TOSHIBA

E6582445

■ Additional sheet

Since 21 June 2023, EN61800-5-1 2007 / A1 (2017) / A11 (2021) has been harmonized standard listed on the Low Voltage Directive (2014/35/EU).

VF-S15 followed by suffix “-CH” that comply with Low Voltage Directive (2014/35/EU) have CE mark on the nameplate.

This additional sheet is very important to use VF-S15 inverter safely, prevent injury to yourself and other people around you as well as to prevent damage to property in the area. Thoroughly familiarize yourself with the symbols and indications shown in the VF-S15 instruction manual (E6582175: English) and read E6582175 with ignoring suffix “-W1” of VF-S15 type-form, then continue to read this additional manual.
Refer to web page https://www.inverter.co.jp/ for Declaration of Conformity and VF-S15 instruction manual (E6582175).
VF-S15 instruction manual (E6581897: Chinese for -CH model) is provided with product.

⚠ WARNING	
Mandatory action	• Read this manual and VF-S15 instruction manual before installing or operating the inverter unit. Otherwise, this will result in electric shock, fire and other injuries. • Operation of this equipment requires detailed installation and operation instructions intended for use with this product. This information is provided on VF-S15 Instruction manual. This manual should be retained with this device at all times.

Safety precautions

The Safety precautions described in the VF-S15 instruction manual (E6582175) and on the inverter itself are very important so that you can use safely the inverter, prevent injury to yourself and other people around you as well as to prevent damage to property in the area.
Thoroughly familiarize yourself with Safety precautions in the instruction manual.
Make sure that you observe all warnings given.

NOTE

All information contained in this manual and the VF-S15 instruction manual(E6582175) will be changed without notice.

PKR87172-00

Compliance with Low Voltage Directive 2014/35/EU

This additional manual includes the correction and additional information for section 9 of E6582175 to comply with Low Voltage Directive 2014/35/EU under the condition below.

- Applicable standard: EN61800-5-1:2007 / A1:2017 / A11:2021 (IEC61800-5-1 Ed2.1)
- Pollution degree: 2
- Overvoltage category: 3
- The electronic power output short-circuit protection circuitry meets the requirements of IEC 60364-4-41:2005/AMD1 - Clause 411.

When incorporating the inverter into a power drive system, take the following measures to comply with IEC61800-5-1 Ed 2.1.

(1) Installation and upstream protection devices
- Install the inverter on a wall or into the enclosure with proper short circuit protective device (SCPD) in accordance with the table of prospective short-circuit current (Isc) rating shown in following pages.
- Semiocnductor fuses (gR, gS or aR) are mandatory in case of using DC bus and/or braking ports. Refer to “Prospective short-circuit current rating (Isc) table with semiconductor fuse”.

(2) Grounding
- Connect a dedicated wire to the grounding terminal on inverter, or install EMC plate (option) and connect to the earth terminal on the EMC plate. Refer to the section 9.1 of E6582175.
- Ground each inverter directly when grounding multiple inverters.
- Refer to the table in the section 10.1 of E6582175 to select wire size.

(3) Overload protection
- For overload protection of inverter, refer to section 5.6 of E6582175.

(4) Motor overload protection and overtemperature protection
- For electronic motor thermal protection, refer to section 5.6 of E6582175.
- For motor integrated PTC thermal protection, refer to section 6.29.16 of E6582175.

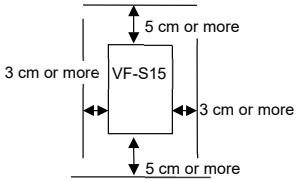
1. General

⚠WARNING	
Mandatory Action	- RISK OF ELECTRIC SHOCK - DANGEROUS VOLTAGE MAY EXIST FOR _15_MINUTES AFTER REMOVING POWER • The following steps must be performed before wiring and servicing. (1) Turn off all input power. (2) Wait at least 15 minutes and check to make sure that the charge lamp is no longer lit. (3) Use a tester that can measure DC voltage (800VDC or more), and check to make sure that the voltage to the DC main circuits (across PA/+ and PC/-) is 45V or less. If these steps are not properly performed, the wiring will cause electric shock.

