EUROTHERM
DRIVES

590H Series
DC Converter

Addendum

HA466272U001 Issue 1

WARRANTY

Eurotherm Drives warrants the goods against defects in design, materials and workmanship for the period of 12 months from the date of delivery on the terms detailed in Eurotherm Drives Standard Conditions of Sale IA058393C.

Eurotherm Drives reserves the right to change the content and product specification without notice.

Safety Information

Requirements

IMPORTANT: Please read this information BEFORE installing the equipment.

Intended Users

This manual is to be made available to all persons who are required to install, configure or service equipment described herein, or any other associated operation.

The information given is intended to highlight safety issues, and to enable the user to obtain maximum benefit from the equipment.

Application Area

The equipment described is intended for industrial (non consumer) motor speed control utilising dc shunt machines.

Personnel

Installation, operation and maintenance of the equipment should be carried out by qualified personnel. A qualified person is someone who is technically competent and familiar with all safety information and established safety practices; with the installation process, operation and maintenance of this equipment; and with all the hazards involved.

Hazards

WARNING!

This equipment can endanger life through rotating machinery and high voltages. Failure to observe the following will constitute an ELECTRICAL SHOCK HAZARD.

- The equipment must be **permanently earthed** due to the high earth leakage current.
- The drive motor must be connected to an appropriate safety earth.
- Before working on the equipment, ensure isolation of the mains supply from terminals L1, L2 and L3 and auxiliary supply terminals L/N.
- Never perform high voltage resistance checks on the wiring without first disconnecting the drive from the circuit being tested.
- When replacing a drive in an application and before returning to use, it is essential that all user defined parameters for the product's operation are correctly installed.
- This equipment contains electrostatic discharge (ESD) sensitive parts. Observe static control precautions when handling, installing and servicing this product.

IMPORTANT: Metal parts may reach a temperature of 90 degrees centigrade in operation.

Application Risk

The specifications, processes and circuitry described herein are for guidance only and may need to be adapted to the user's specific application. Refer to page 5-1.

Eurotherm Drives does not guarantee the suitability of the equipment described in this Manual for individual applications.

Risk Assessment

Under fault conditions, power loss or other operating conditions not intended, the equipment may not operate as specified. In particular:

- The motor speed may not be controlled
- The direction of rotation of the motor may not be controlled
- The motor may be energised

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Safety Information

Enclosure

Ensure that the enclosure this product is mounted in is suitable for the environment. This product may be IP00 or IP20 and hence requires further protection to avoid personal injury.

Guards

The user must provide guarding and /or additional safety systems to prevent risk of injury and electric shock.

Protective Insulation

- All control and signal terminals are SELV, i.e. protected by double insulation. Ensure all wiring is rated for the highest system voltage.

Note: *Thermal sensors contained within the motor must be double insulated.*

- All exposed metalwork in the Converter is protected by basic insulation and bonding to a safety earth.

RCDs

These are not recommended for use with this product but ,where their use is mandatory, only Type B RCDs should be used.

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GETTING STARTED

Introduction

The 590H and 591H (Digital, Link and Analog) are the high power frame sizes of Eurotherm Drives' 590 Series DC Converters.

There are two products: 4Q regenerative 590H, and 2Q non-regenerative 591H. Each has a total of 8 build standards; 4 current breaks and 2 voltage breaks.

Standard Equipment

The following equipment is supplied as standard with each controller:

- Lifting brackets
- Fan assembly
- Fan ducting
- M12 bolts, nuts and washers (quantity 34)
- Product Manual and Addendum

Optional Equipment

Item	Part Number
EMC Installation Guidelines for Modules and Systems *A Eurotherm Drives application manual detailing EMC requirements*	HA388879
ConfigEd Lite *Eurotherm Drives' Windows-based block programming software*	Order by name

Table 1-1 Optional Equipment

Equipment Inspection and Storage

- Check for signs of transit damage
- Check the product code on the rating label conforms to your requirement.

If the unit is not being installed immediately, store the unit in a well-ventilated place away from high temperatures, humidity, dust, or metal particles.

Refer to Chapter 2: "An Overview of the Converter" to check the rating label/product code.

Refer to Chapter 5: "Routine Maintenance and Repair" for information on returning damaged goods.

Refer to Chapter 6: "Technical Specifications" - Environmental Details for the storage temperature.

About this Manual

This manual is intended for use by the installer, user and programmer of the 590 Converter. It assumes a reasonable level of understanding in these three disciplines.

Note: *Please read all Safety Information before proceeding with the installation and operation of this unit.*

This manual is the Addendum to the following manuals:

- *590 Series DC Digital Converter - Product Manual*
- *590 Series DC Analog Converter - Product Manual*
- *590 Series DC Link Converter - Product Manual*

Each 590H/591H is shipped with this Addendum and a copy of the appropriate Product Manual. Refer to the Product Manual for details of the following:

- commissioning procedures
- safety information
- control specification
- software configuration
- diagnostics
- fault finding
- application information

How the Manual is Organised

Text in this Addendum is either in addition to, or is a replacement for equivalent text found in the Product Manual.

AN OVERVIEW OF THE CONVERTER

Component Identification

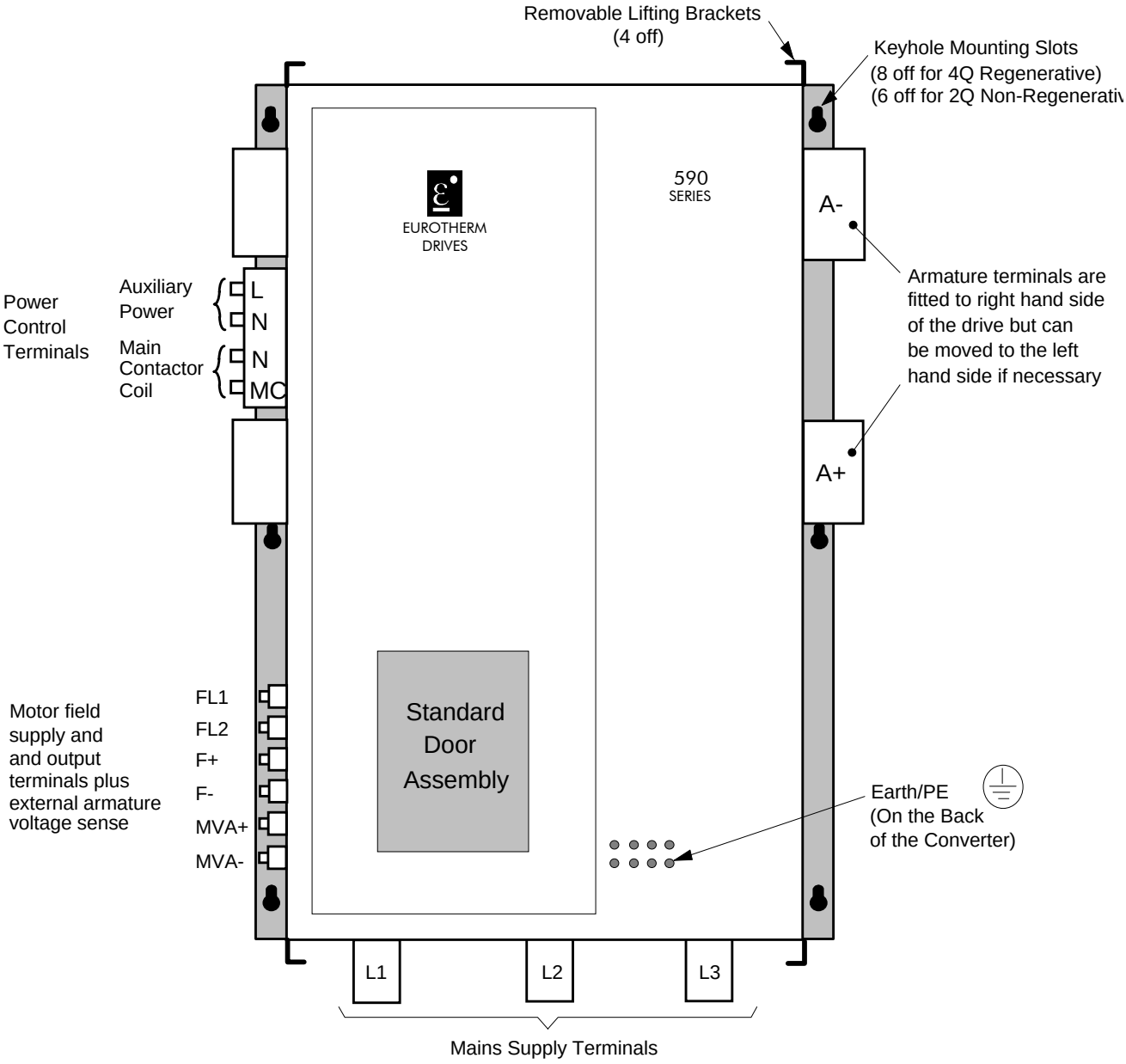


Figure 2-1 View of Component Parts

Understanding the Product Code

The 590H unit is fully identified using an alphanumeric code which records how the Converter was calibrated, and its various settings when despatched from the factory.

The Product Code appears as the "Model No.". Each block of the Product Code is identified in the Product Manual, however, the following blocks are substituted for the 590H types:

Block No.	Variable	Description
1	XXXXX	Five digits identifying the basic product: 3-phase 4Q Regenerative — 3-phase 2Q Non-Regenerative **590HD** Digital — **591HD** Digital **590HL** Link — **591HL** Link **590HA** Analog — **591HA** Analog
2	XXXXX	Five numbers identifying the maximum dc output current rating that may be calibrated for each size of product: **12000 -**1200A, **17000 -**1700A, **22000 -**2200A, **27000 -**2700A
3	X	1 digit identifying the nominal 3 phase ac power, supply voltage; **5** = 380V **6** = 415V **7** = 440V **8** = 460V **9** = 480V **A** = 500V **B** = 550V **C** = 600V **D** = 660V **E** = 690V
4	X	1 digit identifying the auxiliary ac control supply voltage and fan voltage: **0** = 110V **1** = 115V **2** = Unused **3** = 220V **4** = 240V

590HD Digital and 590HL Link

Block No.	Variable	Description
5	X	One digit specifying the user interface language. 0 = English 1 = (reserved) 2 = French 3 = German (refer to Customer Services) 4 = Italian (refer to Customer Services) 5 = Spanish (refer to Customer Services)
6	X	One character specifying any feedback option installed over and above the standard features of the product: 0 = Armature Voltage 1 = DC Tacho 2 = 5701 Plastic Fibre Microtach 3 = Wire-ended Encoder 4 = 5901 Glass Fibre Microtach
7	X	One character specifying the communications protocol and its hardware implementation method: 0 = No serial link 1 = Fitted RS422/485 serial link
8	XX	Two characters specifying special options (hardware): 00 = No special options 01 to 99 = Documented special options
9	XXX	Three characters specifying special options (software): 000 = No special options 001 to 999 = Documented special options

590HA Analog

Block No.	Variable	Description
5	XX	Two characters specifying special options (hardware): 00 = No special options 01 to 99 = Documented special options

INSTALLING THE CONVERTER

Mechanical Installation

Unpacking the Converter

Caution

The packaging is combustible and, if disposed of in this manner incorrectly, may lead to the generation of lethal toxic fumes.

