



Guideform Specification

High Resistance Grounding Specification

Bender Series 2 Intermediate High Resistance Grounding System (BHRG2)

****To specifying engineers, for any clarification or assistance please contact your Bender sales representative or inside sales technical support.****

Part 1 - General

1.1 Submittals

1. Submit shop drawings for products specified in this Section. The submittal should include but not be limited to the following:
 - a. Manufacturer's bill of material.
 - b. Manufacturer's installation instructions with schematic and wiring diagrams.
 - c. Product dimensioned drawings.
 - d. Manufacturer's testing and commissioning instructions.
2. Submit Operation and Maintenance manuals.

1.2 Standards

1. The latest versions of the following codes and standards used by the authority having jurisdiction should apply during design and manufacturing.

Electrical codes:

- a. CSA C22.1 – Canadian Electrical Code
- b. NFPA 70 – National Electrical Code

Enclosure standards:

- a. CSA C22.2 No. 94.1 – Enclosures for electrical equipment, nonenvironmental considerations
- b. CSA C22.2 No. 31 – Switchgear assemblies
- c. UL 50 – Enclosures for Electrical Equipment
- d. NEMA ICS 6 – Industrial Control and Systems: Enclosures
- e. NEMA 250 – Enclosures for electrical equipment (1000 Volts Maximum)
- f. ANSI/IEC 60529 – Degree of protection provided by enclosures (IP Code)
- g. ANSI Z535.4 – Safety labels

Industrial control equipment standards:

- a. CSA C22.2 No. 14 – Industrial Control Equipment
- b. ANSI C19.3 – Industrial Control Apparatus – General
- c. UL 508 – Industrial Control Equipment
- d. UL 508A – Industrial Control Panels





Neutral grounding devices standards:

- a. IEEE 32 – Requirements, Terminology, and Test Procedure for Neutral Grounding Devices
- b. IEEE 142 – Recommended Practice for Grounding of Industrial and Commercial Power Systems
- c. IEEE C57.32 – IEEE Standard for Requirements, Terminology, and Test Procedures for Neutral Grounding Devices
- d. CSA C22.2 No. 295 – Neutral Grounding Devices
- e. CSA M421 – Use of Electricity in Mines

Part 2 - Products

2.1 Intent

1. This specification provides design and performance details of the Bender Series 2. Intermediate High Resistance Grounding system (BHRG2). The supplied system shall meet or exceed the requirements of this specification.

2.2 Scope of Work

1. Provide a Bender BHRG2 system to high-resistance ground, and to detect and locate ground faults on an electrical power distribution system. The scope of work includes but is not limited to the following:
 - a. Review of proposed electrical power distribution system equipment design with a Bender technical representative prior to submission of pricing. Ensure proposal meets the full requirements to complete work, meets owner's requirements, and addresses the manufacturer recommendations.
 - b. Review conductor and bussing sizes, if requested, to verify that correct ground-fault current-transformer types, sizes and quantities are selected.
 - c. Identification of components and equipment.
 - d. Test the system as recommended by Bender.

2.3 High Resistance Grounding System

The BHRG2 system is supplied as a pre-engineered package that grounds the power distribution system and controls ground-fault currents to a level that allows continuous operation during a single-phase-to-ground fault. The BHRG2 system detects and annunciates the location of a ground fault to the feeder or load level. Local indication and remote communication as described below should be provided. The BHRG2 system shall meet the following:

1. System Controls

- a. Shall be mounted internal to the electrical power distribution equipment.
- b. Shall include a number of 12-channel RCMS490 ground-fault monitors sufficient for the number of monitored feeders/loads, with individual output contacts, 6 mA to 20 A setting range with pre-alarm warning, LC display, data logging, communications interface, password protection, harmonic analysis, and AC/DC current-detection capability.
- c. The RCMS490(s) shall provide local and remote indication of the occurrence of ground fault by dry contacts.





- d. Shall monitor the health of the NGR and its connections with the NGRM700 Resistor Monitoring Relay. See Section 5 for details.
- e. Harmonic analysis and filtering of ground fault current must be available.
- f. A Bender COM465 Integrated Gateway with Ethernet interface shall be included to provide remote communication of ModBUS TCP/IP and web-based communication.

