

**INTRODUCTION**  
 This document explains how to install Furse surge protective devices for Wind Turbines:

**ESP 690/12.5/WT, ESP 690/25/WT**

using connecting & earthing bars:  
**ESP CE7, ESP CE9, ESP CE10, ESP CE13**



**1. Safety note:**  
 Warning! Installation by person with electrotechnical expertise only.

Warning! Installation nur durch elektrotechnische Fachkraft.

Avvertenza! Fare installare solo da un elettricista qualificato.

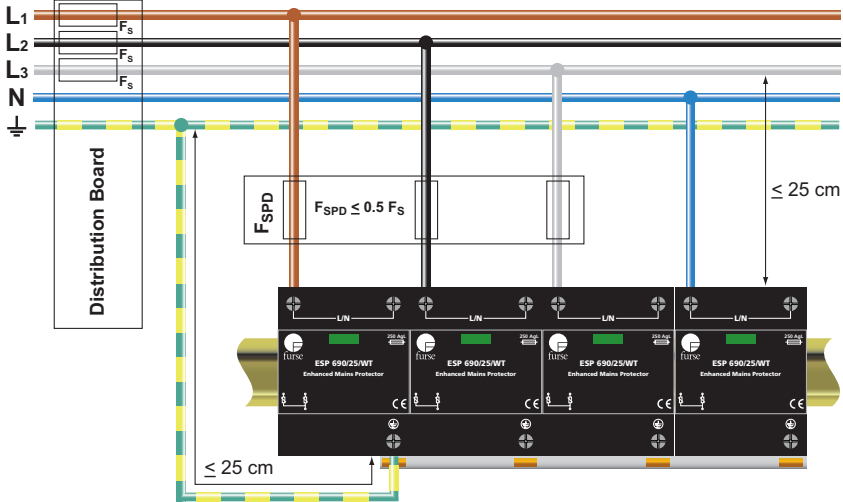
Avertissement! Installation uniquement par des personnes qualifiées en électrotechnique.

Advertencia! La instalación deberá ser realizada únicamente por electricistas especializados.

**2. Application**

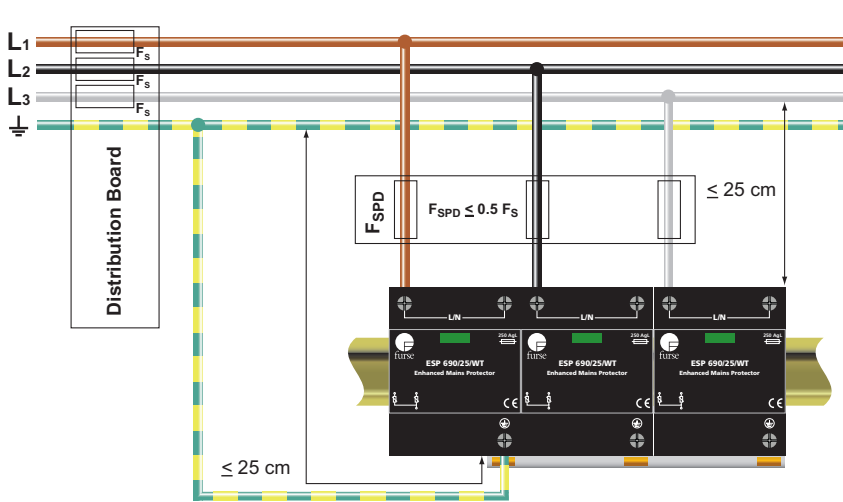
**2.1** Furse ESP WT Combined Type 1 & 2 Series Protectors are suitable for use on wind turbine distribution board(s) to protect the three phase 690 V supply. They are suitable for equipotential bonding to protect wind turbine electronics against damage from flashover as a result of lightning.

Combined Type 1 and Type 2 protection enables the ESP WT Series Protector to meet the requirements for protecting wind turbine electrical and electronic systems systems connected to the 690 V supply in line with DD CLC/TS 50539-22.



Connecting leads should be 16 mm<sup>2</sup> (copper)

**Figure 1:**  
 For TN-S systems, 4 ESP WT Protectors are required (ESP 690/25/WT and ESP CE13 shown here) for connection to all live conductors, neutral & earth.



Connecting leads should be 16 mm<sup>2</sup> (copper)

**Figure 2:**  
 For TN-C systems, 3 ESP WT Protectors are required (ESP 690/25/WT and ESP CE9 shown here) for connection to all live conductors & earth

**Note: Additional ESP mains power Protectors should be installed on all 230/400V supplies within the wind turbine to protect these lines. Furthermore, all data, signal and telecommunications lines at risk from lightning should be protected by a suitable Furse ESP Protector - see Furse Application Note AN015.**

**3. Installation**

**3.1 Location**

ESP WT Protectors need to be installed very close to the power supply to be protected. ESP WT Protectors are installed in a set, dependent on the system configuration (see Figures 1 & 2, and Section 3.4). Installation will usually be at the main power distribution board, either inside it or right next to it in an enclosure. Where the distance between the main distribution board and any subsequent distribution boards is less than 10 m, a single set of ESP WT Protectors installed very close to the 690 V power supply will suffice.

