


<p style="text-align: center;"><b>TECHNICAL SPECIFICATIONS for</b>  <b>Three Phase, 15 to 2000 KVA</b>  <b>Power System with Conditioning and Regulation</b></p>	
<p style="text-align: center;"><b>Industrial Power-Regulator</b></p>	<p style="text-align: center;">160-GS Rev. B 10/31/2024</p>

## 1.0 General:

This specification covers the physical, electrical, and environmental characteristics and general requirements for a three-phase power Regulating/conditioning system. The specified equipment herein shall be referred to as a "Power Regulator". The Power Regulator includes all components and systems required to install, operate, and maintain the system. The systems shall be a zero current tap switching Regulator technology.

## 2.0 Applicable Documents:

- 2.1 The National Electrical Code NFPA 1984. (Latest Edition)
- 2.2 American National Standards Institute Corp. and its applicable standards C39.1, C80.1, C89, C84.1.
- 2.3 FCC Part 15, Sub-Part J, Class A.
- 2.4 IEC 435 International Electrotechnical Commission Recommendation "Safety of Data Processing Equipment".
- 2.5 VDE 0804/3.77 Verbrauch Deutscher Elektrotechniker standard. "Telecommunication and Electronic Data Processing Unit and Systems".
- 2.6 UL 1950 - Underwriters Laboratories, Inc. Safety of Information Technology Equipment. Including Electrical Business Equipment.
- 2.7 VDE 0806 Verband Deutscher Elektrotechniker Standard "Safety Design".
- 2.8 CSA 22.1 Canadian Standards Association, "Data Processing Equipment".
- 2.9 NEMA National Electrical Manufacturers Association and its applicable standards.
- 2.10 Local Inspection Authorities having jurisdiction over electrical equipment and its installation.

## 3.0 Major Components:

The basic components of the Power Regulator shall consist of: base, case, isolation transformer, Regulating electronics, bypass switch, internal wiring, single point ground and EMI shielding, input filter, Optional output filter.

#### **4.0 System Package and Construction:**

##### **4.1 Agency approval.**

The Power Regulator shall be listed to UL standard 1950.

##### **4.2 Cabinet**

The cabinet shall consist of the following:

###### **1. Frame**

The base shall be of heavy gage sheet metal of a minimum of 14 gage. Each base shall be painted with of smooth finish paint. Four holes of a minimum of 9/16 "shall be provided in the base for the purpose of securing the unit to the floor.

###### **2. Internal Sheet Metal**

All internal sheet metal attached to the base shall be plated Gold Zinc Wash or galvanized to ensure RFI, EMI susceptibility reduced to the absolute minimum. Minimum thickness shall be 16 gage.

###### **3. Removable Access Panels**

Removable front and rear panels shall be provided as minimum.

###### **4. Cover**

A cover shall be provided with a solid top. The top shall be easily removed to provide access to the transformer for field changes.

###### **5. Conduit Entry**

###### **a. 15-400kVA (480V input) and 15-200kVA (208V input)**

Input and output conduit entry shall be provided in the right and left lower side panels as well as provision for bottom entry.

###### **b. 500-2000kVA (480V input) and 225-2000kVA (208V input)**

Input and output conduit entry shall be provided in the right and left lower side panels.

##### **4.3 Transformer**

15 to 2000kVA Isolation Transformer:

A double-shield, multi-tapped, all copper, baked varnish, convection cooled, delta-wye three phase isolation transformer shall be provided. The isolation transformer shall be mounted on rubber isolation pads to prevent 60Hz hum of the core from being transmitted to the base. The transformer core clamp shall be grounded to the base through a copper strap. The transformer insulation system shall be 220°C. The transformer rise shall be 150° C. Taps shall be provided on the primary to accommodate the tap-switching electronics. Two temperature monitors shall be provided: 140°C (alarm) and 160°C (shutdown). The construction of the transformer shall separate the primary connections and the secondary connections by placing them on opposite side of the core for up to 200kVA and front and back of the core for 500kVA and up. In addition, the output terminals of the secondary shall be at opposite ends of the coil for the input terminals of the primary to minimize the possibility of transverse mode injection. A copper foil shield shall be provided to allow a large surface area for shunting RFI signals of the core to ground. Full load taps shall be provided (2) FLAN and (4) FLBN for connection of the tap switching Regulator module.

