

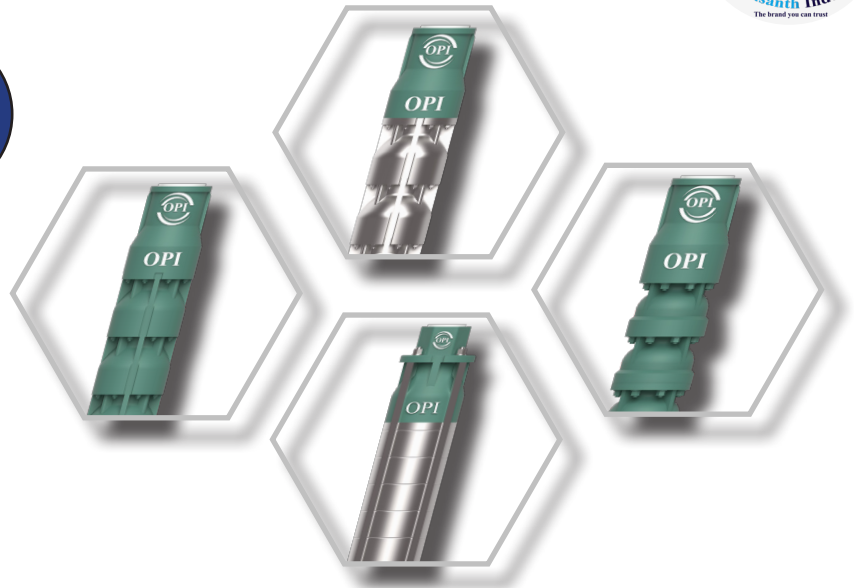
## SUBMERSIBLE V6

TOOLS  
REQUIRED

PRE  
INSTALL

CABLE  
JOINT

ERECTION  
PROCESS



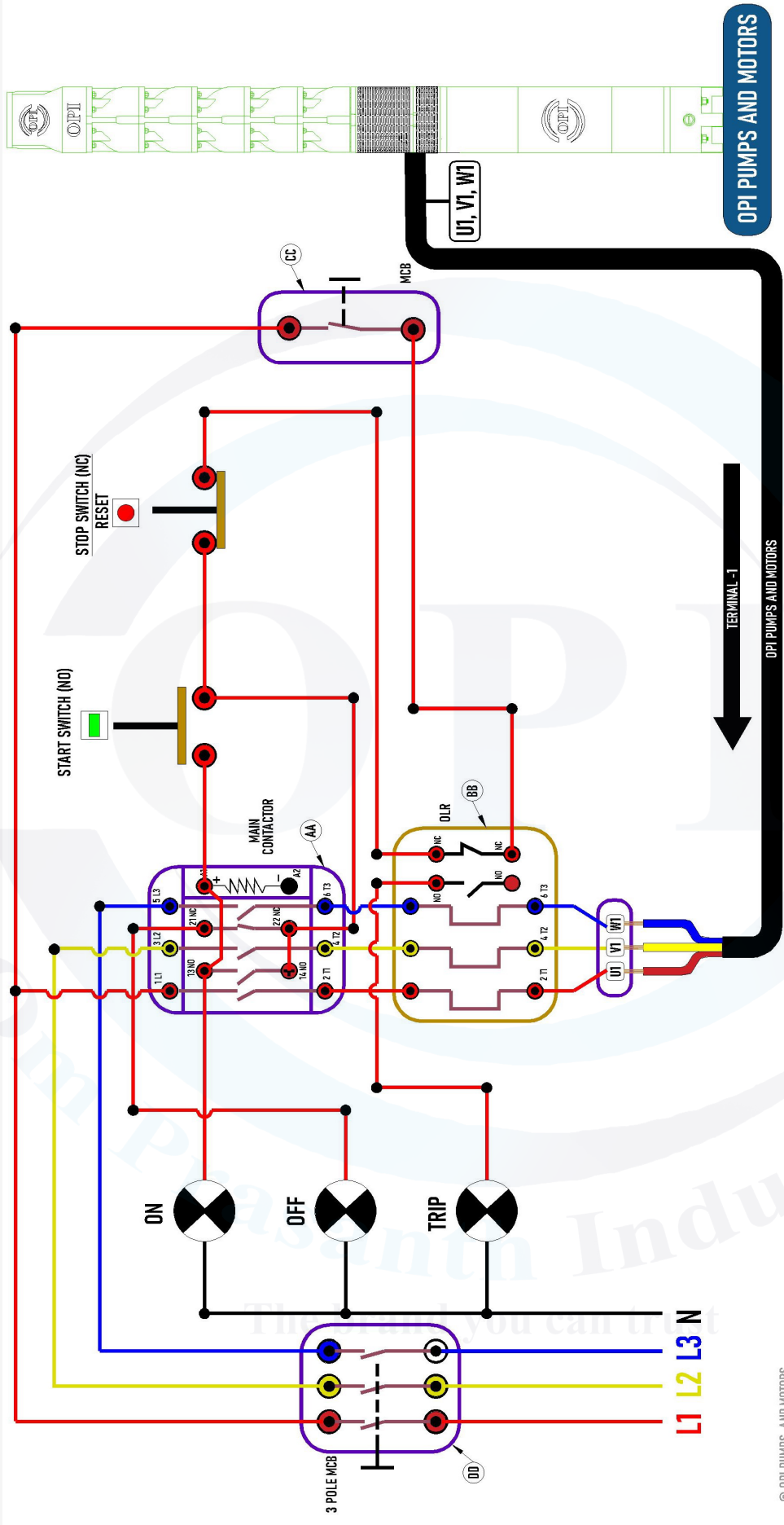
## OPI INSTALLATION GUIDE

HOW TO INSTALL  
V6 SUBMERSIBLE PUMP

OPI V6 INSTALLATION  
MANUAL

# 6" BOREWELL SUBMERSIBLE PUMPSET -OPI V6

## 26. CIRCUIT DIAGRAM FOR DIRECT ON LINE STARTER



| DOL STARTER |          |
|-------------|----------|
| CABLE       | TERMINAL |
| RED         | U1       |
| YELLOW      | V1       |
| BLUE        | W1       |

| PART NO | PART NAME      |
|---------|----------------|
| AA      | MAIN CONTACTOR |
| BB      | OVERLOAD RELAY |
| CC      | MCB            |
| DD      | 3 POLE MCB     |

## 27. PROCEDURE FOR DIRECT ON LINE STARTER (DOL) CONNECTION :

### 1. Overview of Components :

- **3 Pole MCB (Miniature Circuit Breaker):** Protects the circuit from overload or short circuit.
- **Main Contactor (AA):** Electrically operates to switch the motor ON or OFF.
- **Overload Relay (OLR - BB):** Protects the motor from thermal overload.
- **Push Buttons:**
  - Start Switch (NO): Normally Open button for starting the motor.
  - Stop Switch (NC): Normally Closed button for stopping the motor.
- **Indicators:**
  - ON, OFF, and TRIP: Indicate the motor's operational status.
- **Connections to Motor Terminals:** U1, V1, W1.

### 2. Wiring Procedure

1. **Input Power:**
  - Connect L1, L2, L3 (three-phase supply) to the input terminals of the 3-pole MCB.
  - Connect the neutral (N) to the circuit if needed.
2. **MCB to Contactor:**
