

YASKAWA

FP605 DRIVE

INSTALLATION MANUAL

IP55/UL TYPE 12 HEATSINK EXTERNAL MOUNTING

CATALOG CODE:

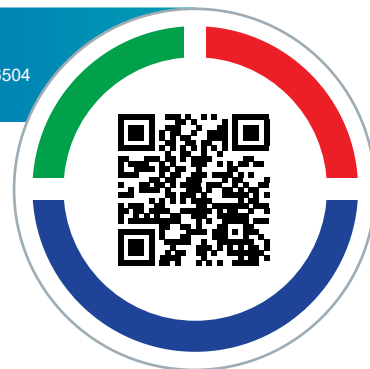
FP65UxxxxWx

Three-Phase 200 V class: 55 to 110 kW (75 to 150 HP)

Three-Phase 400 V class: 112 to 450 kW (150 to 600 HP)

PDF

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1 Preface and General Precautions

This chapter gives information about important safety precautions for the use of this product. Failure to obey these precautions can cause serious injury or death, or damage to the product or related devices and systems. Yaskawa must not be held responsible for any injury or equipment damage as a result of the failure to observe these precautions and instructions.

◆ Overview

An IP55/UL Type 12 Heatsink External Mounting drive lets you install the drive in a Type 12 enclosure or panel with the heatsink external and keep the Type 12 rating.





◆ Applicable Documentation

Document	Description
FP605 Series IP55/UL Type 12 Heatsink External Mounting Installation Manual	Read this manual before you install this drive. This manual gives information about how to install the IP55/UL Type 12 Heatsink External Mounting drive.
FP605 Series AC Drive for Industrial Fan and Pump Applications Installation & Primary Operation	For information about drive settings, refer to the manuals. The manuals provide information about basic installation, wiring, operation procedures, functions, troubleshooting, and maintenance.
FP605 Series AC Drive for Industrial Fan and Pump Applications Technical Reference	The manuals also include important information about parameter settings and tuning the drive. You can download drive manuals from the Yaskawa product and technical information website shown on the back cover of this manual.

◆ Safety

Read the safety instructions carefully before you install, wire, or operate this product.

■ Explanation of Signal Words

-  **DANGER** This signal word identifies a hazard that will cause serious injury or death if you do not prevent it.
-  **WARNING** This signal word identifies a hazard that can cause death or serious injuries if you do not prevent it.
-  **CAUTION** This signal word identifies a hazardous situation, which, if not avoided, can cause minor or moderate injury.
-  **NOTICE** This signal word identifies a property damage message that is not related to personal injury.

■ General Safety Instructions

Yaskawa Electric manufactures and supplies electronic components for a variety of industrial applications. The selection and application of Yaskawa products is the responsibility of the designer of the equipment or the customer who assembles the final product. Yaskawa is not responsible for how our products are incorporated into the final system design. In all cases, Yaskawa products should not be incorporated into a product or design as the exclusive or sole safety control function. All control functions are designed to dynamically detect failures and operate safely without exception. All products that are designed to incorporate parts manufactured by Yaskawa must be provided to the end user and include proper warnings and instructions regarding their safe use and operation. All warnings from Yaskawa must be promptly issued to the end user. Yaskawa offers warranties only for the quality of our products, in compliance with standards and specifications that are described in the manual. Yaskawa does not offer other warranties, either explicit or implied. Injuries, property damage, and lost business opportunities caused by improper storage or handling and negligence oversight on the part of your company or your customers will void Yaskawa's warranty for the product.

Note:

- Read this manual carefully when mounting, operating, and repairing AC drives.
- Obey all warnings, cautions, and notices.
- Approved personnel must perform all work.
- Install the drive according to this manual and local codes.

⚠ DANGER *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, remove the covers before measuring for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

⚠ WARNING *Fire Hazard. Do not connect main power supply wiring to drive motor terminals U/T1, V/T2, and W/T3. Connect main power supply wiring to main circuit input terminals R/L1, S/L2, and T/L3. Incorrect wiring can cause serious injury or death from fire.*

⚠ WARNING *Electrical Shock Hazard. Do not modify the drive body or drive circuitry. Modifications to drive body and circuitry can cause serious injury or death, will cause damage to the drive, and will void the warranty. Yaskawa is not responsible for modifications of the product made by the user.*

⚠ WARNING *Crush Hazard. Only approved personnel can operate a crane or hoist to move the drive. If unapproved personnel operate a crane or hoist, it can cause serious injury or death from falling equipment.*

⚠ WARNING *Electrical Shock Hazard. Only let approved personnel install, wire, maintain, examine, replace parts, and repair the drive. If personnel are not approved, it can cause serious injury or death.*

⚠ WARNING *Electrical Shock Hazard. Always ground the motor-side grounding terminal. If you do not ground the equipment correctly, it can cause serious injury or death if you touch the motor case.*

⚠ WARNING *Electrical Shock Hazard. Do not wear loose clothing or jewelry when you do work on the drive. Tighten loose clothing and remove all metal objects, for example watches or rings. Loose clothing can catch on the drive and jewelry can conduct electricity and cause serious injury or death.*

⚠ WARNING *Sudden Movement Hazard. Before you do Auto-Tuning, remove all personnel and objects from the area around the drive, motor, and load. The drive and motor can start suddenly during Auto-Tuning and cause serious injury or death.*

⚠ WARNING *Sudden Movement Hazard. Remove all personnel and objects from the area around the drive, motor, and machine and attach covers, couplings, shaft keys, and machine loads before you energize the drive. If personnel are too close or if there are missing parts, it can cause serious injury or death.*

⚠ WARNING *Damage to Equipment. Do not apply incorrect voltage to the main circuit of the drive. Operate the drive in the specified range of the input voltage on the drive nameplate. Voltages that are higher than the permitted nameplate tolerance can cause damage to the drive.*

⚠ WARNING *Fire Hazard. Do not put flammable or combustible materials on top of the drive and do not install the drive near flammable or combustible materials. Attach the drive to metal or other noncombustible material. Flammable and combustible materials can start a fire and cause serious injury or death.*

⚠ WARNING *Fire Hazard. Tighten all terminal screws to the correct tightening torque. Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.*

⚠ WARNING *Fire Hazard. Tighten screws at an angle in the specified range shown in this manual. If you tighten the screws at an angle not in the specified range, you can have loose connections that can cause damage to the terminal block or start a fire and cause serious injury or death.*

⚠ WARNING *Crush Hazard. Use a crane or hoist to move large drives when necessary. If you try to move a large drive without a crane or hoist, it can cause serious injury or death.*

⚠ WARNING *Electrical Shock Hazard. Do not cause a short circuit on the drive output circuit. A short circuit on the output can cause serious injury or death.*

⚠ WARNING *Electrical Shock Hazard. When there is a DC component in the protective earthing conductor, the drive can cause a residual current. When a residual current operated protective or monitoring device prevents direct or indirect contact, always use a type B Ground Fault Circuit Interrupter (GFCI) as specified by IEC/EN 60755. If you do not use the correct GFCI, it can cause serious injury or death.*

⚠ WARNING *Electrical Shock Hazard. Ground the neutral point on the power supply of the drives to comply with the EMC Directive before you turn on the EMC filter. If you turn ON the EMC filter, but you do not ground the neutral point, it can cause serious injury or death.*

⚠ WARNING *Crush Hazard. Test the system to make sure that the drive operates safely after you wire the drive and set parameters. If you do not test the system, it can cause damage to equipment or serious injury or death.*

⚠ WARNING *Electrical Shock Hazard. After the drive blows a fuse or trips a GFCI, do not immediately energize the drive or operate peripheral devices. Wait for the time specified on the warning label at a minimum and make sure that all indicators are OFF. Then check the wiring and peripheral device ratings to find the cause of the problem. If you do not know the cause of the problem, contact Yaskawa before you energize the drive or peripheral devices. If you do not fix the problem before you operate the drive or peripheral devices, it can cause serious injury or death.*

⚠ WARNING *Fire Hazard. Install sufficient branch circuit short circuit protection as specified by applicable codes and this manual. The drive is suitable for circuits that supply not more than 100,000 RMS symmetrical amperes, 240 Vac maximum (200 V Class), 480 Vac maximum (400 V Class). Incorrect branch circuit short circuit protection can cause serious injury or death.*

⚠ CAUTION *Crush Hazard. Tighten terminal cover screws and hold the case safely when you move the drive. If the drive or covers fall, it can cause moderate injury.*

⚠ CAUTION *Burn Hazard. Do not touch a hot drive heatsink. De-energize the drive, wait for a minimum of 15 minutes, then make sure that the heatsink is cool before you replace the cooling fans. If you touch a hot drive heatsink, it can burn you.*

NOTICE *Damage to Equipment. When you touch the drive and circuit boards, make sure that you observe correct electrostatic discharge (ESD) procedures. If you do not follow procedures, it can cause ESD damage to the drive circuitry.*

NOTICE *Do not break the electrical connection between the drive and the motor when the drive is outputting voltage. Incorrect equipment sequencing can cause damage to the drive.*

NOTICE *Damage to Equipment. Do not do a withstand voltage test or use a megohmmeter or megger insulation tester on the drive. These tests can cause damage to the drive.*

NOTICE *Do not operate a drive or connected equipment that has damaged or missing parts. You can cause damage to the drive and connected equipment.*

NOTICE *Install branch circuit protection, for example fuses or ground fault circuit interrupters (GFCIs) as specified in the drive instructions. If you do not install these components, it can cause damage to the drive and connected equipment.*

NOTICE *Make sure that all connections are correct after you install the drive and connect peripheral devices. Incorrect connections can cause damage to the drive.*

NOTICE *Do not connect phase-advancing capacitors, LC/RC noise filters, or leakage breakers (GFCI) to the motor circuit. If you connect these devices to the output circuits, it can cause damage to the drive and connected equipment.*

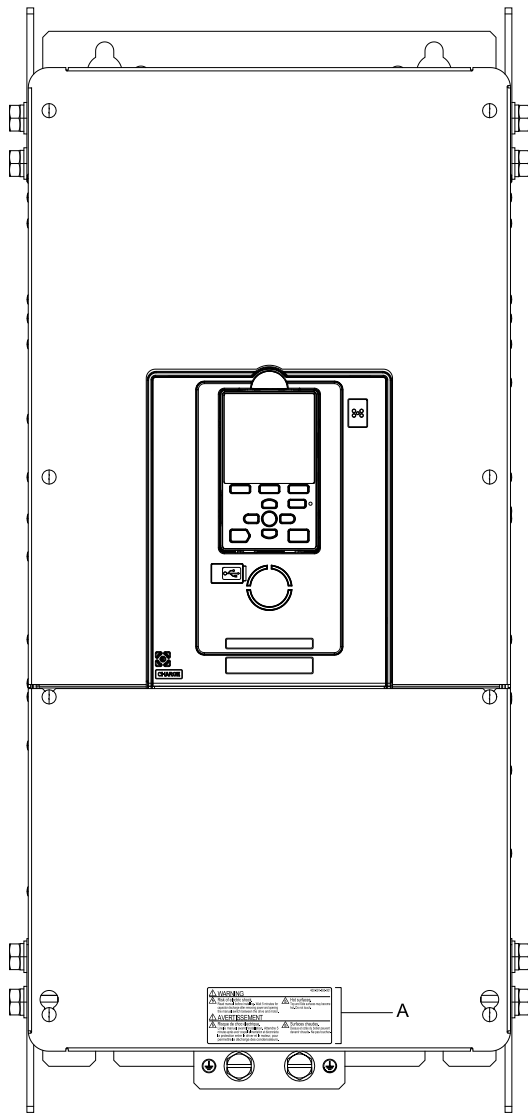
NOTICE *Use an inverter-duty motor or vector-duty motor with reinforced insulation and windings applicable for use with an AC drive. If the motor does not have the correct insulation, it can cause a short circuit or ground fault from insulation deterioration.*

Note:

Do not use unshielded wire for control wiring. Use shielded, twisted-pair wires and ground the shield to the ground terminal of the drive. Unshielded wire can cause electrical interference and unsatisfactory system performance.

◆ Warning Label Content and Location

The drive warning label is in the location shown in [Figure 1.1](#). Use the drive as specified by this information.



A - Warning label

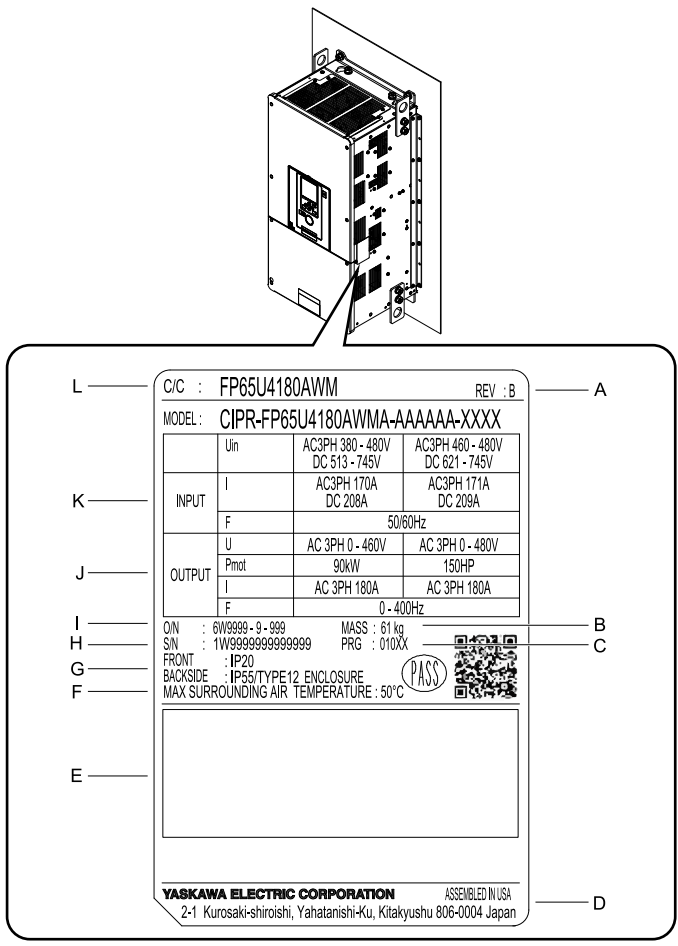
<p>⚠ WARNING</p>	
<p>⚠ Risk of electric shock. Read manual before installing. Wait 5 minutes for capacitor discharge after removing power and opening the manual switch between the drive and motor.</p>	<p>⚠ Hot surfaces. Top and Side surfaces may become hot. Do not touch.</p>
<p>⚠ AVERTISSEMENT</p>	
<p>⚠ Risque de choc électrique. Lire le manuel avant l'installation. Attendre 5 minutes après avoir coupé l'alimentation et déconnecté la protection entre le driver et le moteur, pour permettre la décharge des condensateurs.</p>	<p>⚠ Surfaces chaudes. Dessus et cotés du boîtier peuvent devenir chauds. Ne pas toucher.</p>

Figure 1.1 Warning Label Content and Location

2 Receiving

1. Inspect the product for damage and missing parts. Immediately contact the shipping company if the drive is damaged. The Yaskawa warranty does not cover damage from shipping.
2. Check the catalog code in the “C/C” section of the drive nameplate to make sure that you received the correct model.
3. If you did not receive the correct drive or if your drive does not operate correctly, contact your supplier.
4. Check drive and motor compatibility for systems with more than one drive.

NOTICE *Damage to Equipment. Do not install or use damaged parts or damaged motors into the drive system.*



- A - Hardware revision
- B - Weight
- C - Drive software version
- D - The address of the head office of Yaskawa Electric Corporation
- E - Standards compliance
- F - Surrounding air temperature
- G - Enclosure protection design
- H - Serial number
- I - Lot number
- J - Output specifications
- K - Input specifications
- L - Catalog code

Figure 2.1 Nameplate Example

◆ How to Read the Catalog Code

Use the information in Figure 2.2 and Table 2.1 to read the drive catalog codes.

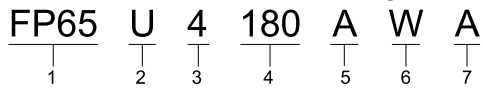


Figure 2.2 Drive Catalog Code

Table 2.1 Catalog Code Details

No.	Description
1	FP605 Series
2	Region code U: Americas
3	Input power supply voltage <ul style="list-style-type: none"> • 2: Three-Phase AC 208 V • 4: Three-Phase AC 480 V

3 Mechanical Installation

No.	Description
4	Rated output current Note: Refer to the rated output current list for more information.
5	EMC noise filter A: No built-in EMC filter
6	Protection design <ul style="list-style-type: none"> • B: IP20/UL Open Type • F: IP20/UL Type 1 • W: IP55/UL Type 12 Heatsink External Mounting
7	Environmental specification A: Standard

3 Mechanical Installation

This section gives information about the standard environment for correct installation.

◆ Installation Environment

The installation environment is important for the lifespan of the product and to make sure that the drive performance is correct. Make sure that the installation environment agrees with these specifications.