However, where the distance between the main distribution board and subsequent distribution board(s) within the wind turbine exceeds 10 m, then a set of ESP WT Protectors must be installed at each distribution board (for example if the main distribution board is in the wind turbine base, but a further distribution board is installed in the nacelle, over 10 m distant, both locations must be protected).

Installation of ESP WT Protectors should also be considered:

- between the main distribution board and the transformer, where the transformer is external to the wind turbine and the distance between transformer and distribution board exceeds 10 m
- at the 690 V supply line from the generator to any distribution board, where the distance exceeds 10 m

See Furse Application Note AN015 for further information.

The ESP WT Protector includes a DIN foot for mounting onto 35 mm top hat DIN rails.

**3.2 Enclose the ESP Protector**

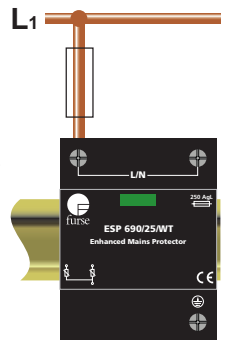
The ESP WT Protector has exposed terminals and therefore, for electrical safety, must be installed within a distribution board or enclosure. Suitable enclosures are available from Furse. Use cable glands to retain the enclosure's IP rating. ESP WT Protectors should always be installed in a dry environment.

**3.3 Parallel connection**

The ESP WT Protector should be connected in parallel with the supply to be protected (see Figures 1 & 2). The connecting leads do not carry the load current of the supply, only the current associated with suppressing the transient overvoltage. Connecting leads to the ESP WT Protector need to be kept short in order to minimise additive inductive voltages.

**3.4 Connection to phase, neutral and earth**

Connections are made to each supply conductor including earth.



**Figure 3:**  
 Only one connection for EITHER live (L) OR neutral (N) should be used on each ESP WT Protector. DO NOT connect L and N to a single protector.

**Note: A separate ESP WT Protector should be installed for each line (see Figures 1 & 2).**

Connection can be made to either of the top two terminals (marked L/N) of the ESP WT Protector, for EITHER live (L) OR neutral (N) connection as appropriate. However, there must only be one connection per ESP WT Protector - DO NOT connect to both terminals on a single protector (see Figure 3).

Maximum torque is 4.5 Nm power terminals, with cable stripping length 11 mm. The torque rating for the volt-free contacts is 0.25 Nm and cable stripping length 7 mm.

**Note: Hand tighten connections only. Do NOT use power driven screwdrivers to make connections to the ESP Protector.**

### TN-S systems

Terminals must be connected to phase/live, neutral & earth. Install a separate ESP WT Protector for each phase/live connection and neutral (see Figure 1).

Earth separate ESP WT Protectors using an appropriate Furse Connecting & Earthing (CE) Bar, with the final connection to earth from a single ESP WT Protector.

	No. of ESP Protectors	Connecting & Earthing Bar
ESP 690/12.5/WT	4	ESP CE10
ESP 690/25/WT	4	ESP CE13

Alternatively, where a Furse Connecting & Earthing bar is unavailable, all ESP WT Protectors should be earthed from their earth terminal sited at the base of each ESP WT Protector to the local earth bar.

### TN-C systems

Terminals must be connected to phase/live & earth. Install a separate ESP WT Protector for each phase/live connection (see Figure 2).

Earth separate ESP WT Protectors using an appropriate Furse Connecting & Earthing (CE) Bar, with the final connection to earth from a single ESP WT Protector.

	No. of ESP Protectors	Connecting & Earthing Bar
ESP 690/12.5/WT	3	ESP CE7
ESP 690/25/WT	3	ESP CE9

Alternatively, where a Furse Connecting & Earthing bar is unavailable, all ESP WT Protectors should be earthed from their earth terminal sited at the base of each ESP WT Protector to the local earth bar.

### 3.5 Isolation

It is good practice to be able to isolate or disconnect the ESP WT Protector from the supply. A means of isolation should therefore be installed in the connection to the ESP WT Protector.

Fusing the connection to the ESP WT Protector can be achieved through use of a switchfuse, MCCB or type 'C' MCB.

### 3.6 Fuse connecting leads

The connecting leads to the phase/live terminals of the ESP WT Protector should be fused.

This is to protect the connecting leads in the event of a short circuit.

The fuse to the ESP WT Protector (FSPD) should be lower than the upstream supply fuse FS by a sufficient enough factor to ensure fuse discrimination.

As a general guide a factor of at least 2 could be used ( $FSPD \leq 0.5 FS$ ), where the maximum fuse required to the ESP WT Protector is 250 Amps (if the supply fuse is 500 Amps or greater).