##### **4.4 Regulation Electronics**

A solid state, electronic, zero crossing tap switching regulation system shall be provided. This regulator shall use SCR (Silicon Controlled Rectifiers) technology in its construction and shall be rated at 100% above worst-case ratings (26% below nominal) without adverse affect. The Regulation system shall respond to a change in the input voltage within one cycle. The electronics shall be separated from the transformer area by a heat shield of sheet metal for units up to 400kVA, this barrier shall be zinc plated for maximum conductivity, or located inside a separate compartment for 500kVA and up.

- a. All SCRs to be on the primary side to shielded transformer to eliminate switching noise to the load.
  - b. All SCRs to be conductive of primary winding current for longer life expectancy
- 4.5 Bypass switch (Regulation Only)  
A manually operated bypass switch shall be provided. If the Regulation circuit malfunctions, it shall select the 100% tap of the isolation transformer and provide unregulated nominal power to the output circuit. Access to the bypass switch shall not require removal of any panels. The bypass switch is a "break-before-make" switch.
- 4.6 Auto Bypass 100-2000kVA **(OPTIONAL)**  
The Auto Bypass circuit is built-in within the unit to ensure that the output voltages are always available, even when the tap change CKT fails.
- 4.7 Internal Wiring  
All internal wiring shall be UL Listed appliance wire or power wiring of multi stranded construction. Primary & Secondary Power wiring from the transformer shall not be in close proximity of each other.
- 4.8 Single Point Ground (SPG)  
A single point ground bus shall be provided and shall be of copper construction. Minimum thickness shall be 1/4" X 1/4" and be silver plated to provide connection of the lowest possible resistance to all ground wires secured to the SPG. The following shall be grounded to the SPG:
  - 1. Equipment grounds.
  - 2. Neutral of isolation transformer.
  - 3. Core of the Transformer.
  - 4. Primary and Secondary shields.
  - 5. Frame.
  - 6. Equipment grounding conductor from the branch circuit.
  - 7. Case.
  - 8. Regulation Electronics.
- 4.9 Input Transient Noise Filter  
The Input Transient Noise Filter consists of a resistor/capacitor network which acts as a large snubber circuit to eliminate high frequency impulses from entering the power system.
- 4.10 Output Transient Noise Filter **(OPTIONAL)**  
The Output Transient Noise Filter consists of a capacitor network which is installed on the secondary of the unit. This capacitor network, when coupled with the input filter, virtually eliminates most electronic noise from reaching the applied load or being fed back to the unit from noise generating loads.
- 4.11 TVSS, Transient Volt Surge Suppressor **(OPTIONAL)**  
The TVSS is a protective device with a modular thermally protected transient voltage surge suppressor. The Transient Volt Surge Suppressor shall be located on the primary of the isolation transformer. The device shall meet UL 1449 third edition, IEC 61643-1, ANSI/IEEE C62.41
  - 1. Parallel (Shunt) Protection.
  - 2. 50kA 8/20  $\mu$ s surge capacity (per mode)
  - 3. 100kVA 8/20  $\mu$ s surge capacity (per phase).
  - 4. VPR (voltage protection rating): 800V L-G, 1500V L-L (208 NOMINAL VOLTAGE)  
1500V L-G, 3000V L-L (480 NOMINAL VOLTAGE)
  - 5. SCCR: 100kA
  - 6. Each device shall provide visual service indicators (one for each phase).