2. Compliance with Installation

A Low Voltage directive was granted on the assumption that the inverter would be installed in an enclosure. Therefore, install the inverter in an enclosure and if necessary, take measures to maintain the inverter ambient temperature (temperature in the enclosure) within the specified temperature range.
Be sure to apply the minimum enclosure size shown in the remark under Table 4 and Table 5.

Standard installation



Environments

Location of use	Indoors; not exposed to direct sunlight, corrosive gas, explosive gas, flammable gas, oil mist, dust, or metal powder ; and vibration of less than 5.9m/s2 (10 to 55Hz).
Elevation	3000m or less for TN/TT/IT system. 2000m or less for Corner-earthed system. (Current reduction required over 1000 m) Note 1)
Ambient temperature	-10 to +60°C Note 2)
Storage temperature	-25 to +70°C (Temperature applicable for a short term.)
Relative humidity	5 to 95% (free from condensation and vapor).
Pollution degree	2

For addtional details, refer to section 12.1 in E6582175

Note 1) Current must be reduced by 1% for each 100 m over 1000 m. For example, 90% at 2000m and 80% at 3000m.
Note 2) When using the inverter in locations with temperatures above 40°C, remove the protective label on the top of the inverter and use the inverter with the output current reduced according to section 6.18 in E6582175.
To align the inverters side-by-side horizontally, remove the protective label on the top of the inverter before use. When using the inverter in locations with temperatures above 40°C, use the inverter with the output current reduced.

3. Compliance with Connection

⚠ DANGER	
Mandatory action	• The opening of the branch circuit protective device may be an indication that a fault current has been interrupted. To reduce the risk of fire or electrical shock, current-carrying parts and other components of the controller should be examined and replaced if damaged. If burnout of the current element of an overload relay occurs, the complete overload relay must be replaced.

⚠ CAUTION	
Mandatory action	• This product can cause a DC current in the PE conductor. Where a residual current operated protective device (RCD) is used for protection against electric shock, only an RCD of Type B is allowed on the supply side of this product. All upstream RCD, up to the supply transformer, shall be of Type B. If proper device above is not used, it can result in electric shock.

Use the following cables (Rating 75 °C or more, Use the copper conductors only.) to the main circuit terminals (R/L1, S/L2, T/L3, U/T1, V/T2, W/T3).

⇒ For recommended tightening torque, Refer to Table 1.

⇒ Use the ring terminal for the earth cables, Refer to Table 2.

⇒ For recommended electric wire sizes, Refer to Table 3.

Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with any additional local codes.

Table 1 Tighten the screws to specified torque

Recommended tightening torque for screws on the terminal board		
	N·m	lb·in
M3.5	1.0	8.9
M4	1.4	12.4
M5	2.4	20.8
M6	4.5	40.0
M4 (grounding terminal)	1.4	12.4
M5 (grounding terminal)	2.8	24.8

Table 2 Ring terminal sizes for earth cables

Earth Cable Sizes	M4 (grounding terminal)	M5 (grounding terminal)
AWG14	R2-4 [JIS standard]	R2-5 [JIS standard]
AWG12	R5.5-4 [JIS standard]	R5.5-5 [JIS standard]
AWG10	R5.5-4 [JIS standard]	R5.5-5 [JIS standard]

