ZBB ENERSECTION™

AC- Power Conversion Unit

25kVA UL-1741 INVERTER

Operation Manual

30-000072

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I. IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions for Model **11-ENER-INV25** that shall be followed during installation and maintenance of the ZBB ENERSECTION™ AC-POWER CONVERSION UNIT.

• THIS MANUAL CONTAINS IMPORTANT INSTRUCTIONS FOR ZBB ENERGY CORPORATION EQUIPMENT THAT SHALL BE FOLLOWED DURING INSTALLATION, OPERATION, MAINTENANCE, AND ROUTINE SERVICE.

• FOLLOW ALL APPLICABLE SAFETY INFORMATION DURING INSTALLATION, OPERATION, INSPECTION, SERVICE, AND MAINTENANCE OF ZBB ENERGY CORPORATION EQUIPMENT.

INTRODUCTION & CONTACT INFORMATION

ZBB Energy Corporation (hereafter, "ZBB") products meet all applicable industry safety standards. ZBB actively promotes safe practices in the use and service of its equipment through training programs, manuals, and the various proactive efforts of its personnel covering design, engineering, manufacturing, marketing, and service.

This manual cannot possibly cover all details or variations in equipment, procedures, or processes described, and cannot provide directions for every possible contingency during operation, inspection, or service. When additional information is needed or desired to meet a situation not covered sufficiently, consult

ZBB Service and Technical Support:

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Business Hours

7:00 a.m. to 5:00 p.m.
United States Central Time Zone

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SAFETY INFORMATION

The following information provides GENERAL safety information, including a brief overview of safety, designation of signal words and symbols, hazard statement definitions, notification of hazards, methods to help avoid hazards, and brief statements of the consequences that can occur when failing to follow the safety information. For safe operation and service of ZBB equipment, read, understand, and follow all safety information.

Initial Start-up / Commissioning
The initial verification of system installation, startup of the equipment and / or system, known as *commissioning*, is a very specific and necessary safety procedure. **Equipment and system commissioning is to be performed only by a ZBB-factory certified technician.** Contact the factory to arrange a time and place to have the equipment or system serviced. Violation of this commissioning statement could result in a voided warranty.

The information contained in this manual does not replace any other safety information, practices, or proper judgment. Government agencies, various corporations and employers have their own laws, regulations, codes, and rules. Before starting to operate or work on the equipment, ask about the safety policy in effect at the equipment location. BEFORE attempting to operate, inspect, service, maintain, or test the equipment, learn the safety requirements that are in effect at each location. Safety depends on properly following all appropriate safety requirements.

Safety is most important. Many factors contribute to safe – or unsafe – conditions, including but not limited to:

- Alcohol and / or Drugs
- Attitude
- Carelessness
- Distractions
- Fatigue
- Inattentive / irresponsible behavior
- Overload
- Unfamiliarity with the equipment

YOU are the most important contributor to your own safety. Equipment can be repaired or replaced – death and many injuries are permanent. For the best results, think and act safely and encourage others to do so as well.

Invest in your safety by reading, understanding, and following the information in this manual. Obey all applicable laws, regulations, rules, codes, locally-mandated practices and

procedures. Before attempting to conduct any operation or operation-service on ZBB and associated equipment, consider all of the circumstances, conditions, and other factors that can have an effect on the safety of personnel and property. Take appropriate action to assure safety at all times.

This manual is not intended as a substitute for appropriate training and experience covering the safe operation of the equipment. Only ***authorized, qualified personnel*** with the proper background and knowledge are permitted to inspect, install, operate, and service ZBB equipment.

AUTHORIZED, QUALIFIED PERSONNEL

The term "authorized, qualified personnel" is used throughout this manual and is defined as follows: **Authorized, qualified personnel meet these *minimum* qualifications:**

- *Trained and experienced with safe operating practices, procedures, and accepted high-voltage and low-voltage safety and practical techniques covering electrical power devices and power electronics equipment.*
- *Trained and experienced with the use and care of Personal Protective Equipment (PPE), including but not limited to flash-protective clothing, voltage-insulating rubber gloves, face shield, hard hat, safety glasses, and more.*
- *Trained and authorized to work with the type of equipment that this instruction manual covers, including but not limited to energizing, de-energizing, grounding, and clearing electrical power equipment.*
- *Trained and authorized to work with applicable tools and instruments,*
- *Trained, authorized, and qualified by ZBB Energy Corporation to inspect, install, operate, and service ZBB products.*
- *Has read, understands and follows this manual.*

ONLY ***authorized, qualified*** personnel, *as defined*, are permitted to access equipment supplied by ZBB Energy Corporation.

