City of Anaheim
Public Utilities Department
Electrical Engineering

Generation Interconnection Standards and Guidelines

July 1, 2020

This generation interconnection standards and guidelines has been reviewed and approved by the Transmission & Distribution and Electric System Planning managers.

Signed: _____

Tony Mai
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Transmission & Distribution Division

Dated: 07/01/2020

Signed: _____

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Electric System Planning Manager
Electric System Planning & Substation
Engineering Division

Dated: July 1, 2020

These standards and guidelines have been prepared by the City of Anaheim's Public Utilities Department. They are available to interested parties for information, planning design, and construction of interconnection facilities for customer generators including microgrids in the City of Anaheim. Copies of this document and information pertaining to other requirements for electrical system interconnection to the City of Anaheim distribution system may be obtained by downloading directly from https://www.anaheim.net/501/Generation-Interconnection or by contacting the Electrical Engineering Division, 201 South Anaheim Boulevard, Suite 701, Anaheim, California 92805 (Phone: 714-765-5156).

This document, in conjunction with other Electrical Engineering Division specifications and construction standards, as well as applicable city, county, state and federal rules and regulations combine to form the standard to which all new interconnecting facilities for customer generation including microgrids, within the City of Anaheim, shall conform.

The effective date of these standards and guidelines and revision dates are indicated on the title page of each document. All requirements of the guidelines are subject to change without notice; therefore, those who are contemplating any venture with the City of Anaheim, which will be regulated by these standards and guidelines, should make sure that they have the most current and latest revision.

The purpose of this document is to standardize equipment and facilities relating to interconnection facilities for both customer-owned and City-owned distributed generation systems within the City of Anaheim. Distributed generation is generally defined as generating sources whose combined gross output is less than 20 megawatts (MW) that is connected to the electric utility system at a single point of interconnection. This document is designed to provide typical standards and guidelines for interconnection facilities for most distributed generation systems including solar, battery storage, gas-fired turbines, fuel cells, reciprocating engines, and microgrids, however, design requirements are subject to adjustment as necessary.

Standards, rules and regulations of other agencies with jurisdiction in areas covered by this document are not altered in any way by these standards and guidelines. Any and all questions regarding applicability of various rules and regulations shall always be resolved in favor of the more stringent requirements.

Modifications and/or deviations to/from the requirements of the standards and guidelines contained in this document must be authorized, in writing, by the Transmission & Distribution and the Electric System Planning managers. No work, which includes modifications to this document, should proceed without this written approval.

Generation Interconnection Standards and Guidelines

1.0 Introduction

These standards and guidelines state the minimum requirements for safe and effective operation of customer-owned and City-owned generation including microgrids on the City of Anaheim Public Utilities electric system. Customers and City personnel shall be guided by this document when planning installations of distributed generation including microgrids that is capable of extended parallel operation with the electric system.

1.1 Policy on Customer Generation

As specified in the City of Anaheim Electric Rates, Rules and Regulations, Rule No. 22, it is the policy of Anaheim Public Utilities Department to permit any customer to operate generating equipment including microgrids in parallel with the electric system whenever this can be done without adverse effects on the general public, or to City equipment or personnel. Certain protective devices (relays, circuit breakers, etc.), specified by the City must be installed at any location where a customer desires to operate generation in parallel with the City system. The purpose of these devices is to promptly disconnect the customer's generating equipment from the City system whenever faults, abnormal, or unsafe operation occur. Other modifications to electrical system configuration or protective relays may be required in order to accommodate parallel generation.

Anaheim Public Utilities Department will not assume any responsibility for protection of the customer's generator(s), or of any other portion of the customer's electrical equipment. The customer is fully responsible for protecting his equipment in such a manner that faults or other disturbances on the City system do not cause damage to the customer's equipment, or adversely affect the customer in any way.

1.2 Generation Sources

The customer may elect to use any of a variety of energy sources including solar, wind, battery storage or other types of sources, in addition to conventional fossil fuels. The end conversion of the connection to the utilities system must be into 60 Hz alternating current.

The customer may elect to run the generator including microgrids in parallel with the utility or as a separate system with the capability of non-parallel load transfer between the two independent sources. The requirements of these two methods of operation are outlined in Sections 1.3 and 1.4.

1.3 Separate Systems

A separate system is defined as one in which there is no possibility of connecting the customer's generating equipment in parallel with the utility's system. For this design to be practical, the customer must be capable of transferring load between the two systems in an open transition or non-parallel mode. This can be accomplished by either an electrically or mechanically interlocked switching arrangement that precludes operation of both switches in the closed position. Separate systems are typically designed as standby or backup emergency generation that serves dedicated loads at the customer facility in the event of an outage, i.e., when there is no electric service from the City.

If the customer has a separate system including microgrids, the City will require verification that the transfer scheme meets the non-parallel requirements. This will be accomplished by approval of drawings by the City in writing and, if the City so elects, by field inspection of the transfer scheme. The City will not be

responsible for approving the customer's generation equipment and assumes no responsibility for its design or operation.

Most Uninterruptible Power Supply (UPS) systems do not specifically meet the separate system criteria. However, if they are not capable of backfeed, they will be classified as a separate system. If they can backfeed, they must meet the requirements of parallel operation.

1.4 Parallel Operation

A parallel system is defined as one in which the customer's generation can be connected to a bus common with the utility's system. A transfer of power between the two systems is a direct and often desired result. A consequence of such parallel operation is that the parallel generator becomes an electrical part of the utility system that must be considered in the electrical protection of the utility's facilities.

Utility lines are subject to a variety of natural and man-made hazards. The electric problems that can result from these hazards require that the damaged equipment be de-energized as soon as possible because of the hazards they pose to the public and to the operation and stability of the utility system.

