

## Board Policy No. 624

### **SUBJECT: Alternate Energy Production**

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It is the policy of *Sullivan County Rural Electric Cooperative, Inc.* ("Cooperative") to permit and encourage Alternative Energy System (AES)/Qualifying Facility (QF) Owners to operate cogeneration and small power production facilities and safely and reliably interconnect them with the Cooperative electric distribution system. The term AES/QF shall be used throughout this document to define any form of generation that is not owned and operated by the Cooperative, and is interconnected with the Cooperative. Alternative Energy Systems are defined under Pennsylvania's Alternative Energy Portfolio Standards Act of 2004 (Act 213-2004). Qualifying Facilities are defined under the Public Utility Regulatory Policies Act of 1978 (PURPA). This policy will enable the AES/QF Owner to deliver total or excess energy into the Cooperative's distribution system. Compensation for such delivered energy shall be based on Allegheny Electric Cooperative, Inc.'s (Allegheny) avoided costs. The interconnection of an AES/QF and the Cooperative's distribution system is subject to the following conditions:

- A. If the AES/QF has nondiscriminatory access to one of the following: (1) independently administered, auction-based day ahead and real time energy markets and wholesale markets for long-term capacity sales, or (2) an open access transmission and interconnection service provided by a FERC-approved regional transmission organization and competitive wholesale markets that provide an opportunity to sell capacity and energy, then Allegheny's obligation to purchase the energy and capacity generated by an AES/QF may be waived by petitioning FERC for relief from the obligation to purchase energy and capacity on a service territory-wide basis by demonstrating that options (1) and (2) are available to the AES/QF.
- B. Prior to the time of interconnection, the AES/QF Owner must submit to the Cooperative complete and detailed electrical drawings, signed by a licensed Pennsylvania Professional Engineer of the AES/QF. Any new or proposed AES/QF must undergo an operational, safety, and technical screening and review to determine potential effects on the Cooperative's electric system. The AES/QF Owner shall provide the Cooperative with a Certificate of Completion when the unit is ready to be energized. Written approval must be received from the Cooperative prior to the physical interconnection of the AES/QF to the Cooperative's electric system. The *SAFETY & INTERCONNECTION REQUIREMENTS FOR ALTERNATE ENERGY PRODUCTION Document* provides additional details regarding the evaluation of proposed generators.

The AES/QF Owner shall be responsible for payment of any incremental costs incurred by the Cooperative or Allegheny to interconnect with, synchronize, or accept output from the AES/QF. This would include, but not be limited to:

1. The costs associated with an engineering or evaluation study to accommodate the AES/QF interconnection.
2. Increase in transformer capacity and service conductor size or length.
3. Change or addition of type of service; e.g.
  - a. Single-phase to three-phase.
  - b. Voltage change (120/240 to 240/480, etc.).
4. Line extension or system upgrade for an AES/QF.
  - a. Single-phase line extension to the facility
  - b. Three-phase extension line to the facility
  - c. Reconductoring a circuit to increase current carrying capability

All AES/QF wiring must be in compliance with the National Electrical Code (NEC) and all other applicable codes and ordinances, and must be approved by an electric inspection agency acceptable to the Cooperative. Proper grounding is imperative in ensuring safe operation. NEC Section 250-2005 and IEEE Green Book ANSI C114.1-1973 / IEEE Standard 142-1972 should be referenced.

Any reference in this Policy to a code, standard, regulation, or guideline shall be construed to mean the then-current version of that document.

- C. The interconnection equipment must be of a "fail safe" design to ensure, in the event of any electrical supply or equipment failure, that the AES/QF's and the Cooperative's electric system will be physically separated automatically. To prevent islanding on specific AES/QF applications, a transfer trip scheme may be required. The AES/QF will remain separated until the Cooperative's electric system returns to its normal operating status. The AES/QF will synchronize with the Cooperative's electric system only when the Cooperative electric facilities' voltage and frequency are within acceptable industry tolerances. Adherence to IEEE 1547-2003 relaying guidelines is required.

The AES/QF electric system should be able to withstand all expected electric transients that occur on Cooperative's electric distribution and transmission systems, including outages. For instance, fuse coordination and operation of Cooperative reclosers should not cause damage that would require repair of the AES/QF's electric system. Manual or automatic reset of system protective devices, either by the Cooperative or the AES/QF Owner, is acceptable.

- D. The interconnection equipment must include an approved manual, visible load break safety switch lockable in the open position and be accessible at all times to the Cooperative's personnel. The AES/QF Owner shall agree that the

Cooperative may open the disconnect switch without prior notice for the following reasons:

1. Emergency conditions on the Cooperative's system.
  2. Inspection of the AES/QF by the Cooperative reveals a hazardous condition or lack of proper maintenance of AES/QF facilities.
  3. The AES/QF interferes with electric service to Cooperative Members or with the Cooperative's electric system. Interference may include, but not be limited to: over or under voltage or frequency, harmonics, etc.
  4. Repair work on the Cooperative's system. Where time permits, the Cooperative will attempt to provide advance notice to the AES/QF Owner of imminent disconnection of the AES/QF and the reasons for same.
- E. The AES/QF must be operated so that no adverse effect(s) or power quality issue(s) occur to the Cooperative's electric system or to others connected thereto. If such adverse effect(s) occur, the AES/QF Owner must discontinue operation of the AES/QF and take corrective action(s) at the AES/QF Owner's sole expense, as deemed necessary by the Cooperative, and/or industry standards, including IEEE Standard 1547-2003, IEEE 929-2000, and UL 1741-2001. Adverse effect(s) and power quality issues include, but are not limited to: voltage regulation flicker and/or harmonics.
- F. The AES/QF Owner must inform the Cooperative of any changes to the AES/QF and obtain the Cooperative's approval, in writing, before changes are made to the AES/QF in order to address the adverse effect(s) referred to in Paragraph D above. Prior to reconnecting, the AES/QF Owner must inform the Cooperative of its intent to reconnect.
- G. The AES/QF Owner will own, install and maintain at his expense, all safety and interconnection equipment as specified by the Cooperative. Minimum required interconnection facilities are described in Section B hereto. The Cooperative reserves the right to observe and witness the installation and testing of interconnection facilities pursuant to industry practices, codes, and IEEE Standard 1547-2003, IEEE 929-2000, and UL 1741-2001.
- H. The AES/QF must be installed to meet the C2-2002 National Electrical Safety Code (NESC) or other applicable code requirements for clearances from the nearest Cooperative electric facility, or such other distance as the Cooperative deems necessary for safety or electric operation-related reasons.
- I. The Cooperative or Allegheny reserves the right to inspect the AES/QF and interconnection equipment at any time.
- J. Except for residential consumer-members, the AES/QF Owner must have a current liability insurance policy adequate in amount to cover all forms of liability that may arise from the operation of the AES/QF interconnected to the Cooperative's electric system and the policy should list the Cooperative and Allegheny as additional named insureds. A copy of this policy must be on file

