Appendix A- Energy Storage System Configuration Diagrams

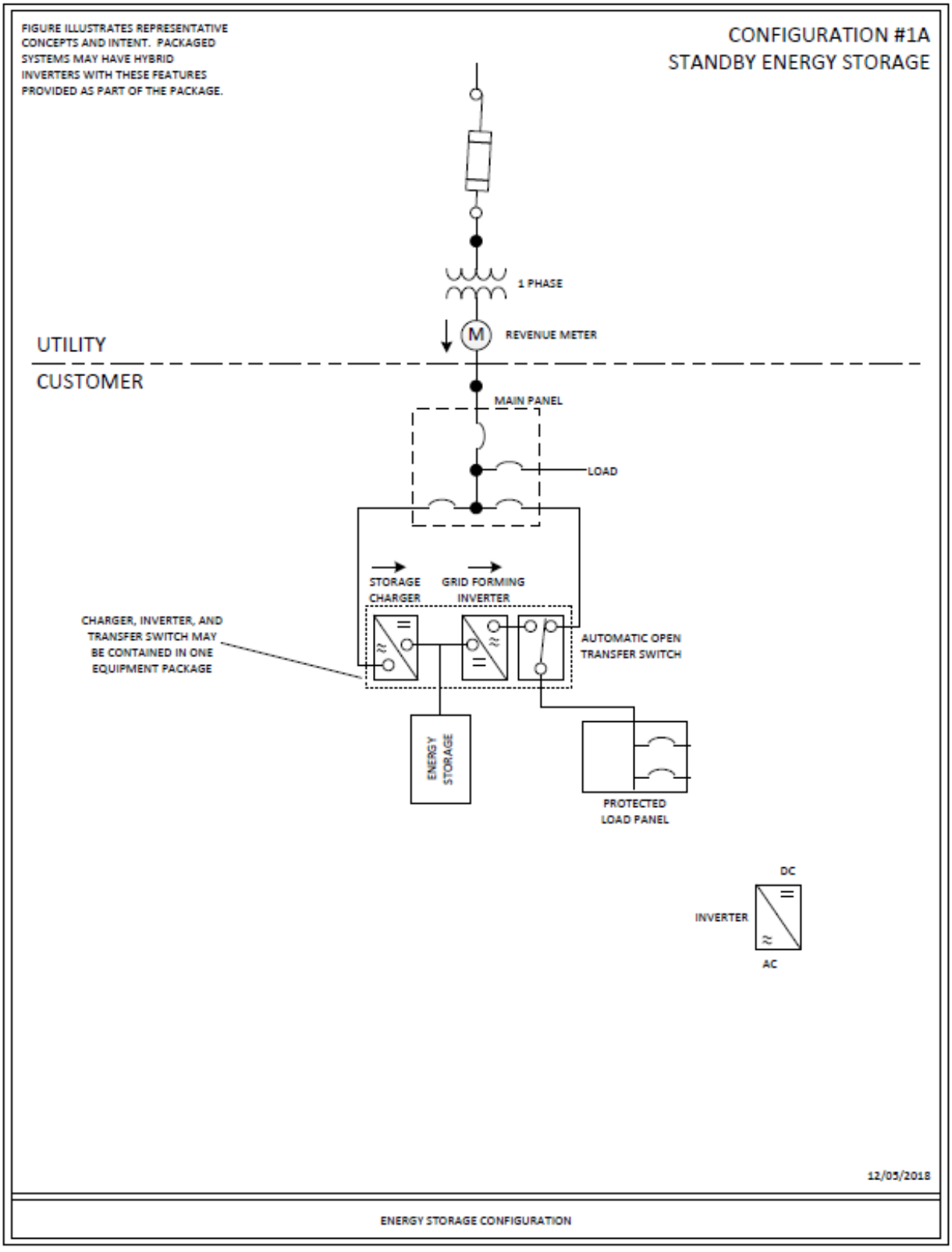
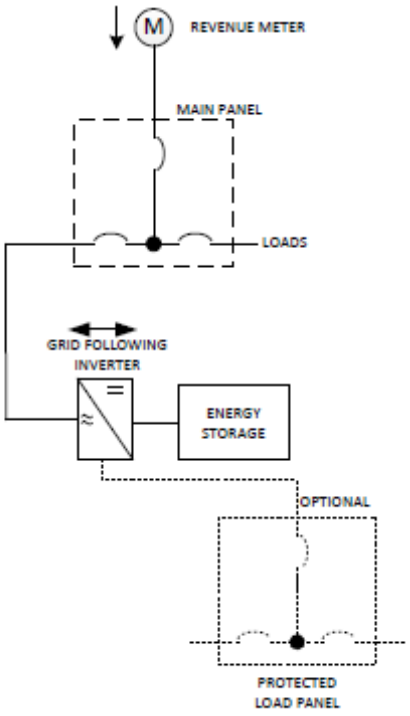
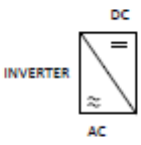


FIGURE ILLUSTRATES REPRESENTATIVE CONCEPTS AND INTENT. PACKAGED SYSTEMS MAY HAVE HYBRID INVERTERS WITH THESE FEATURES PROVIDED AS PART OF THE PACKAGE.
CONFIGURATION #1A
STANDBY ENERGY STORAGE
1 PHASE
M
REVENUE METER
UTILITY
CUSTOMER
MAIN PANEL
LOAD
STORAGE CHARGER
GRID FORMING INVERTER
CHARGER, INVERTER, AND TRANSFER SWITCH MAY BE CONTAINED IN ONE EQUIPMENT PACKAGE
AUTOMATIC OPEN TRANSFER SWITCH
ENERGY STORAGE
PROTECTED LOAD PANEL
DC
INVERTER
AC
12/05/2018
ENERGY STORAGE CONFIGURATION

FIGURE ILLUSTRATES REPRESENTATIVE CONCEPTS AND INTENT. PACKAGED SYSTEMS MAY HAVE HYBRID INVERTERS WITH THESE FEATURES PROVIDED AS PART OF THE PACKAGE.