Environment	Conditions
Area of Use	Indoors
Power Supply	Overvoltage Category III
Ambient Temperature Setting	IP20/UL Open Type/Heatsink External Mounting: -10 °C to +50 °C (14 °F to 122 °F) IP20/UL Type 1: -10 °C to +40 °C (14 °F to 104 °F) IP55/UL Type 12 Heatsink External Mounting; front side: -10 °C to +50 °C (14 °F to 122 °F) IP55/UL Type 12 Heatsink External Mounting; back side: -10 °C to +40 °C (14 °F to 104 °F) <ul style="list-style-type: none"> • When you install the drive in an enclosure, use a cooling fan or air conditioner to keep the internal air temperature in the permitted range. • Do not let the drive freeze. • You can use IP20/UL Open Type drives at a maximum of 60 °C (140 °F) when you derate the output current. • You can use IP20/UL Type 1 drives at a maximum of 50 °C (122 °F) when you derate the output current.
Humidity	95% RH or less Do not let condensation form on the drive.
Storage Temperature	-20 °C to +70 °C (-4 °F to +158 °F) (short-term temperature during transportation)
Surrounding Area	Pollution degree 2 or less Install the drive in an area without: <ul style="list-style-type: none"> • Oil mist, corrosive or flammable gas, or dust • Metal powder, oil, water, or other unwanted materials • Radioactive or flammable materials. • Harmful gas or fluids • Salt • Direct sunlight Keep wood and other flammable materials away from the drive.
Altitude	1000 m (3281 ft) maximum Note: Derate the output current by 1% for each 100 m (328 ft) to install the drive in altitudes between 1000 m to 4000 m (3281 ft to 13123 ft). It is not necessary to derate the rated voltage in these conditions: <ul style="list-style-type: none"> • Installing the drive at 2000 m (6562 ft) or lower • Installing the drive between 2000 m to 4000 m (6562 ft to 13123 ft) and grounding the neutral point on the power supply. Contact Yaskawa or your nearest sales representative when not grounding the neutral point.
Vibration	<ul style="list-style-type: none"> • 10 Hz to 20 Hz: 1 G (9.8 m/s², 32.15 ft/s²) • 20 Hz to 55 Hz: 0.2 G (2.0 m/s², 6.56 ft/s²)
Installation Orientation	Install the drive vertically for sufficient airflow to cool the drive.

NOTICE Do not let unwanted objects, for example metal shavings or wire clippings, fall into the drive during drive installation. Put a temporary cover over the drive during installation. Remove the temporary cover before start-up. Unwanted objects inside of the drive can cause damage to the drive.

Note:

Do not put drive peripheral devices, transformers, or other electronics near the drive. Shield the drive from electrical interference if components must be near the drive. The drive or the devices around the drive may malfunction due to electrical interference.

◆ IP55/UL Type 12 Heatsink External Mounting Drive and Cut-Out Dimensions and Installation

Model	Exterior and Mounting Dimension Diagram		Panel Cut-Out Dimension Diagram		Installation Procedure	
2211, 2273 4180 - 4302	Exterior and Mounting Dimension Diagram 1	11	Panel Cut-Out Dimension Diagram 1	14	Procedure A	18
2343, 2396 4361, 4414	Exterior and Mounting Dimension Diagram 2	12	Panel Cut-Out Dimension Diagram 2	15		
4477 - 4720	Exterior and Mounting Dimension Diagram 3	13	Panel Cut-Out Dimension Diagram 3	16	Procedure B	19

◆ IP55/UL Type 12 Heatsink External Mounting Drive Dimensions

■ Models 2211, 2273, 4180 to 4302

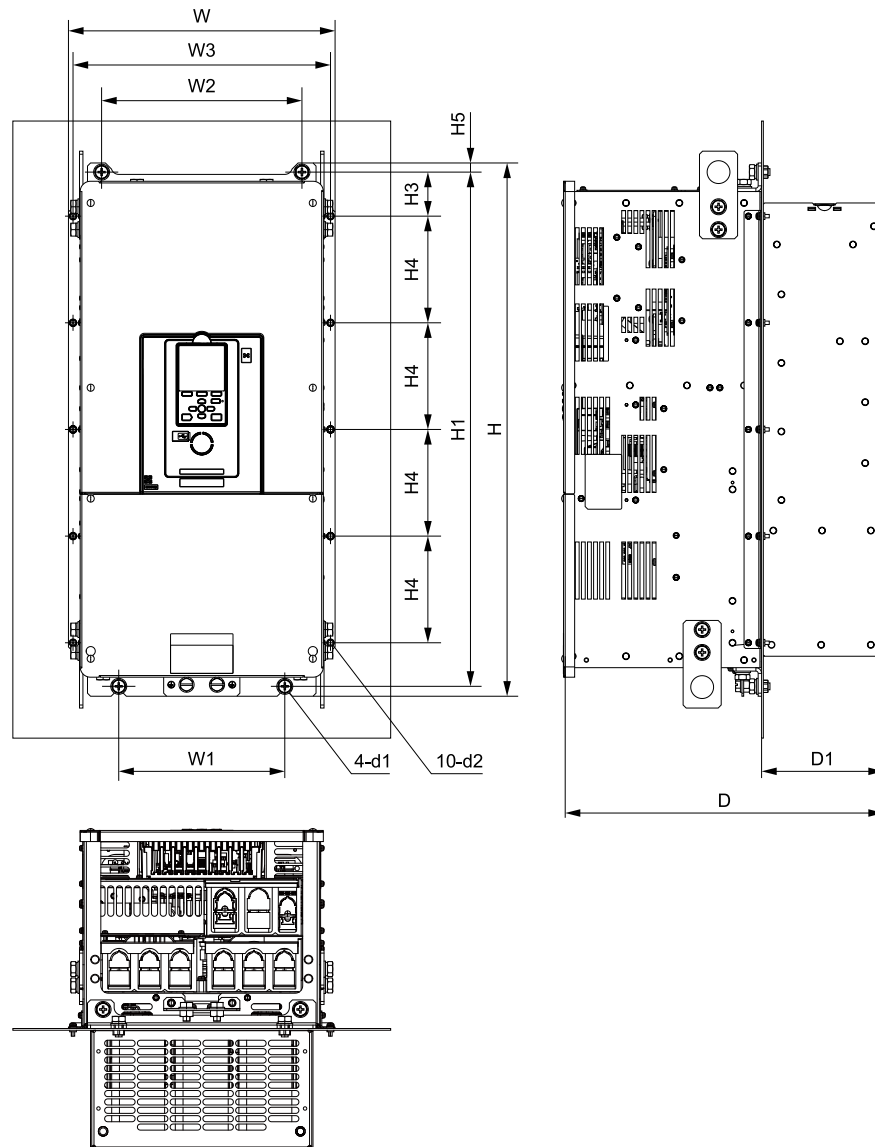


Figure 3.1 Dimension Diagram 1

3 Mechanical Installation

Model	Dimensions mm (in)												
	W	H	D	D1	W1	W2	W3	H1	H3	H4	H5	d1	d2
2211, 2273 4180 - 4302	350 (13.78)	700 (27.56)	420 (16.54)	160 (6.30)	218 (8.58)	263 (10.35)	338 (13.31)	675 (26.56)	60 (2.36)	139 (5.47)	12 (0.47)	M10	M5

■ Models 2343, 2396, 4361, 4414

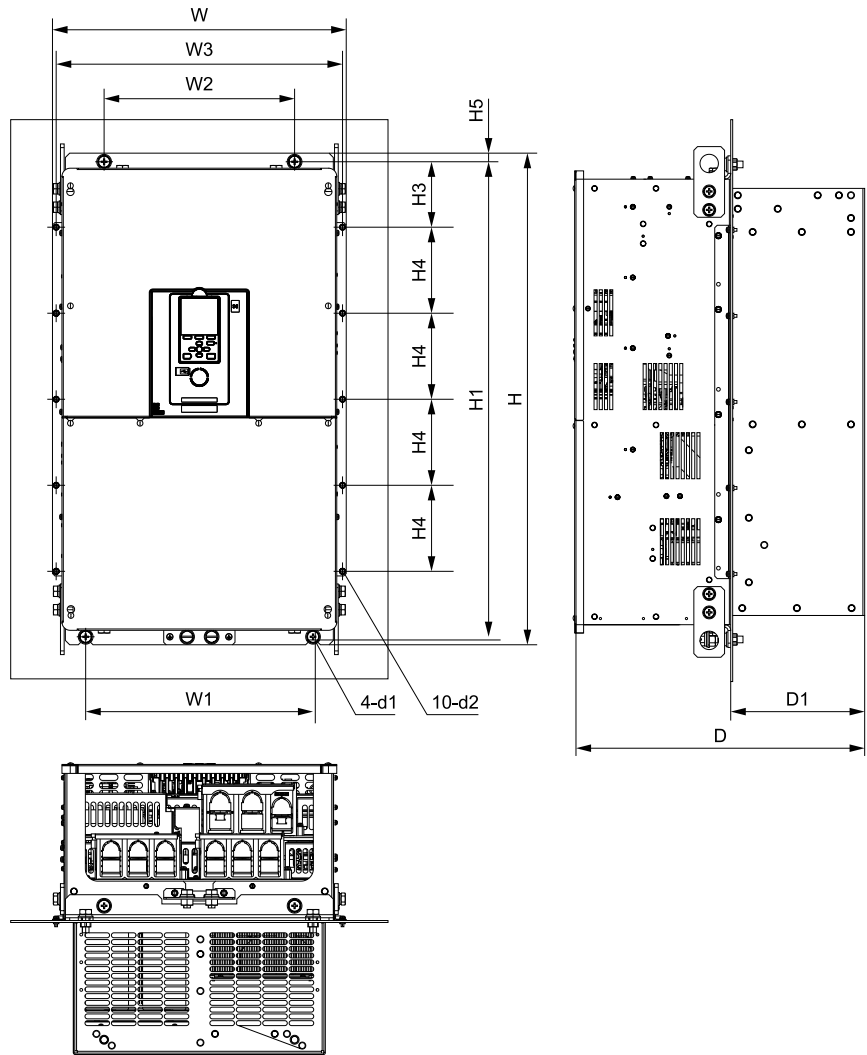


Figure 3.2 Dimension Diagram 2

Model	Dimensions mm (in)												
	W	H	D	D1	W1	W2	W3	H1	H3	H4	H5	d1	d2
2343, 2396 4361, 4414	478 (18.82)	800 (31.50)	472 (18.58)	218 (8.58)	370 (14.57)	310 (12.20)	466 (18.35)	773 (30.43)	106.5 (4.19)	140 (5.51)	14 (0.55)	M12	M5

■ Models 4477 to 4720

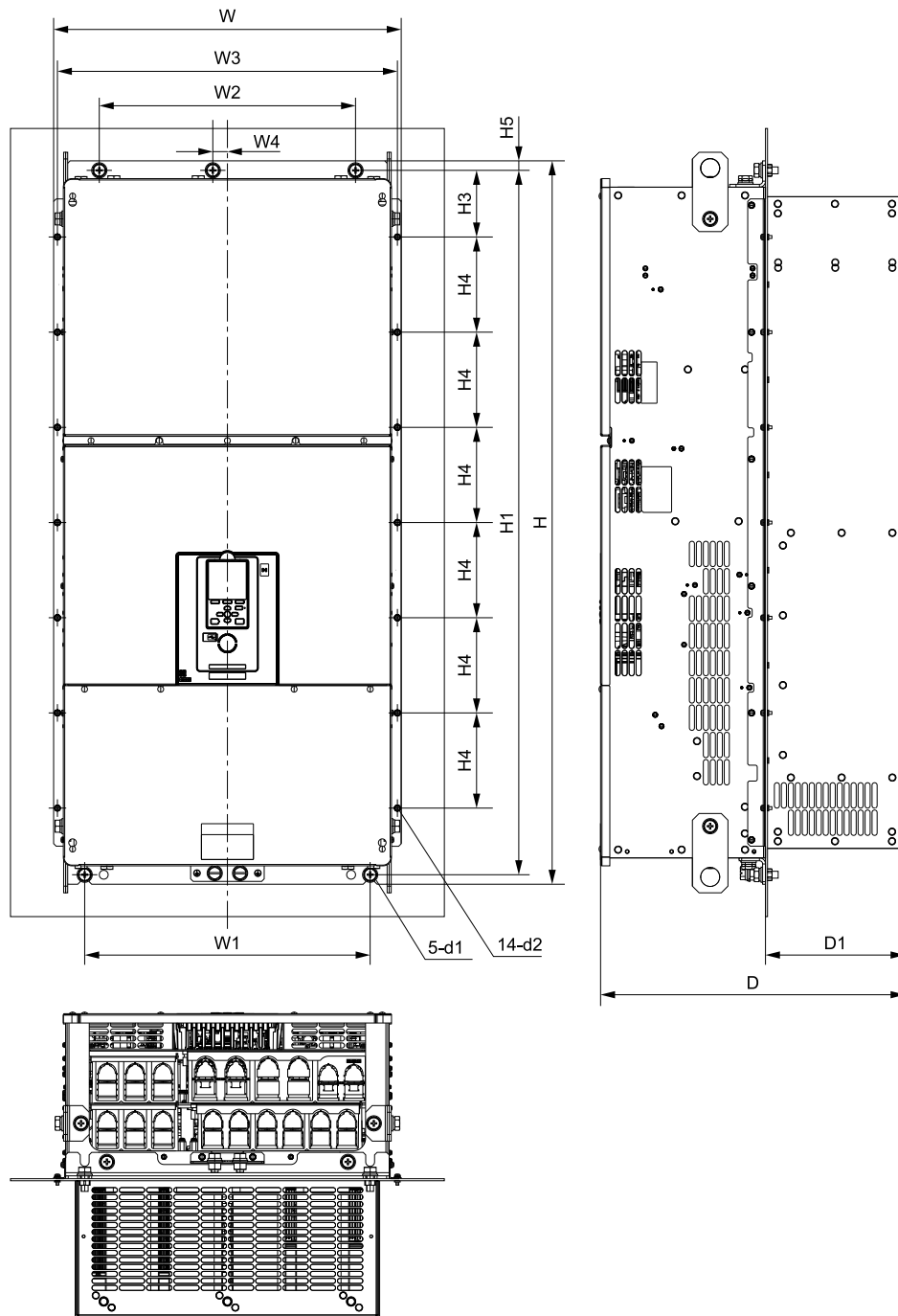


Figure 3.3 Dimension Diagram 3

Model	Dimensions mm (in)													
	W	H	D	D1	W1	W2	W3	W4	H1	H3	H4	H5	d1	d2
4477 - 4720	548 (21.57)	1140 (44.88)	480 (18.90)	220 (8.66)	450 (17.72)	404 (15.91)	536 (21.10)	23 (0.91)	1110 (43.70)	105 (4.13)	150 (5.91)	15 (0.59)	M12	M5

◆ Panel Cut-Out Dimensions (IP55/UL Type 12 Heatsink External Mounting)

■ Drive Model and Panel Cut-Out Dimension Diagram

Model	Reference
2211, 2273 4180 - 4302	14
2343, 2396 4361, 4414	15
4477 - 4720	16

■ Models 2211, 2273, 4180 to 4302

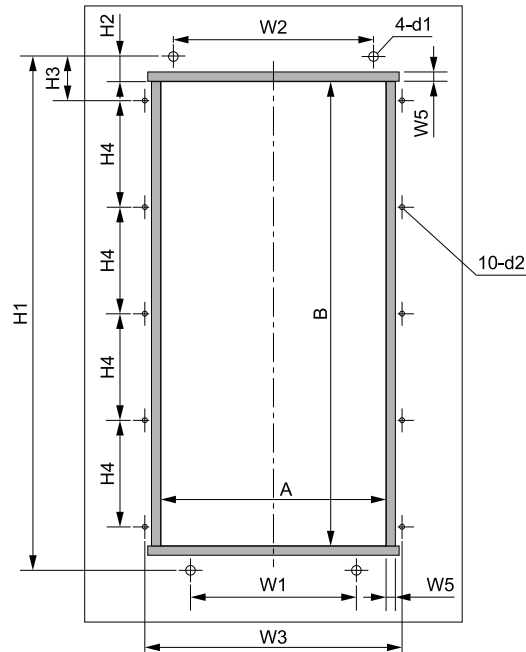


Figure 3.4 Panel Cut-Out Dimension Diagram 1

Model	Dimensions mm (in)											
	W1	W2	W3	W5	H1	H2	H3	H4	A	B	d1	d2
2211, 2273 4180 - 4302	218 (8.58)	263 (10.35)	338 (13.31)	7 (0.28)	675 (26.56)	33 (1.30)	60 (2.36)	139 (5.47)	296 (11.65)	610 (24.02)	M10	M5

■ Models 2343, 2396, 4361, 4414

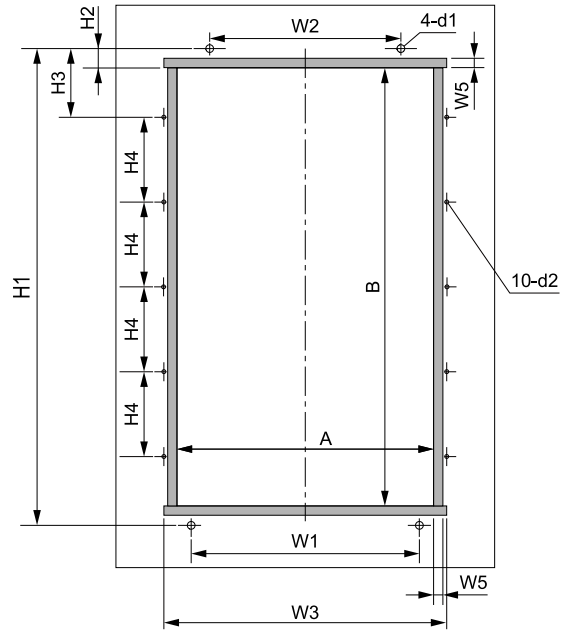


Figure 3.5 Panel Cut-Out Dimension Diagram 2

Model	Dimensions mm (in)											
	W1	W2	W3	W5	H1	H2	H3	H4	A	B	d1	d2
2343, 2396 4361, 4414	370 (14.57)	310 (12.20)	466 (18.35)	7 (0.28)	773 (30.43)	31.5 (1.24)	106.5 (4.19)	140 (5.51)	414 (16.30)	710 (27.95)	M12	M5