with the Cooperative. Lapse of the policy must be automatically reported to the Cooperative by the insurer, and shall result in the immediate disconnection of the AES/QF from the Cooperative's electric system. In general, a minimum of \$1 Million in liability insurance is suggested, but a more specific amount can be based on the Cooperative's review of the specific AES/QF. Residential consumer-members that are AES/QF Owners are encouraged to maintain a current liability insurance policy adequate in amount to cover all forms of liability that may arise from the interconnection of the AES/QF interconnected to the Cooperative's electric system.

- K. The AES/QF Owner shall agree to hold the Cooperative and/or Allegheny harmless and indemnify the Cooperative and/or Allegheny in connection with any damages or injury affecting any party, resulting from the installation or the interconnection of the AES/QF to the Cooperative's or Allegheny's system, and the purchase of any output from the AES/QF, or operation of the AES/QF. The AES/QF Owner agrees to indemnify the Cooperative and/or Allegheny for any money damages, liabilities, administrative, and/or legal expenses incurred by the Cooperative and/or Allegheny as a result of the failure of the AES/QF Owner's equipment to meet any requirement or condition set forth herein.
- L. The AES/QF Owner shall sell electric energy to Allegheny, pursuant to PURPA or ACT 213-2004 (as applicable) requirements, or upon written notification to Allegheny, to another entity. If another power purchasing entity is selected, a transmission or other charge may apply to wheel or transport the electric power over the Cooperative's or Allegheny's electric facilities.
- M. The AES/QF Owner is responsible for executing a contract with Allegheny to receive compensation for energy and/or capacity delivered into the Cooperative's electric system. At the end of each annual period, Allegheny shall compensate the AES for kilowatt-hours generated by the AES over the amount of kilowatt-hours billed by the Cooperative during the annual period at Allegheny's avoided cost of wholesale power.

Any AES/QF interconnected to a residential account may only be designed to generate no more than 110% of the member's annual electric generation consumption as determined during the 12 months immediately proceeding the year of interconnection and may not have a nameplate capacity greater than 25 kW.

If the account associated with the AES/QF is purchasing electric generation from an alternate electric generation supplier (EGS), the member will not receive credits or compensation from the Cooperative for energy produced by the AES/QF.

Administrative, application and/or service fees may be charged to any account with an interconnected AES/QF to avoid inter-class or intra-class cost shifting as a result of the costs associated with administering an AES/QF.N.

- N. For AES/QF's of 500 kW or less, the attached Rate Schedule applies (Exhibit C).
- O. For AES/QF facilities of more than 500 kW, Allegheny will evaluate the proposed facility and negotiate potential purchase rates, administrative fees and other related costs to prevent intra system cost shifting. Allegheny's purchase of facility output will be based on: (1) Allegheny's avoided costs for contracts with terms of one year or less; or (2) negotiated pricing for contracts with longer terms. If a net metered generator with more than 500 kW in capacity produces generation that results in a 10% or greater reduction in the member's purchase of electricity from the Cooperative compared to the year immediately preceding the interconnection then the member shall be responsible for its share of stranded costs obligation as determined by the Cooperative.
- P. Allegheny may refuse to purchase output from an AES/QF from time-to-time so the Cooperative can (1) construct, install, maintain, repair, replace, remove, investigate, or inspect any of the Cooperative's equipment or any part of the Cooperative's System; or (2) if the Cooperative and/or Allegheny determine(s) that curtailment, interruption, or reduction of deliveries of energy or energy and capacity is appropriate because of emergencies, forced outages, operating conditions on the Cooperative's system, or as otherwise required by industry standard electric practices.
- Q. Synchronous Generators will operate in the lagging VAR area of the capability curve at a power factor recommended by the Cooperative.

Date  
Adopted

September 17, 2013

Attest

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Walter E. Botsford, Secretary

**SULLIVAN COUNTY RURAL ELECTRIC COOPERATIVE, INC.**

**SAFETY & INTERCONNECTION REQUIREMENTS FOR  
ALTERNATE ENERGY PRODUCTION**

**SUPPLEMENT TO POLICY on  
ALTERNATE ENERGY PRODUCTION**

The **SULLIVAN COUNTY RURAL ELECTRIC COOPERATIVE, INC.** (“the Cooperative”) has developed the *POLICY on ALTERNATE ENERGY PRODUCTION* enabling residential and commercial/industrial consumers to safely use electric power generated from non-traditional or renewable resources. Renewable resources, such as photovoltaics and fuel cells, may supplement the consumer’s source of energy.

