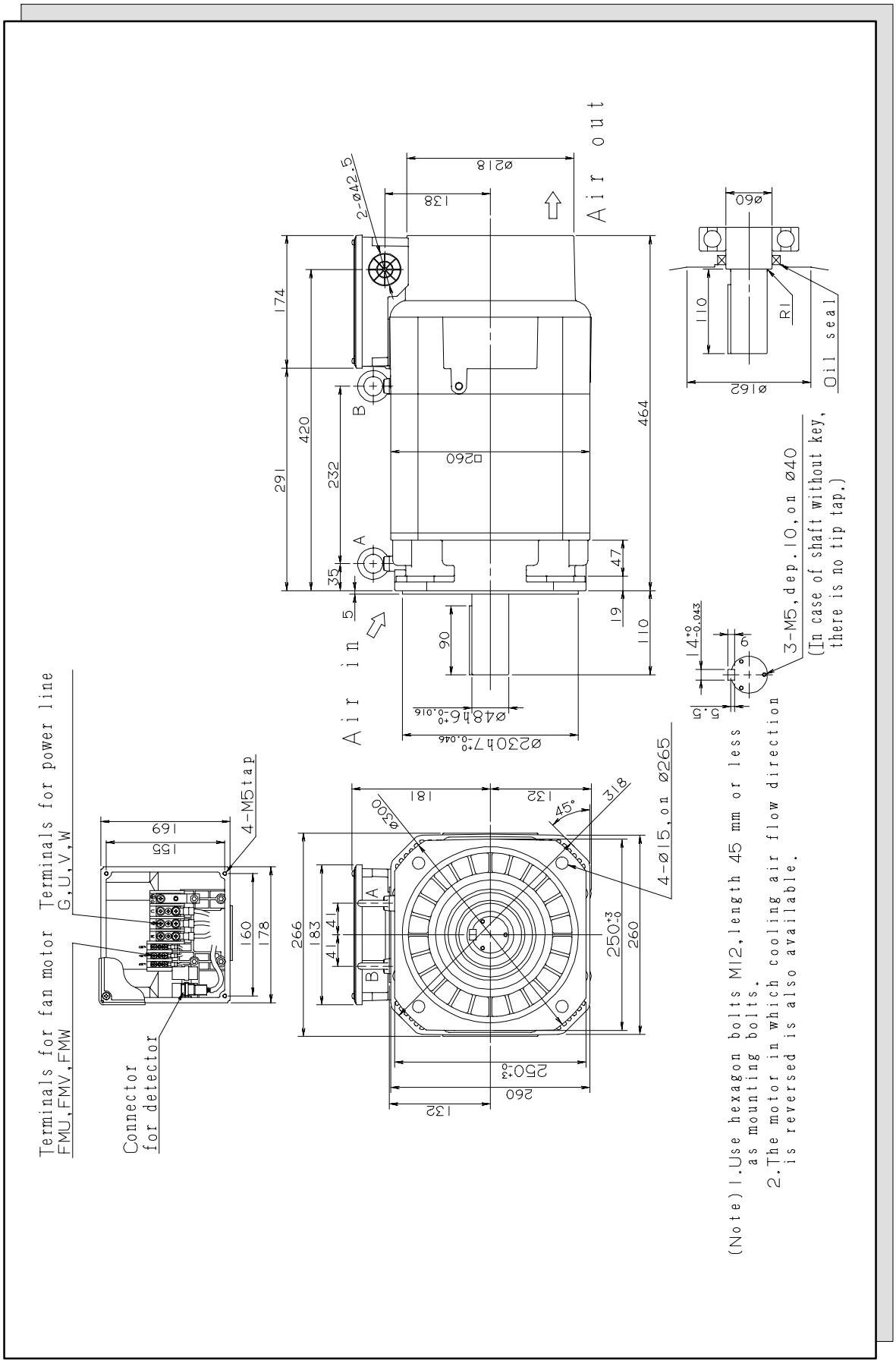


Fig.8(d) Model αP12,αP15 (Foot mounting type)

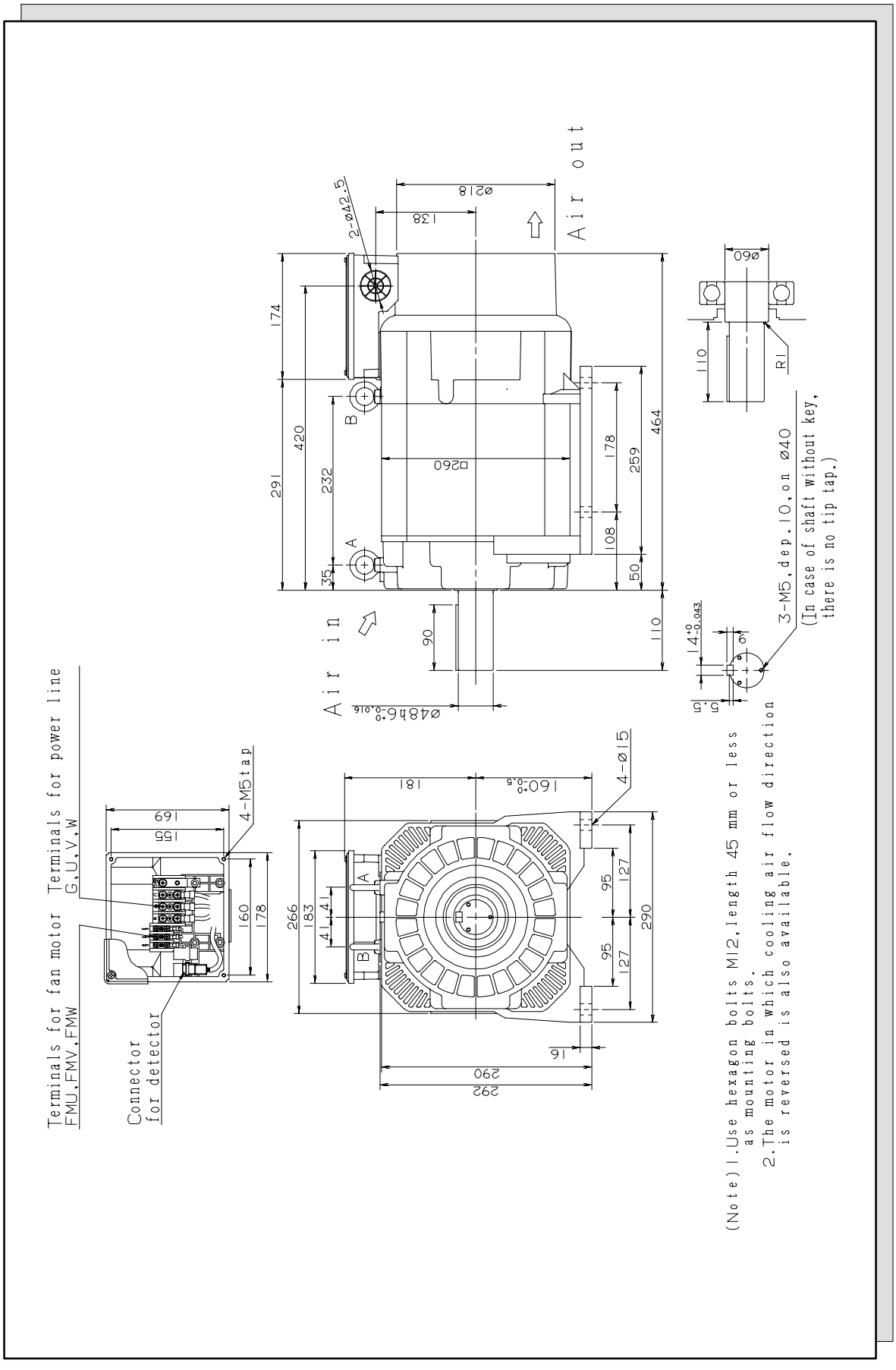


Fig.8(e) Model αP18,αP22 (Flange mounting type)

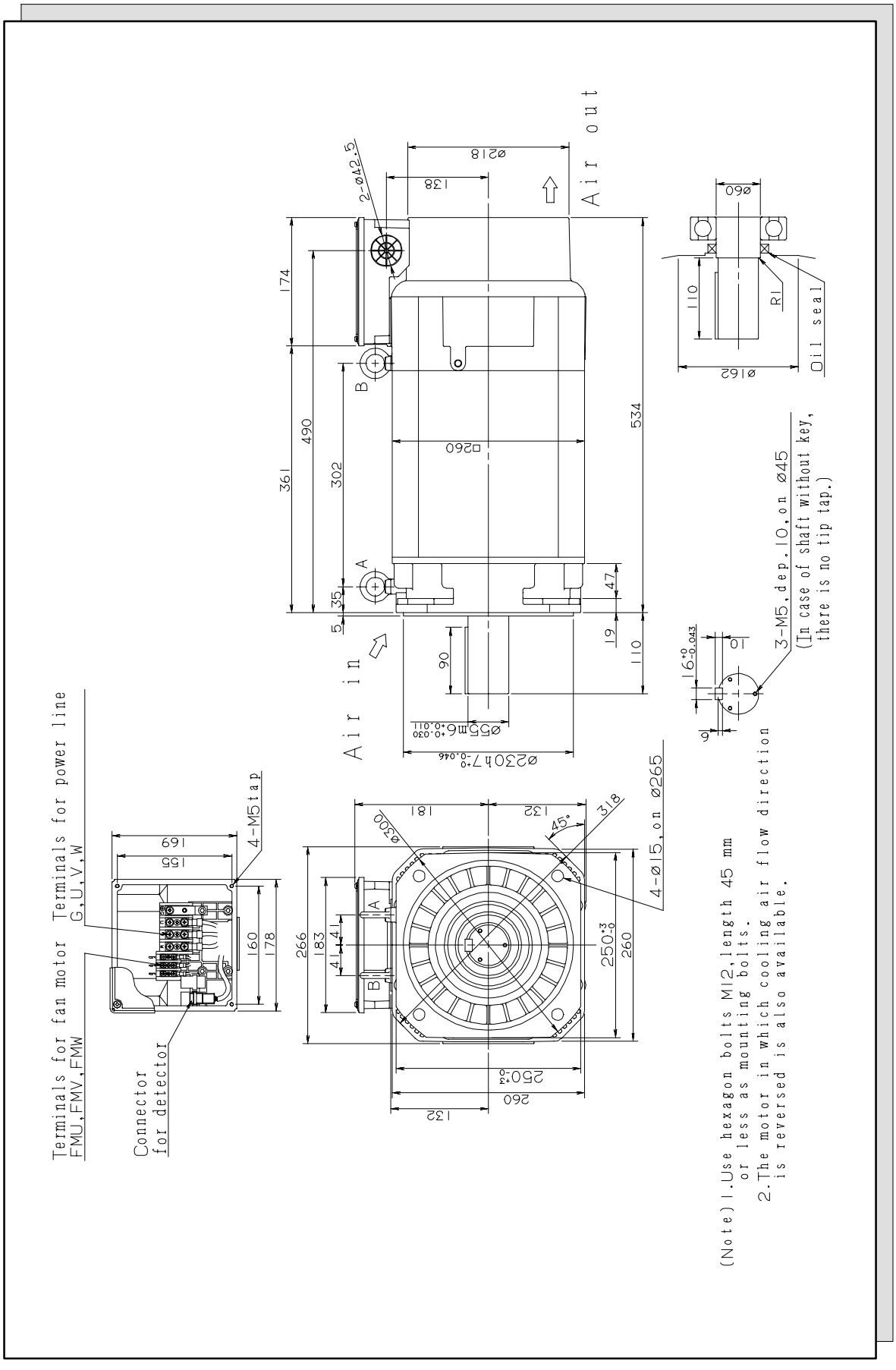


Fig.8(f) Model αP18,αP22 (Foot mounting type)

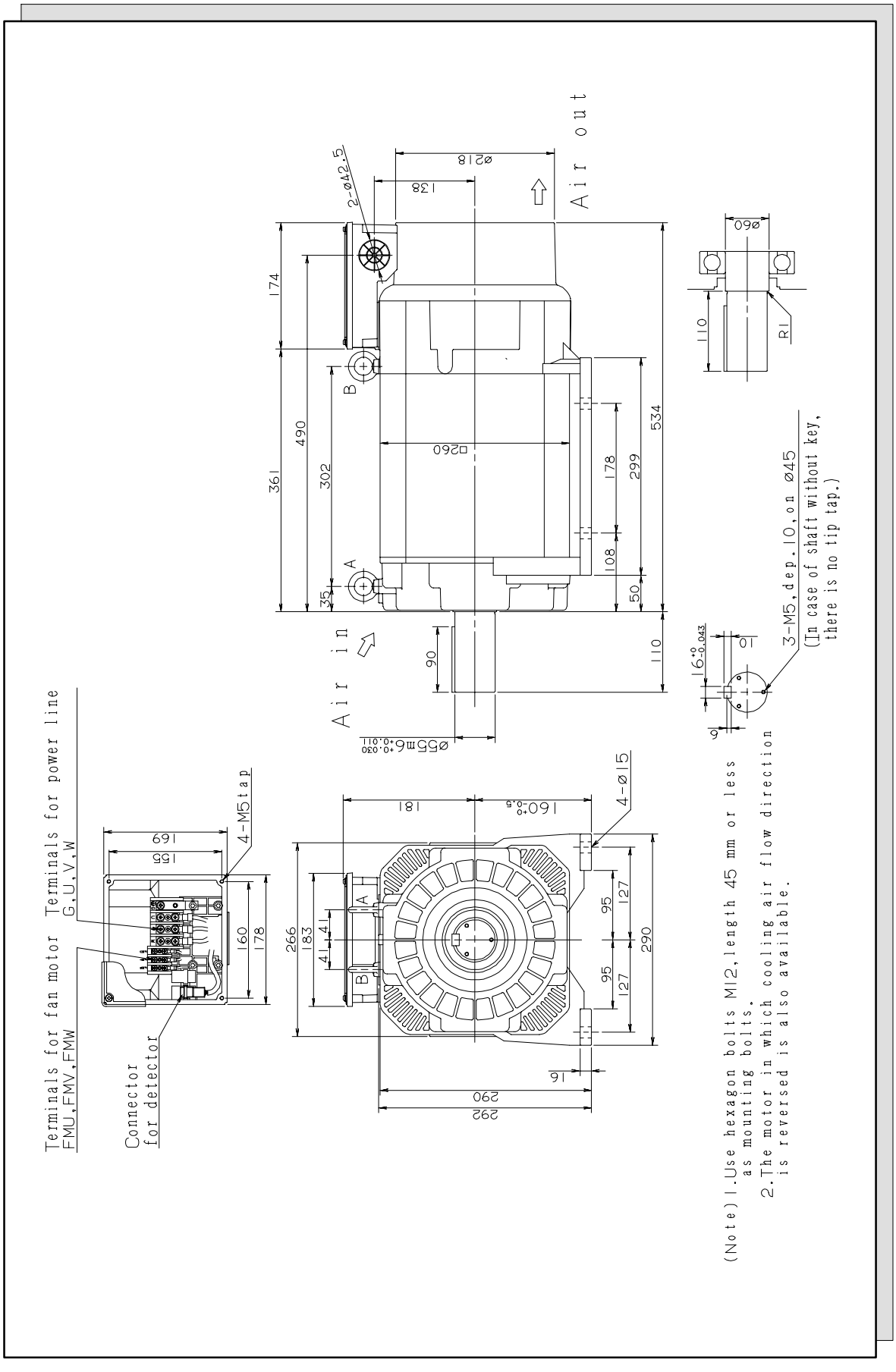


Fig.8(g) Model αP30,αP40 (Flange mounting type)

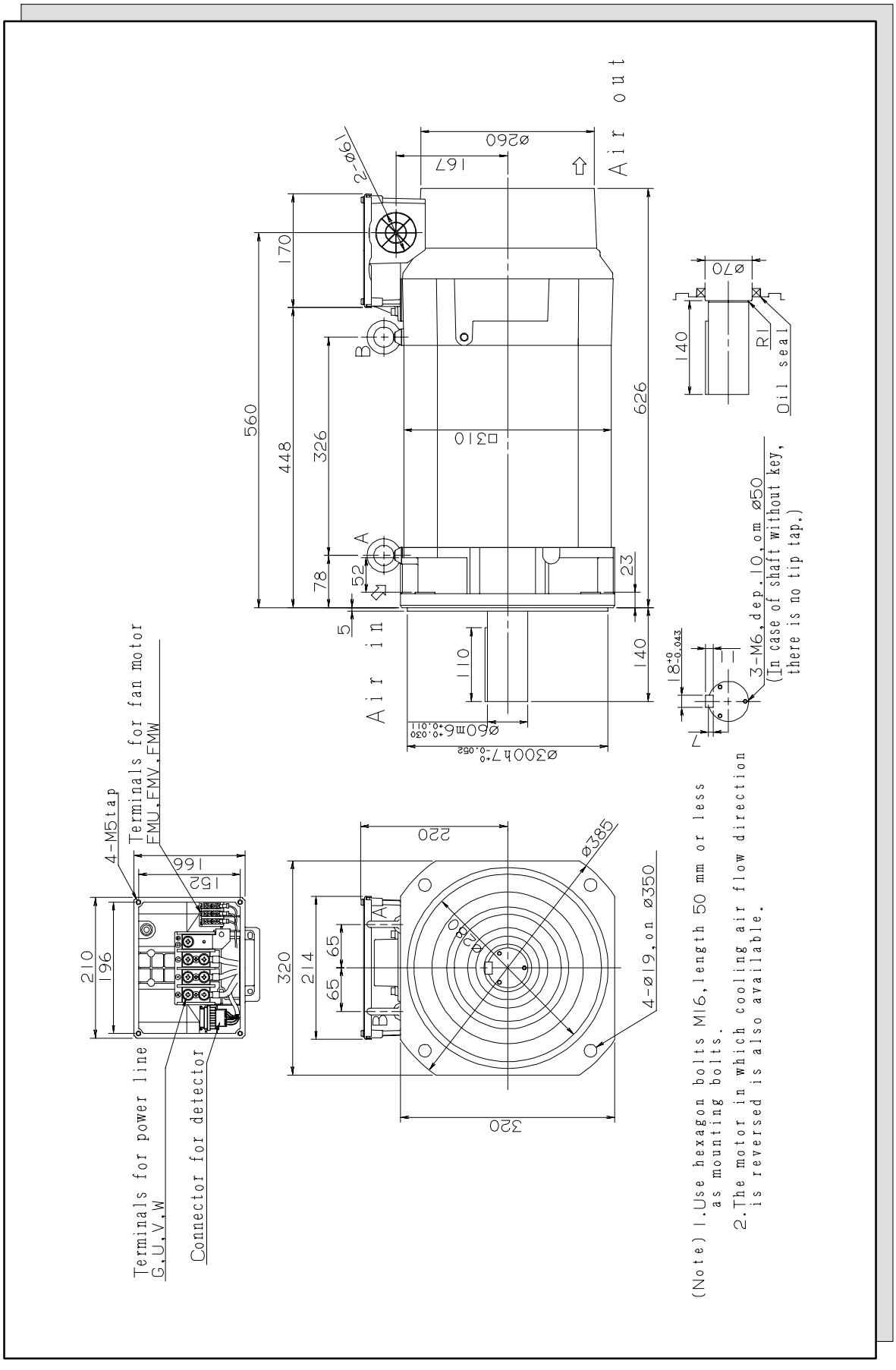


Fig.8(h) Model αP30,αP40 (Foot mounting type)

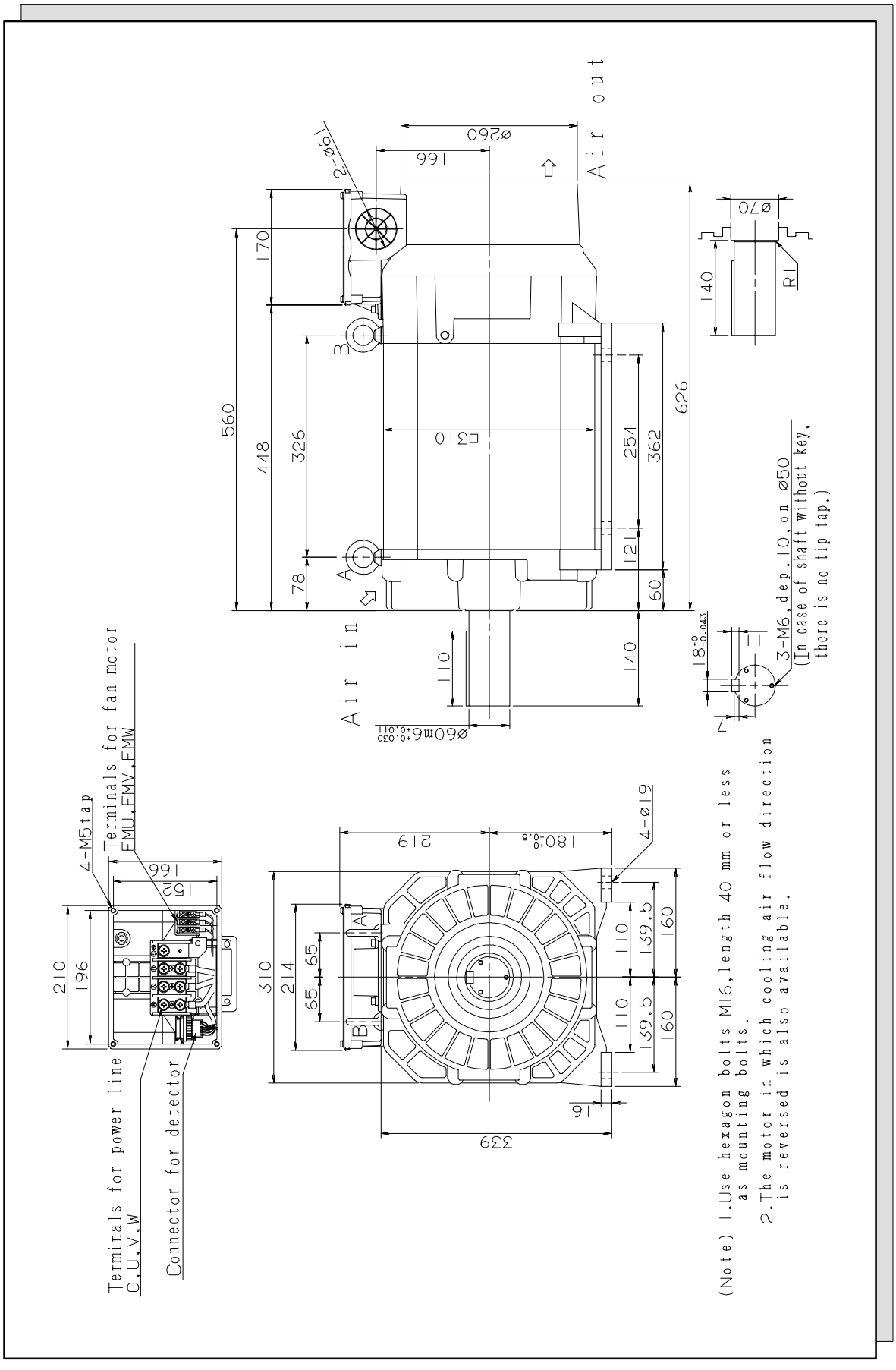


Fig.8(i) Model αP50(Flange mounting type)

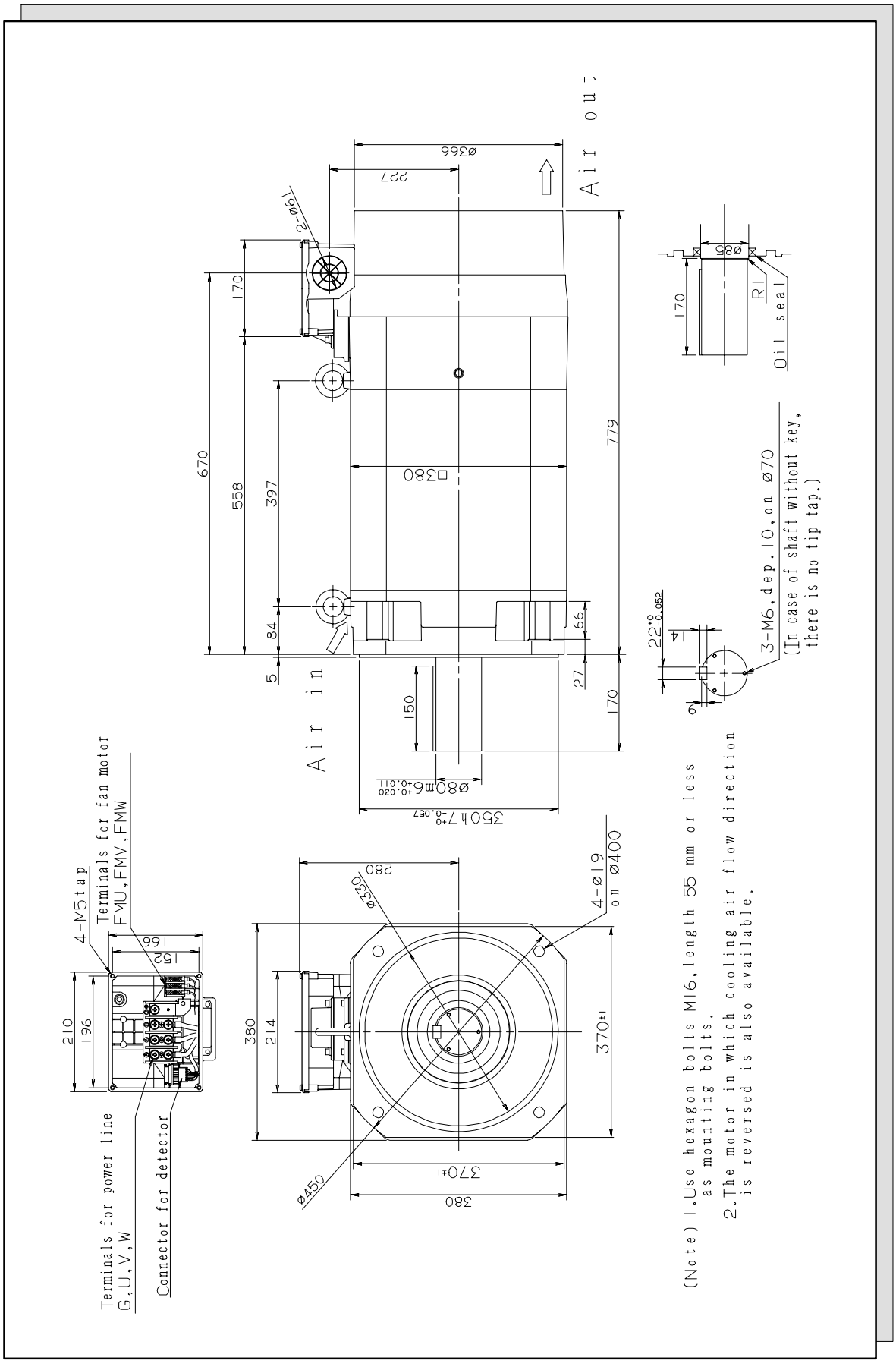


Fig.8 (j) Model αP50 (Foot mounting type)

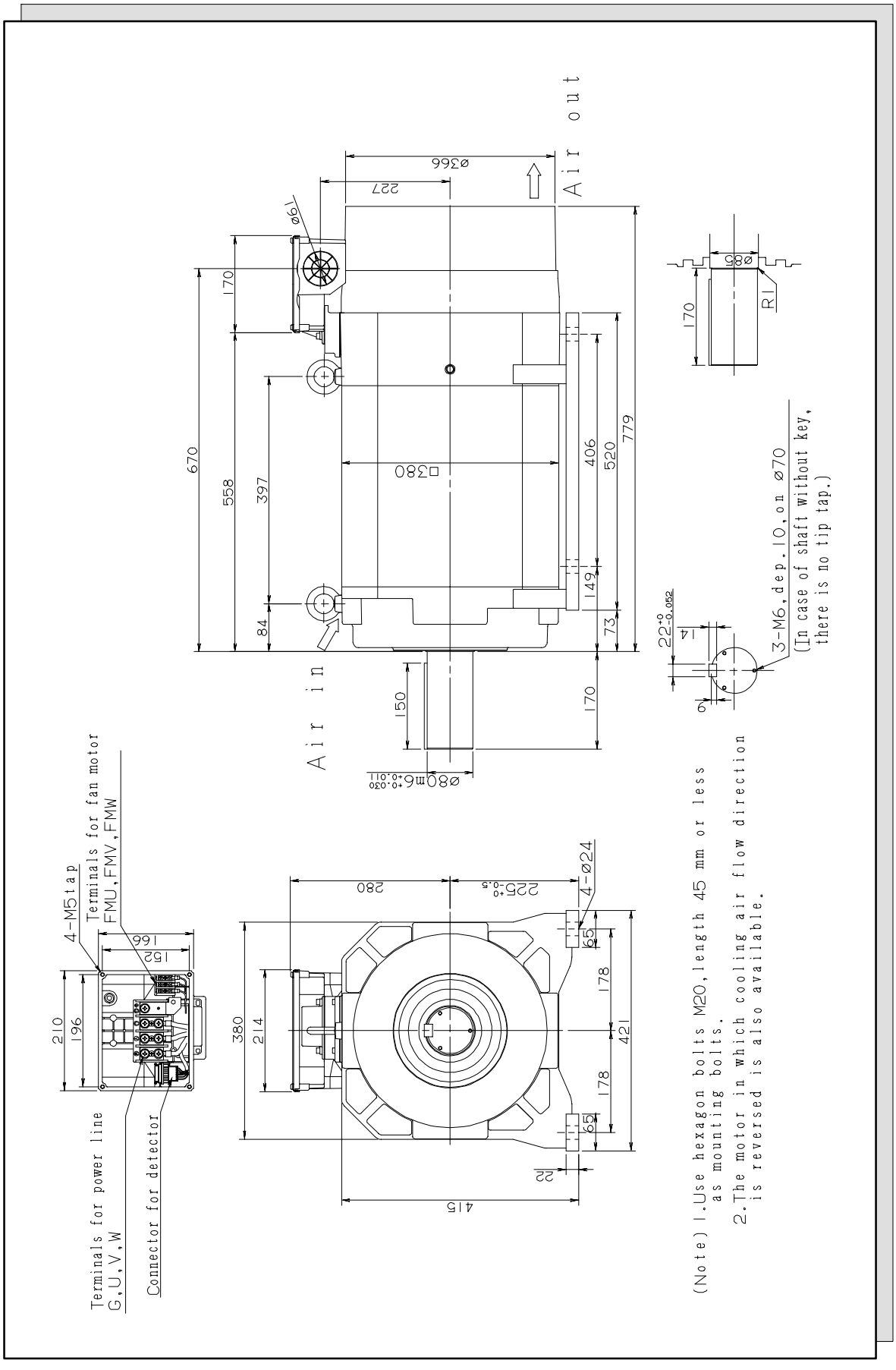


Fig.8(k) Model αP60 (Flange mounting type)

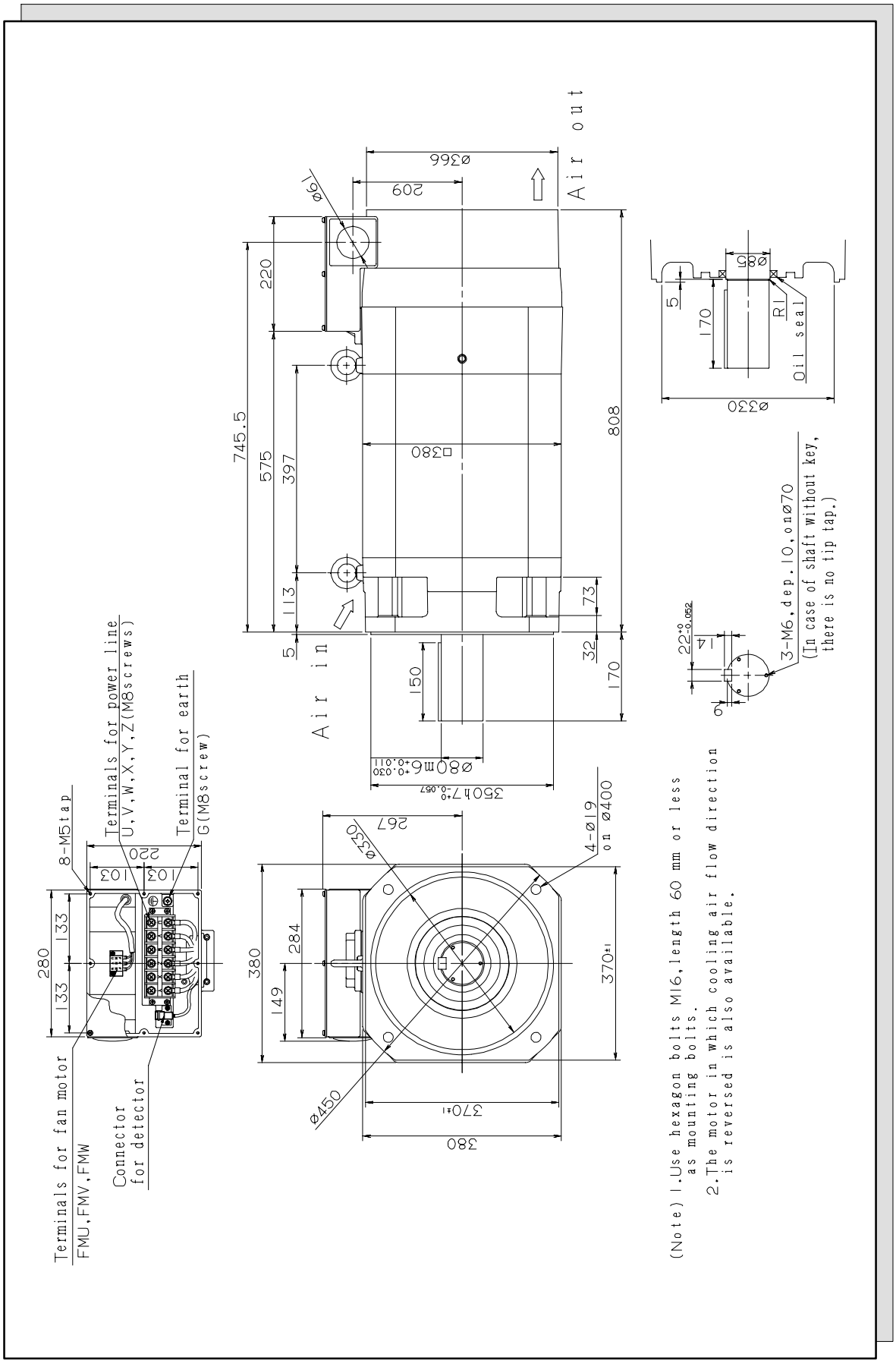


Fig.8 (l) Model αP60 (Foot mounting type)

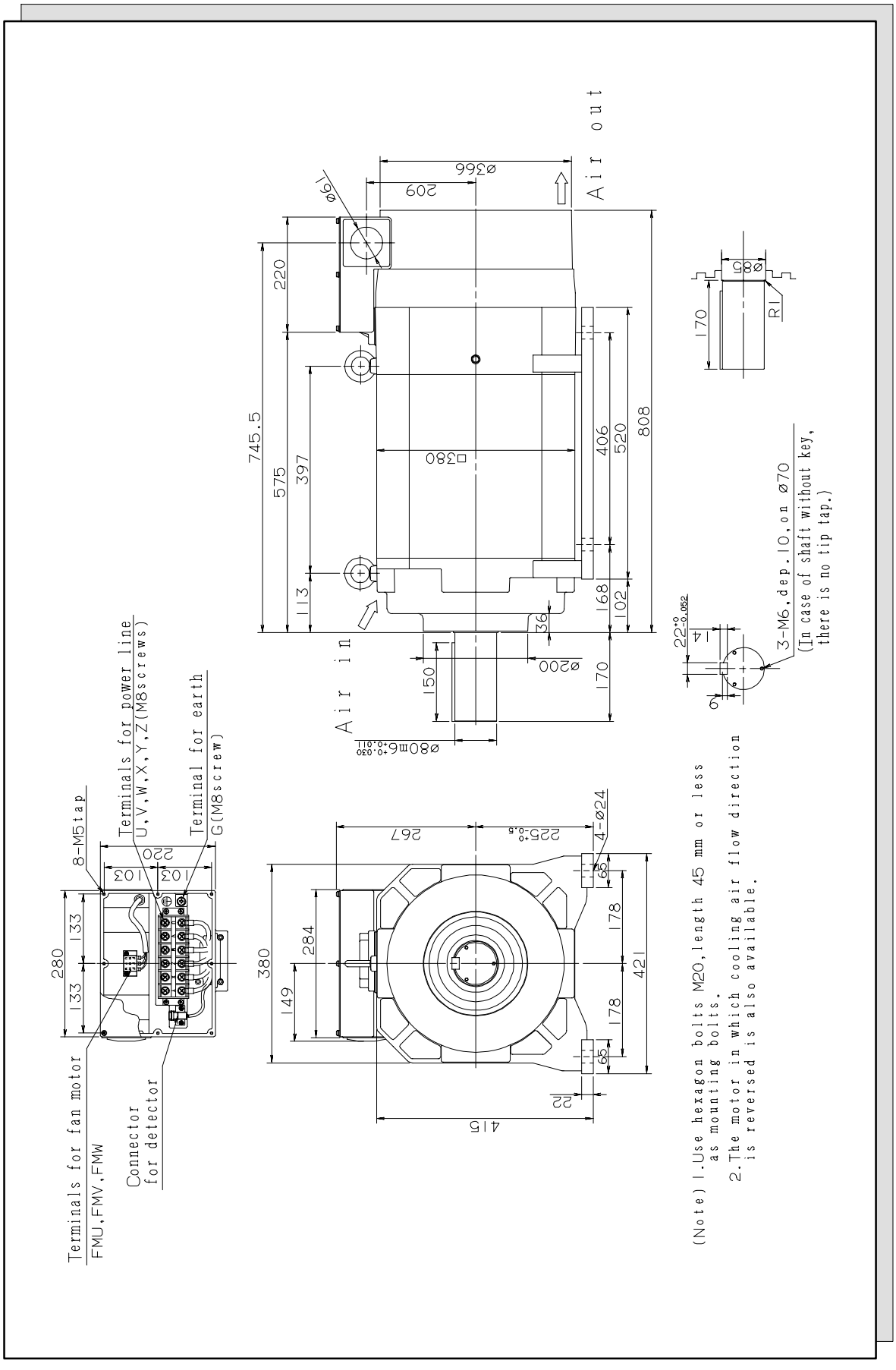


Fig.8(m) Model αP8/8000 (Flange mounting type)

