

## **GENERAL APPLICATION NOTE**

### **EMC Installation Guide for SD750 series Unscreened Cable and Screened Cable Including Requirements for Submersible Pumps**



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## 1. Background EMC information

This guide provides the installer with sufficient information to ensure correct installation of the SD750 series so that they meet the electromagnetic compatibility (EMC) levels to which they have been tested and certified to. Correct EMC installation will minimize the likelihood of faulty operation or radio frequency interference (RFI) with surrounding equipment.

In New Zealand variable speed drives (VSDs) must be marked with “C-tick” in order to verify compliance with the relevant standard, IEC 61800-3 (2004): “Adjustable Speed Electrical Power Drive Systems”. Part 3: “EMC Requirements and Specific Test Methods”. The “C-tick” marking is managed by the Ministry of Economic Development’s Radio Spectrum Management group (RSM). The SD750 series are marked “C-Tick”.

## 2. The Electrical Environment

IEC 61800-3 defines two types of electrical environment. Select the correct installation environment for which you intend to install either the SD750 series based on the following definitions:

- First environment

The First Environment includes domestic premises. It also includes establishments directly connected without an intermediate transformer to a low-voltage power supply network which supplies buildings used for domestic purposes such as shopping malls, cinemas, hospitals...

- Second environment

Second Environment includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes. E.g. factories and those other premises supplied by their own dedicated transformer.

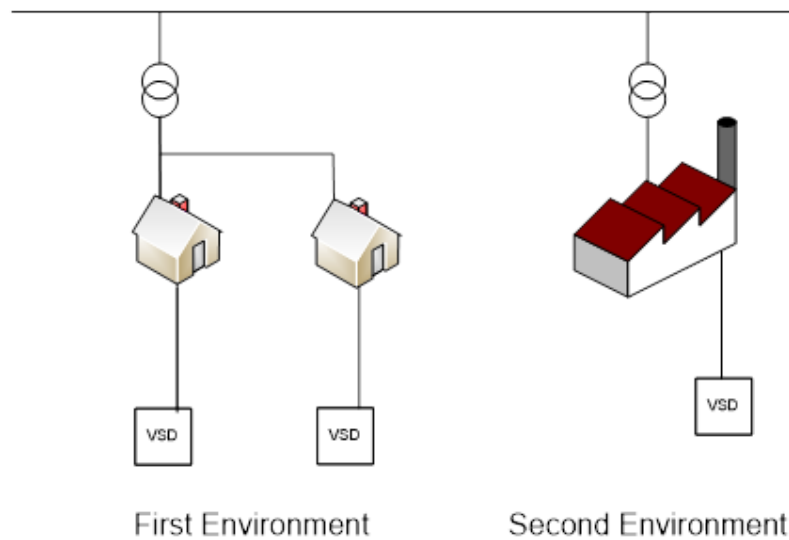


Figure 1 – Environments

### 3. SD750 Series Power Wiring – unscreened cables

#### General Requirements for Second Environment Installations- Industrial

The SD700 series complies with IEC 61800-3 with 300m of unscreened motor cable. The following conditions must be adhered to when installing the SD750 with unscreened motor cables.

- Earth conductor must have a cross sectional area equal to or larger than the phase conductors
- Motor cable conductors must be laid in a trefoil arrangement with the earth conductor tied directly to the side of the phase conductors
- Unscreened motor cable(s) must not exceed 300m in length.
- Control cables must be separated from the motor conductors by a minimum of 1m.

Motor earth must be connected to the drive earth terminal and not the installation's ground. Installation ground must be connected to the SD750 earth terminal. Do not install the motor cables parallel to the main input supply cables.

It is possible to use either single core cables or a composite cable provided the above conditions are adhered to. Flexible copper cables offer superior performance to hard drawn copper conductors or aluminium conductors.

When using parallel single core cables it is important to lay up the cables in two groups of parallel conductors. Please refer to figure 2 below.