AES/QF Owners, as defined in the *RURAL ELECTRIC COOPERATIVE, INC., POLICY on ALTERNATE ENERGY PRODUCTION*, can generate electricity for their own use, or for resale, within specific guidelines. AES/QF installations generally are non-utility sources of electric power that are connected to, and can supply power to, the cooperative-owned distribution or transmission system. The AES/QF can be non-consumer-owned, and can be powered either by renewable resources, or by non-renewable resources.

The Cooperative recognizes the various electric industry standards and safety codes as they pertain to Alternative Energy System (AES) or Qualifying Facilities (QF). The standards and codes to be followed include, but are not limited to: Institute of Electronic and Electrical Engineers (IEEE), the Mid-Atlantic Distributed Resource Initiative (MADRI), PJM Interconnection, National Electric Safety Code (NESC), National Electric Code (NEC), National Fire Protection Association (NFPA), Underwriters Laboratories (UL), state, and local entities. Any reference in this Policy to a code, standard, regulation, or guideline shall be construed to mean the then-current version of that document.

At a minimum, the Cooperatives require the use of AES/QF equipment that meets the intent of the IEEE 1547-2003, and/ or IEEE 929-2000, and/ or UL 1741-2001 Standards, and any other current industry standards.

## **GENERAL TECHNICAL REQUIREMENTS**

### **Overview**

The technical requirements for connection of AES/QF will be those necessary to assure the safety and integrity of the Cooperative's electric system, and to maintain the quality and reliability of service to the Cooperative's electrical system or to others connected thereto. If an adverse effect(s) occurs in the sole opinion of the Cooperative, the AES/QF Owner must discontinue operation and take corrective action.

### **Disconnecting Device**

The technical requirements require a lockable disconnecting device, installed at a Cooperative approved location, with an appropriate control and protective scheme that automatically isolates the AES/QF from the utility system for, but not necessarily limited to, the following conditions:

- An electrical or mechanical fault on the AES/QF.
- An electrical or mechanical fault on the Cooperative's electrical system.
- An abnormal operating voltage and/or frequency on either system.
- A separation of the Cooperative's main system from the circuit that is interconnected with the AES/QF.

The reconnection of the AES/QF to the Cooperative distribution system shall not occur until normal system conditions are present.

## **Installation**

The AES/QF units are to be installed in a workmanlike manner. Minimum Interconnection requirements will include, but may not be limited to, meeting or exceeding IEEE 1547-2003 and/ or UL 1741-2001 functionality requirements, or any other code or ordinance listed in this document. Facilities shall be installed to current NFPA 70-2005 codes or applicable electrical/ building codes. Additional operational or equipment requirements may be imposed on the AES/QF depending on the point of connection on the Cooperative's electrical facilities and the impact of the AES/QF on the Cooperatives' system. The Cooperative reserves the right to observe Generator start-up testing procedures to verify the proper system AES/QF interaction, or testing after modifications have been made to the Member's system.

### **Related Information**

Depending on the size of the AES/QF, guidelines established by the PJM Interconnection L.L.C. will need to be followed. The PJM website at [www.pjm.com](http://www.pjm.com) contains details on IEEE 1547-2003, and other interconnection information.

If the electrical output of the AES/QF will be transmitted over the electric system of another entity, the AES/QF may need to meet additional requirements of that entity.

### **Assumptions and Limitations**

IEEE 1547-2003 is not all-encompassing in its coverage of AES interconnections. Limitations and assumptions affecting its application include:

- The assumption that the AES/QF operates at 60 Hz.
- The assumption that the aggregate capacity of the AES is 10 MVA or less at the point of common connection.
- The assumption that IEEE 1547-2003 is focused on the activities of a AES on radial primary and secondary distribution systems.
- The limitation that IEEE 1547-2003 does not address the protection or operating requirements, planning, designing, or maintenance of the distribution system.

## **Monitoring Provisions / Other Communications / Control**

Depending on the intended use and application of the AES/QF, monitoring provisions may be needed. Small units providing supplemental residential power likely will not need monitoring, whereas larger units generating power in excess of local use may require additional metering, or the use of an indicator sent either to the Cooperative or another entity controlling the electric system. The communication capabilities required to coordinate the AES/QF with protective or monitoring devices, may include but not be limited to, a Remote Terminal Unit (RTU), and shall be installed at the AES/QF Owners expense.

Net Metering will require the use of metering equipment, located between the Cooperative's source and the Owner's electrical load, that will measure the flow of electricity from the Cooperative to the Owner. The metering will also measure the flow of electricity supplied by the AES/QF Owner to the Cooperative. These independent meter registers will be used to determine the amount of energy provided to the Cooperative, and will be the basis for potential monthly billing credits.

### **SPECIFIC TECHNICAL REQUIREMENTS – PROTECTION**

- A. Fault protection can be provided by various methods, but must be capable of detecting and clearing faults that can occur in AES/QF and/or Cooperative facilities. Typical schemes are shown in, but are not limited to, Exhibit 1.

- B. Isolation protection is required to immediately and automatically disconnect AES/QF generation from the Cooperative system upon the loss of Cooperative power.

This protection generally can be accomplished by either a synchronous inverter used in DC generation or by applying the following isolation relays:

1. Undervoltage relay which may be time-delayed and instantaneous overvoltage relay.
2. Underfrequency relay where generators equal to or greater than 100 kW are utilized.
3. Overfrequency relay on certain installations.

Typical protection schemes are illustrated in Figures 1 through 5 of Exhibit 1 for Qualifying Facilities of 100 kW or less. Requirements for Qualifying Facilities of greater than 100 kW will be developed on a case by case basis.

- C. AES/QF fault protection must coordinate with Cooperative system protective devices for faults in AES/QF equipment. The Cooperative will provide the characteristics of the protective device with which the AES/QF must coordinate.