■ Models 4477 to 4720

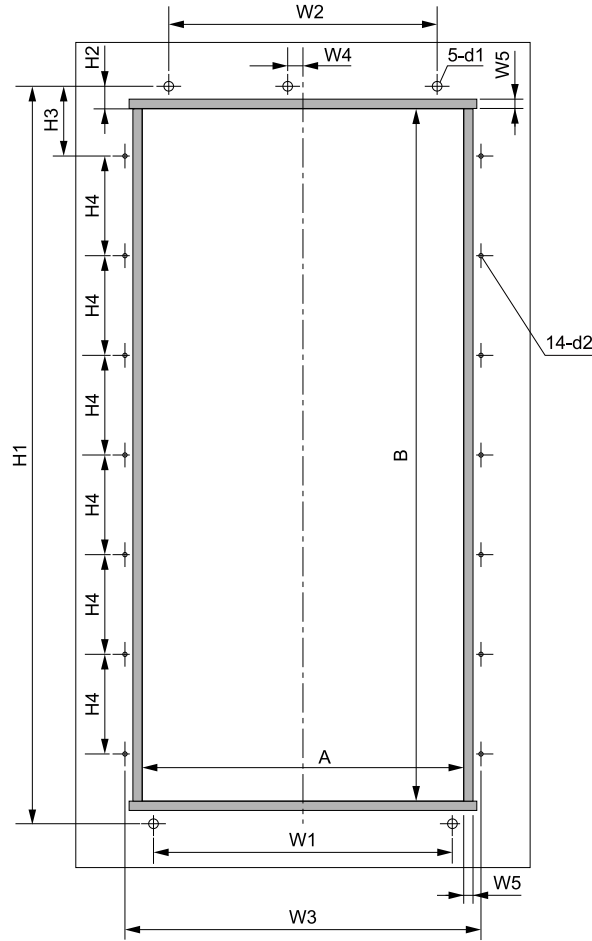


Figure 3.6 Panel Cut-Out Dimension Diagram 3

Model	Dimensions mm (in)												
	W1	W2	W3	W4	W5	H1	H2	H3	H4	A	B	d1	d2
4477 - 4720	450 (17.72)	404 (15.91)	536 (21.10)	23 (0.91)	7 (0.28)	1110 (43.70)	34 (1.34)	105 (4.13)	150 (5.91)	484 (19.06)	1042 (41.02)	M12	M5

◆ Estimated Weights (IP55/UL Type 12 Heatsink External Mounting)

Table 3.1 Three-Phase 200 V Class (IP55/UL Type 12 Heatsink External Mounting)

Model	Est. Weight *1 kg (lb)	Model	Est. Weight *1 kg (lb)
2211	59 (130.10)	2343	101 (222.71)
2273	62 (136.71)	2396	107 (235.94)

*1 The estimated weights are for drives with hardware revision D or later. For estimated weights of drives with hardware revision C or earlier, contact Yaskawa or your nearest sales representative. The "REV" column on the nameplate on the right side of the drive identifies the hardware revision. Refer to [Receiving on page 8](#) for more information.

Table 3.2 Three-Phase 400 V Class (IP55/UL Type 12 Heatsink External Mounting)

Model	Est. Weight *1 kg (lb)	Model	Est. Weight *1 kg (lb)
4180	61 (134.51)	4361	107 (235.94)
4240	63 (138.92)	4414	113 (249.17)
4302	66 (145.53)	4477	192 (423.36)

Model	Est. Weight *1 kg (lb)
4515	192 (423.36)
4590	206 (454.23)

Model	Est. Weight *1 kg (lb)
4720	207 (456.44)

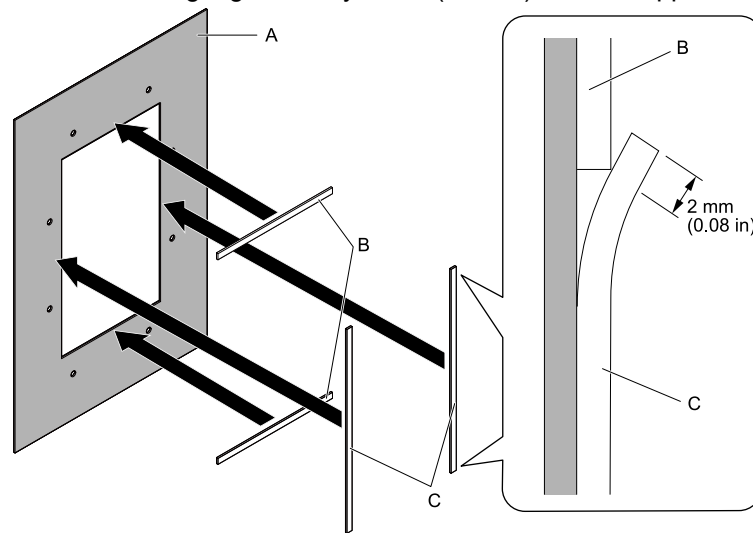
*1 The estimated weights are for drives with hardware revision D or later. For estimated weights of drives with hardware revision C or earlier, contact Yaskawa or your nearest sales representative. The "REV" column on the nameplate on the right side of the drive identifies the hardware revision. Refer to [Receiving on page 8](#) for more information.

◆ Install the Gasket

Cut an opening in the enclosure panel before you install the gasket. Refer to [Panel Cut-Out Dimensions \(IP55/UL Type 12 Heatsink External Mounting\) on page 14](#) for more information.

1. Install the upper and lower gaskets around the cut opening of the enclosure panel and then install the left and right gaskets.

Overlap the ends of the left and right gaskets by 2 mm (0.08 in) over the upper and lower gaskets.



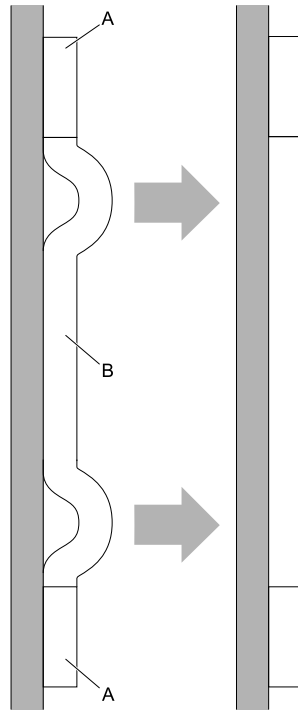
A - Enclosure panel

B - Upper and lower gasket

C - Left and right gasket

Figure 3.7 Install the Gasket

2. Push the overlapped part of the gasket and make a flat surface. Make sure that there are no gaps between the gaskets.



A - Upper and lower gasket

B - Left and right gasket

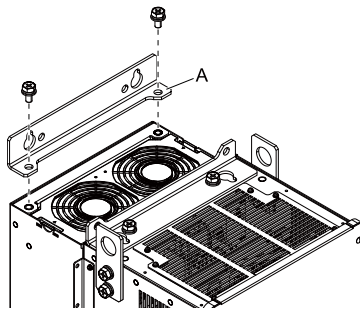
Figure 3.8

◆ Installation Procedure

■ Install the Drive (Procedure A)

Cut an opening in the enclosure panel before you install the attachment. Refer to *Panel Cut-Out Dimensions (IP55/UL Type 12 Heatsink External Mounting)* on page 14 for more information.

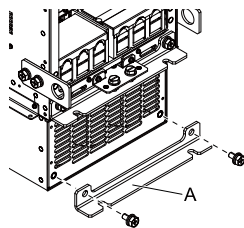
1. Remove the shipping attachment from the top of the drive.



A - Shipping attachment

Figure 3.9 Remove the Shipping Attachment

- Remove the shipping attachment from the bottom of the drive.



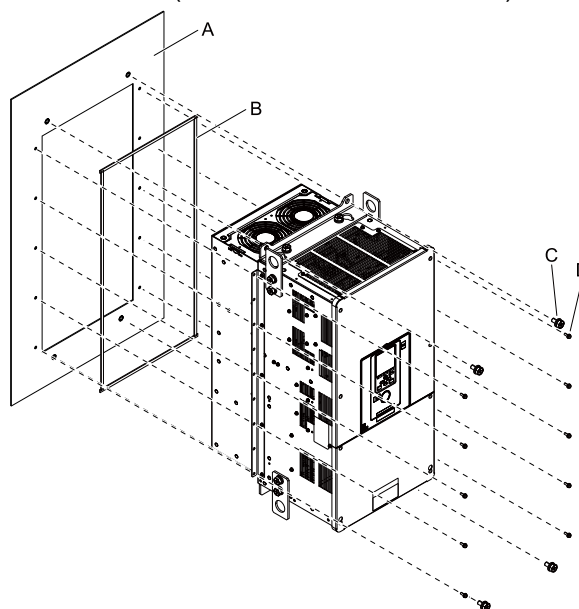
A - Shipping attachment

Figure 3.10 Remove the Shipping Attachment

- Install the drive in the cut opening of the enclosure panel and use screws to safety it to the enclosure panel.

Tighten the screws to a correct tightening torque:

- M5 screws: 1.96 N·m to 2.53 N·m (17.35 lbf·in to 22.39 lbf·in)
- M10 screws: 17.65 N·m to 22.56 N·m (156.22 lbf·in to 199.67 lbf·in)
- M12 screws: 31.38 N·m to 39.23 N·m (277.74 lbf·in to 347.22 lbf·in)



A - Enclosure panel

B - Gaskets

C - M10 screws or M12 screws

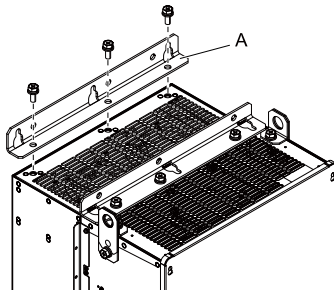
D - M5 screws

Figure 3.11 Install the Drive into the Opening of the Enclosure Panel

■ Install the Drive (Procedure B)

Cut an opening in the enclosure panel before you install the attachment. Refer to [Panel Cut-Out Dimensions \(IP55/UL Type 12 Heatsink External Mounting\)](#) on page 14 for more information.

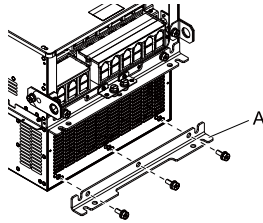
1. Remove the shipping attachment from the top of the drive.



A - Shipping attachment

Figure 3.12 Remove the Shipping Attachment

2. Remove the shipping attachment from the bottom of the drive.



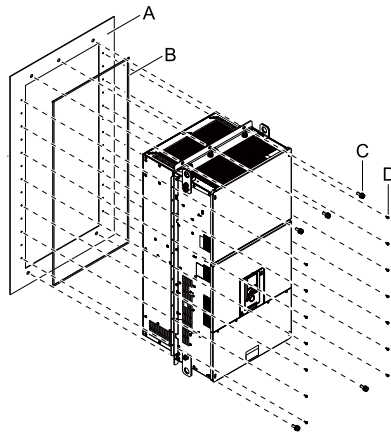
A - Shipping attachment

Figure 3.13 Remove the Shipping Attachment

3. Install the drive in the cut opening of the enclosure panel and use screws to safety it to the enclosure panel.

Tighten the screws to a correct tightening torque:

- M5 screws: 1.96 N·m to 2.53 N·m (17.35 lbf·in to 22.39 lbf·in)
- M12 screws: 31.38 N·m to 39.23 N·m (34.70 lbf·in to 43.37 lbf·in)



A - Enclosure panel

B - Gaskets

C - M12 screws

D - M5 screws

Figure 3.14 Install the Drive into the Opening of the Enclosure Panel

◆ Gasket Models

Table 3.3 Gasket Models

Drive Model	Gasket
2211, 2273 4180 - 4302	400-126-141-006
2343, 2396 4361, 4414	400-126-141-007
4477 - 4720	400-126-141-017

4 Maintenance

Refer to the Maintenance & Troubleshooting Manual (TOEPYAIFP601) for more information.

Only let authorized persons do maintenance, examine, or replace components on the drive.

Read this manual carefully and know all the precautions and safety information before installing, wiring, repairing, or examining the drive or replacing components.

Examine and maintain the drive and peripheral devices regularly to extend the life of the drive and decrease performance deterioration, decrease early wear, and decrease drive failures.

Regular examinations and maintenance will also decrease system downtime.

Refer to the Technical Reference (SIEPC7106171F) for more information about maintenance and examinations.

Examine the drive one time each year at a minimum.

The operating conditions, environmental conditions, and use conditions will have an effect on the examination frequency for connected equipment.

Examine the drive more frequently if you use the drive in bad conditions or in these conditions:

- High ambient temperatures
- Frequent starting and stopping
- Changes in the AC power supply or load
- Too much vibration or shock loading
- Dust, metal dust, salt, sulfuric acid, or chlorine atmospheres
- Unsatisfactory storage conditions.

The drive has Maintenance Monitors that keep track of component wear and warn maintenance period when the estimated performance life is approaching. This Maintenance Monitor eliminates the need to shut down the entire system for unexpected problems.

Users can set alarm notifications to inform the maintenance periods for a specific drive component.

◆ Replace Cooling Fans and Circulation Fans

⚠ CAUTION *Injury to Personnel. Some fan units are not easily accessible from a standing position. Make sure that you can safely and comfortably remove and replace the fan. If you try to remove a fan that you cannot easily access, the fan unit can fall and cause minor to moderate injury.*

NOTICE *Use the instructions in this manual to replace the cooling fans. When you do maintenance on the fans, replace all the fans to increase product life. If you install the fans incorrectly, it can cause damage to the drive.*

■ Cooling Fans and Circulation Fans by Drive Model

Table 4.1 Cooling Fans and Circulation Fans

Model	Cooling Fan	Circulation Fan	Circuit Board Cooling Fan	Procedure	Ref.
2211, 2273 4180 - 4302	2	-	-	Procedure A	22
4361	2	1	-	Procedure B	24

Model	Cooling Fan	Circulation Fan	Circuit Board Cooling Fan	Procedure	Ref.
2343, 2396 4414	3	1	-	Procedure B	24
4477 - 4590	2	1	2	Procedure C	31
4720	3	1	2	Procedure D	39

■ Fan Replacement (Procedure A)

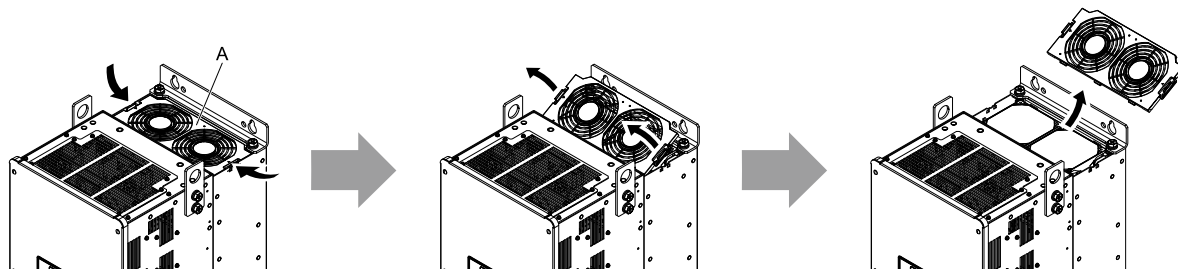
⚠ DANGER *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, remove the covers before measuring for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

⚠ CAUTION *Burn Hazard. Do not touch a hot drive heatsink. De-energize the drive, wait for a minimum of 15 minutes, then make sure that the heatsink is cool before you replace the cooling fans. If you touch a hot drive heatsink, it can burn you.*

NOTICE *Use the instructions in this manual to replace the cooling fans. When you do maintenance on the fans, replace all the fans to increase product life. If you install the fans incorrectly, it can cause damage to the drive.*

Fan Removal

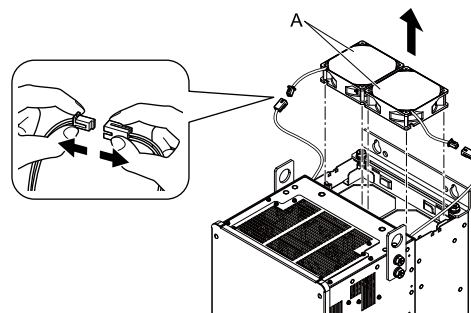
1. To remove the fan finger guard from the drive, push the tabs on the left and right sides of it and pull up the back side of the guard.



A - Fan finger guard

Figure 4.1 Remove the Fan Finger Guard

2. Pull the cooling fans straight up from the drive. Disconnect the relay connectors and remove the fans from the drive.



A - Cooling fans

Figure 4.2 Remove the Cooling Fans

Fan Installation

Reverse the removal procedure for fan installation.