  - Output of MCB (L1, L2, L3) is connected to the main contactor input terminals (1L1, 3L2, 5L3).
3. **Contactor to Overload Relay (OLR):**
  - Connect the output terminals of the contactor (2T1, 4T2, 6T3) to the input terminals of the OLR.
4. **Overload Relay (OLR) to Motor:**
  - Connect the output terminals of the OLR to the motor's terminals (U1, V1, W1).
5. **Control Circuit:**
  - Start Button (NO): Wire one terminal to L1 and the other to the contactor coil terminal (A1).
  - Stop Button (NC): Place in series with the start button and wire to the coil terminal (A1).
6. **Overload Relay Protection:**
  - Wire the NC contact of the OLR in series with the control circuit (between the stop button and the contactor coil terminal A1).
7. **Indicator Lights:**
  - ON Indicator: Connected parallel to the main contactor coil.

- OFF Indicator: Connected through the NC stop button.
- TRIP Indicator: Connected through the overload relay trip contacts.

### **Auxiliary Contacts:**

- Connect auxiliary NO and NC contacts (13-14, 21-22) for interlocking as shown in the diagram.
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## **3. Operating Procedure**

### **1. Initial Setup:**

- Ensure the MCB is turned ON.
- Verify the wiring and connections for safety and correctness.

### **2. Starting the Motor:**

- Press the Start Button (NO) to energize the main contactor coil.
- The motor will start running through the OLR, and the ON indicator will glow.

### **3. Stopping the Motor:**

- Press the Stop Button (NC) to de-energize the main contactor coil.
- The motor will stop, and the OFF indicator will glow.