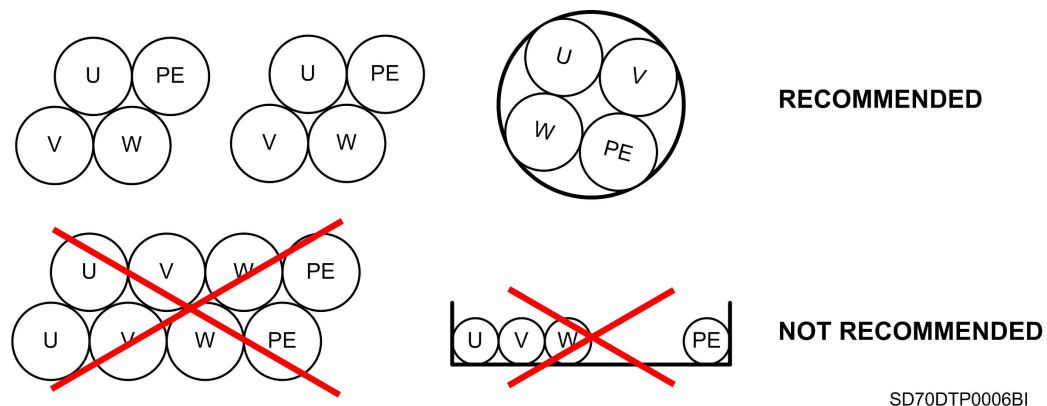


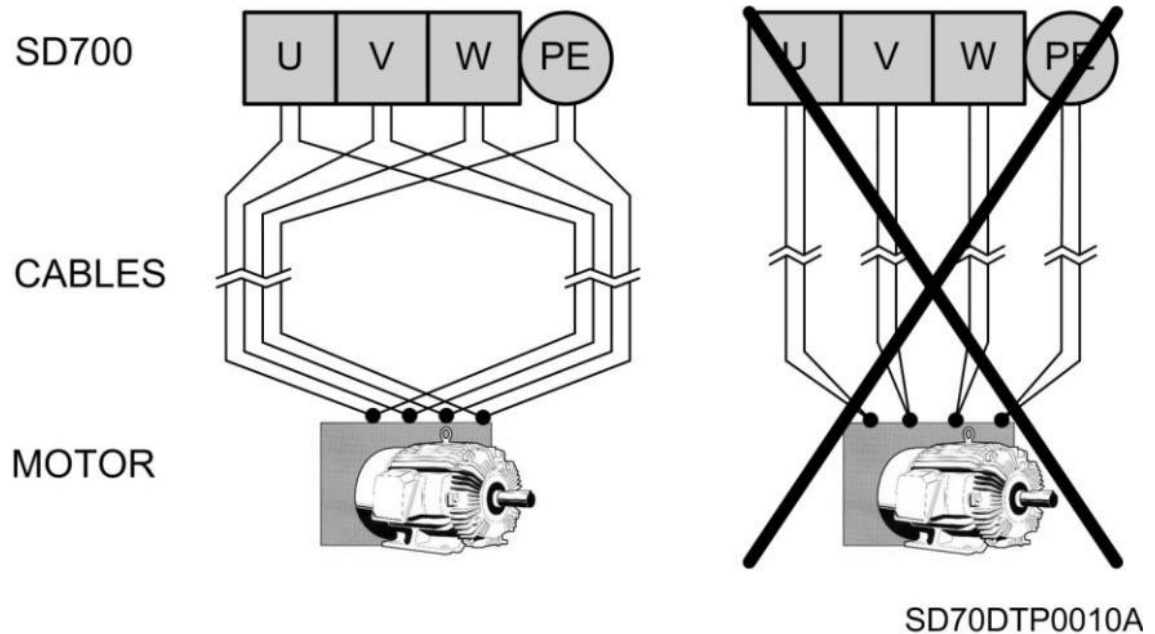
Figure 2 – Typical unscreened cable lay-up.

The entire SD750 range includes  $dV/dt$  filtering fitted as standard. Part of the integrated  $dV/dt$  filter comprises toroids in the output stage. These toroids have been selected to ensure optimum output stage and cable impedance matching. For optimum EMC performance the number of output phase conductors should match the toroids used in the  $dV/dt$  filter as per the following table:

Table 1 – Number of output conductors per phase

SD750 series frame size	No. of toroids per phase	No. of conductors per phase
1	1	1
2	1	1
3	1	1
4	1	1
5	1	1
6	2	2
7	3	3
8	4	4

Figure 3 – Parallel cable termination



The SD750 series is fitted with radio frequency interference (RFI) filters as standard. External supply side RFI filters are not required when the drive is installed in an industrial environment. Shielded mains supply cables are not necessary to meet EMC requirements.

When housing the SD750 within an MCC ensure that the motor earth cable is terminated directly to the SD750 earth terminal and not the MCC main earth bar.

