Generator Interconnection Supplement

To

DTE Energy Generator

Interconnection Requirements

Contents

DTE ELECTRIC SYSTEM OPERATION

Electric System Operation Overview

The DTE Energy electric system is comprised of two classes of distribution voltages, sub-transmission and distribution, that are served by an ITC-owned transmission system. ITC operates at voltage levels of 345 kV, 230 kV and 120 kV. These voltages are stepped down at sub-transmission stations to sub-transmission voltages of 120 kV, 41.6 kV and 24 kV. The DTE Energy sub-transmission system has a radial 120 kV component and looped 41.6 kV and 24 kV components that provide reliable mid-voltage power to the distribution substations. DTE Energy distribution voltages are 13.2 kV, 8.32 kV, and 4.8 kV. For the most part, the distribution system is a radial system, however, some loops exist throughout the system.

120 kV, 41.6 kV and 24 kV System Planning and Operation

The sub-transmission system is used to transmit power and energy from transmission stations to step-down substations, to permit the exchange of power between the system and neighboring utilities, and to accommodate such inadvertent or loop flow power as may occur due to interconnected operations of others. The sub-transmission system is designed so that reasonably foreseeable normal and contingency conditions do not result in equipment damage or loss of load in a major portion of the system. The sub-transmission system meets all requirements of the National Electric Safety Code. Planning studies to evaluate projected shutdown conditions (a single element shutdown plus a single element forced contingency) are evaluated at a load level not exceeding 87% of peak load. The sub-transmission system thermal capacity will be planned to serve a peak load occurring on a day with 83F mean temperature (corresponding to a 50 percent probability of occurrence). Reactive power supply will be planned to serve a peak load occurring on a day with 85F mean temperature (corresponding to a 25 percent probability of occurrence).

The sub-transmission system is designed to withstand the forced outage of any single element. The single contingency should not result in the loss of load except for tapped substations or when bus voltages are involved. The sub-transmission system shall not be designed to withstand the forced outage of two system elements at peak load.

120kV, 41.6 kV and 24 kV System Relaying

The sub-transmission system is protected by a variety of directional and non-directional relays for phase and ground fault protection. This approach allows rapid detection and isolation of faults and other disturbances while minimizing the effect on the overall system. Phase fault protection for the 41.6 kV and 24 kV systems is provided by overcurrent relays. These relays have both inverse-time-overcurrent characteristics and instantaneous overcurrent elements. The operation of these relays is, in some cases, supervised by impedance relays to provide the directional logic and to allow their settings to be optimized for the detection of faults while limiting their response to normal system load conditions. Ground fault detection for the 41.6 kV and 24 kV systems is provided by directional and non-directional overcurrent ground relays. The design of these relays is optimized for ground fault detection, and includes the necessary design characteristics to provide the directional control. Both inverse-time-overcurrent and instantaneous characteristics are present in these relays. The settings for the relaying at 41.6 kV and 24 kV are meticulously determined using fault studies representing a wide range of possible system conditions. Motor operated air-break switches are widely used in the 41.6 kV lines. These switches are not usually capable of breaking any magnitude of current, and open automatically after a time delay for dead line conditions, and may automatically reclose to isolate only the minimum portion of the system. Automatic reclosing is widely used in the 41.6 kV and 24 kV systems. Depending on the location and whether any motor-operated air-break switches are employed, each end of a line may reclose as many as three times.

120 kV, 41.6 kV, 24 kV Operation Synopsis

There are specific rules that DTE Energy follows regarding safety on the 120 kV radial, 41.6 kV and 24 kV systems. These rules work to protect the public and utility workers from potential hazards associated with high voltage systems. Those who wish to add generators to DTE Energy's systems must not create any safety hazards in the sub-transmission systems or detract from the safety of the existing system.

In general, DTE Energy does not perform maintenance on the 41.6 kV and 24 kV systems during heavy electric load periods. The 41.6 kV and 24 kV systems are sometimes reconfigured to minimize equipment loading and customer interruption should an unplanned outage occur during regular maintenance periods. Due to this potential impact on generator operations, system configuration during maintenance periods should be evaluated by potential generators when selecting connection configurations to the 41.6 kV and 24 kV systems.