### **4. Trip Condition:**

- If the motor overloads, the OLR will trip, interrupting the circuit.
- The TRIP indicator will glow, and the motor will stop.

### **5. Resetting the Trip:**

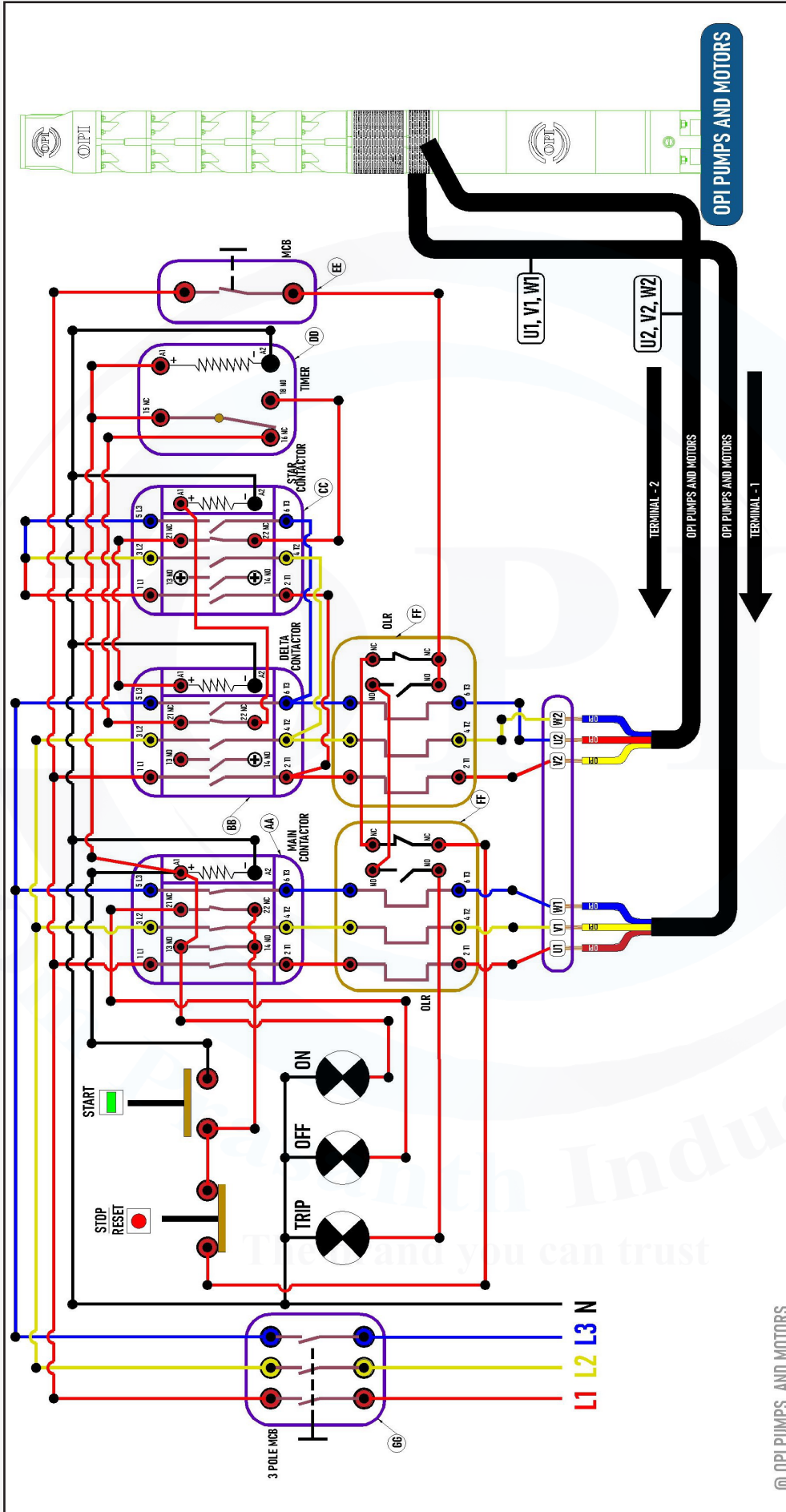
- Manually reset the OLR by pressing its reset button.
- 

## **4. Safety Tips**

- Always disconnect the power supply before making wiring changes.
- Set the OLR according to the motor's full load current.
- Ensure all terminals are secure and insulated.