Save the packaging in case of return. Improper packaging can result in transit damage.

The 590H/591H converter is supplied in special packaging to protect the drive whilst in transit.

Remove all fixings from the drive, see Figure 3-1. (The packaging is designed so that the sides can be removed to reveal the drive).

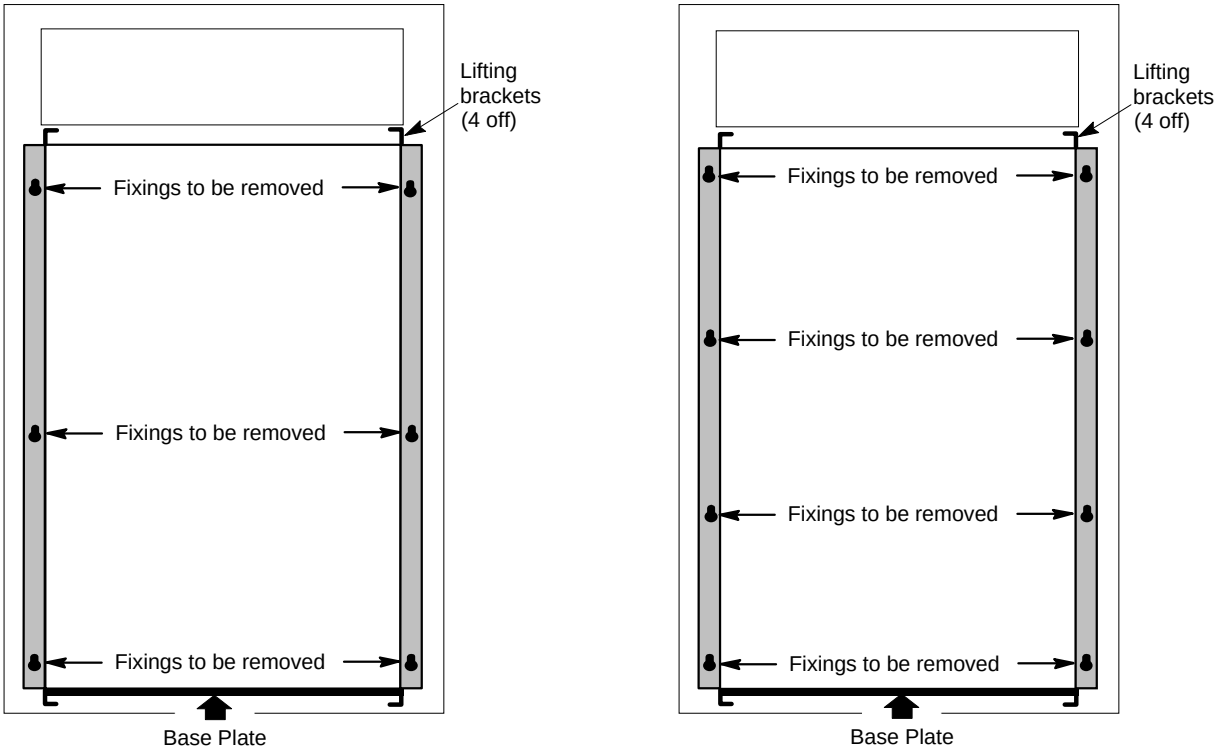


Figure 3-1 Lifting Details

Lifting the Converter

Use a safe and suitable lifting procedure when moving the drive. Never lift the drive by its terminal connections.

- The drive is supplied with a lifting bracket fitted to each corner for hoisting. Remove the brackets when the drive is in its final position, however, **the fixings MUST be re-fitted.** Refer to Chapter 11: "Technical Specifications" - Fixing Types and Torques.
- A plate is fitted to the base to enable the drive to be set-on-end by a forklift. Remove the plate before wiring the power terminals.

Prepare a clear, flat surface to receive the drive before attempting to move it. Do not damage any terminal connections when putting the drive down.

Weight

590H drive weighs 270Kg without packaging and fan assembly

591H drive weighs 160Kg without packaging and fan assembly

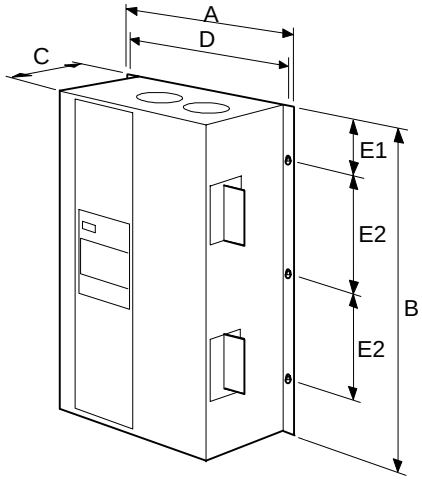
Fan weighs 18.5Kg.

Mounting the Converter

Refer to the Installation Drawings.

Mount the unit vertically on a solid, flat, vertical surface. It is mounted using bolts or screws into the fixing points (keyhole slots). Refer to Chapter 11: "Technical Specifications" - Fixing Types and Torques.

It must be mounted inside a suitable cubicle. To comply with the European safety standards VDE0160 (1994)/EN50178 (1998), the cubicle must require a tool for opening.



950A - 2700A

Current Rating (A)	Model	Overall Dimensions			Fixing Centres		
		A	B	C	D	E1	E2
950 - 2700	590H	850	1406 *	396	810	78	4 x 400
950 - 2700	591H	850	956 *	396	810	78	3 x 400

* For top mounted fan, B = +133 *Dimensions are in millimetres*

Ventilation and Cooling Requirements

Refer to Chapter 11: "Technical Specifications" - Environmental Details. (For operation above the quoted temperature, derating of the converter may be necessary. Refer to Eurotherm Drives for further information.)

The drive is force-cooled using the fan units supplied with the drive.

The Converter gives off heat in normal operation and must therefore be mounted to allow the free flow of air through the air entries and exits. Maintain the minimum air clearances (as a general rule allow at least 150mm (6 inches) of clear space above and below the drive for free air flow) to ensure that heat generated by other adjacent equipment is not transmitted to the Converter, be aware that other equipment may have its own clearance requirements. When mounting two or more 590 Series Converters together, these clearances are cumulative.

Installing the Fan

The fan unit supplied should be installed on the cubicle, with or without ducting (refer to the Installation Drawing). For wiring details refer to "Fan Wiring" page 3-8.

AC Line Choke

We recommend that you always use the specified ac line choke with the Converter to provide a known supply impedance for effective operation of the thyristor transient suppression circuits.

At least 2% line impedance should be provided in the supply side of the converter. For recommended AC line chokes refer to Chapter 11: “Technical Specifications” - AC Line Choke.

Changing DC Output Terminals

- Remove the left-hand cover plate(s) and retain the cover and screws.
- Remove and retain the 12 M6 nuts clamping the outgoing terminals to the cross plates.
- Remove the 12 M6 bolts securing the outgoing busbar assembly (assemblies). Remove the assembly (assemblies).
- Carefully remove the gasket(s) for use on the left-hand side.
- Refit the cover to the right-hand side of the drive.
- Refit the gasket to the left-hand side of the drive.
- Refit the terminal assemblies.

Note: *The 2Q terminal assembly is not polarised and may be fitted in any orientation. The 4Q terminal assemblies are handed and must be reversed to fit on the left-hand side.*

- Move the terminal markers as appropriate, the A+ terminal will still be at the bottom or AC input at the end of the product.
- Tighten terminal assembly bolts to the torque given on page 11-3.

Electrical Installation

IMPORTANT: Please read the Safety Information on pages Cont. 3 and 4 before proceeding.

WARNING!

Ensure that all wiring is electrically isolated and cannot be made “live” unintentionally by other personnel.

Cables are considered to be electrically *sensitive*, *clean* or *noisy*. You should already have planned your cable routes with respect to segregating these cables for EMC compliance. If not, refer to the Product Manual.

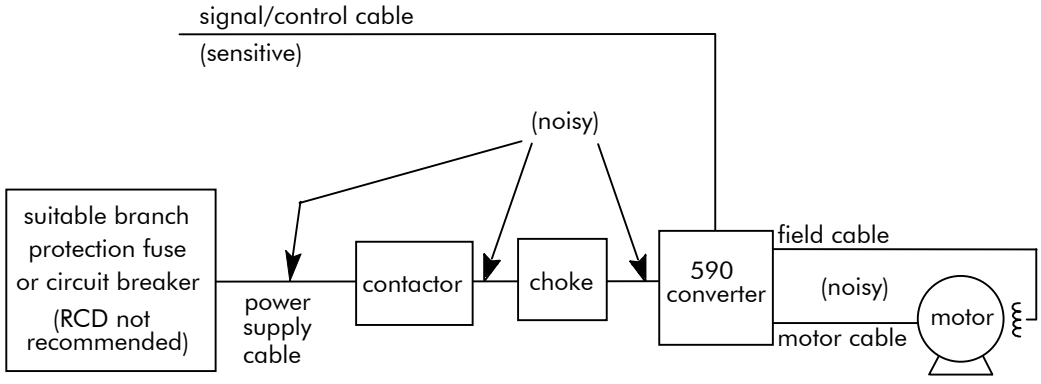


Figure 3-2 Cabling Requirements

Minimum Connection Requirements

Note: *Because of the complexity of showing all possible configurations, this Chapter deals only with a `general purpose' operation as a basic speed controller. Special wiring options usually form part of a customer-specific system and connection details will be provided separately.*

MINIMUM CONNECTION REQUIREMENT

The minimum connection requirements for operating the Converter are highlighted in the following text with the symbol opposite.