In systems without parallel generation, the utility controls the only source of power supply to a given line and therefore has the responsibility to install equipment which is adequate, under expected circumstances, to detect faulted equipment and de-energize it. A parallel generator connected to a utility line represents another source of power to energize the line and must also have adequate protective devices installed to sense trouble on the utility system.

For installations with larger generators, the probability of isolated operation is higher since the available generation may be sufficient to carry the entire load of the City's circuit. For these installations, specific devices are required for the detection of short circuits and grounds on the utility system as well as voltage and frequency relays to detect isolated operation.

The general and specific requirements for parallel generation installations of various sizes are discussed in the following sections.

2.0 General Design Requirements

2.1 Design Requirements

2.1.1 The customer's installation must meet all applicable national, state and local construction and safety codes.

a. Major equipment that is not included on the California Energy Commission's eligible equipment lists shall be evaluated for compliance with these interconnection guidelines.

b. It shall comply with the latest requirements of the following standards:

- ANSI/IEEE 1547 Standards for Interconnecting Distributed Resources with Electric Power Systems
- IEEE 1547.1 Standards for Conformance Tests Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems
- UL 1741 and UL 1741-SA Standards for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

- NFPA 70 National Electrical Code (NEC) Standards for the Safe Installation of Electrical Wiring and Equipment
- National Electrical Safety Code (NESC®) Safety Standards for Overhead and Underground Electric Utility and Communications Utility Installations
    - Section 9 Grounding Methods for Electric Supply and Communications Facilities
    - Section 11 Protective Arrangements in Electric Supply Stations

2.1.2 Protective devices (relays, fuses, circuit breakers, ground banks, etc.) for the protection of the City's system, and synchronizing equipment must be installed as required by the City. A producer shall be solely responsible for providing adequate protection of its generating facility. Producer's protective functions shall not impact the operation of other protective functions on the City's system in a manner that would affect the City's capability of providing reliable service to its customers. For all generation systems including inverter based resources, the responsible engineer/consultant shall make sure that work meets all the required safety and government rules and regulations and the correctness of protection. The Substation/Automation/Protection Engineering group will review and approve the protection and SCADA interface requirements only.

2.1.3 Visible, Accessible, Lockable disconnect required. Customer shall furnish and install ganged, manually-operated isolation switch near the point of interconnection to isolate the generator from the City's electric system. The following requirements shall be met:

- The disconnecting device shall allow visible verification that separation of the generator from the City's system has been accomplished. This requirement may be met by opening the enclosure to observe contact separation.

- The disconnecting device shall include markings or signage that clearly indicates open and closed positions.

- During electrical emergencies, it may be required to disconnect the generator from the City's system. Therefore, the disconnecting device shall be capable of being accessed quickly and conveniently 24 hours a day, 7 days a week by City personnel without obstacles or requiring those seeking access to obtain keys, special permission, or security clearances, unless other arrangements for access are mutually agreed upon by both parties.

- The disconnecting device shall be capable of being locked using standard City padlocks in the open position.

- The disconnecting device shall be clearly marked on the submitted one-line diagram and its type and location approved by the City prior to installation.

- The disconnecting device shall be installed in such a location and in such a manner that City personnel will have access under all conditions and at all times.

2.1.4 Metering requirements are subject to the City's approval. Metering equipment must meet EUSERC specifications for service panel equipment and Rule 2 of the Anaheim Public Utilities Electric Rates, Rules and Regulations.

- For Commercial Distributed Generation sites with an output rating of equal to or less than 200Amps, the power production meter requires a commercial type service panel with test blocks

- For Distributed Generation sites with an output rating of more than 200Amps, the power production meter requires a commercial type service panel that is at minimum 400Amps and is Current Transformer (CT) rated.

- Connection to metering equipment from Distributed Generation AC output must be to the top meter clips of the power production meter.

2.1.5 The customer shall provide two (2) sets of preliminary design drawings for initial review by the City, and four (4) sets of final design drawings once all approvals are met. The City may request a title block on the drawings to allow for approval signatures as necessary. Drawings may be submitted in digital format; the City utilizes the latest version of AutoCAD. Design packages shall include:

Mandatory for all distributed generation systems including microgrids:

- Interconnection Application Form

- Interconnection Agreement or Net Energy Metering Agreement

- Single-line diagram

- Site layout diagram, with generating source(s) and safety devices clearly identified

- Description of safety features (mechanical and electrical)

- All electrical elementary/wiring diagrams

Other information as required by the City:

Description of the distributed generation system, electrical parameters, mechanical parameters, operating principles and procedures

- All relay settings and coordination calculations, fuse sizes, breaker settings, and any associated data

- Transformer and cable data

- The design limitation of the excitation system for synchronous generators

- The design of the ground grid system

- The design and application of any solidly grounded transformer

- Certified test reports on all COA-required relays showing relay settings and trip tests to the appropriate circuit breaker. The customer must specify that COA will approve only those portions of the drawings which apply to protection of COA system. The City Electrical Engineering Division may comment on other areas which appear to be incorrect or deficient but will not assume responsibility for the correctness of protection pertaining to the customer's system.

2.2 General Operating Requirements

2.2.1 The interconnection of the customer's generating equipment with the City system shall not cause any reduction in the quality of service being provided to other customers, with no abnormal voltages, frequencies, or interruptions being permitted. If high or low voltage complaints or flicker complaints result from operation of the customer's generation, such generating equipment shall be disconnected until the problem is resolved.

2.2.2 The customer may not commence parallel operation of generator(s) until the City has reviewed the design submittal and given final written approval. The City reserves the right to inspect the customer's facility and witness testing of any equipment or devices associated with the interconnection.

2.2.3 Customer shall comply with all the terms of the applicable Interconnection Agreement or the Net Metering Agreement.

2.2.4 The customer will not be permitted to energize a de-energized utility circuit.

2.2.5 Operation of the customer's generator shall not adversely affect the voltage regulation of the City's system. Adequate voltage control shall be provided, by the customer, to minimize voltage regulation on the system caused by changing generator-loading conditions.