CONFIGURATION #1B
PARALLEL ENERGY STORAGE
-STORAGE NOT ALLOWED TO EXPORT TO GRID



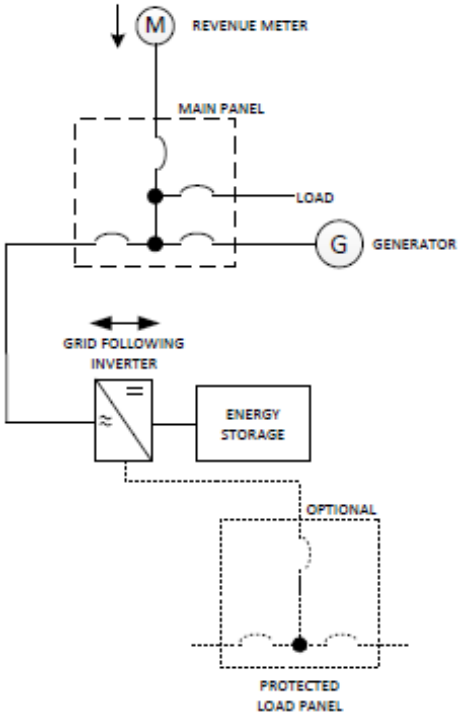


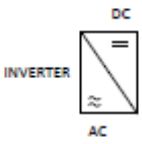
12/05/2018

ENERGY STORAGE CONFIGURATION

FIGURE ILLUSTRATES REPRESENTATIVE CONCEPTS AND INTENT. PACKAGED SYSTEMS MAY HAVE HYBRID INVERTERS WITH THESE FEATURES PROVIDED AS PART OF THE PACKAGE.

CONFIGURATION #1C
PARALLEL ENERGY STORAGE + GENERATION
-GENERATION AND ENERGY STORAGE NOT ALLOWED TO EXPORT TO GRID





12/05/2018

DER + ENERGY STORAGE CONFIGURATION

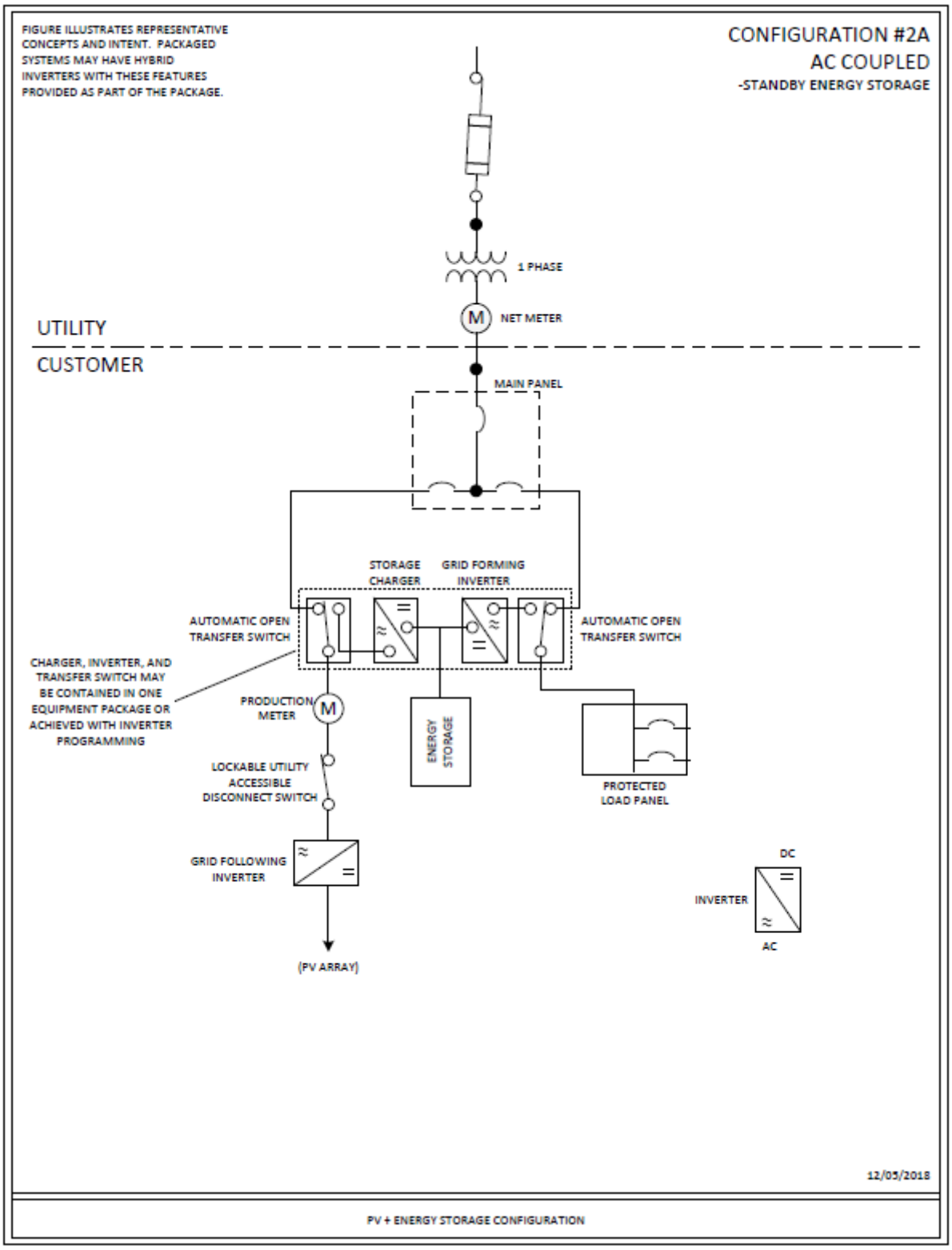


FIGURE ILLUSTRATES REPRESENTATIVE CONCEPTS AND INTENT. PACKAGED SYSTEMS MAY HAVE HYBRID INVERTERS WITH THESE FEATURES PROVIDED AS PART OF THE PACKAGE.
CONFIGURATION #2A
AC COUPLED
-STANDBY ENERGY STORAGE
1 PHASE
M
NET METER
UTILITY
CUSTOMER
MAIN PANEL
STORAGE CHARGER
GRID FORMING INVERTER
AUTOMATIC OPEN TRANSFER SWITCH
AUTOMATIC OPEN TRANSFER SWITCH
CHARGER, INVERTER, AND TRANSFER SWITCH MAY BE CONTAINED IN ONE EQUIPMENT PACKAGE OR ACHIEVED WITH INVERTER PROGRAMMING
PRODUCTION METER
M
ENERGY STORAGE
PROTECTED LOAD PANEL
LOCKABLE UTILITY ACCESSIBLE DISCONNECT SWITCH
GRID FOLLOWING INVERTER
(PV ARRAY)
DC
INVERTER
AC
12/05/2018
PV + ENERGY STORAGE CONFIGURATION