Table 3 Selection of wire size

Voltage class	Inveter type-form	Applicable motor (kW)	Wire size (mm²) Note 4)					
			Power circuit Note 1)					
			Input		Output	DC Reactor (Optional) Note 5)	Braking resistor (optional)	Grounding cable
			without DCL	with DCL				
1 phase 240V class	VFS15S-2004PL-CH	0.4	1.5	1.5	1.5	1.5	1.5	2.5
	VFS15S-2007PL-CH	0.75	1.5	1.5	1.5	1.5	1.5	2.5
	VFS15S-2015PL-CH	1.5	2.5	2.5	1.5	2.5	1.5	2.5
	VFS15S-2022PL-CH	2.2	4.0	4.0	1.5	4.0	1.5	4.0
3 phase 500V class	VFS15-4004PL1-CH	0.4	1.5	1.5	1.5	1.5	1.5	2.5
	VFS15-4007PL1-CH	0.75	1.5	1.5	1.5	1.5	1.5	2.5
	VFS15-4015PL1-CH	1.5	1.5	1.5	1.5	1.5	1.5	2.5
	VFS15-4022PL1-CH	2.2	1.5	1.5	1.5	1.5	1.5	2.5
	VFS15-4037PL1-CH	4.0	2.5	1.5	1.5	1.5	1.5	2.5
	VFS15-4055PL-CH	5.5	4.0	1.5	2.5	2.5	1.5	4.0
	VFS15-4075PL-CH	7.5	6.0	2.5	2.5	4.0	2.5	6.0
	VFS15-4110PL-CH	11	10	4.0	6.0	6.0	4.0	10
	VFS15-4150PL-CH	15	16	6.0	10	10	6.0	16

Note 1) Sizes of the wires connected to the input terminals R/L1, S/L2 and T/L3 (Single-phase models are R/L1 and S/L2/N) and the output terminals U/T1, V/T2 and W/T3 when the length of each wire does not exceed 30m.

Note 2) For the control circuit, use shielded wires 0.75 mm^2 or more in diameter.

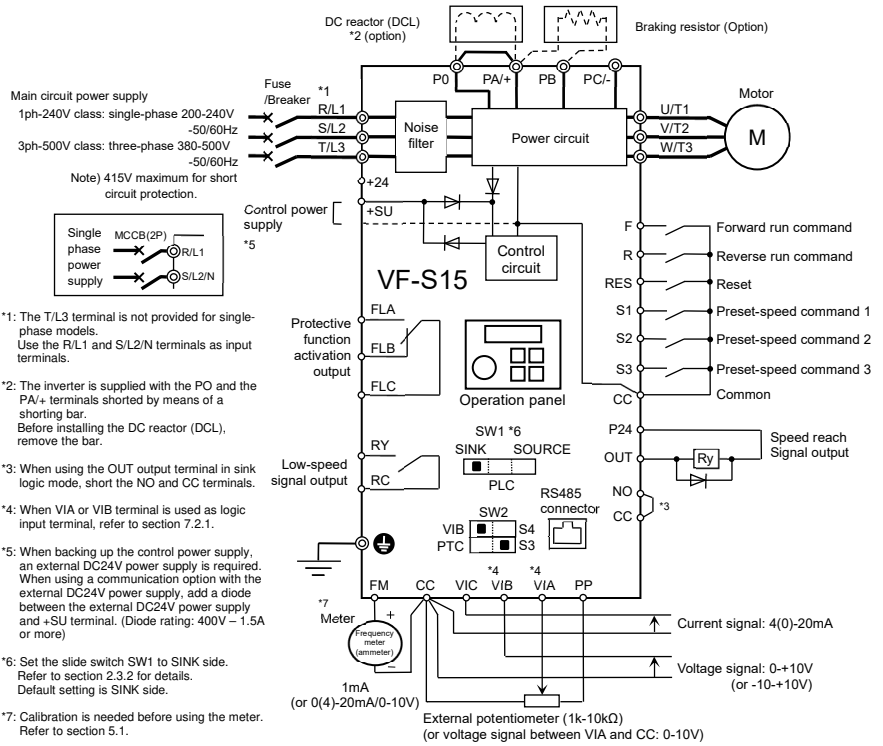
Note 3) For grounding, use wires with a size equal to or larger than the above.

Note 4) The wire sizes specified in the above table apply to HIV wires (copper wires shielded with an insulator with a maximum allowable temperature of 75°C) used at an ambient temperature of 50°C or less.

Main and control circuit terminals

This diagram shows an example of wiring of the main and control circuit (in case of sink logic).

Standard connection diagram – SINK (Negative) (common: CC)



*1: The T/L3 terminal is not provided for single-phase models.
Use the R/L1 and S/L2/N terminals as input terminals.

