Cable Short Circuit Ratings

Short circuit ratings are published for both the conductor and the screen/armour wire, depending on the cable construction. The conductor fault level is known as the symmetrical or three-phase rating. The screen/armour fault level is known as the asymmetrical or single-phase (phase to earth) rating.

The short circuit ratings that the Prysmian Group publish are calculated using the published methods outlined in **IEC 60949**. This is the international standard for such calculations.

The values we publish are **adiabatic**. This means no account is made for any heat transfer to any surrounding materials (insulation and sheath). If this heat transfer is accounted for, then the term is known as non-adiabatic and is a higher value than the adiabatic value for the same cross sectional area. A non-adiabatic value is not permissible for a conductor, but can be calculated for the screen or armour layer, improving the fault rating of the screen/armour component of the cable.

For the conductor fault calculation, Prysmian Group uses a 90-250°C temperature rise for our thermosetting insulated cables - 250°C is the limiting temperature of the XLPE/EPR insulation in a fault. For cables with a thermoplastic insulation (e.g. PVC), a 70-160°C temperature rise is used - 160°C is the limiting temperature for PVC insulation in a fault. These temperature rises assume that the conductor is running at its maximum operating temperature at the time of the fault. In theory the value quoted will be conservative, as any fault is unlikely to occur when the cable is at its full load/temperature. A lower conductor temperature will therefore result in a higher calculated fault level capacity.

For the screen/armour fault calculation, the cable is again assumed to be at its maximum operating temperature - for armoured or screened cables, this will be normally be 90°C. The temperature at the screen/armour will be approximately 10°C lower when the conductor is at its full load. The final temperature in the calculation is limited by the sheathing material. PVC and LSOH sheaths are limited to a final temperature of 200°C, whilst MDPE sheaths have been demonstrated to operate to a final temperature of 250°C without causing damage to the MDPE sheath. Prysmian Group therefore uses an 80-200°C temperature rise for PVC/LSOH sheathed cables and an 80-250°C temperature rise for MDPE sheathed cables when calculating the fault ratings of screens or armours.

We quote a 1 second value to enable designers to calculate other durations up to a **limit of 5 seconds**. These alternative fault values can be calculated by dividing the 1 second fault rating by square root of the time required in seconds. This calculation is valid for times between 0.2s and 5s. For example the 3 second value of the screen would be:

6.2/SQRT(3) = 3.5kA

Where 6.2 = the 1 second fault value and 3 = the time in seconds

Fault Sharing between Two Metallic layers (Cu Tape Screen & Armour)

For our medium Voltage armoured cable range (BS6622 & BS7835 cable types), Prysmian Group only quote the fault rating of the armour layer. This is because it is not normally necessary for the screen tape itself to be rated highly as the majority of any earth fault current will in practice be taken by the armour wires. The armour wires and the copper tape screens should be bonded together at every joint/termination position so that external fault currents will be taken preferentially by the parallel armour path. In the case of an internal cable earth-fault the breakdown arc will connect through to the armour which will again preferentially take the current.

In the event of a breakdown of the XLPE insulation the conducting arc produced would vaporise the cable armour bedding at the fault position and bring the armour wires into circuit as a parallel path. The fault current will preferentially flow in the armour wire as the resistance of the copper tape will be very much higher than that of the armour wire.

Over the past 30 years of manufacturing these types of cables i.e. MV copper tape screened & armoured, we have not come across a situation where the copper tape screen has been thermally damaged throughout the length of the cable due to an earth fault.

The purpose of the copper tape screen itself is only to manage the electric field (keep it radial) and provide a conducting path for the charging current. It will not carry any significant fault current.

Copper Wire Screen MV Cables for the DNOs

Utility companies tend not to use armoured cables, rather copper wire screened cables manufactured in accordance with **BS7870-4.10**. Each DNO/Utility will have a defined fault level on their network and will specify the fault level that the wire screen must meet. Typically their specification requirements are defined by the size of the cooper wire screen, rather than the actual fault level.

Cables to the aforementioned standard are typically manufactured to a defined range of copper wire screen sizes e.g. 35mm², 35mm², 50mm², 70mm² or 95mm², with 35mm² and 50mm² being the most commonly specified screen sizes. The table below provides the one second, adiabatic rating, assuming an MDPE sheath with a final sheath temperature of 250°C.

Screen Size	Fault ratings (kA)
25	3.8
35	4.9
50	7.1
70	9.7
95	13.3

To note, some of the DNOs require LSOH derivatives and for these, a lower fault level is defined due to the lower 200°C final temperature of this material.