Before attempting to operate or service ZBB equipment, know where to obtain medical assistance, how to contact emergency personnel, and how to use a first aid kit and a fire extinguisher or other type of fire suppression system. *If working alone, routinely check with another person to help assure your safety.*

Keep emergency telephone numbers (fire, police, first responder, etc.) with you:

Fire: _____

Police: _____

First Responder: _____

Other (personal, etc.): _____

HAZARD STATEMENT IN THIS MANUAL

The exclamation mark within a triangle is the Safety Alert Symbol:

The Safety Alert Symbol means **ATTENTION!** BE ALERT! SAFETY IS INVOLVED!

The symbol is used to direct your attention to safety hazards involving the equipment or procedures. It is used throughout this manual.

Whenever you see the Safety Alert Symbol: **PAY ATTENTION!** Read, understand, and follow the information included. Your life, health, and safety depend on your appropriate actions.

The message that follows the Safety Alert Symbol includes important details about safety. To avoid possible death or injury, carefully read, understand, and follow all safety messages. Fully understand the potential causes of death or injury and other hazards and comply with safe methods to avoid death or injury.

Hazard Statement Definitions

FAILURE TO UNDERSTAND AND OBEY THESE HAZARD STATEMENTS AND THE ACCOMPANYING INFORMATION COULD RESULT IN DEATH, SERIOUS INJURY / DISMEMBERMENT, OR DAMAGE TO PROPERTY.

This manual contains four basic types of hazard communication statements identified by signal words and the presence, or lack, of the Safety Alert Symbol:

DANGER: Indicates an impending hazardous situation, which, if not avoided, *WILL* lead to death or serious injury.

The signal word **DANGER** signifies that an extremely hazardous situation exists and will definitely result in **death or severe injury** if proper precautions are not taken.

WARNING: Indicates a potentially hazardous situation, which, if not avoided, *could* lead to death or serious injury.

The signal word **WARNING** signifies that a hazardous situation exists with, or involving, the equipment, which can result in **death or injury** if proper precautions are not taken.

CAUTION: Indicates a potentially hazardous situation, which, if not avoided, *may* lead to moderate or minor injury. May also provide an alert to help avoid unsafe practices.

The signal word **CAUTION** signifies that a potentially hazardous situation exists and may result in **injury** if proper precautions are not taken.

CAUTION: Indicates a potentially hazardous situation, which, if not avoided, may lead to equipment damage.

The absence of the Safety Alert Symbol with the use of the signal word **CAUTION** signifies that a potentially hazardous condition exists that may result in **equipment damage only** if proper precautions are not taken.

Additional Types of Special Messages

This instruction also includes the following types of special information:

IMPORTANT! Indicates important information required for proper installation, maintenance, and / or operation.

NOTE: Provides further information covering procedures, methods, etc.

HAZARD STATEMENT ON EQUIPMENT

There are safety symbol(s) and label(s) adhered to the equipment. They are used to direct your attention to safety hazards involving the equipment or procedures.

General Symbol

The electrical shock mark within a triangle is the CAUTION – RISK OF ELECTRICAL SHOCK Symbol:

The CAUTION – RISK OF ELECTRIC SHOCK Symbol means **ATTENTION!** BE ALERT! SAFETY IS INVOLVED!

Whenever you see the CAUTION – RISK OF ELECTRIC SHOCK symbol: **PAY ATTENTION!** Read, understand, and follow the information included. Your life, health, and safety depend on your appropriate actions.

Additional Safety Information (I)

Information following the "CAUTION – RISK OF ELECTRIC SHOCK" symbol will alert and/or advise personnel of potential danger.