All required protection design and associated settings must be provided to and approved formally by the Cooperative prior to connecting AES/QF equipment to the Cooperative system. The following information must be supplied to the Cooperative:

1. One-line relay application diagram.
  2. Connection diagrams showing all external connections to individual components of the protective scheme.
  3. Instruction manuals for all protective components. Component specifications and internal wiring diagrams must be provided If not included in manuals.
  4. Generator data - equivalent impedances, time constants, etc. required to analyze fault contributions and load current flows.
  5. All protective equipment ratings.
- D. All relay settings for isolation protection must be coordinated and consistent with Cooperative equipment.
  - E. Maintenance for required fault and isolation protection must be performed and documented by the AES/QF Owner at specified intervals and specifications established by the equipment manufacturer or at intervals otherwise acceptable to the Cooperative.

- F. A lockable, manually operable, visible load-break disconnecting device is required for all AES/QF interconnections. The device will be installed at a Cooperative-approved and accessible location.
- G. The AES/QF will contain or employ a disconnecting device to automatically isolate the AES/QF generation from the Cooperative system when the Cooperative's circuit is either partially energized or fully de-energized. The disconnecting device also must be blocked from closing in on a partially energized or a de-energized Cooperative circuit.
- H. The Cooperative has the right, as required, to inspect all required protective equipment associated with the AES/QF interconnection.
- I. The AES/QF is responsible for properly synchronizing the Facility's generation with the Cooperative system.
- J. The AES/QF is responsible for providing a phase protection device on three-phase generators that will prevent damage to the generator or the Cooperative's system or Cooperative Members' equipment due to the loss of energy in any phase of a poly-phase system.
- K. The AES/QF electrical system should be able to withstand any and all electrical transients that occur on Cooperative's electrical distribution and transmission systems, including but not limited to, voltage surges, sags, swells, and outages. For instance, fuse coordination and operation of Cooperative reclosers should not cause damage that would require repair of the AES/QF's electrical system. Manual or automatic reset of system protective devices, either by the Cooperative or the AES/QF Owner, is acceptable.
- L. It is acknowledged that AES/QF technologies, such as fuel cells and wood powered steam turbines, continue to evolve. While the latest industry standard may not be specifically listed in this document, the Cooperative expressly reserves the right to use the latest industry standards in the interconnection evaluation process for any AES/QF technology.
- M. Additional resources on protection systems:
- ANSI/IEEE Std 1001-1988 "IEEE Guide for Interfacing Dispersed Storage and Generation Facilities with Electric Power Systems."
  - PJM "Small Generator (2 MW or less) Technical Requirements and Standards."
  - NFPA 70-2005 National Electric Code. *Note: Attention is directed to Article 250 – Grounding and Bonding.*

- IEEE Green Book – ANSI C114.1-1973/IEEE Std 142-1972 “IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems.”
- IEEE Orange Book – ANSI/IEEE Std 446-1980 “IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications.”

## **PROJECT REVIEW**

Additionally, to ensure that other Cooperative Members’ electric service is not negatively affected by one (or more) operating AES/QF units, the Cooperative will perform a technical review of the AES/QF unit. The review process should reveal potential problems prior to the operation of the AES/QF, as well as provide a cost estimate for the necessary work to accept AES/QF generation. Any cost of studies associated with the proposed installation of a AES/QF shall be borne by the AES/QF Owner.

The Cooperative, however, reserves the right to reevaluate the continued operation of the AES/QF if any actual or potential safety, quality, or reliability issues arise or occur. Any corrective actions recommended by the Cooperative or its agent must be implemented at the AES/QF Owner’s expense. This may include termination of the operation of one or more AES/QF units interconnected on the same line section.

## **RESPONSIBILITY**

It shall be the responsibility of the AES/QF Owner to design and operate a system adequate to meet the technical requirements generally set forth above and to assure reliability of the protection scheme as predicated by the design and location of Member generation. In addition, this protection must be compatible with Cooperative system protective devices. Paralleling Member generation with the Cooperative system will be permitted only upon obtaining formal Cooperative approval in advance.