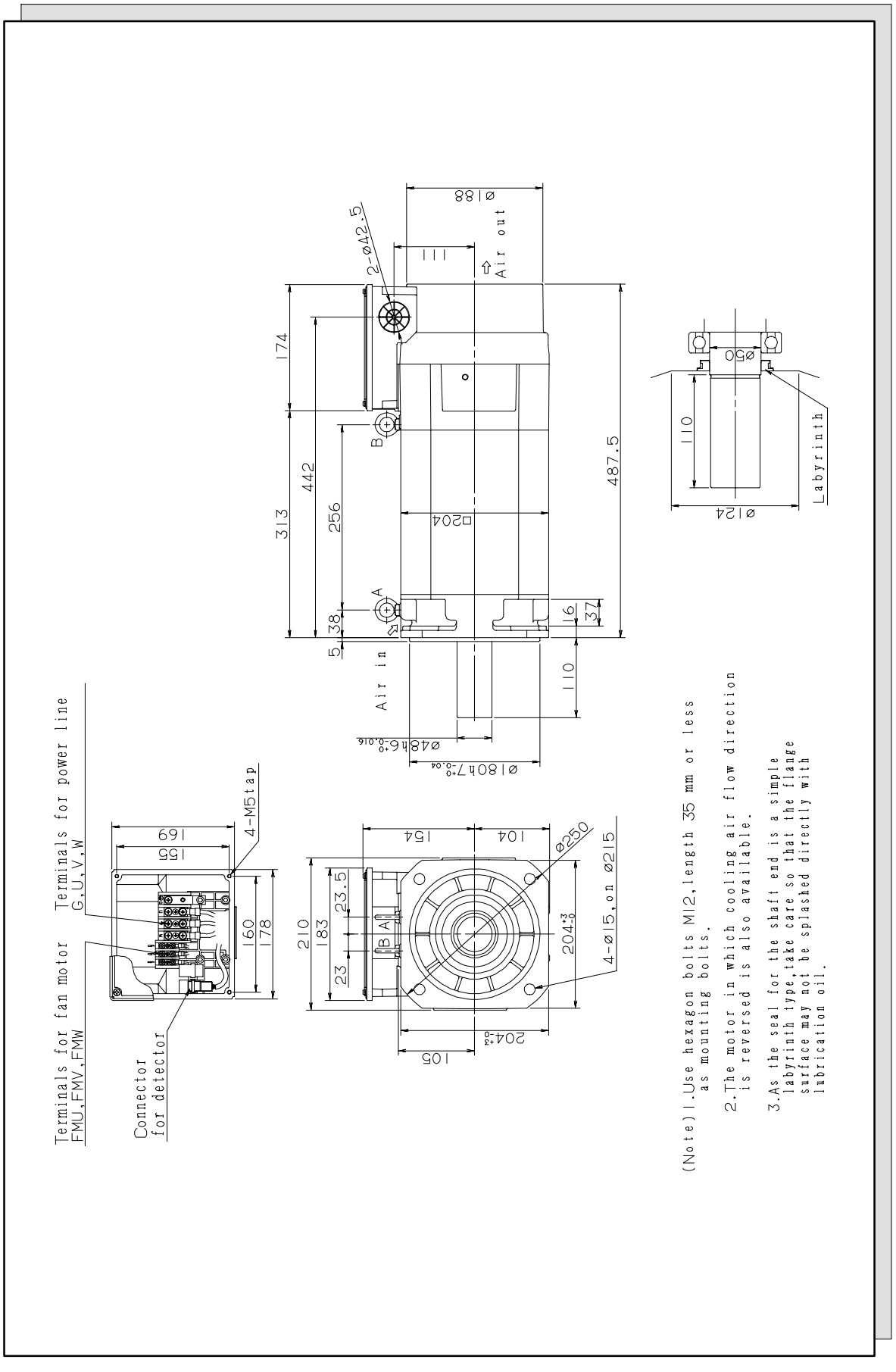


Fig.8(n) **Model αP12/8000, αP15/8000 (Flange mounting type)**

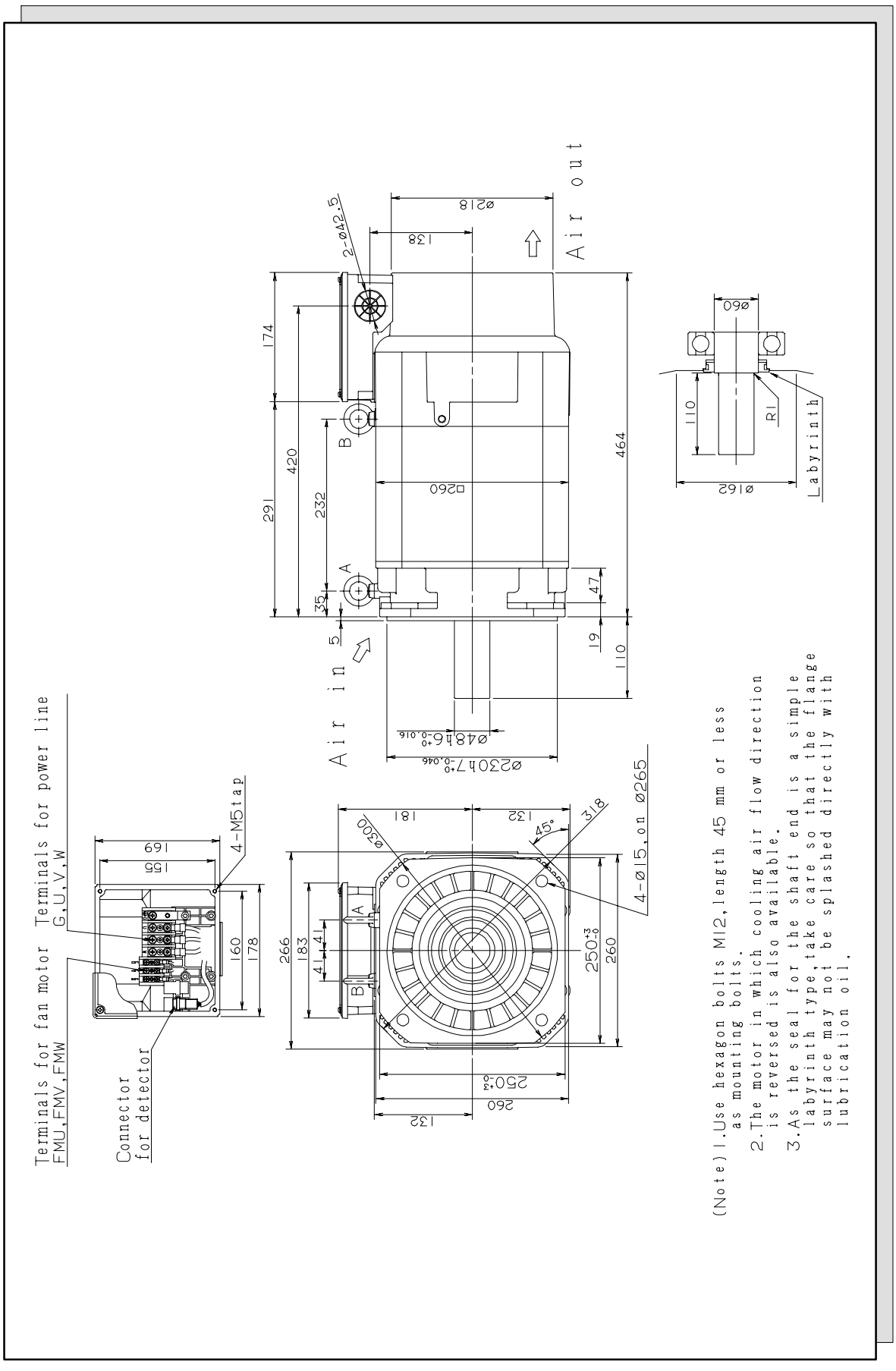


Fig.8(o) Model αP18/8000, αP22/8000 (Flange mounting type)

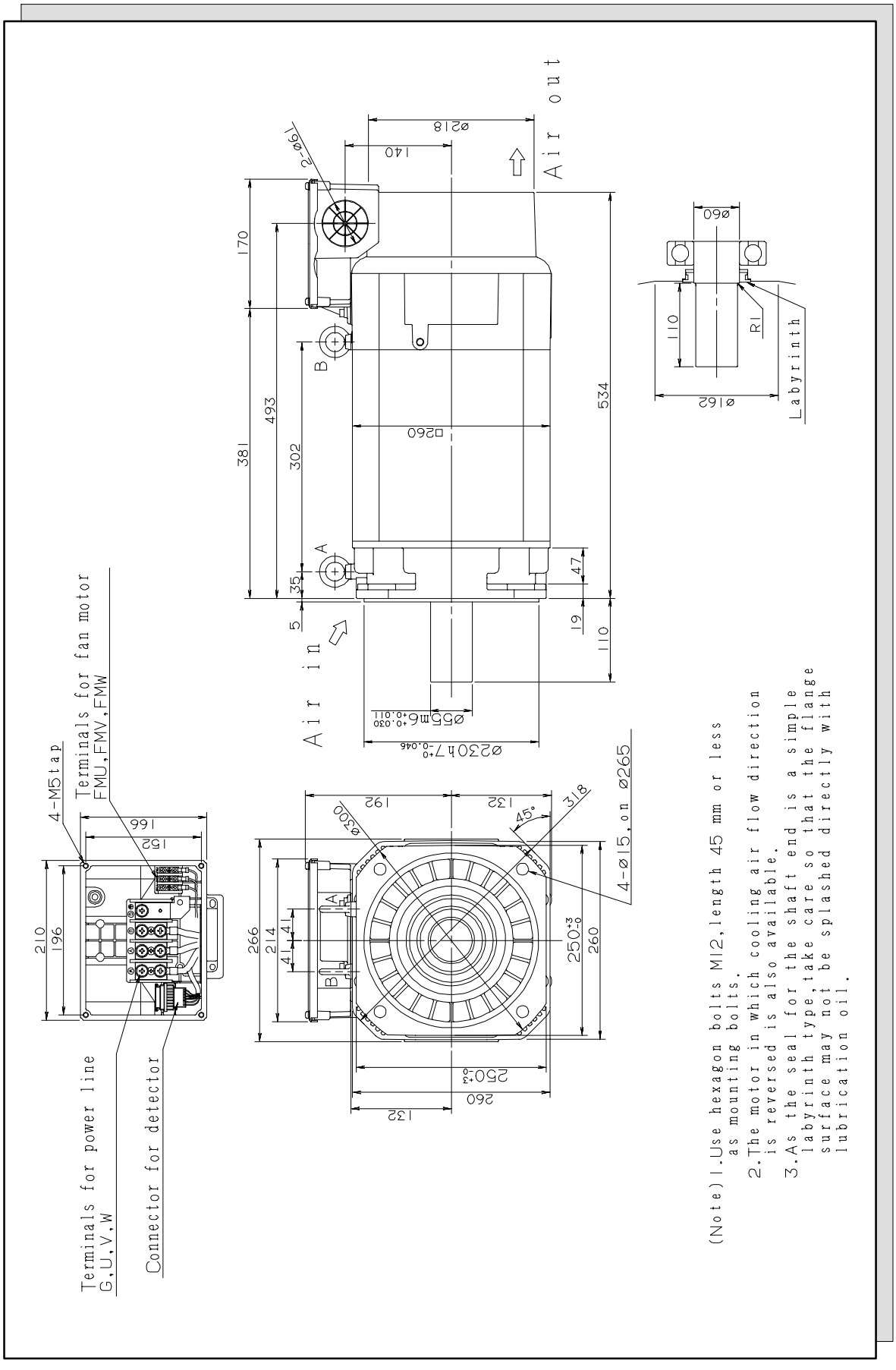
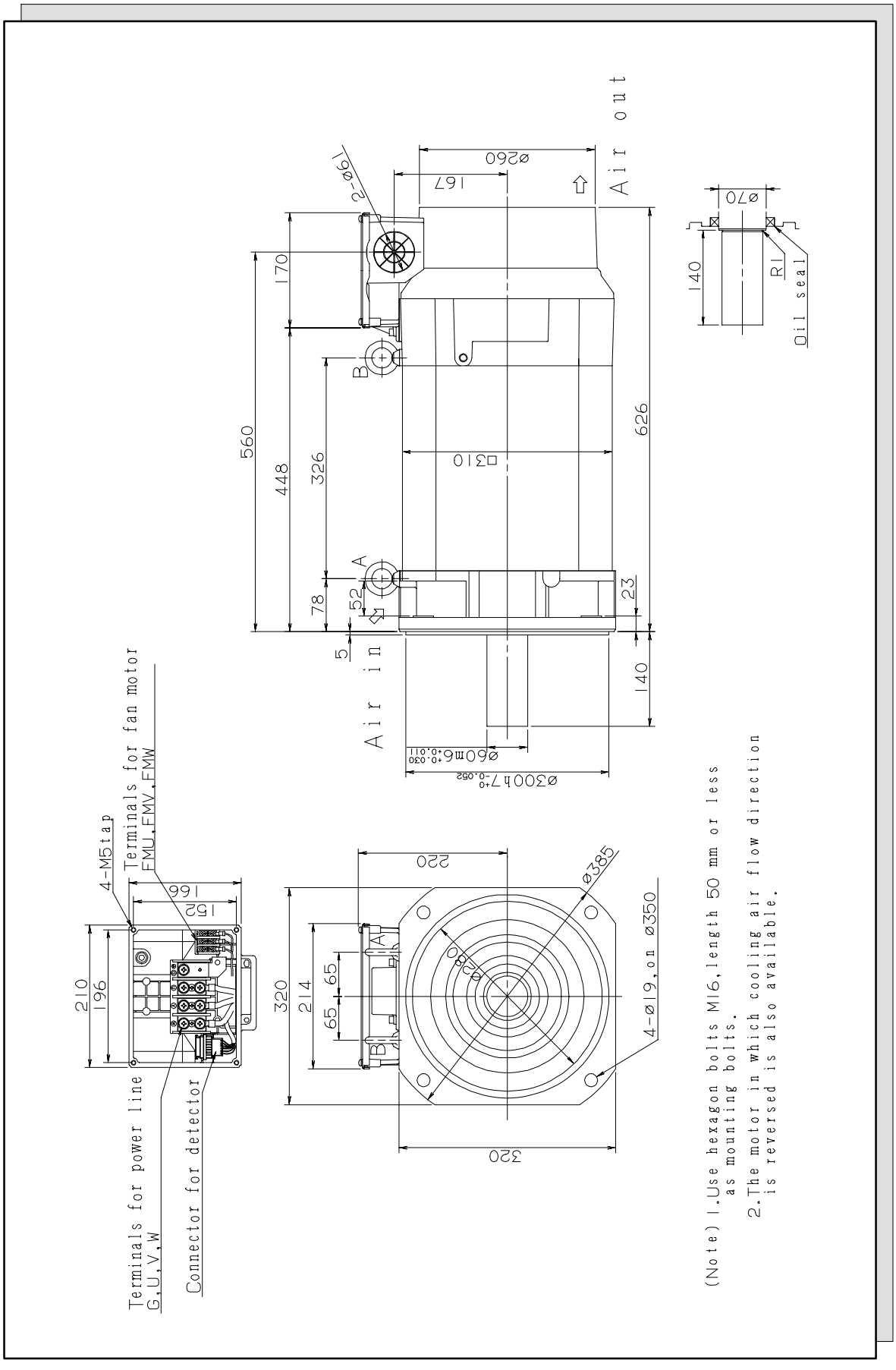


Fig.8 (p) Model αP30/6000, αP40/6000 (Flange mounting type)



IV. FANUC AC SPINDLE MOTOR
α(HV) series

1 GENERAL

A 400/460 VAC power supply of FANUC AC SPINDLE MOTOR α(HV) series can be connected not via a power transformer but directly to the control amplifier for driving.

Features

- A 400/460VAC power supply can be connected directly to control amplifier without power transformer.
- The dimensions of the α (HV) series are the same as those of the α series. So the α (HV) series can be installed without any structural modification of machine tools.
- Waterproof and pressure–proof design conforming to the international standard (IEC) is employed to improve reliability and make it resistant to most environments.

2 SPECIFICATIONS

SPECIFICATIONS

Series			α (HV) series								
Item \ Model			α 6HV	α 8HV	α 12HV	α 15HV	α 18HV	α 22HV	α 30HV	α 40HV	α 60HV
Output (*1)	Cont. rated	kW (HP)	5.5 (7.4)	7.5 (10)	11 (14.7)	15 (20.1)	18.5 (24.8)	22 (29.5)	30 (40.2)	37 (49.6)	60 (*2) (80.4)
	30min rated	kW (HP)	7.5 (10)	11 (14.7)	15 (20.1)	18.5 (24.8)	22 (29.5)	26 (34.9)	37 (49.6)	45 (60.3)	75 (100.5)
	S3 60% [40%] (*3) (*4)	kW (HP)	7.5 (10)	11 (14.7)	15 (20.1)	18.5 (24.8)	22 (29.5)	26 (34.9)	37 (49.6)	45 (60.3)	75 (100.5)
Rated current A (*5)	Cont. rated		18	22	26	36	46	52	69	85	138
	30 min rated S3 60%	(*3)	21	28	32	45	52	58	81	98	163
Speed min^{-1}	Base Speed		1500	1500	1500	1500	1500	1500	1150	1500	1150
	Max. Speed		8000	6000	6000	6000	6000	6000	4500	6000	4500
Output torque (Cont. rated torque ar aconst. rated torque range)		N·m (kg·cm)	35.0 (357)	47.7 (487)	70.0 (714)	95.4 (974)	117.7 (1201)	140 (1428)	249.1 (2540)	235.5 (2402)	415.1 (4234)
Rotor inertia	$kg \cdot m^2$		0.0215	0.0275	0.09	0.09	0.128	0.128	0.295	0.355	0.49
	$kgf \cdot cm \cdot s^2$		0.22	0.28	0.93	0.93	1.29	1.29	3.0	3.6	5.0
Weight		kg	60	80	110	110	143	143	250	290	468
Vibration			V5								V10
Noise			75dB(A) or less								80dB (A) or less
Cooling system		(*6)	Totally enclosed and fan cooled IC0A5						Totally enclosed and fan cooled IC0A6		
Cooling fan		W	20		56				84		90
Installation		(*7)	The output shaft must be oriented in the range from 45° above the horizontal to 90° below the horizontal. IMB5, IMV1, IMB3, IMB6, IMB7, IMB8, IMV5								
Allowable overload capacity (1min)		(*8)	120% of 30 min rated output								
Insulation			Class H								
Ambient temperature			0–40°C								
Altitude			Height above sea level not exceeding 1000 m								
Painting color			Munsell system N2.5								
Detector			M sensor or MZ sensor								
Type of thermal protection		(*9)	TP211								
Resolution of the MZ sensor			4096								
Number of detected gear teeth per rotation		(*10)	256 teeth								
Bearing lubrication			Grease								
Maximum output during acceleration (*11)		kW	9.0	13.2	18.0	22.2	26.4	31.2	44.4	54.0	90.0
Applicable spindle amplifier			SPM–15HV			SPM–26HV			SPM–45HV		SPM–75HV

NOTE

*1 The rated output is guaranteed at the rated voltage. (Amplifier input: AC 400/460V +10% –15%, 50/60Hz ±1Hz) If the input voltage fluctuates, it is possible that the rated output cannot be obtained even when such fluctuations are within the allowable fluctuation range.

*2 60 kW is 120 min rated from 1150 min^{-1} to 1380min^{-1}.

*3 S3 40% for α 30HV and α 60HV.

*4 The cycle time is 10 minutes, S3 60%: ON 6 minutes, OFF 4 minutes, S3 40%: On 4 minutes, OFF 6 minutes.

*5 The rated current is the maximum current for each rated output.

*6 IC code conforms to IEC 34–6.

*7 IM code conforms to IEC 34–7.

*8 This is not a guaranteed value but a guideline for the maximum motor output at a rated supply voltage.

*9 Type conforms to IEC 34–11.

*10 128 teeth for motors with a high resolution magnetic pulse coder.

*11 These values are to be used only as guidance for selecting a power supply module and are not guaranteed.

*12 Degree of protection: with oil seal: IP54, without oil seal: IP40.

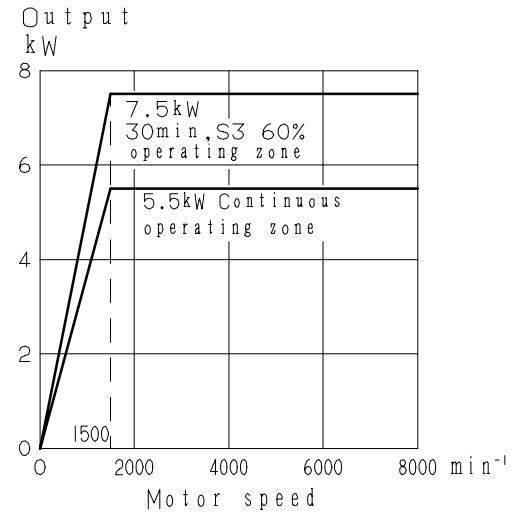
3 OUTPUT/TORQUE CHARACTERISTICS

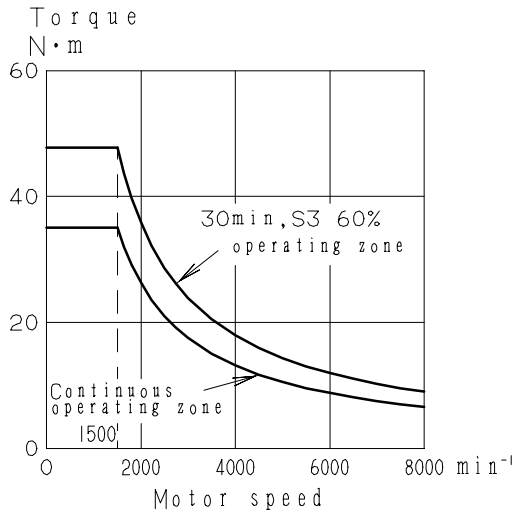
(Reference) Calculation for torque

Torque T can be obtained by the following equation.
$T[N \cdot m]=P[kW] \times 1000/0.1047/N[min^{-1}]$
P[kW]: motor output
$N[min^{-1}]$: motor speed

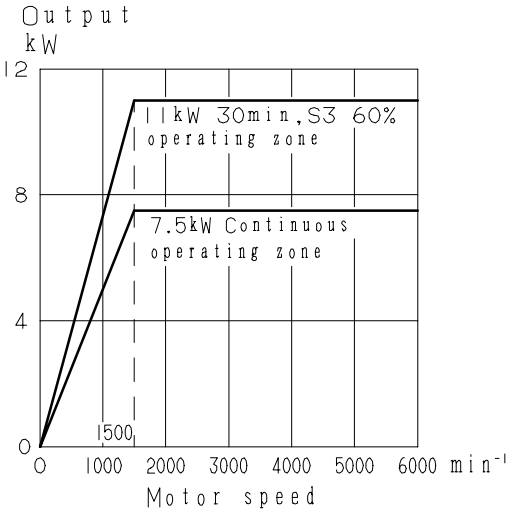
When the unit of T is $[kg \cdot m]$,
$T[kg \cdot m]=P[kW] \times 1000/1.0269/N[min^{-1}]$

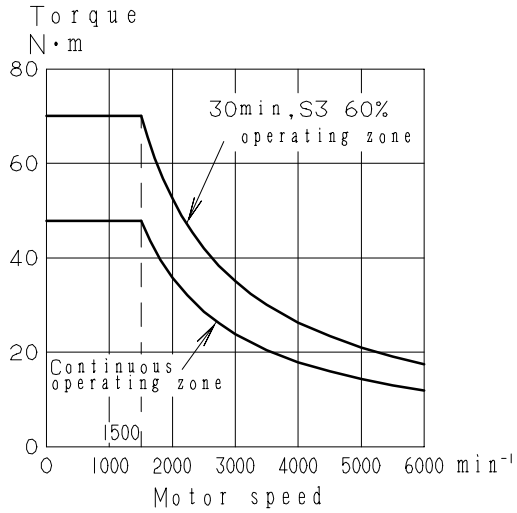
(1)Model α6HV



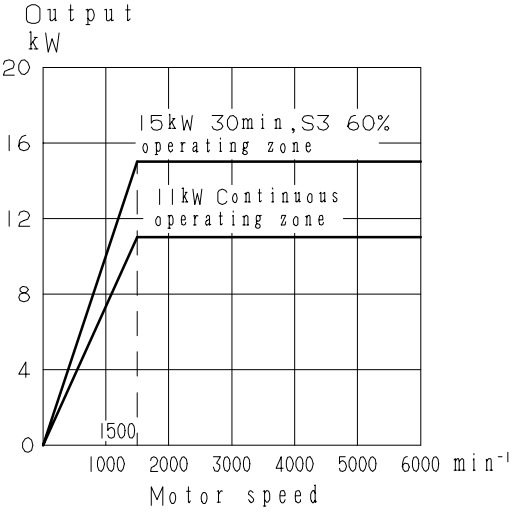


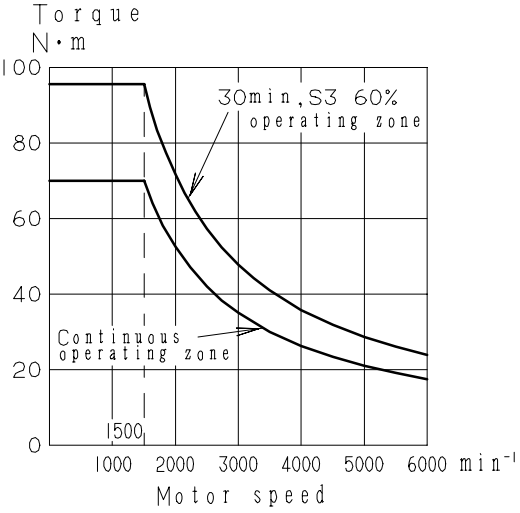
(2)Model α8HV



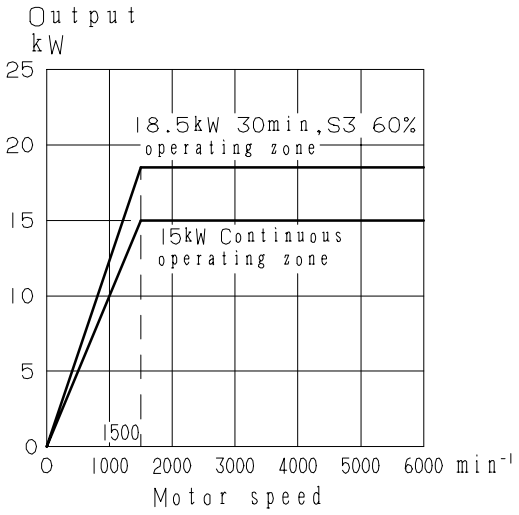


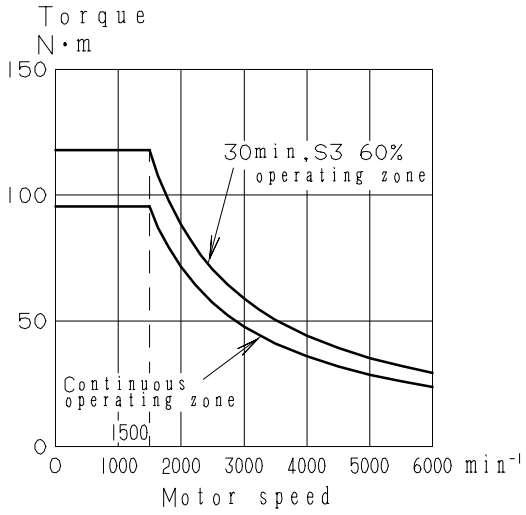
(3)Model α12HV



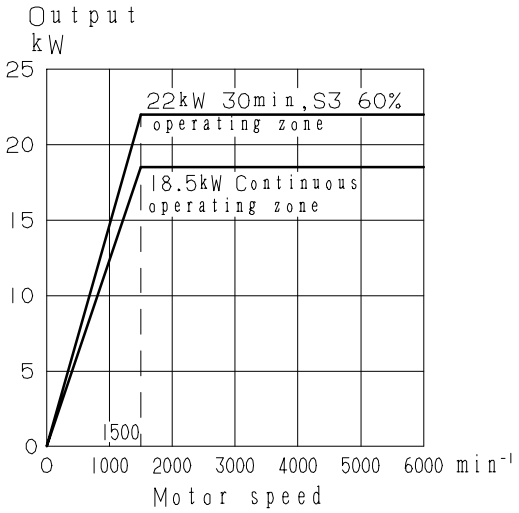


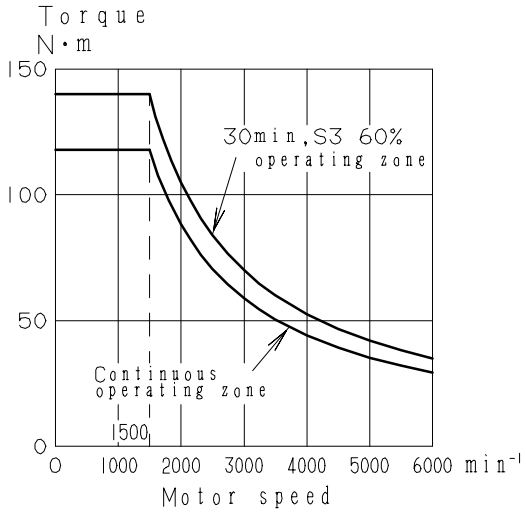
(4)Model α15HV



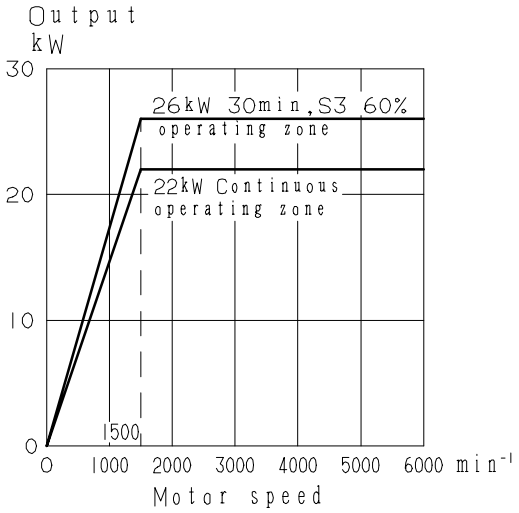


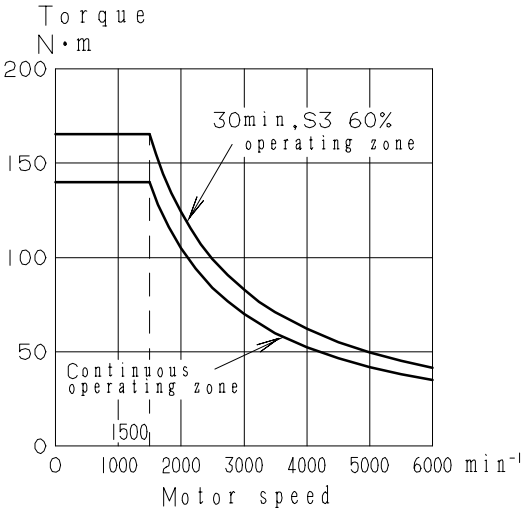
(5)Model α18HV



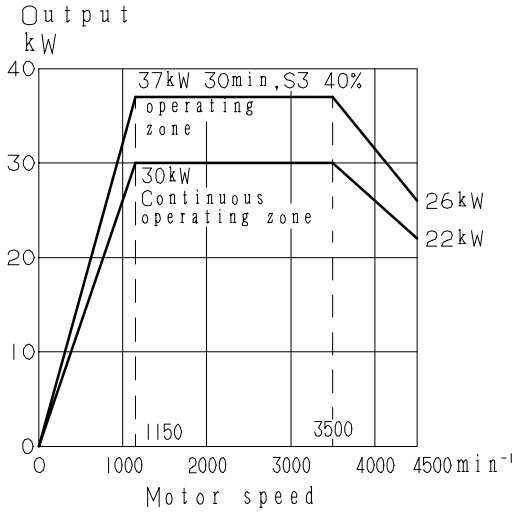


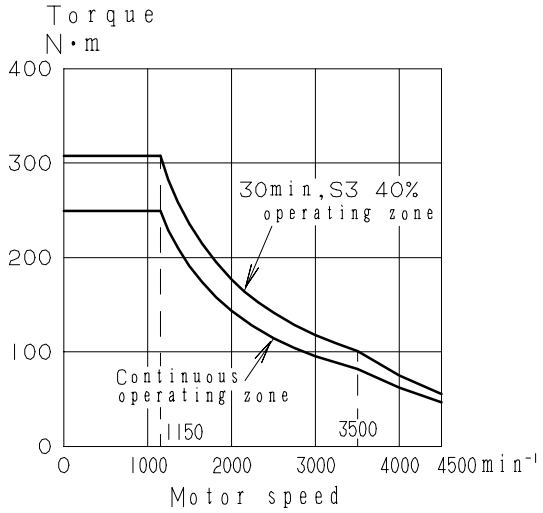
(6)Model α22HV



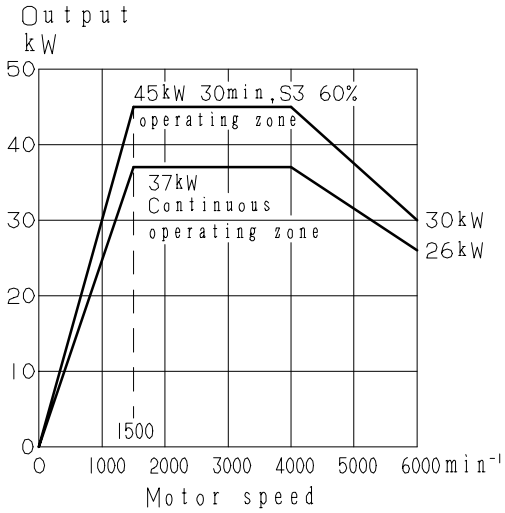


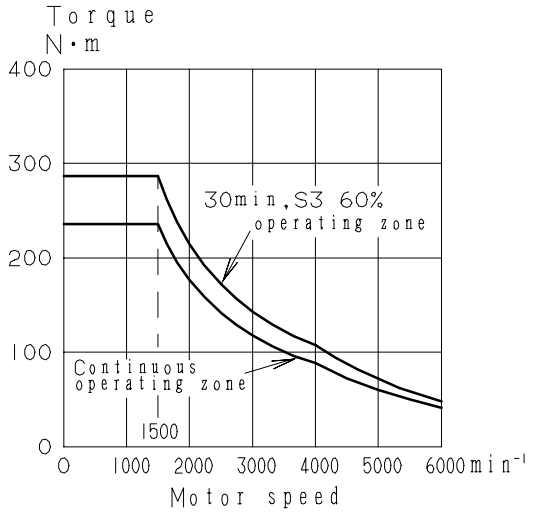
(7)Model α30HV



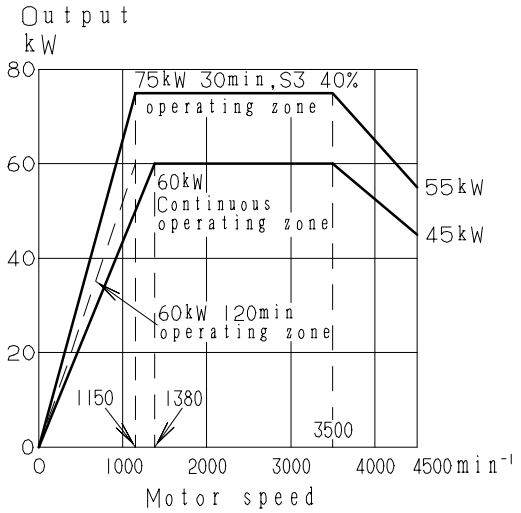


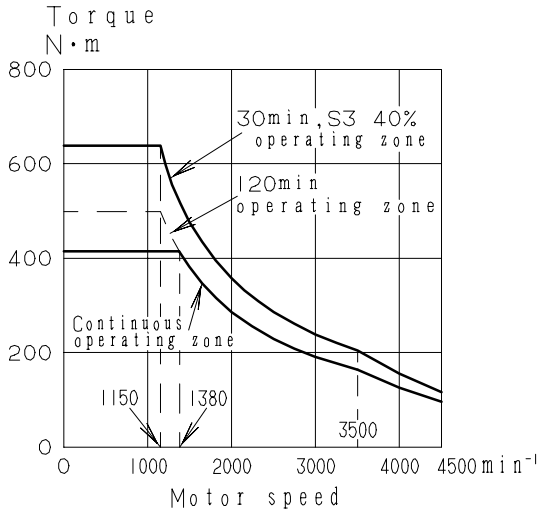
(8)Model α40HV





(9)Model α60HV





4 ORDERING NUMBER

(1) α (HV) series

Name		Ordering number	Remarks
Model α 6HV	Flange mounting	A06B–0874–B100 A06B–0874–B101 A06B–0874–B300 A06B–0874–B301	8000 min^{-1}, has key, exhaust rear 8000 min^{-1}, has key, exhaust front 8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0874–B200 A06B–0874–B201 A06B–0874–B400 A06B–0874–B401	8000 min^{-1}, has key, exhaust rear 8000 min^{-1}, has key, exhaust front 8000 min^{-1}, no key, exhaust rear 8000 min^{-1}, no key, exhaust front
Model α 8HV	Flange mounting	A06B–0875–B100 A06B–0875–B101 A06B–0875–B300 A06B–0875–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0875–B200 A06B–0875–B201 A06B–0875–B400 A06B–0875–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
Model α 12HV	Flange mounting	A06B–0876–B100 A06B–0876–B101 A06B–0876–B300 A06B–0876–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0876–B200 A06B–0876–B201 A06B–0876–B400 A06B–0876–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
Model α 15HV	Flange mounting	A06B–0877–B100 A06B–0877–B101 A06B–0877–B300 A06B–0877–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0877–B200 A06B–0877–B201 A06B–0877–B400 A06B–0877–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
Model α 18HV	Flange mounting	A06B–0878–B100 A06B–0878–B101 A06B–0878–B300 A06B–0878–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0878–B200 A06B–0878–B201 A06B–0878–B400 A06B–0878–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front

NOTE
1 The listed ordering numbers are for motors with a M sensor. The end of the ordering number for the motor with a MZ sensor is B□9□.
2 Refer to the ordering list (B–65151E) for available motors except above.