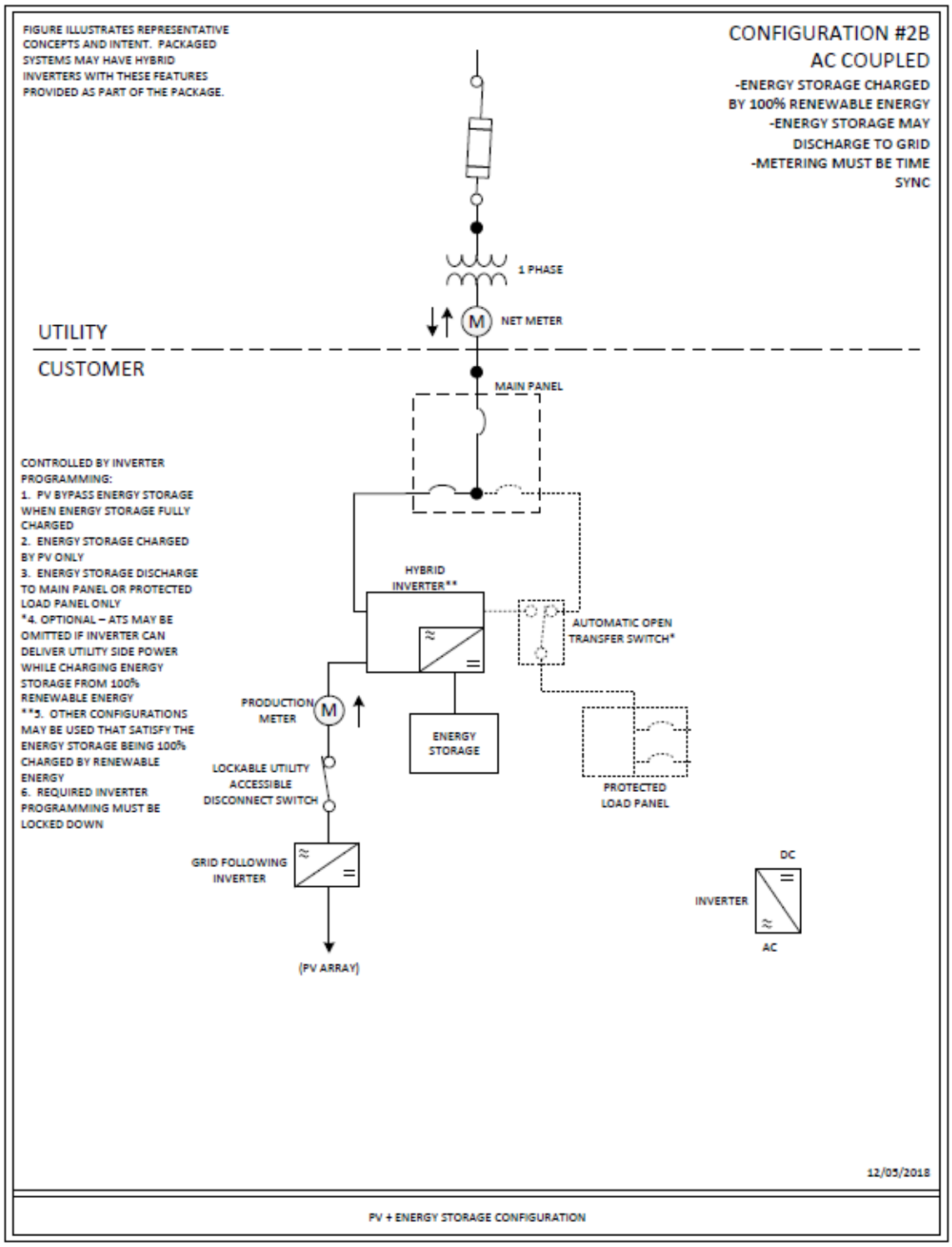


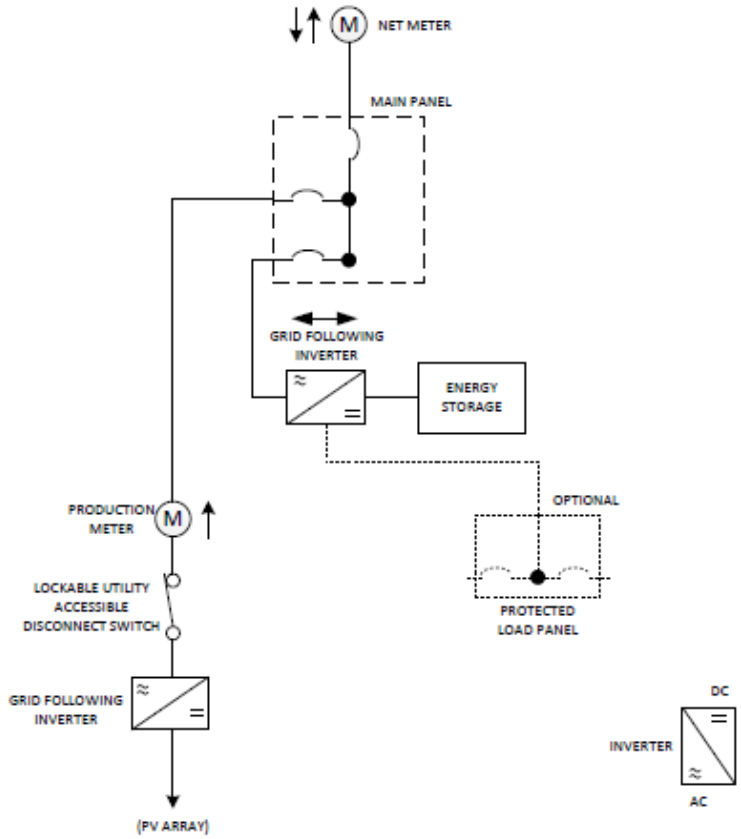
FIGURE ILLUSTRATES REPRESENTATIVE CONCEPTS AND INTENT. PACKAGED SYSTEMS MAY HAVE HYBRID INVERTERS WITH THESE FEATURES PROVIDED AS PART OF THE PACKAGE.
CONFIGURATION #2B
AC COUPLED
-ENERGY STORAGE CHARGED BY 100% RENEWABLE ENERGY
-ENERGY STORAGE MAY DISCHARGE TO GRID
-METERING MUST BE TIME SYNC
1 PHASE
NET METER
UTILITY
CUSTOMER
MAIN PANEL
CONTROLLED BY INVERTER PROGRAMMING:
1. PV BYPASS ENERGY STORAGE WHEN ENERGY STORAGE FULLY CHARGED
2. ENERGY STORAGE CHARGED BY PV ONLY
3. ENERGY STORAGE DISCHARGE TO MAIN PANEL OR PROTECTED LOAD PANEL ONLY
*4. OPTIONAL – ATS MAY BE OMITTED IF INVERTER CAN DELIVER UTILITY SIDE POWER WHILE CHARGING ENERGY STORAGE FROM 100% RENEWABLE ENERGY
**5. OTHER CONFIGURATIONS MAY BE USED THAT SATISFY THE ENERGY STORAGE BEING 100% CHARGED BY RENEWABLE ENERGY
6. REQUIRED INVERTER PROGRAMMING MUST BE LOCKED DOWN
HYBRID INVERTER**
AUTOMATIC OPEN TRANSFER SWITCH*
PRODUCTION METER
ENERGY STORAGE
PROTECTED LOAD PANEL
LOCKABLE UTILITY ACCESSIBLE DISCONNECT SWITCH
GRID FOLLOWING INVERTER
(PV ARRAY)
DC
INVERTER
AC
12/05/2018
PV + ENERGY STORAGE CONFIGURATION

