Safety Compliance Guide
(IEC 62368-1)

IMPORTANT:
The power supply modules described in this document are Component Power Supplies designed for integration into end-user equipment. They are not intended for operation as standalone devices. This document provides critical data for classification according to IEC/EN/UL 62368-1 (Hazard-Based Safety Engineering), including Energy Source (ES), Power Source (PS), and Thermal Source (TS) classifications, as well as isolation ratings and conditions of acceptability.

1. GENERAL REQUIREMENTS & COMPLIANCE PRINCIPLE

For the end-product to meet safety standards, the following conditions must be satisfied:

Protective Earthing: The module is Class I equipment. The metal case/baseplate must be reliably connected to the system Protective Earth (PE).

Fire Enclosure: The module must be installed within a Fire Enclosure (V-1 or V-0 rated material) to prevent fire propagation. For low-power modules (< 100 W), a fire enclosure is recommended.

Wiring Sizing: All external input and output wiring must be sized appropriately for the maximum operating currents to prevent dangerous overheating of the conductors and potential fire hazards.

Cooling: The integrator must ensure the module case temperature does not exceed maximum case temperature.

Soldering: Ensure proper soldering temperature profiles to prevent damage to pin seals.

2. AC/DC POWER SUPPLIES

This section applies to single-phase and three-phase AC/DC converter series.

2.1. Energy Source Classifications (HBSE)

The AC/DC power supply interfaces are classified as follows under normal and single-fault conditions:

- Input Interface classified as **ES3 (Hazardous Voltage)**. Access to the AC mains input must be prevented by a solid enclosure or insulation.
- Output Interface classified as **ES1 (Safe Energy Source).**
  - **Condition:** Nominal output voltage is ≤60 VDC.
  - **Safeguard:** Safe to touch. No additional protection against electric shock is required for the output terminals.
  - **Exception for JETA-H / JETNA-H:** Output Interface is classified as **ES3 (Hazardous Voltage)** up to 400 VDC. Accessibility must be prevented, and output wiring must meet the same insulation/enclosure standards as the AC input. If mechanical or time-delay interlocks are not used, an instructional safeguard (such as a warning label stating **"CAUTION: Hazardous voltage. Wait before servicing"**) may be required on the end-product.
- Power Source (PS) Classification: **PS3 (Potential Ignition Source).**
  - **Reasoning:** The maximum available power exceeds 100 W (or can exceed it under fault conditions).
  - **Safeguard:** The module must be installed within a Fire Enclosure (V-1 or V-0 rated material, or metal) to prevent fire propagation.

- Thermal Source (TS) Classification: **TS3.**
  - **Reasoning:** The case temperature (T_{case}) can exceed +90°C at full load.
  - **Safeguard:** If the module case is accessible to a user or service person, an Instructional Safeguard (Warning Label) is required.

2.2. Isolation & Insulation Ratings

The modules utilize a galvanic isolation barrier designed for **Overvoltage Category II** (OVC II) and Pollution Degree 2 environments:

- **Input to Output:** 3000 VAC (Electric Strength). Since the isolation is Reinforced, the output circuits are considered separated from the mains. The output can be accessible to the user without requiring further isolation in the end-product.
- **Input to Case:** 1500 VAC (Electric Strength). Since this is Basic Insulation the metal case **MUST be connected to Protective Earth** to provide the second layer of protection against electric shock.
- **Case to Output:** 500 VAC (Electric Strength). Meets **Functional Insulation**. This isolation is for noise immunity and operation only.

2.3. Fuses & Overcurrent Protection

The module contains an input internal fuse. However, to protect the external cabling, prevent upstream circuit breaker trips, and comply with safety requirements (IEC 62368-1), an external slow-blow (time-delay) fuse must be installed on the Line (L) conductor (or on all active phases for three-phase systems).

Recommended fuse selection guidelines:

- **Type:** Ceramic, time-delay (slow-blow) with high breaking capacity (to handle initial inrush currents without nuisance blowing).
- **Voltage Rating:** Minimum 275 VAC for single-phase systems; minimum 500 VAC for three-phase systems (rated for Line-to-Line voltage).
- **Current Rating:** The fuse current rating should be selected to be 3 times the maximum nominal input current of the power supply at the lowest operating input voltage.

3. DC/DC CONVERTERS

This section applies to low-voltage and high-voltage DC/DC converter series.