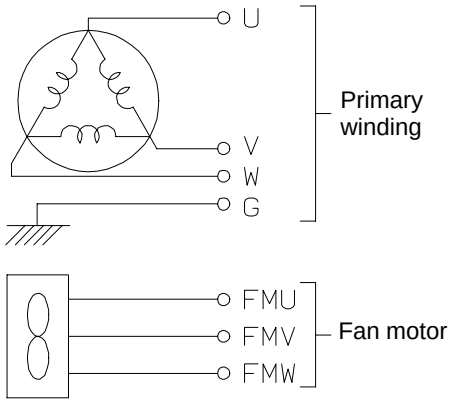
(Continued from the previous page)

Name		Ordering number	Remarks
Model α 22HV	Flange mounting	A06B–0879–B100 A06B–0879–B101 A06B–0879–B300 A06B–0879–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0879–B200 A06B–0879–B201 A06B–0879–B400 A06B–0879–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
Model α 30HV	Flange mounting	A06B–0880–B100 A06B–0880–B101 A06B–0880–B300 A06B–0880–B301	4500 min^{-1}, has key, exhaust rear 4500 min^{-1}, has key, exhaust front 4500 min^{-1}, no key, exhaust rear 4500 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0880–B200 A06B–0880–B201 A06B–0880–B400 A06B–0880–B401	4500 min^{-1}, has key, exhaust rear 4500 min^{-1}, has key, exhaust front 4500 min^{-1}, no key, exhaust rear 4500 min^{-1}, no key, exhaust front
Model α 40HV	Flange mounting	A06B–0881–B100 A06B–0881–B101 A06B–0881–B300 A06B–0881–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0881–B200 A06B–0881–B201 A06B–0881–B400 A06B–0881–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
Model α 60HV	Flange mounting	A06B–0883–B100 A06B–0883–B101 A06B–0883–B300 A06B–0883–B301	4500 min^{-1}, has key, exhaust rear 4500 min^{-1}, has key, exhaust front 4500 min^{-1}, no key, exhaust rear 4500 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0883–B200 A06B–0883–B201 A06B–0883–B400 A06B–0883–B401	4500 min^{-1}, has key, exhaust rear 4500 min^{-1}, has key, exhaust front 4500 min^{-1}, no key, exhaust rear 4500 min^{-1}, no key, exhaust front

NOTE
1 The listed ordering numbers are for motors with a M sensor. The end of the ordering number for the motor with a MZ sensor is B□9□.
2 Refer to the ordering list (B–65151E) for available motors except above.

5 CONNECTIONS

Cables of power line and fan motor are connected to the terminal block. The M sensor (or MZ sensor) and overheat signals are connected to the connector manufactured by AMP.
Connector housing and connector manufactured by AMP are attached to the motor.

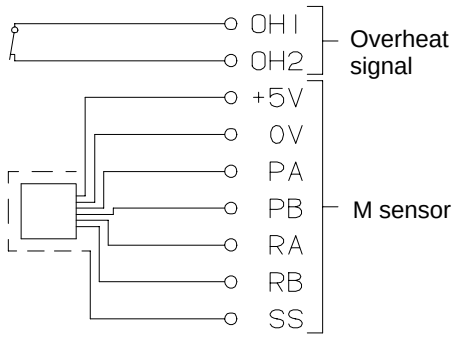


Type of screws used in the terminal block

Motor model \ Terminal name	U, V, W, G	FMU~FMW
α6HV–α15HV	M5	M4
α18HV, α22HV	M8	M4
α30HV–α60HV	M10	M3.5

NOTE1 Screws of high speed models are same as above.
2 Refer to FANUC SERVO AMPLIFIER α series DESCRIPTIONS (B–65162E) for specifications of connection cables.

When M sensor is provided



Pin assignment in the connector

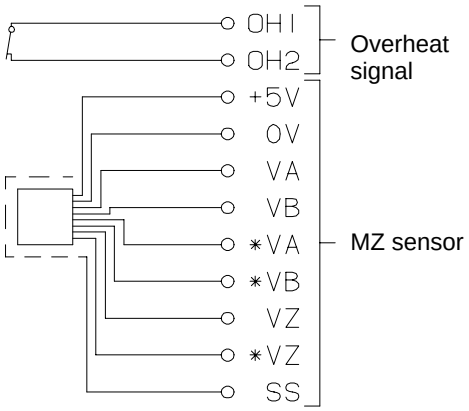
Number	B1	B2	B3	B4	B5	B6
Color		Green	White		Yellow	
Signal						
Number	A1	A2	A3	A4	A5	A6
Color	Red	Black	Blue		No color	
Signal	+5V	PA	PB		SS	OH1

Connector: Manufactured by D–3000 series

	Motor side		Cable side	
	FANUC purchase specification	AMP specification	FANUC purchase specification	AMP specification
Housing	A63L–0001–0535/121KDF	178964–6	A63L–0001–0460/121KD	178289–6
Contact	A63L–0001–0456/ASMT	175288-2	A63L–0001–0456/ASM	1–175217–2

Crimping tool : 919601–1
Extractor : 914677–1

When MZ sensor is provided



Pin assignment in the connector

Number	B1	B2	B3	B4	B5	B6
Color		Blue	White–orange	White–purple	Orange	
Signal		*VA	*VB	*VZ	0V	OH2
Number	A1	A2	A3	A4	A5	A6
Color	Red	Black	Green	Gray	No color	
Signal	+5V	VA	VB	VZ	SS	OH1

Connector, Crimping tool and Extractor are same as above case of M sensor.

6 ALLOWABLE RADIAL LOAD

Use the motor output shaft below the allowable radial loads shown in the table below.

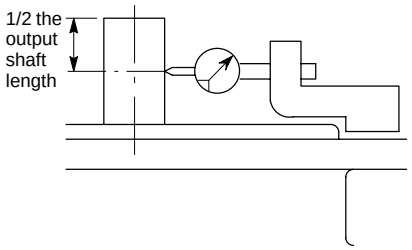
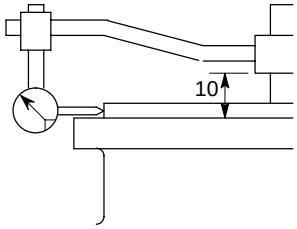
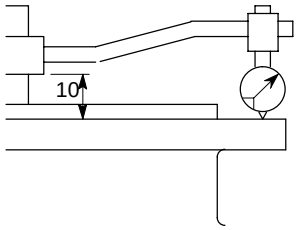
Model	Allowable radial load (kg)	
	At output shaft end	At output shaft center
α 6HV	200	225
α 8HV	300	344
α 12HV, α 15HV	300	348
α 18HV, α 22HV	450	509
α 30HV, α 40HV	550	626
α 60HV	–	2000

CAUTION

1 When using a belt, adjust the tension so the allowable loads indicated above are not exceeded. If an excessive load is applied, consider the use of a support bearing on the machine side to maintain the long–term reliability of the motor. (If an excessive load is applied, it is possible that an abnormal sound may occur.)
2 When the belt tension is maximized at a point outside the output shaft end, the allowable loads are less than those at the output shaft end.
3 If a thrust load is applied when a helical gear is used, the shaft moves in the direction of the thrust. So, as a general rule, never apply a thrust load.

7 ASSEMBLING ACCURACY (T.I.R Total Indicator Reading)

Conform to JEM 1401

Model / Item	α 6HV to α 22HV	α 30HV to α 60HV	Measuring method
Vibration at the end of the output shaft	20 μm or less		
Vibration of the faucet joint for mounting the flange against the core of the shaft (Only for flange type)	40 μm or less	60 μm or less	
Vibration of the flange mounting surface against the core of the shaft (Only for flange type)	80 μm or less	100 μm or less	

8 EXTERNAL DIMENSIONS

Refer to the following pages.

Model name		Number of figure
Model	**Type**	
Model α 6HV	Flange mounting type	Fig.8 (a)
	Foot mounting bype	Fig.8 (b)
Model α 8HV	Flange mounting type	Fig.8 (c)
	Foot mounting bype	Fig.8 (d)
Model α 12HV, α 15HV	Flange mounting type	Fig.8 (e)
	Foot mounting bype	Fig.8 (f)
Model α 18HV, α 22HV	Flange mounting type	Fig.8 (g)
	Foot mounting bype	Fig.8 (h)
Model α 30HV	Flange mounting type	Fig.8 (i)
	Foot mounting bype	Fig.8 (j)
Model α 40HV	Flange mounting type	Fig.8 (k)
	Foot mounting bype	Fig.8 (l)
Model α 60HV	Flange mounting type	Fig.8 (m)
	Foot mounting bype	Fig.8 (n)

Fig.8 (a) Model α6HV (Flange mounting type)

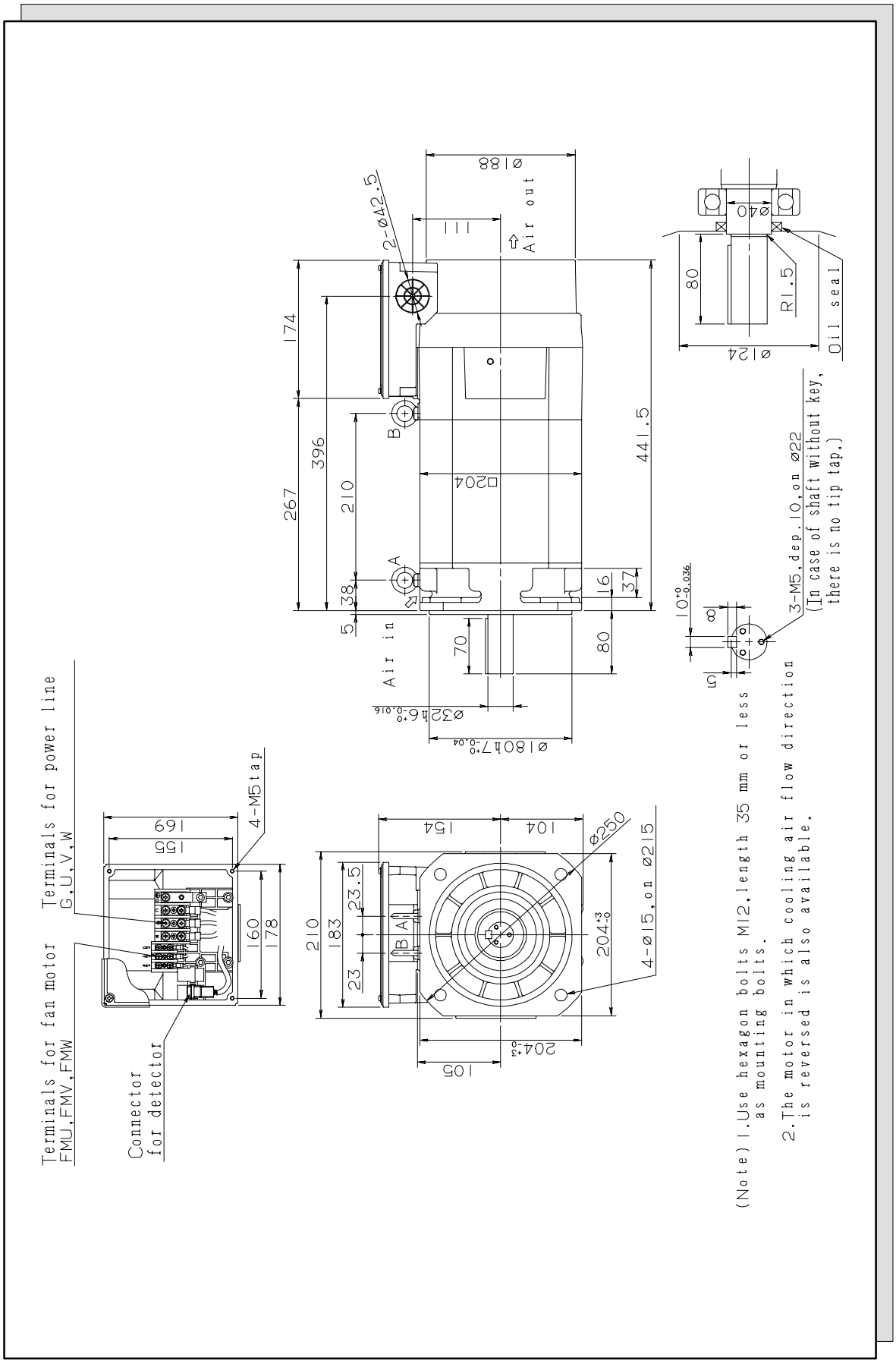


Fig. 8(b) **Model α6HV (Foot mounting type)**

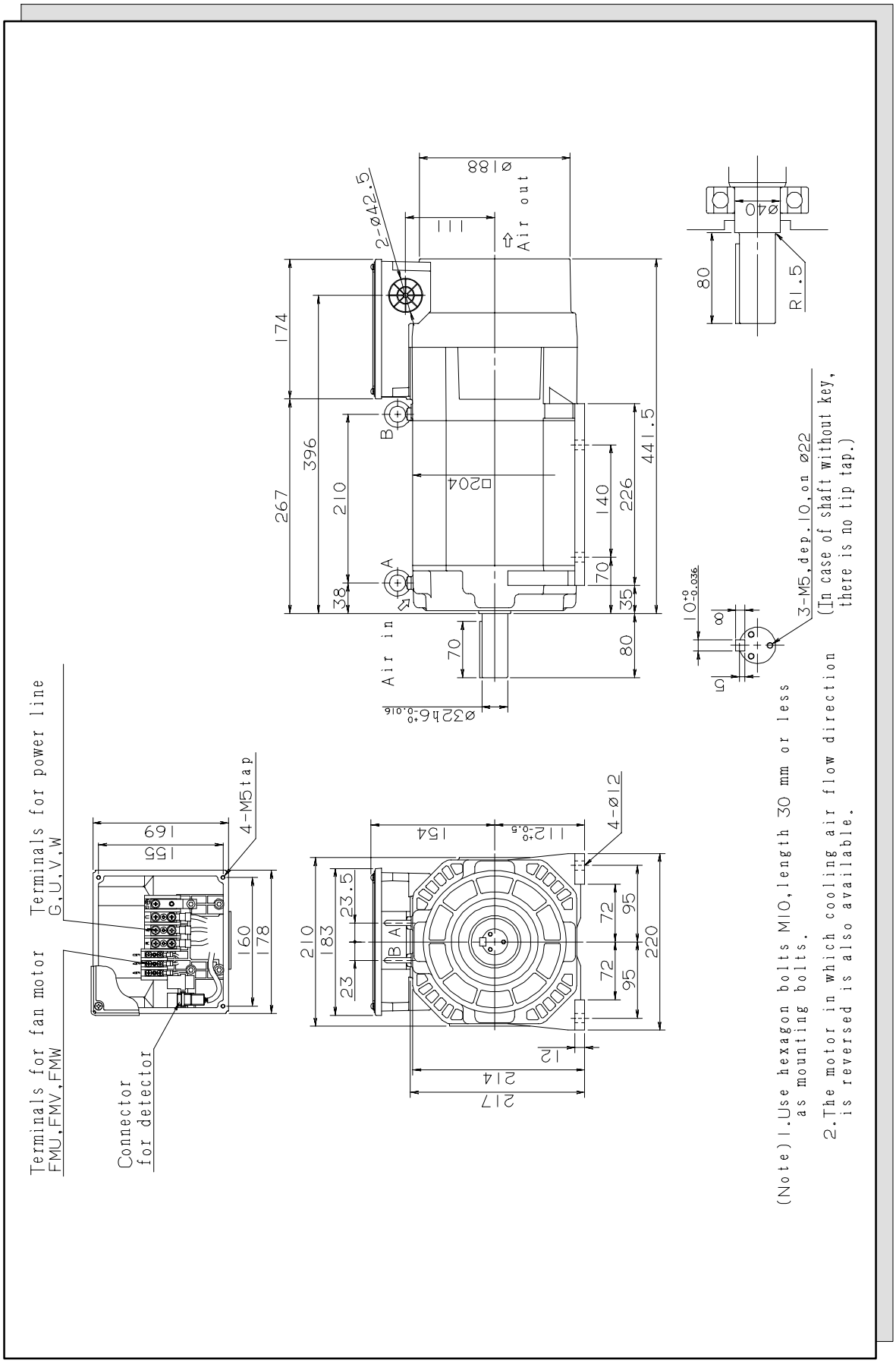


Fig.8(c) Model α8HV (Flange mounting type)

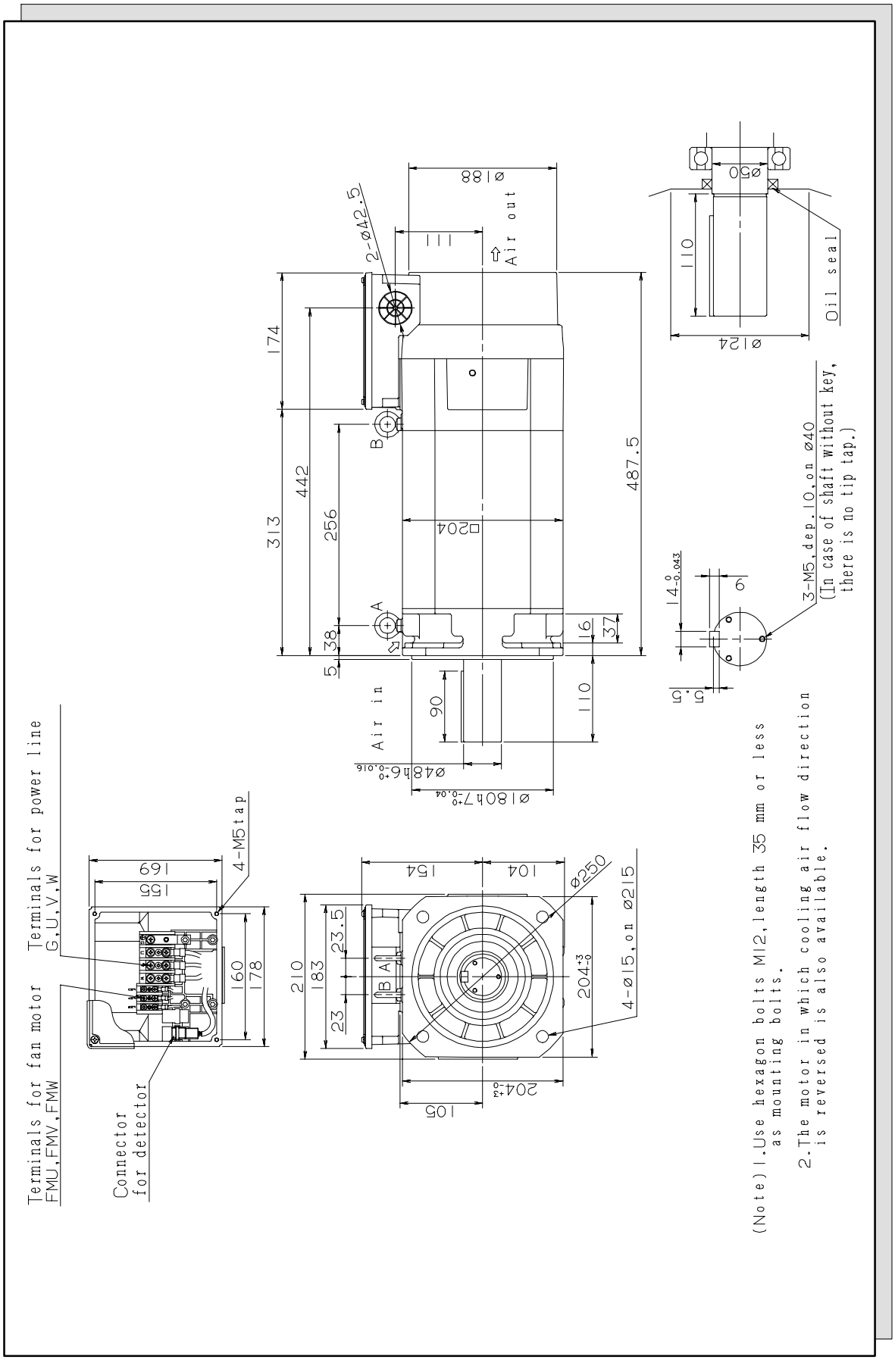


Fig.8(d) Model α8HV (Foot mounting type)

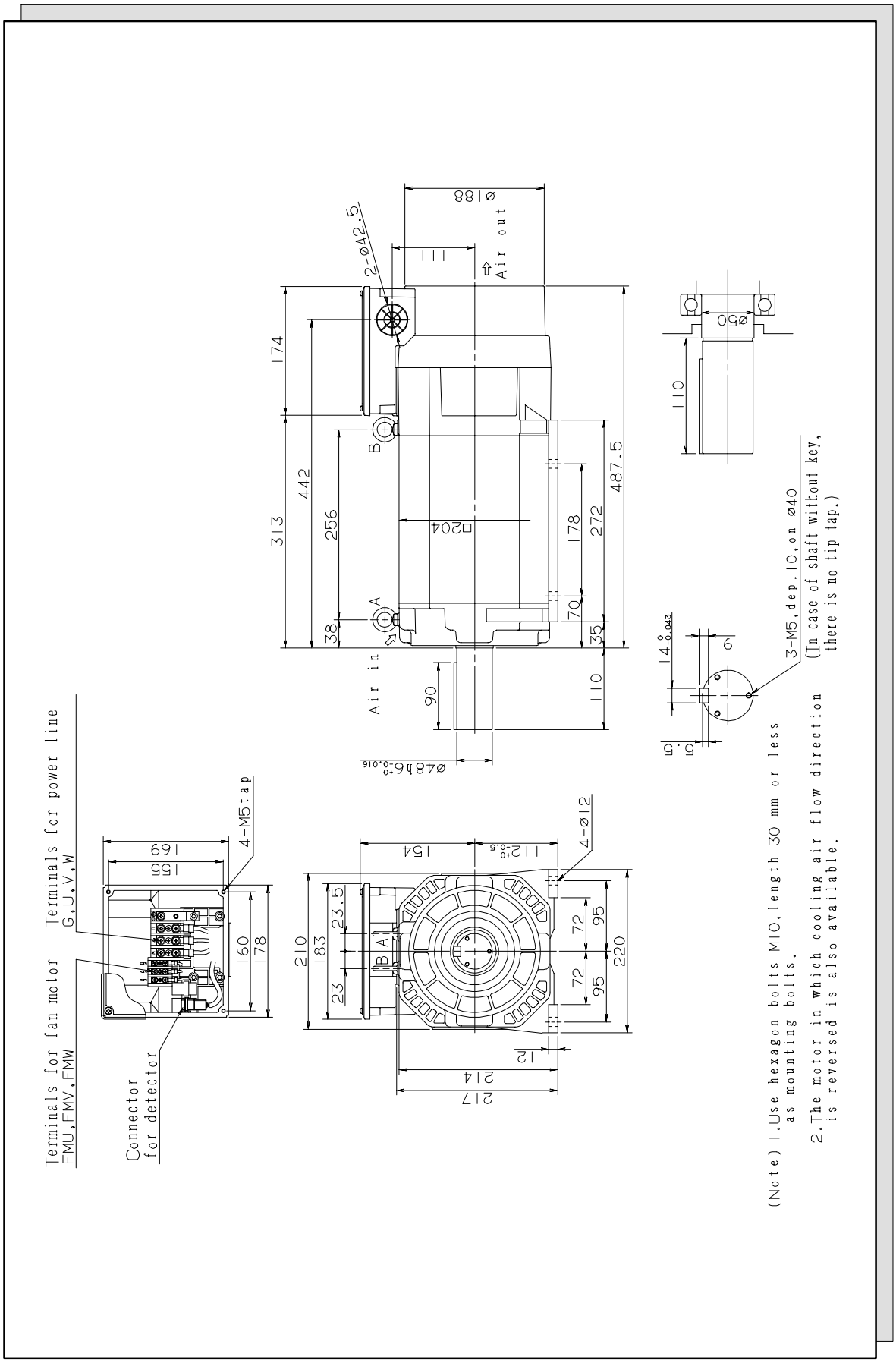


Fig.8(e) **Model α12HV, α15HV (Flange mounting type)**

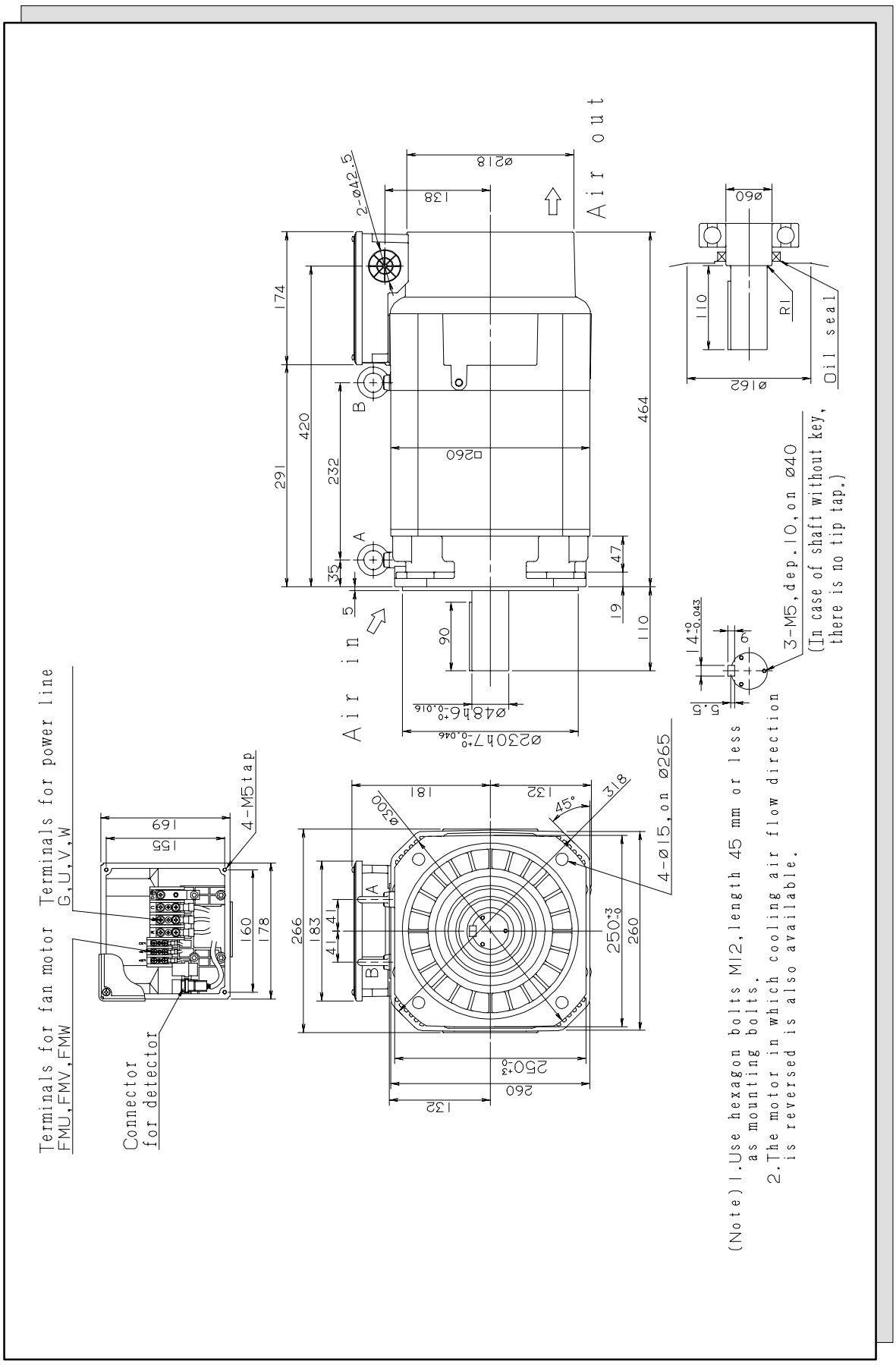


Fig.8(f) Model α12HV, α15HV (Foot mounting type)

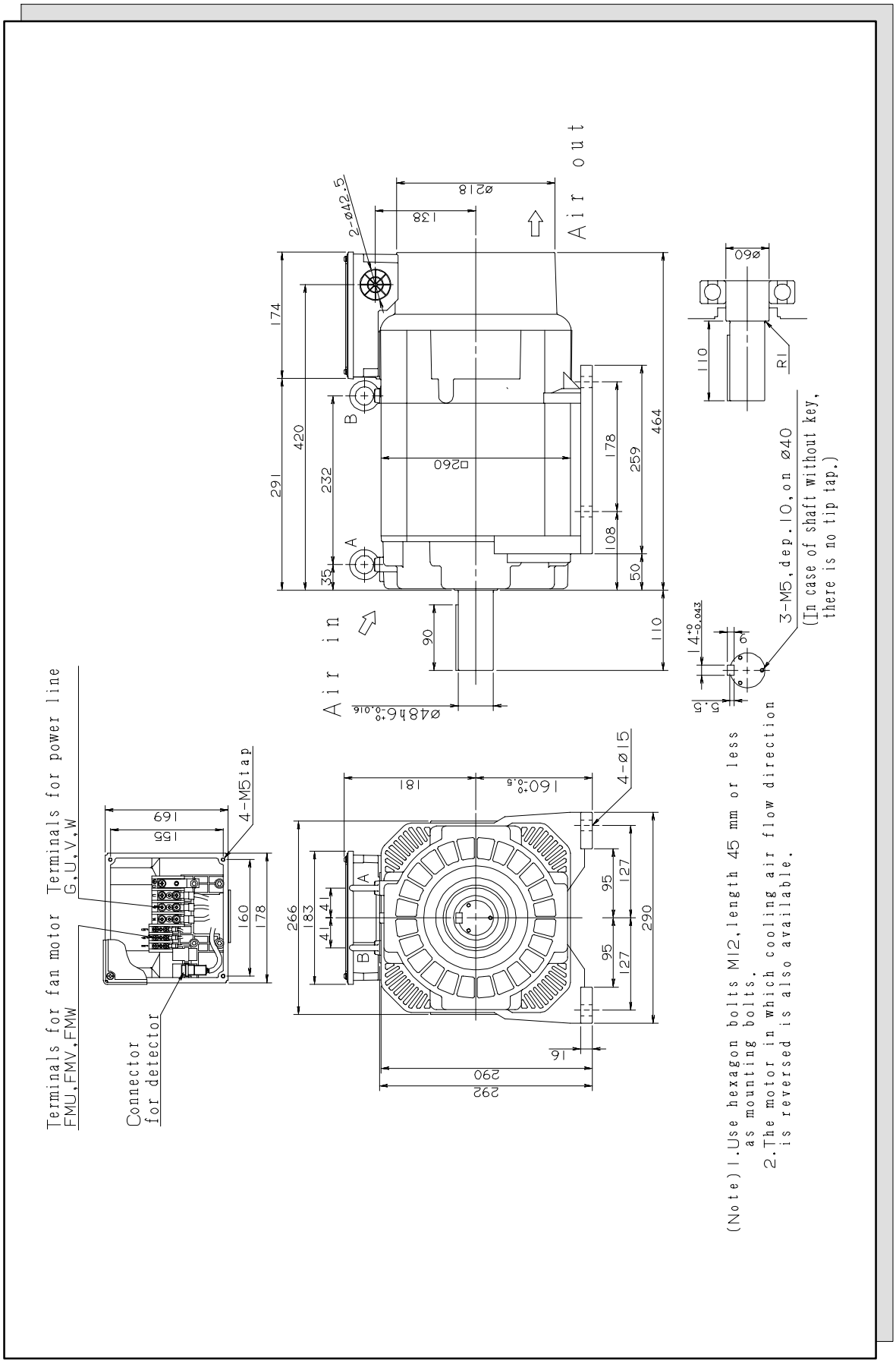


Fig.8(g) Model α18HV, α 22HV (Flange mounting type)

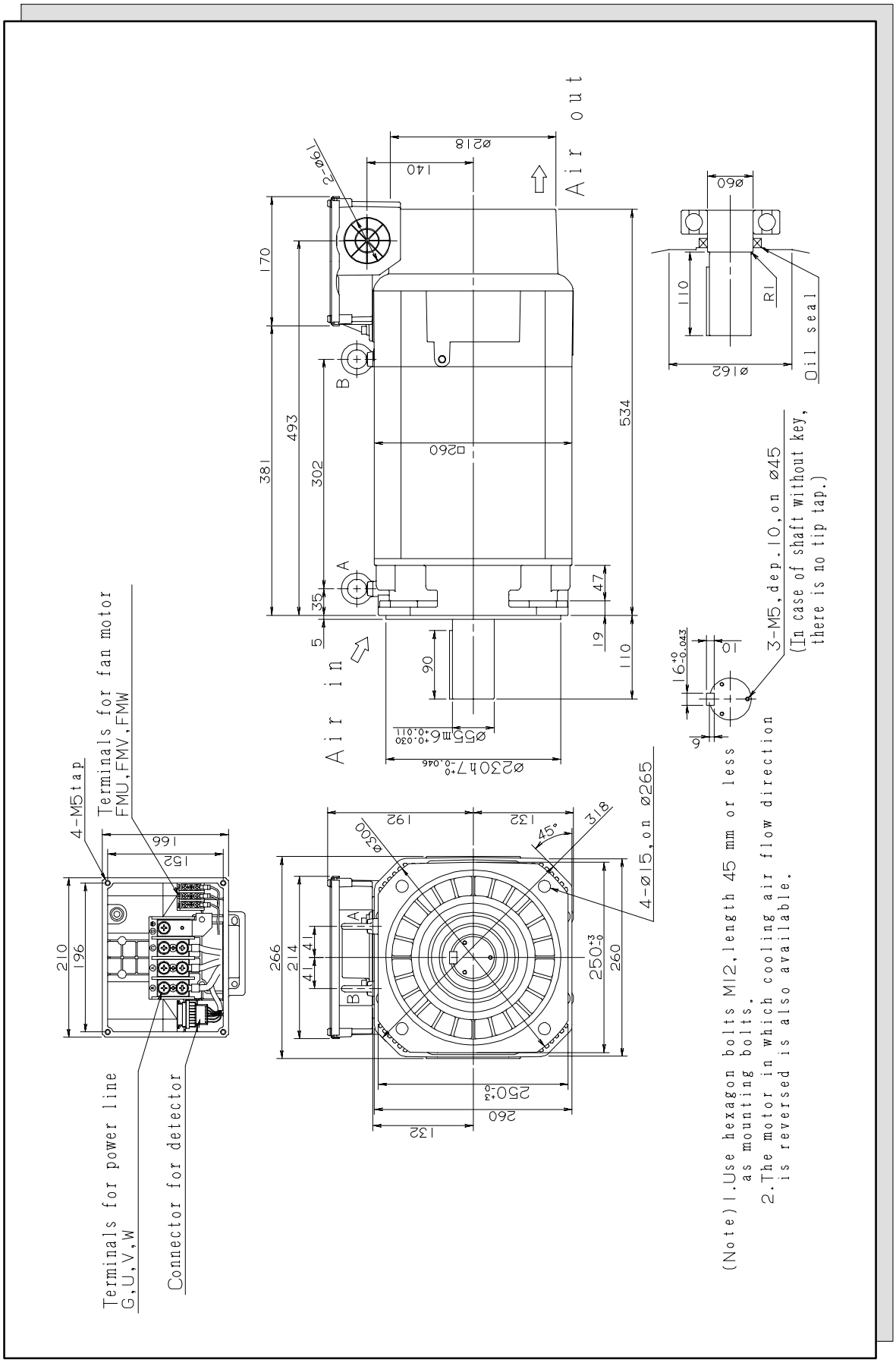


Fig.8(h) Model α18HV, α22HV (Foot mounting type)

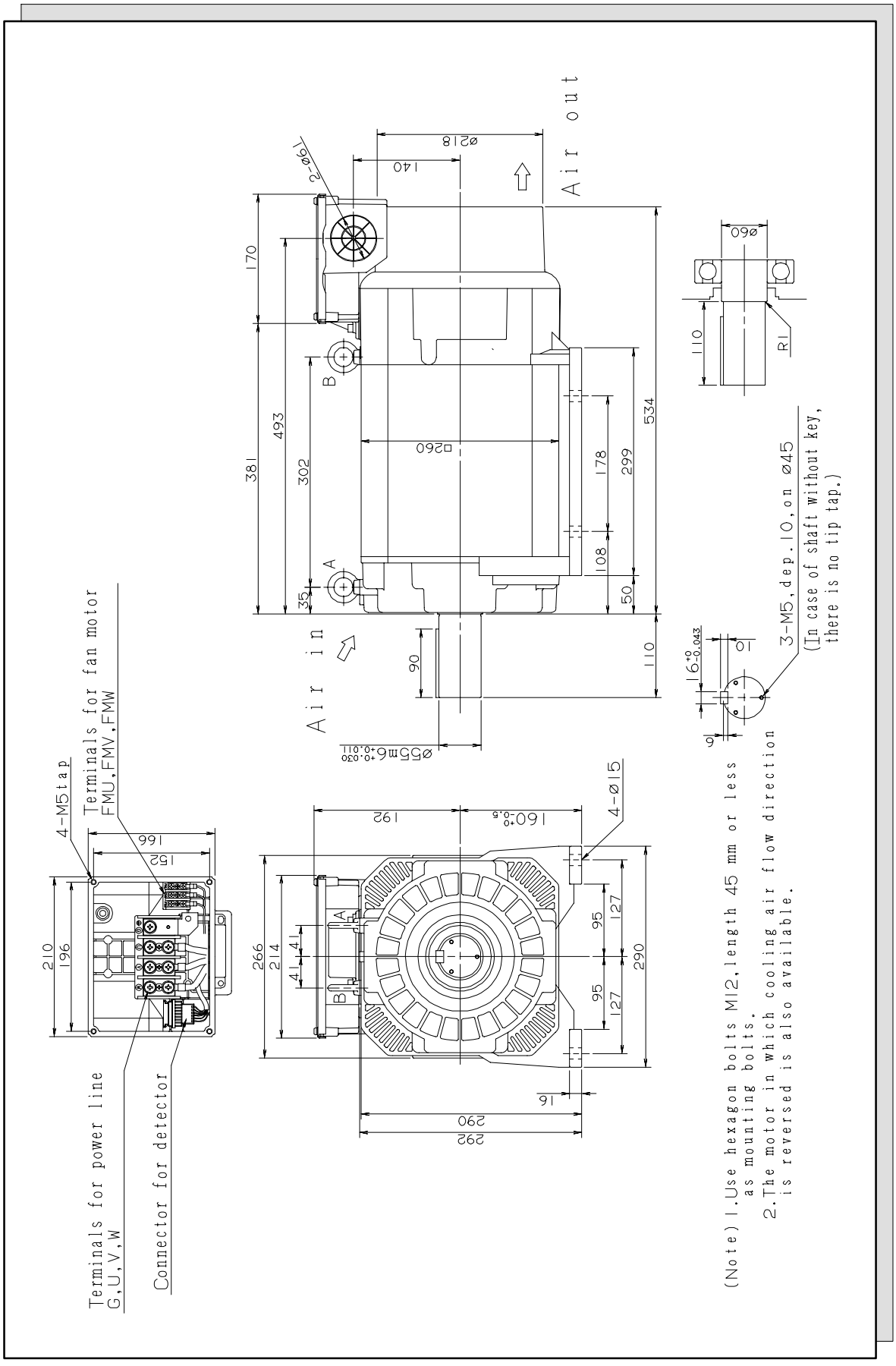


Fig.8(i) Model α30HV (Flange mounting type)