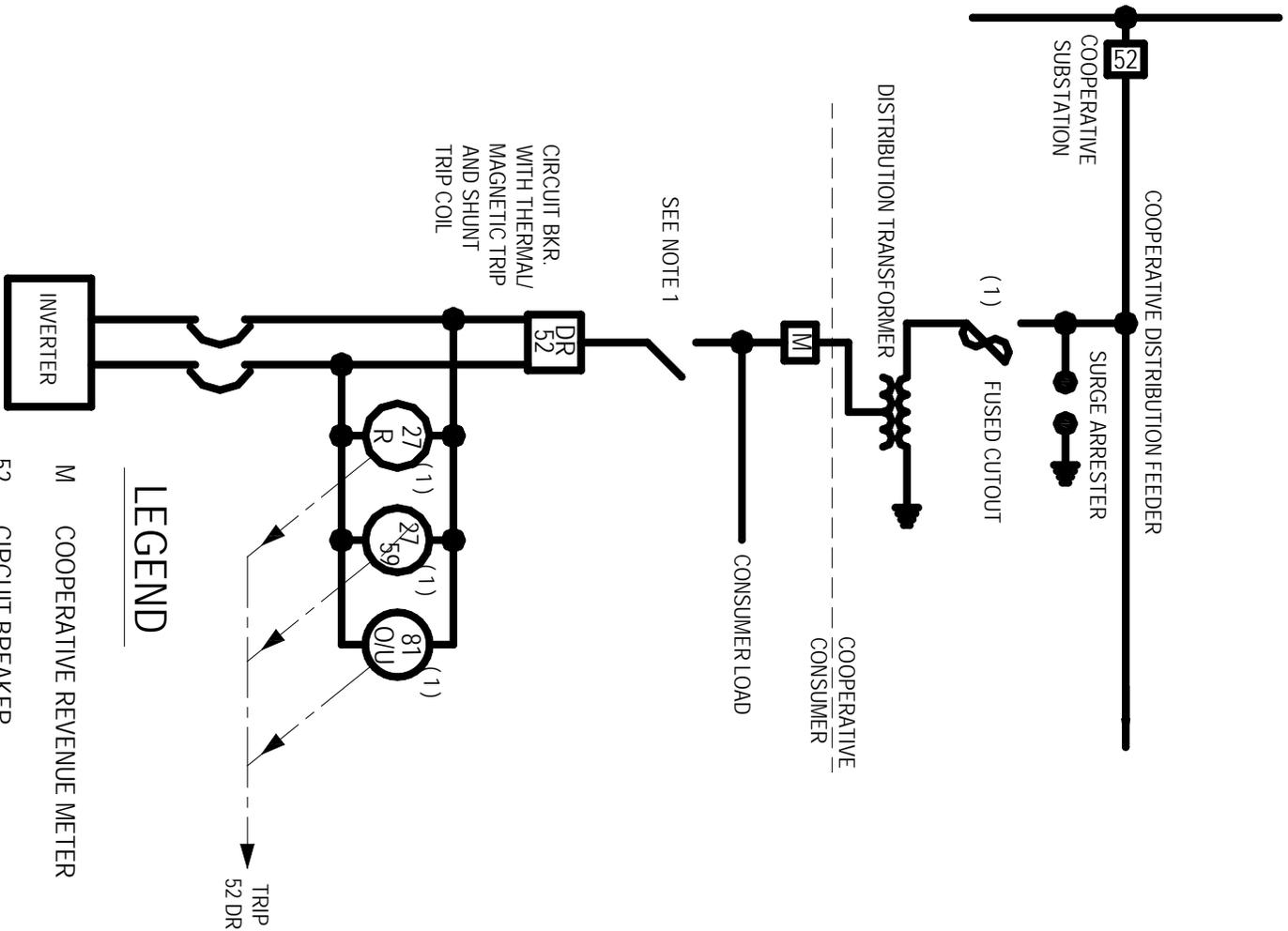
The AES/QF Owner is solely responsible for providing adequate protection for his equipment.

## EXHIBIT 1

### GENERAL PROTECTION REQUIREMENTS

#### Figure

- 1 Protection for a three-phase synchronous generator
- 2 Protection for a single-phase induction generator
- 3 Protection for a three-phase induction generator
- 4 Protection for a single-phase inverter
- 5 Protection for a three-phase inverter



SEE NOTE 1

**LEGEND**

- M COOPERATIVE REVENUE METER
- 52 CIRCUIT BREAKER
- 27R INSTANTANEOUS UNDERVOLTAGE RELAY
- 27/59 TIME UNDER/OVER VOLTAGE RELAY
- 81 O/U OVER/UNDER FREQUENCY RELAY

NOTE:

1. SWITCH MUST BE PADLOCKABLE AND AVAILABLE TO THE COOPERATIVE AT ALL TIMES

Revisions  
RFG 1/9/06

ALLEGHENY ELECTRIC COOPERATIVE

Harrisburg, Pennsylvania

Drawn: DRF

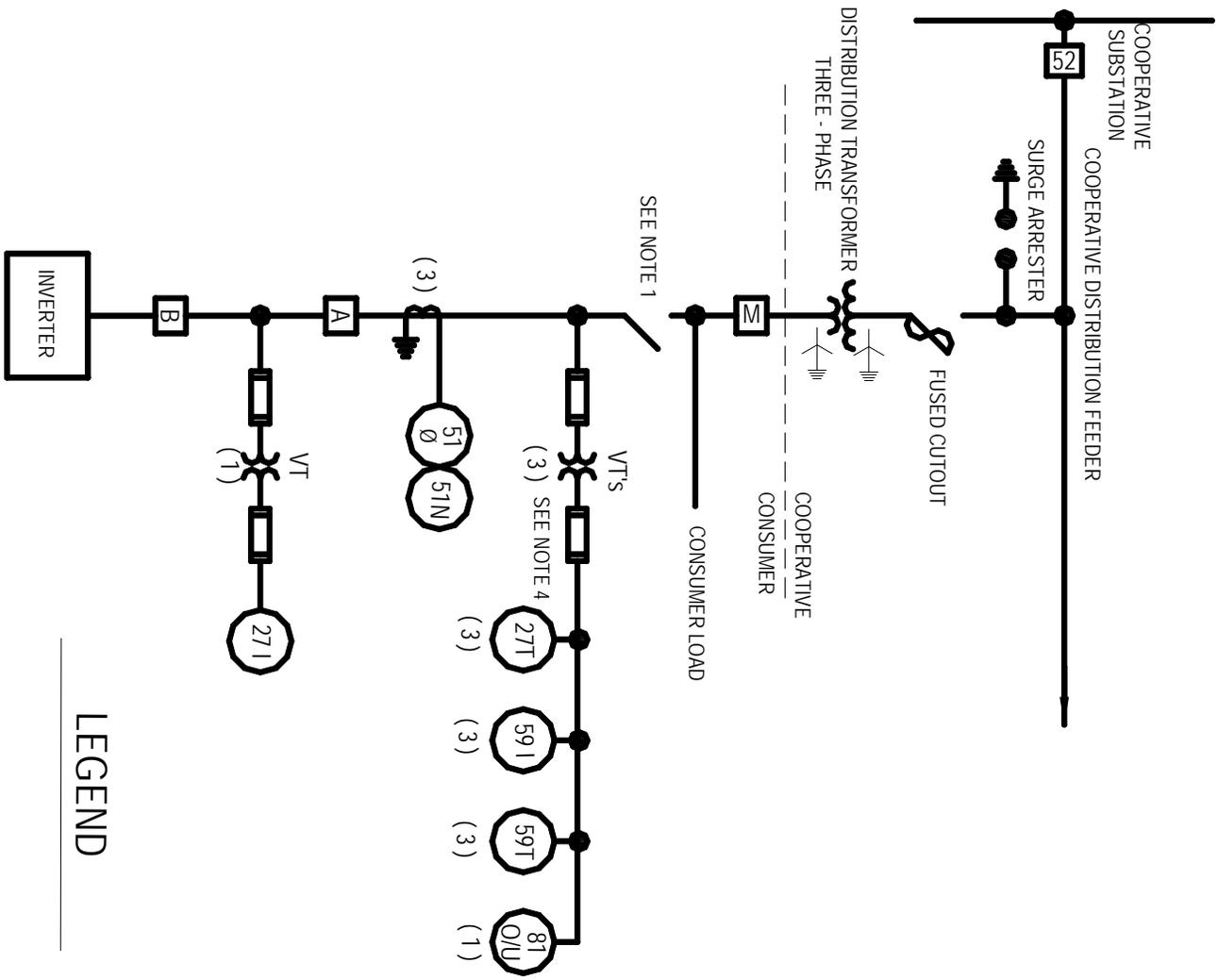
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Approved: BH