Refer to the fuse manufacturer's operating characteristics to ensure discrimination, particularly where an installation includes a mixture of types of fuse, or of fuses and circuit breakers.

Live/phase connecting leads can be fused by either:

- installing appropriate high rupture capacity (HRC) fuses or switchfuses in the connecting leads at the supply end of the lead, or
- installing an appropriate MCCB

### 3.7 Size of connecting leads

The connecting leads between the terminals of the ESP WT Protector and the power supply, should be multi stranded conductor no less than 16 mm<sup>2</sup> (copper).

**Note: The size of the connecting leads to the ESP WT Protector(s) must not be less than the size of leads of the associated system.**

If required, the terminals on the ESP WT Protector will accept connecting leads of up to 25 mm<sup>2</sup>.

### 3.8 Length of connecting leads

The connecting leads should be kept as short as possible and ideally should not exceed 25 cm (10 inches) from the busbars to the ESP WT Protector's terminals.

**ESP WT Protectors can be mounted upside down or on their side if this facilitates shorter connecting leads.**

**WARNING:** The longer the connecting leads (between the mains cable or busbars and the terminals of the ESP WT Protector) the greater the additive voltage let-through by the installed protector. If the resultant let-through voltage is higher than the withstand voltage of the equipment to be protected, damage will result.

### 3.9 Bind connecting leads

Connecting leads should be tightly bound together using Ty-Raps®, tape or spiral wrap. This should be done for the entire length of the cable or as far as is possible.

### 4. Protector operation/status indication

**4.1** The ESP WT Protector includes an internal thermal supervision device which continually monitors its operation. Status is displayed via the front facing window.

During normal operation the status display is clear.

Should a fault occur, the supervision device disconnects the ESP WT Protector from the mains supply and displays a red indicator in the status window.

**Note: After the supervision device has disconnected surge protection, the ESP WT Protector should be replaced to prevent the risk of flashover causing dangerous sparking and equipment damage.**

### 5. Remote indication

**5.1** A remote indication facility is provided for linking the ESP WT Protector to a management system/remote alarm. A volt free contact on the ESP WT Protector allows a remote alarm to be tripped if a fault develops within the protector. When a fault occurs terminals 11-14 (14 is NC) break contact and terminals 11-12 (12 is NO) make contact.

**Note: Unless further specific surge protection is in place the signalling wires for remote alarm contact should only be routed inside the wind turbine, otherwise the overall surge protection may be affected.**

**5.2** The terminal for the volt free contact accepts 1.5 mm<sup>2</sup> cable and is located on the bottom of the ESP WT Protector.

The ESP WT Protector's remote indication is rated at 0.5 Amp, 250 V AC.

### 6. Maintenance

**6.1** Maintenance should be conducted at least once a year and also following lightning activity. Visually check:

- Status indication window (clear = ok, red = fault/disconnected)
- Condition of connecting leads and terminations

### 7. Application notes

#### 7.1 ESP coordination

ESP WT Series Protectors are designed to operate on 690 V wind turbine power systems. Additional Type 1 and Type 2 ESP Protectors should be installed to provide protection on the 230/400 V AC supply. ESP WT Series Protectors fully coordinate with ESP Type 1 units (such as ESP 415/XXX) on the same installation.

Always ensure ESP Protectors are used on the same installation to ensure coordination. Mixing ESP Protectors with alternative manufacturers' units could result in damage to both protection units and connected equipment through poor coordination.

**Note: For full system protection, data, signal and telecommunications lines within the wind turbine should also be protected against lightning risk. Refer to Furse Application Note AN015 for further information regarding installation of Furse ESP Protectors within wind turbines.**

#### 7.2 Insulation tests (flash testing)

The ESP WT Protector should be fully disconnected from the circuit before testing. Otherwise the ESP WT Protector will treat the insulation test as a transient overvoltage and control the voltage to a low level - thereby defeating the object of the test.

#### 7.3 Use of powered screwdrivers

The use of powered screwdrivers is not recommended. Hand tighten connections. Maximum torque is 4.5 Nm for power terminals, with cable stripping length 11 mm. The torque rating for the remote contacts is 0.25 Nm and cable stripping length 7 mm.

**Environment**  
Consider the protection of the environment! Used electrical and electronic equipment must NOT be disposed of with domestic waste. The device contains valuable raw materials which can be recycled. Therefore, contact ABB for disposal of this equipment.



ESP WT Series  
For wind turbine surge  
protective devices  
INSTALLATION INSTRUCTIONS



### Contact us

**ABB Furse  
UK Office**  
Wilford Road  
Nottingham NG2 1EB  
Tel: +44 (0) 115 964 3700  
Fax: +44 (0) 115 986 0071  
National Sales Tel: +44 (0) 333 999 9900  
National Sales Fax: +44 (0) 333 999 9901  
E-Mail: enquiry@furse.com

[www.furse.com](http://www.furse.com)