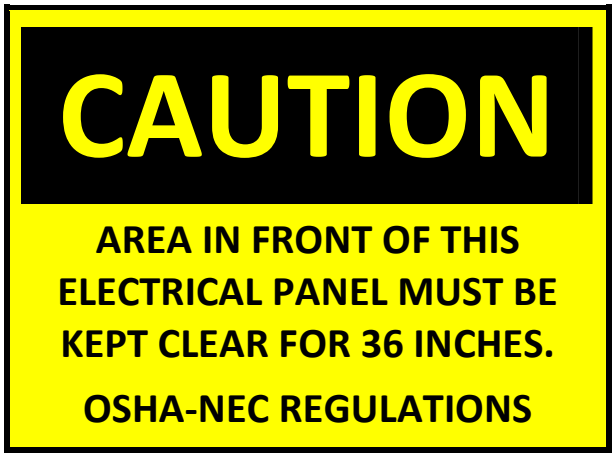
LIVE VOLTAGE

EXCLUSIVE OF DEVICE'S OPERATION

Additional Safety Information (II)

Whenever you see the "CAUTION" in bold yellow letters accented by a dark background with additional safety information, **PAY ATTENTION!** Read, understand, and follow the information included. Your life, health, and safety depend on your appropriate actions.

Example of Cautionary Label:



Additional Safety Information (III)

Additional Types of Special Messages

The unit also includes the following types of special information:

IMPORTANT! Indicates important information required for proper installation, maintenance, and / or operation.

NOTE: Provides further information covering procedures, methods, etc.

II. INTRODUCTION

This manual provides set up and installation instructions, operation information and basic troubleshooting procedures for the ZBB Power Control Unit; hereafter referred to as the PCU Module.

Read This Manual First

BEFORE attempting to operate or to install this equipment, read, understand, and follow this manual. Follow all locally approved procedures and safety practices.

WARNING: POTENTIAL FOR DEATH OR SERIOUS INJURY.

- This manual is intended for use by ***authorized, qualified*** personnel ONLY.
- To help reduce the risk of electric shock, DO NOT attempt to operate or service the unit in any manner other than described in this manual.

Standards

ZBB Energy Corporation equipment is designed and/or tested in accordance with ANSI standards IEEE 1547, NEC, NFPA, and UL 1741.

The Quality System at the ZBB Energy Corporation factory is ISO 9001 certified.

Additional Information

These instructions cannot cover all details or variations in the equipment, procedures, or process described, nor to provide directions for meeting every possible contingency during installation, operation, or maintenance. When additional information is desired to satisfy a problem not covered sufficiently for the user's purpose, please contact ZBB Energy Corporation Service & Technical Support.

ACCEPTANCE AND INSPECTION

Each unit is completely assembled, inspected, tested, adjusted, and properly packed for shipping at the factory. All ZBB equipment is in good condition when accepted by the carrier for shipment with appropriate documentation(s).

At the time of receipt, refer to packaging document(s) & inspect all equipment for physical damage. Conduct the inspection in the presence of your personnel and / or a representative of ZBB Energy Corporation. Refer to appendixes for Incoming Inspection List & Corrective Action Response form.

Upon receipt of ZBB equipment:

1. Inspect the equipment thoroughly for physical damage and loss of parts incurred during shipment. If damage or loss is discovered, file a claim with the carrier immediately.
2. Record and describe all physical damage; when possible make a photographic record and report all negative findings to the shipping company and / or delivery personnel, including submitting a Corrective Action Response to ZBB.
3. With ZBB approve & if applicable, tighten any fasteners that may have loosened during shipment, especially those securing components and wiring connectors to the base of the unit.
4. Examine equipment to ensure that all mechanical components function as designed. Verify that there electrical components have not sustained “breaking force” and that there is no water damage to the unit. Check for signs of obvious trauma, abuse and / or damage.

HANDLING AND STORAGE

Handle and store the equipment in such a way as to help minimize the possibility of any type of damage, particularly to the electronic components.

The ZBB PCU mechanical ratings & dimensions are given in the Appendixes and is packed and shipped in a secure container or crate. Use appropriate lifting methods, preferably with the assistance of a helper and avoid personal injury or equipment damage.

If the equipment is to be stored for an appreciable time before installation, provide a clean, dry, safe INDOOR storage area and keep the equipment in its original shipping carton.

General Description

The ZBB PCU is a component that converts from and to various types of ac and dc power.

The PCU offers a modular, configurable architecture that connects multiple AC and DC power sources directly to energy storage units with variable AC & DC power load outputs. The PCU is designed to operate in grid interactive, grid independent and grid conversion scenarios providing active and reactive power control.

The PCU can function in a wide array of applications and is basically a dc-to-ac converter that is self-supportive and can be positioned on or off the grid.

The PCU is provided with a NEMA 3R enclosure, operating from -30°C to +50°C and grounding is via a grounding bar conveniently positioned at the enclosure's bottom front entrance.

The PCU is fully self-protected from utility disturbances and externally applied short circuits (ac, dc and input power).