13.2 kV, 8.3 kV and 4.8 kV Planning and Operation

The distribution system provides electric service from the distribution substation to the customer's metering point. The high voltage part of the distribution circuit (13.2 kV, 8.3 kV and 4.8 kV) is referred to as the "primary" and any lower voltage is referred to as the "secondary". The distribution circuit is designed to provide adequate electric service to the customer in an economical and reliable manner. The 4.8 kV circuits are three phase, three wire, ungrounded delta design. The 8.3 kV and 13.2 kV circuits are three phase, four wire, grounded wye designs. The maximum design capacity of a circuit is based on industry and company design standards. The capacity for a 13.2 kV circuit is 10 MVA while 8.3 kV and 4.8 kV circuits are limited by cable size and voltage.

The distribution system is permitted to accept anticipated day-to-day overloads. The allowable loading on a distribution transformer is 110% of its day-to-day rating and 100% of its emergency rating. The allowable loading on a distribution overhead or underground wire is 115% day-to-day rating and 100% of its emergency rating.

The general guidelines for the distribution system state that projects required to replace equipment that is unsafe to operate and presents a hazard should be implemented. Projects required to connect new customers and committed increases in load at existing customers should proceed. Also, the relocation of Detroit Edison facilities on public property required by federal, state, or local governmental units should proceed. DTE Energy performs all necessary emergency retirement unit changeout projects such as those projects brought by storm damage and failure of equipment.

Distribution circuits are designed so that the short circuit ratings of Detroit Edison equipment are not exceeded. Distribution circuits are designed to meet power quality and reliability needs. The number of times that a customer's service is interrupted and the length of those interruptions must be considered in establishing the reliability of the customer service. The service reliability criteria defines reasonable limits of this frequency and duration which an average customer may experience without hardship. A distribution circuit is considered poor performing and should be evaluated for possible modifications if the outage duration in a given year is over 180 minutes or the number of outages is over 4.

13.2 kV, 8.3 kV, 4.8 kV System Relaying

The distribution system is protected by a variety of three-phase and single-phase hydraulic reclosers, and fuses. The three-phase reclosers are usually equipped with electronic recloser controls that allow some flexibility to adjust the sensitivity. The single-phase reclosers are generally designed with a specific sensitivity, and must be replaced if a different sensitivity is needed. These protective systems automatically disconnect any portion of the system that becomes faulted, while minimizing the portion of the system isolated. The fault must not be allowed to exist for more than a predetermined period of time. The sensitivity of the protective devices must also allow normal load to be served without interruption. The reverse power flow conditions that generators are capable of producing must be evaluated to ensure proper coordination is not compromised. Reclosers automatically open to isolate faults. They typically reclose three times and may reclose in less than one second.

13.2 kV, 8.3 kV, 4.8 kV System Synopsis

There are specific rules that DTE Energy follows regarding safety on the 13.2 kV, 8.3 kV and 4.8 kV systems. These rules work to protect the public and utility workers from potential hazards associated with high voltage systems. Those who wish to add generators to DTE Energy's systems must not create any safety hazards in the sub-transmission systems or detract from the safety of the existing system.

DTE PROTECTION SYSTEMS

Protection Systems

Natural hazards (lightning, wind), human interference (automobiles, vandalism) and equipment malfunction can cause damage to the distribution system. Damage to equipment can result in short circuits referred to as faults by the utility. When faults occur they create a safety hazard for personnel, jeopardize the stability of the entire electrical network and impose severe damage to the faulted equipment. Protection systems are installed by the utility to minimize the effects of faults. All of the electrical equipment that comprises a utility network is protected by protection systems.

The Effect of Parallel Generation on System Protection

Generation connected in parallel with the distribution system has the potential to create two problems for the utility. One, it provides an additional energy source that increases fault current magnitudes. This additional fault current can interfere with the operation of the existing protective devices on the distribution system. Secondly, the generation can become isolated from the utility while still tied to a portion of the utility's system. This condition is referred to as islanding and is an unacceptable mode of operation. In order to prevent these problems from adversely affecting the utility, studies must be performed to determine a solution. This may require modifications to the existing system.