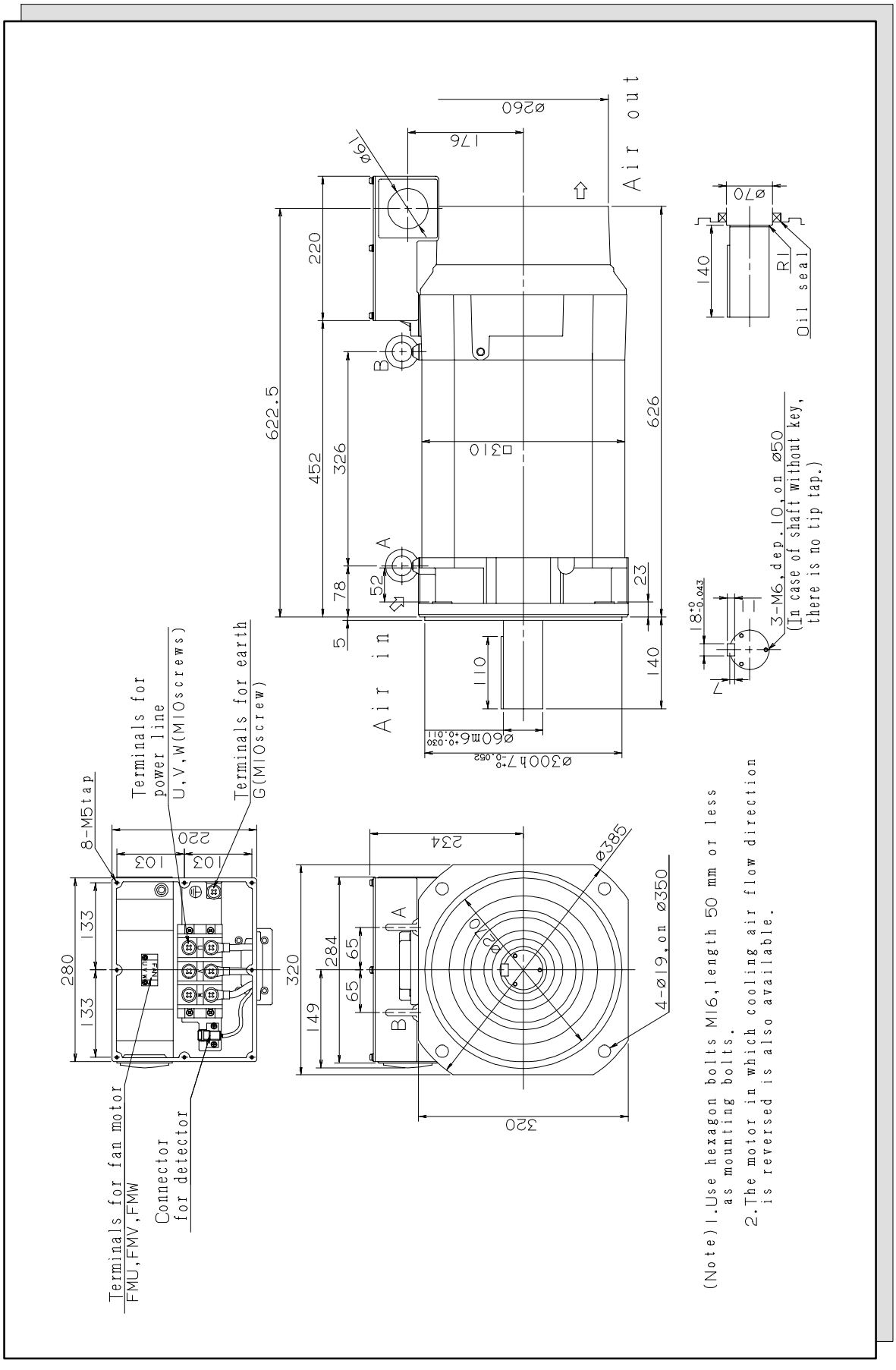


Fig.8(j) Model α30HV (Foot mounting type)

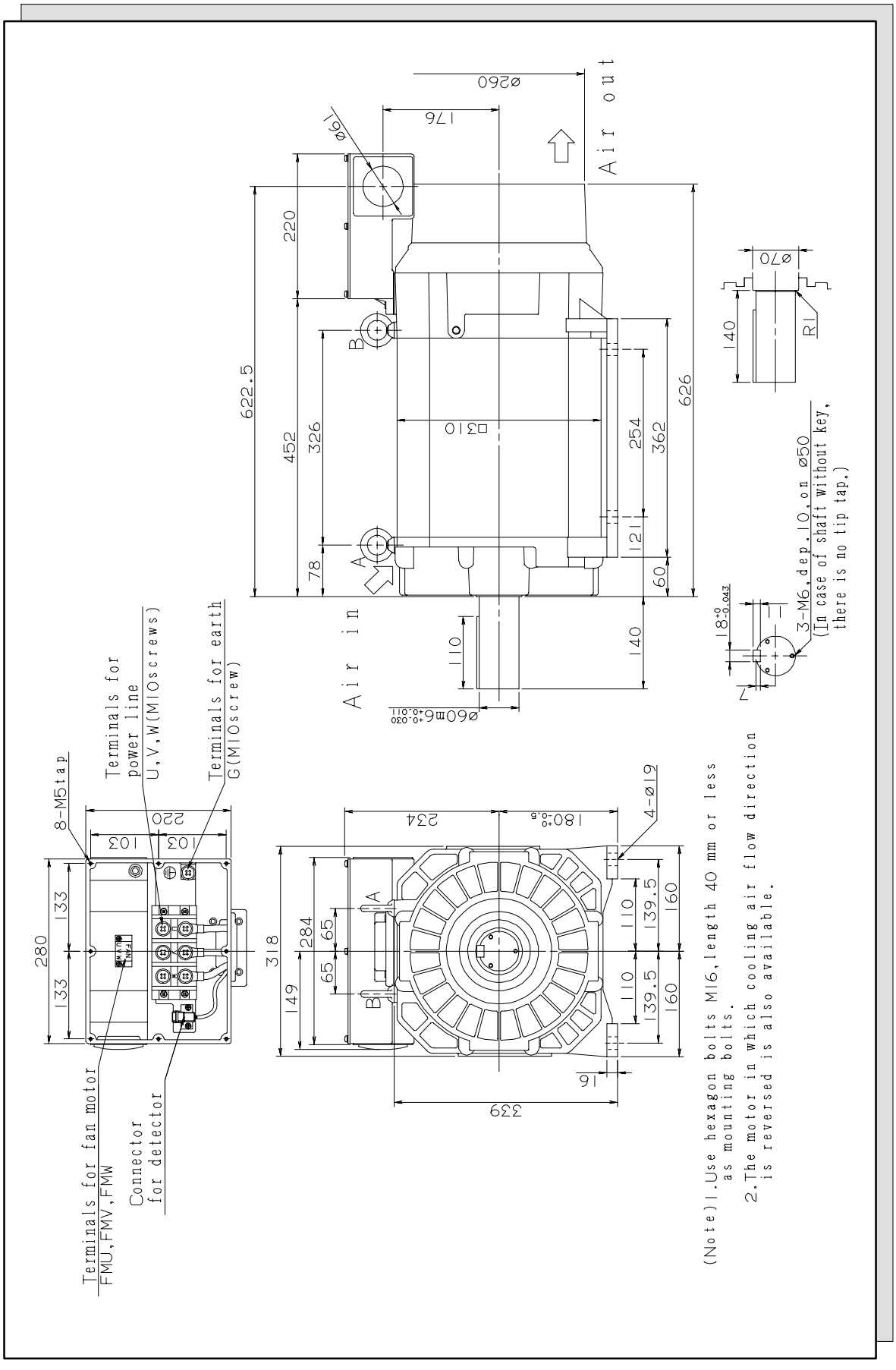


Fig.8(k) Model α40HV (Flange mounting type)

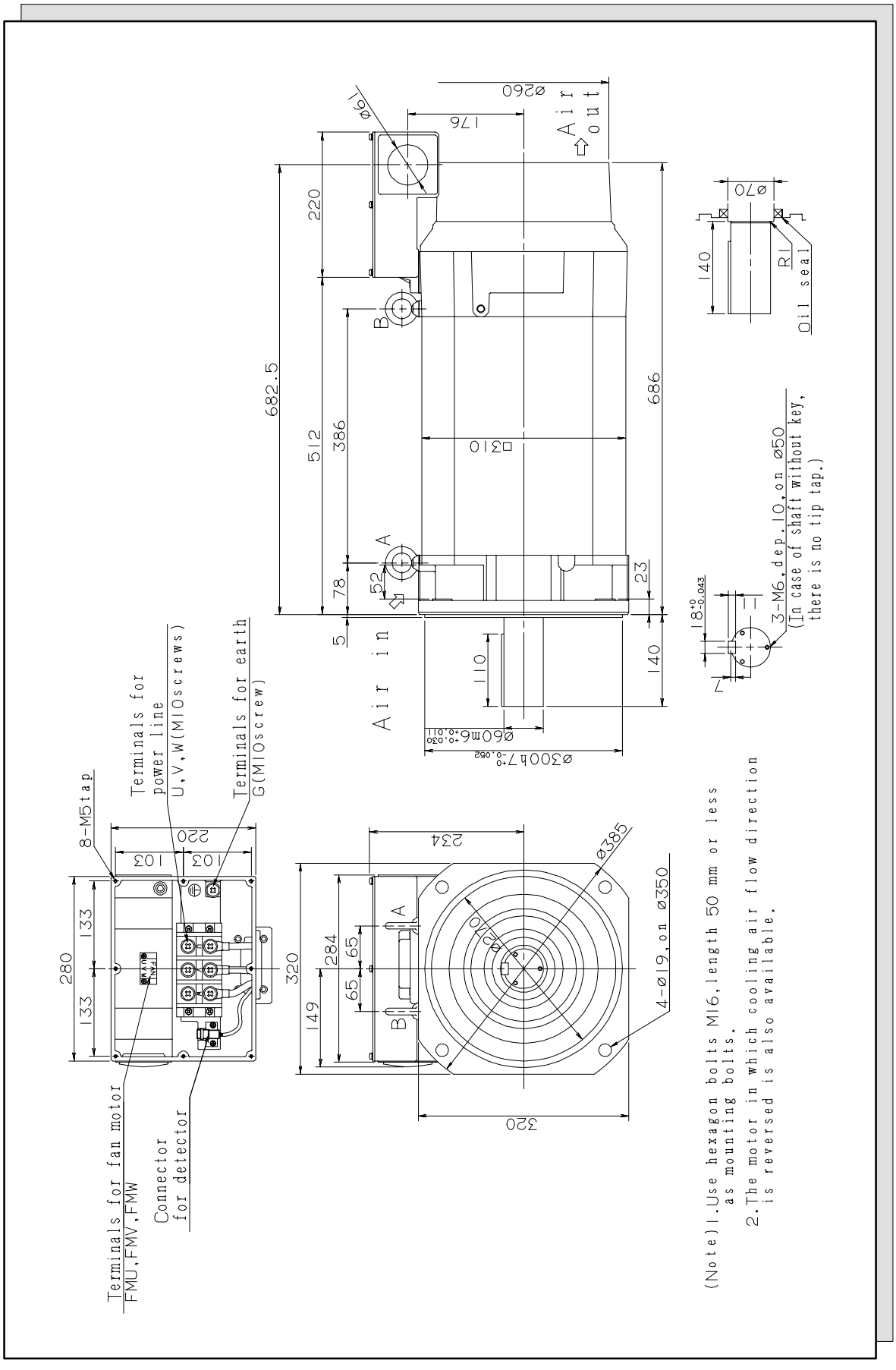


Fig.8(l) Model α40HV (Foot mounting type)

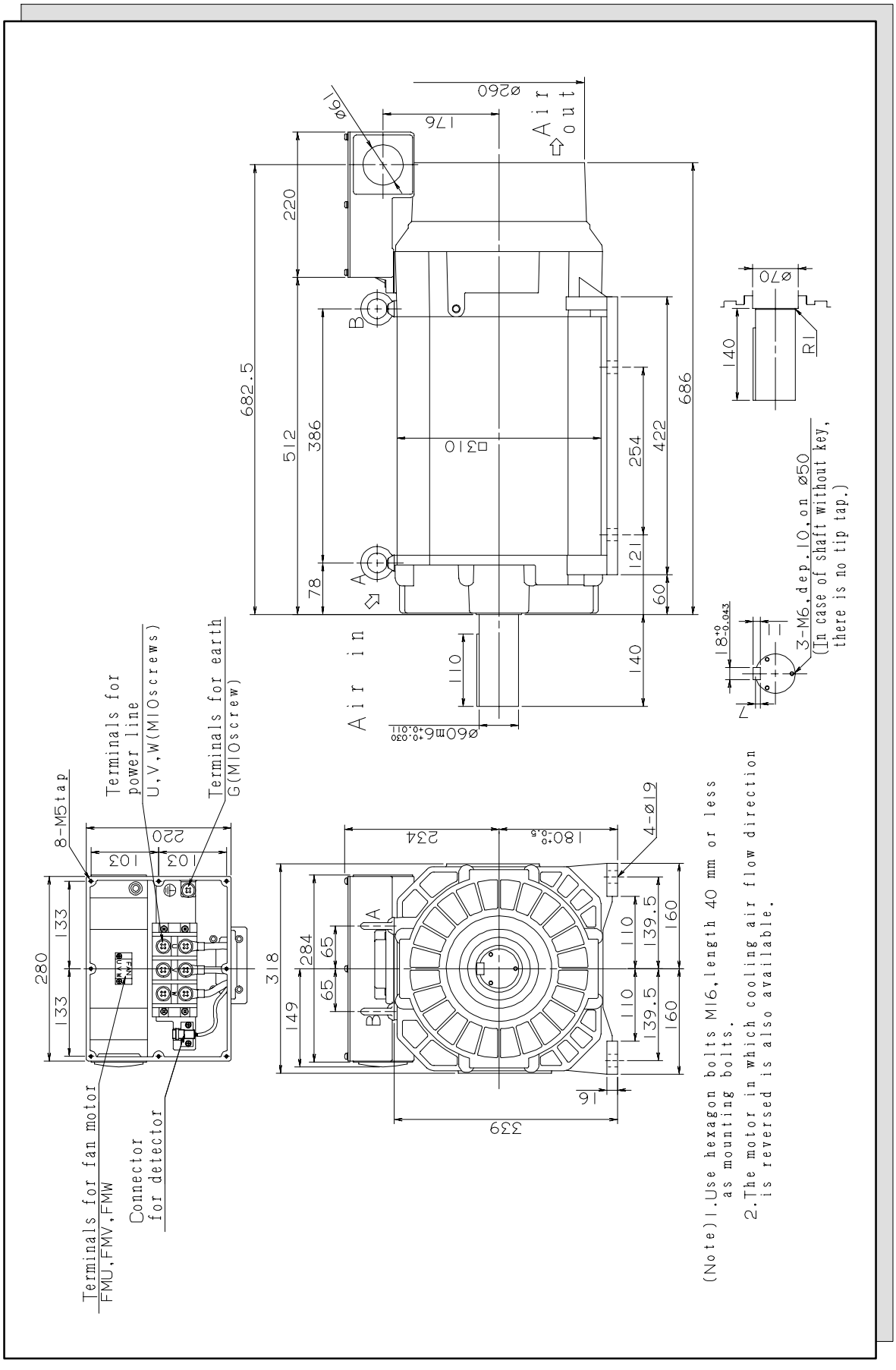


Fig.8(m) Model α60HV (Flange mounting type)

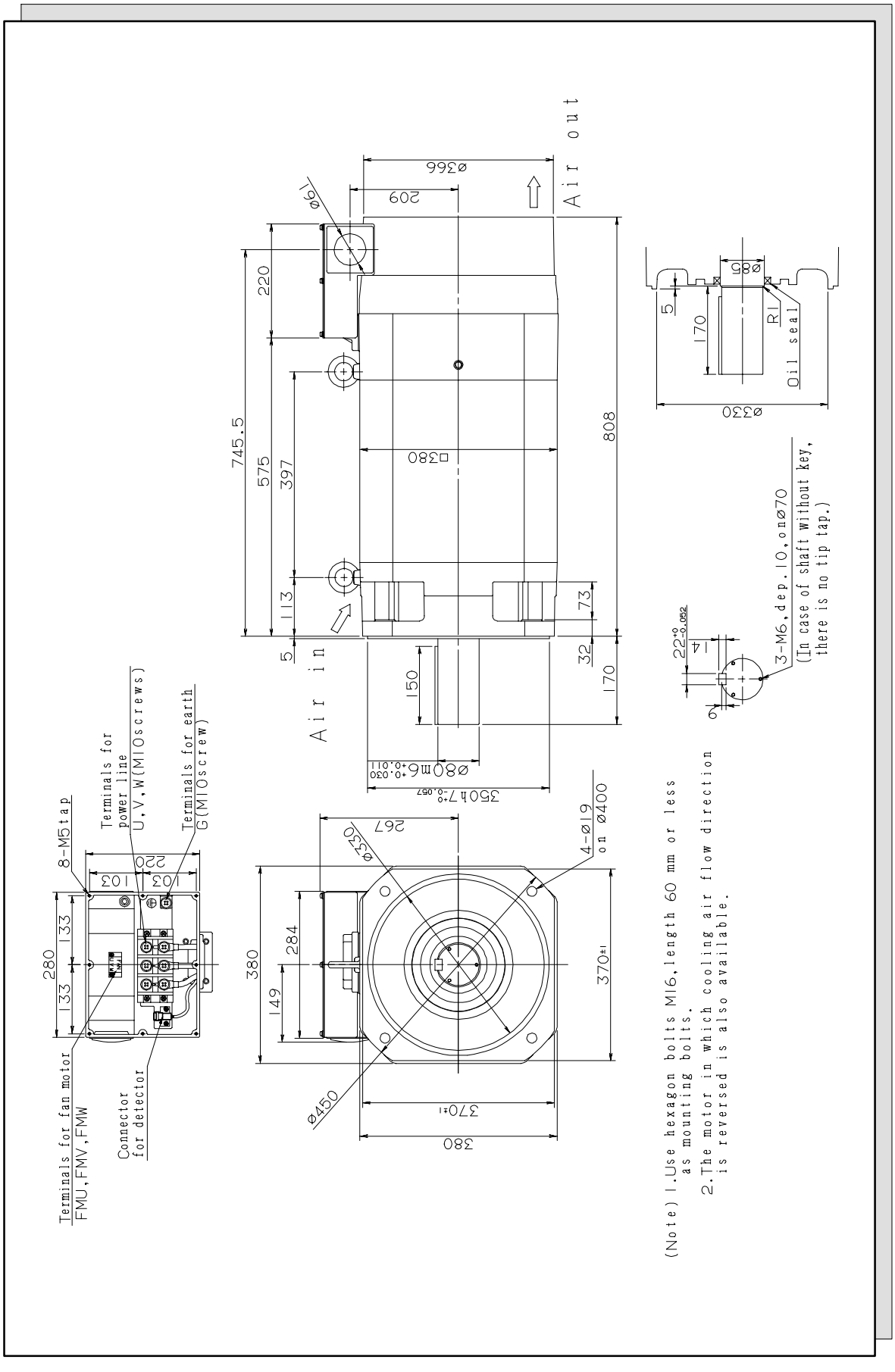
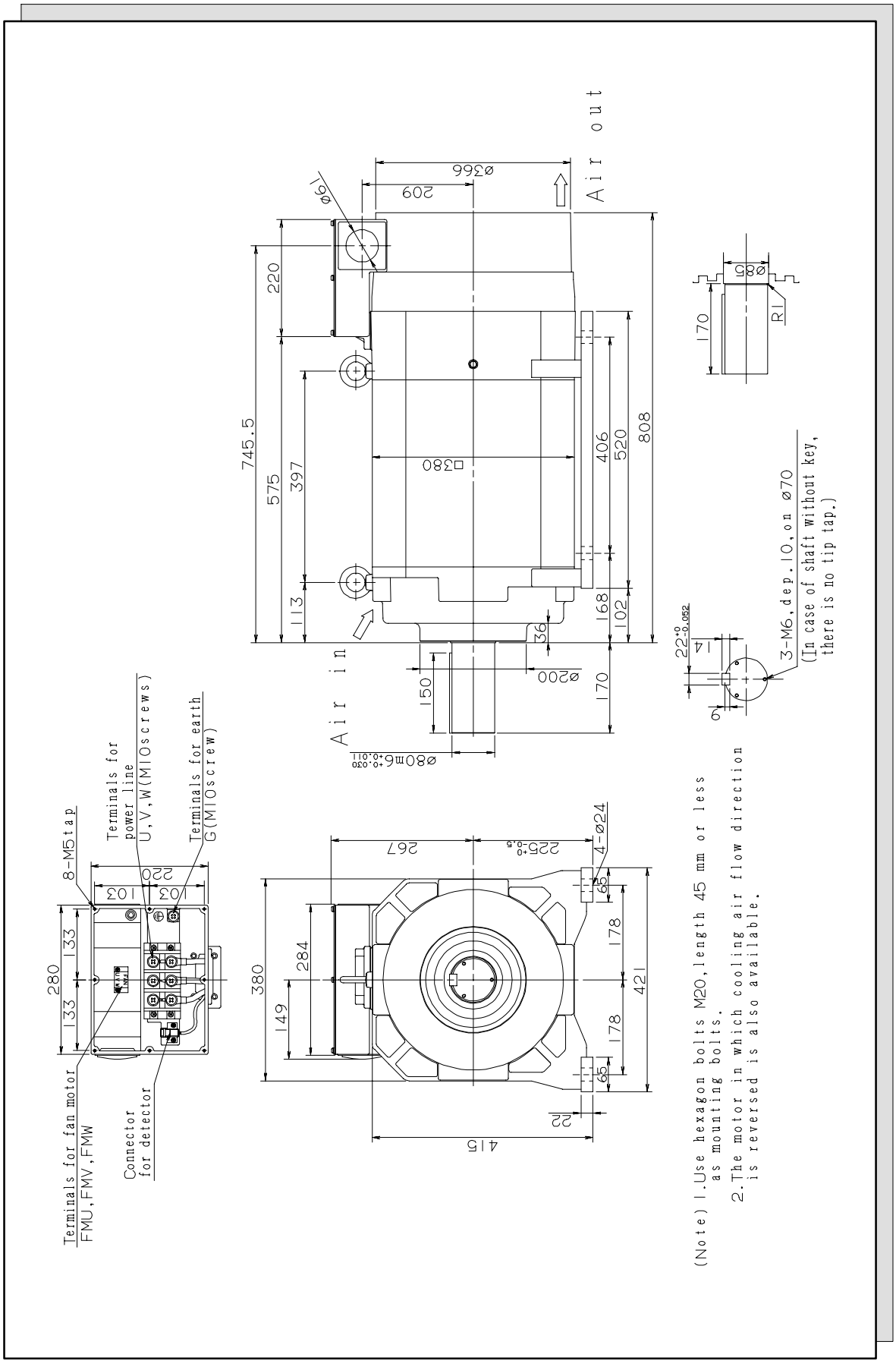


Fig.8(n) Model α60HV (Foot mounting type)



V. FANUC AC SPINDLE MOTOR
α C series

1 GENERAL

The FANUC AC spindle motor αC series is economical and ideal for small lathes.

Features

- Economical configuration includes a control amplifier.
- Waterproof and pressure–proof design conforming to the international standard (IEC) is employed to improve reliability and make it resistant to most environments.

2 SPECIFICATIONS

SPECIFICATIONS

Series		α C series									
Item \ Model		α C1	α C1.5	α C2	α C3	α C6	α C8	α C12	α C15	α C18	α C22
Output (*1)	Cont. rated kW (HP)	1.5 (2.0)	1.1 (1.5)	2.2 (3.0)	3.7 (5.0)	5.5 (7.4)	7.5 (10)	11 (14.7)	15 (20.1)	18.5 (24.8)	22 (29.5)
	30 min rated [15 min, 10min] kW (*2) (HP)	2.2 (3.0)	3.7 (5.0)	3.7 (5.0)	5.5. (7.4)	7.5 (10)	11 (14.7)	15 (20.1)	18.5 (24.8)	22 (29.5)	26 (34.9)
	S3 40% [60%, 25%] kW (*3) (*4) (HP)	2.2 (3.0)	3.7 (5.0)	3.7 (5.0)	5.5 (7.4)	7.5 (10)	11 (14.7)	15 (20.1)	18.5 (24.8)	22 (29.5)	26 (34.9)
Rated current A (*5)	Cont. rated	12	14	20	24	36	44	54	74	90	105
	30 min rated (*2) S3 60% (*3)	14	28	27	30	44	56	75	93	105	117
Speed min^{-1}	Min. speed (*6)	60	60	60	60	60	60	60	60	45	45
	Base speed	3000	1500	1500	1500	1500	1500	1500	1500	1500	1500
	Max. speed	6000	6000	6000	6000	6000	6000	6000	6000	4500	4500
Output torque N·m (Cont. rated torque at const. rated torque range) (kg·cm)		4.77 (48.7)	7.00 (71.4)	14.0 (143)	23.5 (240)	35.0 (357)	47.7 (487)	70.0 (714)	95.4 (974)	117.7 (1201)	140.0 (1428)
Rotor inertia	$kg \cdot m^2$	0.003	0.0043	0.0078	0.0148	0.0215	0.0275	0.09	0.09	0.128	0.128
	$kgf \cdot cm \cdot s^2$	0.03	0.04	0.08	0.15	0.22	0.28	0.93	0.93	1.29	1.29
Weight kg		18	24	27	46	60	80	110	110	143	143
Vibration		V5									
Noise		75 dB (A) or less									
Cooling system (*7)		Totally enclosed and fan cooled IC0A6	Totally enclosed and fan cooled IC0A5								
Cooling fan W		17	20					56			
Installation (*8)		The output shaft must be oriented in the range from 45° above the horizontal to 90° below the horizontal. IMB5, IMV1, IMB3, IMB6, IMB7, IMB8, IMV5									
Insulation		Class H									
Ambient temperature		0–40°C									
Altitude		Height above sea level not exceeding 1000m									
Painting color		Munsell system N2.5									
Type of thermal protection (*9)		TP211									
Bearing lubrication		Grease									
Maximum output during acceleration (*10) kW		2.64	4.44	4.44	6.6	9.0	13.2	18.0	22.2	26.4	31.2
Applicable spindle amplifier		SPMC–2.2	SPMC–5.5			SPMC–11		SPMC–15	SPMC–22		SPMC–26

NOTE

*1 The rated output is guaranteed at the rated voltage.
(Amplifier input: 200/220/230V AC +10% –15%, 50/60 Hz ±1Hz)
If the input voltage fluctuates, it is possible that the rated output cannot be obtained even when such fluctuations are within the allowable fluctuation range.
*2 The output for α C1 and α C2 is 15 min rated. That for α C1.5 is 10 min rated.
*3 S3 60% for α C1, α C2 and α C6. S3 25% for α C1.5.
*4 The cycle time is 10 minutes, S3 60%: ON 6 minutes, OFF 4 minutes, S3 40%: ON 4 minutes, OFF 6 minutes and S3 25%: ON 2.5 minutes, OFF 7.5 minutes.
*5 The rated current is the maximum current for each rated output.
*6 Output power and torque t speed less than min. speed are not guaranteed.
*7 IC code conforms to IEC 34–6.
*8 IM code conforms to IEC 34–7.
*9 Type conforms to IEC 34–11.
*10 These values are to be used only as guidance for selecting a power supply module and are not guaranteed.
*11 Degree of protection: with oil seal: IP54, without oil seal: IP40.

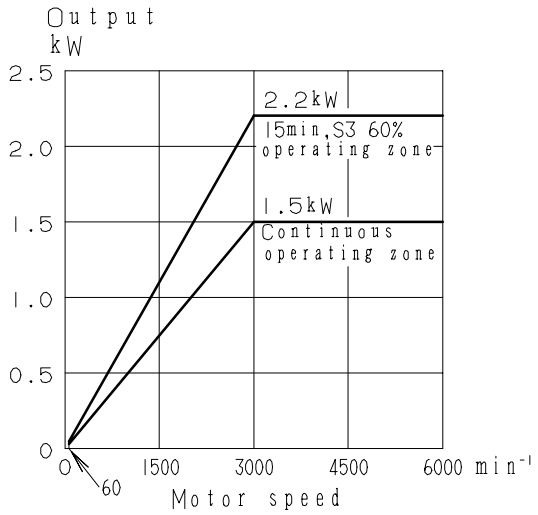
3 OUTPUT/TORQUE CHARACTERISTICS

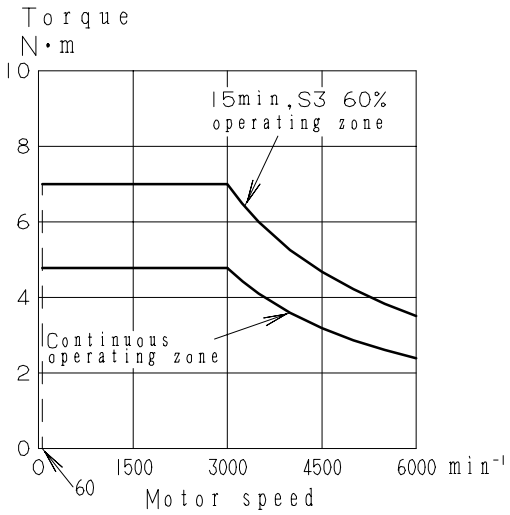
(Reference) Calculation for torque

Torque T can be obtained by the following equation.
$T[N \cdot m]=P[kW] \times 1000/0.1047/N[min^{-1}]$
P[kW]: motor output
$N[min^{-1}]$: motor speed

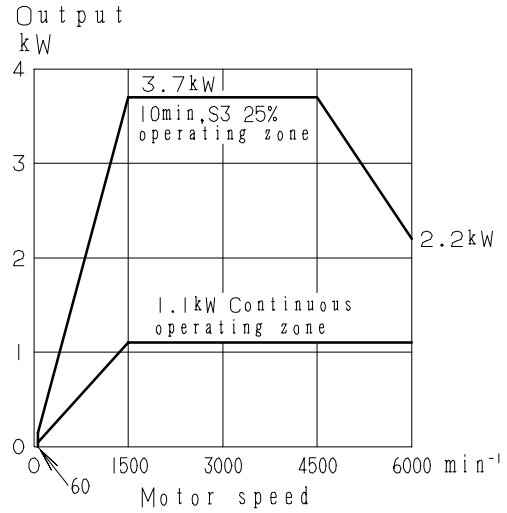
When the unit of T is $[kg \cdot m]$,
$T[kg \cdot m]=P[kW] \times 1000/1.0269/N[min^{-1}]$