2.2.6 The customer shall maintain his equipment in good order. The City reserves the right to inspect the customer's facilities whenever it appears that the customer is operating in a manner hazardous to the City system's integrity.

2.2.7 The customer shall discontinue parallel operation when requested by the City:

a. To facilitate maintenance, test, or repair of utility facilities.

b. During system emergencies.

c. When the customer's generating equipment is interfering with other customers on the system.

d. When an inspection of the customer's generating equipment reveals a condition hazardous to the City system or a lack of scheduled maintenance or maintenance records for equipment necessary to protect the City system.

2.2.8 When required, and typically for larger generators (>1,000 kW), the customer shall maintain an operating log at each generating facility indicating changes in operating status (available or unavailable), maintenance outages, trip indications or other unusual conditions found upon inspection. For generators that are "block-loaded" to a specific kWh level, changes in this setting shall also be logged.

2.2.9 The City typically requires separate metering for distributed generation systems. The cost of the metering shall be at the expense of the Customer. In most cases, the Customer may be required to establish a new service account for the generating system. Contact Customer Service to establish a new service account.

2.3 Design Information – The City System

2.3.1 The City's primary distribution voltage is 12 kilovolts (kV), 4-wire, effectively grounded system (phase to neutral connected loads), and subtransmission voltage is 69 kV, 3-wire, delta system. The customer should contact the Utility for information on the specific circuit serving the customer's facility.

2.3.2 Because most short circuits on overhead lines are of a temporary nature, it is the City's practice to reclose the circuit breakers on such lines within a few seconds after they have automatically tripped. This practice improves continuity of service to all customers. Protection specified by the City for parallel generation interconnection is intended to disconnect the generation from faulty or isolated lines before reclosing occurs.

Should the customer desire additional protection against the possibility that reclosing might occur with his generator still connected to the line (a potentially damaging occurrence for synchronous generators), the City can provide "Hot Line Reclose Blocking" at the necessary points on the system. The City's preference is to avoid such equipment because of the possible adverse effects on service continuity and the problems of moving or rearranging the equipment to accommodate system changes. Costs for installing, maintaining, and/or rearranging such equipment will be borne by the customer(s) requesting the equipment.

2.3.3 Customers with three-phase generators should be aware that certain conditions in the Utility system might cause negative sequence currents to flow in the generator. It is the sole responsibility of the customer to protect his equipment from excessive negative sequence currents.

2.3.4 In projects where the customer is served from a four-wire, multi-grounded neutral distribution circuit, adequate grounding must be provided to ensure neutral stability during accidental isolation of the line from the main system. This is necessary to avoid dangerous overvoltages on other customers served from phase-to-neutral connected distribution transformers. Adequate grounding can be provided either by the use of a wye-delta main power transformer, or by installing an appropriate grounding transformer. In order to limit the effects of such grounding on the City's ground relay sensitivity, the City may require that the grounding impedance be limited to the highest value suitable for neutral stabilization.

2.4 Induction Generators

Reactive power supply for induction generators may pose difficult design problems, depending on the generator size. For generator aggregating less than 100 kVA capacity, the City will supply the var requirements from general system sources without a specific charge to the customer. Installations over 100 kVA capacity will likely require capacitors to be installed to limit the adverse effects of reactive power flow on the City's system voltage regulation. Such capacitors will be installed at generating customer's expense. The installation of capacitors for reactive power supply at, or near, in induction generator greatly increases the risk that the induction machine may become self-excited if accidentally isolated from the City's system. Where self-excitation problems appear likely, special service arrangements will be required such as two-line loop service or subtransmission service in order to avoid the induction generator becoming isolated with small amounts of load. In many cases, the additional expense for such special service methods may outweigh the cost savings associated with induction generators.

In cases where starting of, or load changing on, induction generators will have an adverse impact on system voltage, step-switched capacitors or other techniques may be required to bring the voltage changes to acceptable levels.

2.5 Synchronous Generators

For synchronous generators, sufficient generator reactive power capability shall be provided to withstand normal voltage changes on the City system. The generator voltage-var schedule, voltage regulator, and transformer ratio settings will be jointly determined by the City and the customer to ensure proper coordination of voltages and regulator action. Customers are encouraged to generate their own var requirements to minimize power factor adjustment charges and enhance generator stability. When the City installs capacitors to meet the var requirements of the system resulting from the customer's generator, the customer shall pay all costs of labor and associated costs incurred by the City in completing such installation.

Synchronous generator installations require a three-phase ground bank on the City system for sensing ground faults. The ground bank will be furnished and installed by the City at the Customer's expense.

2.6 Inverter Systems

Reactive power supply requirements for inverter systems are similar to those for induction generators and the general guidelines discussed in Section 2.4 apply. Likewise, inverter systems are also capable of isolated operation.

Self-commutated inverters have this capability of design. Line commutated inverters could operate isolated if connected to rotating machines which provide the necessary commutation. Because of these possibilities of self-excited operation, inverter systems are treated as induction machines in these guidelines.

If a customer using such a device is found to be adversely affecting the power quality of other customers or the utility, the Customer shall be required to install filtering to bring the harmonic output of his inverter to acceptable levels.

2.7 Microgrids

Microgrid comprises a set of interconnected loads and distributed generating resources within clearly defined electrical boundaries that can operate in parallel (grid connected) with or separated (island mode) from the City's electric system. Depending on the types of distributed resources (synchronous, induction, or inverted based resources) utilized within the microgrid, additional reactive power requirements may be required in order to maintain unity power factor at the point of interconnection. Microgrid customers/developers have three (3) options of interconnection with the City's electric system:

1. Non-export parallel operation – microgrid normally operates in parallel with the City's system and provides energy to its own load, and does not always export power to the grid.