*2: The inverter is supplied with the PO and the PA/+ terminals shorted by means of a shorting bar.
Before installing the DC reactor (DCL), remove the bar.

*3: When using the OUT output terminal in sink logic mode, short the NO and CC terminals.

*4: When VIA or VIB terminal is used as logic input terminal, refer to section 7.2.1.

*5: When backing up the control power supply, an external DC24V power supply is required. When using a communication option with the external DC24V power supply, add a diode between the external DC24V power supply and +SU terminal. (Diode rating: 400V – 1.5A or more)

*6: Set the slide switch SW1 to SINK side.
Refer to section 2.3.2 for details.
Default setting is SINK side.

*7: Calibration is needed before using the meter.
Refer to section 5.1.

For sections,
refer to VF-S15 instruction manual E6582175
,

Main circuit terminals

Terminal symbol	Terminal function
⏚	Grounding terminal for connecting inverter. There are 3 terminals in cooling fin or mounting part of EMC plate.
R/L1,S/L2,T/L3	200/240 V class Single-phase 200 to 240V-50/60Hz 400/500 V class : Three-phase 380 to 500V-50/60Hz * Single-phase inputs are R/L1 and S/L2/N terminals.
U/T1,V/T2,W/T3	Connect to three-phase motor.
PA/+, PB	Connect to braking resistors. Change parameters F304, F305, F308, F309 if necessary.
PA/+	This is a positive potential terminal in the internal DC main circuit.
PC/-	This is a negative potential terminal in the internal DC main circuit.
PO, PA/+	Terminals for connecting a DC reactor (DCL: optional external device). Shorted by a shorting bar when shipped from the factory. Before installing DCL, remove the shorting bar.

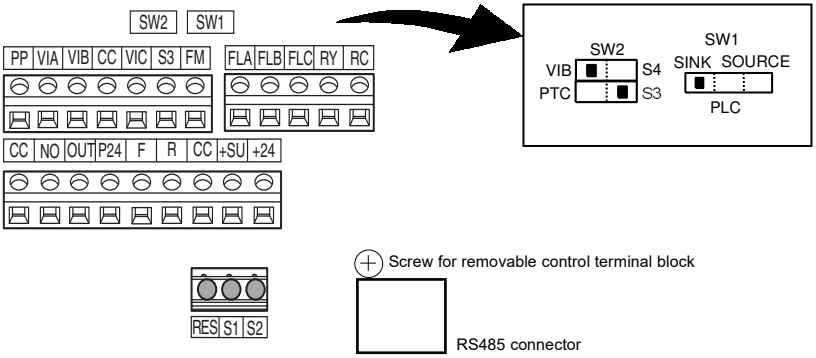
The arrangements of power circuit terminals are different from each range.

Control circuit terminals

The control circuit terminal block is common to all equipment.

This section is different between E6582175 and E6581987.

Refer to the followings for -CH model and the section 2.3.2 of E6581987.



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Screw size	Recommended tightening torque
M3 screw	0.5 N·m
	4.4 lb·in

Stripping length: 6 (mm)
Screwdriver: Small-sized flat-blade screwdriver
(Blade thickness: 0.5 mm, blade width: 3.5 mm)