FIGURE ILLUSTRATES REPRESENTATIVE CONCEPTS AND INTENT. PACKAGED SYSTEMS MAY HAVE HYBRID INVERTERS WITH THESE FEATURES PROVIDED AS PART OF THE PACKAGE.

CONFIGURATION #2C
AC COUPLED

-ENERGY STORAGE CHARGED FROM GRID OR RENEWABLE ENERGY
-ENERGY STORAGE NOT ALLOWED TO EXPORT TO GRID
-METERING MUST BE TIME SYNC

REGARDING THE ENERGY STORAGE INVERTER:
1. REQUIRED INVERTER PROGRAMMING MUST BE LOCKED DOWN
2. INVERTER MAY BE CONNECTED TO PROTECTED LOAD PANEL IF INVERTER CAN PROVIDE TRANSFER SWITCH FUNCTION



12/03/2018

PV + ENERGY STORAGE CONFIGURATION

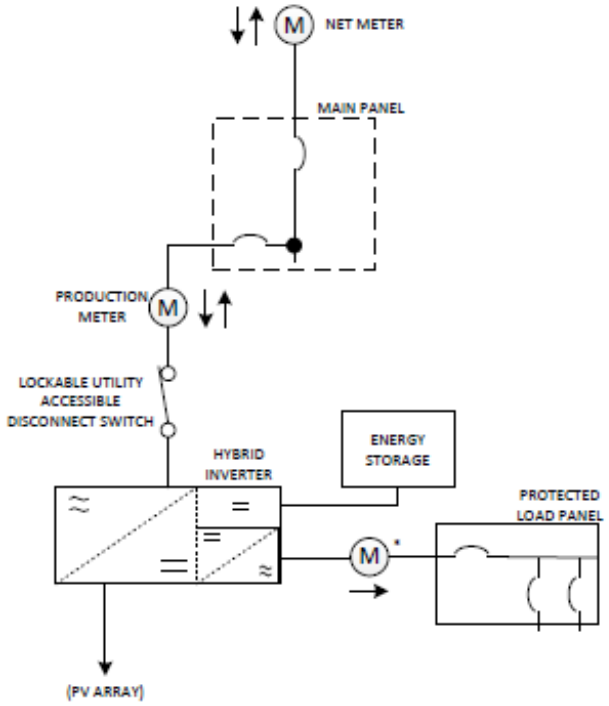
FIGURE ILLUSTRATES REPRESENTATIVE CONCEPTS AND INTENT. PACKAGED SYSTEMS MAY HAVE HYBRID INVERTERS WITH THESE FEATURES PROVIDED AS PART OF THE PACKAGE.

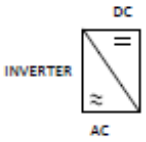
CONFIGURATION #3A
HYBRID EXAMPLE
METER OPTION

-ENERGY STORAGE MAY EXPORT
-METERING MUST BE TIME SYNC

1. GRID FOLLOW
2. GRID FORM
3. CHARGER
4. TRANSFER
5. REQUIRED INVERTER PROGRAMMING MUST BE LOCKED DOWN

*6. METER REQUIRED WHEN PROTECTED LOAD PANEL IS INSTALLED ON INVERTER SIDE OF PRODUCTION METER





12/05/2018

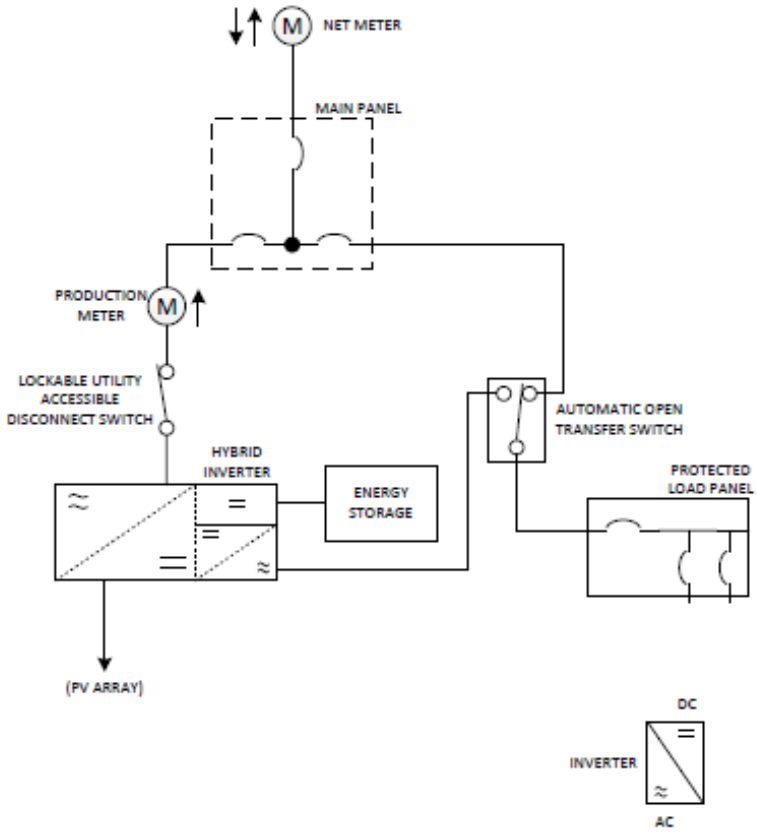
PV + ENERGY STORAGE CONFIGURATION

FIGURE ILLUSTRATES REPRESENTATIVE CONCEPTS AND INTENT. PACKAGED SYSTEMS MAY HAVE HYBRID INVERTERS WITH THESE FEATURES PROVIDED AS PART OF THE PACKAGE.