1. Connect the relay connectors between the drive and cooling fans.

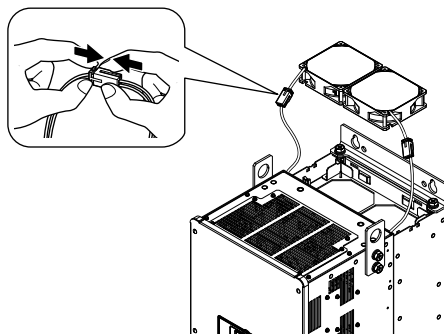
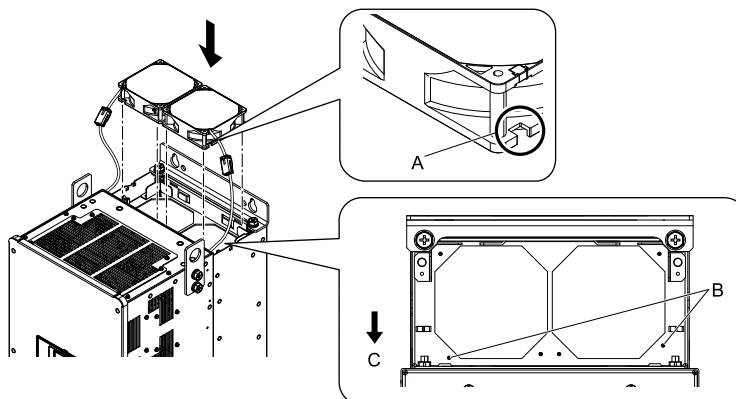


Figure 4.3 Connect the Relay Connectors

2. Align the notches on the fans with the pins on the drive and install the cooling fans in the drive.

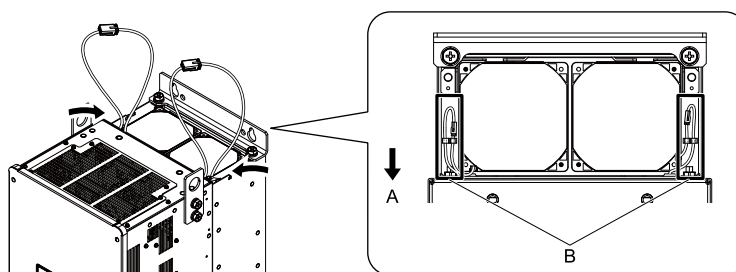


A - Notch on fan
B - Alignment pins on drive

C - Front of drive

Figure 4.4 Install the Cooling Fans

3. Put the cables and connectors in the recess of the drive.



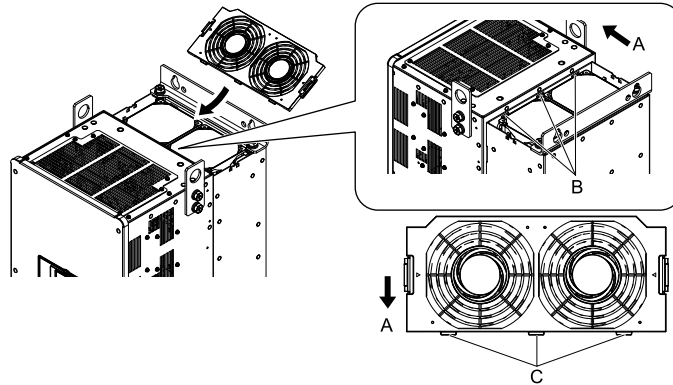
A - Front of drive

B - Space for cables ^{*1}

Figure 4.5 Put the Cables and Connectors in the Drive Recess

*1 Make sure that the cables and connectors are in the correct space.

4. Hold the fan finger guard at an angle and put the connector tabs on the fan finger guard into the holes on the drive.



A - Front of drive
B - Drive holes

C - Connector tabs

Figure 4.6 Reattach the Fan Finger Guard

5. Push the hooks on the left and right sides of the fan finger guard and click it into place on the drive.

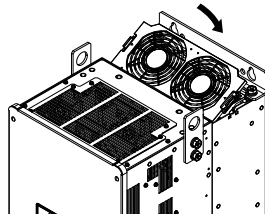


Figure 4.7 Reattach the Fan Finger Guard

6. Energize the drive and set $\alpha 4-03 = 0$ [Fan Operation Time Setting = 0 h] to reset the fan operation time.

■ Fan Replacement (Procedure B)

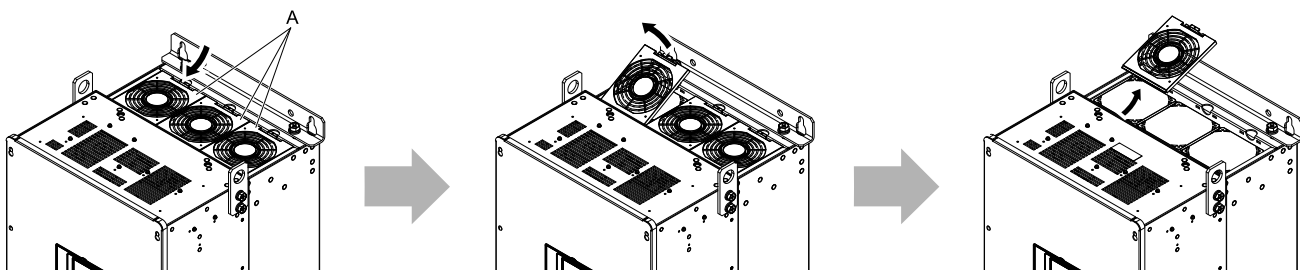
⚠ DANGER *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, remove the covers before measuring for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

⚠ CAUTION *Burn Hazard. Do not touch a hot drive heatsink. De-energize the drive, wait for a minimum of 15 minutes, then make sure that the heatsink is cool before you replace the cooling fans. If you touch a hot drive heatsink, it can burn you.*

NOTICE *Use the instructions in this manual to replace the cooling fans. When you do maintenance on the fans, replace all the fans to increase product life. If you install the fans incorrectly, it can cause damage to the drive.*

Fan Removal

1. To remove the fan finger guards from the drive, push the hook on the back side of each guard and pull up.



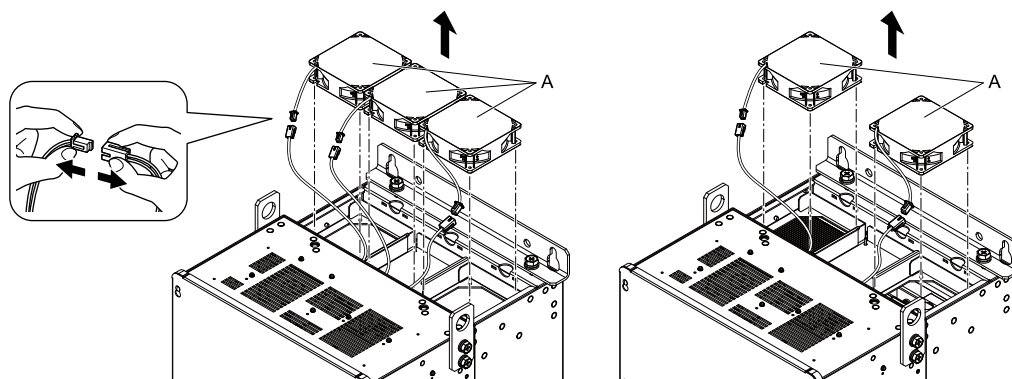
A - Fan finger guards

Figure 4.8 Remove the Fan Finger Guards

2. Pull the cooling fans straight up from the drive. Disconnect the relay connectors and remove the fans from the drive.

Note:

The number of fans is different for different drive models.



A - Cooling fans

Figure 4.9 Remove the Cooling Fans

Fan Installation

Reverse the removal procedure for fan installation.

1. Connect the relay connectors between the drive and cooling fans.

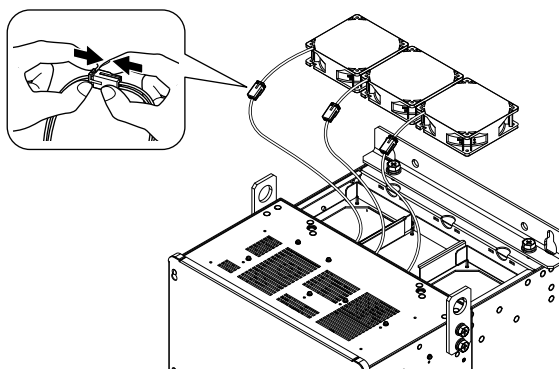
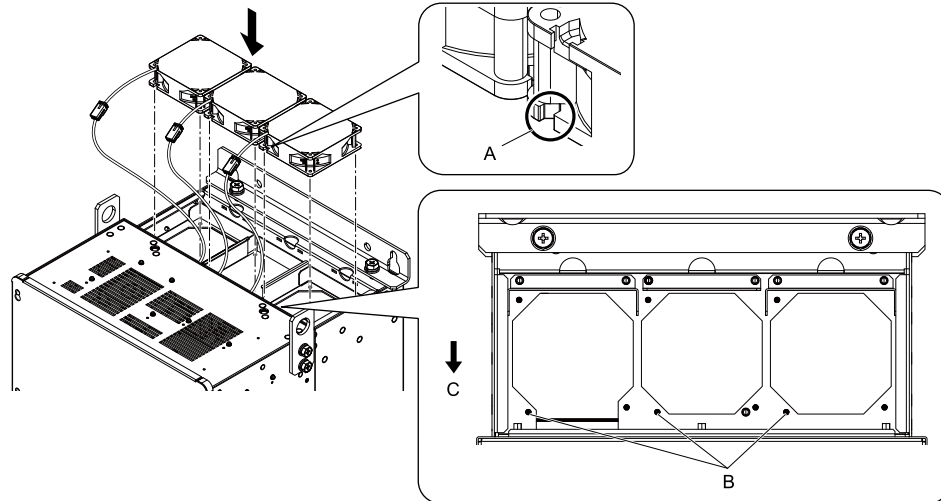


Figure 4.10 Connect the Relay Connectors

- Align the notches on the fans with the pins on the drive and install the cooling fans in the drive.

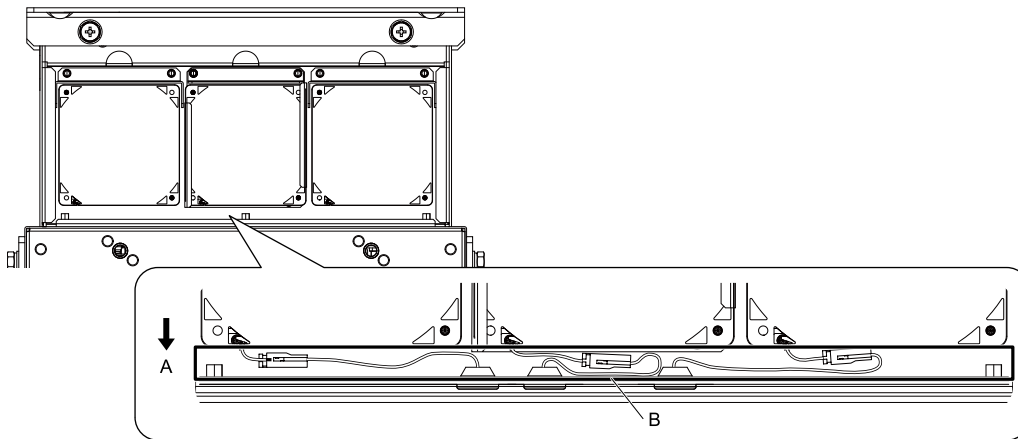


A - Notch on fan
B - Alignment pins on drive

C - Front of drive

Figure 4.11 Install the Cooling Fans

- Put the cables and connectors in the recess of the drive.



A - Front of drive

B - Space for cables ^{*1}

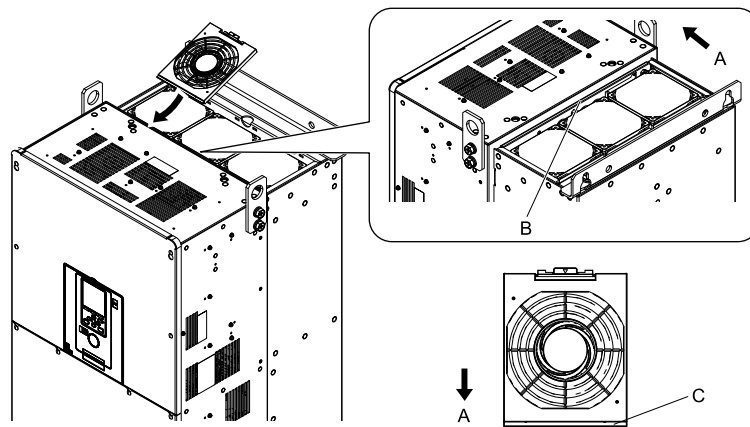
Figure 4.12 Put the Cables and Connectors in the Drive Recess

^{*1} Make sure that the cables and connectors are in the correct space.

- Hold the fan finger guards at an angle and put the connector tabs on the fan finger guards into the holes on the drive.

Note:

When you install the cooling fans, make sure that you do not pinch cables between the fan finger guards and the drive.



A - Front of drive
B - Insertion area

C - Connector tab

Figure 4.13 Reattach the Fan Finger Guards

5. Push the hooks on the back side of the fan finger guards and click them into place on the drive.

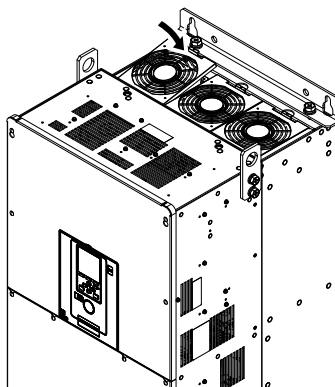


Figure 4.14 Reattach the Fan Finger Guards

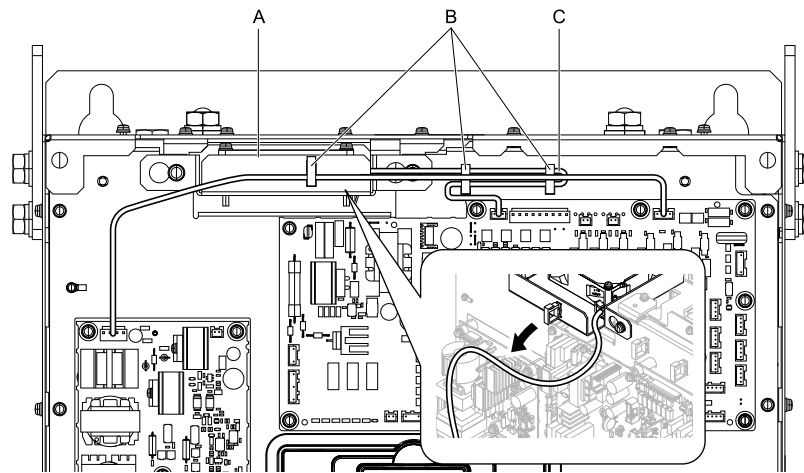
6. Energize the drive and set $\alpha 4-03 = 0$ [Fan Operation Time Setting = 0 h] to reset the fan operation time.

Circulation Fan Removal

Remove the drive cover before you start this procedure.

CAUTION Crush Hazard. Loosen the cover screws. Do not fully remove them. If you fully remove the cover screws, the terminal cover can fall and cause moderate injury.

1. Remove the cable from the clamps.



A - Fan unit
B - Clamps

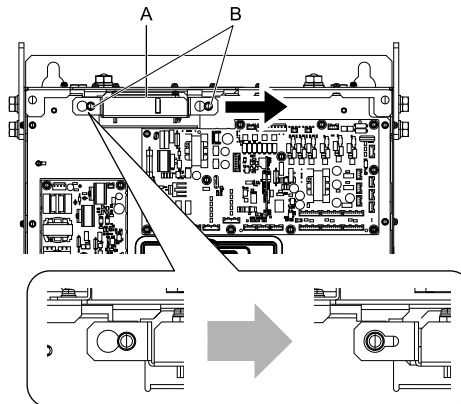
C - Fan cable

Figure 4.15 Remove the Fan Cable

2. Loosen the screws that safety the fan unit and slide the fan unit to the right.

Note:

To remove the fan unit, it is only necessary to loosen the screws.



A - Fan unit

B - Screws

Figure 4.16 Slide the Fan Unit

3. Disconnect the relay connector and remove the fan unit.

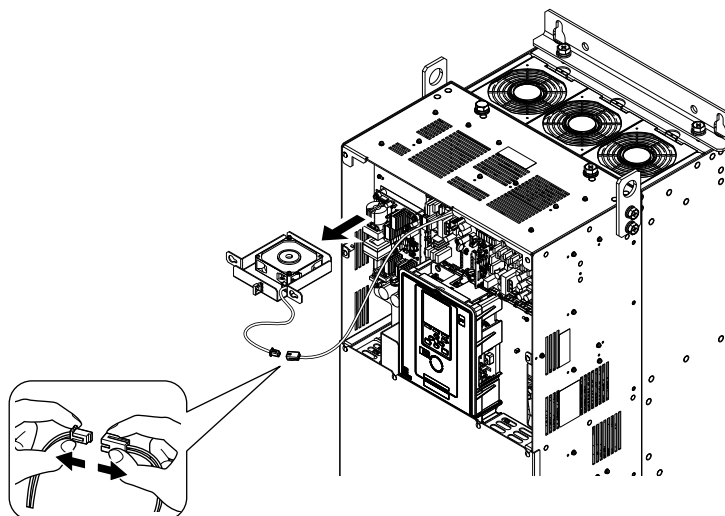
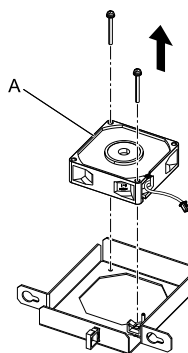


Figure 4.17 Remove the Fan Unit

4. Remove the screws that safety the circulation fan and remove the fan.



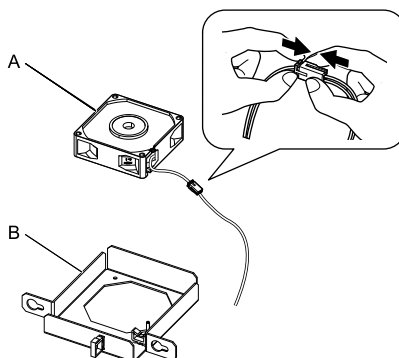
A - Circulation fan

Figure 4.18 Remove the Circulation Fan

Circulation Fan Installation

Reverse the removal procedure for fan installation.