**IMPORTANT NOTE:**

The SD750 is not suitable for installation in the first environment with unscreened motor cables. When installing the SD750 in the first environment please use screened motor cables. Refer to section 4 “General Requirements for First Environment Installation – Domestic”

#### 4. SD750 Series Power Wiring – screened cables

##### General Requirements for Domestic and Industrial Environments

Motor cables must be three core, symmetrical with an overall screen providing greater than 90% coverage. A proper VSD screened cable with three symmetrical earths is preferable. Conduits or metal ducting can be used for part of the shielding length provided that this is continuous. Maximum motor cable length is not to exceed 150m.

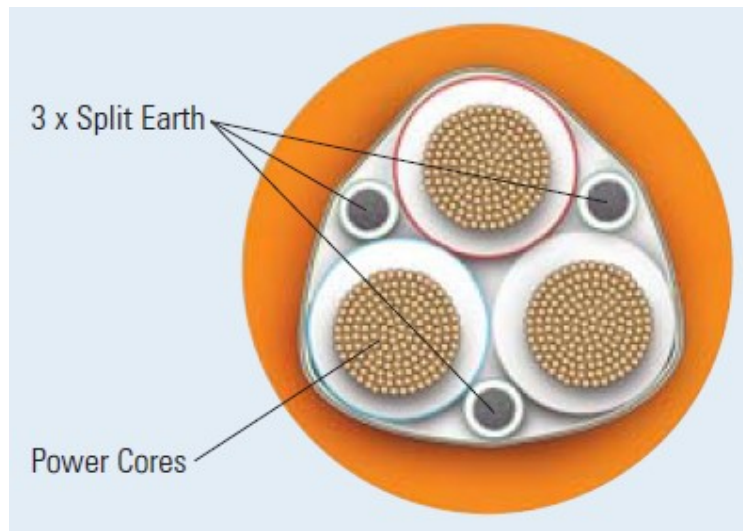


Figure 4 – Flexible rubber braided EMC VSD cable

A screened cable gland suitably designed and sized for the screened cable type used should be fitted at the motor end. **Do not** wind the screen into a “pigtail” and terminate under the earth terminal within the motor terminal box. Terminate the earth conductor(s) to the motor earth terminal(s) located inside the motor terminal box.

When installing the SD700 directly on the wall (no additional enclosure) a screened cable gland suitably designed and sized for the screened cable type used should be fitted at the SD700 gland plate. **Do not** wind the screen into a “pigtail” and terminate under the earth terminal within the SD700 terminal box. Terminate the earth conductor(s) to the SD700 earth terminal(s) located inside the terminal box.

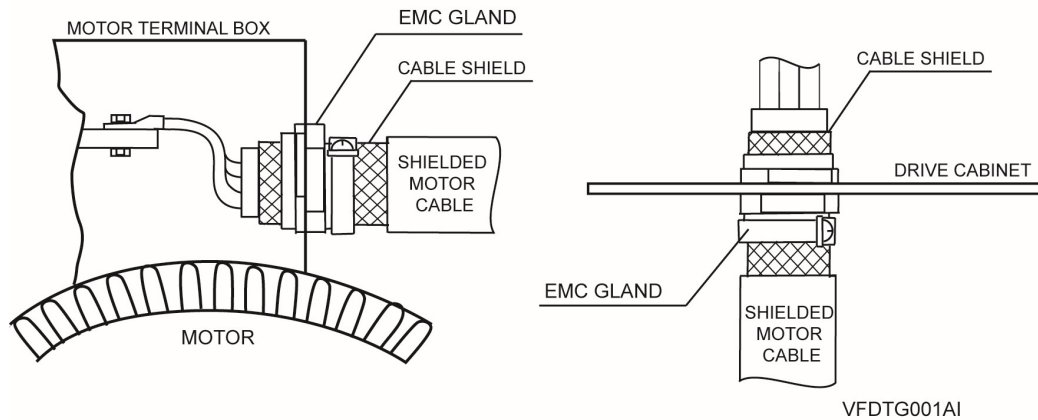


Figure 5 – Correct screened cable termination techniques for motor and SD750 end

When housing the SD750 within an MCC enclosure make sure that the screen of the motor cable is terminated to the SD750 earth terminal and not the MCC main earth bar. When housing the SD750 in its own metal enclosure, the enclosure can be used as part of the overall screen. In this circumstance a screened cable gland suitably designed and sized for the screened cable type used should be fitted to the enclosure. An earth conductor should then be connected from the gland to the main earth terminal on the SD750. NB. If the enclosure is painted, remove paint around the gland to ensure good contact is made between the gland and the metal of the enclosure.