The Converter is using the default Armature Voltage feedback when following the `minimum connections' instructions.

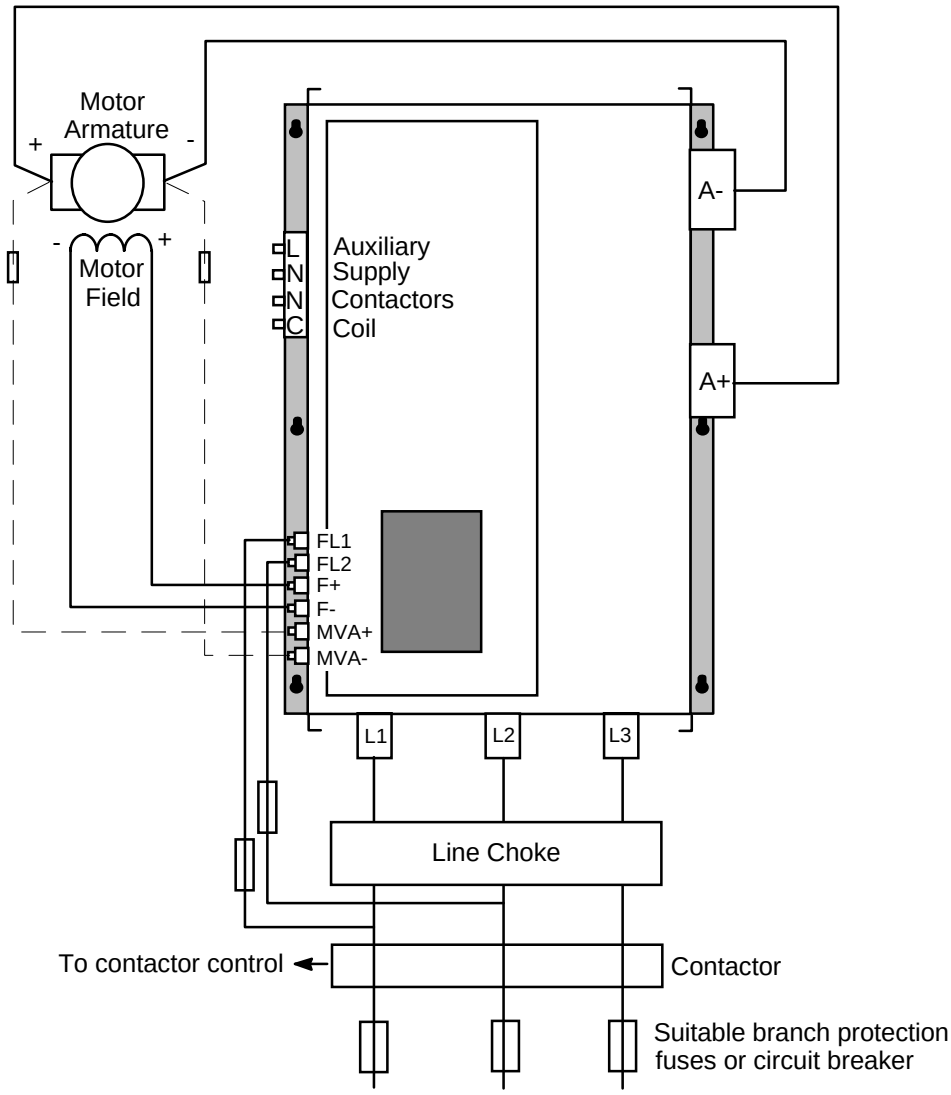


Figure 3-3 Minimum Connection Requirements (`general purpose' configuration)

IMPORTANT: Indicator lamps, annunciators, etc., for "Drive On" condition should be switched by an auxiliary contactor of the main contactor, not by the controller auxiliary relay.

To avoid damaging the drive NEVER carry out high voltage resistance or dielectric strength tests without first completely disconnecting the drive from the circuit being tested.

- Power connections must have a minimum rating of 1.1 x full load current. (1.25 x FLC when required to comply with UL requirements).
- All incoming main AC power supply connections must be protected with high speed semiconductor fuses. Refer to Chapter 11: “Technical Specifications” for fuse information.
- The External AC Supply EMC Filter must only be fitted on the mains side of the contactor.

Protective Earth Connections (PE)

This information is provided in full, without need for reference to the Product Manual.

IMPORTANT: The Converter must be **permanently earthed**. Each conductor used for permanent earthing (refer to Figure 2-1) must *individually* meet the requirements for a protective earth conductor (refer to Chapter 11: "Technical Specifications" - Earthing/Safety Details.

For installations to EN 60204 in Europe:

- For permanent earthing, the converter requires one conductor (≥10mm² cross-section) connected to an independent protective earth/ground point near the drive.
- Run the motor protective earth/ground connection in parallel with the motor supply conductors, ideally in the same conduit/screen/armour, and connect to an independent protective earth/ground point near the drive.
- Connect the drive to the independent earth/ground point.

590D - Refer to Product Manual,Chapter 12: "Certification for the Converter" - Screening & Earthing (cubicle mounted, Class B).

Refer to Figure 2-1 and Chapter 11: "Technical Specifications" - External Fuses and Recommended Wire Sizes.

Power Wiring Connections

This information is provided in full, without need for reference to the Product Manual.

> **WARNING!**
>
> The power terminals carry electrical voltage which can be lethal. Never work on any control equipment or motors without first removing all power supplies from the equipment and allow to discharge for 3 minutes.

3-Phase Contactor (D5, D6)

2 MINIMUM CONNECTION REQUIREMENT

A 3-phase contactor should be connected in the main ac power supply connections with a rating suitable (AC1) for the controller concerned. The contactor does not switch current and is primarily for disconnection and sequencing of the power bridge. The main contactor must be energised directly from the controller by connecting the coil to terminals D5 (Line) and D6 (Neutral). No additional series contacts or switches are permitted since they will interfere with the sequencing of the controller and cause unreliability and possible failure.

Note: *A slave relay must be used to drive the contactor coil. The contactor and slave relay must have coil voltages compatible with the controller auxiliary supply voltage.*

A dc contactor can be used but the sequencing must be adjusted to accommodate its use, an auxiliary normally open volt-free contact of the contactor must be connected in series with the "enable" input C5 to disable the drive until after the contactor is closed.

3-Phase Supply, AC Line Choke (L1, L2, L3)

3 MINIMUM CONNECTION REQUIREMENT

Refer to Figure 3-3.

The main ac power is connected to busbar terminals L1, L2 and L3, there is no specific phase connection to these three terminals as the controller is phase rotation independent. The connections must be made via the main contactor and the ac line choke.

High speed, semi-conductor fuses are provided in the unit to protect the thyristor stack in case of direct ouput short circuits. You should provide suitable branch protection fuses to protect cabling.

Fit a 3-phase ac line choke in series with the incoming main 3-phase ac power supply. (Eurotherm Drives can provide suitable choke for this duty, mechanically designed to connect directly to the controller ac supply terminals.) The choke should be connected between the controller and the ac contactor for optimum protection and safety.

The choice of ac or dc contactors is a user preference. Eurotherm Drives prefer ac contactors as they isolate the converter and motor when not in use. The only restriction on the use of a dc contactor is that an interlocking contact should be provided into the Enable input.

Auxiliary Supply (L, N)

4 MINIMUM CONNECTION REQUIREMENT

Connect the auxiliary supply (single phase 50/60Hz) to terminals L (Line) and N (Neutral) with suitable external fuse protection. The steady state current absorbed by the controller is nominal., the external fuse is determined chiefly by considering the contactor holding VA and the controller cooling fans.

Note: *The auxiliary supply must be connected directly to the incoming supply, no series sequencing switches or contacts are permitted without consultation with Eurotherm Drives.*

Field (F-, F+)

5 MINIMUM CONNECTION REQUIREMENT

Connect the motor field (-) to terminal F- and field (+) to terminal F+. If the motor has no field connections, is a permanent magnet motor, or if the field is derived externally, you must inhibit the FIELD ENABLE parameter. Refer also to "Fuse Rating and Recommended Wire Sizes", page 11-2.

MMI Menu Map

1 SETUP PARAMETERS

2 FIELD CONTROL

FIELD ENABLE

Motor Armature (A+, A-)

6 MINIMUM CONNECTION REQUIREMENT

The motor armature is connected to busbar terminals A+ and A-. If a DC contactor is used the poles should be interposed between the controller terminals and the motor terminals.

When the controller is operating in a regenerating mode for extended periods acting as a load generator for another machine, it is advisable to fit additional protection in the armature circuit. A DC fuse or a high speed circuit breaker will provide this protection, if in doubt consult the Eurotherm Drives Engineering Department.

External AC Field (FL1, FL2)

MINIMUM CONNECTION REQUIREMENT

Specific to the 590H / 591H

An external field supply is required to the controller under all circumstances. Connect this supply to terminals FL1 and FL2. The magnitude of this voltage is determined by the desired field voltage. The supply must be protected externally with suitable fuses. Always derive the supply from the Red and Yellow phases of the main power supply, with the Red phase connected to terminal FL1 and the Yellow phase connected to FL2.

IMPORTANT: It is important that connection of the controller and the external field supply is consistent when using an externally supplied field regulator. The supply must be derived from L1 (Red) and L2 (Yellow) phases directly or indirectly through a transformer. L1 must be connected to FL1, and L2 connected to FL2.

External Armature Volts

External Armature Volts can be used where a more sensitive reading of terminal volts is required. When required the terminal MVA+ should be wired to the Motor A+ terminal and MVA- should be wired to Motor A- terminal via suitable fuses.

Control Wiring Connections

For all connection requirements refer to the Product Manual.

Removing the Cover

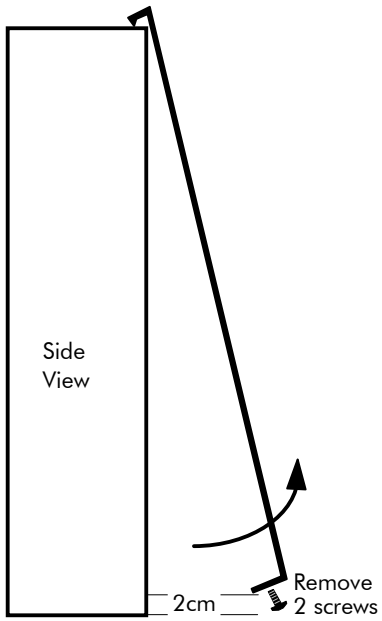
The cover is manufactured from sheet metal and weighs:-

- 2Q Non-Regenerative = 10kg
- 4Q Regenerative = 15kg

To remove the cover use a flat headed screwdriver to undo the two screws at the base of the cover.