When supplied with other ZBB products and systems, such as the ZBB Zinc Energy Storage System (EnerStore) or other bulk energy storage devices, the ZBB PCU helps to comprise a platform that creates an expandable power plant system to independently optimize supply of each generating source.

Each unique platform configuration provides an intelligent energy management system to realize multiple value streams including reducing use of fossil gen sets, firm and shift renewable generation outputs, deliver "supply response" storage dispatch, improve power quality and even be used as an emergency power system independently of the grid during outages.

The ZBB family of modular designs aims to increase or decrease power needed by either adding or subtracting modules in the string. This scalability allows for products suited to almost any power application. Other products do not provide these modular capabilities or transportable designs with their added benefits and flexibility.

III. INSTALLATION

ZBB technical services personnel are available to assist in the physical placement of the system equipment, if necessary.

SET UP

The PCU ships as a single cabinet. Mechanical and electrical connections shall be performed by an ***authorized, qualified*** responsible party. Installation and the wiring of the equipment are only to be performed by ZBB-trained personnel.

Lifting and Handling

Lift the PCU with a fork lift when the PCU is mounted on its pallet of by the lifting lugs.

CAUTION: POTENTIAL FOR PERSONAL INJURY.

- Improper lifting may result in moderate or minor injury.
- Follow all locally approved safety practices when lifting and mounting the equipment.
- Obtain the help of an assistant whenever possible.
- Use the lifting lugs provided.
- Lift the load smoothly.
- DO NOT allow the load to shift.
- Prevent body parts (including hair) and clothing from getting trapped between the unit and its mounting location.
- Provide adequate spacing in front of the unit per OSHA regulation.

CAUTION: POTENTIAL FOR EQUIPMENT DAMAGE.

- Improper lifting can result in equipment damage.
- Follow all locally approved safety practices when lifting and mounting the equipment.
- Use the lifting lugs provided. Lift the load smoothly and do not allow the load to shift.
- Provide adequate spacing in front of the unit to allow ventilation & opening door.

IV. COMMISSIONING

COMMISSIONING

WARNING: POTENTIAL FOR DEATH OR SERIOUS INJURY.

• These operation instructions are intended for use by ***authorized, qualified*** personnel as defined in the Safety section of these instructions.

Commissioning

The power up or re-start after service to the PCU, as with the initial verification of system installation, startup of the equipment and / or system, is a very specific and necessary safety procedure known as commissioning. **Equipment and system commissioning is to be performed only by a ZBB-factory certified technician.** Contact the factory to arrange a time and place to have your equipment or system serviced. Violation of this commissioning statement could result in a voided warranty.

IMPORTANT! This unit or system is provided with fixed trip limits and shall not be aggregated above 30 kW on a single Point of Common Connection.

POWER /CONTROL CABLE CONNECTIONS

IMPORTANT! Only ***authorized, qualified*** personnel may make cable connections to the unit.

Contact ZBB Energy Corporation for technical service.

COMMUNICATIONS CONNECTION

System Communication between the PCU and the user is serially through a PC (remotely) or supplied operator (locally). Any serial communication software may be used as long as it can run the necessary serial protocol described below. Any standard computer will then both be able to display various system signals as well as access to controls necessary to run the PCU. Two wire Fiber optic connections are used for direct connection between the PCU and serial interface.

Serial Communications

Using a fiber optic to DB-9 RS232 Connector, the following two DB-9 pins will be used:

Receive Data: Pin 2
Transmit Data: Pin 3

32 bit Serial (RS232) Communications Protocol

- Asynchronous serial transmission control
- Baud 19200
- 1 stop bit, 1 start bit
- Even Parity Check
- Start character $55 (0x55 in C)

PRE-ENERGIZE CHECKLIST

1. Confirm that all ac and dc power upstream / downstream of the ZBB PCU is locked out and tagged out and that all breakers are OFF.
2. Confirm that the PCU's power switch (es) are in the OFF position.
3. Confirm that all AC & DC connections are terminated properly.
4. Conduct a general inspection of the PCU. Verify that there is no visible damage, loose wires, moisture, etc.
5. Close and latch all panels and cabinet doors.

IMPORTANT! If unit was previously powered, allow 10 minutes for unit to dissipate power prior to touching any circuits.

APPYLING POWER

WARNING: POTENTIAL FOR DEATH OR SERIOUS INJURY.