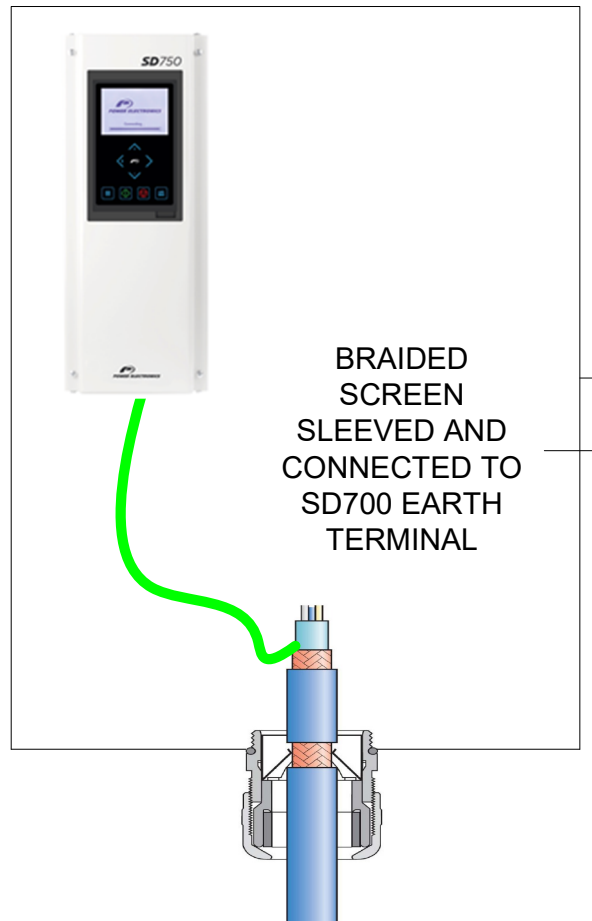


Figure 6 - Showing typical arrangement when SD750 is within MCC or Enclosure.

Note - RFI screen is not usually terminated at the earth terminal of the SD750 when a proper VSD cable gland is used.

Motor earth must be connected to the drive earth terminal and not the installation's ground. It is recommended that the cross section of the earth conductor should be greater than or equal to the phase conductor.

Installation ground must be connected to the SD750 earth terminal.

Do not install the motor cables parallel to the main input supply cables.



#### General Requirements for First Environment Installation – Domestic

When installing the SD750 series into a domestic environment it is necessary to fit an additional RFI filter into the main supply side. This filter should be mounted directly alongside the SD750.

Mount the RFI filter as close as possible to the incoming mains supply of the wiring enclosure, usually directly after the circuit breaker or supply switch.

Care should be taken to remove paint from around the mounting holes and face area of the gear plate to ensure the best possible earthing of the RFI filter.

Connect the mains supply to the filter terminals marked LINE. Connect the earth conductor to the RFI filter earth stud. Connect the filter terminal marked LOAD to the main input of the SD750 using as short a cable length as possible.

Securely connect the RFI filter earth stud to the SD750 earth terminal and the enclosure earth (including the gear plate)

Fit a ferrite core into the SD750 output cable (motor cable). Pass the three phase conductors of the motor cable through the center of the ferrite core twice. Terminate the motor cable as previously described.

NOTE: IT IS IMPORTANT TO KEEP CABLE LENGTHS AS SHORT AS POSSIBLE.

**Never install the RFI filter in the output of the SD750 as this could damage the drive.**

**Do not use an RFI filter when connected to a floating earth installation.**

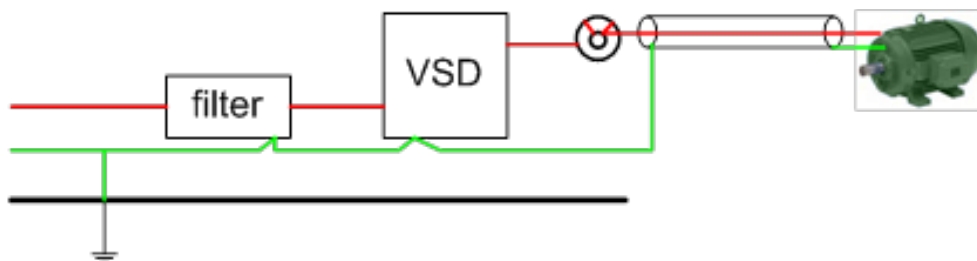


Figure 7– SD750 with external First Environment RFI Filter

## 5. SD750 Control Wiring

Always use screened cables for the control wiring connected to the SD750. Screened cables comprising of twisted pairs is best for noise rejection.