When modifications are required to the existing protection system, the extent of this modification is dependent upon both the size of the generation and the electrical characteristic of the utility's system at the point of common coupling. A relatively simple protection system may be required for a small generator that will never export power into the utility, while a more complex, high-speed scheme may be required for larger generators that will export power. In most cases the utility will require the customer-owned generation to have protective systems at the point of common coupling. These relays will serve to protect the utility's electrical system. It remains the Customer's responsibility for protecting customer-owned equipment from damage in the event of recloser operation, system faults, lightning strikes or any other disturbance on the Detroit Edison System.

Reclosing of Detroit Edison Supply Lines

The majority of faults on an overhead distribution line are transient in nature. Tree branches blown into wires cause a momentary fault as do lightning-induced flashover of insulators. By quickly de-energizing the line and then automatically re-energizing or reclosing it, the fault is usually cleared and the line is returned to service. The industry uses automatic reclosing of overhead lines as an effective way to improve the reliability of service to customers. When successful, a customer will only see a momentary interruption of power due to a recloser operation instead of a sustained outage if no automatic reclosing was used.

Effects of Automatic Reclosing on Parallel Generation

Generating equipment connected to distribution lines can experience severe damage during automatic reclosing. This occurs as the tie between the generator and the utility is re-established with the two entities out of synchronism. A system disturbance created by this event may result in a safety hazard and/or damage to both the utility and it's customer's facilities. When it is determined that automatic reclosing could lead to equipment damage and a possible safety hazard involving the Detroit Edison System or other customers, Detroit Edison will require the installation of supplemental protective equipment.

REVENUE METERING REQUIREMENTS

Revenue Metering Requirements

Metering of the output of each customer-owned generator may be needed. If required, instrument transformers and metering will be provided by Detroit Edison. When practical, multiple generators may be metered at a common point provided that the metered quantity represents only gross generator output. For sell-back arrangements, special interconnection revenue metering will be required in addition to the generator metering. The Customer shall provide, at a location approved by Detroit Edison, a suitable place for the Detroit Edison owned, operated, and maintained metering equipment. Normally the metering equipment is a stock item for Detroit Edison, but at times this equipment must be ordered and may have a substantial delivery time. It is in the best interest of the Customer to contact Detroit Edison early in the design stage to avoid any delays due to metering equipment arrival. The Customer shall provide authorized employees and agents of Detroit Edison access to the premises at all reasonable hours to install, turn on, disconnect, inspect, test, read, repair or remove the metering equipment. The Customer may, at its option, have a representative witness this work. The metering installation specifications are outlined in the Design Requirements section of this guideline.

DTE APPROVED RELAYS

Approved Relays

(For use as protection of the Detroit Edison System at independently owned generation facilities)

UTILITY GRADE

Items

1. • Under & Over/Underfrequency (81U & 81O/U)
   - Basler BEl-81
     BEI-81 O/U
2. • Undervoltaqe (27)
   - General Electric IAV54
   - ABB CV-2
     CVD*
3. • Overvoltage (59)
   - General Electric IAV51
     PJV
   - ABB CV-4
     SV-1
4. • Zero Sequence Overvoltage (N-59)
   - General Electric PJV
   - ABB SV-1
5. • Primary Neutral Overcurrent (N-A51)
   - General Electric IAC53
   - ABB CO-8
6. • Voltage Restraint Time Overcurrent (51V).
   - General Electric IJCV
7. • Reverse Power (32)
   - Basler BEI-32R* (30 or 10)
     BEl-32 ON
   - ABB H3*
8. • Timing (62)
   - General Electric SAM
   - ABB TD-5
9. • Transfer Trip

INDUSTRIAL GRADE

Items

10. • Reverse Power (32)

Basler	BE4-32 (10)*

11. • Timing (62)

Agastat	7000 Series

* Requires separate time delay relay

Note: The exact model or style of the above listed relays will be dependent upon the particular site-specific application, or Detroit Edison specification.