1. Connect the relay connector between the drive and circulation fan.



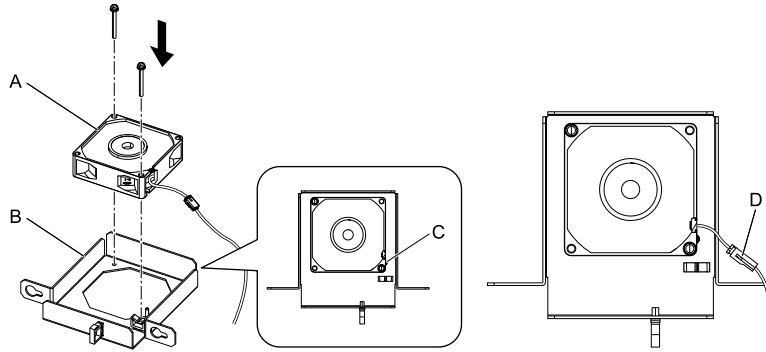
A - Circulation fan

B - Fan unit base

Figure 4.19 Connect the Relay Connector

2. Align the pin on the fan unit base with the notch on the fan and put the fan in the fan unit base, then use the screws to safety it.
Tighten the screws to a correct tightening torque:

- 0.98 N·m to 1.33 N·m (8.67 lbf·in to 11.77 lbf·in)

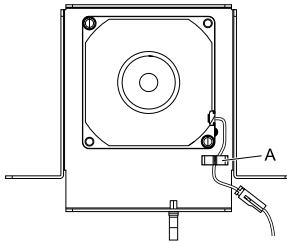


A - Circulation fan
B - Fan unit base

C - Alignment pin on fan unit base
D - Circulation fan connector

Figure 4.20 Install the Circulation Fan

3. Safety the fan cable through the clamp.



A - Clamp

Figure 4.21 Safety the Fan Cable

4. Put the fan unit into the specified location and slide it to the left, then use screws to safety it to the drive.
Tighten the screws to a correct tightening torque:
• 0.98 N·m to 1.33 N·m (8.67 lbf·in to 11.77 lbf·in)

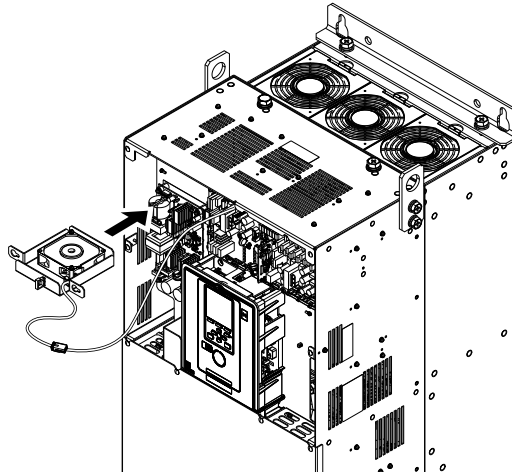


Figure 4.22 Install the Fan Unit

5. Safety the cable through the clamps.

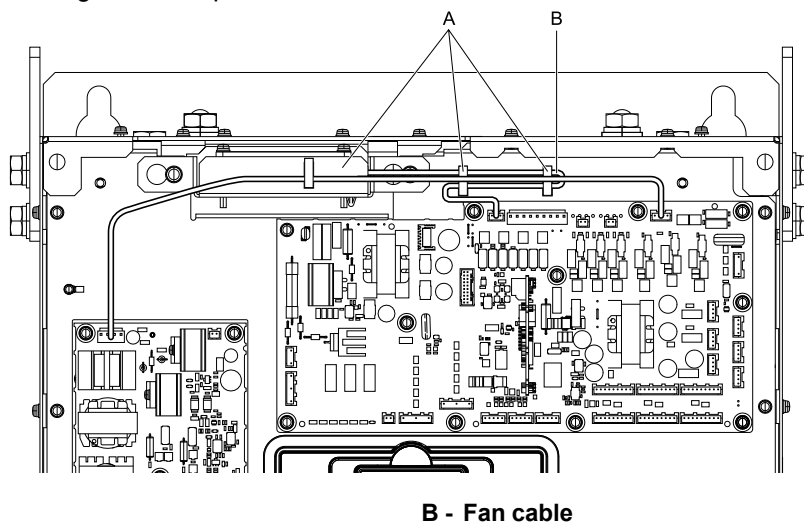


Figure 4.23 Safety the Fan Cable through the Clamps

6. Install the drive cover.
7. Energize the drive and set $o4-03 = 0$ [Fan Operation Time Setting = 0 h] to reset the fan operation time.

■ Fan Replacement (Procedure C)

⚠ DANGER *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, remove the covers before measuring for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

⚠ CAUTION *Burn Hazard. Do not touch a hot drive heatsink. De-energize the drive, wait for a minimum of 15 minutes, then make sure that the heatsink is cool before you replace the cooling fans. If you touch a hot drive heatsink, it can burn you.*

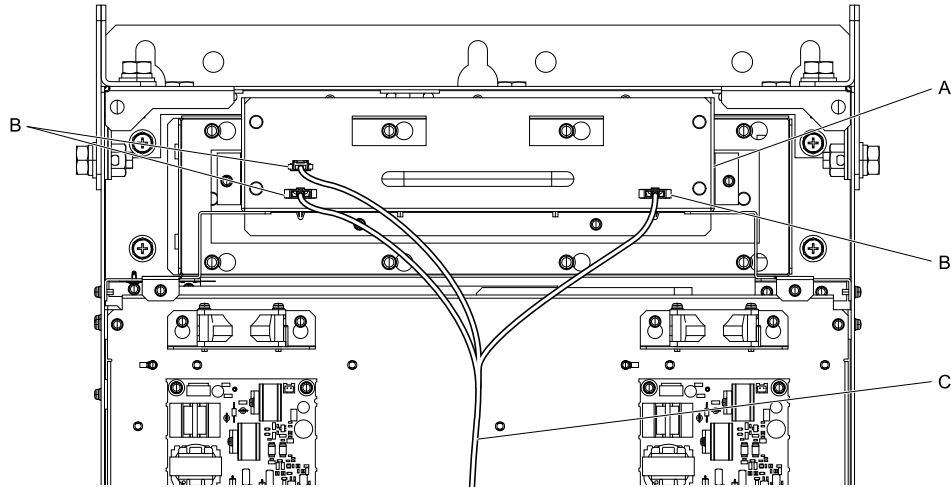
NOTICE *Use the instructions in this manual to replace the cooling fans. When you do maintenance on the fans, replace all the fans to increase product life. If you install the fans incorrectly, it can cause damage to the drive.*

Fan Removal

1. Remove the drive cover.

⚠ CAUTION *Crush Hazard. Loosen the cover screws. Do not fully remove them. If you fully remove the cover screws, the terminal cover can fall and cause moderate injury.*

- Unplug the fan cable from the fan connectors.



A - Fan unit
B - Fan connectors

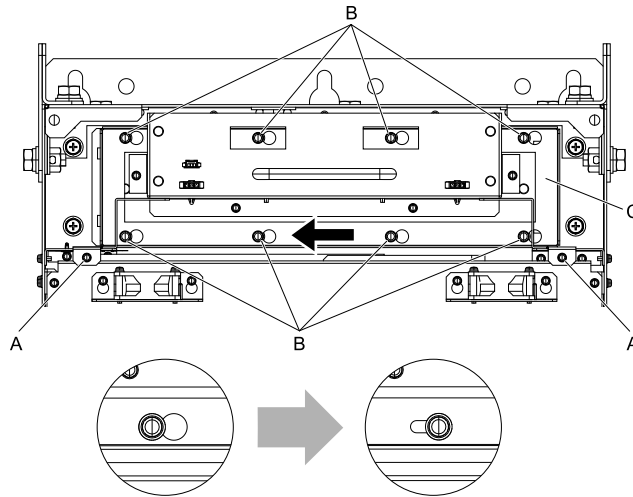
C - Fan cable

Figure 4.24 Remove the Fan Cable

- Loosen the screws that safety the fan unit and slide the slide panel to the left.

Note:

To remove the fan unit, it is only necessary to loosen the screws in position B.
Remove the screws in position A.



A - Screw position A
B - Screw position B

C - Slide panel

Figure 4.25 Slide the Slide Panel

- Remove the fan unit and the slide panel at the same time.

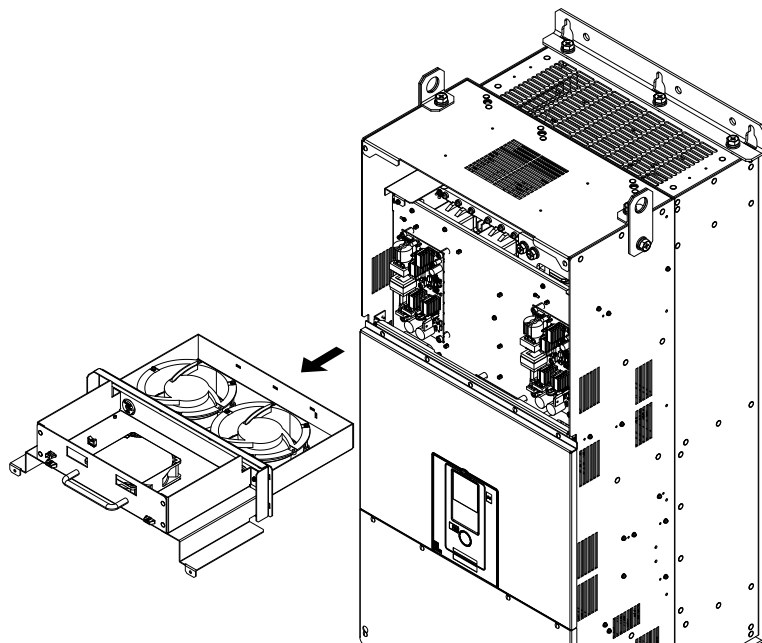
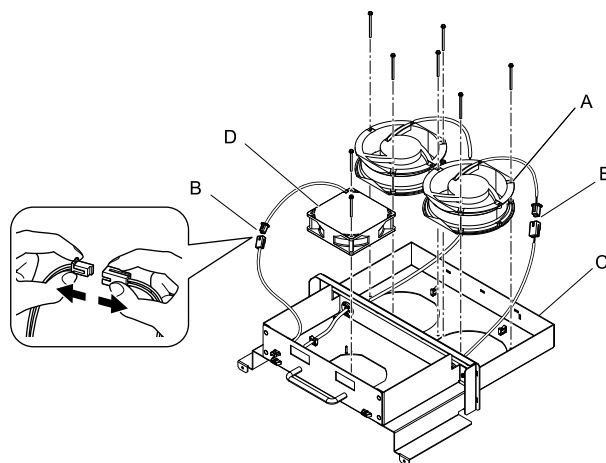


Figure 4.26 Remove the Fan Unit

- Unplug the relay connectors, remove the screws that safety the cooling fans and circulation fan, and then remove the fans.



A - Cooling fans
B - Relay connectors

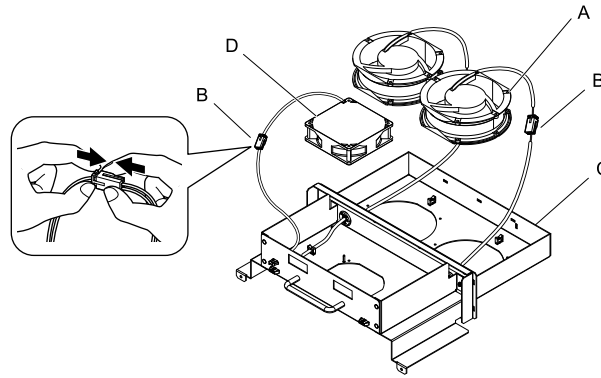
C - Fan unit base
D - Circulation fan

Figure 4.27 Remove the Cooling Fans and Circulation Fan

Fan Installation

Reverse the removal procedure for fan installation.

1. Connect the relay connectors on the fan unit base to the cooling fans and the circulation fan.



A - Cooling fans
B - Relay connectors

C - Fan unit base
D - Circulation fan

Figure 4.28 Connect the Relay Connectors

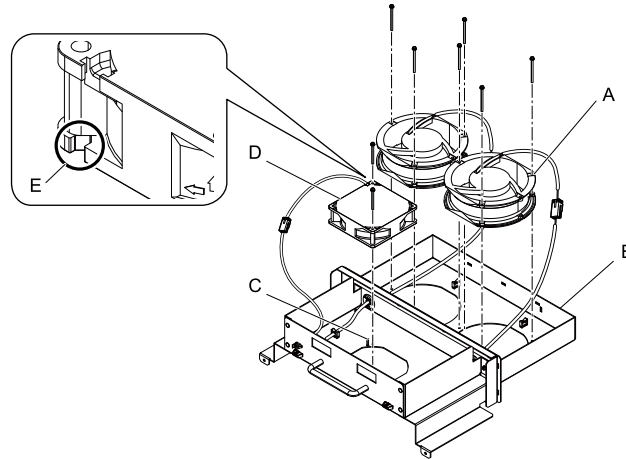
2. Align the pins on the fan unit base with the notches on the fans and put the fans in the fan unit base, then use the screws to safety them.

Tighten the screws to a correct tightening torque:

- 0.98 N·m to 1.33 N·m (8.67 lbf·in to 11.77 lbf·in)

Note:

Make sure that you do not pinch cables between the fans and the fan unit base.



A - Cooling fans
B - Fan unit base
C - Alignment pin on fan unit base

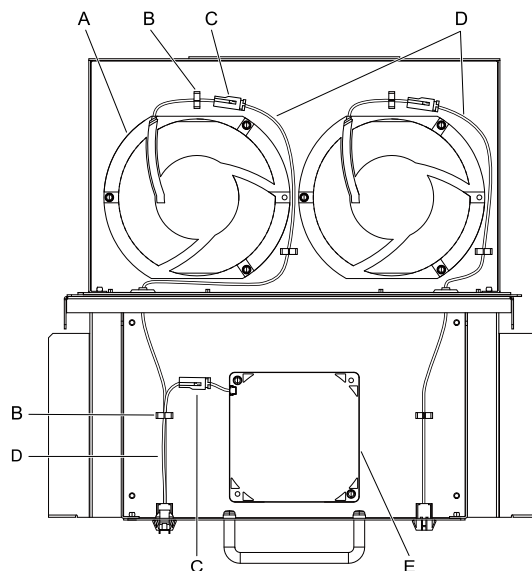
D - Circulation fan
E - Notch on fan

Figure 4.29 Install the Cooling Fans and Circulation Fan

3. Put the cables and connectors in the recess of the drive.

Note:

Safety the relay cables to the hooks.



A - Cooling fans
 B - Cable hooks
 C - Relay connectors

D - Relay cables
 E - Circulation fan

Figure 4.30 Put the Cables and Connectors in the Drive Recess

4. Put the fan unit into the specified location.

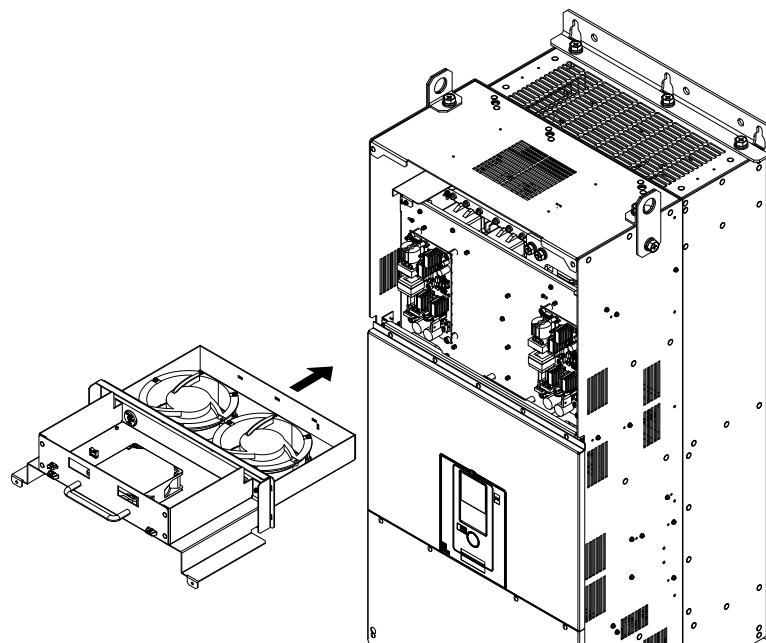
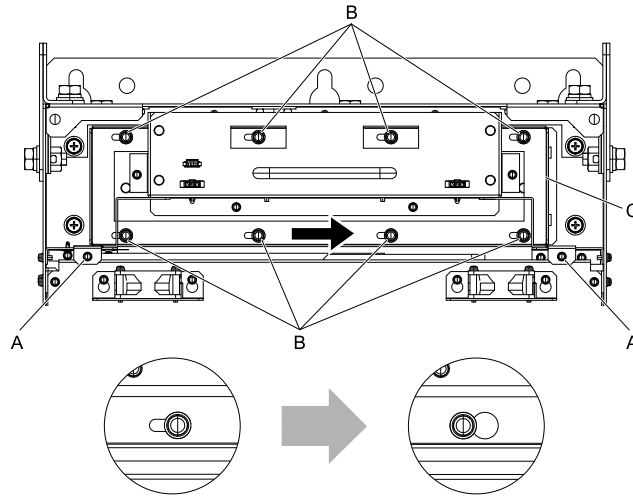


Figure 4.31 Install the Fan Unit

5. Slide the fan unit to the right and use the screws to safety it to the drive.
 Tighten the screws to a correct tightening torque:
 - Screws in Position A: 0.98 N·m to 1.33 N·m (8.67 lbf-in to 11.77 lbf-in)
 - Screws in Position B: 1.96 N·m to 2.53 N·m (17.35 lbf-in to 22.39 lbf-in)