CONFIGURATION #3B
HYBRID EXAMPLE
TRANSFER OPTION

-ENERGY STORAGE MAY EXPORT
-METERING MUST BE TIME SYNC

1. GRID FOLLOW
2. GRID FORM
3. CHARGER
4. TRANSFER
5. REQUIRED INVERTER PROGRAMMING MUST BE LOCKED DOWN



12/03/2018

PV + ENERGY STORAGE CONFIGURATION

Appendix B- Energy Storage System Declarations

Declaration of Electric Storage Operation Limited to and in Compliance with NEC Article 702 and Configurations 1A and 2A in Section 10 of Xcel Energy's Technical Specifications Manual

Purpose of Declaration

Historically, Distributed Energy Resources (DERs) were assembled from discrete components or functional assemblies where the logic and operational approaches could be seen and analyzed. Today, much of the functionality is handled by an on-board computer following firmware and software instructions in order to achieve the desired results. Industry standards such as IEEE 1547 create a set of requirements that can be certified by Nationally Recognized Testing Laboratories for use on the Area EPS. However, many of the functionalities in Energy Storage Systems that are important to the Area EPS have no governing standard that they can be certified to, although efforts in the industry are underway. Lacking industry standards at this time for Energy Storage Systems, the functionalities need to be verified through extensive detailed review of the operating manuals and often inquiries with the manufacturer.

Declarations are used to provide supplemental information to the SD Distributed Generation Application to ensure correct documentation and ratings are used for the "first use of a design" review, if needed, and to confirm subsequent applications for an approved package match the previously approved package in order to expedite approval. *An update to the firmware which modifies or adds operation modes and changes the required functionality is considered a facility modification and may be subject to a partial or full interconnection review*. This applies to all sources, whether generators or energy storage.

In Section 3.1.1 of the Xcel Energy Guidelines for Interconnection of Electric Energy Storage with the Electric Power Distribution System document (Energy Storage Guidelines document), EConfiguration 1A, the energy storage equipment is not capable of operating in parallel[1] with the grid. The declaration allows interconnection of the energy storage device without an interconnection review if this mode is secure from change. In Energy Storage Guidelines document Section 3.2.1, Configuration 2A, the energy storage equipment is not capable of operating in parallel with the grid. If the energy storage system is operated ONLY in a non-paralleling mode, and such operating mode is secured from changes by unqualified personnel and end users[2], submittal of this signed declaration allows interconnection of the energy storage portion without an interconnection review by Xcel Energy. The NEM-eligible energy source portion of the facility, if added under the same application, must be reviewed and is

[1] See Definition section.
[2] Inaccessible may include locks or other physical security. Inaccessible and/or password protection must be restricted to the manufacturer/developer/installer.

subject to an Interconnection Agreement under MN DIP.

Definitions

"Parallel Operation of Energy Storage" – a source operated in parallel with the grid when it is connected to the distribution grid and can supply energy to the Interconnection Customer simultaneously with the Company's supply of energy[3].

"**Operating Mode**" – a combination of the functionality in the physical configuration and the functionality in the software programming, some of which is not shown in the configuration diagram. Operating Mode is the combined function designed to achieve an Operating Objective that may vary with a change of settings. Operating Modes are established as a function, not by a diagram designation. Operating Modes include, but are not limited to, battery non-export, maximize self-consumption, maximize export, perform time shifting, and perform peak shaving. *A change of Operating Mode may constitute a change of Operating Objective*.

"**Operating Objective**" – the functional purpose of the DER operation achieved by the combination of the approved configuration and Operating Mode. *Any alterations to an Operating Mode may result in unacceptable changes to the Operating Objective as originally approved*. Such changes may render the facility ineligible for use without additional mitigations.

[3] A 1A or 2A energy storage system may charge from the utility as long as it cannot discharge or contribute fault current to the utility.

Declaration[4]

I, (print name and title of Installer/Developer)_____
_____declare that the electric storage system identified below complies with National Electric Code (NEC) Article 702 for optional standby power and complies with the applicable provisions of the Energy Storage Guidelines document for systems that are not capable of Parallel Operation of Energy Storage. (Applicable sections are 3.1.1 and Sections 3.2.1)

I further declare and/or agree that:

1. Applicable state or local safety inspections have been obtained, including specific inspection as to compliance to National Electric Code (NEC) Article 702 for optional standby power.

Installer/developer initials _____

2. System software and programming that is required to meet NEC Article 702[5] and the Energy Storage Guidelines document provisions are inaccessible and/or password protected, with access restricted to manufacturer/developer/installer. This may include locks or other physical security or other means of securing the settings; or as mutually agreed upon on a case-by-case basis and identified in this declaration[6].

Installer/developer initials _____

3. Xcel Energy has the right to conduct an inspection to verify compliance at a later date if problems arise or indications of possible non-compliance to NEC Article 702 or the applicable Technical Specification Manual provisions are present.

Installer/developer initials _____

Applications that cannot parallel and cannot be readily changed to parallel operation may interconnect without review or Interconnection Agreement as stated in the Technical Specification Manual.

Electric Storage System (ESS) Details

[4] Declaration must be agreed to and this form signed for eligibility for the non-parallel storage portion waiver of Interconnection Agreement as described in the Technical Specification Manual.
[5] If specific settings are required to achieve the 702 mode, these must be listed in Section 3 below.
[6] If the Operating Mode cannot be secured to ensure continued operation in a NEC 702 Standby compliant manner, the electric storage system is not eligible for use of the declaration in lieu of full interconnection review. A full interconnection review will examine all operating modes that are readily selectable and establish operating restrictions and mitigations to cover all selectable modes.