POWER QUALITY

Voltage Flicker Limits

Distribution Flicker Limits

The normal operating characteristics of equipment such as motors, welders and electric furnaces can cause abrupt changes in supply and voltage. Repetitive abrupt voltage change (fluctuating voltage) is defined as voltage flicker. A fluctuating voltage will cause lights to flicker, which may become objectionable to customers. Because of this, flicker limits are established to limit the amount of flicker one customer can impose upon another, and to inform the customer of these limits prior to the installation of their equipment. The limits in Table 1.0 will maintain the flicker at an acceptable level for the majority of people.

TABLE 1.0

Distribution Flicker Limits in Volts on a 120 Volt Base							
Location	**Very Infrequent**	**Infrequent**	**Frequent**	**Very Frequent**	**Extremely Frequent**	**Cyclic**	**Residential A/C**
Substation Bus; or Distribution Circuit Primary	10.0	6.0	3.0	2.0	2.0	0.5	3.0
Power Line [1] Primary	10.0	8.0	6.0	4.0	4.0	0.5	-
Distribution [2] Circuit Secondary							
A. Customer Causing Flicker	10.0	6.0	6.0	4.0	3.0	0.5	9.0
B. Customer Not Causing Flicker	10.0	6.0	5.0	3.0	2.0	0.5	6.0
Detroit Edison does not impose flicker limits on customer-owned buses or systems (≤10% recommended).							

1. These limits refer to a power line that serves multiple customers. If the power line serves only one customer, no flicker limitation other than the customer requirements and the limits that apply at the substation bus.
2. These limits are measured at the customer's metering point.

Notes and Definitions

Very Infrequent Flicker includes cases occurring once per day or motor starts for storm pumping.

Infrequent Flicker includes cases occurring 6 times or less in 24 hours, but not more than once between 1800 hr. and 2400 hr. This provision is intended to cover apparatus such as motor generators, fans, pumps, etc., which normally run continuously throughout the working day, and capacitors being turned on and off.

Frequent Flicker includes cases occurring not more than 3 times per hour, except that they shall not occur more than once per hour between 1800 hr. and 2400 hr. This provision is intended to cover apparatus such as machine tools, electric resistance furnaces, etc., which are periodically started and stopped throughout the working day.

Very Frequent Flicker includes cases occurring not more than once per minute on the average and will include all, except rapidly and regularly recurring flickers. This provision is intended to cover such apparatus as elevator motors, automatic pumps, ice machines, etc., which start frequently, but in general are not regularly recurring several times a minute.

Extremely Frequent Flicker includes cases occurring more often than one per minute, but at a rate of less than once per second. This provision is intended to cover such apparatus as flashing signs, spot welders, gravel pit hoists, and certain electric arc furnaces which are frequently and repeatedly stopped and started or have rapidly fluctuating loads during normal cycle use.

Cyclic Flicker includes cases occurring rapidly and regularly at a rate in excess of once per second. This provision is intended to cover such apparatus as seam and pulsation type welders, reciprocating compressors, and certain large electric arc furnaces which exhibit load fluctuations occurring at a cyclic rate. Prior to 1977 cyclic flicker limits were governed by the curve shown in Figure 2.1 on page 70-2-4, titled Cyclic Flicker Limits. Cyclic flicker can be extremely annoying and dependent on the frequency of operation of equipment. In 1997 the cyclic flicker limits were changed to 0.5 volts on a 120 volt base, both for distribution and subtransmission lines.

Residential Air Conditioners are not to exceed four (4) starts per hour.

Subtransmission Flicker Limits

The normal characteristics of industrial equipment such as large motors, welders, and electric furnaces can cause short duration current flow magnitudes on the subtransmission system of several times the steady-state flow. The resultant short duration voltage disturbances are referred to as voltage flicker. The allowable flicker limits on the subtransmission level at the point of common coupling with other customers is defined in Table 2.0.