- These operation instructions are intended for use by ***authorized, qualified*** personnel as defined in the Safety section of these instructions.
- Read & understand the instructions prior to energizing the unit.
- At any instance where the PCU is faulted or there is cause for potential issue(s), record fault code & shutoff the PCU and contact a ZBB representative immediately.

IMPORTANT! Prior to energizing the unit, familiarize with the **PCU OPERATION** in the following section.

1. Complete the **Pre-Energize Checklist**.
2. Operate ac & dc switch (es) upstream of the ZBB PCU as applicable to the on position.
3. **CONFIRM** the voltage feeding the PCU and that they are within the PCU ratings specified in Appendixes.
4. Operate the DC Switch to the ON position.

Note: If there is voltage on the DC bus, follow Steps 4.a-d before proceeding; otherwise skip to next step.

   a. Controller communication established.
   b. PCU is not in fault state & in state 1 (stop). If in fault state, reset to stop state. If unsuccessful, contact ZBB Service & Technical Support.
   c. DC Voltage / Current are typical with startup parameters.
   d. Confirm kW / kVar request & dispatch; typically set to 0.

5. Completing the previous step, operate the AC Switch to the ON position & confirm PCU'S controller is operating & parameters are within specs.
   a. Controller communication established.
   b. PCU is not in fault state & in state 1 (stop). If in fault state, reset to stop state. If unsuccessful, contact ZBB Service & Technical Support.
   c. AC Voltage / Current are typical with startup parameters.
6. Completing Step 5 and enabling the PCU (locally or remotely) through the interface, the PCU will automatically startup per IEEE 1547. During this wait period, the PCU will actively sense & sync to the Grid's Voltage/Frequency.
7. Once IEEE 1547 standard is met, the PCU is readily available to request or dispatch full kW / kVar (limited by Grid and/or renewable(s) power capacity)
8. Fans rotation will begin at any step once power is applied to the PCU's AC connections and is dependent on PCU internal temperature.

V. PCU OPERATIONS

This section provides procedures used to operate the PCU using serial communication controls.

(!	WARNING: POTENTIAL FOR DEATH OR SERIOUS INJURY. • This manual is intended for use by authorized, qualified personnel ONLY. • To help reduce the risk of electric shock, DO NOT attempt to operate or service the unit in any manner other than described in this manual.

Serial Protocol can be divided into two types:

Monitored Signals – Includes all pertinent system monitoring feedback information. (Read-Only)

Controls – Includes controller set points: state control, power request, and user configurable. (Read/Write)

The following table steps through how to operate the PCU when both the serial communications are established and the default parameters settings are valid.

Start Up Configuration	
Request Power(kW) to 0 kW	Write 0
Request Reactive (kVAR) to 0 kVAR	Write 0
Starting Unit	
Request state to Run	Write 3
Changing Power request	
Request Power(kW) to 6 kW	.i.e. Write 6
Request Reactive (kVAR) to 1 kVAR	.i.e. Write 1
Stopping Unit	
Request state to stop	Write 1

Monitoring Unit	
User State	.i.e. State 1
Last Fault (refer to Appendix E for description)	.i.e. 1000 Bus Over Voltage
Voltage AC Output (L-N)	.i.e. 120 Vrms
Current AC Output	.i.e. 68 Arms
Voltage DC	.i.e. 425 Vdc
Real Power (kW)	.i.e. 15kW
Reactive Power (kVAR)	.i.e. 15 kVAR

Power Down Procedure

The following power down procedure is for normal shut down of the ZBB PCU ONLY. Under Emergency situation, devices upstream / downstream of the PCU shall be exercised to isolate the PCU.

1. Confirm PCU is not requesting / dispatching real and/or reactive power & in state 1. Additionally check circuits upstream & downstream affected by procedure.

⚠	**WARNING**: POTENTIAL FOR DEATH OR SERIOUS INJURY. • If switches & overprotection devices are operated during load; run the risk of damaging unit and more importantly injuring or causing death to person(s).

2. Operate the DC Switch to the OFF position.
3. Operate the AC Switch to the OFF position.
4. Operate ac & dc switch (es) upstream of the ZBB PCU to the OFF position.

5. Confirm that all ac and dc power upstream / downstream of the ZBB PCU is locked out and tagged out and that all breakers are OFF.

6. BEFORE attempting to perform any operator-service verify that there is no power to or from any of the ac or dc circuits before proceeding.