2. Isolated operation – microgrid normally operates on "isolated operation mode" and disconnected from the City's system with provisions for an open transition back to and from the grid or momentary parallel operations.

3. Net Energy Metering (NEM) parallel operation with paired storage – microgrid with qualified renewable generation normally operates in parallel with the grid and provides energy to its own load or exporting energy to the grid applying applicable NEM tariff provisions. The current NEM rate schedule can be downloaded from here https://www.anaheim.net/DocumentCenter/View/1252/Developmental-Net-Energy-Metering-PDF?bidId=.

3.0 Specific Requirements

The city has established three different classes for customer-owned parallel generation, each with distinctive protection, metering and operating requirements. These classes are:

1. Less than or equal to 100 kW

2. Greater than 100 kW and less than 1,000 kW

3. Greater than 1,000 kW, with customer-owned protection

Where multiple generators are connected to the City's system through a single service point, the class will be determined by the sum of the ratings of the generators.

It should be understood that these classes have been established for convenience and are based on urban/suburban circuits with normal load density. The final decision as to the requirements for each installation will be made depending on customer load, the magnitude of other load connected to that circuit/system, available short circuit contribution, etc.

3.1 Total Generation Less Than Or Equal To 100 kW

3.1.1 The following requirements for small generators are based on an assumed low density of parallel generation customers on the serving circuit. Other conditions may be imposed should the density exceed a tolerable limit. **Refer to Figure A and/or D.**

3.1.2 Customer generator controls to be equipped with a line voltage relay or contactor that will prevent the generator from being connected to a de-energized or single-phased (if normally three-phase) source. This relay is to disconnect the generator from a de-energized utility line and prevent its reconnection until the City reenergizes the line.

3.1.3 Specific site or technology conditions may have additional requirements.

3.2 Total Generation Greater Than 100 kW And Less Than 1,000 kW

3.2.1 Customer generator controls to be equipped with a line voltage relay or contactor that will prevent the generator from being connected to a de-energized or single-phased (if normally three-phase) source. This relay is to disconnect the generator from a de-energized utility line and prevent its reconnection until the City reenergizes the line.

3.2.2 Customer is to be served through a dedicated distribution transformer that serves no other customers. The purpose of the dedicated transformer is to ensure that the generator cannot become isolated with a small amount of other customer load. It also serves to confine any voltage fluctuations or harmonics produced by the generator to the customer's own system. In instances where it is impractical to provide a dedicated transformer, the relays may be accepted in lieu of the dedicated transformer. The relays may be arranged to de-energize the contactor. **Refer to Figure B and/or D.**

3.2.3 In order to reduce the possibility of self-excited operation, all reactive power requirements for induction generators or power inverters shall be supplied by the City. Except in an unusual situation, this var supply will be from general utility sources and no specific charge will be made to the customer for the reactive power.

3.2.4 Existing kWh meters may be equipped with a ratchet device, or equivalent, to prevent reverse operation. Where surplus power sales are anticipated, the City will install additional metering so that kWh (in) and kWh (out) are separately recorded. Additional metering for kW and kVAR will be determined by the requirements of the individual installation.

3.3 Total Generation Greater Than 1,000 kW, With Customer-Owned Protection

3.3.1 All installations in this class require City review of the protective functions to be provided. **Refer to Figure C for a typical installation.** Note that certain requirements regarding liability and indemnity may apply to installations using customer-owned protection, which shall be defined in an Interconnection Agreement.

3.3.2 The customer shall provide adequate protective devices to:

a. Detect and clear the generator(s) from short circuits or grounds on the City facilities serving the customer.

b. Detect the voltage and frequency changes, which can occur if the City facilities serving the customer are disconnected from the system, and clear the customer generation from the isolated system.

c. Prevent re-paralleling the customer generation, after an incident of trouble, unless the City service voltage is of normal magnitude and phase sequence.

3.3.3 Typical protection devices which may be required to satisfy the above requirements are:

a. Phase overcurrent trip devices (Device 51).

   In some cases, these will have to be voltage-restrained or voltage-controlled overcurrent relays in order to provide coordination with the City's relays.

b. Residual overcurrent or overvoltage relays to trip for ground faults on the City's system (Devices 51N or 59N).

c. Under/overvoltage relays (Device 27/59).

   Undervoltage relays should be adjustable from 75-90% of nominal voltage and have time delay to prevent unnecessary tripping on external faults. Overvoltage relays should be adjustable from 110-120% of nominal voltage and may be instantaneous. Setting change with temperature variation should not exceed ± 2 volts over the expected temperature range.

d. Under/over frequency relays (Device 81).

   The underfrequency relay should be adjustable from 55-59 Hz and the overfrequency relay from 61-65 Hz. Setting change with temperature variation over the expected range, or voltage variation over ± 10%, should not exceed ± 1 Hz.

e. Phase sequence/undervoltage relay (Device 47/27).

   To permit paralleling when the City's voltage and phase sequence are normal.

f. Synchronizing relay (Device 25)

   To permit parallel operation, and to synchronize with the City's system.

3.3.4 In specific installations, particularly with large generators (over 1,000 kW), the City may require specific additional protective functions such as loss of excitation, loss of synchronism and overexcitation protection, if these conditions would have an impact on the City system.

3.3.5 Depending on the size of the generation and the size of the distribution or subtransmission system to which it is connected, the City may require the customer to utilize "utility quality" protective relays, which are subject to the City's approval. Such relays have more stringent tolerances and more flexible, widely published characteristics than "industrial quality" relays. This requirement can be invoked only if generation is of such size that close coordination with the City relays is required. In general, installations aggregating less than 1,000 kVA will not be subject to this requirement.

3.3.6 Where induction generators or static inverters are employed rather than synchronous machines the phase overcurrent protective devices required by the City will be waived since these sources will not deliver sustained overcurrents.