TABLE 2.0

Subtransmission Flicker Limits in Volts on a 120 Volt Base					
Location	**Infrequent**	**Frequent**	**Very Frequent**	**Extremely Frequent**	**Cyclic**
120 kV Buses	1.0	1.0	1.0	1.0	0.5
120 kV Lines	1.0	1.0	1.0	1.0	0.5
24 or 40 kV Buses	1.5	1.0	1.0	1.0	0.5
24 or 40 kV Lines	3.0	1.5	1.5	1.5	0.5
There are no Detroit Edison imposed flicker limits on customer-owned buses or systems (≤10% recommended).					

DEFINITION OF TERMS

<u>Acceptance Test for Service</u>

Perform a series of field tests on a newly installed relay scheme to prove its acceptability for service. The sequence of tests includes phasing of current, potential and control circuits; meggering (500V d.c.) and hipotting (1000V a.c.) to verify the quality of insulation of the current, potential and control wiring; confirming the ratio and deriving the saturation characteristics of current transformers; calibrating relays; determining minimum operating levels of auxiliary control relays; and performing functional tests to verify that the relay scheme actually operates as intended and that the proper relay operation indicators (targets) are obtained.

Detroit Edison shall perform such tests only on the relaying and control required for protection of the Detroit Edison System.

<u>Applicant</u>

A customer or entity who intends to apply or has applied to Detroit Edison for interconnection.

<u>Area Control Error</u> (ACE)

The mismatch (in megawatts) between generation and load for a particular geographical area. The figure also accounts for interchange agreements with utilities beyond the area boundaries. Automatic generation control attempts to minimize this mismatch. May also contain a component of power to account for frequency adjustment.

<u>Automatic Generation Control</u> (AGC)

Computer control of generation output for a given geographical area. Generation output is raised or lowered to match system load and also to satisfy any interchange agreements with utilities beyond the area boundaries. AGC normally tries to minimize ACE and make maximum use of the most efficient generation.

<u>Automatic Reclosing</u>

Process in which the closing circuit of a circuit breaker is automatically energized by a reclosing relay following a relay-initiated trip. The prime reason for the use of reclosing relays is continuity of service since the majority of faults on overhead circuits are temporary and therefore there is a high probability that an overhead circuit can be successfully reestablished.

<u>Automatic Shutdown</u>

Upon the loss of the Detroit Edison source, the capability to cease generating without manual intervention.

Auxiliary Contacts

Contacts of a power circuit breaker that are separate from the main power contacts of the breaker. Such contacts operate in unison with the power contacts. Circuit breakers are often equipped with "a" auxiliary contacts that are closed when the power contacts are closed and open when the power contacts are open. They are also often equipped with

"b" contacts that are open when the power contacts are closed and closed when the power contacts are open. Such contacts are used to provide input to protective relay equipment, automatic control equipment, and telemetering equipment.

Communication Channel

Communication path that interconnects two or more locations for the purpose of transmitting electrical signals from one location to another. When provided for protective relaying, the communication channel is used to operate a remote interrupting device.

Communication Link (As used for 24 hour contact with customer-owned generation)

Standard, dial-up, voice grade, telephone equipment.

Customer

Any entity interconnected to the company's utility system for the purpose of receiving or exporting electric power. In this guideline "Customer" is anyone applying to interconnect generation to the Detroit Edison System.

Data Circuit (As used by Detroit Edison SCADA equipment)

A leased, four-wire circuit continuously available for the transmission of data. The circuit differs from a standard voice channel in that it uses two wires (one pair) to send data from the master station computer to the electronic equipment at a remote site and the other two wires (other pair) to send data in the opposite direction. The circuit is specifically conditioned to carry data while voice grade circuits are not so conditioned. Voice grade circuits almost always consist of two wires that form a circuit capable of passing voice in both directions simultaneously.

Dedicated Service Transformer or Dedicated Transformer

A transformer with a secondary winding that serves only one customer.

DG (or Distributed Generation)

An electrical generating facility located at a customer's point of delivery (point of common coupling) of usually 40 MW or less and connected at or below 41.6 kV, which may be connected in parallel operation to the utility system. May include energy storage technologies as well as conventional generation technologies.

Direct Transfer Trip (DTT)

Remote operation of a circuit breaker by means of a communication channel.