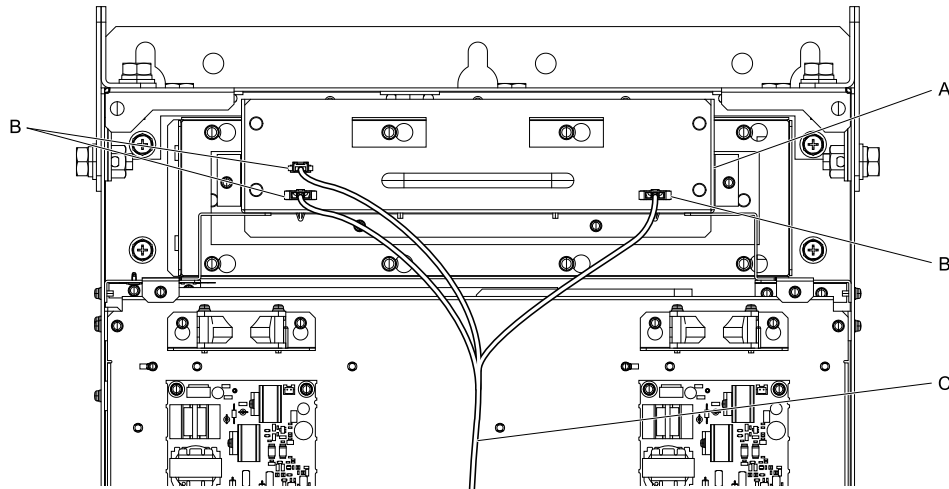


A - Screw position A
 B - Screw position B

C - Fan unit

Figure 4.32 Slide the Fan Unit

6. Connect the fan cable to the fan connectors.



A - Fan unit
 B - Fan connectors

C - Fan cable

Figure 4.33 Connect Cooling Fan Connectors

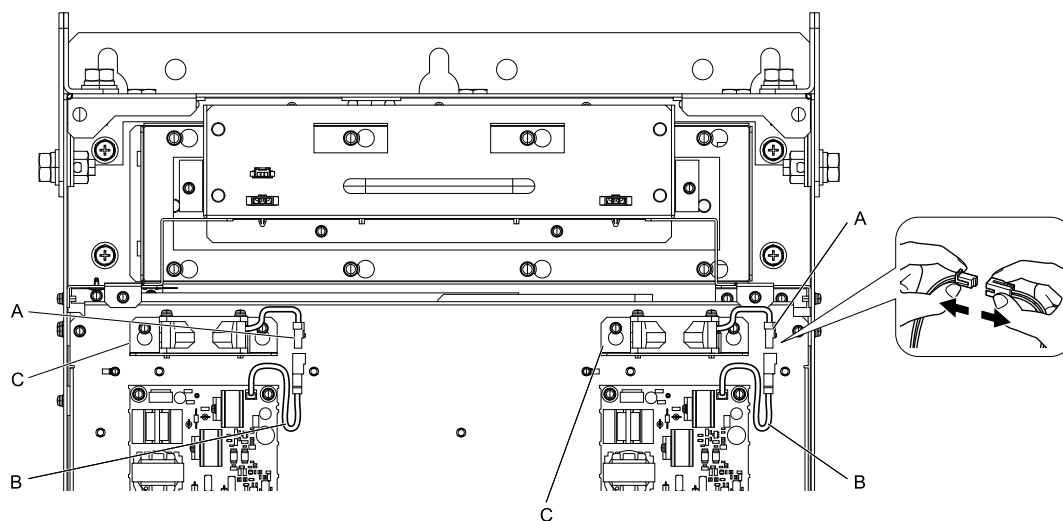
7. Install the drive cover.
8. Energize the drive and set $\alpha 4-03 = 0$ [Fan Operation Time Setting = 0 h] to reset the fan operation time.

Circuit Board Cooling Fan Removal

Remove the drive cover before you start this procedure.

CAUTION *Crush Hazard. Loosen the cover screws. Do not fully remove them. If you fully remove the cover screws, the terminal cover can fall and cause moderate injury.*

1. Unplug the fan cables from the fan connectors.



A - Fan connectors
B - Fan cables

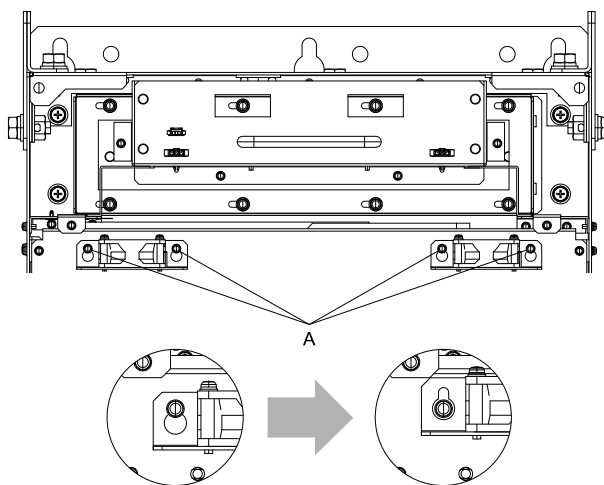
C - Circuit board cooling fan units

Figure 4.34 Unplug the Fan Cables

2. Loosen the screws that safety the circuit board cooling fan unit and slide the circuit board cooling fan unit up.

Note:

To remove the fan unit, it is only necessary to loosen the screws.



A - Screws

Figure 4.35 Slide the Circuit Board Cooling Fan Units

3. Remove the circuit board cooling fan units.

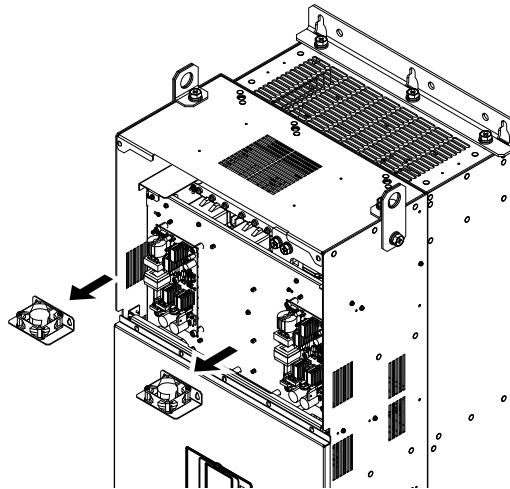
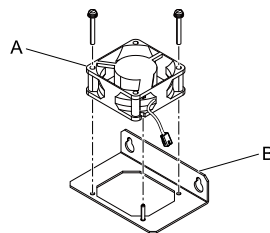


Figure 4.36 Remove the Circuit Board Cooling Fan Units

4. Remove the screws that safety the circuit board cooling fans and remove the fans.



A - Circuit board cooling fan

B - Fan unit base

Figure 4.37 Remove the Circuit Board Cooling Fans

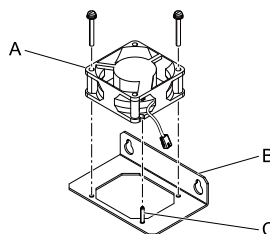
Circuit Board Cooling Fan Installation

Reverse the removal procedure for fan installation.

1. Align the pin on the fan unit base with the notch on the fan and put the circuit board cooling fan in the fan unit, then use the screws to safety the circuit board cooling fan to the fan unit base.
Tighten the screws to a correct tightening torque:
 - 0.98 N·m to 1.33 N·m (8.67 lbf·in to 11.77 lbf·in)

Note:

Make sure that you do not pinch cables between the circuit board cooling fan and the fan unit base.



A - Circuit board cooling fan

B - Fan unit base

C - Alignment pin on fan unit base

Figure 4.38 Install the Circuit Board Cooling Fan

2. Put the circuit board cooling fan unit into the specified location and slide it down, then use the screws to safety it to the drive.
Tighten the screws to a correct tightening torque:
 - 0.98 N·m to 1.33 N·m (8.67 lbf·in to 11.77 lbf·in)

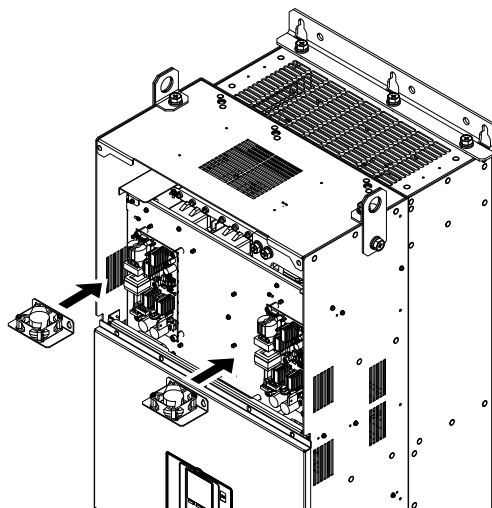
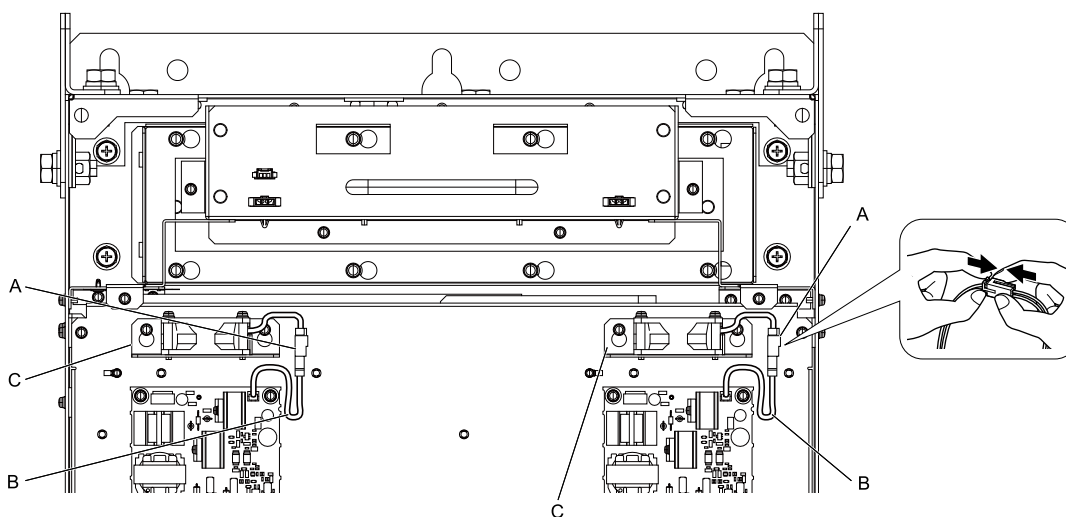


Figure 4.39 Install the Circuit Board Cooling Fan Unit

3. Connect the fan cable to the fan connectors.



A - Fan connectors
B - Fan cable

C - Circuit board cooling fan units

Figure 4.40 Fan Connect Cooling Fan Connectors

4. Install the drive cover.
5. Energize the drive and set $\alpha 4-03 = 0$ [Fan Operation Time Setting = 0 h] to reset the fan operation time.

■ Fan Replacement (Procedure D)

⚠ DANGER *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, remove the covers before measuring for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

⚠ CAUTION *Burn Hazard. Do not touch a hot drive heatsink. De-energize the drive, wait for a minimum of 15 minutes, then make sure that the heatsink is cool before you replace the cooling fans. If you touch a hot drive heatsink, it can burn you.*

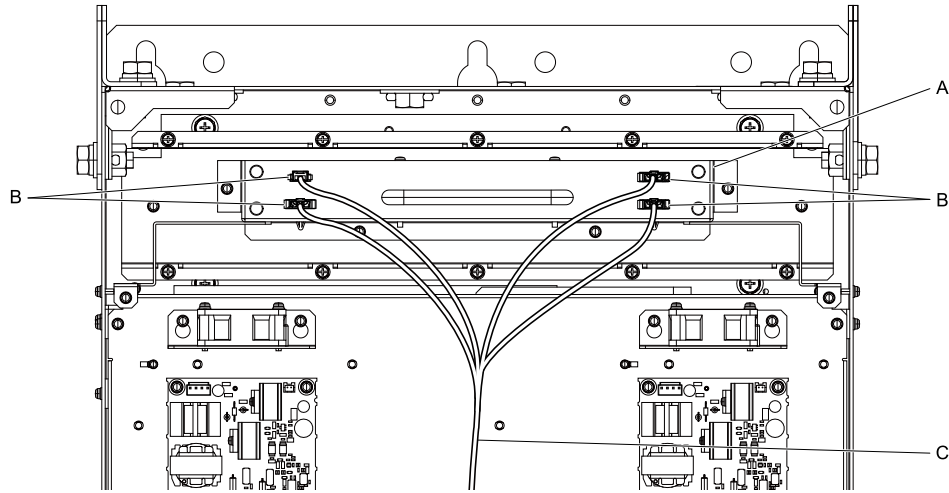
NOTICE *Use the instructions in this manual to replace the cooling fans. When you do maintenance on the fans, replace all the fans to increase product life. If you install the fans incorrectly, it can cause damage to the drive.*

Fan Removal

1. Remove the drive cover.

CAUTION Crush Hazard. Loosen the cover screws. Do not fully remove them. If you fully remove the cover screws, the terminal cover can fall and cause moderate injury.

2. Unplug the fan cables from the fan connectors.



A - Fan unit
B - Fan connectors

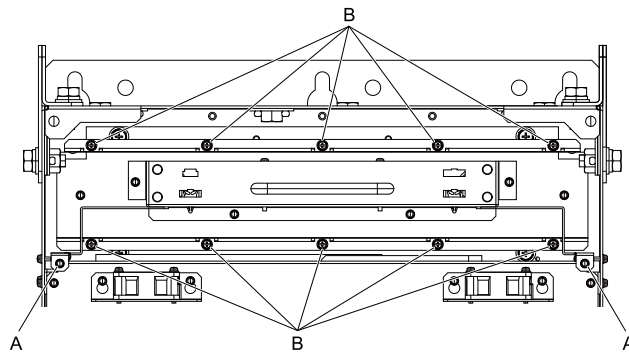
C - Fan cable

Figure 4.41 Unplug the Fan Cables

3. Loosen the screws that safety the fan unit.

Note:

To remove the fan unit, it is only necessary to loosen the screws in position B. Remove the screws in position A.



A - Screw position A

B - Screw position B

Figure 4.42 Loosen the Screws

- Remove the fan unit.

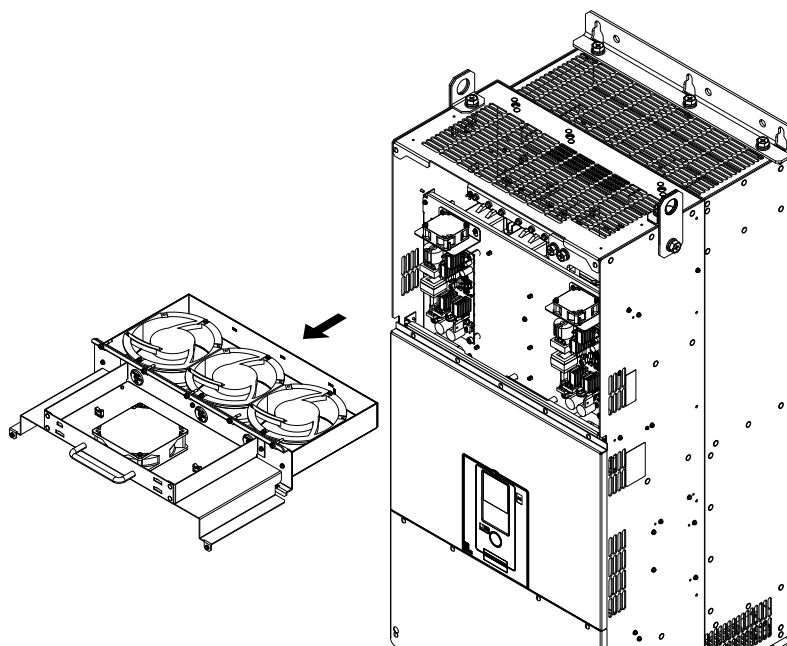
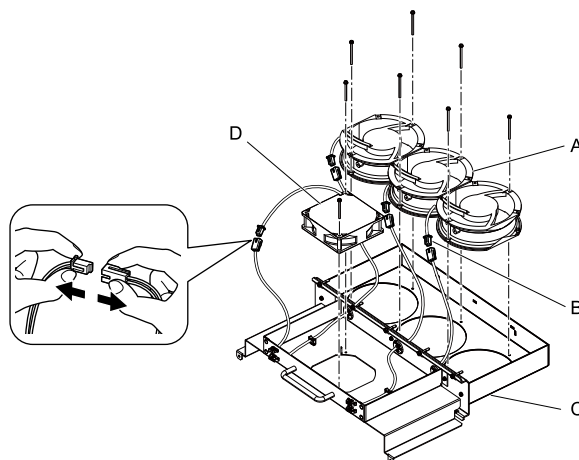


Figure 4.43 Remove the Fan Unit

- Unplug the relay connector, remove the screws that safety the cooling fans and circulation fan, and then remove the fans.



A - Cooling fans
B - Relay connectors

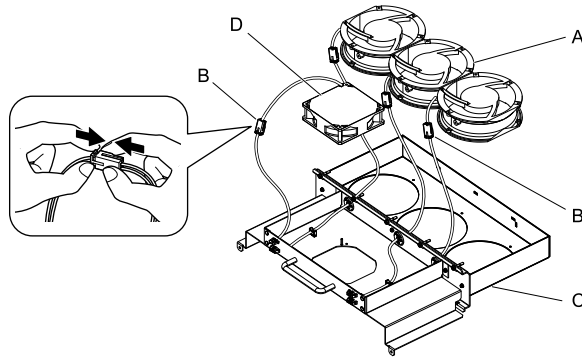
C - Fan unit base
D - Circulation fan

Figure 4.44 Remove the Cooling Fans and Circulation Fan

Fan Installation

Reverse the removal procedure for fan installation.