This declaration covers the following electric storage system in whole or part as identified below:

Interconnection Customer Information:

Name _____

Address _____

City _____ State _____ ZIP _____

_____

ESS Equipment Details

ESS Battery (B) Rating & ESS Inverter (I) Information

(B) Energy Capacity (kWh)	
(B) Real Power, max continuous charge (kW)	
(B) Real Power, recovery charge rate after utility outage (kW)	
(B) Real Power, max continuous discharge (kW)	
(I) Real Power, peak output (kW)	
(I) Peak Output Duration Capability (sec)	
(I) Apparent Power, max continuous for charging (kVA)	
(I) Apparent Power, peak during discharge (kVA)	
(I) Power Factor Output Range (+/- range)	+/-
(I) Power Factor Capability at full rated real power (+/- range)	+/-
(I) Charging: using rectifier or inverter	
(B) Charge Rate kW (Maximum continuous)	
(B) Charge Rate kW (Recovery charge rate)	
(I) Firmware version	
(I) Operating Modes available	
(I) Operating Modes enabled	

Additional ESS Hardware: Description, Model and Part Number and General Specifications

To be used for devices such as the charge controller, external automatic transfer switches, etc.

Model Number(s)	
Model Name(s)	
UL Listing(s)	
Firmware Version	

Summary of Energy Storage Programming and Operation

(Include mode selection and specific settings required)

When ESS is transitioning the loads between off-grid and on-grid, the following steps will occur:

Prior to grid outage, describe system operation	
Detail steps taken to disconnect from the grid to meet NEC 702	
Detail steps taken to reconnect to the grid to meet NEC 702	
Operating Modes available	
Operating Modes enabled	

System Installer:

I, (print name and title of Installer/Developer)_____certify that I have personal knowledge of the facts stated in this declaration and have the authority to make this declaration on behalf of the Interconnection Customer. I further certify that all of the statements and representations made in this declaration are true and correct.

Installer/Developer Signature_____

Date_____

Interconnection Customer:

I, (print name of Interconnection Customer)_____ authorize the above identified Installer/Developer to represent the declarations on my behalf and will operate and maintain the system within the requirements set forth in this declaration for the life of the system in this authorized configuration.

Customer Signature_____

Date_____

Declaration of Electric Storage Operation Limited to and in Compliance with NEC Article 702 and Configurations 1B and 1C in Section 3 of Xcel Energy's Energy Storage Guidelines document

Purpose of Declaration

Historically, Distributed Energy Resources (DERs) were assembled from discrete components or functional assemblies where the logic and operational approaches could be seen and analyzed. Today, much of the functionality is handled by an on-board computer following firmware and software instructions in order to achieve the desired results. Industry standards such as IEEE 1547 create a set of requirements that can be certified by Nationally Recognized Testing Laboratories for use on the Area EPS. However, many of the functionalities in Energy Storage Systems that are important to the Area EPS have no governing standard that they can be certified to, although efforts in the industry are underway. Lacking industry standards at this time for Energy Storage Systems, the functionalities need to be verified through extensive detailed review of the operating manuals and often inquiries with the manufacturer.

Declarations are used to provide supplemental information as an Attachment to the SD Distributed Generation Application to ensure correct documentation and ratings are used for the "first use of a design" review, if needed, and to confirm subsequent applications for an approved package match the previously approved package in order to expedite approval. *An update to the firmware which modifies or adds operation modes and changes the required functionality is considered a facility modification and may be subject to a partial or full interconnection review*. This applies to all sources, whether generators or energy storage.

Definitions

"Parallel Operation of Energy Storage" – a source operated in parallel with the grid when it is connected to the distribution grid and can supply energy to the Interconnection Customer simultaneously with the Company's supply of energy[7].

"**Operating Mode**" – a combination of the functionality in the physical configuration and the functionality in the software programming, some of which is not shown in the configuration diagram. Operating Mode is the combined function designed to achieve an Operating Objective that may vary with a change of settings. Operating Modes are established as a function, not by a diagram designation. Operating Modes include, but are not limited to, battery non-export, maximize self-consumption, maximize export, perform time shifting, and perform peak shaving. *A change of Operating Mode may constitute a change of Operating Objective*.

"**Operating Objective**" – the functional purpose of the DER operation achieved by the combination of the approved configuration and Operating Mode. *Any alterations to an Operating Mode may result in unacceptable changes to the Operating Objective as originally approved*. Such changes may render the facility ineligible for use without additional mitigations.

[7] A 1A or 2A energy storage system may charge from the utility as long as it cannot discharge or contribute fault current to the utility.

Configurations Covered

Energy Storage System Configurations 2B and 2C, as detailed in Sections 3.2.2 and 3.2.3 in the Energy Storage Guidelines document:

- 1B Non-Exporting Parallel Energy Storage System without Generation
- 1C Non-Exporting Parallel Energy Storage System and Non-Exporting Non-Renewable Generation

Key requirements and Functionality

1. Energy storage operates in parallel[8] with the grid.
2. Generation, if present is non-renewable.
3. Metering is standard (non-net-metered).
4. Energy storage and generation, if present, are not allowed to export energy to the grid[9].

The method of achieving #4 must be fully illustrated in the oneline diagram or described below. Any aspect that is imbedded in equipment and governed by firmware must be described, any additional equipment must be specified, and **specific settings needed to achieve #4 must be listed**.

System software and programming that is required to meet the Energy Storage Guidelines document provisions are inaccessible and/or password protected, with access restricted to manufacturer/developer/installer. This may include locks or other physical security or other means of securing the settings; or as mutually agreed upon on a case-by-case basis and identified in this declaration[10].

Xcel Energy has the right to conduct an inspection to verify compliance at a later date if problems arise or indications of possible non-compliance with the applicable Technical Manual Specifications provisions are present.

[8] See Definition section.
[9] Subject to the Inadvertent Export requirements as stated in the Xcel Energy Storage Guideline document
[10] If the Operating Mode cannot be secured to ensure continued operation in a 1B or 1C compliant manner, as applicable, the facility will require full interconnection review that includes all operating modes that are readily selectable and establish operating restrictions and mitigations to cover all selectable modes.