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## 28. CIRCUIT DIAGRAM FOR STAR DELTA STARTER



| PART NO | PART NAME       |
|---------|-----------------|
| AA      | MAIN CONTACTOR  |
| BB      | DELTA CONTACTOR |
| CC      | STAR CONTACTOR  |
| DD      | TIMER           |

| PART NO | PART NAME             |
|---------|-----------------------|
| EE      | MCB                   |
| FF      | OVER LOAD RELAY (OLR) |
| GG      | 3 POLE MCB            |

| STAR DELTA STARTER |            |         |            |
|--------------------|------------|---------|------------|
| CABLE 1            | TERMINAL 1 | CABLE 2 | TERMINAL 2 |
| RED                | U1         | RED     | U2         |
| YELLOW             | V1         | YELLOW  | V2         |
| BLUE               | W1         | BLUE    | W2         |

## ■ 29. PROCEDURE FOR STAR DELTA COONNECTION :

### 1. Components and Connections

#### Power Circuit

##### 1. Input Power:

- Connect the three-phase power supply lines (L1, L2, L3) to the input terminals of the 3-Pole MCB (GG).
- The MCB output is connected to the input terminals of the Main Contactor (AA) at terminals 1L1, 3L2, and 5L3.

##### 2. Main Contactor to Motor Connections:

- The output terminals of the Main Contactor (2T1, 4T2, 6T3) are connected to:
  - The input terminals of the Star Contactor (CC).
  - The input terminals of the Delta Contactor (EE).

##### 3. Motor Windings:

- Motor winding terminals U1, V1, W1 are connected to the output of the Delta Contactor.
- Motor winding terminals U2, V2, W2 are connected to the output of the Star Contactor, forming a neutral connection during the Star mode.

##### 4. Overload Relay (OLR - FF):

- The output of the Delta Contactor (2T1, 4T2, 6T3) is passed through the OLR before connecting to the motor terminals U1, V1, W1.
- The OLR ensures motor protection during both Star and Delta modes.

#### Control Circuit

##### 1. Start Button (NO) and Stop Button (NC):

- The Start Button energizes the Main Contactor and begins the timer operation.
- The Stop Button disconnects the control circuit to stop the motor.

##### 2. Timer (DD):

- Connect the timer in the control circuit to manage the transition from Star to Delta.
- Timer output:
  - Initially energizes the Star Contactor (CC).
  - After the preset time, de-energizes the Star Contactor and energizes the Delta Contactor (EE).

##### 3. Interlocking Circuit:

- Auxiliary NO and NC contacts of Star and Delta Contactors are used for electrical interlocking:
  - The Delta Contactor is prevented from energizing while the Star Contactor is active, and vice versa.

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## 1. Indicator Lights:

- **ON Indicator:** Connected parallel to the Main Contactor coil.
- **OFF Indicator:** Connected via the Stop Button (NC).
- **TRIP Indicator:** Wired to the NC trip contact of the Overload Relay.

## 2. Sequence of Operation

### 1. Starting the Motor:

- Press the Start Button to energize the Main Contactor and the Star Contactor.
- The motor starts in Star Mode with reduced voltage to the windings.

### 2. Transition to Delta Mode:

- The timer de-energizes the Star Contactor after its preset time and energizes the Delta Contactor.
- The motor runs at full voltage in Delta Mode.

### 3. Stopping the Motor:

- Press the Stop Button to de-energize all contactors and stop the motor.

### 4. Overload Protection:

- The OLR trips the circuit in case of an overload, stopping the motor and activating the TRIP indicator.

## Key Connection Points to Verify

1. Ensure the neutral point in the Star Contactor connection is properly wired by connecting U2, V2, and W2 together during Star mode.
2. Verify the interlocking auxiliary contacts are properly connected to prevent simultaneous energizing of Star and Delta Contactors.
3. Check the timer wiring to ensure it correctly switches between Star and Delta modes.
4. Confirm that the Overload Relay (OLR) is installed between the Delta Contactor and the motor, covering both modes.

## 3. Safety Checks

- Ensure the OLR setting matches the motor's full-load current.
- Double-check all wiring connections for tightness and insulation.
- Verify the timer settings for an appropriate transition time.
- Test the control circuit with a low-voltage simulation before connecting to full power.