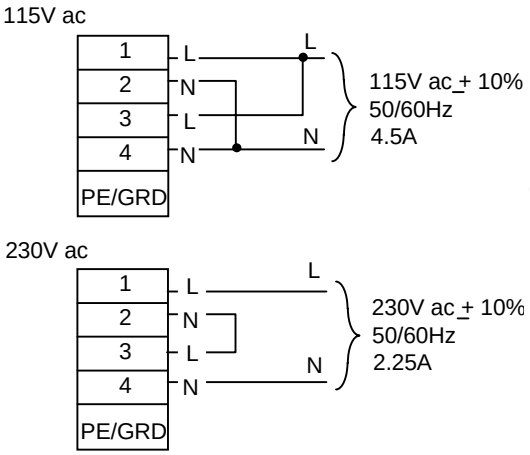
Now lift the cover base outwards and upwards, once the cover has been raised two centimetres it can now be removed.

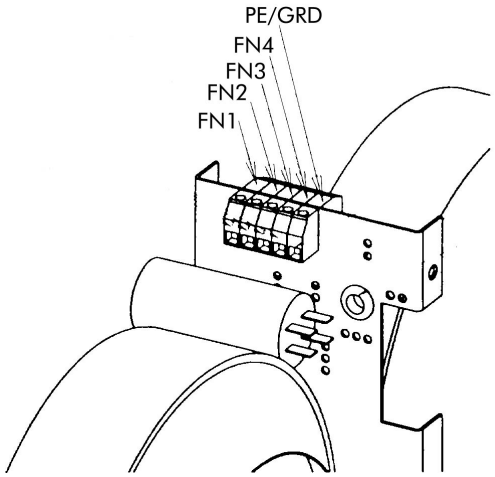
To replace the cover follow the procedure in reverse, engaging the locating studs at the top, moving into final location and tightening fixing screws.



Fan Wiring

The fan assembly provided is permanently wired as shown below.





Refer to Chapter 11: “Technical Specifications” -
Power Supply Details for fan ratings

Figure 3-4 Fan Wiring Diagram

Installation Drawings

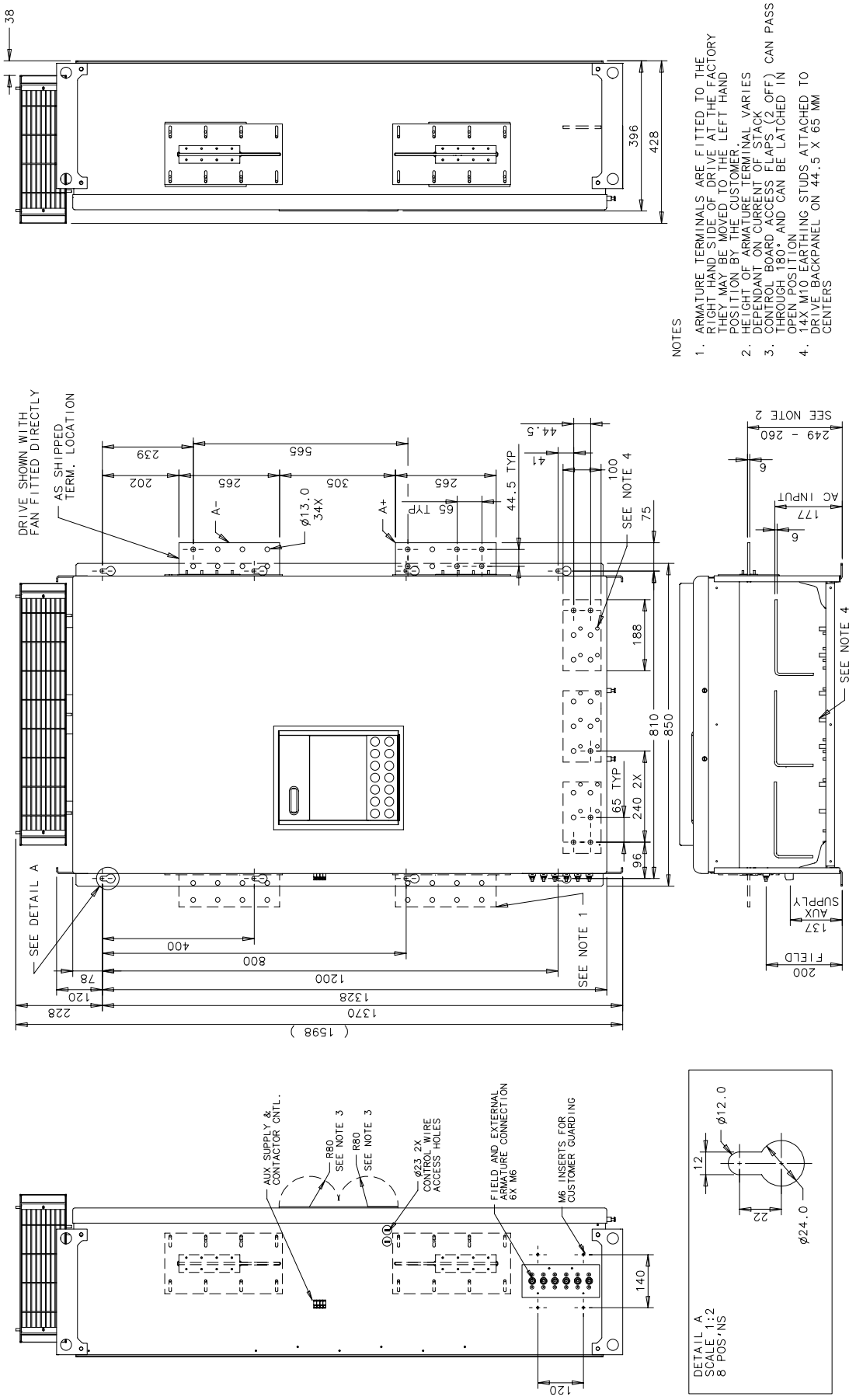


Figure 3-2 590, Regenerative DC Drive Outline 1200 - 2700 Amp, Internally Fitted Cooling Fan

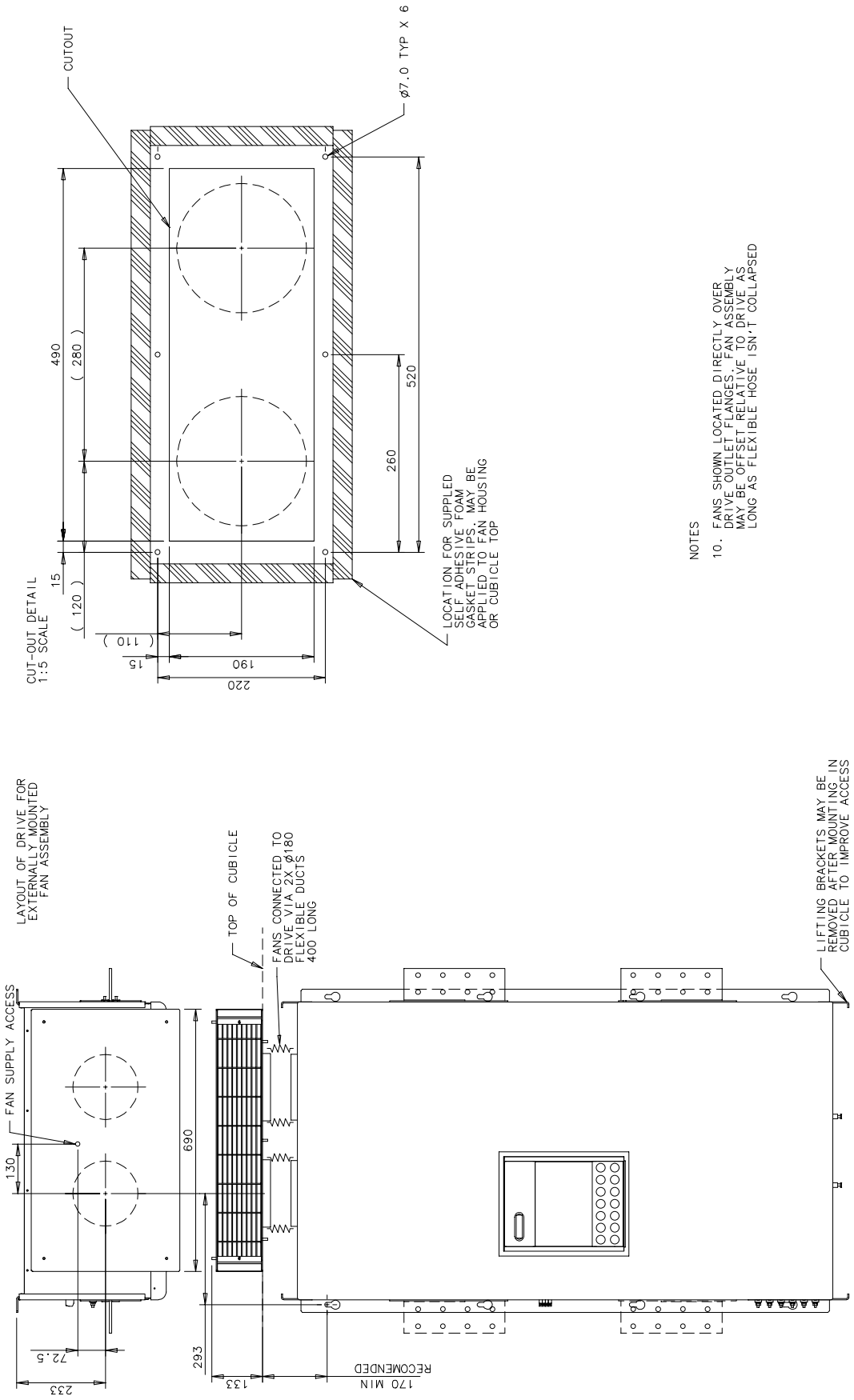


Figure 3-3 590, Regenerative DC Drive Outline 1200 - 2700 Amp, Cubicle Roof Mounted Cooling Fan