3.3.7 In some cases, protective devices supplied with the generating equipment will meet some or all of these requirements, provided that it is capable to trip the generator whenever the City source is lost. If the customer desires to automatically separate from the City and commence isolated operation upon loss of the City source, additional devices will be necessary to affect the separation.

3.3.8 All protective devices supplied to satisfy these requirements shall be equipped with operation indicators (targets) or shall be connected to an annunciator or event recorder so that it will be possible to determine, after the fact, which devices caused a particular trip.

3.3.9 All protective devices supplied to satisfy these requirements shall be tested by qualified personnel at intervals at least as frequent as those used by the City for the relays protecting the line(s) serving the customer. This interval is currently four years for lines of 12.4kV and below. Lines traversing fire hazardous areas are required to have their relays tested annually before May 1st. Special tests may also be requested by the City to investigate apparent misoperations or to have a record of the performance for anticipated litigation.

Each routine or special test shall include both a calibration check and the actual trip of the circuit breaker from the device being tested. For each test a report shall be prepared and sent to the City listing the tests made and the "as found" and "as left" calibration values.

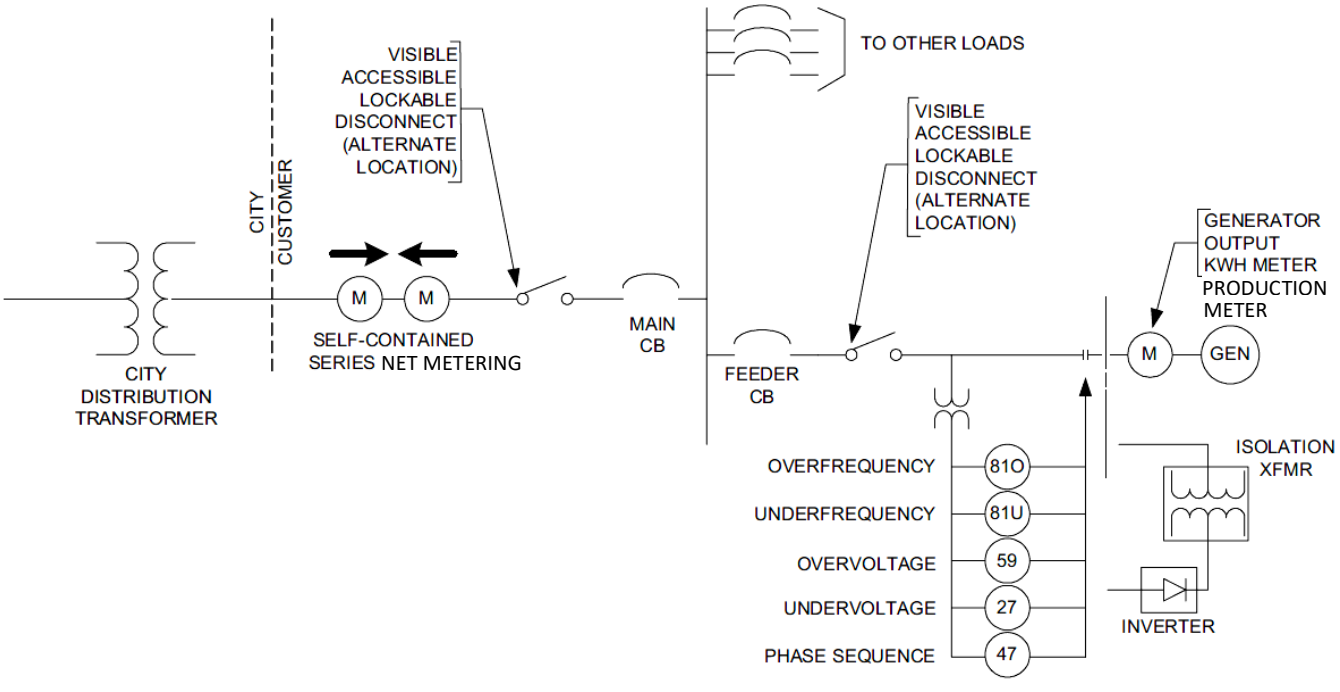
3.3.10 Projects where the customer is served from the City's four-wire multi-grounded neutral distribution circuit, adequate grounding must be provided to ensure neutral stability during any isolation of the line from the main system. This is necessary to avoid dangerous overvoltages on other customers served from phase-to-neutral connected distribution transformers. Adequate grounding can be provided either by the use of a wye-delta main power transformer or by installing an appropriate grounding transformer. In order to limit the effects of such grounding on the City's ground relay sensitivity, the City may require that the grounding impedance be limited to the highest value suitable for neutral stabilization.

3.3.11 Installations where surplus power sales are anticipated and for all simultaneous buy and sell arrangements, the City will install appropriate metering. Generators that export power to the City, with the exception of Net Metered accounts, must execute a separate power sales agreement with the City.

3.3.12 Telemetering equipment at the Generator Metering location may be required at the Producer's (and Customer's) expense. The City shall only require Telemetering to the extent that less intrusive and more cost effective options for providing the necessary data in real time are not available.

FIGURE A

CUSTOMER GENERATION INSTALLATION
(CONCEPTUAL ILLUSTRATION, NOT FOR DESIGN)
LESS THAN 100 KW



NOTES:

1. ALL MAJOR EQUIPMENT MUST BE INCLUDED ON THE CEC'S ELIGIBLE EQUIPMENT LISTS.

2. AN ISOLATION TRANSFORMER SHALL BE REQUIRED TO INTERFACE THE ENERGY SOURCE TO THE SERIES METERING EQUIPMENT FOR THREE-PHASE SYSTEMS, AND MAY BE REQUIRED FOR SINGLE-PHASE SYSTEMS AS DETERMINED BY THE UTILITY.