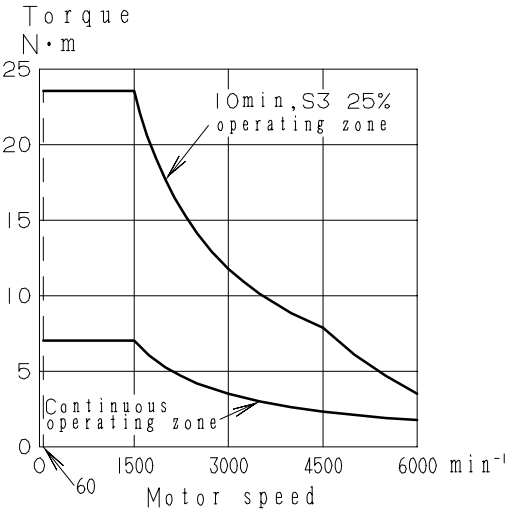
(1)Model αC1



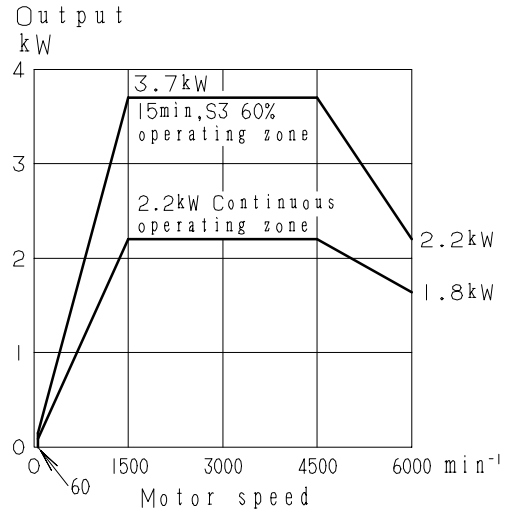


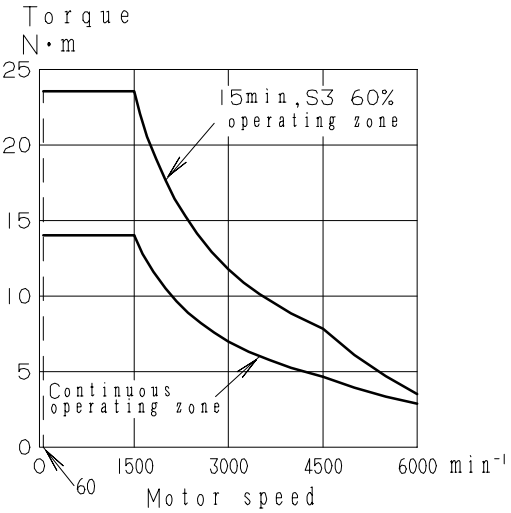
(2)Model αC1.5



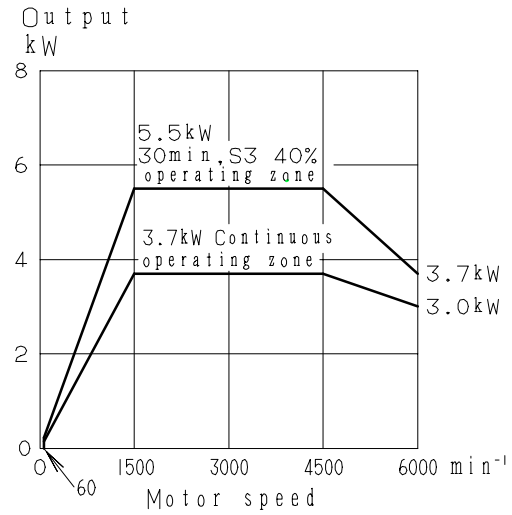


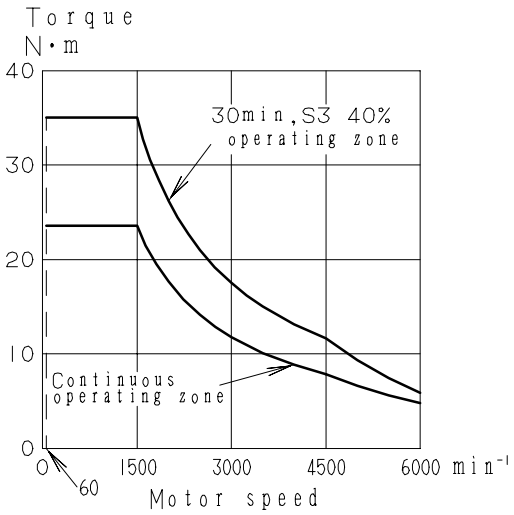
(3)Model αC2



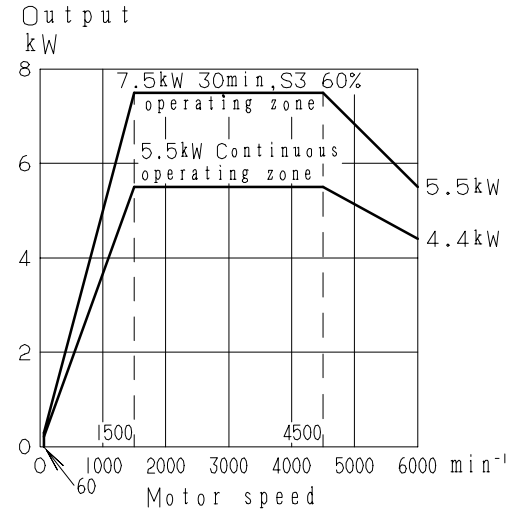


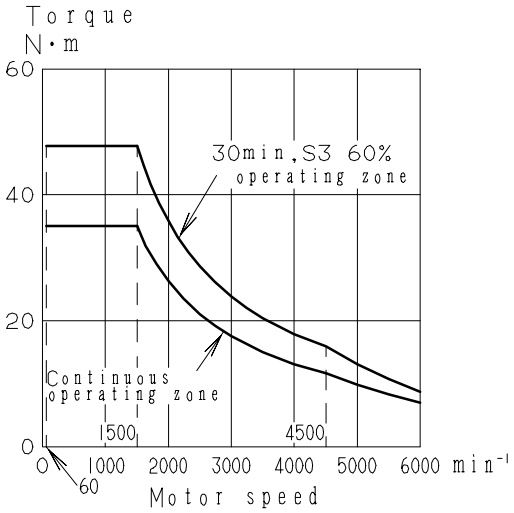
(4)Model αC3



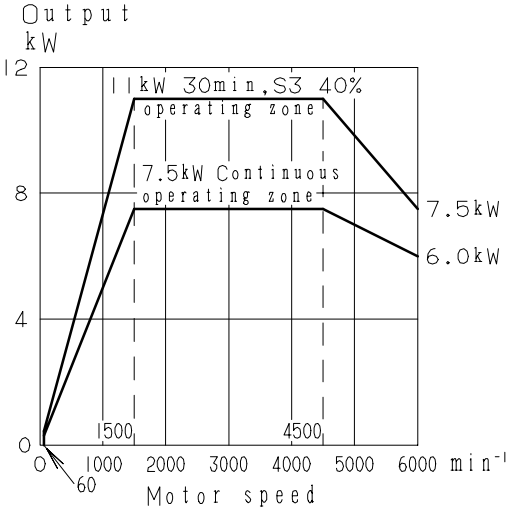


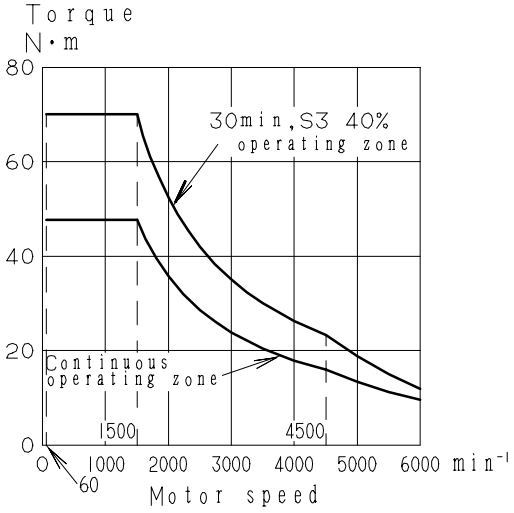
(5)Model αC6



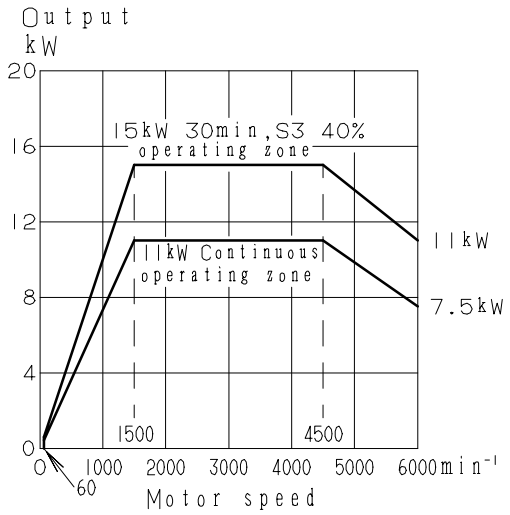


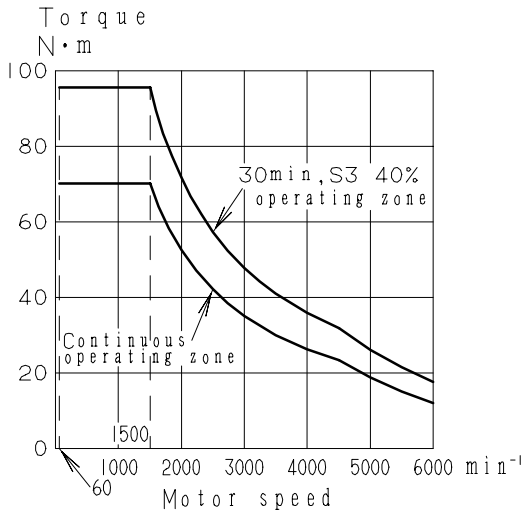
(6)Model αC8



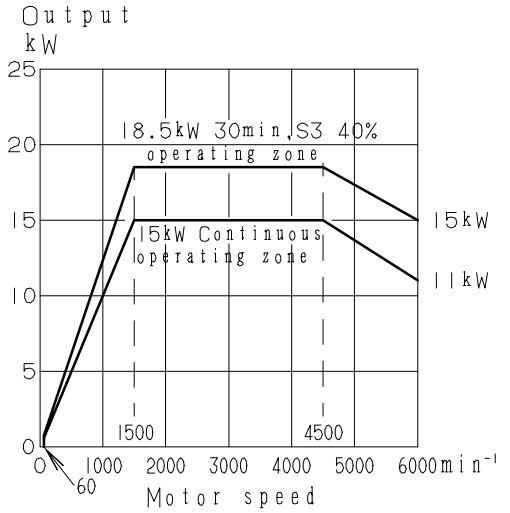


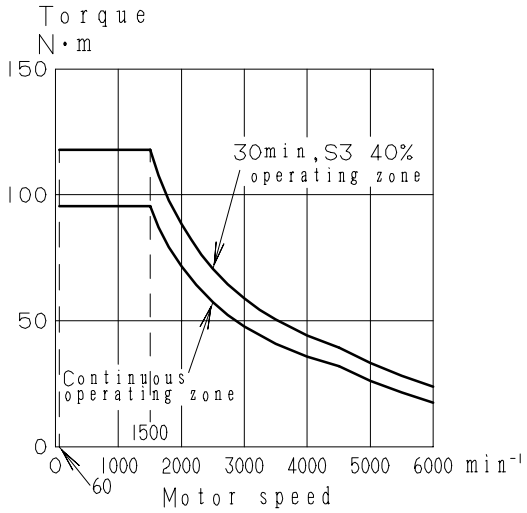
(7)Model αC12



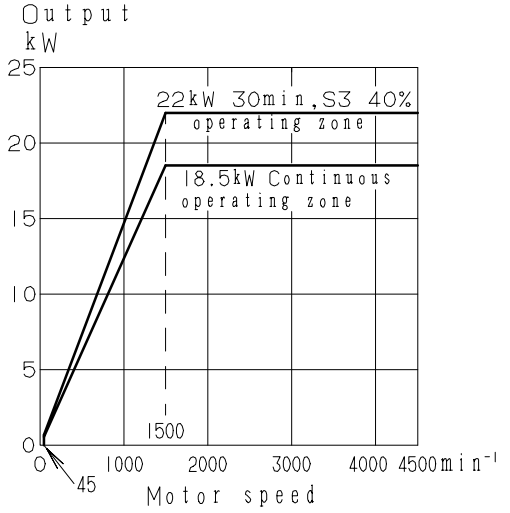


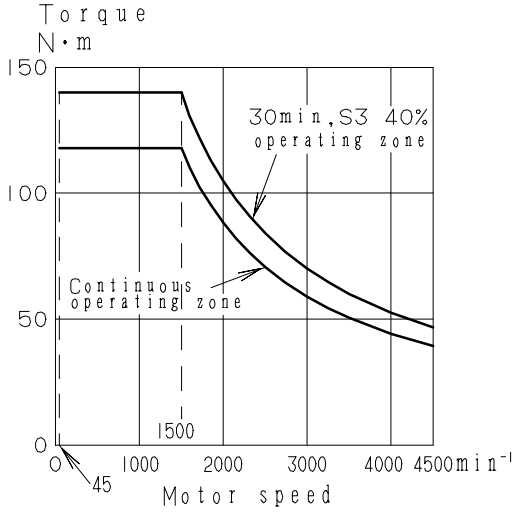
(8)Model αC15



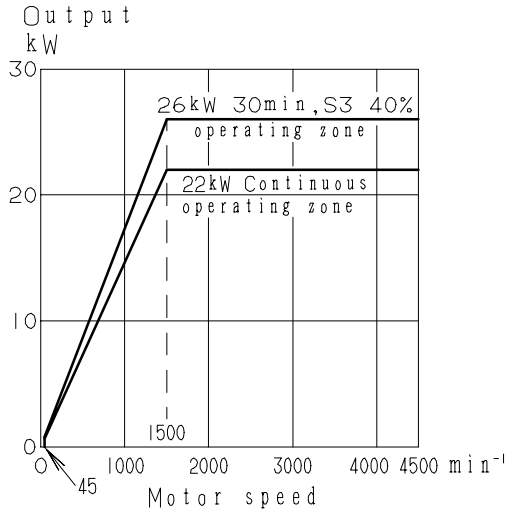


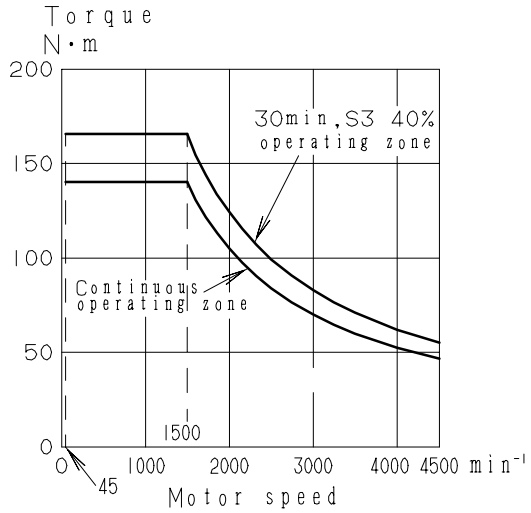
(9)Model αC18





(10)Model αC22





4 ORDERING NUMBER

(1) α C series

Name		Ordering number	Remarks
Model α C1	Flange mounting	A06B–0840–B100 A06B–0840–B101 A06B–0840–B300 A06B–0840–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0840–B200 A06B–0840–B201 A06B–0840–B400 A06B–0840–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
Model α C1.5	Flange mounting	A06B–0841–B100 A06B–0841–B101 A06B–0841–B300 A06B–0841–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0841–B200 A06B–0841–B201 A06B–0841–B400 A06B–0841–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
Model α C2	Flange mounting	A06B–0842–B100 A06B–0842–B101 A06B–0842–B300 A06B–0842–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0842–B200 A06B–0842–B201 A06B–0842–B400 A06B–0842–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
Model α C3	Flange mounting	A06B–0843–B100 A06B–0843–B101 A06B–0843–B300 A06B–0843–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0843–B200 A06B–0843–B201 A06B–0843–B400 A06B–0843–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
Model α C6	Flange mounting	A06B–0844–B100 A06B–0844–B101 A06B–0844–B300 A06B–0844–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0844–B200 A06B–0844–B201 A06B–0844–B400 A06B–0844–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
Model α C8	Flange mounting	A06B–0845–B100 A06B–0845–B101 A06B–0845–B300 A06B–0845–B301	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0845–B200 A06B–0845–B201 A06B–0845–B400 A06B–0845–B401	6000 min^{-1}, has key, exhaust rear 6000 min^{-1}, has key, exhaust front 6000 min^{-1}, no key, exhaust rear 6000 min^{-1}, no key, exhaust front

NOTE
Refer to the ordering list (B–65151E) for available motors except above.

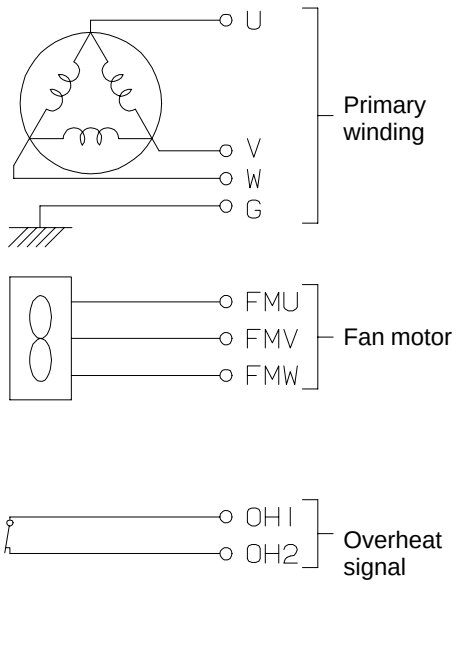
(Continued from the previous page)

Name		Ordering number	Remarks
Model α C12	Flange mounting	A06B–0846–B100	6000 min^{-1}, has key, exhaust rear
		A06B–0846–B101	6000 min^{-1}, has key, exhaust front
		A06B–0846–B300	6000 min^{-1}, no key, exhaust rear
		A06B–0846–B301	6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0846–B200	6000 min^{-1}, has key, exhaust rear
		A06B–0846–B201	6000 min^{-1}, has key, exhaust front
		A06B–0846–B400	6000 min^{-1}, no key, exhaust rear
		A06B–0846–B401	6000 min^{-1}, no key, exhaust front
Model α C15	Flange mounting	A06B–0847–B100	6000 min^{-1}, has key, exhaust rear
		A06B–0847–B101	6000 min^{-1}, has key, exhaust front
		A06B–0847–B300	6000 min^{-1}, no key, exhaust rear
		A06B–0847–B301	6000 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0847–B200	6000 min^{-1}, has key, exhaust rear
		A06B–0847–B201	6000 min^{-1}, has key, exhaust front
		A06B–0847–B400	6000 min^{-1}, no key, exhaust rear
		A06B–0847–B401	6000 min^{-1}, no key, exhaust front
Model α C18	Flange mounting	A06B–0848–B100	4500 min^{-1}, has key, exhaust rear
		A06B–0848–B101	4500 min^{-1}, has key, exhaust front
		A06B–0848–B300	4500 min^{-1}, no key, exhaust rear
		A06B–0848–B301	4500 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0848–B200	4500 min^{-1}, has key, exhaust rear
		A06B–0848–B201	4500 min^{-1}, has key, exhaust front
		A06B–0848–B400	4500 min^{-1}, no key, exhaust rear
		A06B–0848–B401	4500 min^{-1}, no key, exhaust front
Model α C22	Flange mounting	A06B–0849–B100	4500 min^{-1}, has key, exhaust rear
		A06B–0849–B101	4500 min^{-1}, has key, exhaust front
		A06B–0849–B300	4500 min^{-1}, no key, exhaust rear
		A06B–0849–B301	4500 min^{-1}, no key, exhaust front
	Foot mounting	A06B–0849–B200	4500 min^{-1}, has key, exhaust rear
		A06B–0849–B201	4500 min^{-1}, has key, exhaust front
		A06B–0849–B400	4500 min^{-1}, no key, exhaust rear
		A06B–0849–B401	4500 min^{-1}, no key, exhaust front

NOTE
Refer to the ordering list (B–65151E) for available motors except above.

5 CONNECTIONS

Cables of power line and fan motor are connected to the terminal block. The overheat signals are connected to the connector manufactured by AMP.
Connector housing and connector manufactured by AMP are attached to the motor.



Type of screws used int the terminal block

	U, V, W, G	FMU~FMW
αC1–αC15	M5	M4
αC18, αC22	M8	M4

Pin assignment in the connector

Number	B1	B2	B3	B4	B5	B6
Color						
Signal						OH2
Number	A1	A2	A3	A4	A5	A6
Color						
Signal						OH1

Connector: Manufactured by D–3000 series

	Motor side		Cable side	
	FANUC purchase specification	AMP specification	FANUC purchase specification	AMP specification
Housing	A63L–0001–0535/121KDF	178964–6	A63L–0001–0460/121KD	178289–6
Contact	A63L–0001–0456/ASMT	175288-2	A63L–0001–0456/ASM	1–175217–2

Crimping tool : 919601–1
Extractor : 914677–1

6 ALLOWABLE RADIAL LOAD

Use the motor output shaft below the allowable radial loads shown in the table below.

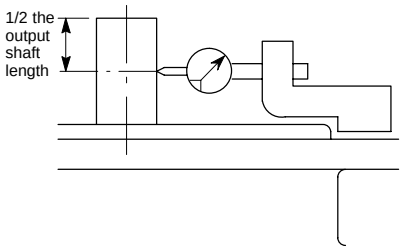
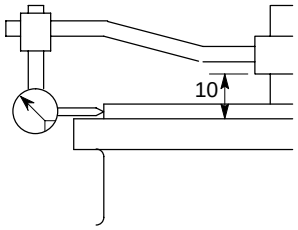
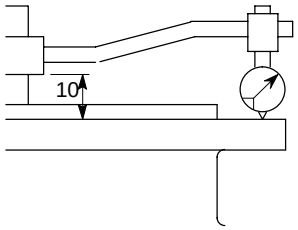
Model	Allowable radial load (kg)	
	At output shaft end	At output shaft center
α C1	40	45
α C1.5	90	100
α C2	90	102
α C3	150	164
α C6	200	225
α C8	300	344
α C12, α C15	300	348
α C18, α C22	450	509

CAUTION

1 When using a belt, adjust the tension so the allowable loads indicated above are not exceeded. If an excessive load is applied, consider the use of a support bearing on the machine side to maintain the long–term reliability of the motor. (If an excessive load is applied, it is possible that an abnormal sound may occur.)
2 When the belt tension is maximized at a point outside the output shaft end, the allowable loads are less than those at the output shaft end.
3 If a thrust load is applied when a helical gear is used, the shaft moves in the direction of the thrust. So, as a general rule, never apply a thrust load.

7 ASSEMBLING ACCURACY (T.I.R Total Indicator Reading)

Conform to JEM 1401

Item \ Model	αC1 to αC22	Measuring method
Vibration at the end of the output shaft	20μm or less	
Vibration of the faucet joint for mountingthe flange against the core of the shaft (Only for fange type)	40μm or less	
Vibration of the flange mounting surface against the core of the shaft (Only for frange type)	80μm or less	

8 EXTERNAL DIMENSIONS

Model name		Number of figure
Model	**Type**	
Model αC1	Flange mounting type	Fig.8 (a)
	Foot mounting type	Fig.8 (b)
Model αC1.5	Flange mounting type	Fig.8 (c)
	Foot mounting type	Fig.8 (d)
Model αC2	Flange mounting type	Fig.8 (e)
	Foot mounting type	Fig.8 (f)
Model αC3	Flange mounting type	Fig.8 (g)
	Foot mounting type	Fig.8 (h)
Model αC6	Flange mounting type	Fig.8 (i)
	Foot mounting type	Fig.8 (j)
Model αC8	Flange mounting type	Fig.8 (k)
	Foot mounting type	Fig.8 (l)
Model αC12, αC15	Flange mounting type	Fig.8 (m)
	Foot mounting type	Fig.8 (n)
Model αC18, αC22	Flange mounting type	Fig.8 (o)
	Foot mounting type	Fig.8 (p)

Fig.8 (a) Model αC1 (Flange mounting type)

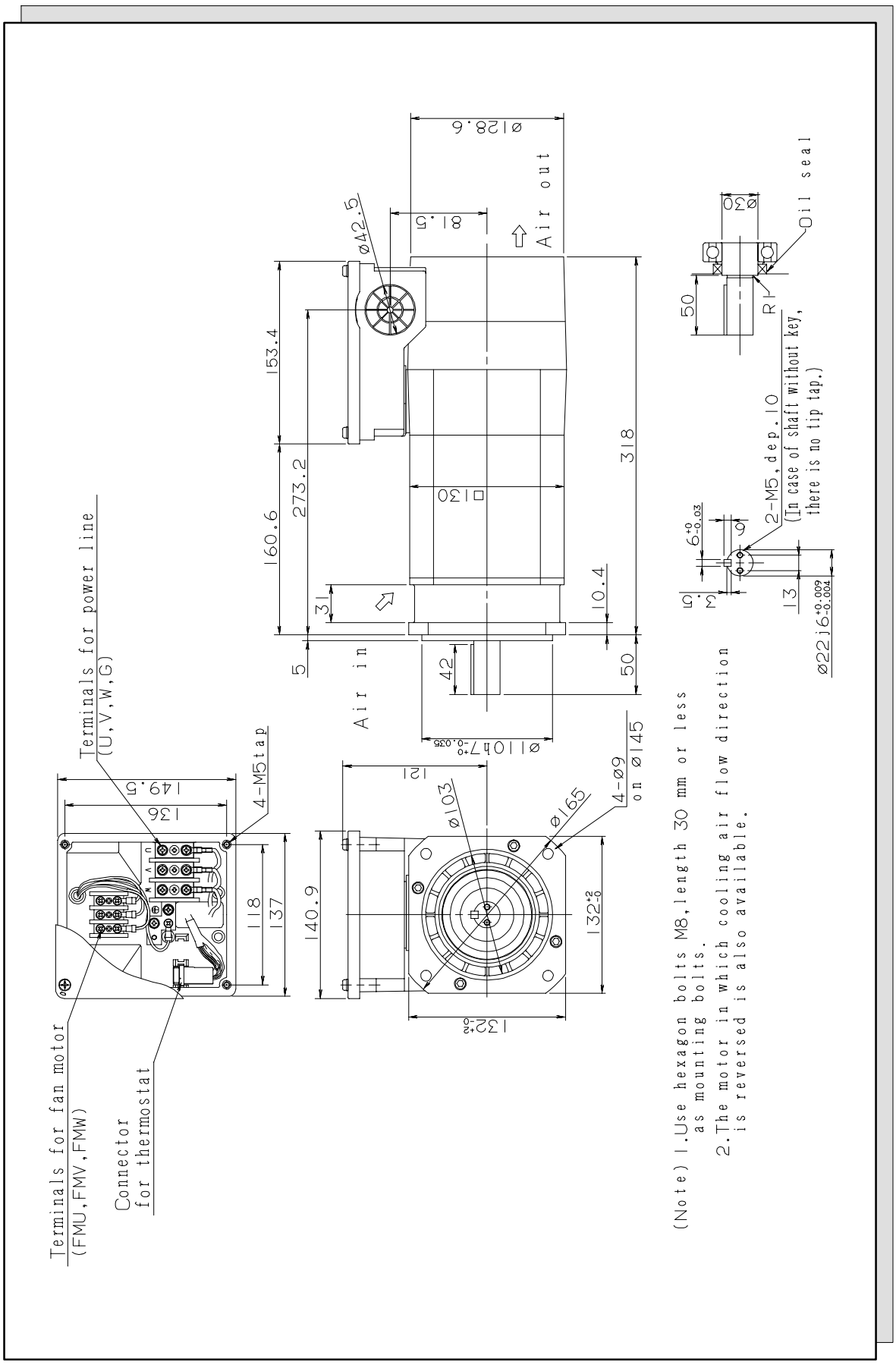


Fig.8 (b) Model αC1 (Foot mounting type)

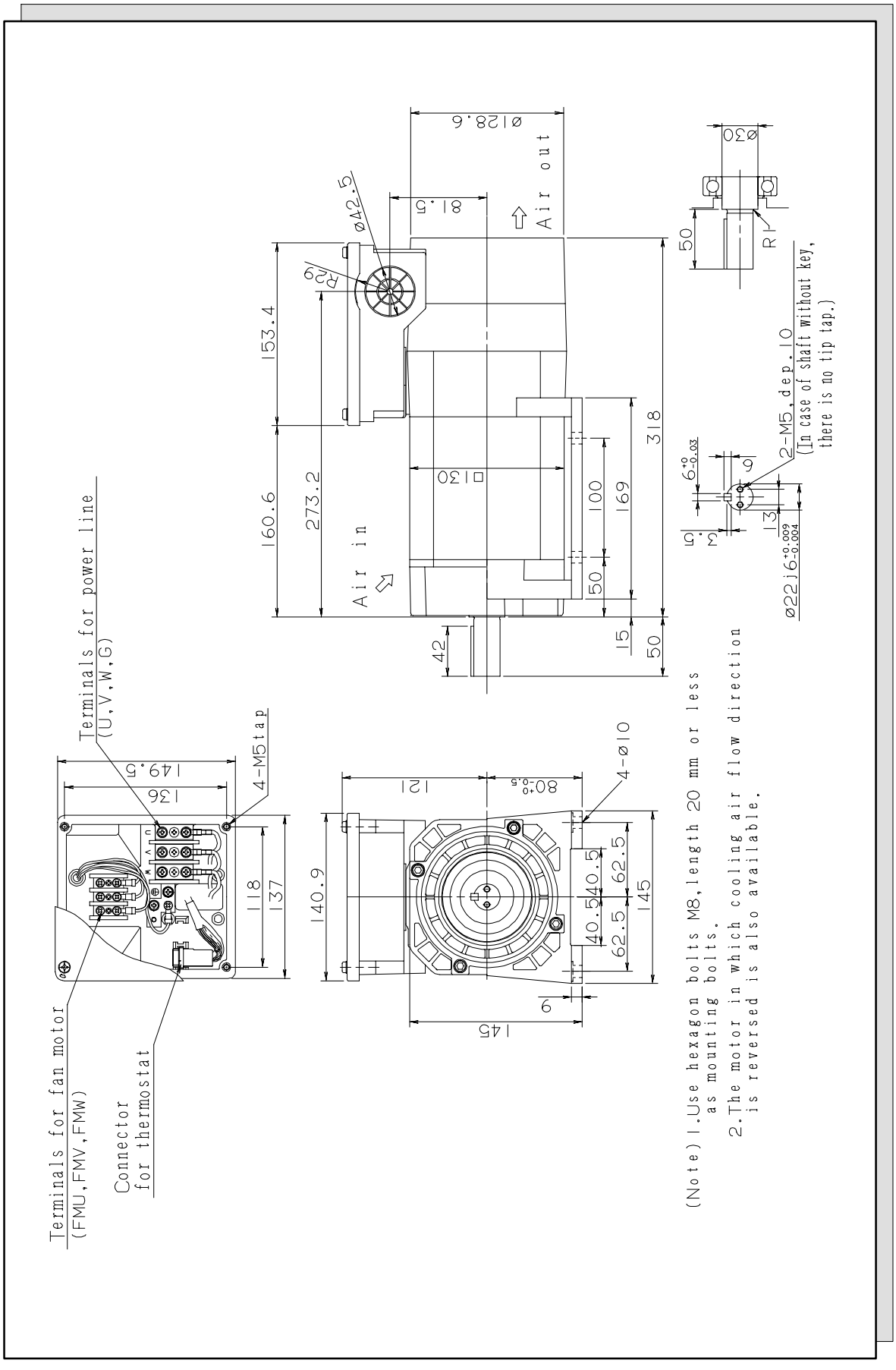


Fig.8 (c) **Model αC1.5 (Flange mounting type)**

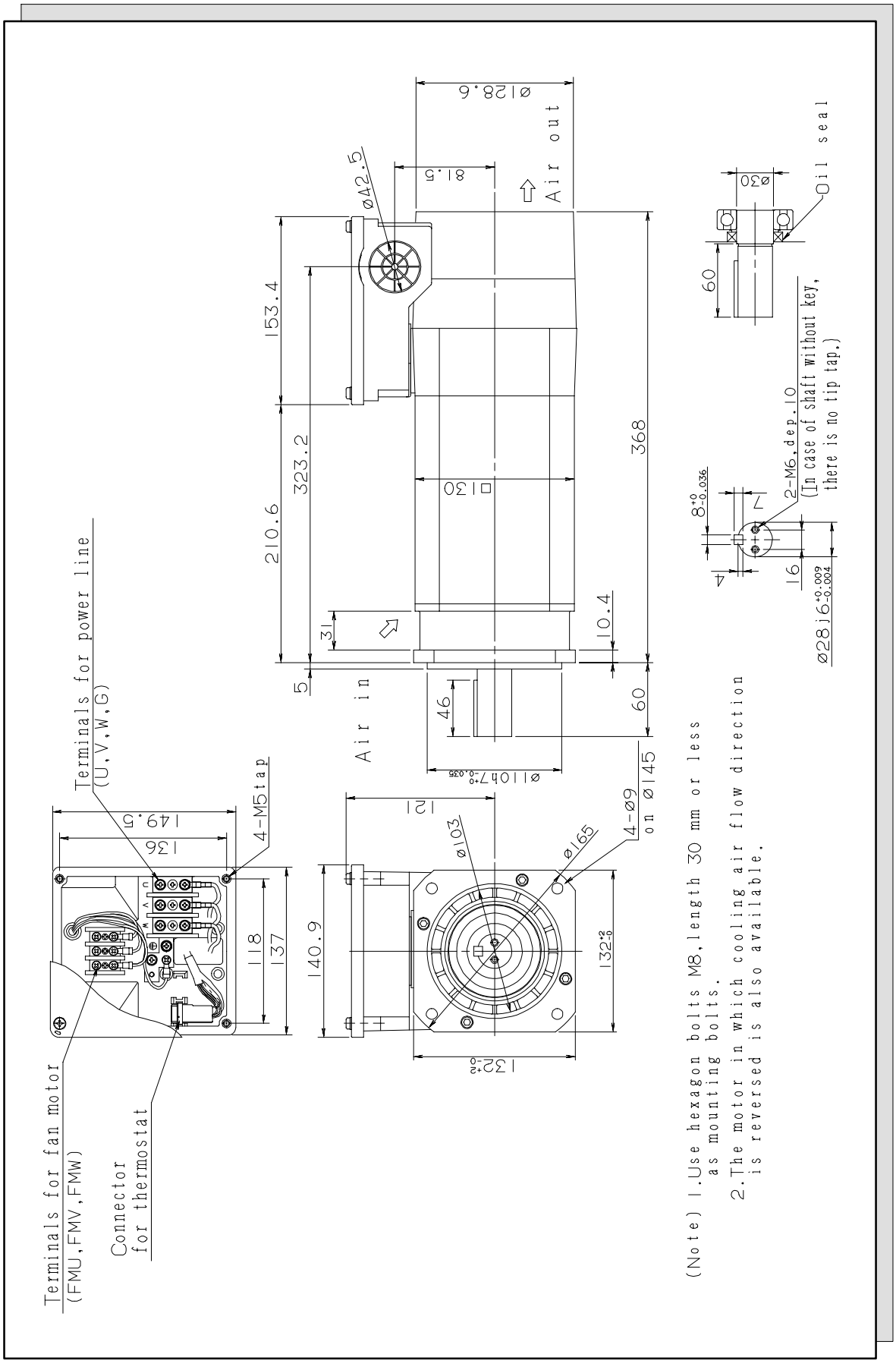


Fig.8(d) Model αC1.5 (Foot mounting type)

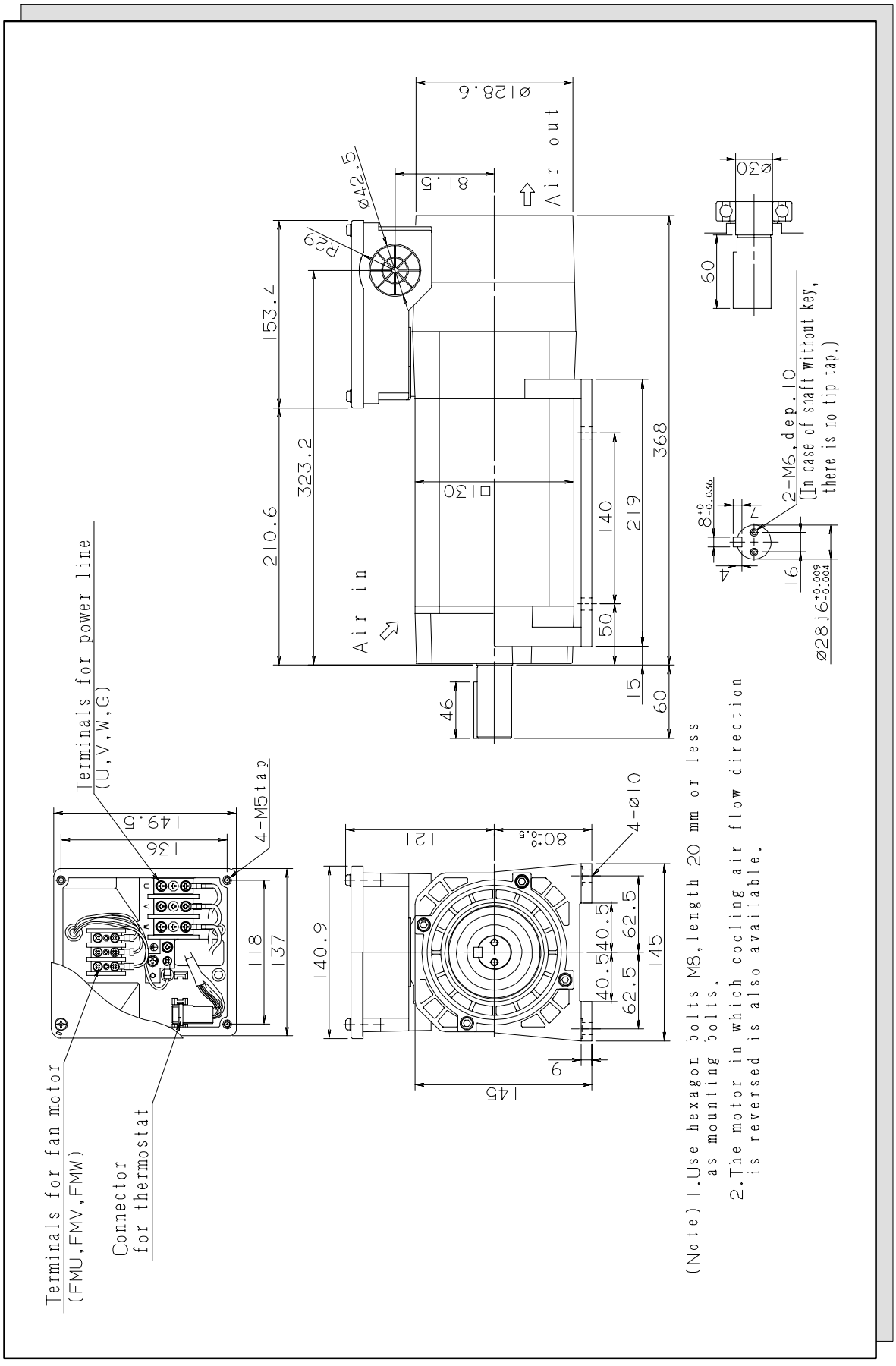


Fig.8 (e) Model αC2 (Flange mounting type)

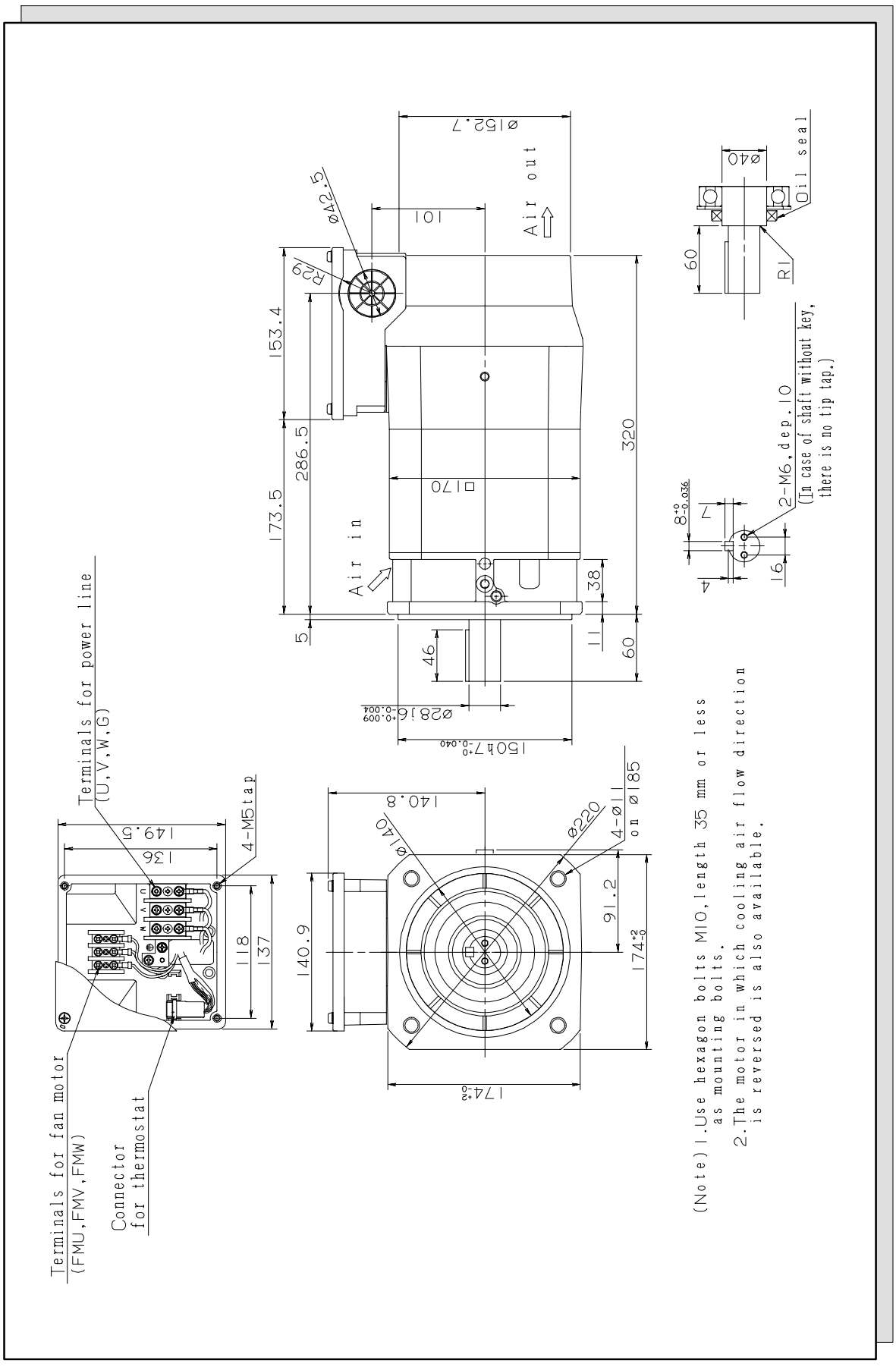


Fig.8 (f) Model αC2 (Foot mounting type)

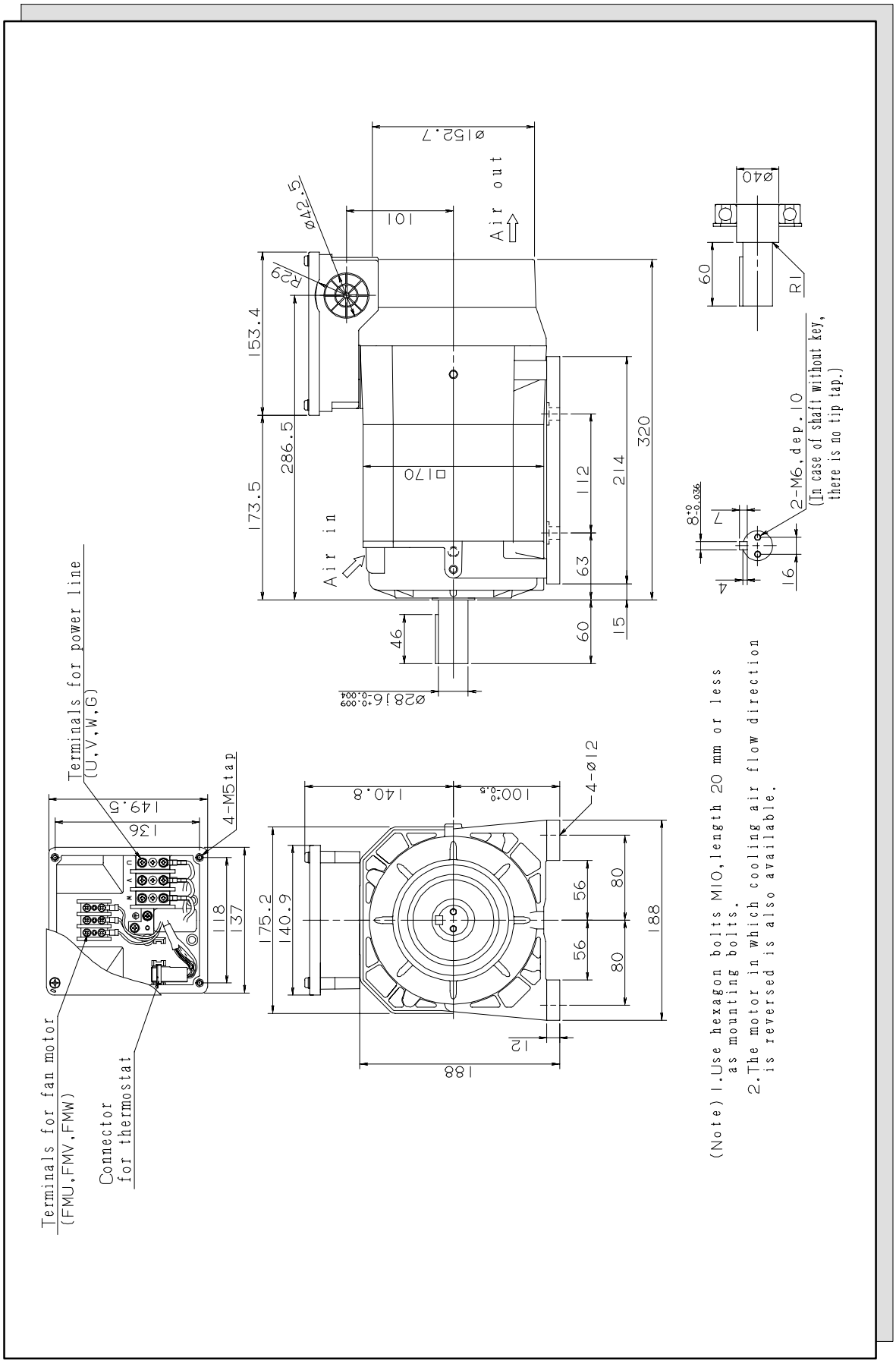


Fig.8 (g) Model αC3 (Flange mounting type)