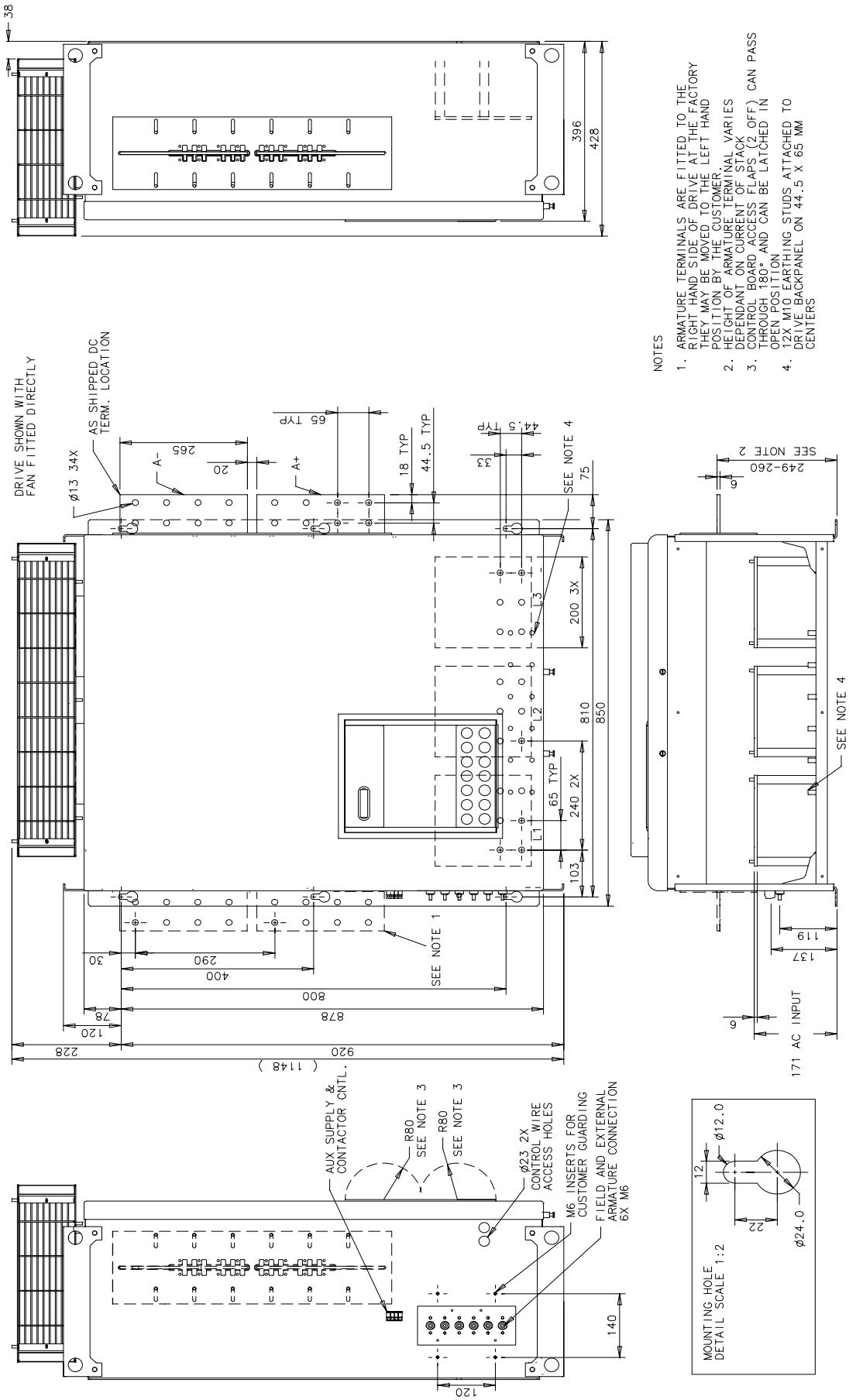


Figure 3-4 591, Non Regenerative DC Drive Outline 1200 - 2700 Amp, Internally Fitted Cooling Fan

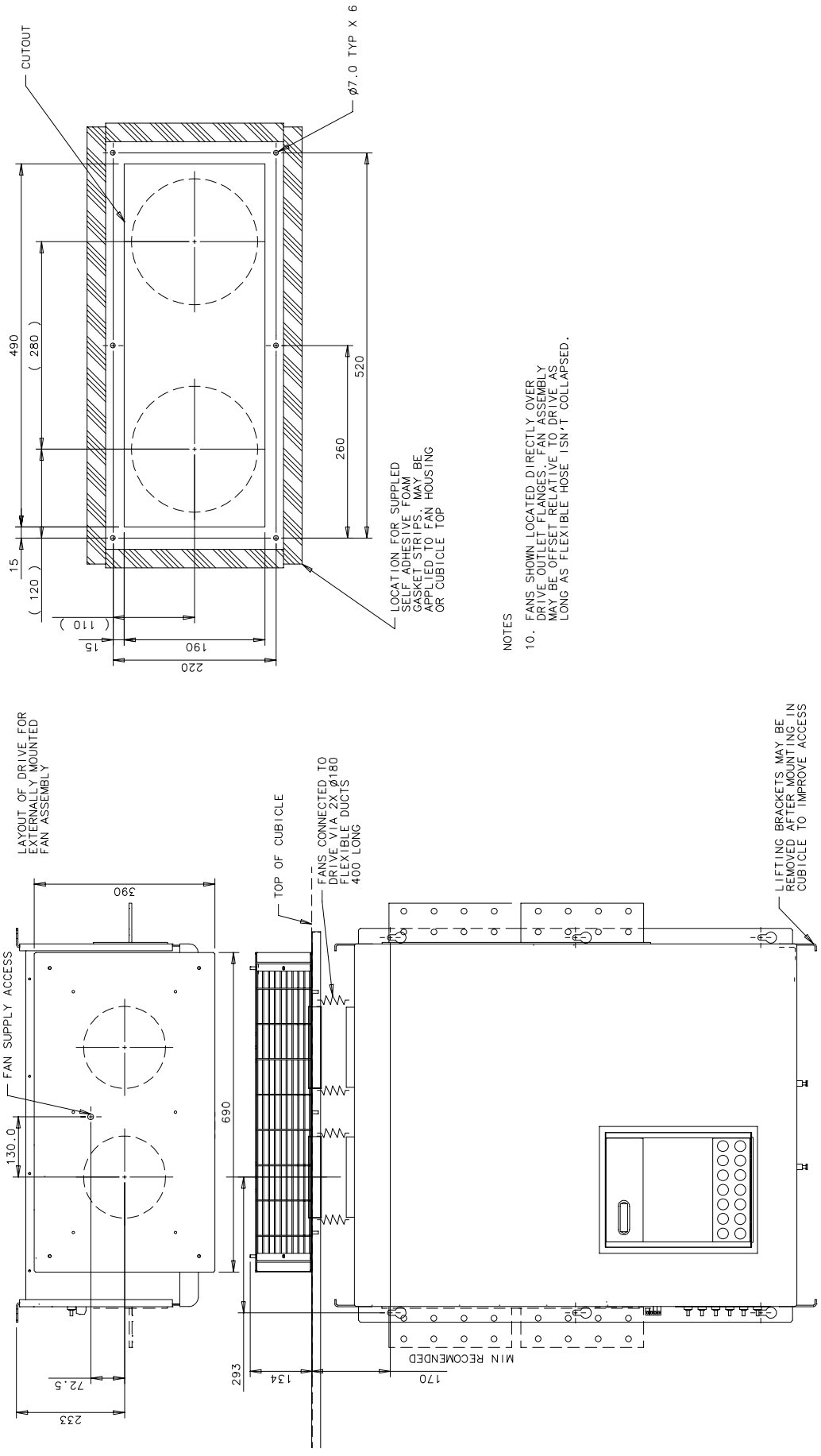


Figure 3-5 591, Non Regenerative DC Drive Outline 1200 - 2700 Amp, Cubicle Roof Mounted Cooling Fan

OPERATING THE CONVERTER

Setting-up the Converter

The following instructions are written in logical order and replace the "Calibration" details given in the Product Manual.

Complete each stage successfully before progressing to the next.

Calibration

NO POWER IS CONNECTED AT THIS STAGE

With the cover removed, you must first calibrate the Converter for use with the motor.

To access the power board, unscrew the two fixings on the right hand side of the control door. Open the door to reveal the power board.

Calibration of the drive is a two stage process:

1. set the calibration switches on the power board
2. calibrate the control door

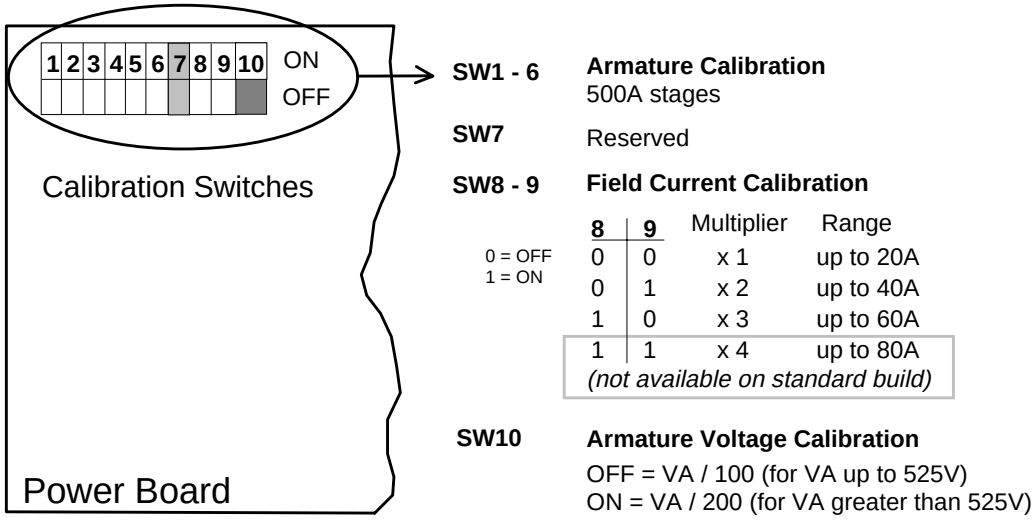


Figure 4-1 Calibration Switches

Armature Current (IA CAL)

1. Set switches 1 to 6 to give the required output current to the nearest 500A step. (Each one switches in a parallel resistor, so any of the six switches can be used).
2. Set the remainder of the required current level on the control board (door).

Example

Required current is 1750A:

- Set the power board calibration switches 1 to 3 to ON to give a basic calibration of 1500 Amps.
- Set the Armature Current (IA CAL) calibration switches on the control board to 250A using SW1, SW2 and SW3.