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## 30. CABLE SELECTION CHART :

Select the appropriate cables for connecting the strater to submersible motor (415 V, 50 Hz, AC )

| Motor Rating |      | Cable size in Sq.mm               |     |     |     |     |     |     |     |     |
|--------------|------|-----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|
|              |      | 1.5                               | 2.5 | 4   | 6   | 10  | 16  | 25  | 35  | 50  |
| KW           | H P  | Maximum Length of Cable in Metres |     |     |     |     |     |     |     |     |
| 1            | 0.75 | 262                               | 437 | 705 |     |     |     |     |     |     |
| 1.5          | 1.1  | 222                               | 370 | 596 | 895 |     |     |     |     |     |
| 2            | 1.5  | 160                               | 267 | 430 | 646 |     |     |     |     |     |
| 3            | 2.2  | 111                               | 185 | 298 | 447 | 773 |     |     |     |     |
| 4            | 3    | 84                                | 141 | 228 | 342 | 590 | 933 |     |     |     |
| 5            | 3.7  | 72                                | 120 | 193 | 290 | 502 | 793 |     |     |     |
| 6            | 4.5  | 60                                | 100 | 161 | 242 | 426 | 661 |     |     |     |
| 7.5 DOL      | 5.5  |                                   | 82  | 133 | 200 | 346 | 547 |     |     |     |
| 7.5 SD       | 5.5  | 86                                | 143 | 231 | 347 | 600 | 947 |     |     |     |
| 9            | 6.7  | 89                                | 115 | 186 | 279 | 483 | 763 |     |     |     |
| 10           | 7.5  | 69                                | 106 | 172 | 258 | 446 | 704 |     |     |     |
| 12.5         | 9.3  | 64                                | 83  | 134 | 201 | 348 | 549 | 852 |     |     |
| 15           | 11   |                                   | 71  | 155 | 173 | 300 | 473 | 735 |     |     |
| 17.5         | 13   |                                   |     | 98  | 148 | 256 | 404 | 626 | 822 |     |
| 20           | 15   |                                   |     | 87  | 129 | 223 | 352 | 546 | 769 |     |
| 25           | 18.5 |                                   |     | 78  | 117 | 202 | 319 | 495 | 697 |     |
| 30           | 22.5 |                                   |     |     | 96  | 167 | 264 | 409 | 577 | 828 |
| 35           | 26   |                                   |     |     |     | 145 | 229 | 355 | 500 | 717 |
| 40           | 30   |                                   |     |     |     | 133 | 211 | 327 | 461 | 662 |

### 1. Voltage and Current Basis

The table provides the maximum allowable length of submersible cables for the specified full load current at a nominal voltage of 415 V.

Symbol:  $V = 415 \text{ V}$

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### 2. Adjustments for Different Voltages

For systems operating at voltages other than 415 V, the cable size and length must be adjusted using the formula:

$$\text{Calculated Length} = \left[ \frac{V_{\text{nominal}}}{V_{\text{actual}}} \right] \times \text{Actual Length}$$

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## 3. Special Consideration for SD Motors (7.5 H.P and Above)

- For motors with 7.5 HP and above (SD motors), the actual current is assumed to be  $1 / \sqrt{3}$  of the full load current.
- Cable size and maximum allowable length are calculated accordingly.

$$I_{\text{actual}} = (1 / \sqrt{3}) \times I_{\text{FL}}$$

## 4. Derating Factors

- The cable length values in the table consider typical derating factor such as :
  - Ambient Temperature
  - Voltage drop limits (typically set to 3%)
  - Real- World resistance variations.

Symbol :  $K_{\text{derating}}$

## 5. Permissible Voltage Drop

- The maximum allowable length is based on voltage drop not exceeding 3% of 415 V (approximately 12.45 V)
- For applications requiring stricter limits (eg: 2% voltage drop), length should be recalculated accordingly

Symbol :  $V_d \leq 3\% \times V_{\text{nominal}}$

## 6. Copper Cables:

- The resistance values used in calculations assume annealed copper conductors with standard resistivity values (e.g..  $0.0172 \Omega/\text{mm}^2/\text{km}$ )

Symbol :  $R_{\text{Copper}}$

## 7. Safety Margins:

- The lengths in the table are conservative, ensuring compliance with safety standards and accounting for installation variations (e.g.. cable bundling or aging).

Symbol :  $S_{\text{safety margin}}$

## Disclaimer:

- The above shown selection chart is for general applications. For specific condition we recommend you to consult us or manufacturer for proper selection.
- The information provided in this document is for general informational purpose only and may not be accurate, complete or up -to-date. we make no representations or warranties of any kind, express or implied, about the accuracy, reliability or completeness of the information.
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