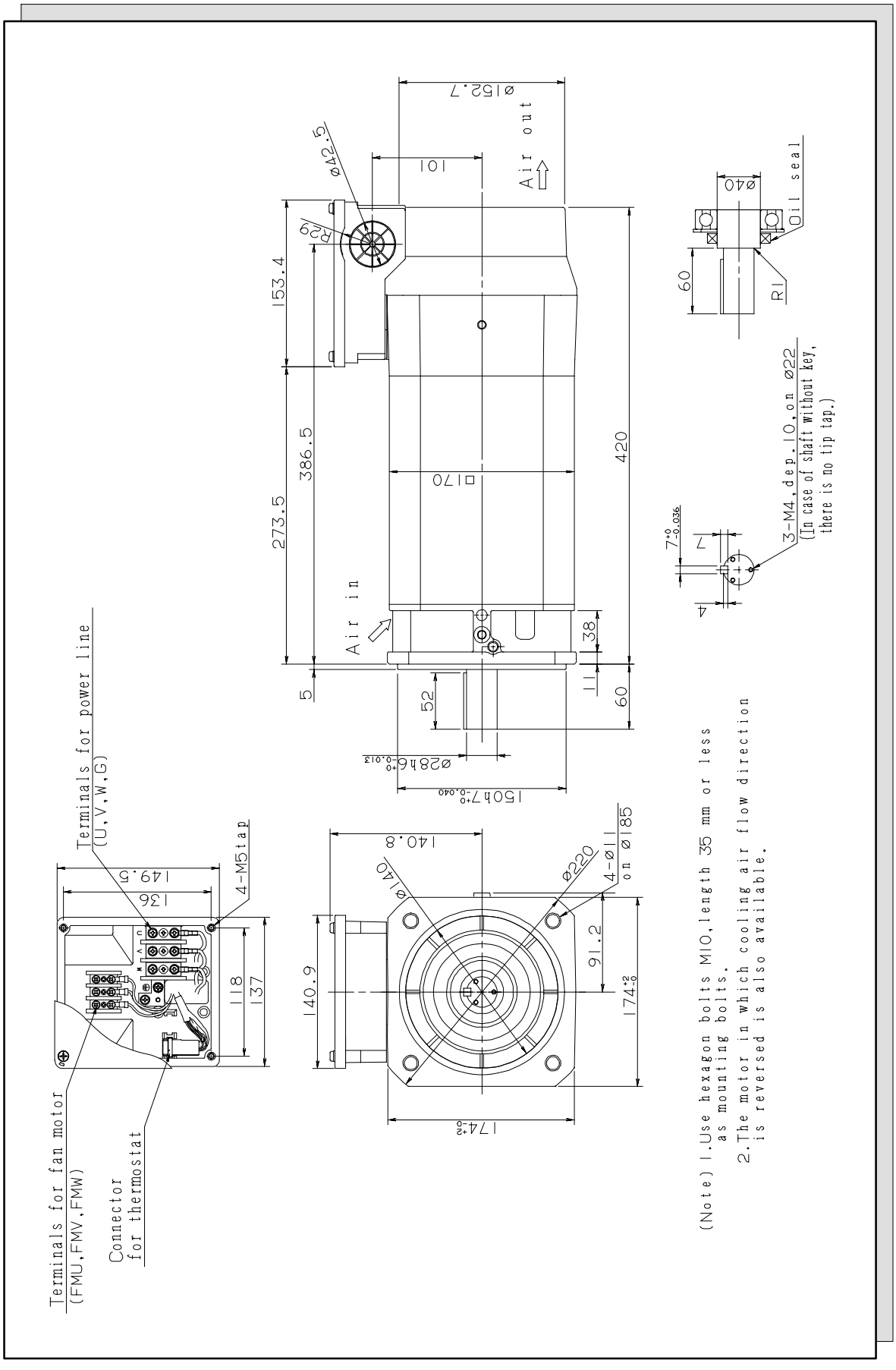


Fig.8 (h) Model αC3 (Foot mounting type)

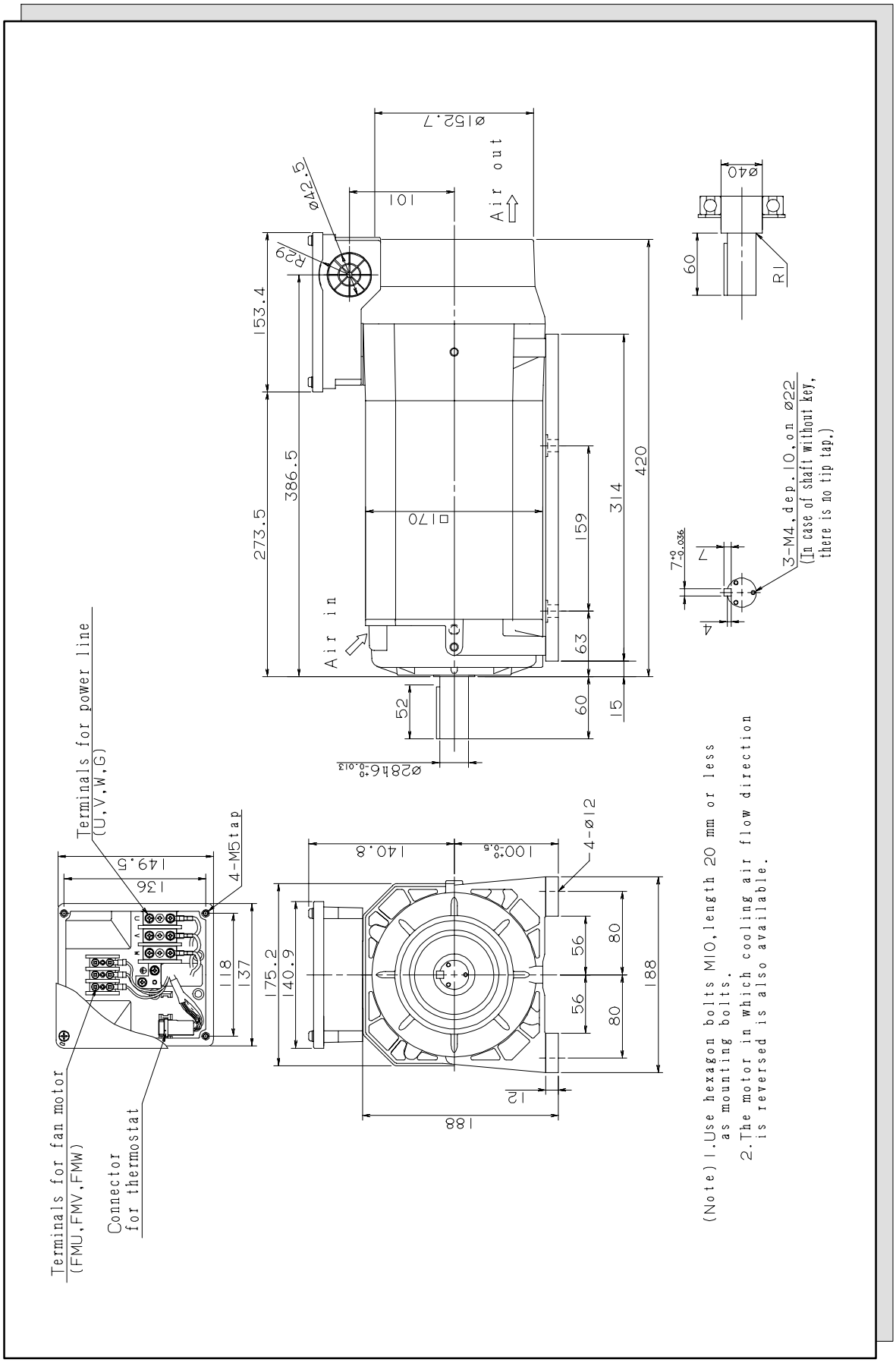


Fig.8 (i) Model αC6 (Flange mounting type)

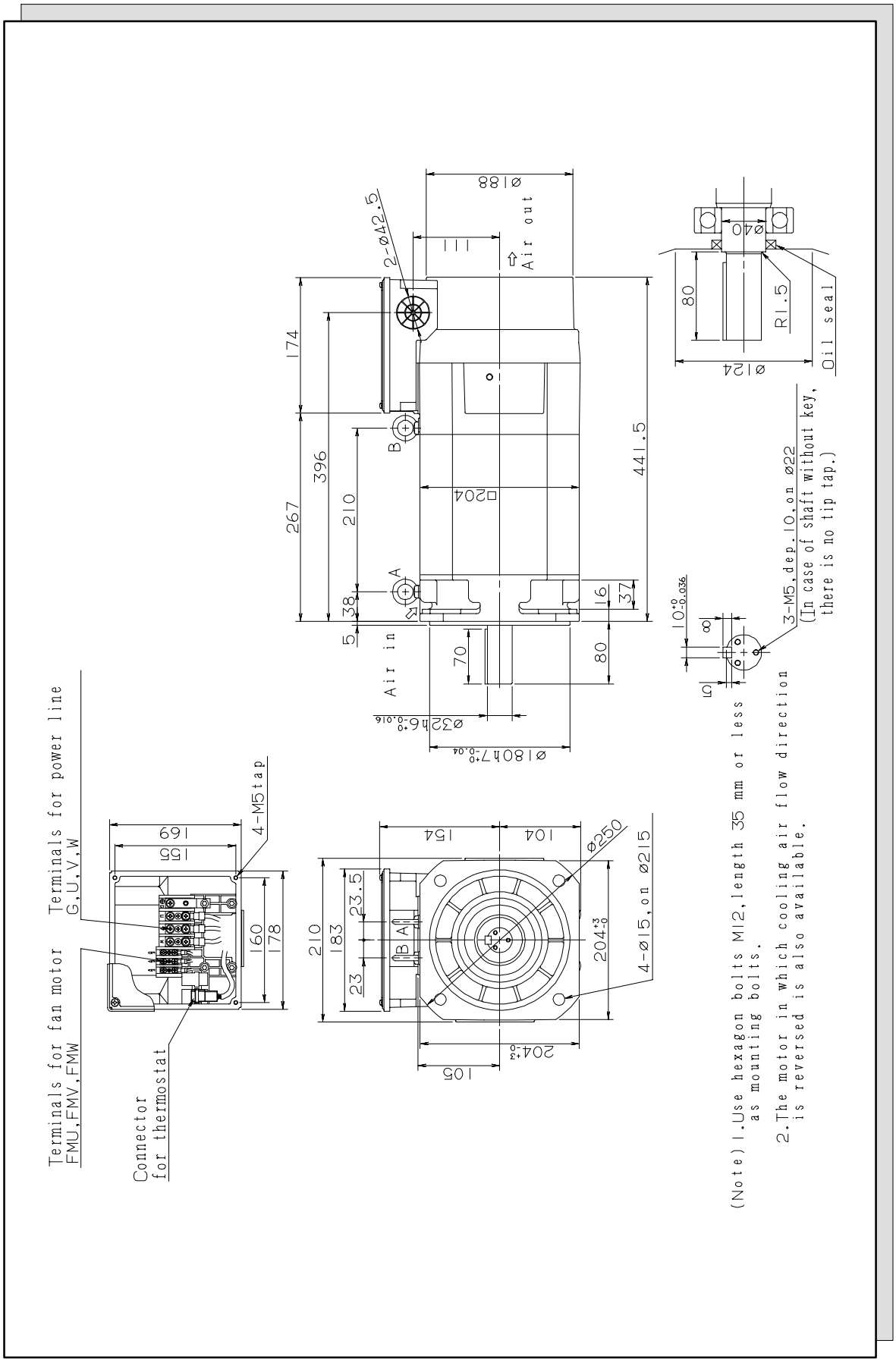


Fig.8 (j) Model αC6 (Foot mounting type)

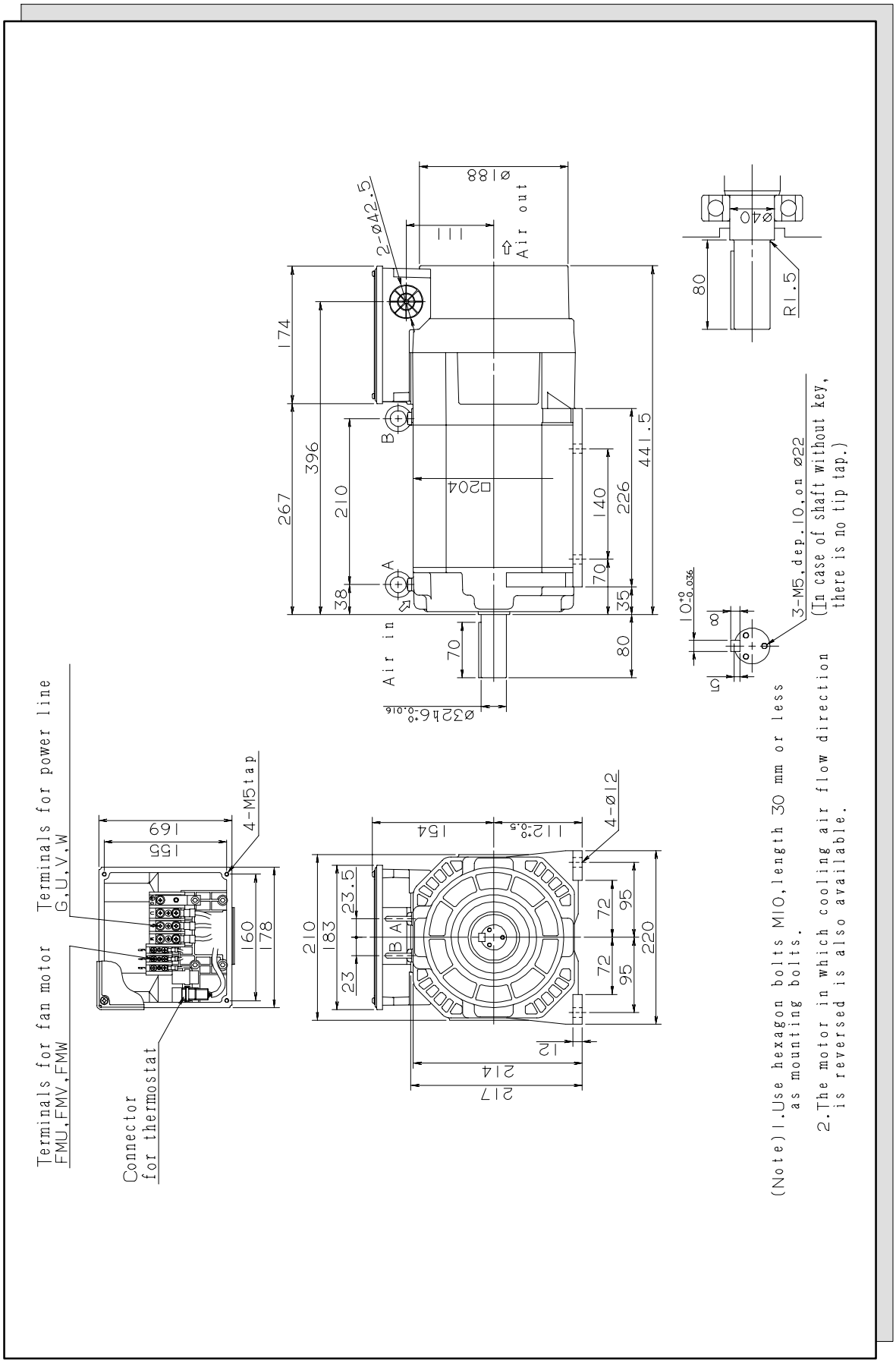


Fig.8 (k) Model αC8 (Flange mounting type)

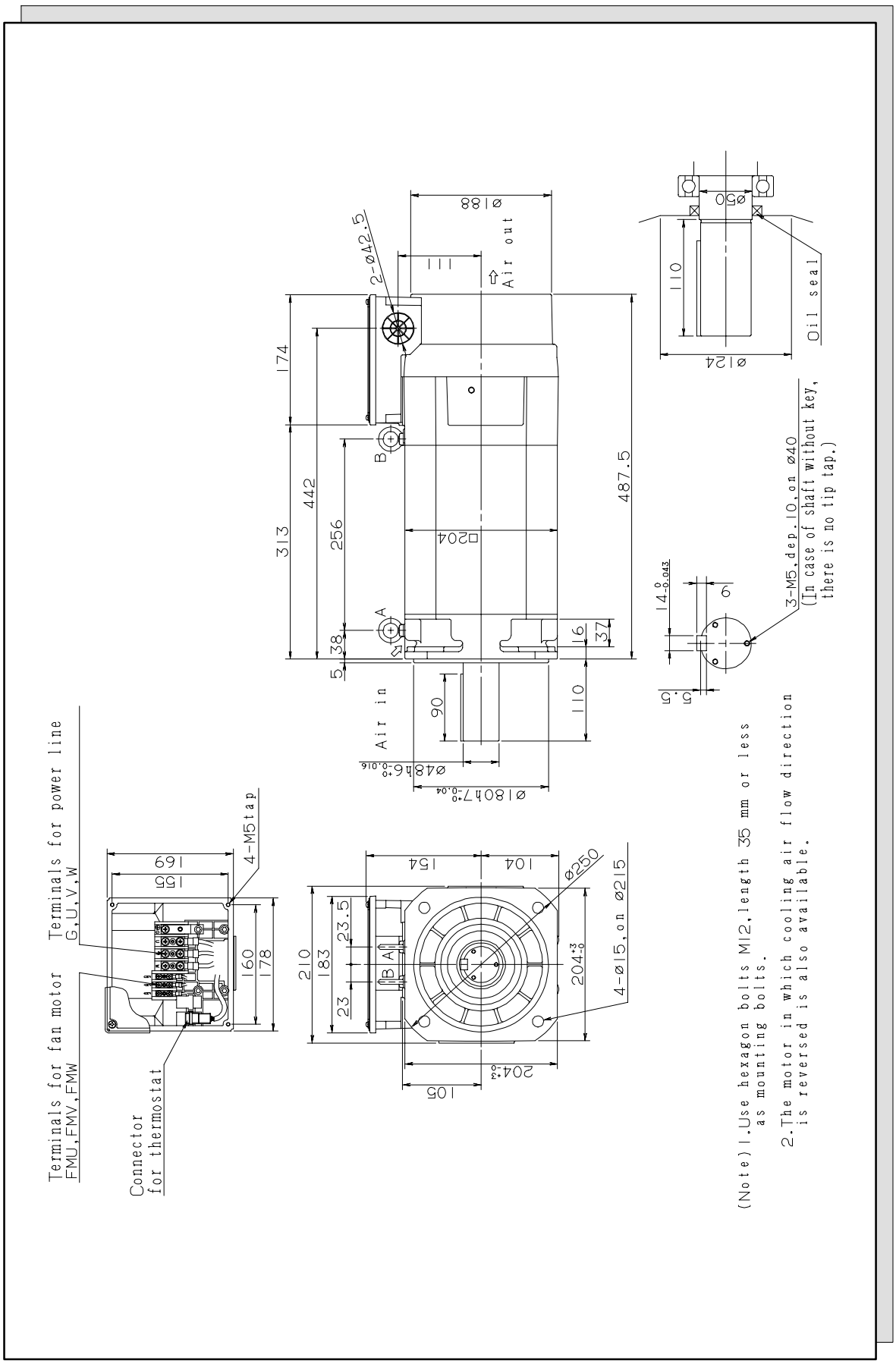


Fig.8 (l) Model αC8 (Foot mounting type)

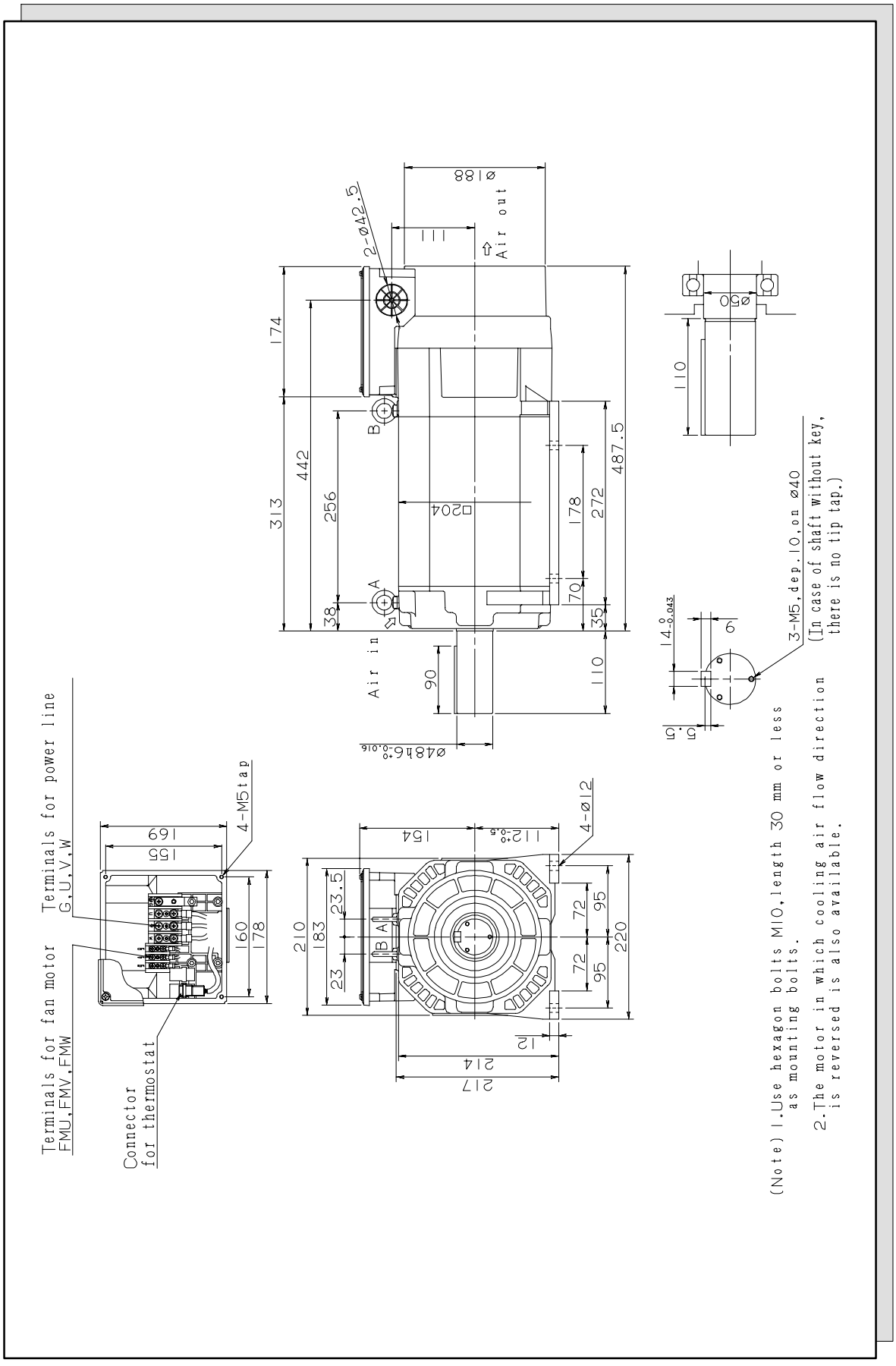


Fig.8 (m) Model αC12, αC15 (Flange mounting type)

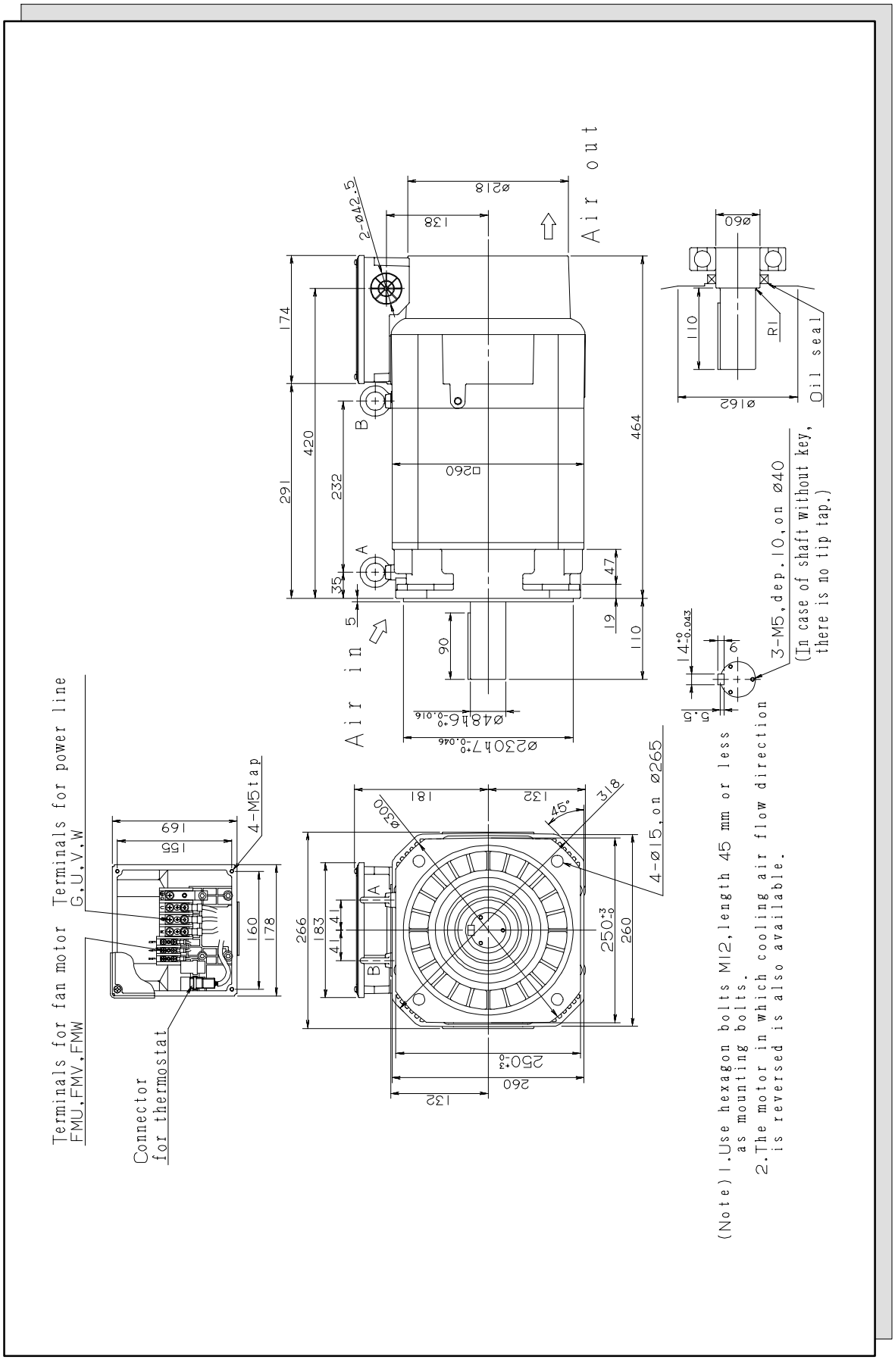


Fig.8 (n) Model αC12, αC15 (Foot mounting type)

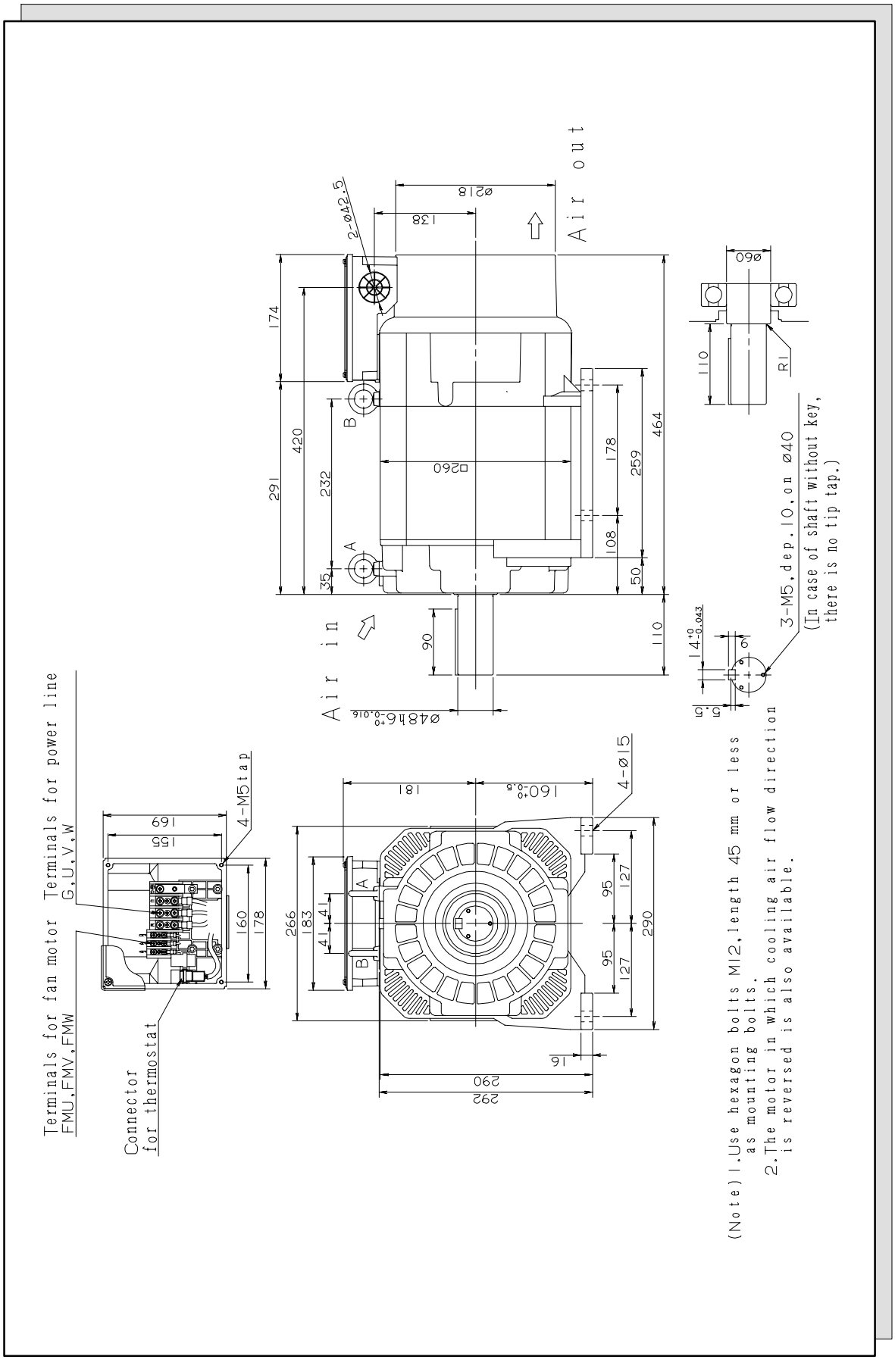


Fig.8 (o) Model αC18, αC22 (Flange mounting type)

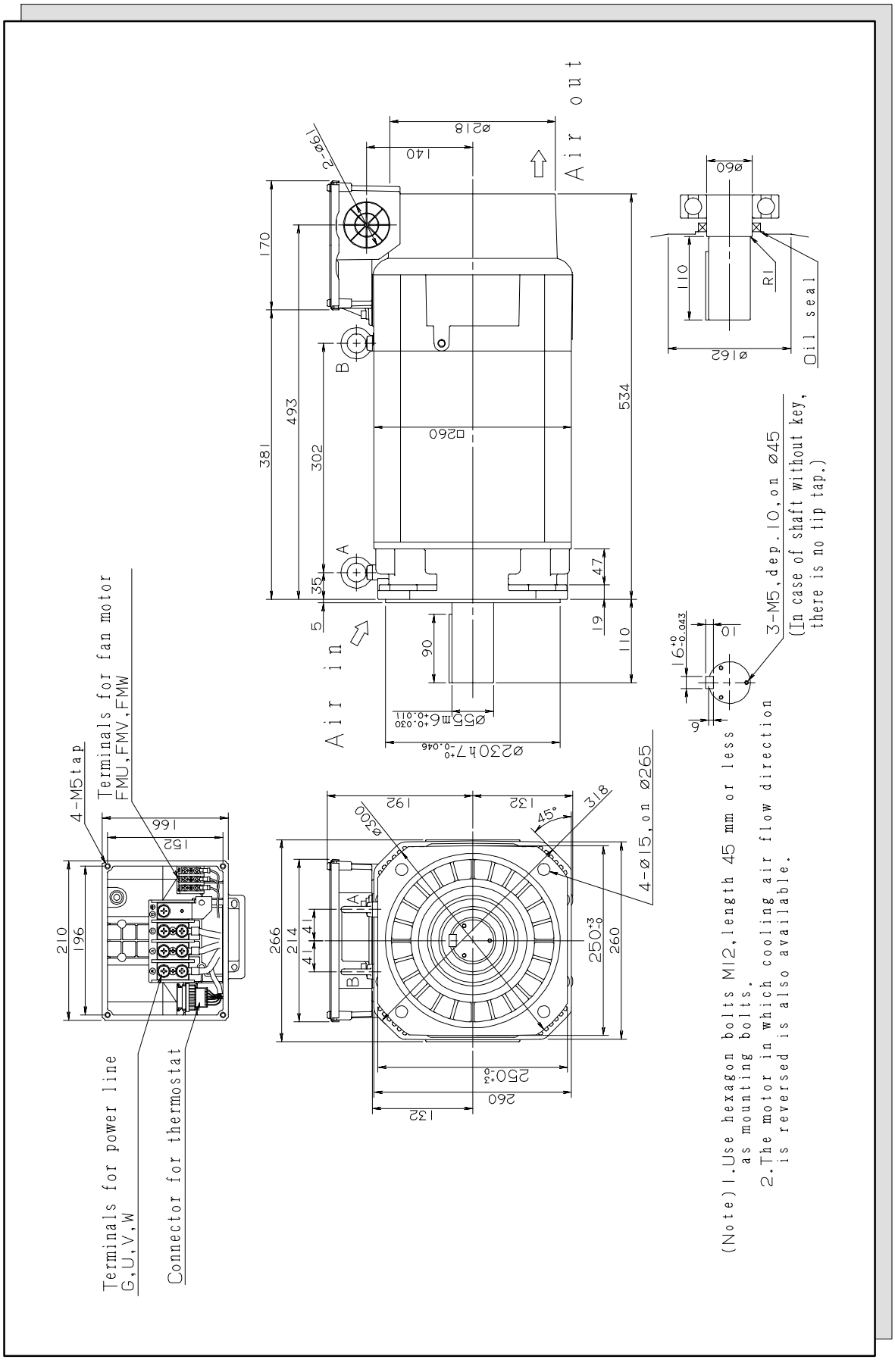
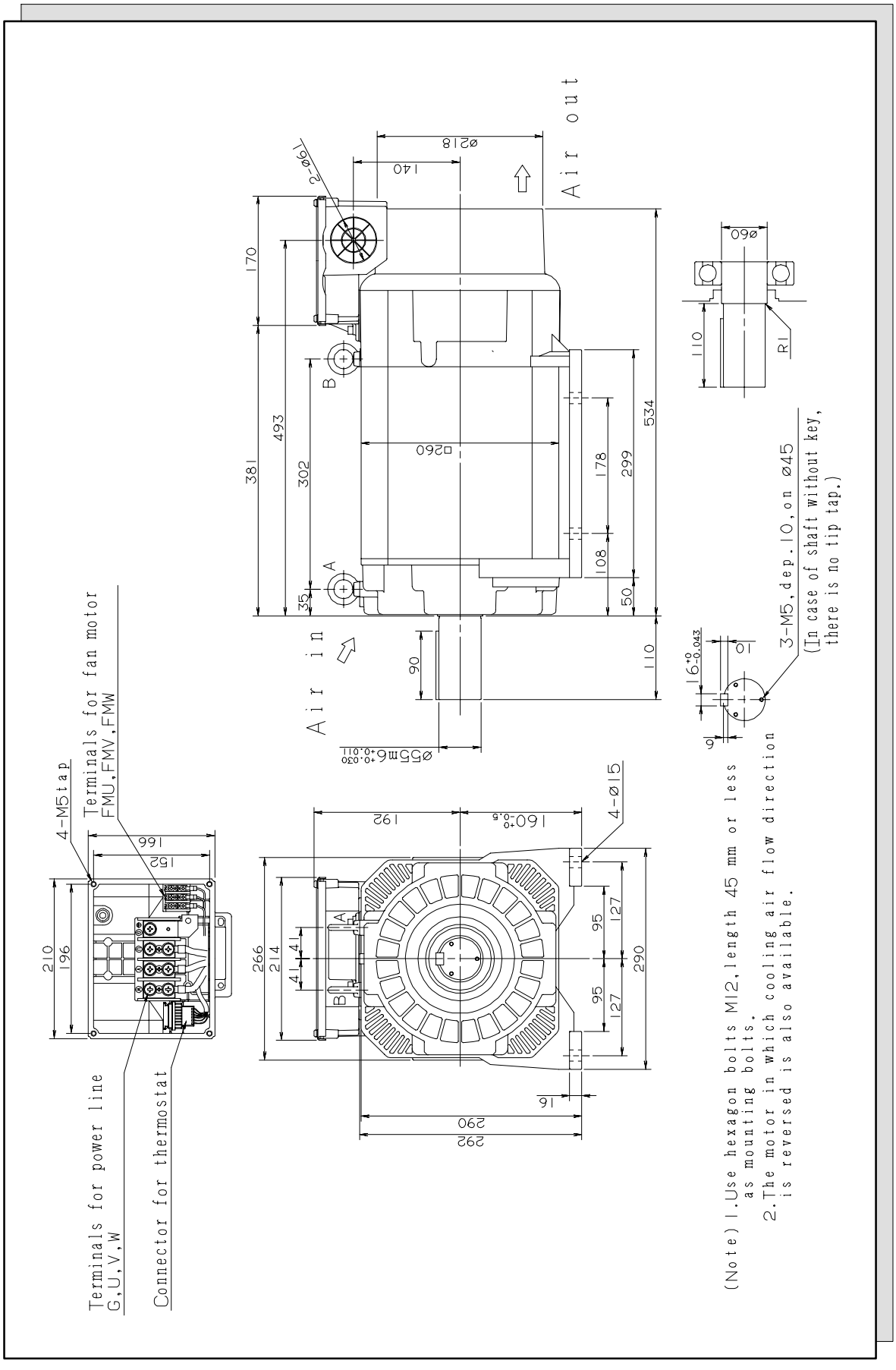


Fig.8 (p) **Model αC18, αC22 (Foot mounting type)**



APPENDIX

A EXTERNAL DIMENSIONS AROUND THE FOOT

Refer to the external dimensions of each motor about the dimensions which are not described in these figures.