7. Allow the system to have ten (10) minutes to completely dissipate its power.

8. After waiting ten (10) minutes, check the system visually.

IMPORTANT! If any lights are lit on the PCU, then it has not been powered down and is NOT safe to touch. Repeat steps 1-8 of this Power Down Procedure again and assure that no lights are lit on the PCU before proceeding.

9. When no lights are lit on the PCU, check the input and output circuits with a multimeter (if applicable) to assure that the PCU has completely discharged. There must be less than 50 volts within ten minutes of power down.

VI. OPERATOR SERVICE

⚠ WARNING: POTENTIAL FOR DEATH OR SERIOUS INJURY.

- These instructions are written for ***authorized, qualified*** personnel as defined in the Safety section of these instructions.
- No user serviceable parts inside.

Only ***authorized, qualified*** service technicians may attempt to service, remove, or replace ZBB Energy Corporation equipment/component.

Beyond the components that needs servicing; please contact ZBB Service & Technical Support.

VII. OPERATOR MAINTENANCE

⚠ WARNING: POTENTIAL FOR DEATH OR SERIOUS INJURY.

- These instructions are written for ***authorized, qualified*** personnel as defined in the Safety section of these instructions.

⚠ CAUTION: POTENTIAL FOR PERSONAL INJURY.

- Routine inspection and maintenance is required to help assure proper operation.
- Improper operation may lead to personal injury.
- Improperly maintained equipment may lead to equipment failure.
- To help prevent personal injury or improper operation, assure that the equipment is appropriately inspected and maintained.

Power electronics equipment manufactured by ZBB Energy Corporation requires routine inspection and maintenance to help assure safety, optimal performance, and proper operation.

When equipment is not properly maintained, operational failure may result. Establish and follow a routine maintenance program to help ensure proper, trouble-free operation.

IMPORTANT! Operator-service maintenance of the ZBB PCU is limited to visual inspection ONLY.

If additional service is needed, contact ZBB Service & Technical Support.

ADDITIONAL SAFETY INFORMATION

Personal Protective Equipment (PPE)

Wear appropriate PPE – safety glasses or goggles, flame resistant clothing, appropriately rated gloves, and head protection.

For example, certain regulations mandate that all workers wear protective helmets in areas where there is a possible danger of head injury from impact, falling or flying objects, or electrical shock and burns. Each worker is required to comply with both industry and company standards concerning when, where, and how to fit and wear protective helmets (hard hats). At a minimum, hard hats must comply with the ASTM Standard F 2413-05 and must be worn at all times when working on the equipment.

At least annually, review all relevant safety materials and standards as they are subject to change. ZBB Energy Corporation encourages and supports the establishment of and adherence to appropriate safety standards along with the use of personal

Lock Out / Tag Out (LOTO)

Now that the equipment has been powered down and this has been verified, conduct the Lock Out / Tag Out (LOTO) procedure in accordance with appropriate guidelines.

At a minimum, the LOTO procedure should be followed as mandated by the United States Occupational Safety and Health Administration (OSHA) and local regulations, including yet not limited to those fostered by ZBB Energy Corporation and its customers.

VIII. TROUBLESHOOTING

The ZBB Energy Corporation PCU is constructed to provide years of trouble-free service. Beyond the recommended maintenance and inspection information and simple fuse replacement, there should be no need for further troubleshooting instructions.

In the event that further information is necessary, consult with ZBB Energy Corporation Service & Technical Support.

IX. Return Goods Authorization

The Return Goods Authorization (RGA) process must be followed whenever a product will be returned to ZBB Energy Corporation.

Consult with your ZBB Energy Corporation project manager to discuss the situation and to determine the appropriate next steps to take regarding whether a return is necessary.

Appendix A

RATINGS AND SPECIFICATIONS (Mechanical)

The ZBB PCU is rated per the specifications displayed in Table 1.a.
The Power Module is rated per the specifications displayed in Table 1.b.

Table 1.a.
PCU Dimensions and Weights

	ENGLISH	METRIC
DEPTH	25.75 inches	64.405 cm
WIDTH	28.85 inches	73.279 cm
HEIGHT	95.25 inches	241.935 cm
WEIGHT	1500 lbs	680.389 kg

Refer to Engineering Document(s) for further details

Table 1.a.
Power Module Dimensions and Weights

	ENGLISH	METRIC
DEPTH	08.375 inches	21.2725 cm
WIDTH	20.000 inches	50.8000 cm
HEIGHT	33.000 inches	83.8200 cm
WEIGHT	165 lbs	74.842741 kg

Appendix A (Continue)

RATINGS AND SPECIFICATIONS (Electrical)

The ZBB PCU is rated per the specifications displayed in Table 2.