Final calibration:	1500	on power board
	250	on control board
	1750	calibrated current

Field Current (IF CAL)

1. Set the power board calibration switches 8 and 9 to give the required field current range.
2. **Divide** the required field current setting by the value of the associated Multiplier to obtain a calculated field current setting. Refer to Figure 4-1 for the Range and associated Multiplier values.
3. Set the Field Current (IF CAL) calibration switches on the control board to the value of the calculated field current using SW4, SW5 and SW6.

Example

Required field current is 37A:

- Set switches 8 and 9 for up to 40A (Multiplier is x2)
- Calculate the field current setting: $\frac{37.0}{2} = 18.5$
- Set the Field Current (IF CAL) calibration switches on the control board to 18.5A

Note: *When using the 590H/591H Analog product, field current cannot be controlled. However, the field current calibration switches on the power board should be set to a suitable range for the motor field current required.*

Armature Voltage (VA CAL)

Refer to the Product Manual for the Armature Voltage table (590D - Product Manual, Chapter 4: "Operating the Converter" - Calibration).

1. For armature voltages less than 525V dc set switch 10 to OFF.
2. For armature voltage greater than 525V dc set switch 10 to ON. The armature voltage calibration is now doubled, i.e. for a 750V dc armature, divide the voltage by 2 giving 375V dc, set the Armature Voltage (VA CAL) 4-way switch SW7 on the control board to the 375V dc range. Adjust final armature voltage trim accordingly.

Note: *When using the 590H/591H Analog product, armature voltage calibration is not required. However, setting switch 10 (and SW7 where necessary) to accommodate final armature voltage is recommended to keep the control circuits in their operating range.*

Refer to the Product Manual instructions to continue setting-up the Converter.

ROUTINE MAINTENANCE AND REPAIR

Caution

Maintenance and repair should only be performed by competent persons using only the recommended spares. Use of incorrect parts may create a hazard and risk of injury.

Routine Maintenance

Refer to the Product Manual.

Repair

Refer to the Product Manual.

Fuse Replacement

1. Remove the front cover.
2. Unplug the ribbon cables to the trigger boards.
3. Open the swing-frame using the two quick-release fixings at the right hand end.

590H 4Q Product (Regenerative)

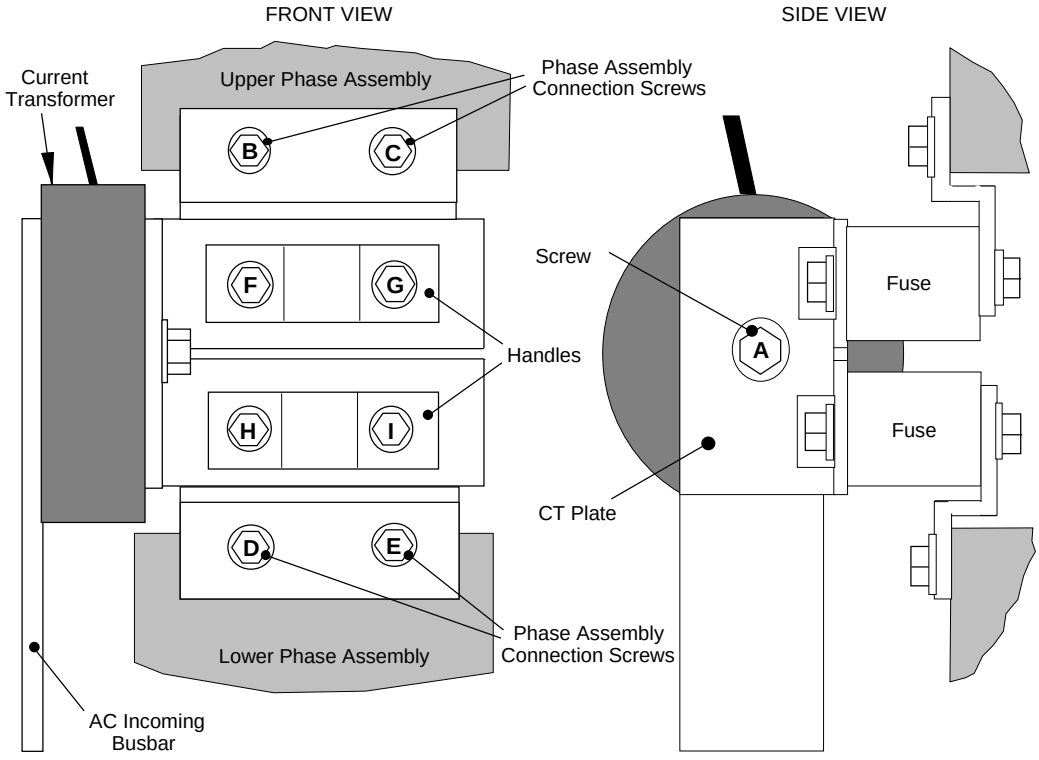


Figure 5-1 590H Fuse Replacement Diagram

IMPORTANT: When re-assembling the unit, apply a `zinc-loaded' jointing compound between the fuses and busbars, and between the busbars and phase assemblies (BICC BX1 - Eurotherm Part No. EA466241)

Observe all tightening torque levels, refer to Chapter 11: "Technical Specifications" - Fixing Types and Torques.

Bench-Top Replacement Procedure

1. Disconnect the relevant fuse microswitch assembly by unplugging the lead assembly from the rear trunking.
2. Remove the M12 (A).
3. Loosen (but do not remove) the four M10 screws (B, C, D, E).
4. Hold the fuse assembly handle in one hand and remove the two screws (D, E) from the lower phase assembly.

   CAUTION: The fuse assembly weighs 9kg maximum.
5. Hold the fuse assembly handles and remove the two screws (B, C) from the upper phase assembly.
6. With the fuse assembly on the bench, remove the M12 screws (F, G, H, I) holding the fuses to the busbars**. Take a note of the fuse microswitch position on the fuse assembly,** do not forget, as the lead assembly will not fit if mounted in the wrong position.

Reverse the above procedure for replacement. Remember to re-connect the fuse microswitches.

In-Situ Replacement Procedure

1. Disconnect the relevant fuse microswitch assembly by unplugging the lead assembly from the rear trunking.
2. Remove the M12 screw (A), and the 4 screws (F, G, H, I). Remove the CT plate and handles.
3. Remove the relevant screws (B, C or D, E) and lift the fuse busbar assembly from the phase assembly.
4. Replace the fuse on the busbar and re-connect the microswitch. Fully tighten the fuse to the busbar.
5. Fit the fuse busbar assembly on to the phase assembly. Don't fully tighten the screws yet.
6. Position the CT plate on top of the fuses. The slack in the fuse busbar assembly will allow the fixing holes to be aligned. Insert the screws.
7. Fully tighten all screws (including those in 5 above).
8. Re-connect the fuse microswitches.

591H 2Q Product (Non-Regenerative)

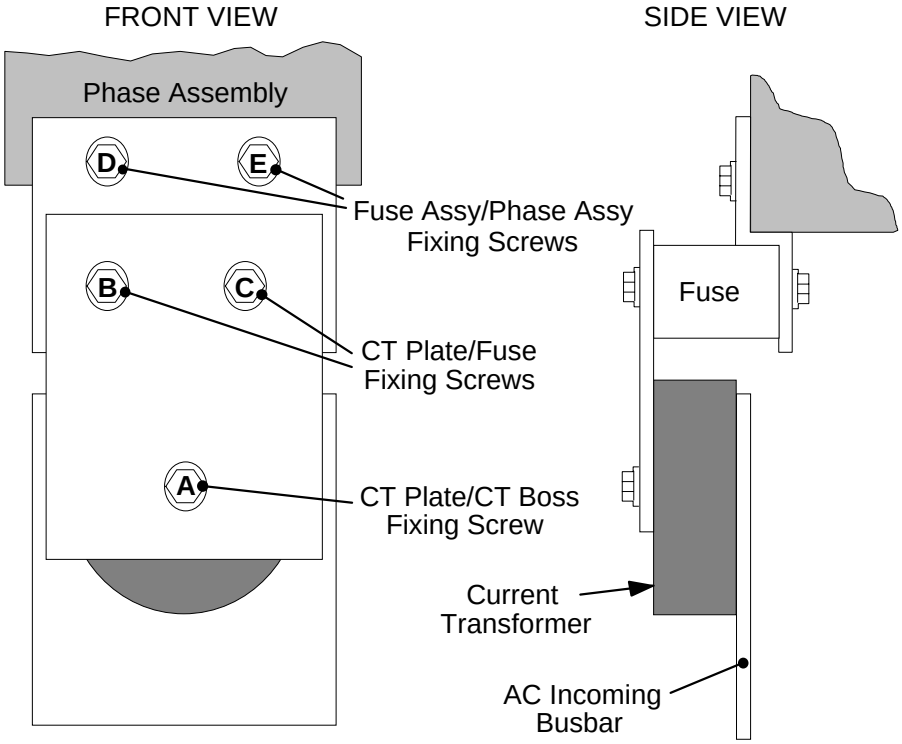


Figure 5-2 591H Fuse Replacement Diagram

IMPORTANT: When re-assembling the unit, apply a `zinc-loaded' jointing compound between the fuses and busbars, and between the busbars and phase assemblies (BICC BX1 - Eurotherm Part No. EA466241)

Observe all tightening torque levels, refer to Chapter 11: "Technical Specifications" - Fixing Types and Torques.

Bench-Top Replacement Procedure

Working on the relevant fuse assemblies:

1. Remove the M12 screw (A).
2. Release the two M12 screws (B, C) and remove the CT plate.
3. Remove the two M10 screws (D, E) fixing the fuse assembly to the phase assembly.
4. On the bench, replace the relevant fuse on the fuse assembly.
5. Reverse the procedure for re-fitting.