Disconnect Switch
A mechanical device used for isolating a circuit or equipment from a source of power.

Distribution Feeder

An electric line operated at or below a voltage of 13.2 kV that serves to deliver power from a utility substation or other supply point to customers.

Engineering Quality Drawings

Engineering quality drawings are complete, neat, accurate, detailed, easily readable and interpretable drawings produced by either computer graphics or utilizing drafting equipment such as straight edge, template, lettering guide, etc.

Exempt Wholesale Generator (EWG)

An entity determined by FERC to be engaged directly or indirectly, through one or more affiliates as defined in PUCHA Section 2(a)(11)(B), exclusively in the business of owning and/or operating all or part of one or more eligible facilities and selling electric energy at wholesale.

FERC

Federal Energy Regulatory Commission.

Harmonic Distortion

Distortion of the normal sine wave typically caused by nonlinear loads or by inverters.

IEEE

The Institute of Electrical and Electronic Engineers.

Independently Owned Generation (IOG)

Term used to refer to generators operating in parallel with the Detroit Edison System which are not owned and operated by Detroit Edison. The term is also sometimes used to refer to the owners and operators of the independently owned generators.

Independent Power Producer (IPP)

As defined by FERC, a non-qualifying producer of electric energy that is unaffiliated with any franchised utilities in the IPP's market area and that for other reasons lacks significant market power.

Induction Generator

A rotating AC (alternating current) machine which operates above synchronous speed over its range of power output. The faster it is driven above synchronous speed by a prime mover, the more power is available. Excitation is provided by the power system in the form of reactive power (vars). The induction generator normally loses its ability to produce voltage and power output when it is isolated from the utility since it loses its source of excitation.

Industrial Grade Relay

Relay having lesser quality than the utility grade relays used by Detroit Edison to protect its system. Industrial grade relays are designed with a lesser degree of reliability.

In-rush Current

The current drawn by the DG during startup.

Instantaneous Reclosing

Reclosing process in which the closing circuit of a circuit breaker is automatically energized instantaneously by the reclosing relay following a relay-initiated trip. A common
automatic reclosing sequence consists of an instantaneous reclosure followed by two time-delayed reclosures.

Insulator

Insulating material in a form designed to support a conductor (wire) physically and separate it electrically from another conductor or object.

Interconnection

The physical connection of distributed generation to the utility system in accordance with the requirements of this document so that parallel operation can occur.

Interconnection Agreement

The interconnection agreement sets forth the contractual conditions under which a utility and a customer agree that one or more facilities may be interconnected with the utility's distribution system.

Inverter

A machine, device or system that changes direct-current power to alternating-current power [IEEE Std. 100].

Islanding

A condition in which a portion of the utility system that contains both load and distributed generation is isolated from the remainder of the utility system. [Adopted from IEEE 929, draft 9].

kV

kilovolt, a level of voltage equal to one thousand volts.

kW

kilowatt, an amount of power equal to one thousand watts.

MW

Megawatt, an amount of power equal to one million watts.

Non Sell-Back

A mode of operation in which the generating facility cannot generate power into the Detroit Edison System.

One-Line Diagram

A one-line representation of the three phase electrical system. The one-line diagram required in these Guidelines must indicate those electrical system components (e.g. buses, feeders, transformers and generators) that are necessary to show how the generation is to be paralleled with the Detroit Edison System. The following information on these system components shall appear on the one-line diagram.

- Breakers - Rating, location and normal operating status (open or closed)
- Buses - Operating voltage
- Capacitors - Size of bank
- Current Transformers - Overall ratio, connected ratio

- Fused load break switches - Type, fuse size, normal operating status
- Generators - Size, location, type, method of grounding
- Grounding Resistors - Size (ohms)
- Potential Transformers - Ratio, connection
- Power Transformers - Size, location, impedance, voltage ratings, primary and secondary connections and method of grounding
- Reactors - Ohms/phase
- Relays - Types, quantity, IEEE device number, operator lines indicating the device initiated by the relays.
- Switches - Location and normal operating status (open or closed)
- Tagging Point - Location, identification

The Guidelines make reference to a preliminary one-line and a final one-line. The final one-line must also include information on the relaying and associated current and/or potential transformers that provide protection for the Detroit Edison System. The preliminary one-line may exclude this information since the site specific relaying required to protect the Detroit Edison System will not have been determined as yet.