Fig.A (a) Model α1, α1.5, αC1, αC1.5 (Foot mounting type)

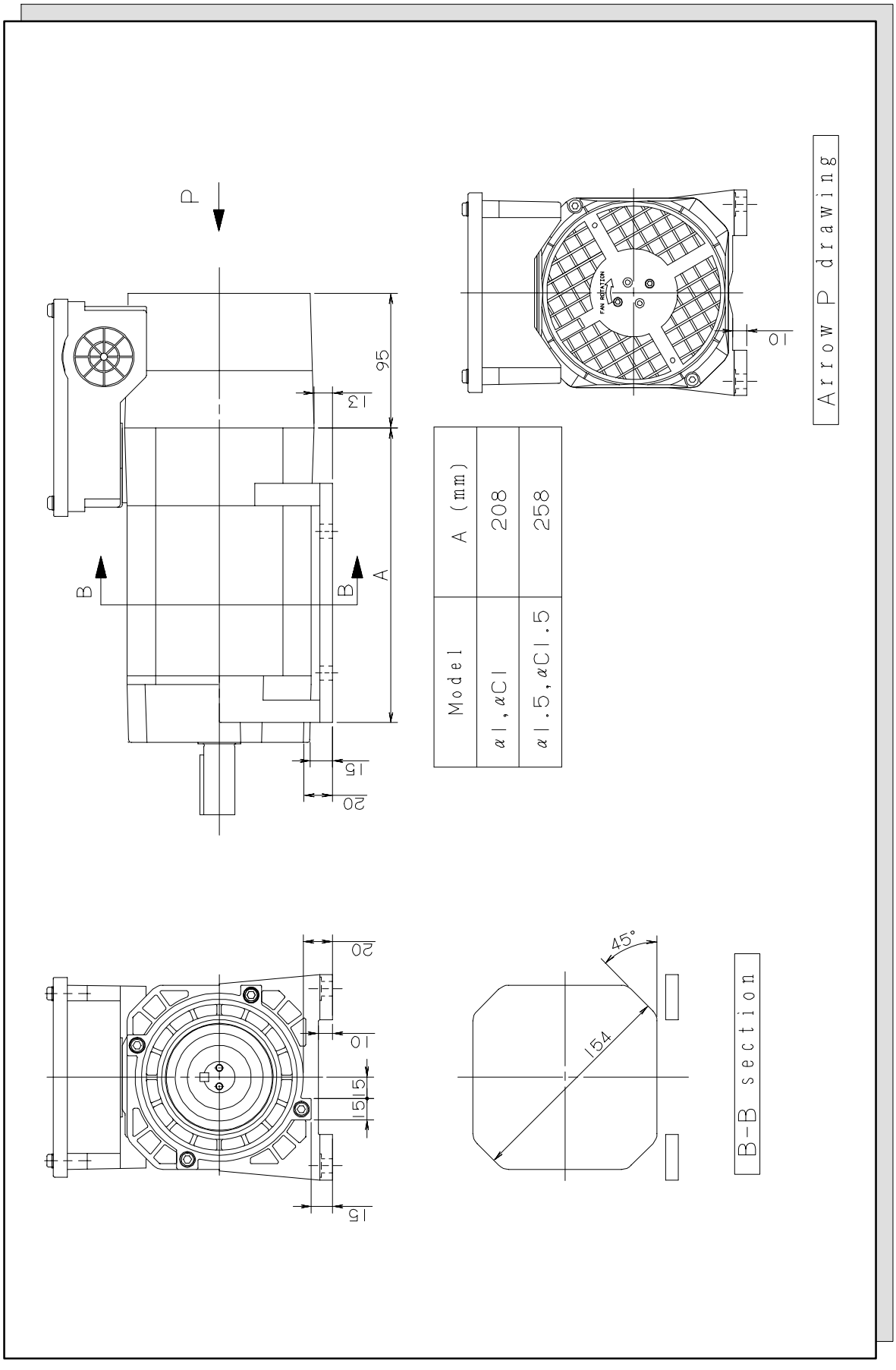
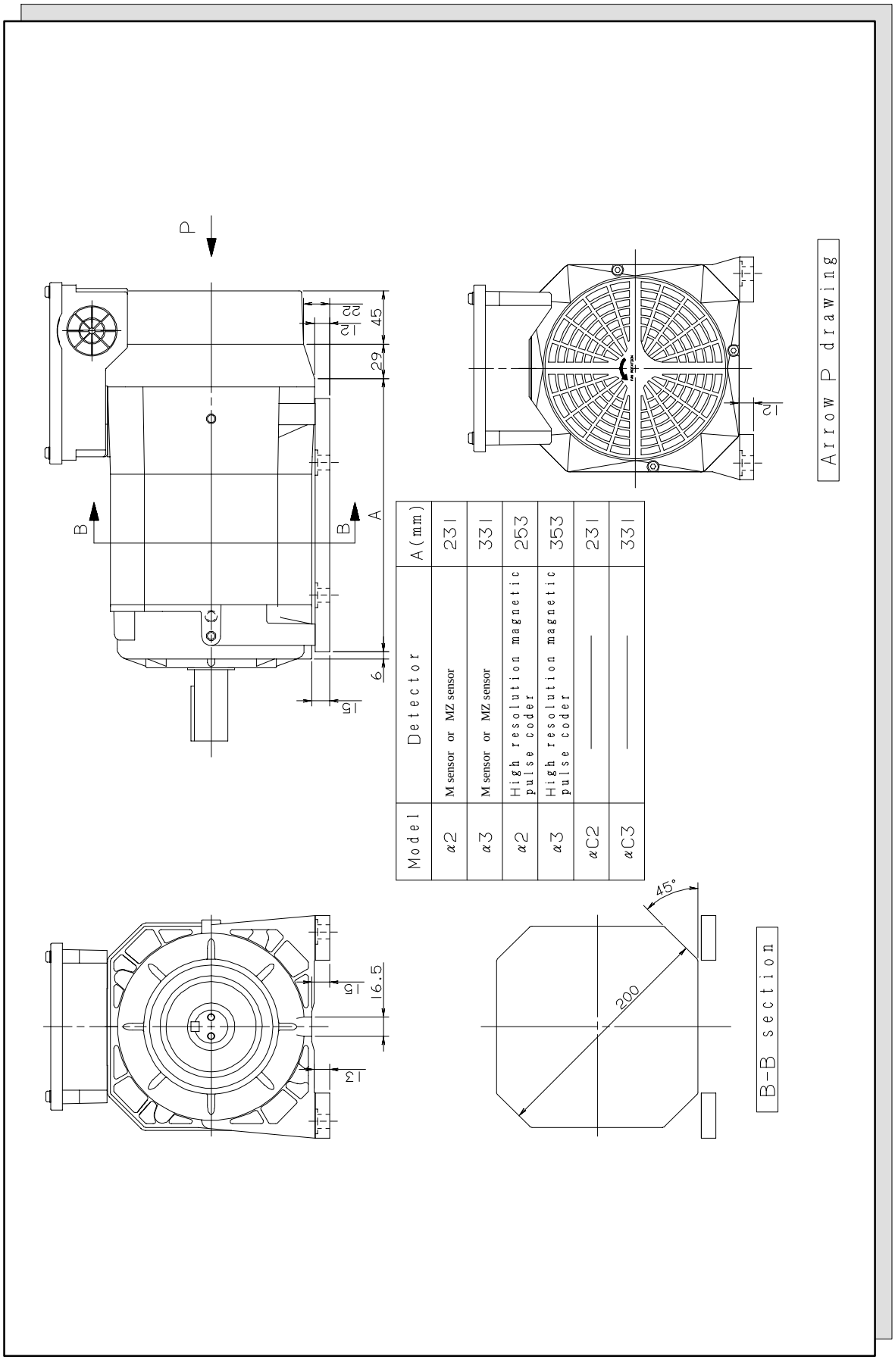


Fig.A (b) Model α2, α3, αC2, αC3 (Foot mounting type)



Model	Detector	A (mm)
αi2	M sensor or MZ sensor	231
αi3	M sensor or MZ sensor	331
α2	High resolution magnetic pulse coder	253
α3	High resolution magnetic pulse coder	353
αC2	———	231
αC3	———	331

Fig.A (c) Model α6, α8, αP8, α6HV, α8HV, αC6, αC8 (Foot mounting type)

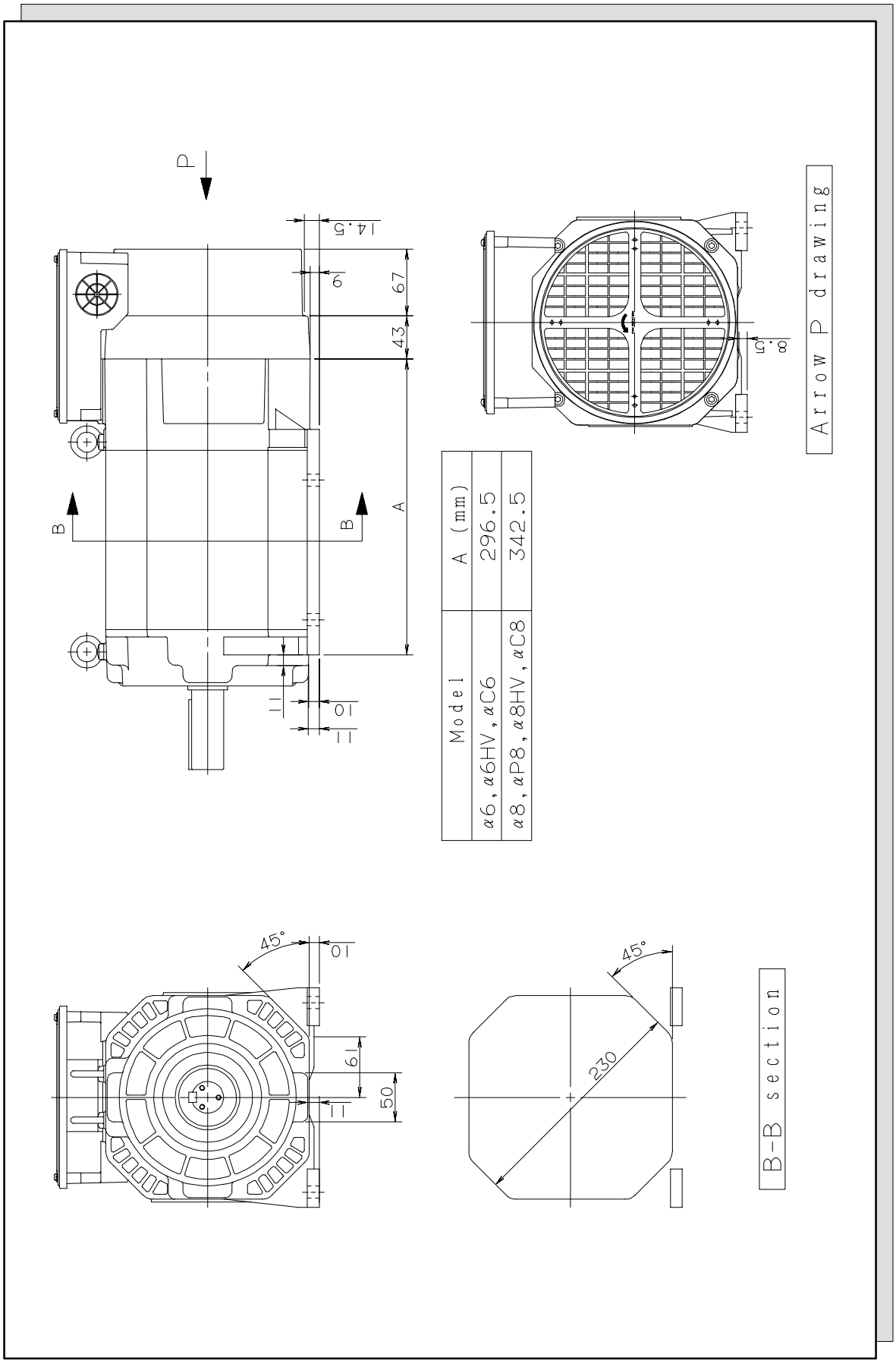
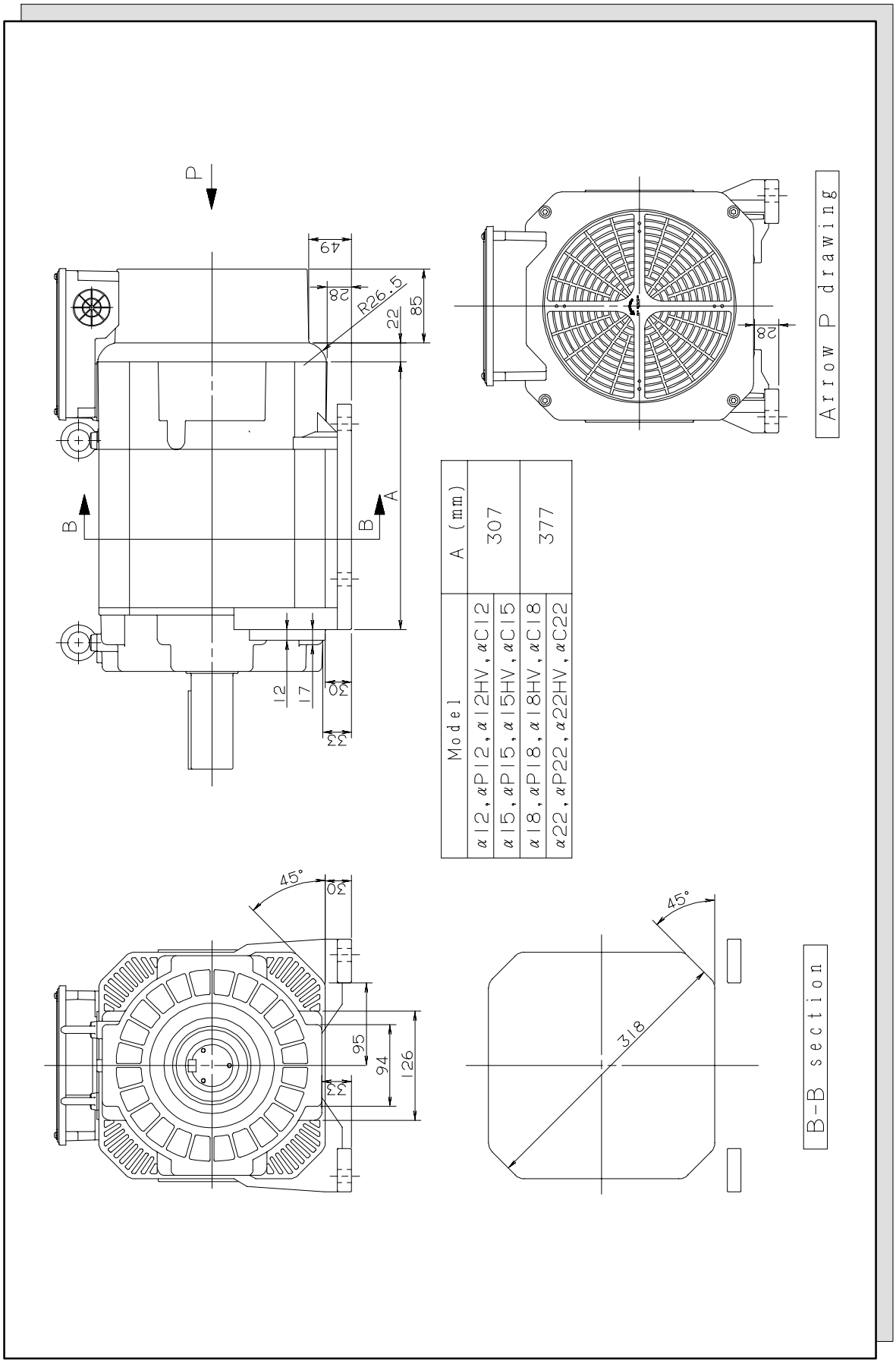
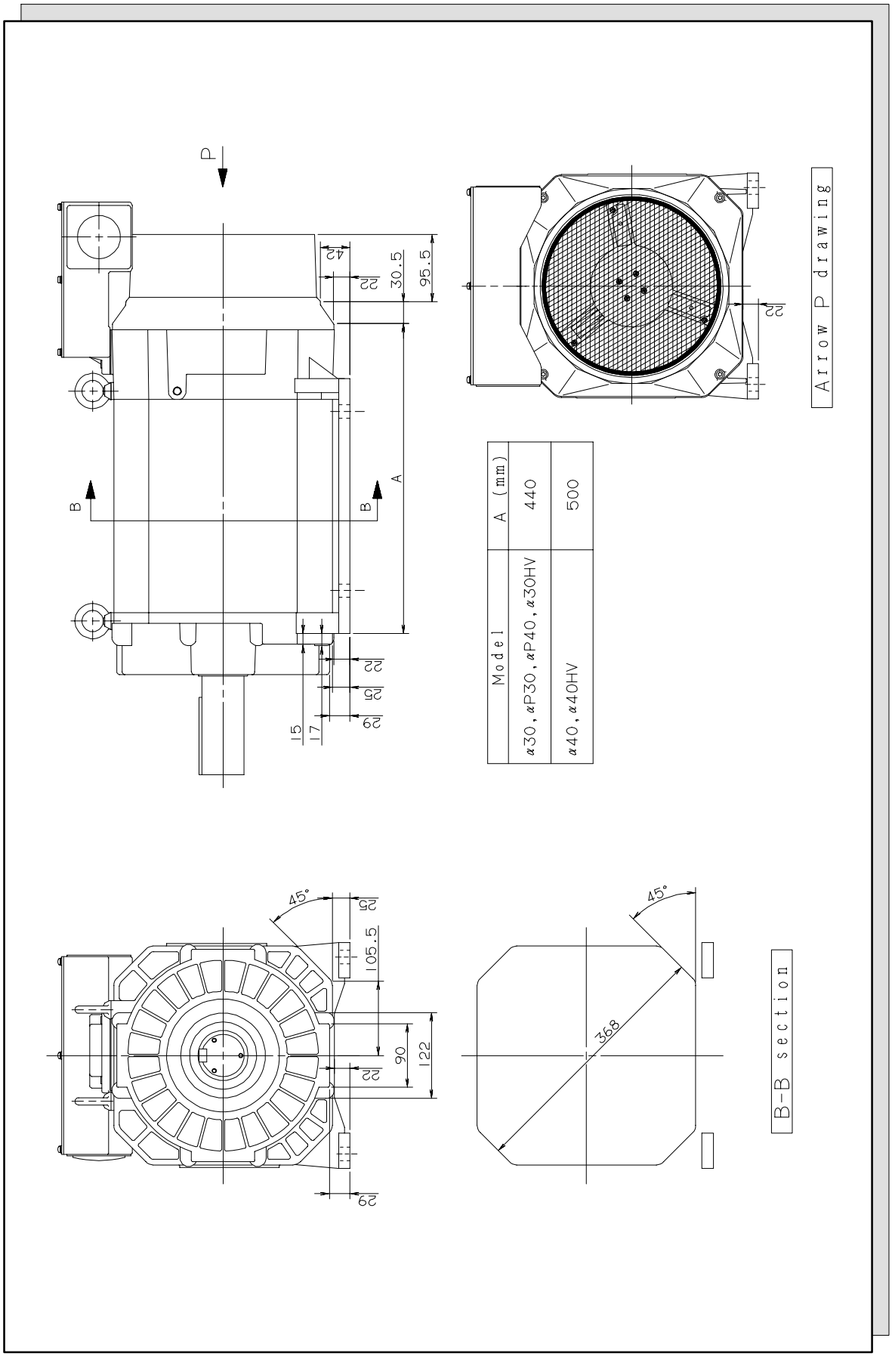


Fig.A (d) **Model α12 to α22, αP12 to αP22, α12HV to α22HV, αC12 to αC22 (Foot mounting type)**



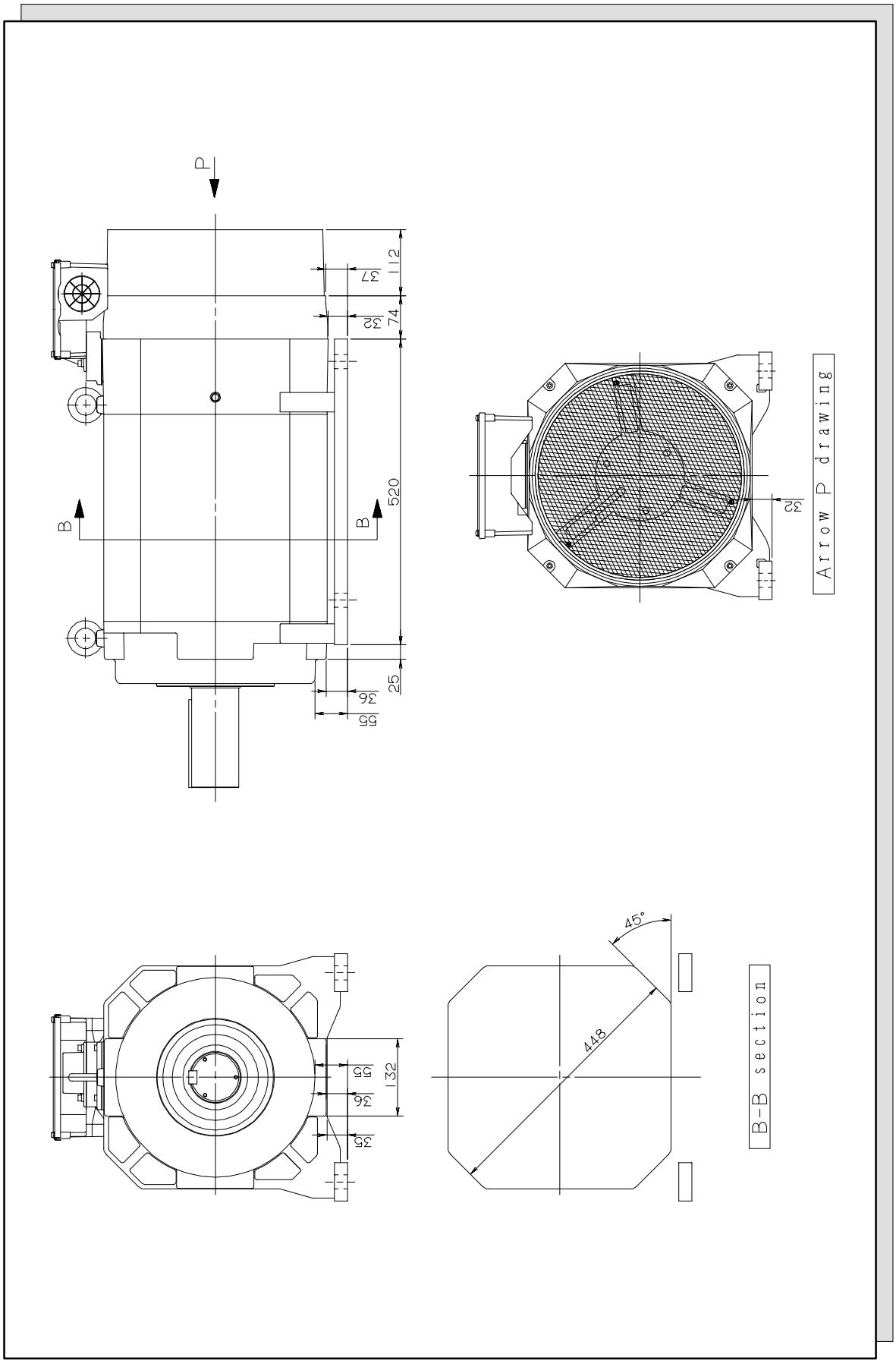
Model	A (mm)
α12, αP12, α12HV, αC12	307
α15, αP15, α15HV, αC15	
α18, αP18, α18HV, αC18	377
α22, αP22, α22HV, αC22	

Fig.A (e) Model α30,α40, αP30, αP40, α30HV, α40HV (Foot mounting type)



Model	A (mm)
α30, αP30, αP40, α30HV	440
α40, α40HV	500

Fig.A (f) Model αP50, αP60, α60HV (Foot mounting type)

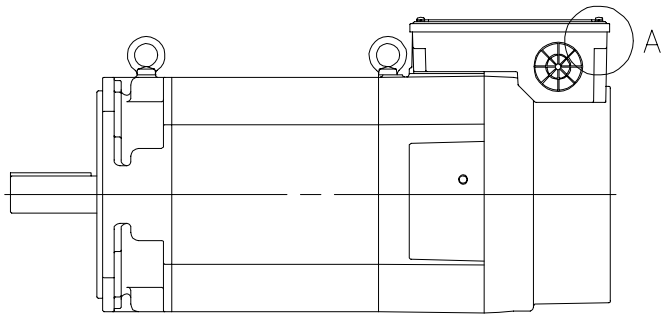


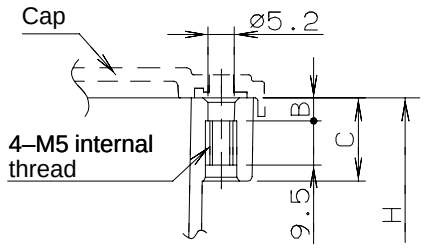
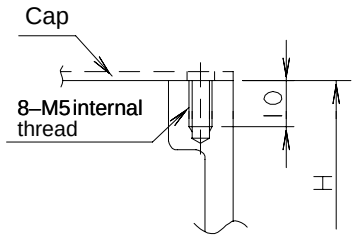
B DIMENSIONS OF INTERNAL THREADS FOR EYEBOLTS

Model	Internal thread	Depth [mm]
α 2, α 3 α C2, α C3	M8	10
α 6, α 8 α P8 α 6HV, α 8HV α C6, αC8	M8	15
α 12 to α 22 α P12 to α P22 α 12HV to α 22HV α C12 to α C22	M10	18
α 30, α 40 α P30, α P40 α 30HV, α 40HV	M12	20
α P50, α P60 α 60HV	M14	24

NOTE
1 Model α 0.5, α 1, α 1.5, α C1 and α C1.5 have no internal threads for eyebolts.
2 Dimensions of high speed models are same as above.

C DIMENSIONS OF THE TERMINAL BOX'S INTERNAL THREAD



MODEL	H (mm)	B (mm)	C (mm)	A (Magnified view)
α1, α1.5, αC1, αC1.5	113	5	18	
α2, α3, αC2, αC3	132.5			
α6, α8, αP8, α6HV, α8HV, αC6, αC8	145			
α12, α15, αP12 to αP22, αC12, αC15, α12HV, α15HV	172			
α18, α22, αC18, αC22, α18HV, α22HV	183	10	23	
αP30, αP40	209			
αP50	270			
α30, α40, α30HV, α40HV	226			
αP60, α60HV	259			

CAUTION
When you use other lid from standard one, please put on a packing, that is IP54 or more, to the lid.

NOTE
Dimensions of high speed models are same as above.

D PARTS FOR MAINTENANCE

(1) Terminal box parts

Model	Terminal box assembly		Terminal box lid
	B□0□ or B□9□ as the last segment of the motor specification number (*1)	**B□3□ as the last segment of the motor specification number (*1)**	
α1, α1.5, αC1, αC1.5	A290–0850–T400	—	A290–0853–V410
α2, α3, αC2, αC3	A290–0853–T400	A290–0853–T401	A290–0853–V410
α6 to α15 αP8 to αP22 α6HV to α15HV αC6 to αC15	A290–0854–T400	A290–0854–T401	A290–0854–V410
α18, α22, α18HV, α22HV αC18, αC22	A290–0731–T420	A290–0731–T421	A290–0731–V410
α30, α40, α30HV to α60HV	A290–0860–T400	A290–0860–T401	A290–1040–X402
αP30 to αP50	A290–0731–T455	A290–0731–T456	A290–0731–V410
αP60	A290–0833–T400	A290–0833–T401	A290–1040–X402
α60HV	A290–0860–T403	A290–0860–T404	A290–1040–X402

NOTE
*1 For example, B□0□ for A06B–0856–B100 and B□3□ for A06B–0856–B130.
*2 This table may not apply to the motors with B9□□.
Please make contact with the FANUC service staff.
*3 Parts of high speed models are same as above.

(2) Fan motor parts

Model	Fan cover	Fan motor	Air flow direction
α1, α1.5 αC1, αC1.5	A290–0850–T500 (*4)	A90L–0001–0446/R	Exhaust rear
	A290–0850–T501 (*4)	A90L–0001–0446/F	Exhaust front
α2, α3 αC2, αC3	A290–0853–X501	A90L–0001–0442/R	Exhaust rear
		A90L–0001–0442/F	Exhaust front
α6, α8, αP8 αC6, αC8	A290–0854–X501	A90L–0001–0443/R	Exhaust rear
		A90L–0001–0443/F	Exhaust front
α12, α15, αP12, αP15, αC12, αC15	A290–0856–X501	A90L–0001–0444/RS	Exhaust rear
		A90L–0001–0444/FS	Exhaust front
α18, α22, αP18, αP22 αC18, αC22	A290–0856–X501	A90L–0001–0444/R	Exhaust rear
		A90L–0001–0444/F	Exhaust front
α30, α40 αP30, αP40	A290–0731–T510 (*4)	A90L–0001–0318/R	Exhaust rear
	A290–0731–T511 (*4)	A90L–0001–0318/F	Exhaust front
αP50, αP60	A290–0832–T500 (*4)	A90L–0001–0319/R	Exhaust rear
	A290–0832–T501 (*4)	A90L–0001–0319/F	Exhaust front
α6HV, α8HV	A290–0854–X501	A90L–0001–0457/R	Exhaust rear
		A90L–0001–0457/F	Exhaust front
α12HV, α15HV	A290–0856–X501	A90L–0001–0458/RS	Exhaust rear
		A90L–0001–0458/FS	Exhaust front
α18HV, α22HV	A290–0856–X501	A90L–0001–0458/R	Exhaust rear
		A90L–0001–0458/F	Exhaust front
α30HV, α40HV	A290–0780–T510 (*4)	A90L–0001–0339/R	Exhaust rear
	A290–0780–T511 (*4)	A90L–0001–0339/F	Exhaust front
α60HV	A290–0883–T500 (*4)	A90L–0001–0400/R	Exhaust rear
	A290–0883–T501 (*4)	A90L–0001–0400/F	Exhaust front

NOTE

*4 These specification number include fan motors.

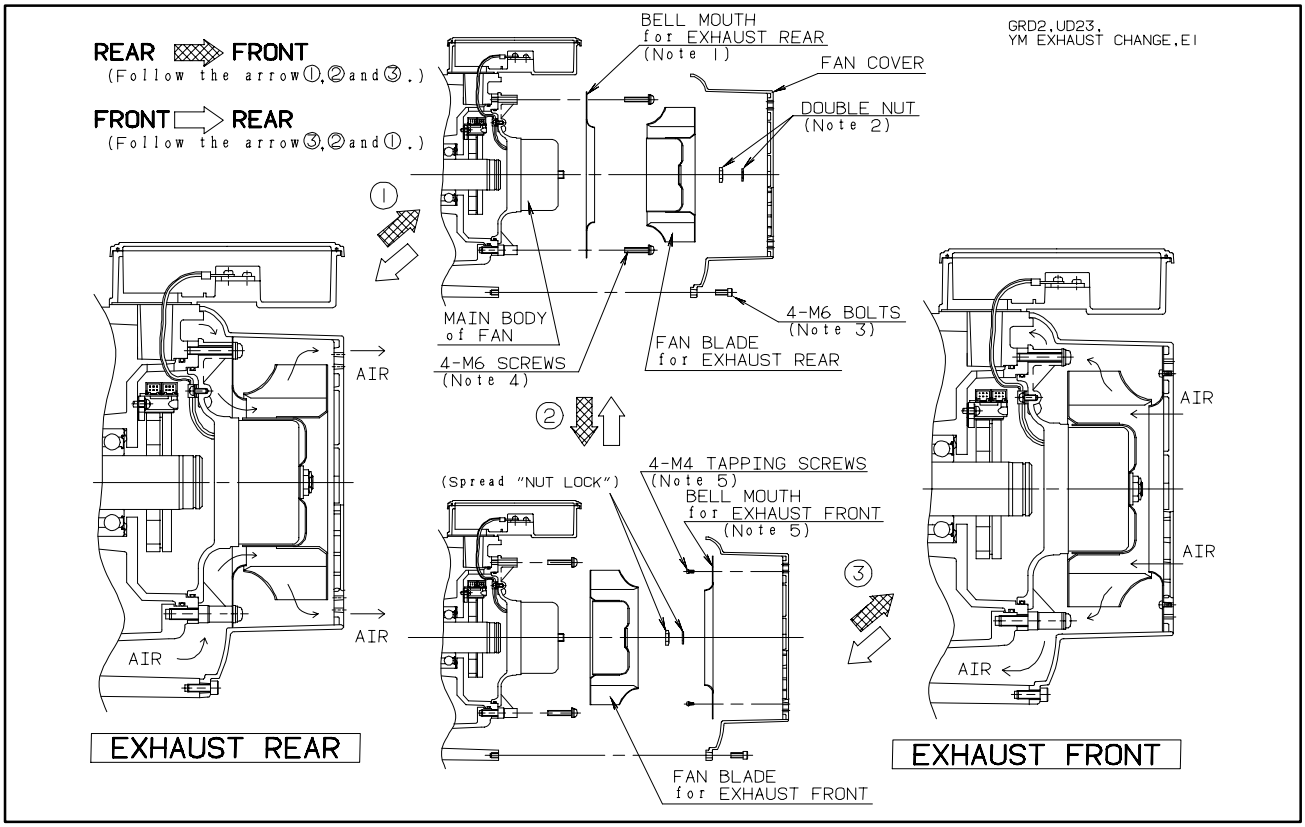
*5 This table may not apply to the motors with B9□□.
Please make contact with the FANUC service staff.

*6 Parts of high speed models are same as above.

E METHOD OF CHANGING EXHAUST DIRECTION

The fan assembly is usually changed to change the exhaust direction. However, for model α2 to α22, αP8 to αP22, α6HV to α22HV and αC2 to αC22, including high speed models, it is possible to change the exhaust direction only by changing a fan blade and a bell mouth. In this case, it is not necessary to change the main body of fan.
The following parts are necessary. Please purchase them.

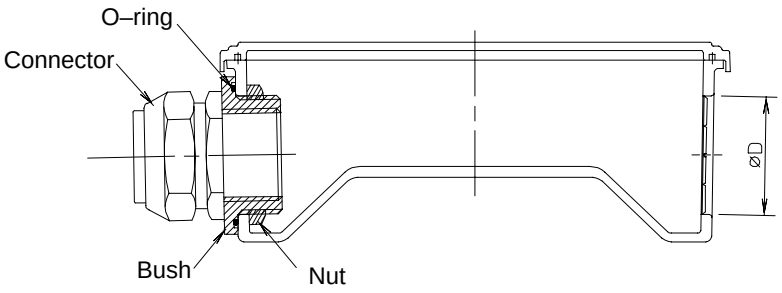
Model	In case of changing front exhaust to rear exhaust	In case of changing rear exhaust to front exhaust
α2, α3, αC2, αC3	A290–0853–T550 (fan blade and plane plate)	A290–0853–T551 (fan blade)
α6, α8, αP8, α6HV, α8HV, αC6, αC8	A290–0854–T550 (fan blade and bell mouth)	A290–0854–T551 (fan blade, bell mouth and four tapping screws)
α12 to α22, αP12 to αP22, α12HV to α22HV, αC12 to αC22	A290–0856–T550 (fan blade and bell mouth)	A290–0856–T551 (fan blade, bell mouth and four tapping screws)



NOTE
1 In case of α2, α3, αC2 and αC3, this is a plane plate.
2 In case of α2 to α6, αP8, α6HV, α8HV and αC2 to αC8, this is a single nut.
3 In case of α2, α3, αC2 and αC3, these are three M5 bolts.
4 In case of α2, α3, αC2 and αC3, these are two M4 bolts.
And for exhaust front, these are not necessary.
5 In case of α2, α3, αC2 and αC3, these are not necessary.

F IN CASE OF USING A SMALLER CONNECTOR THAN THE CABLE HOLE

When you use a smaller connector than the cable hole on the terminal box, please prepare a bush, a nut and an O–ring as below.



Model	ϕD (mm)	Designation of O–ring	
		JIS B 2401	ISO 3601–1
α1 to α15 αP8 to αP22 α6HV to α15HV αC1 to αC15	42.5	P 46	C0462G
α18 to α40 αP30 to αP60 α18HV to α60HV αC18, αC22	61	P 65	C0650G

NOTE
For high speed models, those are same as above.

G CURRENT OF THE FAN MOTOR

(1) Fan motors for α series, αP series and αC series

Model	50 Hz				60 Hz			
	200 V		230 V		200 V		230 V	
	Rated current [A]	Inrush current (*1) [A]	Rated current [A]	Inrush current (*1) [A]	Rated current [A]	Inrush current (*1) [A]	Rated current [A]	Inrush current (*1) [A]
α1, α1.5, αC1, αC1.5	0.086	0.410	0.107	0.460	0.083	0.380	0.088	0.470
α2, α3, αC2, αC3	0.095	0.500	0.112	0.560	0.093	0.480	0.099	0.540
α6, α8, αP8, αC6, αC8	0.107	0.500	0.116	0.560	0.122	0.480	0.125	0.560
α12 to α22, αP12 to αP22, αC12 to αC22	0.168	1.200	0.159	1.300	0.237	1.150	0.223	1.300
α30, α40, αP30, αP40	0.375	3.100	0.358	3.600	0.530	3.200	0.510	3.600
αP50, αP60	0.420	4.200	0.495	4.400	0.445	3.800	0.455	4.400

NOTE
*1 Inrush current at turn–on the fan motor.
*2 These are not guaranteed values but guidelines.
*3 Current of high speed models are same as above.

(2) Fan motors for α(HV) series

Model	50 Hz				60 Hz			
	400 V		460 V		400 V		460 V	
	Rated current [A]	Inrush current (*1) [A]	Rated current [A]	Inrush current (*1) [A]	Rated current [A]	Inrush current (*1) [A]	Rated current [A]	Inrush current (*1) [A]
α6HV, α8HV	0.061	0.300	0.072	0.340	0.068	0.300	0.072	0.340
α12HV to α22HV	0.290	1.000	0.485	1.150	0.220	0.950	0.285	1.050
α30HV, α40HV	0.212	2.000	0.222	2.200	0.272	2.000	0.266	2.200
α60HV	0.218	2.100	0.277	2.400	0.216	2.100	0.231	2.200

NOTE
*1 Inrush current at turn–on the fan motor.
*2 These are not guaranteed values but guidelines.

H EXPLANATION OF RATED OUTPUT

H.1 CONTINUOUS RATED OUTPUT

An output at which the motor may be operated for an unlimited period.

H.2 SHORT TIME RATED OUTPUT

30 min rated output: An output at which the motor may be operated for 30 min, starting at the ambient temperature.

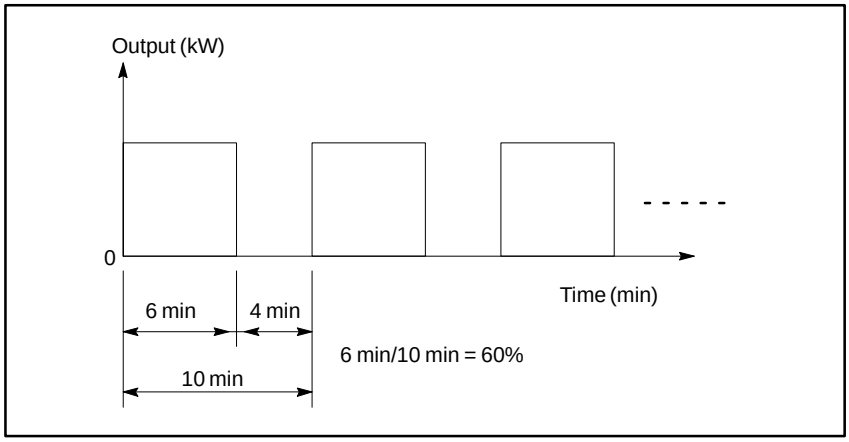
15 min rated output: An output at which the motor may be operated for 15 min, starting at the ambient temperature.