Terminal symbol	Input / output	Function		Electrical specifications
F	Input	Multifunction programmable logic input	Shorting across F-CC or P24-F causes forward rotation; open causes deceleration stop. (When Standby ST is always ON) 3 different functions can be assigned.	No voltage logic input 24Vdc-5mA or less Sink/Source and PLC selectable using slide switch SW1 (Default setting is Sink side) Pulse train input (S2 terminal) Pulse frequency range: 10pps~2kpps Duty: 50±10% PTC input (S3 terminal)
R	Input		Shorting across R-CC or P24-R causes reverse rotation; open causes deceleration stop. (When Standby ST is always ON) 3 different functions can be assigned.	
RES	Input		This inverter protective function is reset if RES-CC or P24-RES is connected. Shorting RES-CC or P24-RES has no effect when the inverter is in a normal condition. 2 different functions can be assigned.	
S1	Input		Shorting across S1-CC or P24-S1 causes preset speed operation. 2 different functions can be assigned.	
S2	Input		Shorting across S2-CC or P24-S2 causes preset speed operation. By changing parameter F146 setting, this terminal can also be used as a pulse train input terminal.	
S3	Input		Shorting across S3-CC or P24-S3 causes preset speed operation. By changing slide switch SW2 and parameter F147 setting, this terminal can also be used as a PTC input terminal.	
CC	Common to Input / output	Control circuit's equipotential terminal (3 terminals)		-
PP	Output	Analog power supply output		10Vdc (permissible load current: 10mAdc)
VIA Note 1)	Input	Multifunction programmable analog input. Default setting: 0-10Vdc (1/1000 resolution) and 0-60Hz (0-50Hz) frequency input. By changing parameter F109, this terminal can also be used as a multifunction programmable logic input terminal.		10Vdc (internal impedance: 30kΩ)
VIB Note 1)	Input	Multifunction programmable analog input. Default setting: 0-10Vdc (1/1000 resolution) and 0-60Hz (0-50Hz) frequency input. The function can be changed to -10-+10V input (1/2000 resolution) by parameter F107 =1 setting. By switching slide switch SW2 and changing parameter F109 setting, this terminal can also be used as a multifunction programmable logic input terminal.		10Vdc (internal impedance: 30kΩ)
VIC	Input	Multifunction programmable analog input. 4-20mA (0-20mA) input.		4-20mA (internal impedance: 250Ω)
FM	Output	Multifunction programmable analog output. Default setting: output frequency. The function can be changed to meter option (0-1mA), 0-10Vdc voltage or 0-20mAdc (4-20mA) current output by parameter F681 setting. Resolution Max. 1/1000.		1mAdc full-scale ammeter 0-20mA (4-20mA) DC ammeter Permissible load resistance: 600Ω or less 0-10V DC volt meter Permissible load resistance: 1kΩ or more

Terminal symbol	Input / output	Function	Electrical specifications
P24	Output	24Vdc power output, by changing SW1 to SINK or SOURCE side.	24Vdc-100mA
	Input	This terminal can be used as a common terminal when an external power supply is used by changing SW1 to PLC side.	-
+24	Output	24Vdc power output	24Vdc-100mA Note 2)
+SU	Input	DC power input terminal for operating the control circuit. Connect a control power backup device (option or 24Vdc power supply) between +SU and CC.	Voltage: 24Vdc±10% Current: 1A or more
OUT NO	Output	Multifunction programmable open collector output. Default setting detect and output speed reach signal. Multifunction output terminals to which two different functions can be assigned. The NO terminal is an equipotential terminal. It is isolated from the CC terminal. By changing parameter F669 settings, these terminals can also be used as multifunction programmable pulse train output terminals.	Open collector output 24Vdc-100mA To output pulse trains, a current of 10mA or more needs to be passed. Pulse frequency range: 10~2kpps
FLA FLB FLC Note 3) Note 4)	Output	Multifunction programmable relay contact output. Detects the operation of the inverter's protection function. Contact across FLA-FLC is closed and FLB-FLC is opened during protection function operation.	Max. switching capacity 250Vac-2A, 30Vdc-2A (cosϕ=1) : at resistive load 250Vac-1A (cosϕ=0.4) 30Vdc-1A (L/R=7ms) Min. permissible load 5Vdc-100mA 24Vdc-5mA
RY RC Note 3) Note 4)	Output	Multifunction programmable relay contact output. Default settings detect and output low-speed signal output frequencies. Multifunction output terminals to which two different functions can be assigned.	

Note 1) When VIA terminal is used as logic input terminal, be sure to connect a resistor between P24 and VIA in case of sink logic, between VIA and CC in case of source logic. (Recommended resistance: 4.7kΩ-1/2W)
It is not needed for VIB terminal.

Note 2) 100mA is the sum of P24 and +24.