Out-of-Phase Reclosing

Reclosing a device, such as a breaker or recloser, to parallel two electrical systems when the systems are not in synchronism or in-phase with each other. Such a reclosing can produce high inrush currents and result in high transient shaft torques and mechanical forces on rotating equipment.

Parallel Operation

Mode of operation in which the generation can normally be connected to a bus common with the Detroit Edison System. It is not intended to include operation where there is only a momentary connection between the generation and the Detroit Edison System such as a closed transition go-back of emergency standby generation.

Point of Common Coupling (PCC)

The point at which the electric utility and the customer interface occurs. Typically, this is the customer side of the utility revenue meter. [Adopted from IEEE 929, draft 9].

Primary Neutral Overcurrent Relay

An over-current relay energized by a current transformer in the neutral of a wye connected primary winding of a transformer. A ground fault on the Detroit Edison System will produce current in the primary neutral which can operate the over-current relay.

Protective Tag

A tag placed on equipment during maintenance and testing. The purpose of a protective tag is the protection of life, by indicating the fact that the piece of equipment to which the tag is attached to Must Not Be Operated.

Protective Tag Location

A location acceptable for the hanging or placement of a Detroit Edison protective tag. Visible breaks such as open switches or open fused cutouts are preferred. Invisible breaks may be used provided they can be properly blocked with Detroit Edison approved devices and tested for back feed.

Qualifying Facility (QF)

As defined by Section 201 of PURPA, a cogenerator or small power producer which meets certain ownership, operating, and efficiency criteria as established by FERC.

Real Time Indication

An indication that is available for use very soon after an actual event. For the purposes of telemetering, real time is normally within 10 seconds of the actual event. A schedule of what generation is planned is not considered a real time indication of the generation. Electronic equipment that provides power flow information which follows any change in generation within 10 seconds of that change is considered to be operating in real time.

Remote Trip Channel

A communication channel to extend relay tripping circuits to remote circuit breaker locations. Initiating relays and control at the Detroit Edison terminal produce transmission of a trip signal over the communication channel. Reception of the trip signal at the remote location results in separation of the generation from the Detroit Edison System.

Reverse Power Scheme

A control circuit consisting of a timing relay initiated from a contact of a directional power relay. The directional power relay is responsive to low levels of power flow so that for power flow in the trip direction, the relay will operate to initiate the timer. The contacts of the timer are connected to trip the appropriate breaker and separate the generation.

SCADA

An acronym for "Supervisory Control And Data Acquisition". Supervisory control means the remote control of a monitored device; monitoring being provided by the data acquisition (telemetering) equipment. At Detroit Edison the controlled device is typically a circuit breaker. The state of the breaker is monitored by the same SCADA equipment, sometimes referred to as telemetering equipment. Please see section on telemetering.

If the System Supervisor is required to change the state of the breaker, he will initiate the transmission of a digital control message from the computer at the main office to the field equipment at the breaker site. The message is carried by a leased data circuit (essentially the same as two phone lines). The electronic equipment at the breaker site is capable of decoding the message and providing a relay contact operation to initiate operation of the breaker.

Secondary Network

A secondary network consists of two or more utility primary distribution feeder sources electrically tied together on the secondary (or low voltage) side to form one power source for one or more customers. The service is designed to maintain service to the customers even after the loss of one of these primary distribution feeder sources.

Sectionalizing

The use of automatic over-current protective devices on distribution circuits to isolate faults so that the minimum number of customers is out of service. The protective devices usually consist of overhead fuse cutouts, power fuses, reclosers and sectionalizers.

Sell-Back

A mode of operation allowing the generating facility to generate power into the Detroit Edison System.

Switchgear

An enclosed metal assembly containing components for switching, protecting, monitoring and controlling electric power systems [IEEE Std. 100].