Date: 11-03-05

TYPICAL PROTECTION  
EXAMPLE FOR SINGLE  
PHASE INVERTER

Dwg. No. CCS - IPD - 01



- NOTE:
1. SWITCH MUST BE PADLOCKABLE AND AVAILABLE TO THE COOPERATIVE AT ALL TIMES
  2. ALL PROTECTIVE RELAYING TRIPS BREAKER A
  3. SOURCE BEHIND INVERTER CAN BE BATTERY, FUEL CELL, PV OR OTHER DC SOURCE, POWER CONDITIONING SHOULD BE DONE BEFORE INVERTER
  4. IF GENERATION IS LESS THAN 100 KW USE ONE EACH OF 27T, 591, 59T AND ONE VT

**LEGEND**

- 27 I INSTANTANEOUS UNDERVOLTAGE
- 27T TIME UNDERVOLTAGE
- 51 TIME OVERCURRENT - PHASE
- 51N TIME OVERCURRENT - GROUND
- 52 CIRCUIT BREAKER
- 59 I INSTANTANEOUS OVERVOLTAGE
- 59T TIME OVERVOLTAGE
- 81 O/U OVER / UNDER FREQUENCY
- M COOPERATIVE REVENUE METER

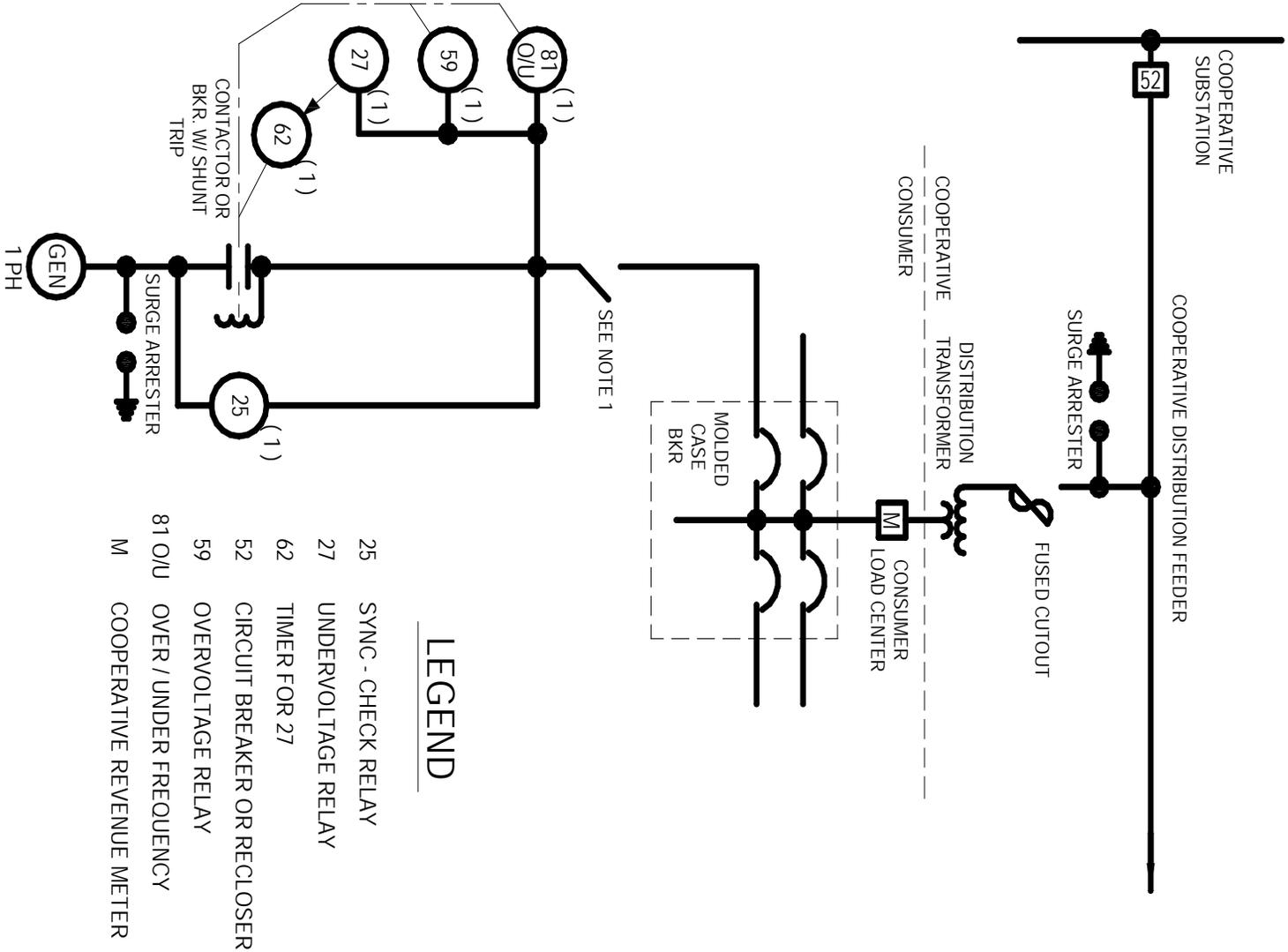
TYPICAL PROTECTION  
EXAMPLE FOR 3 - PHASE  
INVERTER WITH WYE GROUND -  
WYE GROUND TRANSFORMER