Note 3) A chattering (momentary ON/OFF of contact) is generated by external factors of the vibration and the impact, etc. In particular, please set the filter of 10ms or more, or timer for measures when connecting it directly with input unit terminal of programmable controller. Please use the OUT terminal as much as possible when the programmable controller is connected.

Note 4) OVC II: Overvoltage category II

For addtional details, refer to section 2.3.2 in E6581987.

4. Compliance with short circuit protection

Co-ordination with upstream protection devices

・Install short circuit protective devices (SCPD) according to the the maximum prospective short-circuit current (Isc) rating tables to each power output of the inverter shown in following pages.

⚠WARNING	
Mandatory action	• Install proper short-circuit protective device between the power supply and the inverter (primary side). If proper short-circuit protective device is not installed, short circuit current cannot be shut down by inverter alone and it will result in fire. Integral solid state short circuit protection in the inverter does not provide branch circuit protection. Branch circuit protection must be provided in accordance with any local codes. • Take into account the minimum required prospective short-circuit current of short-circuit protective device. If short circuit protective device does not work properly due to lower level short-circuit current, it will result in electric shock or fire. • Install the inverter on the wall or into enclosure based on this manual, and install short-circuit protective device or power distribution devices based on the manufacturer manual. When they are installed with inproper cordination, this will result in electric shock or fire. • The grounding wire must be connected securely. If the grounding wire is not securely connected, when the inverter has failure or earth leakage, this will result in electric shock or fire.

Prospective short-circuit current (Isc) rating table

The rating of the short circuit protection devices in the table 4 and 5 are maximum values with Enclosure. Smaller sizes can be used. Use the wire with the size described in Table 3.

In case of using DC output or Braking function, refer to “Prospective short-circuit current(Isc) rating table (semiconductor fuse IEC60269-4)” in next page.

Table 4. Prospective short-circuit current(Isc) rating table

Reference	Maxinum input Voltage (Vac)	Appli-cable motor (kW)	Maxi-mum Isc (kA)	Short circuit protective device rating			Minimum line reactor (mH)	Minimum enclosure volume (L)
				Fuse gG *1 (A)	Circuit *2 Breaker (PowerPact)	Circuit *2 Breaker (Tesys GV)		
VFS15S-2004PL-CH	240	0.4	5	12	BDL36015	GV2L10	-	53
VFS15S-2007PL-CH		0.7	5	20	BDL36020	GV2L16	-	53
VFS15S-2015PL-CH		1.5	5	40	BDL36030	GV2L20	-	53
VFS15S-2022PL-CH		2.2	5	40	BDL36035	GV2L22	-	53
VFS15-4004PL1-CH	415	0.4	5	4	BDL36015	GV2L07	-	53
VFS15-4007PL1-CH		0.7	5	8	BDL36015	GV2L08	-	53
VFS15-4015PL1-CH		1.5	5	12	BDL36015	GV2L14	-	53
VFS15-4022PL1-CH		2.2	5	16	BDL36015	GV2L14	-	53
VFS15-4037PL1-CH		4.0	5	25	BDL36015	GV2L16	-	53
VFS15-4055PL-CH		5.5	22	40	BGL36020	GV2L22	-	53
VFS15-4075PL-CH		7.5	22	40	BGL36030	GV3L32	-	53
VFS15-4110PL-CH		11	22	63	BGL36040	GV3L40	-	53
VFS15-4150PL-CH		15	22	80	BGL36050	GV3L50	-	53

The Ampare rating of the short circuit protection devices in the table are maximum values. Smaller amp sizes may be used. Branch circuit protection must be provided in accordance with any additional local codes.

*1: Mersen is recommended supplier
*2: PowerPact and Tesys GV series from Schneider Electric are recommended.

Prospective short-circuit current (Isc) rating table (semiconductor fuse IEC60269-4)

The rating of the short circuit protection devices in the table are maximum values. Smaller sizes can be used. Use the wire with the size described in Table 3.