1. Connect the relay connectors on the fan unit base to the cooling fans and the circulation fan.



A - Cooling fans
B - Relay connectors

C - Fan unit base
D - Circulation fan

Figure 4.45 Connect the Relay Connectors

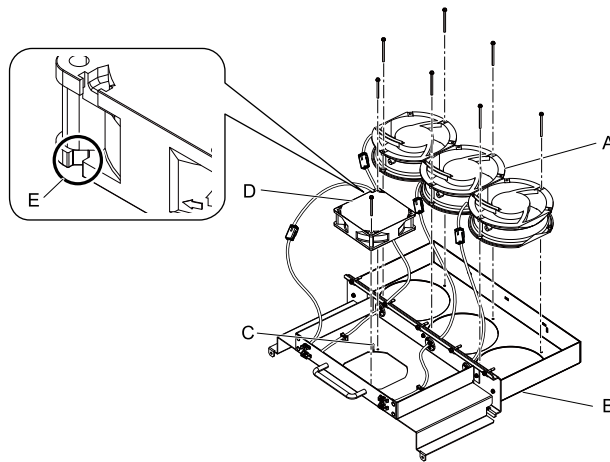
2. Align the pins on the fan unit base with the notches on the fans and put the fans in the fan unit base, then use the screws to safety them.

Tighten the screws to a correct tightening torque:

- 0.98 N·m to 1.33 N·m (8.67 lbf·in to 11.77 lbf·in)

Note:

Make sure that you do not pinch cables between the fans and the fan unit base.



A - Cooling fans
B - Fan unit base
C - Alignment pin on fan unit base

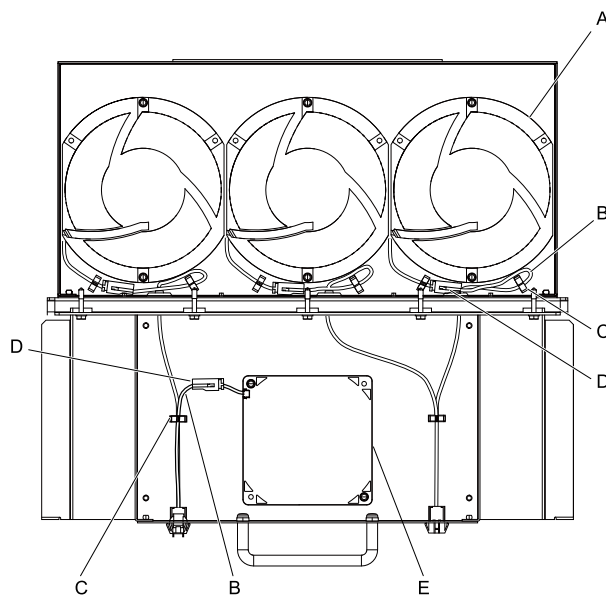
D - Circulation fan
E - Notch on fan

Figure 4.46 Install the Cooling Fans and Circulation Fan

3. Put the cables and connectors in the recess of the drive.

Note:

Safety the relay cables to the hooks.

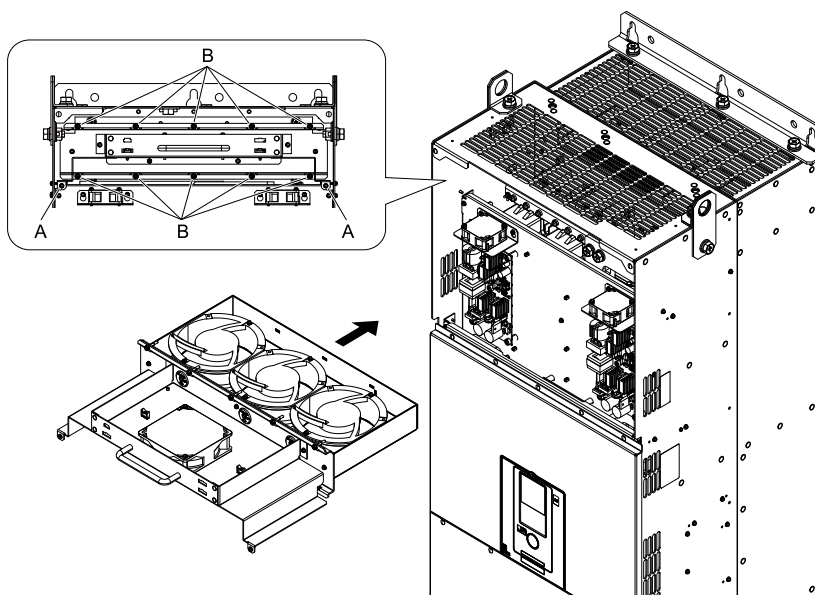


A - Cooling fans
B - Relay cables
C - Cable hooks

D - Relay connectors
E - Circulation fan

Figure 4.47 Put the Cables and Connectors in the Drive Recess

4. Put the fan unit into the specified location and use screws to safety it to the drive.
Tighten the screws to a correct tightening torque:
- Screws in Position A: 0.98 N·m to 1.33 N·m (8.67 lbf·in to 11.77 lbf·in)
 - Screws in Position B: 1.96 N·m to 2.53 N·m (17.35 lbf·in to 22.39 lbf·in)

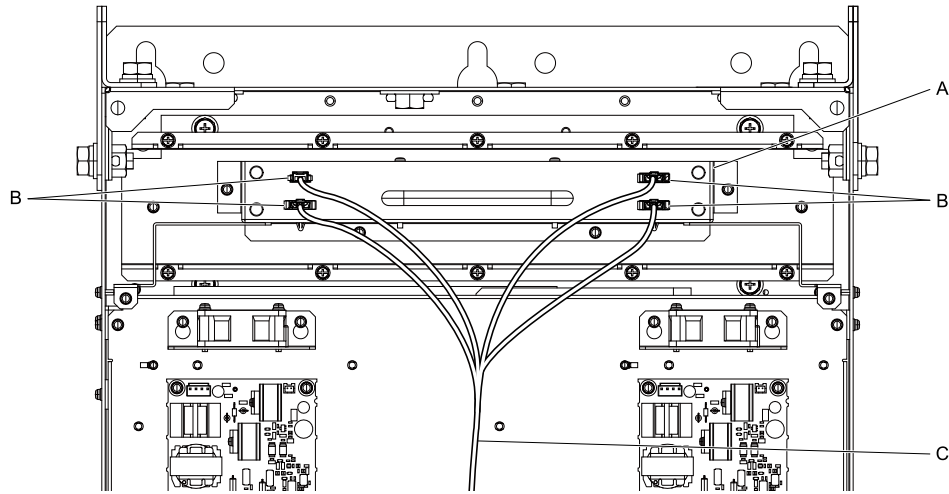


A - Screw position A

B - Screw position B

Figure 4.48 Install the Fan Unit

5. Connect the fan cable to the fan connectors.



A - Fan unit
B - Fan connectors

C - Fan cable

Figure 4.49 Connect Cooling Fan Connectors

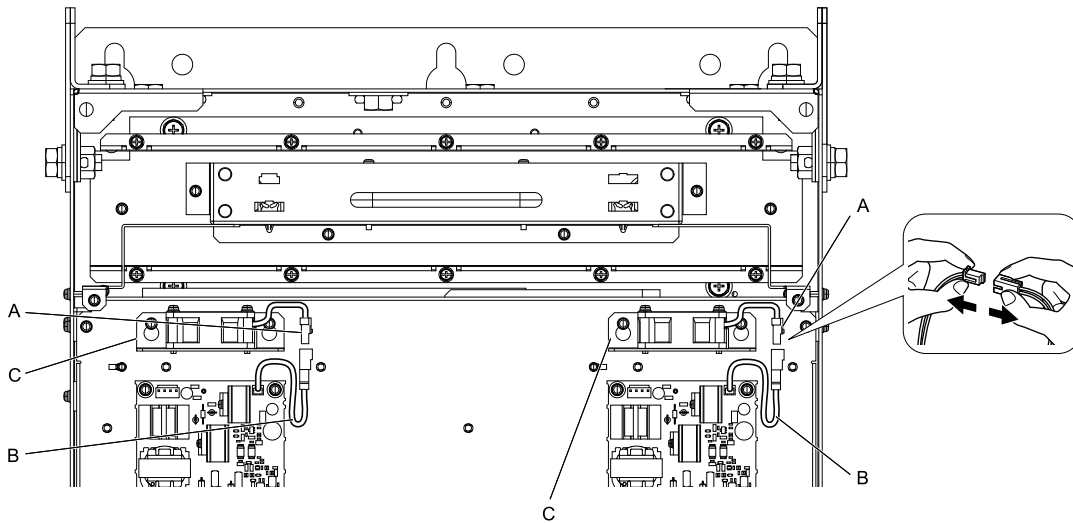
6. Install the drive cover.
7. Energize the drive and set $o4-03 = 0$ [Fan Operation Time Setting = 0 h] to reset the fan operation time.

Circuit Board Cooling Fan Removal

Remove the drive cover before you start this procedure.

CAUTION Crush Hazard. Loosen the cover screws. Do not fully remove them. If you fully remove the cover screws, the terminal cover can fall and cause moderate injury.

1. Unplug the fan cables from the fan connectors.



A - Fan connectors
B - Fan cables

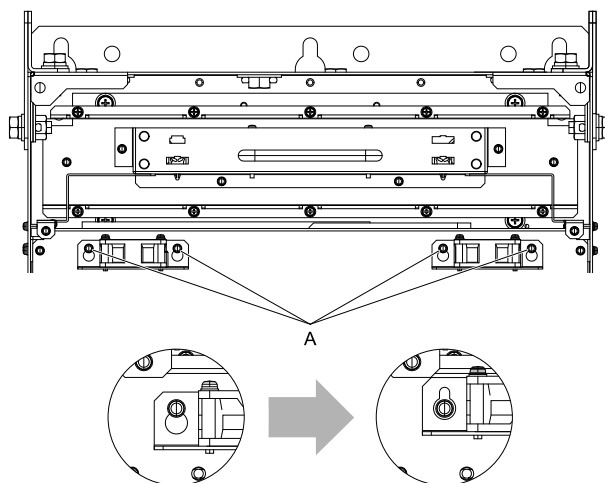
C - Circuit board cooling fan units

Figure 4.50 Unplug the Fan Cables

2. Loosen the screws that safety the circuit board cooling fan unit and slide the circuit board cooling fan unit up.

Note:

To remove the fan unit, it is only necessary to loosen the screws.



A - Screws

Figure 4.51 Slide the Circuit Board Cooling Fan Unit

3. Remove the circuit board cooling fan units.

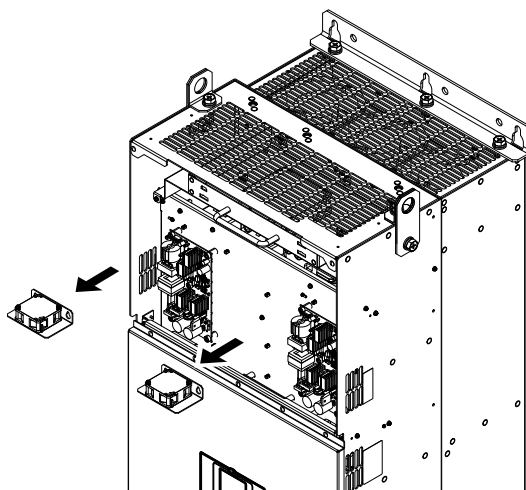
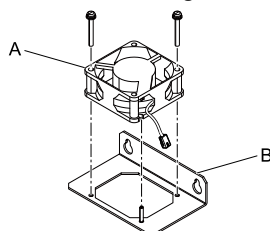


Figure 4.52 Remove the Circuit Board Cooling Fan Units

4. Remove the screws that safety the circuit board cooling fans and remove the fans.



A - Circuit board cooling fan

B - Fan unit base

Figure 4.53 Remove the Circuit Board Cooling Fans

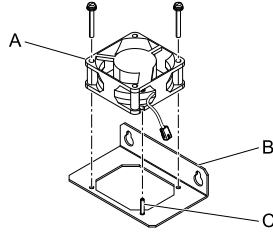
Circuit Board Cooling Fan Installation

Reverse the removal procedure to install a cooling fan.

1. Align the pin on the fan unit base with the notch on the fan and put the circuit board cooling fan in the fan unit, then use the screws to safety the circuit board cooling fan to the fan unit base.
Tighten the screws to a correct tightening torque:
 - 0.98 N·m to 1.33 N·m (8.67 lbf·in to 11.77 lbf·in)

Note:

Make sure that you do not pinch cables between the circuit board cooling fan and the fan unit base.



A - Circuit board cooling fan
B - Fan unit base

C - Alignment pin on fan unit base

Figure 4.54 Install the Circuit Board Cooling Fan

2. Put the circuit board cooling fan unit into the specified location and use screws to safety it to the drive.
 Tighten the screws to a correct tightening torque:
 - 0.98 N·m to 1.33 N·m (8.67 lbf·in to 11.77 lbf·in)

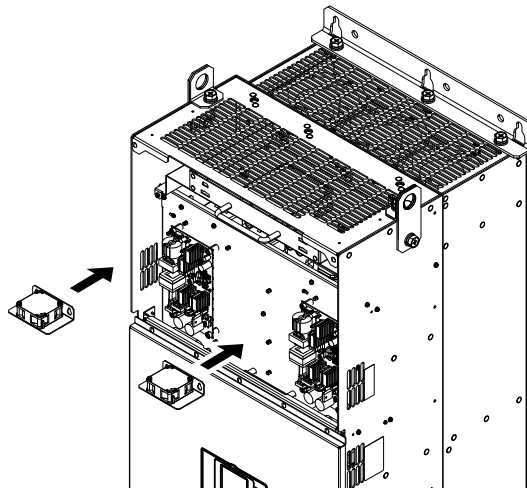
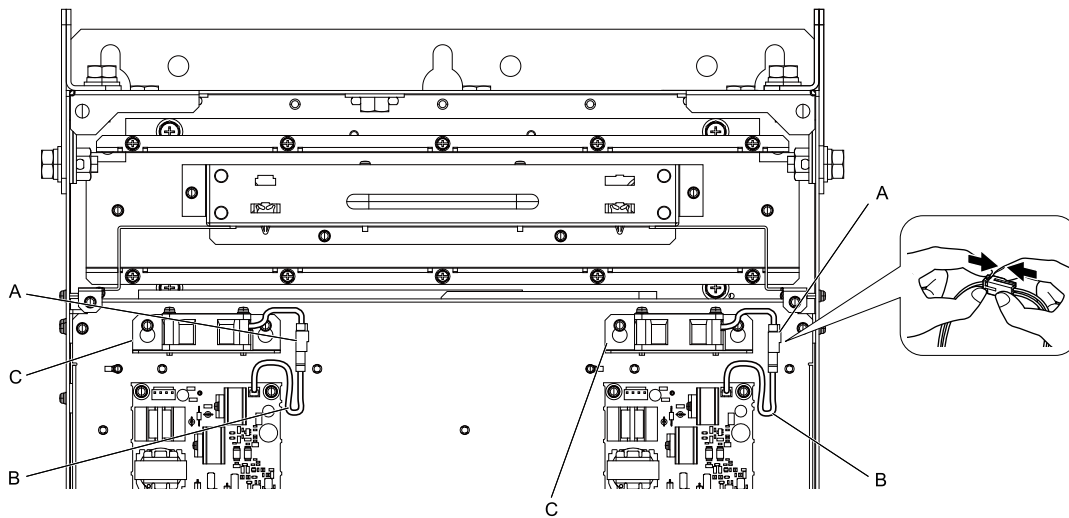


Figure 4.55 Install the Circuit Board Cooling Fan Unit

3. Connect the fan cables to the fan connectors.



A - Fan connectors
B - Fan cables

C - Circuit board cooling fan units

Figure 4.56 Connect the Fan Cables

4. Install the drive cover.
5. Energize the drive and set $o4-03 = 0$ [*Fan Operation Time Setting = 0 h*] to reset the fan operation time.

◆ Replace Gasket

If there is damage to the gasket, replace it with the replacement gasket.

1. Use a plastic scraper to remove the damaged gasket.

Note:

Do not scratch the mounting surfaces.

2. Remove the adhesive cover from the replacement gasket.
3. Install the replacement gasket.
Align the screw holes on the replacement gasket with the holes on the enclosure panel or a fan replacement service panel.

5 Specifications

◆ Common Drive Specifications

Note:

To get the longest product life, install the drive in an environment that meets the necessary specifications.