Table 2.

ZBB ENERSECTION™ AC-PCU 25kVA UL-1741 INVERTER
Model # 11-ENER-INV25

Rating Type	Utility–Interactive	Stand–Alone
Maximum Input Voltage (DC)	450V	450V
Range of input operating voltage (DC)	350-450V	350-450V
Maximum input current (DC)	160A	160A
Maximum input short circuit current	18kA	18kA
Maximum input source backfeed current to input source (AC)	1A	1A
Output power factor rating	0.6 or Greater 25KVA	0.6 or Greater 25KVA
Operating voltage range (AC)	177.7 - 233.8 V	208V +5%, -5%
Operating frequency range or single frequency	59.53 – 60.42 Hz	45 -65 Hz
Nominal Output Voltage (AC)	208V, 3Ph	208V, 3Ph
Normal Output Frequency	50/60Hz	50/60Hz
Maximum Continuous Output Current (AC)	69A	69A
Maximum Continuous Output Power (AC)	25kW	25kW
Maximum Output Fault Current (AC) and Duration	300A Pk 100µS	300A Pk 100µS
Maximum Output Overcurrent Protection	125 A	125 A
Utility Interconnection Voltage and Frequency Trip Limits and Trip Times	Under 166 ms	Under 166 ms
Synchronization In-Rush Current	35Arms	N/A
Trip Limit and Trip Time Accuracy	300A 100ms +/- 50ms	300A 100ms +/- 50ms
Normal Operation Temperature Range	-30°C to +50°C	-30°C to +50°C
Enclosure Type Rating	TYPE 3R	TYPE 3R

NOTE: Power Module does not have an Enclosure Type Rating.

Appendix B

INCOMMING INSPECTION LIST - Mechanical

Examination of Mechanical component(s) shall compose of but not limited to the dimensions, physical locations and mechanical operation of 'non-energized' parts as per checklist. Shall be inclusive of materials & tools listed and comply with guidelines of Industry Standards, National and/or Local Codes and ruling bodies.

Materials & tools need for inspection shall include but not limited to the following: Engineering Document(s), Metric/English Tape Measure and Digital Multimeter.

Recommended inspection list displayed in Table 3.a. If a discrepancy is found, contact a ZBB representative. A Corrective Action Response section is provided in Appendix F to address concerns.

Table 3.a.

	External Inspection List
i.	Visually inspect packaging for shipping & handling indicators. Also included are packaging documents.
ii.	Proper removal/storage of packaging & loose materials & equipment.
iii.	Check the external panel(s) for physical sign damage(s).
iv.	Manually exercise non-energized mechanical components such as door(s), operator(s), circuit breaker(s) and switch(s). Components shall be properly aligned & foreign object shall not obscure their operations.
v.	Dimensions, location & material information shall be reviewed against engineering document(s).
vi.	Physical mating & connections shall be in accordance to engineering document(s).
vii	Grounding/Bonding test shall involve a DMM using continuity settings.
	Internal Inspection List
viii.	Proper removal/storage of packaging & loose materials & equipment.
ix.	Check the internal panel(s) for physical sign damage(s).
x.	Check the panel(s) for physical sign damage(s). (.ie scratches or dents)
xi.	Manually exercise non-energized mechanical components such as, operator(s), circuit breaker(s) and switch(s). Components shall be properly aligned & foreign object shall not obscure their operations.
xiii.	Physical mating & connections shall be in accordance to engineering document(s).
xiv.	Grounding/Bonding test shall involve a DMM using continuity settings.
xv.	Cables installation should be routed in a safe & mechanically appropriate manner.
xvi.	All cables shall be securely attached with straps or clamps to ensure short circuit bracing & avoid loose routing.

Appendix B (continue)

REFERENCED LABELS

User should keep track of the PCU's Product & Serial Number in the provided Table 3.b. to reference when contacting ZBB Service & Technical Support.

Table 3.b.

i.	Nameplate & Rating per Appendix A
ii.	Model No. adhered on the External of the PCU's door. Record Product No. _____
iii.	Serial No. adhered on the Internal of the PCU's door. Record Serial No. _____

Appendix C

ENGINEERING DOCUMENT LIST

The ZBB PCU is supplied with the following Engineering Document as listed in Table 4.

If Engineering Document(s) is/are needed, please contact a ZBB representative.

Table 4.