3. THE CUSTOMER SHALL PROVIDE, INSTALL, AND MAINTAIN THE INDICATED ENERGY SOURCE DISCONNECT EQUIPMENT.

4. THE CUSTOMER SHALL BE RESPONSIBLE FOR THE PROTECTION OF HIS EQUIPMENT AGAINST FAULTS OR OTHER SYSTEM DISTURBANCES.

5. THE VISIBLE, ACCESSIBLE, LOCKABLE DISCONNECTION DEVICE SHALL BE INSTALLED IN SUCH A LOCATION AND IN SUCH A MANNER THAT CITY PERSONNEL WILL HAVE ACCESS UNDER ALL CONDITIONS AND AT ALL TIMES. THE DEVICE SHALL BE CAPABLE OF BEING LOCKED IN THE OPEN POSITION USING STANDARD CITY LOCKS.

6. CUSTOMER MAY BE REQUIRED TO PROVIDE VOLTAGE AND FREQUENCY PROTECTION FOR GRID TIE CONNECTION IN INVERTER CIRCUITRY (REFER TO SECTION 2.5 – INVERTER SYSTEMS IN THIS GUIDLINE).

7. NET METER AND PRODUCTION METER SHOULD BE LOCATED IN SAME AREA; NET METER AND PRODUCTION METER SHALL BE LOCATED NO MORE THAN 5 FEET APART UNLESS APPROVED BY ANAHEIM PUBLIC UTILITIES.