Electric Storage System (ESS) Details

This declaration covers the following electric storage system in whole or part as identified below:

Interconnection Customer Information:

Name _____

Address _____

City _____ State _____ ZIP _____

ESS Equipment Details

ESS Battery (B) Rating & ESS Inverter (I) Information

(B) Energy Capacity (kWh)	
(B) Real Power, max continuous charge (kW)	
(B) Real Power, recovery charge rate after utility outage (kW)	
(B) Real Power, max continuous discharge (kW)	
(I) Real Power, peak output (kW)	
(I) Peak Output Duration Capability (sec)	
(I) Apparent Power, max continuous for charging (kVA)	
(I) Apparent Power, peak during discharge (kVA)	
(I) Power Factor Output Range (+/- range)	+/-
(I) Power Factor Capability at full rated real power (+/- range)	+/-
(I) Charging: using rectifier or inverter	
(B) Charge Rate kW (Maximum continuous)	
(B) Charge Rate kW (Recovery charge rate)	
(I) Firmware version	
(I) Operating Modes available	
(I) Operating Modes enabled	

Additional ESS Hardware: Description, Model and Part Number and General Specifications

To be used for devices such as the charge controller, external automatic transfer switches, etc.

Model Number(s)	
Model Name(s)	
UL Listing(s)	
Firmware Version	

Summary of Energy Storage Programming and Operation

(Include mode selection and specific settings required)

When ESS is transitioning the loads between off-grid and on-grid, the following steps will occur:

Prior to grid outage, describe system operation	
Detail steps taken to disconnect from the grid to meet NEC 702	
Detail steps taken to reconnect to the grid to meet NEC 702	
Operating Modes available	
Operating Modes enabled	

System Installer:

I, (print name and title of Installer/Developer)_____certify that I have personal knowledge of the facts stated in this declaration and have the authority to make this declaration on behalf of the Interconnection Customer. I further certify that all of the statements and representations made in this declaration are true and correct.

Installer/Developer Signature_____

Date_____

Interconnection Customer:

I, (print name of Interconnection Customer)_____ authorize the above identified Installer/Developer to represent the declarations on my behalf and will operate and maintain the system within the requirements set forth in this declaration for the life of the system in this authorized configuration.

Customer Signature_____

Date_____

Declaration of Electric Storage Operation Limited to and in Compliance with NEC Article 702 and Configurations 2B and 2C in Section 3 of Xcel Energy Guidelines document

Purpose of Declaration

Historically, Distributed Energy Resources (DERs) were assembled from discrete components or functional assemblies where the logic and operational approaches could be seen and analyzed. Today, much of the functionality is handled by an on-board computer following firmware and software instructions in order to achieve the desired results. Industry standards such as IEEE 1547 create a set of requirements that can be certified by Nationally Recognized Testing Laboratories for use on the Area EPS. However, many of the functionalities in Energy Storage Systems that are important to the Area EPS have no governing standard that they can be certified to, although efforts in the industry are underway. Lacking industry standards at this time for Energy Storage Systems, the functionalities need to be verified through extensive detailed review of the operating manuals and often inquiries with the manufacturer.

Declarations are used to provide supplemental information as an Attachment to the SD Distributed Generation Application to ensure correct documentation and ratings are used for the "first use of a design" review, if needed, and to confirm subsequent applications for an approved package match the previously approved package in order to expedite approval. *An update to the firmware which modifies or adds operation modes and changes the required functionality is considered a facility modification and may be subject to a partial or full interconnection review*. This applies to all sources, whether generators or energy storage.

Definitions

"Parallel Operation of Energy Storage" – a source operated in parallel with the grid when it is connected to the distribution grid and can supply energy to the Interconnection Customer simultaneously with the Company's supply of energy[11].

"**Operating Mode**" – a combination of the functionality in the physical configuration and the functionality in the software programming, some of which is not shown in the configuration diagram. Operating Mode is the combined function designed to achieve an Operating Objective that may vary with a change of settings. Operating Modes are established as a function, not by a diagram designation. Operating Modes include, but are not limited to, battery non-export, maximize self-consumption, maximize export, perform time shifting, and perform peak shaving. *A change of Operating Mode may constitute a change of Operating Objective*.

"**Operating Objective**" – the functional purpose of the DER operation achieved by the combination of the approved configuration and Operating Mode. *Any alterations to an Operating Mode may result in unacceptable changes to the Operating Objective as originally approved*. Such changes may render the facility ineligible for use without additional mitigations.

[11] A 1A or 2A energy storage system may charge from the utility as long as it cannot discharge or contribute fault current to the utility.

Configurations Covered

Energy Storage System Configurations 2B and 2C, as detailed in sections 3.2.2 and 3.2.3 in the Energy Storage Guidelines document:

- 2B Parallel Energy Storage with Renewable Generation, Net-Metering, with Export
- 2C Parallel Non-Exporting Energy Storage with Renewable Generation, Net Metering

Key requirements and Functionality

1. Energy storage operates in parallel[12] with the grid.
2. Generation is renewable.
3. Revenue metering is net metering.
4. Production metering, if required, is installed.
5. 2B may export to grid if the storage is **100% charged**[13] from on-site renewable generation[14].
6. 2C storage may not export to the grid but may be charged by mixed sources.

The methods of achieving #5 and #6, as applicable, must be fully illustrated in the oneline diagram or described below. Any aspect that is embedded in equipment and governed by firmware must be described, any additional equipment must be specified, and **specific settings needed to assure compliance must be listed**.

System software and programming that is required to meet the Energy Storage Guidelines document provisions are inaccessible and/or password protected, with access restricted to manufacturer/developer/installer. This may include locks or other physical security or other means of securing the settings; or as mutually agreed upon on a case-by-case basis and identified in this declaration[15].

Xcel Energy has the right to conduct an inspection to verify compliance at a later date if problems arise or indications of possible non-compliance with the applicable Technical Specifications Manual provisions are present.

[12] See Definition section.
[13] If a battery exports when non-compliant, the site including PV is not eligible for net metering.
[14] Charging must be 100% renewable energy. Any storage mixture of non-renewable energy disqualifies 2B from exporting. If the battery charging is not 100% renewable, the configuration may be used with non-export from the battery to the grid.
[15] If the Operating Mode cannot be secured to ensure continued operation in a 2B or 2C compliant manner, as applicable, the facility will require full interconnection review that includes all operating modes that are readily selectable and establish operating restrictions and mitigations to cover all selectable modes.