	Engineering Document Description	Document Part Number
i.	Power Control Unit Operation Manual	30-000072
ii.	Mechanical Layout	10-000001

Appendix E

Fault Code – Lookup Table

The ZBB PCU generates fault code(s) as defined by Table 6.

Table 6.

Fault Code	Name	What to do
1000	Bus Over Voltage	Contact ZBB
1250	Bus Under Voltage	Contact ZBB
2030	AC load voltage phase A (non grid tie)	Contact ZBB
2040	AC load voltage phase B (non grid tie)	Contact ZBB
2050	AC load voltage phase C (non grid tie)	Contact ZBB
3000	Over Current phase A1	Contact ZBB
3030	Over Current phase A2	Contact ZBB
3010	Over Current phase B1	Contact ZBB
3040	Over Current phase B2	Contact ZBB
3020	Over Current phase C1	Contact ZBB
3050	Over Current phase C2	Contact ZBB
4000	IGBT 1 Temp Over	Contact ZBB
4250	IGBT 1 Temp Under	Contact ZBB
4001	IGBT 2 Temp Over	Contact ZBB
4251	IGBT 2 Temp Under	Contact ZBB
10	IGBT fault A1	Contact ZBB
20	IGBT fault A2	Contact ZBB
30	IGBT fault B1	Contact ZBB
40	IGBT fault B2	Contact ZBB
50	IGBT fault C1	Contact ZBB
60	IGBT fault C2	Contact ZBB
100	Pre-charge Fault	Contact ZBB
110	External Pre-charge Fault	Contact ZBB
200	Un-decoded Hardware Fault	Contact ZBB
2300	VRMS Under phase A (non grid tied)	Contact ZBB
2310	VRMS Under phase B (non grid tied)	Contact ZBB
2320	VRMS Under phase C (non grid tied)	Contact ZBB
2400	VRMS Over phase A (non grid tie)	Contact ZBB

Fault Code	Name	What to do
2410	VRMS Over phase B (non grid tie)	Contact ZBB
2420	VRMS Over phase C (non grid tie)	Contact ZBB
2600	Voltage Imbalance phases AB	Contact ZBB
2610	Voltage Imbalance phases BC	Contact ZBB
2620	Voltage Imbalance phases CA	Contact ZBB
3500	Current Imbalance phase AB	Contact ZBB
3510	Current Imbalance phase BC	Contact ZBB
3520	Current Imbalance phase CA	Contact ZBB
5000	Overload phase A	Contact ZBB
5010	Overload phase B	Contact ZBB
5020	Overload phase C	Contact ZBB
4010	DSP Temp. Over	Contact ZBB
4260	DSP Temp. Under	Contact ZBB
120	Grid Contactor Fault 1 (dip switch on aepc709 will disable)	Contact ZBB

Fault Code	Name	What to do
121	Grid Contactor Fault 2 (dip switch on aepc709 will disable)	Contact ZBB
510	Digital Ground Fault	Contact ZBB
7000	Ground Fault	Contact ZBB
8000	Line Frequency Over	Contact ZBB
8250	Line Frequency Under	Contact ZBB
2000	Line Transient Voltage Phase A	Contact ZBB
2010	Line Transient Voltage Phase B	Contact ZBB
2020	Line Transient Voltage Phase C	Contact ZBB
2430	Line RMS Over Phase A	Contact ZBB
2440	Line RMS Over Phase B	Contact ZBB
2450	Line RMS Over Phase C	Contact ZBB
2300	Line RMS Under Phase A	Contact ZBB
2340	Line RMS Under Phase B	Contact ZBB
2450	Line RMS Under Phase C	Contact ZBB

Appendix F

CORRECTIVE ACTION RESPONSE

The ZBB PCU is supplied with the following Corrective Action Response form to address open item(s). Print & clearly detail discrepancy with product and/or documentation. Print as needed to capture all correction actions. Following please contact a ZBB representative with a signed copy.

Product Serial No.: _____ Page _____of_____

Inspector(s) name [Print, Sign & Date]:

_____ _____

Description(s)	Action By Person(s)

Corporate Headquarters

N93 W14475 Whittaker Way
Menomonee Falls, WI 53051 USA
Tel: +1 (262) 253-9800
Fax: +1 (262) 253-9822

HISTORY

ISSUE	DATE	DRF	CHK	APP	DESCRIPTION OF CHANGES
01	12/10/11	DV	KD	KD	ISSUE FOR RELEASE