- 4.12 Input meter, 500-2000kVA:480V input/225-2000:208 input **(OPTIONAL)**
- 4.13 Input / output circuit breakers, 500-2000kVA:480V input/225-2000:208 input **(OPTIONAL)**
- 4.14 Bus to end input output configuration, 500-2000kVA:480V input/225-2000:208 input **(OPTIONAL)**
- 4.15 K-factor ratings up to K-50 **(OPTIONAL)**

## **5.0 Electrical Characteristics:**

- 5.1 60 Hz Frequency units **(OPTIONAL 50 Hz)**:
  - 1. Output Rating kVA: 15,30,50,75,100,125,150,175,200,225,250,300,400,500,750,1000,1250,1500,2000
  - 2. Input Voltage: 208 or 480VAC Delta
  - 3. Output Voltage: 208Y/120 or 480Y/277 VAC
  - 4. Input Frequency Tolerance:  $\pm 3$  Hz
- 5.2 Transformer
  - 1. Type: Dry, isolation, multi-shield, copper wound, three phase, computer grade.
  - 2. Impedance: 3% to 5% maximum up to 400kVA, 4-7% 500-2000kVA
  - 3. Efficiency: >97%
  - 4. Load Power Factor: Unity to 0.3 leading or lagging
  - 5. Harmonic distortion: < 1% maximum added
  - 6. Wave form distortion at tap switching: < 1% added
  - 7. Noise Rejection (typical): Common mode: -120 dB ( 0.1Hz to 10MHz )  
Normal Mode: -40 dB/decade ( 1KHz to 10 MHz ) (Optional 60dB/decade)
- 5.3 Audible Noise: Meets or exceeds NEMA standard
- 5.4 Input Voltage Regulation: +10% to -26% of nominal
- 5.5 Output Voltage Regulation:  $\pm 3\%$  Typical,  $\pm 4\%$  maximum for all load and line conditions.
- 5.6 Response Time: 1 cycle typical
- 5.7 Load Rating: Continuous Regardless of line / load conditions.
- 5.8 Overload Inrush Rating: 200% of full load for 10 seconds  
1000% of full load for 1 cycle

## 6.0 Physical characteristics:

### 208 VAC INPUT:

kVA	15-30	50	75	100-300	400-2000
Height (inches)	38	40.5	51.5	66	Consult Factory
Width (inches)	26.5	31.5	40.5	50.5	
Depth (inches)	17	21.5	26.5	32	

### 480 VAC INPUT:

kVA	15-30	50-100	125-150	175-300	400-500	750-1000	1250-2000
Height (inches)	38	40.5	51.5	66	90	90	Consult Factory
Width (inches)	26.5	31.5	40.5	50.5	88	106	
Depth (inches)	17	21.5	26.5	32	50	60	

## 7.0 Operating Environment:

- 7.1 Temperature: 32°F to 104°F ( 0° to 40°C )
- 7.2 Humidity: 10% to 90% relative humidity, without condensation
- 7.3 Altitude: 0 to 7000 ft.

## 8.0 Storage Environment:

- 8.1 Temperature: -4°F to 140°F ( -20°C to 60°C )
- 8.2 Humidity: 0% to 100% relative humidity, without condensation

## 9.0 Warranty:

- 9.1 The manufacturer shall warrant the Power Regulator against defects in materials and workmanship for a period of twenty-four (24) months. The warrant shall cover all parts and labor for a 12-month period beginning with the factory startup, 13<sup>th</sup> through 24<sup>th</sup> month only valid with factory performed preventive maintenance, (extended warranty contract).
- 9.2 Spare parts must be available.

## 10.0 Manufacturer's Qualifications:

The Power Regulator shall be furnished by a manufacturer who specializes in the manufacturing of Power Regulating/Conditioning Systems, has been in business for at least 25 documented years, and with a nation-wide service organization. The manufacturer shall be an ISO9001 certified company.

## 11.0 Qualified systems:

The unit shall be a Power Regulator manufactured by: OnLine Power, Inc., Los Angeles, CA.