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Drawn: DRF  
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Approved: BH  
Date: 11-03-05

ALLEGHENY ELECTRIC COOPERATIVE  
Harrisburg, Pennsylvania

Revisions  
RFG 1/9/06



**LEGEND**

- 25 SYNC - CHECK RELAY
- 27 UNDERVOLTAGE RELAY
- 62 TIMER FOR 27
- 52 CIRCUIT BREAKER OR RECLOSER
- 59 OVERVOLTAGE RELAY
- 81 O/U OVER / UNDER FREQUENCY
- M COOPERATIVE REVENUE METER

NOTE:

1. SWITCH MUST BE PADLOCKABLE AND AVAILABLE TO THE COOPERATIVE AT ALL TIMES

Revisions  
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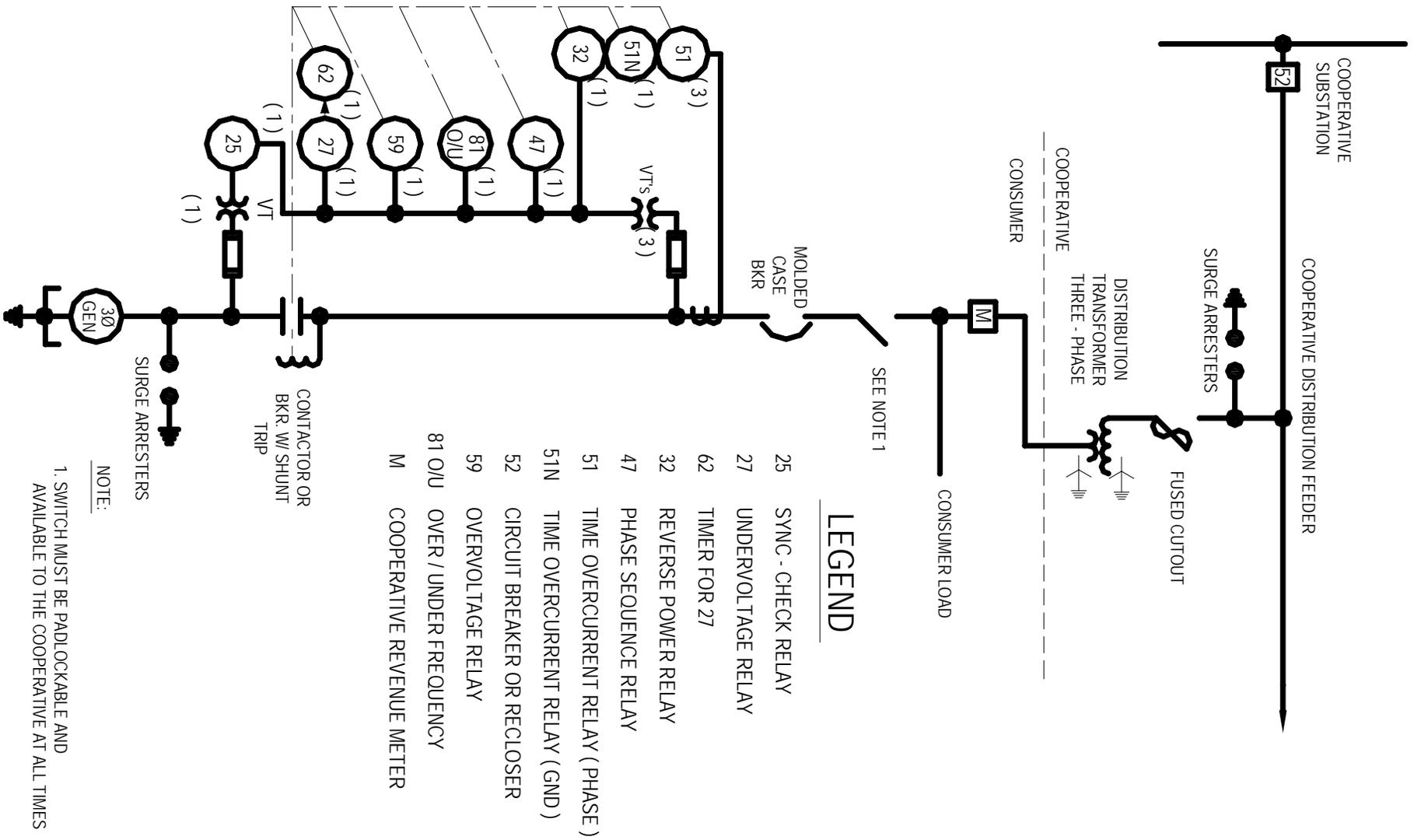
ALLEGHENY ELECTRIC COOPERATIVE

Harrisburg, Pennsylvania

Drawn: DRF  
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 Approved: BH  
 Date: 11-03-05

TYPICAL PROTECTION  
 EXAMPLE FOR SINGLE PHASE  
 INDUCTION GENERATOR

Dwg. No. CCS - IPD - 03



**LEGEND**

- 25 SYNC - CHECK RELAY
- 27 UNDERVOLTAGE RELAY
- 62 TIMER FOR 27
- 32 REVERSE POWER RELAY
- 47 PHASE SEQUENCE RELAY
- 51 TIME OVERCURRENT RELAY (PHASE)
- 51N TIME OVERCURRENT RELAY (GND)
- 52 CIRCUIT BREAKER OR RECLOSER
- 59 OVERVOLTAGE RELAY
- 81 O/U OVER / UNDER FREQUENCY
- M COOPERATIVE REVENUE METER