10 min rated output: An output at which the motor may be operated for 10 min, starting at the ambient temperature.

120 min rated output: An output at which the motor may be operated for 120 min, starting at the ambient temperature.

H.3 S3 xx% RATED OUTPUT

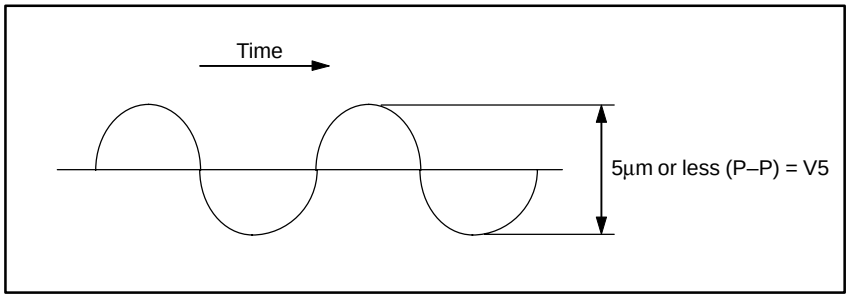
An output at which the motor may be operated on duty cycles. The time for a duty cycle shall be 10 min and the cycle duration factor shall be xx%. In case of S3 60% rated output, the cycle duration factor is 60% as below.



VIBRATIONS

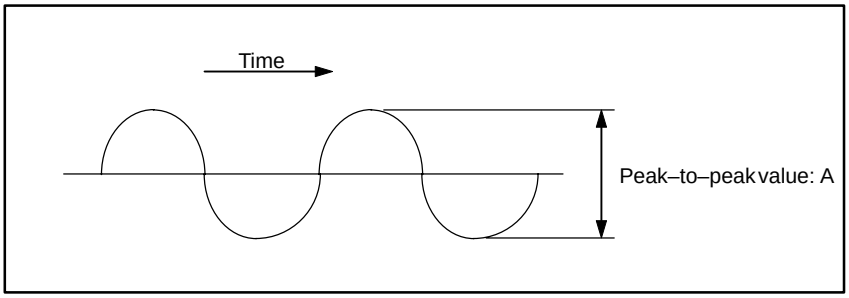
I.1 DESCRIPTION OF VIBRATION LEVEL V5

The amplitude of the vibration may be indicated with a sine wave as shown in the figure below. In this case, when the peak–to–peak (P–P) value of the sine wave is 5μm or less, the vibration level is V5. (When the value is 10μm or less, the level is V10.)



I.2 RELATIONSHIP BETWEEN THE AMPLITUDE OF VIBRATION AND VIBRATION SPEED

Note the following relationship between the peak–to–peak value and the vibration speed. The peak–to–peak value can be calculated from the vibration speed.



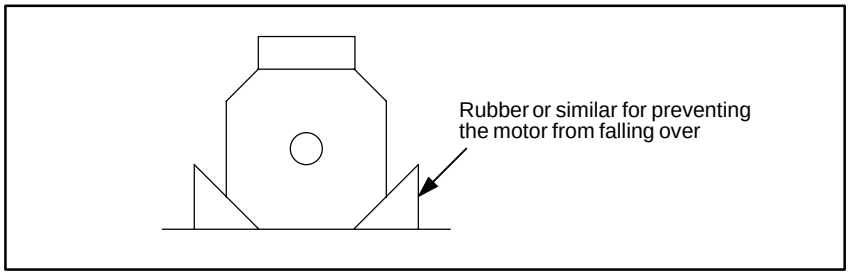
$A = 6 \times 10^5 \times V/\pi/N$

A : Peak–to–peak value [μm]
V : Vibration speed [cm/sec]
N : Motor speed [min^{-1}]

A vibration can be measured based on the vibration speed to remove vibrations caused by the current wave and low–frequency vibrations of the base and other items so that a stable measurement value can be obtained. Therefore, the vibration speed is useful for measuring vibrations caused by an unbalanced spinning body.

I.3 NOTES ON MEASURING VIBRATIONS

- For a motor with a key, fix a half key (key of half the thickness of the supplied key) in the keyway of the output shaft with a pipe or fix the supplied key with a pulley for which the balance has been corrected. (See 5., “Dynamic balance,” in Section 4.1, “Common Items,” in Chapter 4, “Notes on Mounting.”)
- To measure the vibration of the motor itself, hang the motor from a wire rope or place the motor on a rubber sheet 10 to 20 mm thick. When the vibration of a flange mounting type motor is measured on a rubber sheet, the motor may fall over during acceleration/deceleration. To prevent this from occurring, support the motor as necessary.



I.4 RELATIONSHIP BETWEEN AMPLITUDES OF VIBRATION AND VIBRATION SPEEDS

Motor speed [min^{-1}] / Amplitude of vibration	6000	8000	10000	12000	15000
1μm	0.031 (Vibration speed [cm/sec])	0.042	0.052	0.063	0.079
2μm	0.063	0.084	0.105	0.126	0.157
3μm	0.094	0.126	0.157	0.189	0.236
4μm	0.126	0.168	0.210	0.252	0.314
5μm	0.157	0.210	0.262	0.314	0.393
6μm	0.189	0.252	0.314	0.377	0.472
7μm	0.220	0.293	0.367	0.440	0.550
8μm	0.252	0.335	0.419	0.503	0.629
9μm	0.283	0.377	0.472	0.566	0.707
10μm	0.314	0.419	0.524	0.629	0.786

J CONDITIONS OF IEC34 STANDARD CONFORMATIONS

J.1 SCOPE

This chapter describes about the conditions which are required for α, αP α(HV) and αC series motors to be certified to conform IEC34 standard.

(1) When the motors meet the next restrictions and fill the following conditions, they are certified as conforming to IEC–34–1.

Restrictions: Specifying #T0xx or #U0xx on the end of the specifications, or manufacturing on and after April 1995. Following letters (u, v, w, y and z) are limited as follows. u: 1–8, v: 0, 3, 8 or 9, w: 0, 1, 6 or 7, y: 4 or 5, z: 2 or 3, x: no limits

α series

Model name	Motor spec. no.
α0.5	A06B–0866–Buvw, A06B–0866–Buvw#x0xx
α1	A06B–0850–Buvw, A06B–0850–Buvw#x0xx
α1.5	A06B–0851–Buvw, A06B–0851–Buvw#x0xx
α2	A06B–0852–Buvw, A06B–0852–Buvw#x0xx
α3	A06B–0853–Buvw, A06B–0853–Buvw#x0xx
α6	A06B–0854–Buvw, A06B–0854–Buvw#x0xx
α8	A06B–0855–Buvw, A06B–0855–Buvw#x0xx
α12	A06B–0856–Buvw, A06B–0856–Buvw#x0xx
α15	A06B–0857–Buvw, A06B–0857–Buvw#x0xx
α18	A06B–0858–Buvw, A06B–0858–Buvw#x0xx
α22	A06B–0859–Buvw, A06B–0859–Buvw#x0xx
α30	A06B–0860–Buvw, A06B–0860–Buvw#x0xx
α40	A06B–0868–Buvw, A06B–0868–Buvw#x0xx

α series (High speed models)

Model name	Motor spec. no.
α1/15000	A06B–0850–Buvy, A06B–0850–Buvy#x0xx
α2/15000	A06B–0852–Buvy, A06B–0852–Buvy#x0xx
α3/12000	A06B–0853–Buvy, A06B–0853–Buvy#x0xx
α6/12000	A06B–0854–Buvz, A06B–0854–Buvz#x0xx
α8/8000	A06B–0855–Buvz, A06B–0855–Buvz#x0xx
α12/8000	A06B–0856–Buvz, A06B–0856–Buvz#x0xx
α15/8000	A06B–0857–Buvz, A06B–0857–Buvz#x0xx
α18/8000	A06B–0858–Buvz, A06B–0858–Buvz#x0xx
α22/8000	A06B–0859–Buvz, A06B–0859–Buvz#x0xx
α30/6000	A06B–0860–Buvz, A06B–0860–Buvz#x0xx

α P series

Model name	Motor spec. no.
αP8	A06B–0825–Buvw, A06B–0825–Buvw#x0xx
αP12	A06B–0826–Buvw, A06B–0826–Buvw#x0xx
αP15	A06B–0827–Buvw, A06B–0827–Buvw#x0xx
αP18	A06B–0828–Buvw, A06B–0828–Buvw#x0xx
αP22	A06B–0829–Buvw, A06B–0829–Buvw#x0xx
αP30	A06B–0830–Buvw, A06B–0830–Buvw#x0xx
αP40	A06B–0831–Buvw, A06B–0831–Buvw#x0xx
αP50	A06B–0832–Buvw, A06B–0832–Buvw#x0xx
αP60	A06B–0833–Buvw, A06B–0833–Buvw#x0xx

α P series (High speed models)

Model name	Motor spec. no.
αP8/8000	A06B–0825–Buvz, A06B–0825–Buvz#x0xx
αP12/8000	A06B–0826–Buvz, A06B–0826–Buvz#x0xx
αP15/8000	A06B–0827–Buvz, A06B–0827–Buvz#x0xx
αP18/8000	A06B–0828–Buvz, A06B–0828–Buvz#x0xx
αP22/8000	A06B–0829–Buvz, A06B–0829–Buvz#x0xx
αP30/6000	A06B–0830–Buvz, A06B–0830–Buvz#x0xx
αP40/6000	A06B–0831–Buvz, A06B–0831–Buvz#x0xx

α (HV) series

Model name	Motor spec. no.
α6HV	A06B–0874–Buvw, A06B–0874–Buvw#x0xx
α8HV	A06B–0875–Buvw, A06B–0875–Buvw#x0xx
α12HV	A06B–0876–Buvw, A06B–0876–Buvw#x0xx
α15HV	A06B–0877–Buvw, A06B–0877–Buvw#x0xx
α18HV	A06B–0878–Buvw, A06B–0878–Buvw#x0xx
α22HV	A06B–0879–Buvw, A06B–0879–Buvw#x0xx

α C series

Model name	Motor spec. no.
αC1	A06B–0840–Buvw, A06B–0840–Buvw#x0xx
αC1.5	A06B–0841–Buvw, A06B–0841–Buvw#x0xx
αC2	A06B–0842–Buvw, A06B–0842–Buvw#x0xx
αC3	A06B–0843–Buvw, A06B–0843–Buvw#x0xx
αC6	A06B–0844–Buvw, A06B–0844–Buvw#x0xx
αC8	A06B–0845–Buvw, A06B–0845–Buvw#x0xx

When the motors meet the next restrictions and fill the follwoing conditions, they are regarded to conform IEC34–1 and we are now applying for certification.

Restrictions : Following letters (u, v and w) are limited as follows.
u: 1–8, v: 0, 3 or 9, w: 0 or 1, x: no limits

α (HV) series

Model name	Motor spec. no.
α30(HV)	A06B–0880–Buvw, A06B–0880–Buvw#x0xx
α40(HV)	A06B–0881–Buvw, A06B–0881–Buvw#x0xx
α60(HV)	A06B–0883–Buvw, A06B–0883–Buvw#x0xx

α C series

Model name	Motor spec. no.
αC12	A06B–0846–Buvw, A06B–0846–Buvw#x0xx
αC15	A06B–0847–Buvw, A06B–0847–Buvw#x0xx
αC18	A06B–0848–Buvw, A06B–0848–Buvw#x0xx
αC22	A06B–0849–Buvw, A06B–0849–Buvw#x0xx

J.2 DRIVE DEVICE

(1) FANUC AC spindle motor α, αP, αC series should be driven only by FANUC control motor amplifier (for AC200V–AC230V).

(2) FANUC AC spindle motor α(HV) series should be driven only by FANUC control motor amplifier (for AC400V–AC460V).

J.3 DEGREES OF PROTECTION

Degrees of protection specified by IEC34–5 are as follows.

Motor type	Degrees of protection	Condition for certification
Motor with oil–seal as seal for output shaft (except IP55 models)	IP54	Limited to use conduit hose approved as IP54
Motor with labyrinth or without seal as seal for output shaft	IP40	

IP5x: Dust–protected machine
Ingress of dust is not totally prevented but dust does not enter insufficient quantity to interfere with satisfactory operation of the machine.

IPx4: Machine protected against splashing water
Water splashing against the machine from any direction shall have no harmful effect.

Test conditions of IPx4 are as follows. (In case of using the equipment of Figure 5, IEC34–5)

Nozzle dimensions: Refer to Figure 5, IEC34–5.
Delivery rate: 10 ± 0.5 1/min
Water pressure at nozzle: approximately 80–100kPa (0.8–1.0 bar)
Test duration per m^2 of surface area of machine: 1 min
Minimum test duration : 5 min
Distance from nozzle to machine surface: 300–500 mm

IP4x: Machine protected against solid objects greater than 1mm
Ingress of solid objects exceeding 1 mm in diameter

IPx0: Non–protected machine
No special protection against water

CAUTION
As above mentioned IPx4 motors are tested and certificated in short duration time and pure water. Also possibility of water dry after the test is taken into consideration.
Liquids other than water or continuous supply of water may make harmful influence.

J.4 COOLING METHOD (IEC34–6)

Cooling method specified by IEC34–6 is as follows.

Motor model	IC code	Cooling method
α0.5, α1(IP55), α1.5(IP55), α2(IP55), α3(IP55)	IC0A0	Air cooling, free convection.
α1, α1.5, α30, α40, α1/15000, α30/6000, αP30, αP40, αP50, αP60, αP30/6000, αP40/6000, α30HV, α40HV, αC1, αC1.5	IC0A6	Air cooling, circulation by machine–mounted independent fan.
Models except above–mentioned	IC0A5	Air cooling, circulation by integral independent fan.

J.5 MOUNTING METHOD (IEC34–7)

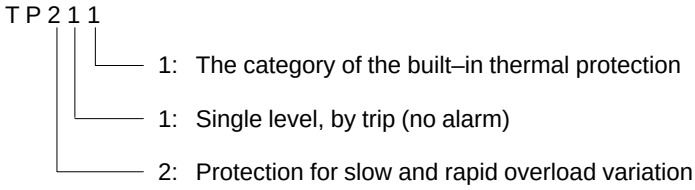
Motors shall be mounted as following method.

IM code	Shaft direction	Mounting type, etc.
IMB5	Horizontal	Flange mounting
IMV1	Vertical down	Flange mounting
IMB3	Horizontal	Foot mounting, foot down
IMB6	Horizontal	Foot mounting, foot left (viewed from shaft end)
IMB7	Horizontal	Foot mounting, foot right (viewed from shaft end)
IMB8	Horizontal	Foot mounting, foot up
IMV5	Vertical down	Foot mounting

NOTE
The output shaft can be oriented in the range from 45° above the horizontal to 90° below the horizontal.

J.6 THERMAL PROTECTION (IEC34–11)

Thermal protection type specified by IEC34–11 is as follows.



J.7 OTHER INFORMATIONS

CAUTION

1 Crimp–style terminal
Use crimp–style terminals with a heat–shrink tube or an insulating tube as those of the power line for the main motor and for the fan motor in the terminal box. When connecting the crimp–style terminal to the terminal block, ensure that the clearance distance between each crimp–style terminal is 1.5mm or more. (3 mm or more for α(HV) series)

2 For plastic terminal box
In case a metal conduit is connected to the plastic terminal box, the conduit should be put to earth on the machine. (For α30, α30/6000, α40, αP60, α30HV, α40HV, and α60HV, those terminal boxes are made from aluminum alloy.)

K CUTTING AMOUNT OF MACHINE

The spindle motor output (HP or KW) of machine tools is specified to indicate their cutting amount, in general.
Regarding the lathing, milling, and drilling, the relation between the rate of metal removal and output power will be described by quoting it from the following reference.

Reference:

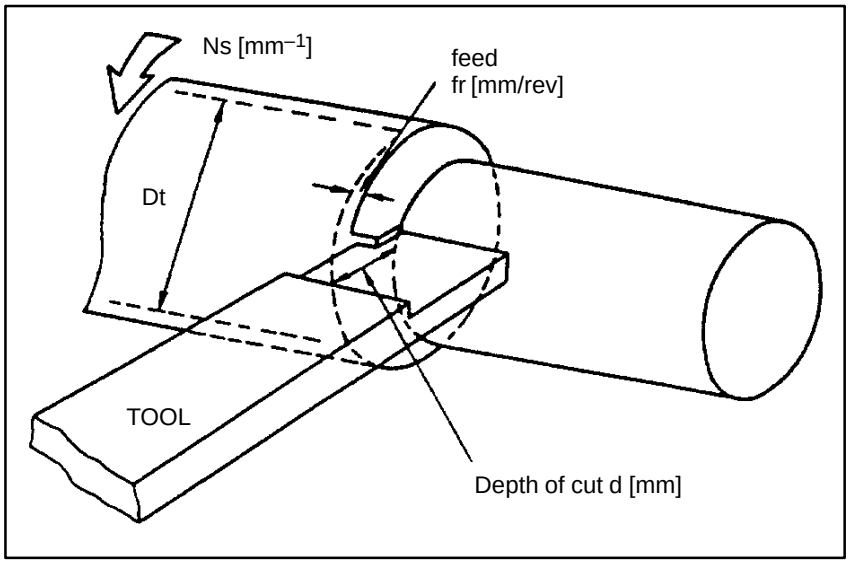
MACHINING DATA HANDBOOK AIR FORCE MATERIAL LABORATORY

K.1 Lathe turning

K.2 Machining center, milling using milling machine

K.3 Machining center, drilling using drilling machine

K.1 TURNING



Cutting conditions:

1) Spindle revolutions Ns (min^{-1})
2) Workpiece diameter Dt (mm)
3) Feed ft (mm/rev)
4) Depth of cut d (mm)

Cutting formulas:

1) Cutting speed
   $Vc = \pi \times Dt \times Ns$ (mm/min)
2) Feed rate
   $fm = fr \times Ns$ (mm/min)
3) Rate of metal removal
   $Q = d \times fr \times Vc/1000$ (cm^3/min)
   $= d \times fr \times \pi/Dt \times Ns/1000$ (cc/min)

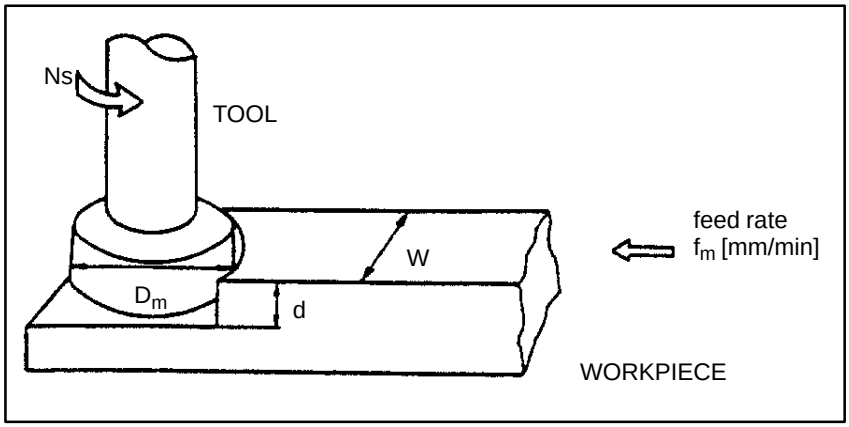
$$\boldsymbol{Q = \pi \times Dt \times d \times fm/1000 \ (cc/min)}$$

4) Power required at spindle
   PS = Q/MRt (kW)
   where,
   MRt : Rate of metal removal per kW (cc/min/kW)
5) Power required at spindle motor

$$\boldsymbol{PM = \frac{1}{\eta} \times Q/MRt \ (kW)}$$

where,
η : Drive efficiency of spindle (%)

K.2 MILLING



Cutting conditions:

1) Spindle revolutions Ns (min^{-1})
2) Diameter of milling cutter Dm (mm)
3) Width of cut w (mm)
4) Depth of cut d (mm)
5) Number of teeth in cutter n (pieces)
6) Feed ft (mm/tooth)

Cutting formulas:

1) Cutting speed
   $Vc = \pi \times Dm \times Ns$ (mm/min)
2) Feed rate
   $fm = ft \times n \times Ns$ (mm/min)
3) Rate of metal removal
   $Q = w \times d \times ft \times n \times Ns/1000$ (cm^3/min)

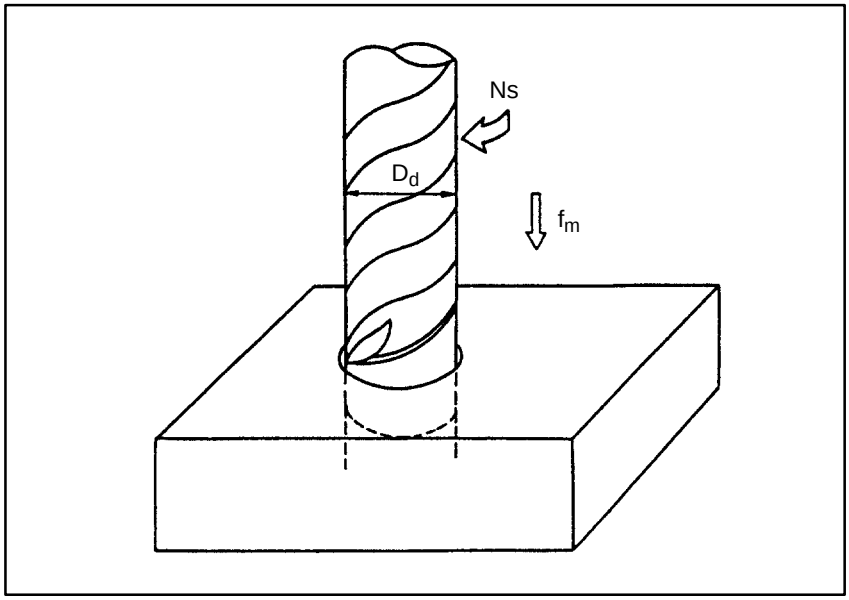
$$Q = w \times d \times fm/1000 \ (cc/min)$$

4) Power required at spindle
   PS = Q/MRm (kW)
   where,
   MRm : Rate of metal removal per kW (cc/min/kW)
5) Power required at spindle motor

$$PM = \frac{1}{\eta} \times Q/MRm \ (kW)$$

where,
η : Drive efficiency of spindle (%)

K.3 DRILLING



Cutting conditions:

1) Spindle revolutions Ns (min^{-1})
2) Drill diameter Dd (mm)
3) Feed ft (mm/rev)

Cutting formulas:

1) Cutting speed
   $Vc = \pi \times Dd \times Ns$ (mm/min)
2) Feed rate
   $fm = fr \times Ns$ (mm/min)
3) Rated of metal removal

$$Q = \frac{\pi}{4} \times Dd^2 \times fr \times Ns/1000 \ (cm^3/min)$$

$$Q = \frac{\pi}{4} \times Dd^2 \times fm/1000 \ (cc/min)$$

4) Power required at spindle
   PS = Q/MRd (kW)
   where,
   MRd : Rate of metal removal per kW (cc/min/kW)
5) Power required at spindle (%)

$$PM = \frac{1}{\eta} \times Q/MRd \ (kW)$$

where,
η : Drive efficiency of spindle (%)

Rate of metal removal per kW (cc/min/kW) (average values)
(when the drive efficiency of spindle is 80%)

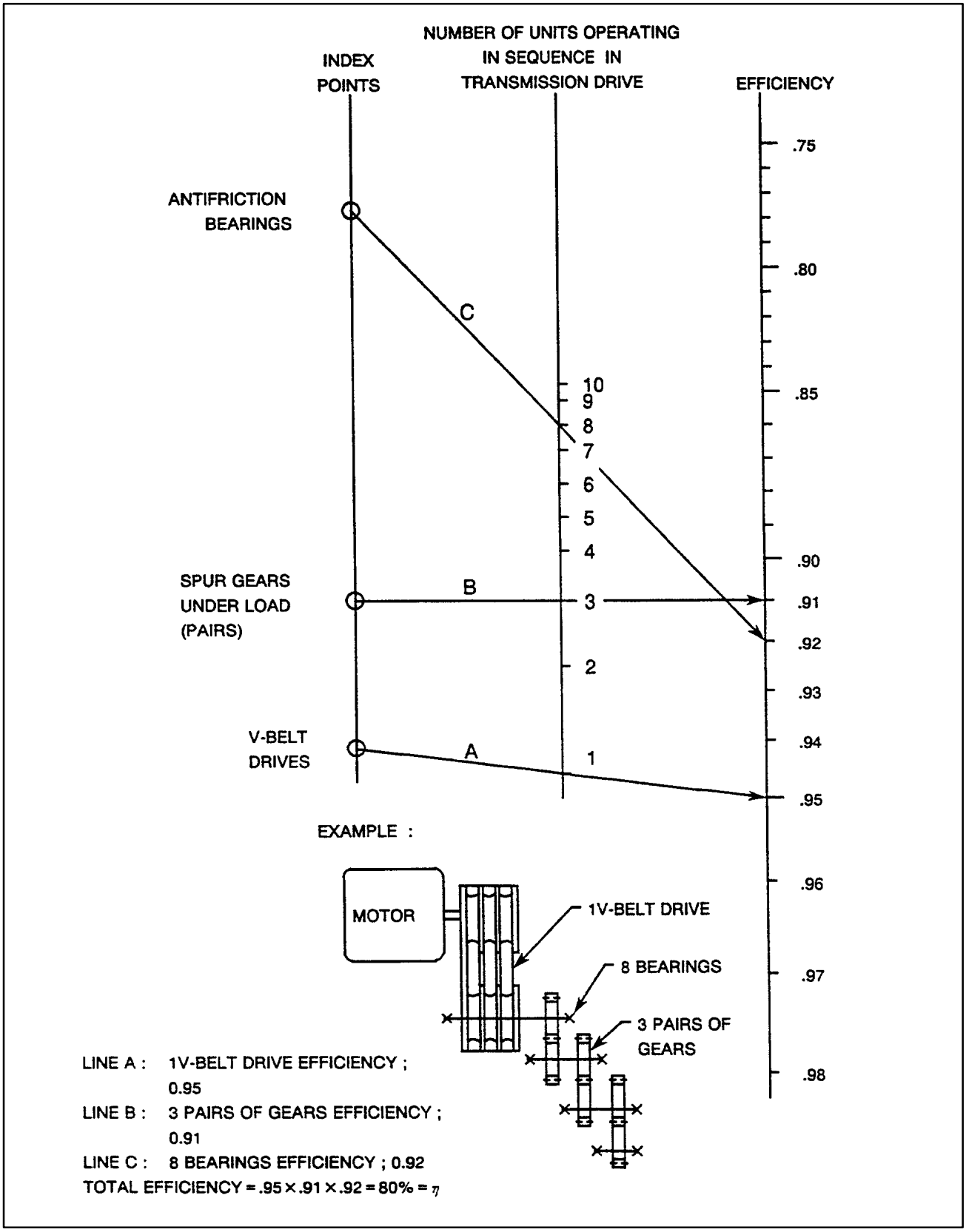
MATERIAL	HARDNESS (*1) Brinell hardness	MR: Rate of metal removal per kW (cc/min/kW)					
		TURNING MRt HSS AND CARBIDE TOOLS feed 0.127 to 0.381 mm/rev		MILLING MRm CARBIDE TOOLS feed 0.127 to 0.305 mm/tooth		DRILLING MRd HSS DRILLS feed 0.05 to 0.203 mm/rev	
		SHARP TOOL	DULL TOOL	SHARP TOOL	DULL TOOL	SHARP TOOL	DULL TOOL
STEEL–WROUGHT AND CAST Plain Carbon Alloy Steels Tool Steels	85 to 200 (*2)	20	15.7	20	15.7	21.9	16.8
	35 to 40 Rc (*3)	15.7	12.9	14.6	11.5	15.7	12.9
	40 to 50 Rc	14.6	11.5	12.2	10	12.9	10.4
	50 to 55 Rc	10.9	8.7	10.4	8.4	10.4	8.4
	55 to 58 Rc	6.4	5.2	8.4	6.8	8.4	6.8 (*4)
CAST IRONS Gray, Ductile and Malleable	110 to 190	31.3	24.4	36.6	27.4	21.9	18.3
	190 to 320	15.7	12.9	20	15.7	13.7	10.9
STAINLESS STEELS Ferritic, Austenitic and Martensitic	135 to 275	16.8	13.7	15.7	12.9	20	15.7
	30 to 45 Rc	15.7	12.9	14.6	11.5	18.3	14.6
PRECIPITATION HARDENING STAINLESS STEELS	150 to 450	15.7	12.9	14.6	11.5	18.3	14.6
TITANIUM	250 to 375	18.3	14.6	20	15.7	20	15.7
HIGH TEMPERATURE ALLOYS Nickel and Cobalt Base	200 to 360	8.7	7.0	10.9	8.7	10.9	8.7
Iron Base	180 to 320	13.7	10.9	13.7	10.9	18.3	14.6
REFRACTORY ALLOYS... Tungsten	321	7.8	6.2	7.5	6.1	8.4	6.6 (*4)
Molybdenum	229	10.9	8.7	13.7	10.9	13.7	10.9
Columbium	217	12.9	10.4	14.6	11.5	15.7	12.9
Tantalum	210	7.8	6.2	10.9	8.7	10.4	8.4
NICKEL ALLOYS	80 to 360	10.9	8.7	11.5	9.1	12.2	10
ALUMINIUM ALLOYS	30 to 150 500 kg	87.8	73.2	68.6	54.9	137.2	109.8
MAGNESIUM ALLOYS	40 to 90 500 kg	137.2	109.8	137.2	109.8	137.2	109.8
COPPER	80Rb (*5)	21.9	18.3	21.9	18.3	24.4	20
COPPER ALLOYS	10 to 80Rb	34.3	27.4	34.3	27.4	45.7	36.6
	80 to 100Rb	21.9	18.3	21.9	18.3	27.4	21.9

NOTE

*1 Brinell hardness, Standard testing method, Steel ball diameter 10mm, Load: 3000kg, Maximum value about 450.
*2 Corresponds to hardness of general steel S45C.
*3 Rc: Rockwell hardness, C scale, Measurement of hardness of comparatively hard metals.
*4 Carbide.
*5 Rb: Rockwell hardness, B scale, Measurement of hardness of soft metals.

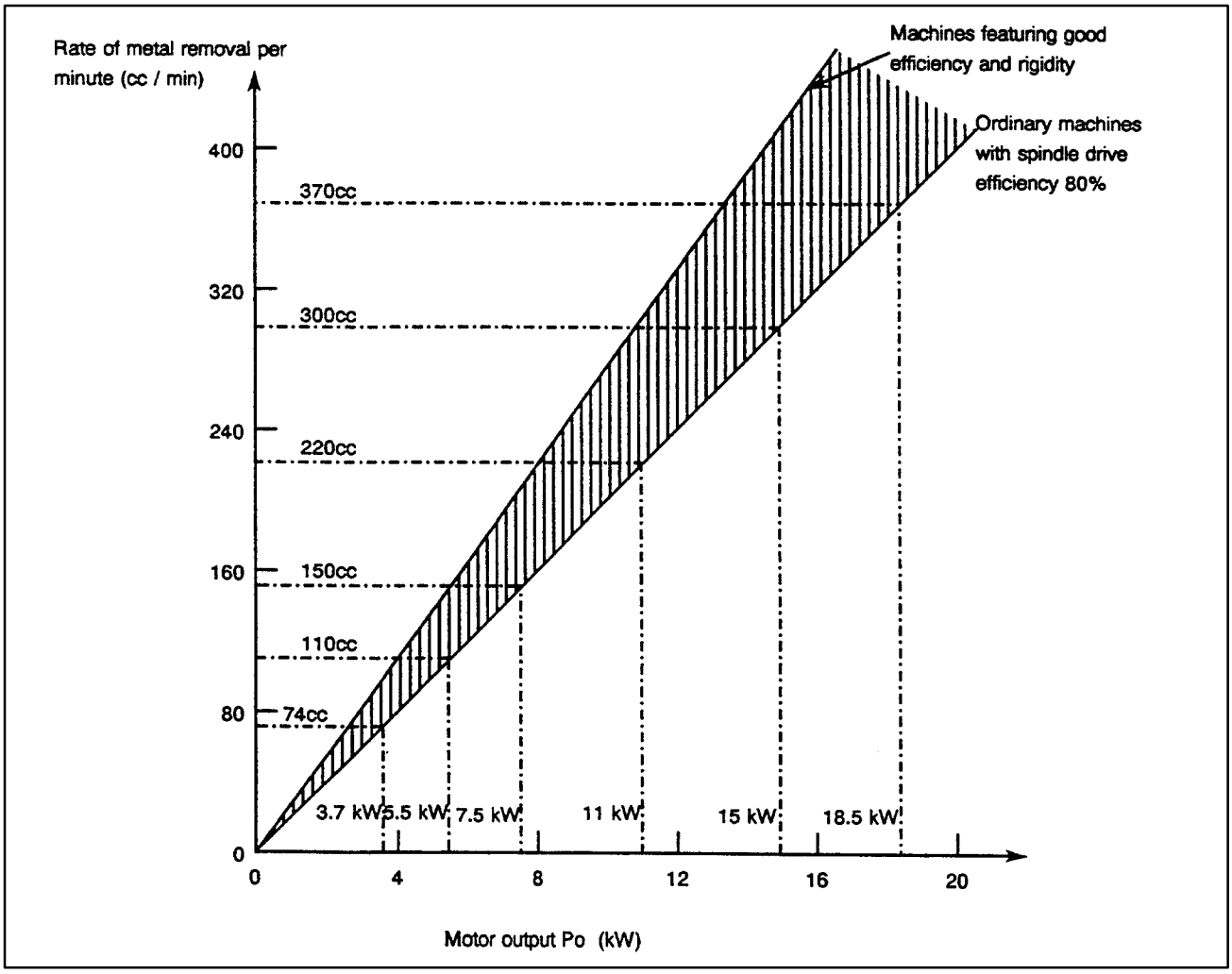
Efficiency of spindle drive system

The efficiency of spindle system can be obtained from the following diagram according to the V belt, number of gear stages, and number of bearings.



Data on rate of metal removal

The rate of metal removal per minute when steel S45C is cut using a new tool on a lathe or machining center is obtained within the shadowed range in the following figure approximately; provided that noload torque such as friction torque, etc. are negligible.



L CUSTOMER RECORDS

Customer records for spindle motor and spindle amplifier module.

Date: Drawn by:

Customer		Machine model	
machine type	Lathe (No. of spindle motor =) /MC/Other ( )		
CNC device	FANUC Series		

L.1
SPINDLE MOTOR

Motor type				
Mounting direction	Horizontal/Output shaft vertical downward/Other ( )		Air exhaust	Front/Rear
Sensor	C axis detector/MZ sensor/M sensor	No. of pulses	128p / 256p / 512p / rev.	

Model	Specification No.	Basic speed / Max. speed	Continuous rating/30min. rating / S3xx%	Special condition
	A06B– –	/ min^{-1}	/ / kW	

L.2
SPINDLE AMPLIFIER MODULE

Model	Specification No.	C axis detection circuit	Special condition
	A06B– –H #H	Required / Not required	

L.3 INSTALLATION CONDITION

Input power voltage	AC200V/230V/400V/460V/Other (V AC)	Frequency	50 Hz / 60 Hz
Ambient temperature	Motor: Approx. °C– °C, Amplifier: approx. °C– ° C		
Ambient humidity	Approx. % – %		

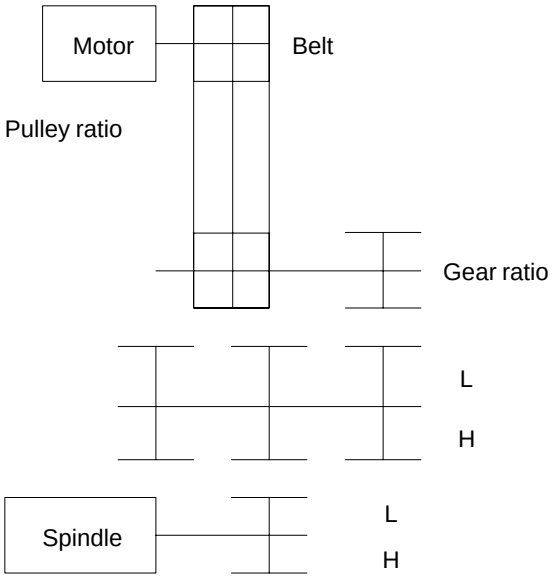
L.4 C AXIS DETECTOR

Detector spec. No.	Drum Outer Dia.	Preamplifier spec. No.	Detection circuit spec. No.	Special condition
	ϕ65 / ϕ97.5 / ϕ130 / ϕ195			
Detector rotation direction	Same direction as motor / Reverse direction as motor			

L.5
SPINDLE CONFIGURATIONS

Driving system	Belt drive / Gear drive / Belt & Gear drive / Direct drive / Other ( )
Gear	1 gear / 2 gears / 3 gears / 4 gears Backlash:
Belt	Type: , Length (Perimeter): mm, Quantity: pcs., V belt / Timing belt
Brake	Used / Unused, Brake pressure: 1 step / 2 steps / 3 steps

Gear ratio / Pulley ratio	Spindle: Motor	Load inertia converted to motor shaft unit	Rotation direction of spindle and motor	Target acceleration time 0 to Max. min^{-1}	Max. spindle speed
HIGH	:	$kg \cdot cm \cdot s^2$	Same/Reverse	sec	min^{-1}
MEDIUM	:	$kg \cdot cm \cdot s^2$	Same/Reverse	sec	min^{-1}
MEDIUM	:	$kg \cdot cm \cdot s^2$	Same/Reverse	sec	min^{-1}
LOW	:	$kg \cdot cm \cdot s^2$	Same/Reverse	sec	min^{-1}



L.6 FUNCTION

Item	Description
C axis control function	Used/Unused Application: Cutting / Spindle index / Other ( )
Rigid tapping function	Used/Unused Target specification: [Example] 2000 min^{-1} for M2
Spindle orientation function	Magnetic sensor system/ Position coder system (Position/MZ sensor) Application: ATC/Spindle index (required index workpiece)/Other
Constant surface speed control function	Used/Unused
Output control function	Used/Unused Application:
Torque control function	Used/Unused Application: Gear change/Other ( )

L.7 Cs CONTOUR CUTTING CONDITIONS

Item	Description
Workpiece material	Iron / Stainless steel / Aluminum / Brass / Others
Cutting radius	mm
Tool	End mill, Diameter: ϕ mm, Number of flutes: , Others ( )
Tool speed	rpm
Depth of cut	mm
Cutting feedrate	mm/min., deg/min
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Revision Record

FANUC AC SPINDLE MOTOR α series DESCRIPTIONS (B–65152E)

Edition	Date	Contents	Edition	Date	Contents
03	Oct.,'98	● Correction of errors			
02	Mar.,'96	● Addition of the descriptions of models α30, α40, αP60, α6HV–α12HV, α30HV–α60HV, αC12–αC22, high speed models of α series, IP55 models of α series and high speed models of αP series.			
01	Dec., '94				

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