2. Alternating-Current Current Transformers (AC CT)

- a. Detect AC ground faults.
- b. AC CT's, when specified, are to be installed to monitor individual feeders or loads.
- c. CT integrity and connections shall be continuously monitored.
- d. AC CT configurations include toroidal, rectangular, and split-core rectangular and have the designations of W, WR, and WS series. The correct configuration(s) shall be used to match application requirements.
- e. AC CT's shall be rated for 600 V.
- f. AC and AC/DC CT's can be used in combination in a BHRG2 system.

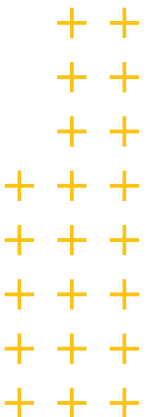
3. AC/DC Current Transformers (AC/DC CT)

When the circuit has a combination of both AC and DC components, as in the case of VFD and UPS applications, that portion of the system should be monitored with AC/DC CT's.

- a. Protects the electrical power system's DC and mixed AC/DC components against ground faults.
- b. AC/DC CT's are to be installed to monitor individual feeders or loads.
- c. CT integrity and connections are to be continuously monitored.
- d. AC/DC CT's are toroidal in shape and have the designation of W-AB series.
- e. AC/DC CT's shall be rated for 600 V.
- f. AC and AC/DC CT's can be used in combination in a BHRG2 system.

4. Neutral Grounding Resistor (NGR)

- a. The NGR shall be installed external to the HRG System Controls in a separate enclosure.
- b. Ground the neutral(s) of three phase electrical power distribution system(s) using NGR(s). Refer to single line drawing or specifications for the required NGR ratings.
- c. If the power-system neutral is not available or accessible, or a neutral is required on the system bus, a zig-zag transformer must be specified to create an artificial neutral. A zig-zag transformer can be supplied in the HRG System Controls or in the external HRG Control. Please refer to the design drawing.
- d. The NGR limits ground-fault current to the designed value. A pulsing function to assist in locating ground faults is required.
- e. Resistive elements are to be made of stainless steel. Wire-wound and edge-wound types are acceptable.
- f. The enclosure of a separately enclosed NGR shall be NEMA 3R of galvanized steel painted ANSI 61 grey.





5. Grounding Resistor Monitor

The integrity of the resistance grounding path shall be monitored by a Bender NGRM700 to:

- a. Monitor the integrity of the neutral grounding resistor and connections continuously to ensure the integrity of the grounding system. NGR and grounding-connection resistance-alarm settings shall have a 10 to 200% of nominal-resistance range.
- b. Detect both open and shorted resistance paths. When measured resistance exceeds the NGR settings (high or low), Resistor Fault contacts operate & the fault is indicated through the HMI display and front-panel LED lamps.
- c. The relay shall be able to provide a wide ground fault detection range including AC/DC fault detection. Harmonic analysis of neutral current and voltage are required.
- d. An AC/DC CT shall be installed to detect any AC or DC fault in the system.
- e. Ground-fault detection shall remain active with an open NGR.
- f. Information including neutral current, neutral voltage, DC content, harmonic content, and phase voltage is displayed through an HMI with LC display.
- g. Shall support Modbus TCP/IP, Modbus RTU, and Webserver communication.
- h. Any products that do not meet the above shall not be used.

6. System Operation

The BHRG2 system detects ground faults and limits ground-fault current to the level as shown on the single line drawing. Upon detection of ground fault, an alarm is issued through LED lights and output contacts, indicating the fault location. Neutral current and voltage are indicated. When so specified, AC and DC content in the fault current, harmonic content, and phase voltages are displayed through an HMI. The pulsing function can be activated to help locate a ground fault on the indicated feeder. Relay outputs for each monitored circuit shall be provided.

7. Indication and Communication

Local and remote communication shall be provided. The following must be included as minimum:

- a. Alarm contacts for remote annunciation of ground fault.
- b. Bender COM465 Integrated Gateway with Ethernet interface for network communication with Modbus TCP/IP. Data logging of past 1000 events shall be provided.



8. Miscellaneous

- a. Provide a portable ground detector with a split-core type ammeter and multiple range switch. The clamp must be capable to enveloping a minimum 6" diameter for locating ground fault.
- b. The product(s) covered by this specification shall be warranted by the manufacturer to be free of manufacturing defects for 24 months from the ship date.