Table 5. Prospective short-circuit current (Isc) rating table (semiconductor fuse IEC60269-4)

Reference *1	Input Vol-tage (V)	Appli-cable motor (kW)	Maxi-mum Isc (kA)	Short circuit protective device rating (fuse type)						Minimum line reactor (mH)	Minimum enclosure volume (L)
				gR *1		gS *1		aR *1*2			
				Rating (A)	Min. Size	Rating (A)	Min. Size	Rating (A)	Min. Size		
VFS15S-2004PL-CH	240	0.4	5	12.5	10x38	-	-	-	-	-	53
VFS15S-2007PL-CH		0.7	5	20	10x38	-	-	20	000	-	53
VFS15S-2015PL-CH		1.5	5	-	-	40	000	40	000	-	53
VFS15S-2022PL-CH		2.2	5	-	-	40	000	40	000	-	53
VFS15-4004PL1-CH	415	0.4	5	4	10x38		-	-	-	-	53
VFS15-4007PL1-CH		0.7	5	8	10x38	-	-	-	-	-	53
VFS15-4015PL1-CH		1.5	5	12.5	10x38	-	-	-	-	-	53
VFS15-4022PL1-CH		2.2	5	16	10x38	-	-	16	000	-	53
VFS15-4037PL1-CH		4.0	5	25	10x38	-	-	25	000	-	53
VFS15-4055PL-CH		5.5	22	40	14x51	-	-	40	000	-	53
VFS15-4075PL-CH		7.5	22	40	14x51	-	-	40	000	-	53
VFS15-4110PL-CH		11	22	-	-	63	000	63	000	-	53
VFS15-4150PL-CH		15	22	-	-	80	000	80	000	-	53

*1: Mersen is recommended supplier.
*2: Use aR type fuse with a proper overload protection.

5. Overload protection

VF-S15 has overload protection.
Over current rating: 150%-1min. 200%-0.5sec.
Refer to the nameplate for the rated current.

Refer to the section 5.6 E6582175 for detailed information.

6. Motor thermal protection

⚠ CAUTION	
Mandatory action	- Risk to damage the motor - Motor thermal protection will not be provided by the drive if the motor's nominal current is 20% lower than that output of the drive. In this case, find an alternative source of thermal protection. Failure to follow these instruction can result in equipment damage.

The devices VF-S15 are provided with integral overload and over-speed protection for the motor after activation of this function by setting.
Protection at 100% of the full load motor current.
The motor thermal protection current (tHr) must be set to the rated current indicated on the motor nameplate.

VF-S15 has the motor thermal protection.
Select the electronic thermal protection characteristics that fit with the ratings and characteristics of the motor.
In case of multi motor operation with one inverter, thermal relay should be connected to each motor.

- tHr : Motor electronic-thermal protection level 1
- OLM : Electronic-thermal protection characteristic selection
- F173 : Motor electronic-thermal protection level 2
- F601 : Motor 150% overload detection time
- F631 : Inverter overload detection method
- F632 : Electronic-thermal memory
- F651 : Overload alarm level

• Function
This parameter allows selection of the appropriate electronic thermal protection characteristics according to the particular rating and characteristics of the motor.

Note) AUL must be set to default setting (1: Constant torque characteristic) for the compliance with Low Voltage Directive.

Refer to section 5.6 in E6582175 for details.

7. Motor PTC thermal protection

Set a parameter F147 and lower slide switch of SW2 to PTC side, when S3 terminal is used as PTC input terminal.

F147: Logic input / PTC input selection (S3)
F645: PTC thermal selection
F646: Resistor value for PTC detection

- Function
  This function is used to protect motor from overheating using the signal of PTC built-in motor.
  The trip display is "E-32".

Refer to section 6.29.16 in E6582175 for details.

8. Other information for compliance

Rating and specification

Refer to section 12.1 in E6582175.

Note) VF-S15 model which suffix is "-CH" doesn't have the Safety Function.

Outside dimensiton and mass

Refer to section 12.2 in E6582175.

Current reduction

Refer to section 6.18 in E6582175.

Maintenance

Refer to section 14.1 and 14.2 in E6582175.