3.1. Energy Source Classifications (HBSE)

The DC/DC converter interfaces are classified as follows under normal and single-fault conditions:

- Input Interface classified as **ES1 or ES2 (Depending on input range).** If Input Voltage is ≤ 60 VDC - **ES1 (Safe).** If Input Voltage is > 60 VDC - **ES2.** If ES2, access to input terminals must be restricted.
    - **Exception for JETDH:** Input Interface is classified as **ES3 (Hazardous Voltage)** up to 620 VDC. Access to input terminals must be prevented. Use wiring rated for 600V/1000V.
- Output Interface classified as **ES1 (Safe Energy Source).**
    - **Condition:** Nominal output voltage is ≤ 60 VDC. Models with custom output **>60 VDC are classified as ES2.**
    - **Safeguard:** Safe to touch. No additional protection against electric shock is required for the output terminals.
    - **Exception for JETDH:** High-voltage output models are classified as **ES3 (Hazardous Voltage);** accessibility must be prevented.
- Power Source (PS) Classification: Low-power models (< 100 W) are **classified as PS2.** High-power models (>= 100 W) are classified as PS3 (Potential Ignition Source).
    - **Safeguard:** For PS3 models, the module must be installed within a Fire Enclosure (V-1 or V-0 rated material). For PS2, a fire enclosure is recommended but depends on the end-product standard.
- Thermal Source (TS) Classification: **TS3.**
    - **Reasoning:** The case temperature (T_{case}) can reach +125°C at full load.
    - **Safeguard:** Accessibility must be prevented, or an Instructional Safeguard (Warning Label 'HOT SURFACE') is required.

3.2. Isolation & Insulation Ratings

The modules utilize galvanic isolation barriers to separate input, output, and case ground.

JETDi, JETDiR, TESND series:

- **Input to Output:** 1500 VDC (Electric Strength). Meets **Basic Insulation.** Provides separation between Input and Output grounds. If Input is ES2 (>60V), this barrier protects the Output (ES1).
- **Input to Case:** 1500 VDC (Electric Strength). Meets **Basic Insulation.** The metal case should be connected to Protective Earth (PE) or System Ground.

- **Case to Output:** 1000 VDC (Electric Strength). **Meets Basic Insulation.** Provided for noise immunity and definition of ground reference.

JETDiV series:

- **Input to Output:** 3000 VAC (Electric Strength). Meets **Reinforced Insulation.** Since the isolation is Reinforced, the output circuits are considered separated from the mains. The output can be accessible to the user without requiring further isolation in the end-product.
- **Input to Case:** 1500 VAC (Electric Strength). Meets **Basic Insulation.** Since this is Basic Insulation, the metal case MUST be connected to Protective Earth (PE) to provide the second layer of protection against electric shock.
- **Case to Output:** 500 VAC (Electric Strength). Meets **Functional Insulation**. This insulation is provided for noise immunity and correct operation of the equipment.

3.3. Fuses & Overcurrent Protection

The module **does not contain any internal input fuses.** To protect against fire hazards, component failure, and reverse polarity faults, an external fuse must be installed on the positive (+) input line.

Recommended fuse selection guidelines:

- **Type:** Fast-acting or time-delay fuses, depending on the system startup characteristics.
- **Voltage Rating:** The fuse must have a DC voltage rating equal to or higher than the maximum operating input voltage of the system (do not use AC-only fuses).
- **Current Rating:** The fuse current rating should be selected to be 3 times the maximum nominal input current of the power supply at the lowest operating input voltage.

3.4. Model List & Specific Requirements

JETDi Series:

- **Mounting (No Holes):** These modules do not have mounting holes. They are designed for PCB mounting (pins) and/or mechanical clamping. Solder connections alone may not be sufficient for environments with vibration or shock. Use of thermally conductive adhesive or mechanical clamping is recommended.
- **Wiring/PCB Tracks:** Input PCB tracks must be sized to handle the input currents (up to 12A for JETDi150 at low line).

JETDiR Series:

- **Mounting:** The module features counter-bore mounting holes. It must be securely mounted to a chassis or heatsink using appropriate screws to ensure thermal transfer and mechanical stability.

- **Wiring/PCB Tracks:** For JETDiR300/600: Input currents can exceed 20A and 40A respectively. PCB tracks or wires must be heavily reinforced to prevent overheating and voltage drop.

TESND Series:

- **Mounting (Flanges):** The module features integrated mounting flanges. It must be securely attached to a chassis or heatsink using 2 or 4 screws (as per datasheet drawing). This ensures both mechanical fixation and thermal interface.
- **Wiring/PCB Tracks:** For TESND250, input currents can reach 20A at low line. Input wiring and PCB tracks must be sized accordingly to prevent overheating.