Segregate control wiring from both power supply cables and motor cables. Use separate trunking or cable tray spaced a minimum of 1m apart for unscreened motor cable installations and 300mm for power supply cables and screened motor cable installations.

Where control wiring must cross power cables ensure this is done at 90 degrees to prevent inducing noise or an EMF into the control wires.

Terminate the screen of the control wiring to the ground of the SD750.

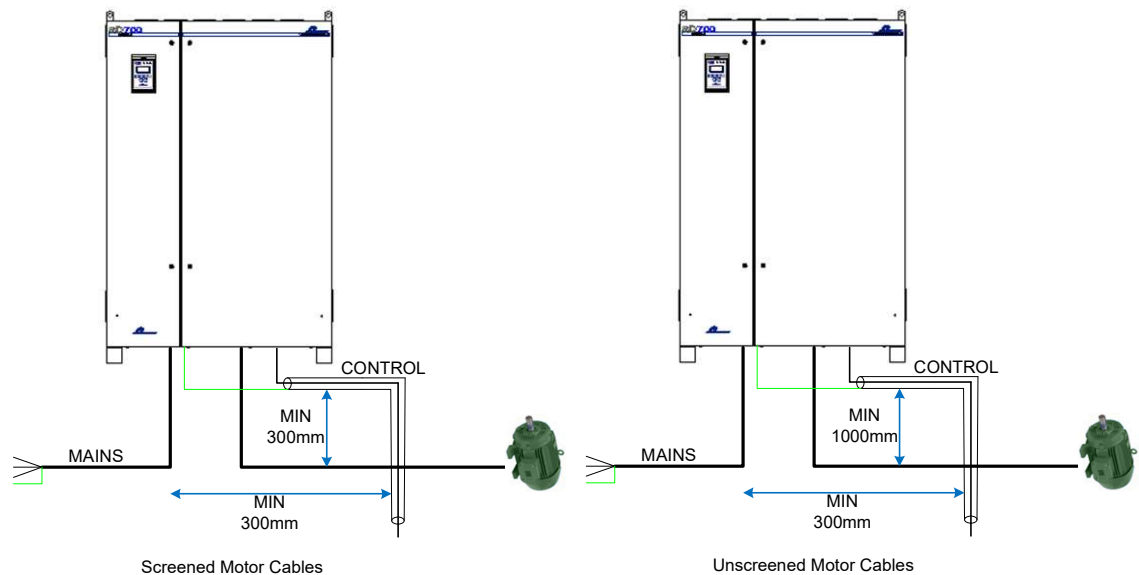


Figure 8 – Control Wiring

## 6. SD750 Submersible Pump Requirements

Submersible pump applications will more than likely require a joint box termination. The connection of the earth and screened cable must be terminated as such as not to interfere with other protective earthing (i.e. ground or external bonding).

In either case the termination joint box needs to have the motor protective earth and screen terminated to an insulated earth stud. This is to ensure the SD750 drive earth is connected to the motor earth only. The joint box can be of fiberglass, polycarbonate or plastic construction. (If the termination box is to be of metal construction, please contact PENZ for further information). Examples shown below for screened and un-screened cables, use with non-metallic termination boxes.