Table 5.1 Control Characteristics

Item	Specification
Control Methods	<ul style="list-style-type: none"> • V/f Control (V/f) • PM Open Loop Vector Control (OLV/PM) • EZ Open Loop Vector Control (EZOLV)
Carrier Frequency	2 kHz without derating the drive capacity <ul style="list-style-type: none"> • Models 2211, 2273, and 4180 to 4414: Derate the drive capacity to use values to 10 kHz maximum. • Models 2343, 2396, and 4477 to 4720: Derate the drive capacity to use values to 5 kHz maximum.
Maximum Output Voltage	<ul style="list-style-type: none"> • 200 V class: Three-phase 200 V to 240 V • 400 V class: Three-phase 380 V to 480 V <p>Note: The maximum output voltage is proportional to the input voltage.</p>
Frequency Control Range	<ul style="list-style-type: none"> • EZOLV: 0.01 Hz to 120 Hz • V/f and OLV/PM: 0.01 Hz to 400 Hz
Frequency Accuracy (Temperature Fluctuation)	Digital inputs: Within $\pm 0.01\%$ of the maximum output frequency ($-10\text{ }^{\circ}\text{C}$ to $+40\text{ }^{\circ}\text{C}$ ($14\text{ }^{\circ}\text{F}$ to $104\text{ }^{\circ}\text{F}$)) Analog inputs: Within $\pm 0.1\%$ of the maximum output frequency ($25\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$ ($77\text{ }^{\circ}\text{F} \pm 18\text{ }^{\circ}\text{F}$))
Frequency Setting Resolution	Digital inputs: 0.01 Hz Analog inputs: 1/2048 of the maximum output frequency (11-bit)
Output Frequency Resolution	0.001 Hz
Frequency Setting Signal	Main speed frequency reference: 0 Vdc to 10 Vdc (20 k Ω), 4 mA to 20 mA (250 Ω), 0 mA to 20 mA (250 Ω) Main speed reference: Pulse train input (maximum 32 kHz)
Starting Torque	<ul style="list-style-type: none"> • V/f: 140%/3 Hz • OLV/PM: 100%/10% speed • EZOLV: 100%/10% speed
Speed Control Range	<ul style="list-style-type: none"> • For Induction Motors: <ul style="list-style-type: none"> – V/f: 1:40 – EZOLV: 1:10 • For Permanent Magnet Motors and Synchronous Reluctance Motors: <ul style="list-style-type: none"> – OLV/PM: 1:20 – EZOLV: 1:10
Torque Limits	Parameter settings allow different limits in four quadrants in EZOLV control method.

5 Specifications

Item	Specification
Accel/Decel Time	0.0 s to 6000.0 s The drive can set two pairs of different acceleration and deceleration times.
V/f Characteristics	Select from 15 pre-defined V/f patterns, or a user-set V/f pattern.
Main Control Functions	Restart After Momentary Power Loss, Speed Search, Overtorque/Undertorque Detection, Torque Limit, 17 Step Speed (max.), Accel/Decel Switch, S-curve Acceleration/Deceleration, 3-wire Sequence, Auto-Tuning (Rotational and Stationary), Dwell Function, Cooling Fan ON/OFF Switch, Slip Compensation, Torque Compensation, Jump Frequency, Upper/Lower Limits for Frequency Reference, DC Injection Braking at Start and Stop, Overexcitation Braking, High Slip Braking, PID Control (with Sleep Function), Energy Saving Control, MEMOBUS/Modbus Communication (RS-485 max. 115.2 kbps), Auto Restart, Application Presets, KEB, Overexcitation Deceleration, Overvoltage Suppression

Table 5.2 Protection Functions

Item	Specification
Motor Protection	Electronic thermal overload protection
Momentary Overcurrent Protection	Drive stops when the output current is more than 175% of the drive rated output current.
Overload Protection	Drive stops when the output current is more than these overload tolerances: <ul style="list-style-type: none"> • 110% of the rated output current for 60 seconds • 140% of the rated output current for 2.5 seconds when the drive output frequency is 3 Hz The permitted frequency of overload is one time each 10 minutes. Note: <ul style="list-style-type: none"> • If output frequency < 6 Hz, the drive can trigger the overload protection function when the output current is in the overload tolerance range. • Derating may be necessary for applications that start and stop frequently.
Overvoltage Protection	200 V class: Stops when the DC bus voltage is more than approximately 410 V 400 V class: Stops when the DC bus voltage is more than approximately 820 V
Undervoltage Protection	200 V class: Stops when the DC bus voltage decreases to less than approximately 190 V 400 V class: <ul style="list-style-type: none"> • Stops when the DC bus voltage decreases to less than approximately 350 V when you use an input voltage less than 400 V • Stops when the DC bus voltage decreases to less than approximately 380 V when you use an input voltage less than 460 V • Stops when the DC bus voltage decreases to less than approximately 440 V when you use an input voltage of 460 V or more
Momentary Power Loss Ride-thru	Immediately stops when power loss is 15 ms or longer. Continues operation if power loss is shorter than 2 s (depending on parameter settings). Note: Stop time may be shortened depending on the load and motor speed.
Heatsink Overheat Protection	The drive stops when the thermistor detects an IGBT temperature more than approximately 100 °C (212 °F). The trip temperature level is different for different drive models.
Stall Prevention	Stall prevention is available during acceleration, deceleration, and during run.
Ground Fault Protection	Electronic circuit protection Note: This protection detects ground faults during run. The drive will not provide protection when: <ul style="list-style-type: none"> • There is a low-resistance ground fault for the motor cable or terminal block • Energizing the drive when there is a ground fault.
DC Bus Charge LED	Charge LED illuminates when DC bus voltage is more than 50 V.
DC Link Choke	Built-in as standard.

Table 5.3 Environment

Item	Specification
Area of Use	Indoors
Power Supply	Overvoltage Category III
	Permitted Frequency Fluctuation: ±5%
	Permitted Voltage Fluctuation: -15% to +10%
	200 V class: <ul style="list-style-type: none"> • Three-phase AC power supply 200 V to 240 V at 50/60 Hz • DC power supply 270 V to 340 V 400 V class: <ul style="list-style-type: none"> • Three-phase AC power supply 380 V to 480 V at 50/60 Hz • DC power supply 513 V to 679 V

Item	Specification
Ambient Temperature Setting	IP20/UL Open Type/Heatsink External Mounting: -10 °C to +50 °C (14 °F to 122 °F) IP20/UL Type 1: -10 °C to +40 °C (14 °F to 104 °F) IP55/UL Type 12 Heatsink External Mounting; front side: -10 °C to +50 °C (14 °F to 122 °F) IP55/UL Type 12 Heatsink External Mounting; back side: -10 °C to +40 °C (14 °F to 104 °F) <ul style="list-style-type: none"> • When you install the drive in an enclosure, use a cooling fan or air conditioner to keep the internal air temperature in the permitted range. • Do not let the drive freeze. • You can use IP20/UL Open Type and IP20/UL Type 1 drives at a maximum of 60 °C (140 °F) when you derate the output current. • You can use IP20/UL Type 1 drives at a maximum of 50 °C (122 °F) when you derate the output current.
Humidity	95% RH or less Do not let condensation form on the drive.
Storage Temperature	-20 °C to +70 °C (-4 °F to +158 °F) (short-term temperature during transportation)
Surrounding Area	Pollution degree 2 or less Install the drive in an area without: <ul style="list-style-type: none"> • Oil mist, corrosive or flammable gas, or dust • Metal powder, oil, water, or other unwanted materials • Radioactive materials or flammable materials, including wood • Harmful gas or fluids • Salt • Direct sunlight
Altitude	1000 m (3281 ft) maximum Note: Derate the output current by 1% for each 100 m (328 ft) to install the drive in altitudes between 1000 m to 4000 m (3281 ft to 13123 ft). It is not necessary to derate the rated voltage in these conditions: <ul style="list-style-type: none"> • When you install the drive at 2000 m (6562 ft) or lower • When you install the drive between 2000 m to 4000 m (6562 ft to 13123 ft) and ground the neutral point on the power supply.
Vibration	<ul style="list-style-type: none"> • 10 Hz to 20 Hz: 1 G (9.8 m/s², 32.15 ft/s²) • 20 Hz to 55 Hz: 0.2 G (2.0 m/s², 6.56 ft/s²)
Installation Orientation	Install the drive vertically for sufficient airflow to cool the drive.

Table 5.4 Standard

Item	Specification
Harmonized Standard	<ul style="list-style-type: none"> • UL 508C • EN 61800-3 • IEC/EN 61800-5-1 • Two Safe Disable inputs and one EDM output according to EN ISO 13849-1:2015 (PL e (Cat.III)), IEC/EN 61508 SIL3

Table 5.5 Enclosure Ratings

Item	Specification
Protection Design	IP20/UL Open Type IP20/UL Type 1 IP55/UL Type 12 Heatsink External Mounting Note: To change an IP20/UL Open Type drive to an IP20/UL Type 1 drive, install a UL Type 1 kit.

◆ Drive Derating

You must derate the drive capacity to operate the drive above the rated temperature, altitude, and default carrier frequency.

■ Carrier Frequency Settings and Rated Current Values

Table 5.6 and Table 5.7 show how the drive rated output current changes when the *C6-02 [Carrier Frequency Selection]* value changes. The output current value changes linearly as the carrier frequency changes. You can use the values from the tables to calculate a frequency that is not shown.

Three-Phase 200 V Class

Table 5.6 Carrier Frequency and Rated Current Derating

Model	Rated Current (A)				
	2 kHz	5 kHz	8 kHz	10 kHz	12.5 kHz
2211	211	189.2	156.4	134.6	-
2273	273	251.6	219.5	198.1	-
2343	343	315.7	-	-	-
2396	396	373.4	-	-	-

Three-Phase 400 V Class

Table 5.7 Carrier Frequency and Rated Current Derating

Model	Rated Current (A)				
	2 kHz	5 kHz	8 kHz	10 kHz	12.5 kHz
4180	180	155.5	118.7	94.2	-
4240	240	212.9	172.3	145.2	-
4302	302	268.8	218.9	185.7	-
4361	361	318.5	254.7	212.2	-
4414	414	369.7	303.3	259	-
4477	477	367.4	-	-	-
4515	515	396.7	-	-	-
4590	590	461.1	-	-	-
4720	720	562.7	-	-	-

◆ Derating Depending on Ambient Temperature

When you install drives in a place where ambient temperatures are higher than the rated conditions or install drives side-by-side in the enclosure panel, set L8-12 [Ambient Temperature Setting] and L8-35 [Installation Method Selection]. Derate the output current as specified in Figure 5.1 to Figure 5.4.

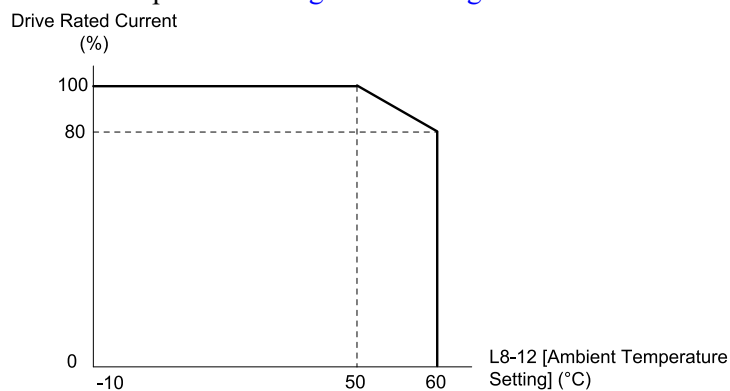


Figure 5.1 Derating for IP20/UL Open Type (L8-35 = 0)

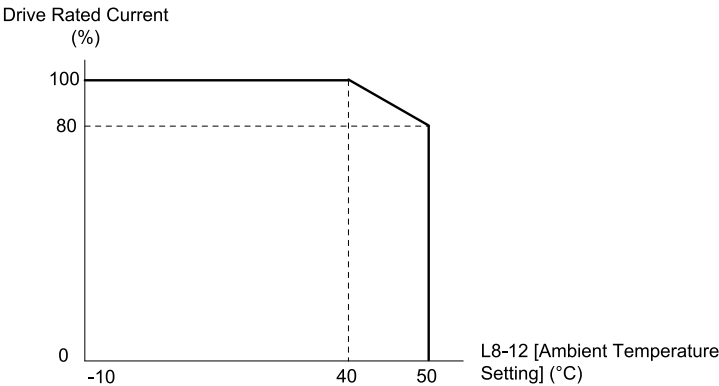
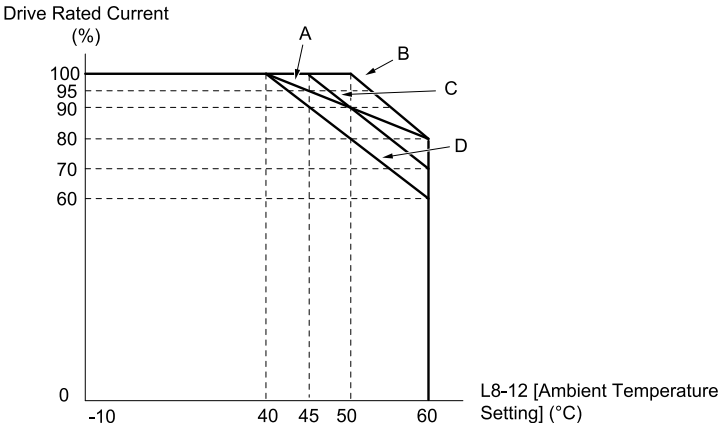


Figure 5.2 Derating for Side-by-Side Mounting (L8-35 = 1)



A - Drive Models: 4005, 4008
 B - Drive Models: 4011 to 4027

C - Drive Models: 4034 to 4065
 D - Drive Models: 2011 to 2396 and 4077 to 4720

Figure 5.3 Derating for IP20/UL Type 1 (L8-35 = 2)

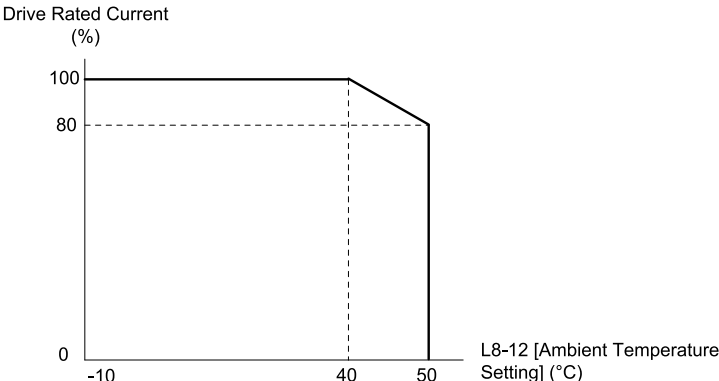


Figure 5.4 Derating for IP55/UL Type 12 (L8-35 = 3)




■ L8-12: Ambient Temperature Setting

No. (Hex.)	Name	Description	Default (Range)
L8-12 (04B8)	Ambient Temperature Setting	<input type="checkbox"/> V/f <input type="checkbox"/> OLVP/PM <input type="checkbox"/> EZOLV Sets the ambient temperature of the drive installation area.	40 °C (Determined by L8-35)

The drive automatically adjusts the drive rated current to the best value as specified by the set temperature. Set the ambient temperature of the area where you install the drive to a value that is more than the drive rating.

Refer to [Derating Depending on Ambient Temperature on page 50](#) for information about derating depending on ambient temperature.

■ L8-35: Installation Method Selection

No. (Hex.)	Name	Description	Default (Range)
L8-35 (04EC)	Installation Method Selection	   Sets the type of drive installation.	Determined by the drive (0 - 3)

Note:

- Parameter *A1-03 [Initialize Parameters]* does not initialize this parameter.
- This parameter is set to the correct value when the drive is shipped. Change the value only in these conditions:
 - When you do a Side-by-Side installation
 - When you install a UL Type 1 kit on an IP20/UL Open Type drive to convert the drive to an IP20/UL Type 1
 - When you convert an IP20/UL Type 1 drive to IP20/UL Open Type
 - When you install models 2011 to 2169 and 4005 to 4156 with the heatsink external to the enclosure
- The drive will detect an *oPE02 [Parameter Range Setting Error]* in these conditions:
 - If you set $L8-12 = 60\text{ }^{\circ}\text{C}$ and $L8-35 = 1$ or 3 on models 2011 to 2114 and 4005 to 4124
 - If you set $L8-35 = 1$ or 3 on models 2143 to 2396 and 4156 to 4720

The drive automatically adjusts the overload protection detection level to the best value as specified by the setting value. Refer to [Derating Depending on Ambient Temperature on page 50](#) for information about derating depending on ambient temperature.

0 : IP20/UL Open Type

Use this setting to install an IP20/UL Open Type drive.

Make sure that there is 60 mm (2.4 in) minimum of space between drives or between the drive and side of the enclosure panel.

1 : Side-by-Side Mounting

Use this setting to install more than one drive Side-by-Side.

Make sure that there is 2 mm (0.08 in) minimum of space between drives.

2 : IP20/UL Type 1

Use this setting to install an IP20/UL Type 1 drive.

3 : IP55/UL Type 12

Use this setting to install an IP55/UL Type 12 drive.

◆ Altitude Derating

Install the drive in a location that has an altitude of 1000 m (3281 ft) or lower.

Derate the output current by 1% for each 100 m (328 ft) to install the drive in altitudes between 1000 to 4000 m (3281 to 13123 ft).

It is not necessary to derate the rated voltage in these conditions:

- Installing the drive at 2000 m (6562 ft) or lower
- Installing the drive between 2000 to 4000 m (6562 to 13123 ft) and grounding the neutral point on the power supply.

If you do not ground the drive with a neutral network, contact Yaskawa or your nearest sales representative.

Revision History

Date of Publication	Revision Number	Section	Revised Content
March 2023	<1>-1	4, 5	Correction: Replaced broken cross-references.
August 2022	<1>	2	Revision: Reviewed and corrected "How to Read the Catalog Code".
		3	Revision: Reviewed and corrected "Gasket Models".
December 2021	-	-	First Edition

YASKAWA

FP605 DRIVE INSTALLATION MANUAL

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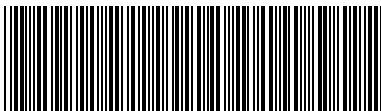
In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.

Specifications are subject to change without notice for ongoing product modifications and improvements.

Original instructions.

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TOEPYAIFP6504

TOEPYAIFP6504
Revision: B <1>-1
March 2023
Published in USA
20-2-22_YAI