Synchronous Generator

A rotating AC (alternating current) machine which maintains a constant speed over its entire range of normal power output. It utilizes a separate DC (direct current) excitation system, independent of the utility source, to produce the magnetic flux required to generate voltage and current.

System Load

The total power flow taken through customer's billing meters. Normally includes system losses. The value is monitored by summing power flow into the system from generators and interconnections.

System Operation Center

Facility located at the Detroit Edison main office where the SCADA computers and the control room used by the System Supervisors are located.

System Supervisors

Persons working in the System Operation Center's control room who are responsible for operation of the Detroit Edison Electrical System. In other utilities, persons performing similar functions are sometimes called dispatchers or controllers.

Telemetering

Providing the reading, of a measurement, to a site that is remote from a measured quantity. In some applications, the term "telemetering" has meant: "to provide a remote reading by using a signal of D.C. current or A.C. frequency whose level is proportional to the measured quantity". At Detroit Edison the majority of telemetering is accomplished by using digital signals which contain a binary representation of the measured quantity.

Power, current and voltage are measured by transducers that provide a low level D.C. output current which is proportional to the measured quantity. Electronic equipment located at the measuring site converts the D.C. current to a digital message which is transmitted via a telephone line to a computer located at the central office of Detroit Edison. In cases where breaker status information is telemetered, the information is already essentially in digital format, (closed = 0, open = 1 in binary format) and no conversion is required.

The same computer displays the telemetered values, in decimal format, on CRT terminals for the System Supervisors. The values are typically displayed on one-line diagrams which represent the monitored electrical equipment in the field.

Telemetering equipment, that uses digitally encoded messages to transmit data, is typically called SCADA (Supervisory Control And Data Acquisition) equipment. Such equipment is normally equipped with control capability which may or may not be fully implemented at any particular Detroit Edison site.

Type Test

A protection device or system that has been certified by a qualified independent testing laboratory as to meeting the requirements listed in the testing section of this proposal is considered "type-tested". Type-testing will typically be sponsored by equipment manufacturers.

UL

Underwriters Laboratories

Utility Grade Relay

Relay having the same quality as those relays used by Detroit Edison to protect its system. Utility grade relays are designed to provide the highest degree of reliability,

repeatability, longevity, security and calibration accuracy. Such relays meet the performance tests and specifications in ANSI/IEEE Standard C37.90.

Physical characteristics include:

- A draw-out case so the relays can be maintained or replaced without disturbing the connections to the external current, potential and control circuits.
- A steel case to minimize the risk of electromagnetic interference.
- Terminal blocks with 600 volt insulation class.
- Operation indicators or targets that are electromechanical and must be reset manually.

Voice Circuit

Standard, dial-up, voice grade, telephone equipment. Please see communication link and data circuit.

Voltage Flicker

A rapid change in voltage, which may repeat at varying intervals. Various operating equipment can be the cause of flicker. This fluctuating voltage will cause lights to flicker, which may be objectionable to customers. Because of this, flicker limits are established to limit the amount of flicker that one customer can impose upon another, and to inform the customer of these limits prior to the installation of their equipment.

Voltage Restrained Time-Overcurrent Relay

A relay in which the operating value of the over-current unit is a function of the applied voltage. The operating value or pickup is greatest at normal voltage and decreases with lower voltage. The relay is set so that maximum load current will not cause operation with the minimum expected system operating voltage. During fault conditions, the reduced voltage causes less restraint and the relay will operate at a lower current.

Wetting Voltage

A voltage applied to "dry" contacts to provide power/energy in order to drive some function dependent on the state of those contacts. Dry contacts are isolated from ground and any voltage source. Electronic monitoring normally attempts to pass a small current through those contacts to determine if they are open or closed. The wetting voltage is what drives the test current.

Zero Sequence Overvoltage Relay

A voltage relay that responds to the sum of these line-to-neutral voltages on a three-phase circuit. The over-voltage relay is connected across the open corner of an open delta connected secondary winding of a potential transformer and is arranged to provide contact closure when the voltage applied to its coil is in excess of a preset level. The potential transformer that provides the operating voltage is connected grounded-wye primary and broken-delta secondary.