**NOTE:**

1. SWITCH MUST BE PADLOCKABLE AND AVAILABLE TO THE COOPERATIVE AT ALL TIMES

Revisions  
RFG 1/9/06

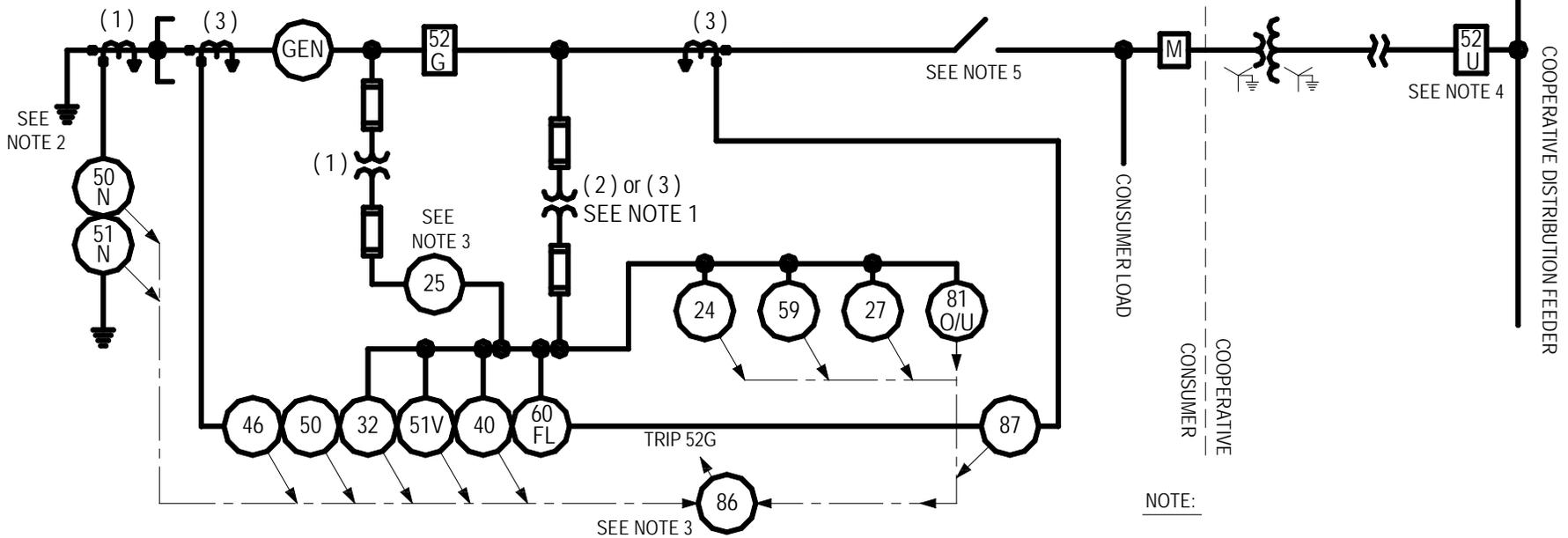
**ALLEGHENY ELECTRIC COOPERATIVE**

Harrisburg, Pennsylvania

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 Approved: BH  
 Date: 11-03-05

TYPICAL PROTECTION  
EXAMPLE FOR THREE - PHASE  
INDUCTION GENERATOR

Dwg. No. CCS - IPD - 04



## LEGEND

M	COOPERATIVE REVENUE METER	51N	TIME OVERCURRENT GROUND RELAY
PROTECTIVE RELAYS			
24	VOLTS / HZ RELAY	51V	VOLTAGE CONTROLLED TIME OVERCURRENT RELAY
27	UNDERVOLTAGE RELAY	59	OVERVOLTAGE RELAY
32	REVERSE POWER (ANTI - MOTORING ) RELAY	60FL	FUSE LOSS DETECTION RELAY
40	LOSS OF FIELD RELAY	81 O/U	OVER / UNDER FREQUENCY RELAY
46	NEGATIVE SEQUENCE OVERCURRENT RELAY	86	LOCKOUT RELAY
50	INSTANTANEOUS OVERCURRENT RELAY	87	DIFFERENTIAL RELAY
50N	INSTANTANEOUS OVERCURRENT GROUND RELAY	CONTROL RELAYS :	
		25	AUTOMATIC SYNCHRONIZER OR SYNC - CHECK RELAY
		52	BREAKER

### NOTE:

1. VT's CAN BE CONNECTED WYE OR OPEN DELTA
2. GENERATOR GROUNDING SHOWN IS LOW IMPEDANCE, HIGH IMPEDANCE GROUNDING CAN BE USED IF DESIRED
3. RELAYING DEVICES SHOWN ARE ALL PART OF A MULTI - FUNCTION RELAY EXCEPT FOR DEVICES 25 AND 86. FUNCTIONS CAN BE INCREASED OR DECREASED AS DICTATED BY THE PARTICULAR APPLICATION
4. IF 52U IS RECLOSING CIRCUIT BREAKER, RECLOSING SHOULD BE SUPERVISED BY A SYNC - CHECK RELAY ( DEVICE 25 )
5. SWITCH MUST BE PADLOCKABLE AND AVAILABLE TO THE COOPERATIVE AT ALL TIMES

Revisions  
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ALLEGHENY ELECTRIC COOPERATIVE

Harrisburg, Pennsylvania

Drawn: DRF

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Approved: BH

Date: 11-03-05

TYPICAL PROTECTION SCHEME  
FOR SMALL SYNCHRONOUS GENERATOR  
INDUCTION GENERATOR  
< 1 MW

Dwg. No. CCS - IPD - 05