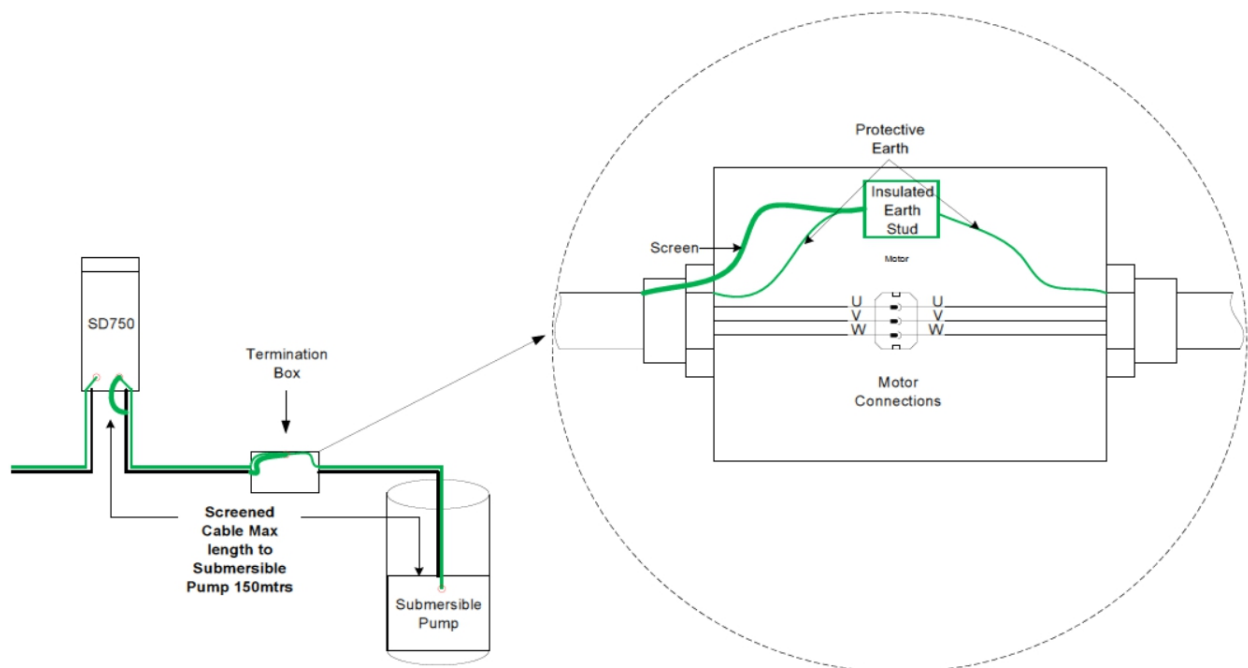


Figure 9- Above Screened Cable Earthing arrangement for SD750 Note-Unscreened cable from Joint box to Motor as supplied.

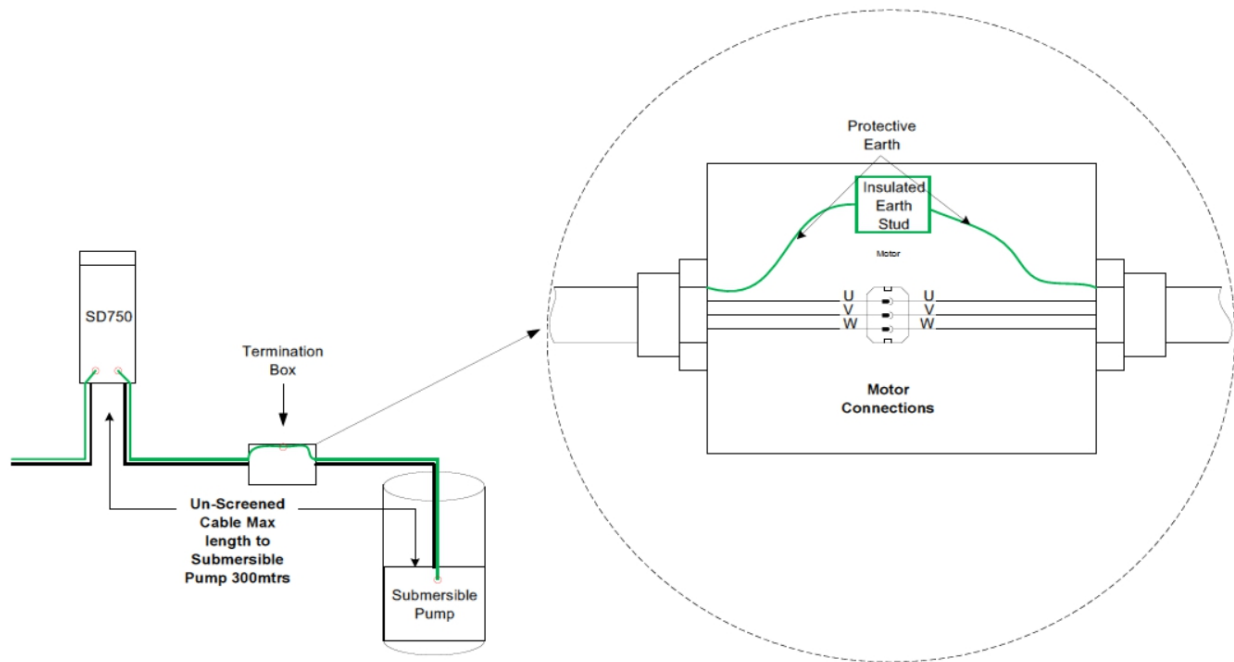


Figure 10- Above Un- Screened Cable Earthing arrangement for SD750