8. NO CONNECTIONS ARE ALLOWED ON THE LINE SIDE OF THE NET METER AND/OR BETWEEN THE NET METER AND THE MAIN BREAKER.

FIGURE B

CUSTOMER GENERATION INSTALLATION
(CONCEPTUAL ILLUSTRATION, NOT FOR DESIGN)
BETWEEN 100 - 1,000 KW

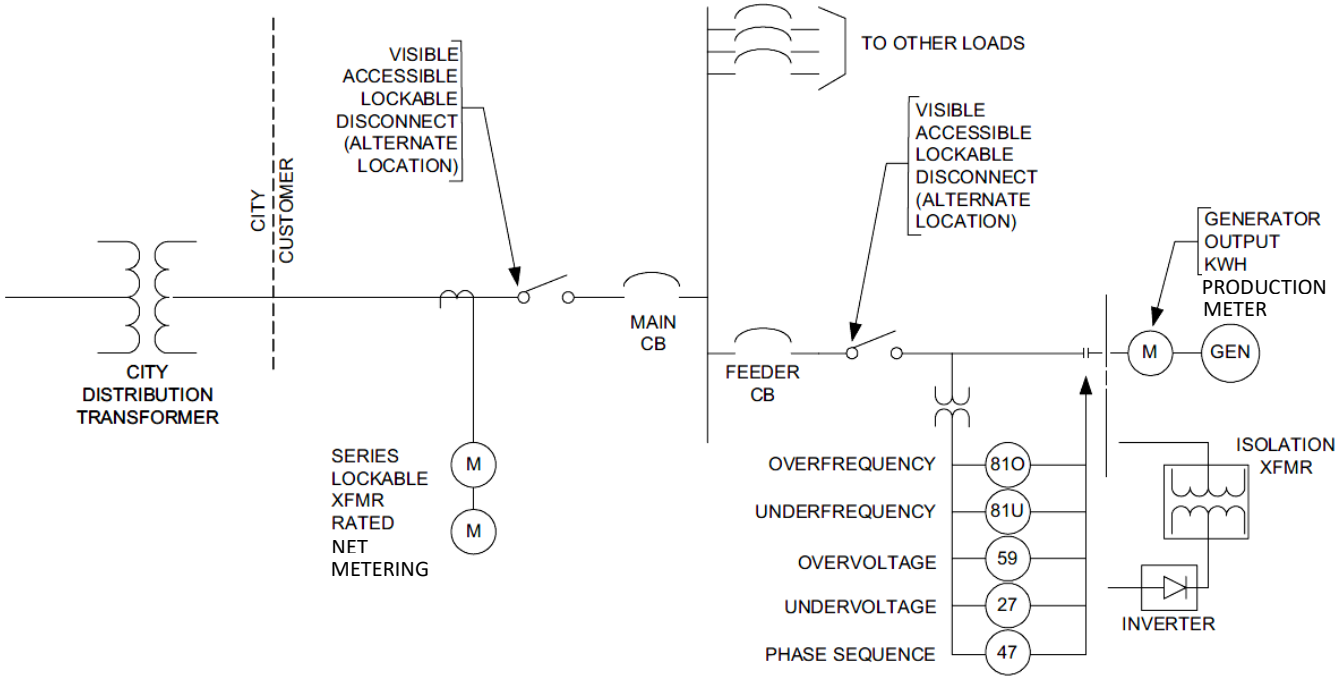


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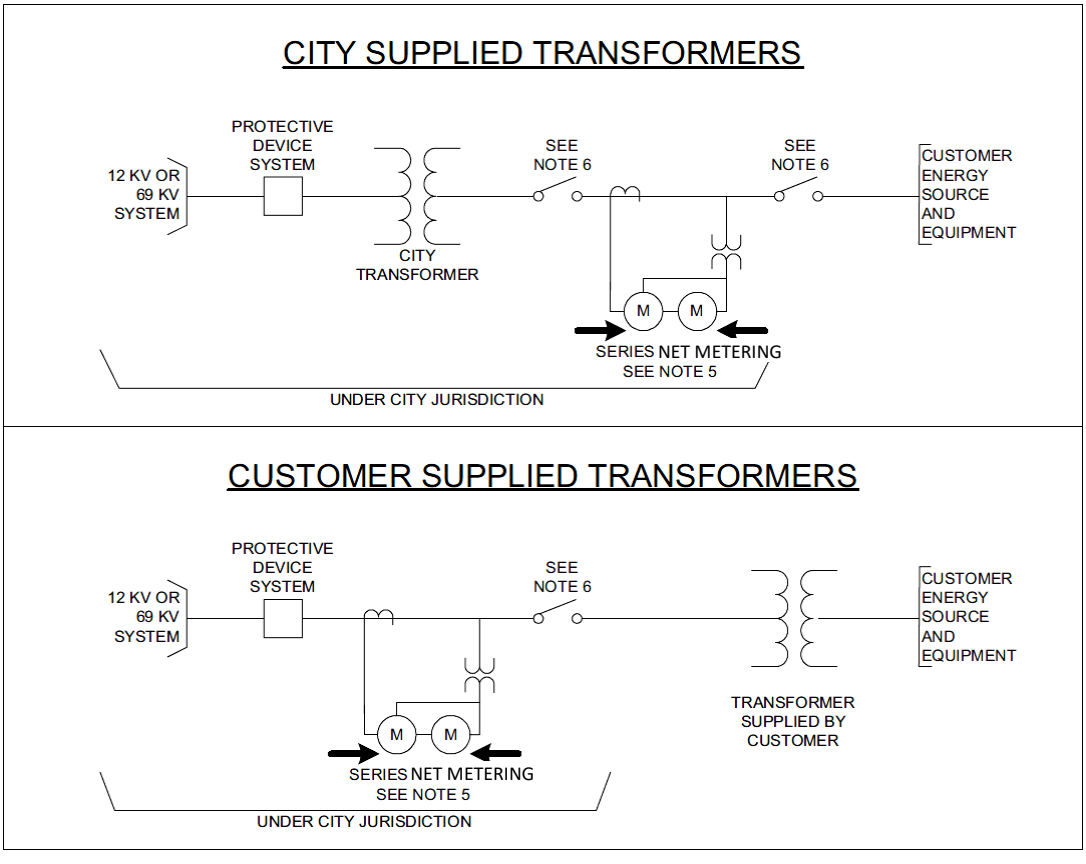
FIGURE C

CUSTOMER GENERATION INSTALLATION
(CONCEPTUAL ILLUSTRATION, NOT FOR DESIGN)
1,000 KW AND OVER



NOTES:

1. ALL MAJOR EQUIPMENT MUST BE INCLUDED ON THE CEC'S ELIGIBLE EQUIPMENT LISTS.

2. AN ISOLATION TRANSFORMER SHALL BE REQUIRED TO INTERFACE THE ENERGY SOURCE TO THE SERIES METERING EQUIPMENT FOR THREE-PHASE SYSTEMS, AND MAY BE REQUIRED FOR SINGLE-PHASE SYSTEMS AS DETERMINED BY THE UTILITY.

3. THE CUSTOMER SHALL BE RESPONSIBLE FOR THE PROTECTION OF HIS EQUIPMENT AGAINST FAULTS OR OTHER SYSTEM DISTURBANCES.

4. ALL ENERGY SOURCE PROTECTION SCHEMES SHALL BE DESIGNED TO BE COMPATIBLE WITH THE CITY EQUIPMENT PROTECTION SCHEMES.

5. METERING REQUIREMENTS ARE SUBJECT TO THE CITY'S APPROVAL.

6. THE CITY SHALL REQUIRE THAT THE CUSTOMER PROVIDE SUITABLE FACILITIES ON CUSTOMER PROPERTY FOR THE CITY TO INSTALL CABLE TERMINATIONS, DISCONNECTS, CIRCUIT BREAKERS AND TRANSFORMERS.

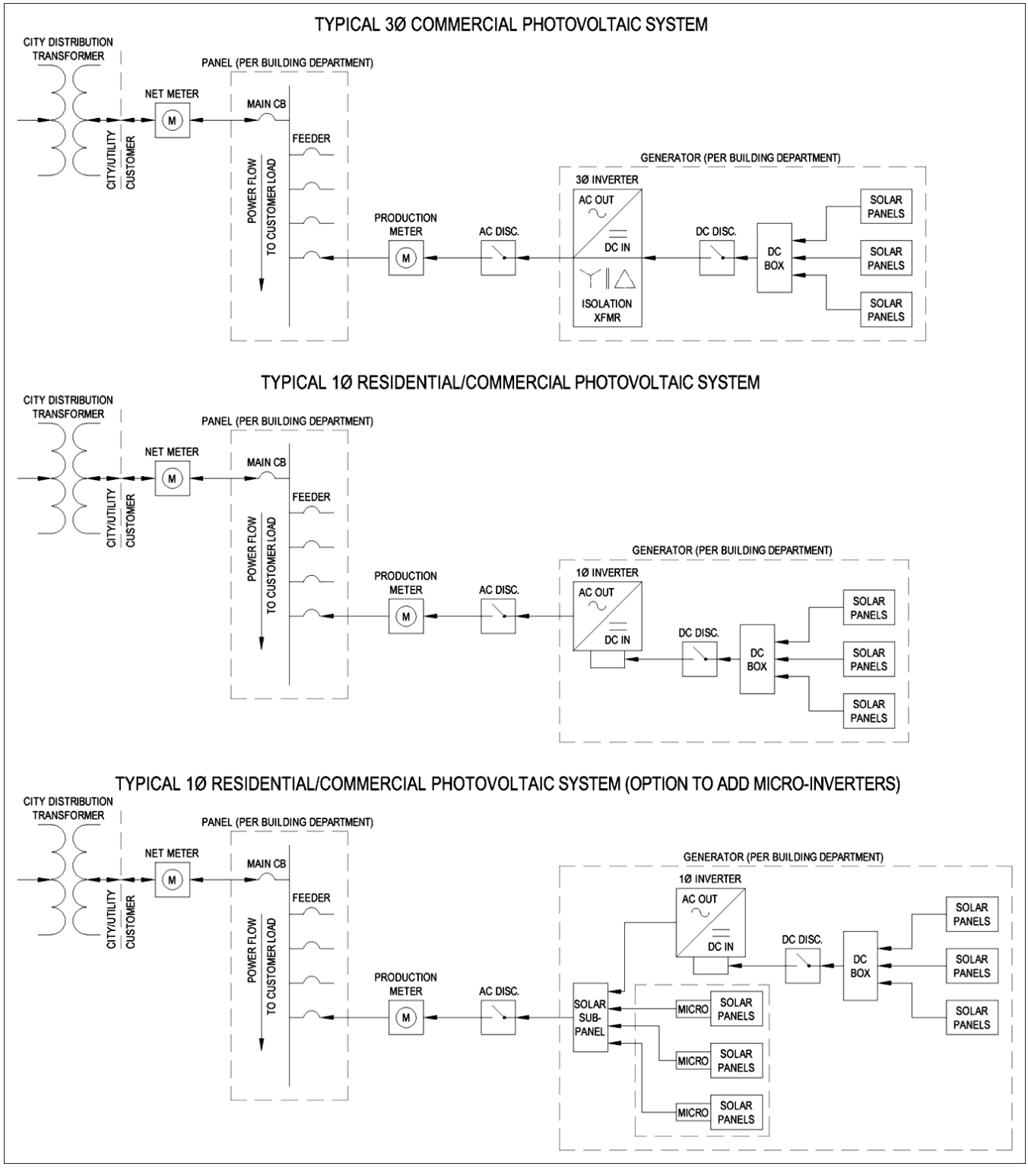
7. THE VISIBLE, ACCESSIBLE, LOCKABLE DISCONNECTION DEVICE SHALL BE INSTALLED IN SUCH A LOCATION AND IN SUCH A MANNER THAT CITY PERSONNEL WILL HAVE ACCESS UNDER ALL CONDITIONS AND AT ALL TIMES. THE DEVICE SHALL BE CAPABLE OF BEING LOCKED IN THE OPEN POSITION USING STANDARD CITY LOCKS.