Phase Assembly Replacement

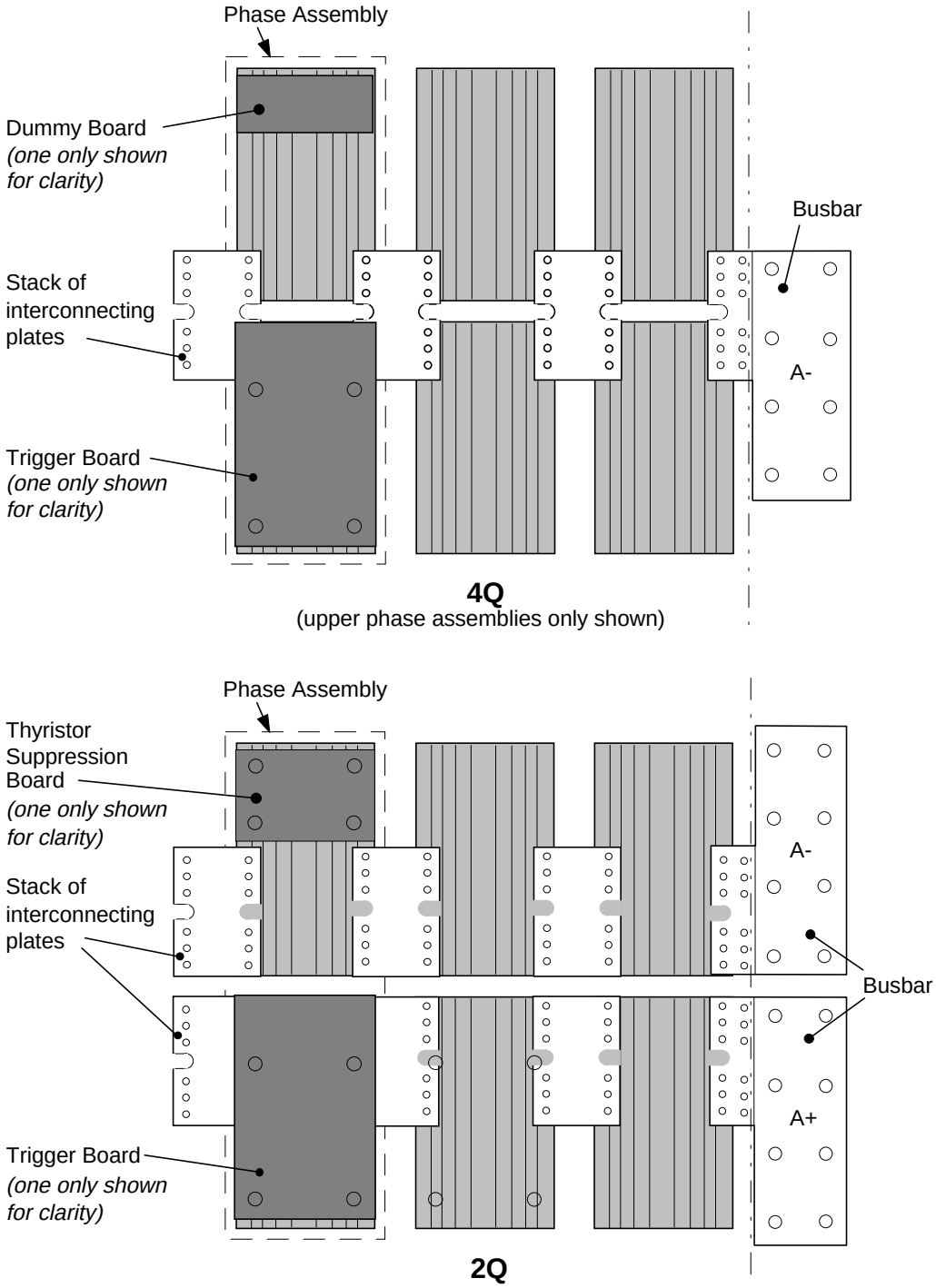


Figure 5-3 Front View of Phase Assemblies

IMPORTANT: When re-assembling the unit, apply a `zinc-loaded' jointing compound between the fuses and busbars, between the busbars and phase assemblies and between the interconnection plates and the heatsink (BICC BX1 - Eurotherm Part No. EA466241)

Observe all tightening torque levels, refer to Chapter 11: "Technical Specifications" - Fixing Types and Torques.

Phase Assembly Removal Procedure

1. Referring to Figure 5-1 (590H) or Figure 5-2 (591H), remove the M12 screw (A). Undo the four screws (B, C, D, E) which allows the CT plate and fuse assembly to be removed.
2. Unplug the thyristor gate leads and the heatsink overtemperature leads from the relevant phase assembly trigger board. Remove the same leads from the adjacent phase assembly or assemblies (this is necessary to gain complete access to the interconnecting plates.) If you are removing the phase assembly from a 591H (2Q) product, also disconnect the thyristor suppression lead from the trigger boards.
3. Remove the trigger board by releasing the four M6 Sems nuts fixing the PCB to the assembly. If you are working on a 590H (4Q), remove the dummy trigger board, or if working on a 591H (2Q) remove the thyristor suppression board. Remove the air duct from the top of the phase assembly to gain access to the DC interconnection plates.
   Do not remove the trigger board support spacers.
4. Remove the DC interconnection plates between the phase assembly and its adjacent assemblies, either output terminals or phase assemblies.
5. If changing an upper phase assembly on a 590H or 591H remove the top baffle. This is achieved by pushing out the two end flaps of the plenum chamber and unclipping the top baffle from the top cover baffle stops and the top of the phase assemblies. Remove the vertical baffles between phase assemblies.
6. If changing a lower phase assembly on a 590H, remove the lower air duct.
7. Remove the complete phase assembly by removing the four M6 Sems nuts at the top and bottom of the phase assembly.

Note: *On the 591H 2Q, the left hand screw retains the phase coding connection which should be pushed to one side before lifting the phase assembly.*

Phase Assembly Fitting Procedure

1. Position the repaired or spare phase assembly on to the back panel spacer. (Remember to re-connect the coding lead to the bottom of the phase assembly when working on a 591H 2Q).

   Check for correct orientation of the assembly. Fix in position with 4 x M6 Sems nuts and tighten to the correct torque level.

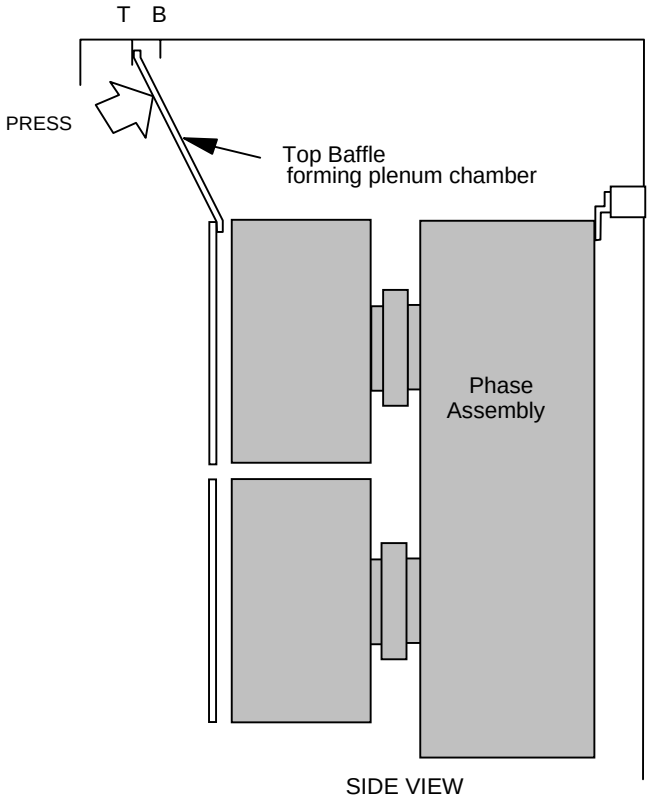
   Refit the interconnecting plate stacks between the phase assemblies. A stack of three plates are used on a 1200 Amp unit, four on a 1700 Amp unit, five on a 2200 Amp unit and six on a 2700 Amp unit. On a 4Q unit the plates interconnect both the upper and lower thyristors and adjacent phase assemblies. On the 2Q unit the plates interconnect adjacent phase assemblies. Tighten to the correct torque level.

Note: *a) When fitting a spare phase assembly there may be some misalignment to the new phase where the interconnection plates do not fit easily. In this case, loosen the trigger support spacers which will allow adjustment of the support bars. Fit the interconnecting plates and re-tighten all units, including spacers.*

b) When re-assembling the interconnection plates it is important that a good electrical contact is made between the plates and the aluminium heatsink. Apply a layer of `zinc-loaded' jointing compound between the interconnection plates and the heatsink.

3. Refit the air duct on the phase assembly ensuring that the duct fits inside the side ducting of the phase assembly.
4. Refit the trigger board (thyristor suppression board or dummy board as appropriate) and secure with the M6 Sems nuts.
5. Reconnect the gate leads, thermostat and suppression lead as necessary. The gate leads cannot be fitted incorrectly as they are polarised by the plugs.
6. Re-fit the top baffle (either plenum cover or lower 4Q air duct) and vertical baffles.
7. Replace the fuse.
8. Re-close the swing-frame.
9. Replace the trigger board connectors.

Top Baffle Setting



The top baffle must be positioned according to the table below. Clip the baffle into position, matching the slots at the bottom of the baffle to rest on the plastic covers of each phase assembly. Press the baffle into the top of the unit until it snaps into place, positions T or B, against the baffle stops. Manoeuvre the baffle into the correct position.

Position to Engage Baffle		1200A		1700A		2200A		2700A	
		LV	HV	LV	HV	LV	HV	LV	HV
T	Top Clip Position						✓	✓	✓
B	Bottom Clip Position	✓	✓	✓	✓	✓			

TECHNICAL SPECIFICATIONS

Environmental Details

Operating Temperature	0°C to +40°C (see the "Electrical Ratings" table) Operating temperature is defined as the ambient temperature to the immediate surround of the Converter, when the Converter and other equipment adjacent to it is operating at worst case conditions.	
Storage Temperature	-25°C to +55°C	
Shipping Temperature	-25°C to +70 °C	
Product Enclosure Rating	Cubicle Mounted	IP2x except terminals (Europe)
Altitude	If >500 metres above sea level, derate Motor Power rating by 1% per 200 metres to a maximum of 5,000 metres	
Humidity	Maximum 85% relative humidity at 40°C non-condensing	
Atmosphere	Non flammable, non corrosive and dust free	
Climatic Conditions	Class 3k3, as defined by EN60721-3-3 (1995)	
Safety		
Overvoltage Category	Overvoltage Category III	
Pollution Degree	Pollution Degree 2	
Europe	EN50178 (1998), when fitted inside a cubicle	

AC Line Choke

AC Line Choke @ 2% line impedance.