8. NET METER AND PRODUCTION METER SHOULD BE LOCATED IN SAME AREA; NET METER AND PRODUCTION METER SHALL BE LOCATED NO MORE THAN 5 FEET APART UNLESS APPROVED BY ANAHEIM PUBLIC UTILITIES.

9. NO CONNECTIONS ARE ALLOWED ON THE LINE SIDE OF THE NET METER AND/OR BETWEEN THE NET METER AND THE MAIN BREAKER.

FIGURE D

CUSTOMER GENERATION INSTALLATION
(CONCEPTUAL ILLUSTRATION, NOT FOR DESIGN)
PHOTOVOLTAIC SOLAR ELECTRIC SYSTEM



NOTES:

1. ALL MAJOR PHOTOVOLTAIC SOLAR ELECTRIC SYSTEM COMPONENTS, INCLUDING PV MODULES AND INVERTERS MUST BE INCLUDED ON THE CEC'S ELIGIBLE EQUIPMENT LISTS.

2. THE CUSTOMER SHALL PROVIDE, INSTALL, AND MAINTAIN THE INDICATED ENERGY SOURCE DISCONNECT EQUIPMENT.

3. THE CUSTOMER SHALL BE RESPONSIBLE FOR THE PROTECTION OF HIS EQUIPMENT AGAINST FAULTS OR OTHER SYSTEM DISTURBANCES.

4. THE VISIBLE, ACCESSIBLE, LOCKABLE AC DISCONNECT DEVICE SHALL BE INSTALLED IN SUCH A LOCATION AND IN SUCH A MANNER THAT CITY PERSONNEL WILL HAVE ACCESS UNDER ALL CONDITIONS AND AT ALL TIMES. THE DEVICE SHALL BE CAPABLE OF BEING LOCKED IN THE OPEN POSITION USING STANDARD CITY LOCKS.

5. CUSTOMER MAY BE REQUIRED TO PROVIDE VOLTAGE AND FREQUENCY PROTECTION FOR GRID TIE CONNECTION IN INVERTER CIRCUITRY (REFER TO SECTION 2.5 – INVERTER SYSTEMS IN THIS GUIDLINE).

6. POWER PRODUCTION METERING REQUIREMENTS ARE SUBJECT TO THE CITY'S APPROVAL. CUSTOMER SHALL FURNISH AND INSTALL METERING PANEL FOR THE POWER PRODUCTION METER. CHECK WITH ELECTRICAL ENGINEERING (714) 765-5156 OR WITH METER SHOP (714) 765-6858 FOR TYPE OF METER PANEL/SOCKET.

- FOR COMMERCIAL SOLAR ENERGY SITES WITH AN OUTPUT RATING OF EQUAL TO OR LESS THAN 200A, THE POWER PRODUCTION METER REQUIRES A COMMERCIAL TYPE SERVICE PANEL WITH TEST BLOCKS

- FOR SOLAR ENERGY SITES WITH AN OUTPUT RATING OF MORE THAN 200A, THE POWER PRODUCTION METER REQUIRES A COMMERCIAL TYPE SERVICE PANEL THAT IS AT MINIMUM 400AMPS AND IS CT RATED.

- ALL SERVICE PANELS MUST MEET ELECTRIC UTILITY SERVICE EQUIPMENT REQUIREMENTS COMMITTEE (EUSERC) SPECIFICATIONS FOR SERVICE PANEL EQUIPMENT.

- CONNECTION TO METERING EQUIPMENT FROM DISTRIBUTED GENERATION AC OUTPUT MUST BE TO THE TOP METER CLIPS OF THE POWER PRODUCTION METER.

7. NET METER AND PRODUCTION METER SHOULD BE LOCATED IN SAME AREA; NET METER AND PRODUCTION METER SHALL BE LOCATED NO MORE THAN 5 FEET APART UNLESS APPROVED BY ANAHEIM PUBLIC UTILITIES.

8. NO CONNECTIONS ARE ALLOWED ON THE LINE SIDE OF THE NET METER AND/OR BETWEEN THE NET METER AND THE MAIN BREAKER.