Code	DC Rating		AC Current	Inductance	Eurotherm Drives Part No.
12000	1200	LV	1080A	15µH	CO466250U012
		HV	1080A	20µH	CO466250U012
17000	1700	LV	1620A	10µH	CO466250U017
		HV	1620A	15µH	CO466250U017
22000	2200	LV	1980A	10µH	CO466250U022
		HV	1980A	15µH	CO466250U022
27000	2700	LV	2520A	7.5µH	CO466250U027
		HV	2520A	10µH	CO466250U027

External Fuses and Recommended Wire Sizes

Local wiring regulations always take precedence.

		Input			Output		
Description	Drive Size	Input Current (A)	* European Copper Busbar Size (40°C) (dim in mm)	✦ North American Wire Size (kc mil)	Output Current (A)	* European Copper Busbar Size (40°C) (dim in mm)	✦North American Wire Size (kc mil)
Main	1200	1100	1 off 60 x 10	500 * 4	1200	1 off 60 x 10	500 * 4
Power	1700	1550	2 off 40 x 10	400 * 6	1700	2 off 50 x 10	500 * 6
	2200	2000	2 off 50 x 10	600 * 6	2200	2 off 60 x 10	700 * 6
	2700	2450	2 off 60 x 10	900 * 6	2700	3 off 50 x 10	700 * 8
Field	60	60	AWG 8	AWG 8	60	AWG 8	AWG 8

Internal Fuses

Information provided on internally fitted for the 590H and 591H.

Product Code	591H		590H	
Block 2	Fuse Rating	Eurotherm Drives Part No.	Fuse Rating	Eurotherm Drives Part No.
12000	500A	CS466260U050	350A	CS466261U035
17000	800A	CS466260U080	550A	CS466261U055
22000	100A	CS466260U100	700A	CS466261U070
27000	1250A	CS466260U125	900A	CS466261U090

Earthing/Safety Details

Earthing	Permanent earthing is mandatory on all units because the earth leakage current exceeds 3.5mA ac/10mA dc under normal operating conditions. Permanent earthing must be provided through an earth conductor with a cross sectional area of not less than half that of the supply conductors. ***Note:*** *Each conductor itself must meet the local requirements for a protective earth conductor.*
Input Supply Details (TN) and (IT)	Units are suitable for use on earth referenced (TN) and non-earth referenced (IT) supplies.
Prospective Short Circuit Current (PSCC)	100kA maximum
Earth Leakage Current	>50mA (all models)

Electrical Ratings

For operating temperatures in the range 0°C to +40°C.

Model	Max Supply Voltage (V) (LV/HV)	Continuous Max Output Current (armature, A)	Max Field Current Rating (A)	Overload Rating (max 100% armature current, A)			Approximate Power Loss (W @ 100%)
				150% 30s	150% 60s	200% 10s	
590H & 591H	500/690	1200	60	1050	1000	900	3600
	500/690	1700	60	1450	1400	1250	5200
	500/690	2200	60	1950	1900	1750	6600
	500/690	2700	60	2350	2250	2150	8100

Power Supply Details

Control Voltage		110/240V ±10%, Single phase, 45-65Hz
Power Supply Fusing		Internal PSU/Fans/Contactor : 3A
3-Phase Supply	LV Build	500V rms max
	HV Build	690V rms max
Contactor Output		3A maximum @ Control Voltage
Fan Supply		110/120V ± 10% 50/60 Hz depends on wiring, refer to Chapter 3: "Installing the Converter" - Fan Wiring. 220V/240V ± 10% 50/60Hz depends on wiring, refer to Chapter 3: "Installing the Converter" - Fan Wiring.
Fan Rating		115V ac 50Hz, 1.67A, 177W, 2750 rpm, motor run capacitor 18µF 115V ac 60Hz, 2.21A, 240W, 2660 rpm, motor run capacitor 18µF

Fixing Types and Torques

Description	Fixing Size	Spanner Size	Format	Torque Nm
Drive Mounting Fixings	M12	19mm	Bolt	57.2
Earth studs on back panel	M10	17mm	Nut	32.8
Fuse assy to Phase assy	M10	17mm	Bolt	24
AC Input & DC Output Bus bars	M12	19mm	Nut & Bolt	57.2
Fuse assembly	M12	19mm	Bolt	42
Fuse assembly to CT	M12	19mm	Bolt	42
DC Output terminal panel to side panel	M6	10mm	Bolt	6.8
DC Bus bars	M6	10mm	Nut	6.8
I/P terminal assy	M6	10mm	Nut	4
Lifting Bracket Fixings	M10	17mm	Bolt	24

Spares Available

Figures in brackets give the number required per drive.

Phase Assembly Order Code	DC Rating		Eurotherm Drives Part Number								
			Phase Assembly		Fuse		Trigger Assy		Thyristor Supp.		Snubber	
			590H	591H	590H (12)	591H (6)	590H (6)	591H (3)	590H	591H (3)	590H (3)	591H (3)
12000	1200	LV	LA466059U012		CS466261U035	CS466261U050	AH466003U001	AH466003U001		AH466003U003	AH466004U001	AH466004U001
		HV	LA466059U112		CS466261U035	CS466261U050	AH466003U002	AH466003U002	not	AH466003U004	AH466004U002	AH466004U002
17000	1700	LV	LA466059U017		CS466261U055	CS466260U080	AH466003U001	AH466003U001	fitted	AH466003U003	AH466004U001	AH466004U001
		HV	LA466059U117		CS466261U055	CS466260U080	AH466003U002	AH466003U002	on	AH466003U004	AH466004U002	AH466004U002
22000	2200	LV	LA466059U022		CS466261U070	CS466260U100	AH466003U101	AH466003U101	4Q	AH466003U103	AH466004U101	AH466004U101
		HV	LA466059U122		CS466261U070	CS466260U100	AH466003U102	AH466003U102	drives	AH466003U104	AH466004U102	AH466004U102
27000	2700	LV	LA466059U027		CS466261U090	CS466260U125	AH466003U101	AH466003U101		AH466003U103	AH466004U101	AH466004U101
		HV	LA466059U127		CS466261U090	CS466260U125	AH466003U102	AH466003U102		AH466003U104	AH466004U102	AH466004U102
Fan Assembly		LA466038										

Field	PCB Assy		Thyristor Mod.		Diode Mod.	
	590H	591H	590H	591H	590H	591H
LV	AH466002U001	AH466002U001	CF385524U016	CF385524U016	CW46432U016	CW464321U016
HV	AH466002U002	AH466002U001	CF385524U022	CF385524U022	CW464322U022	CW464322U022

Common Parts	Power PCB		VDRs (1 per Phase)		Cooling Fans (2 per Assy)	
	590H	591H	590H	591H	590H	591H
LV	AH466001U001	AH466001U001	CK466151U018	CK466151U018	DL466242	DL466242
HV	AH466001U001	AH466001U001	CK466151U018 CK466151U007	CK466151U018 CK466151U007	DL466242	DL466242

Terminal Information

Terminal Description	Terminal Function	Terminal Number
Three phase supply	Drive supply	L1 - L3
Armature +	Drive output to motor armature	A+
Armature -	Drive output to motor armature	A-
External field supply (Red Phase)	Required AC Input Voltage = 1.11 x Nominal DC Output. The field regulator will control the field current provided that the Nominal DC Output voltage exceeds the field voltage by at least 10%. i.e. $V_{AC} = 1.11 \times V_{DC}$ and $V_{DC} = 1.1 \times V_{FIELD}$ therefore $V_{AC} = 1.22 \times V_{FIELD}$ The external AC supply must be fitted with high speed fuses to protect the field regulator. For controllers with 10A field capability 10A fuses should be used, those with 20A field capability 20A fuses, etc. *Note: When using an external AC input it is important to have the correct phase relationship on the terminals. The supply must be derived from L1 (Red) and L2 (Yellow) phases directly or indirectly through a transformer. L1 must be connected to D1, and L2 to D2.*	FL1
External field supply (Yellow Phase)	-- as FL1 above --	FL2
Field Output (DC+)	Motor field connections The DC output voltage at these terminals will depend upon the AC supply voltage and the mode of field control. Please refer to the Product Manual for details of the drive capability and operation. Maximum drive capability is 60A DC.	F+
Field Output (DC-)		F-
External Armature Volts Sense (+)	This connection can be used if a more accurate value of armature voltage is required, for example a DC line choke may be fitted. This terminal should be connected directly to the positive motor armature terminal.	MVA+
External Armature Volts Sense (-)	This terminal should be connected directly to the negative motor armature terminal (see above).	MVA-
Auxiliary Supply Live 110-240V	These terminals are the mains input connections for control supply transformer and contactor relay supply	L
Auxiliary Supply Neutral		N
Main contactor coil V AC	This terminal is internally connected to the auxiliary supply neutral and provides a convenient connection point for the contactor coil neutral connection	N
Main contactor coil V AC	This terminal is the switched output from the contactor control relay and is derived from the auxiliary supply. The output is internally fused at 3A hence contactor coils having a high pick-up current must be operated via a slave relay. *Note: The contacts of the Contactor Control Relay are suppressed by a series connected resistor (680 Ohms) and capacitor (22nF) to protect the relay contacts. Users should be aware that when the contactor Control Relay is "De-energised", a leakage current of approximately 2mA can be expected and this should be considered when interfacing to these terminals. Typically, there could be the energisation of very sensitive relays.*	C

ISS.	MODIFICATION	ECN No.	DATE	DRAWN	CHK'D
A	Initial Issue (HA466272)	13088	1.10.98	FEP	DN
B	Global updates and changes.	--	21.10.98	FEP	GDR
C	Chapter 5 - added fuse information. Global updates and changes.	--	27.10.98	FEP	GDR
D	Figure 2-1: replaced 1-4 with L, N, N, MC; and DC- and DC+ with A- and A+. Page 3-1: corrected weights and added fan weight. Page 3-1: amendments to AC Supply Choke, and added Changing DC Output Terminals. Updated Installation Drawings. Table 3-1: removed HP column. Page 6-3: corrected Torque Nm from 46 to 42 and 4.5 to 4. Page 6-4: added to Spares Available.	--	11.12.98	FEP	GDR
1	Initial print run (HA466272U001). Printed and cross-referenced to coincide with the release of HA467078, 590 Digital Product Manual.	13088	1.4.99	CM	GDR

FIRST USED ON	MODIFICATION RECORD
File Name: P:\590_H\DOCS\MANUAL\ISSUE_1\ZZ.DOC	590H Series DC Converter
EUROTHERM DRIVES	DRAWING NUMBER ZZ 466272U001 C
	SHT. 1 OF 1