Electric Storage System (ESS) Details

This declaration covers the following electric storage system in whole or part as identified below:

Interconnection Customer Information:

Name _____

Address _____

City _____ State _____ ZIP _____

ESS Equipment Details

ESS Battery (B) Rating & ESS Inverter (I) Information

(B) Energy Capacity (kWh)	
(B) Real Power, max continuous charge (kW)	
(B) Real Power, recovery charge rate after utility outage (kW)	
(B) Real Power, max continuous discharge (kW)	
(I) Real Power, peak output (kW)	
(I) Peak Output Duration Capability (sec)	
(I) Apparent Power, max continuous for charging (kVA)	
(I) Apparent Power, peak during discharge (kVA)	
(I) Power Factor Output Range (+/- range)	+/-
(I) Power Factor Capability at full rated real power (+/- range)	+/-
(I) Charging: using rectifier or inverter	
(B) Charge Rate kW (Maximum continuous)	
(B) Charge Rate kW (Recovery charge rate)	
(I) Firmware version	
(I) Operating Modes available	
(I) Operating Modes enabled	

Additional ESS Hardware: Description, Model and Part Number and General Specifications

To be used for devices such as the charge controller, external automatic transfer switches, etc.

Model Number(s)	
Model Name(s)	
UL Listing(s)	
Firmware Version	

Summary of Energy Storage Programming and Operation

(Include mode selection and specific settings required)

When ESS is transitioning the loads between off-grid and on-grid, the following steps will occur:

Prior to grid outage, describe system operation	
Detail steps taken to disconnect from the grid to meet NEC 702	
Detail steps taken to reconnect to the grid to meet NEC 702	
Operating Modes available	
Operating Modes enabled	

System Installer:

I, (print name and title of Installer/Developer)_____certify that I have personal knowledge of the facts stated in this declaration and have the authority to make this declaration on behalf of the Interconnection Customer. I further certify that all of the statements and representations made in this declaration are true and correct.

Installer/Developer Signature_____

Date_____

Interconnection Customer:

I, (print name of Interconnection Customer)_____ _____ authorize the above identified Installer/Developer to represent the declarations on my behalf and will operate and maintain the system within the requirements set forth in this declaration for the life of the system in this authorized configuration.

Customer Signature_____

Date_____

Declaration of Electric Storage Operation Limited to and in Compliance with NEC Article 702 and Configurations 3A and 3B in Section 3 of Xcel Energy Guidelines for Interconnection of Energy Storage with the Electric Power Distribution System

Purpose of Declaration

Historically, Distributed Energy Resources (DERs) were assembled from discrete components or functional assemblies where the logic and operational approaches could be seen and analyzed. Today, much of the functionality is handled by an on-board computer following firmware and software instructions in order to achieve the desired results. Industry standards such as IEEE 1547 create a set of requirements that can be certified by Nationally Recognized Testing Laboratories for use on the Area EPS. However, many of the functionalities in Energy Storage Systems that are important to the Area EPS have no governing standard that they can be certified to, although efforts in the industry are underway. Lacking industry standards at this time for Energy Storage Systems, the functionalities need to be verified through extensive detailed review of the operating manuals and often inquiries with the manufacturer.

Declarations are used to provide supplemental information as an Attachment to the SD Distributed Generation Application to ensure correct documentation and ratings are used for the "first use of a design" review, if needed, and to confirm subsequent applications for an approved package match the previously approved package in order to expedite approval. *An update to the firmware which modifies or adds operation modes and changes the required functionality is considered a facility modification and may be subject to a partial or full interconnection review*. This applies to all sources, whether generators or energy storage.

Definitions

"Parallel Operation of Energy Storage" – a source operated in parallel with the grid when it is connected to the distribution grid and can supply energy to the Interconnection Customer simultaneously with the Company's supply of energy[16].

"**Operating Mode**" – a combination of the functionality in the physical configuration and the functionality in the software programming, some of which is not shown in the configuration diagram. Operating Mode is the combined function designed to achieve an Operating Objective that may vary with a change of settings. Operating Modes are established as a function, not by a diagram designation. Operating Modes include, but are not limited to, battery non-export, maximize self-consumption, maximize export, perform time shifting, and perform peak shaving. *A change of Operating Mode may constitute a change of Operating Objective*.

"**Operating Objective**" – the functional purpose of the DER operation achieved by the combination of the approved configuration and Operating Mode. *Any alterations to an Operating Mode may result in unacceptable changes to the Operating Objective as originally approved*. Such changes may render the facility ineligible for use without additional mitigations.

[16] A3A or 3B energy storage system may charge from the utility as long as it cannot discharge or contribute fault current to the utility.

Configurations Covered

Energy Storage System Configurations 3A and 3B, as detailed in Sections 3.3.1 and 3.3.2 in the Energy Storage Guidelines document:

- 3A Parallel DC Coupled Energy Storage with Renewable Generation, Net-Metering, with Export
- 3B Parallel DC Coupled Energy Storage with Renewable Generation, Net-Metering, ATS, with Export

Key requirements and Functionality

1. Energy storage operates in parallel[17] with the grid via hybrid inverter.
2. Generation is renewable.
3. Revenue metering is net metering.
4. Production metering, if required, is installed.
5. 3A and 3B may export to grid if the storage is **100% charged**[18] from on-site renewable generation[19].
6. If a Protected Load Panel (PLP) is present on the inverter side of any required production meter for Configuration 3A, a second load meter must be installed on the PLP.

The method of achieving #5 must be fully illustrated in the oneline diagram or described below. Any aspect that is embedded in equipment and governed by firmware must be described, any additional equipment must be specified, **and specific settings needed to assure compliance must be listed**.

System software and programming that is required to meet the Technical Specifications Manual provisions are inaccessible and/or password protected, with access restricted to manufacturer/developer/installer. This may include locks or other physical security or other means of securing the settings; or as mutually agreed upon on a case-by-case basis and identified in this declaration[20].

Xcel Energy has the right to conduct an inspection to verify compliance at a later date if problems arise or indications of possible non-compliance with the applicable Energy Storage Guidelines document provisions are present.

[17] See Definition section.
[18] If battery exports when non-compliant, the site including PV is not eligible for net metering
[19] Charging must be 100% renewable energy. Any storage mixture of non-renewable energy disqualifies 3A or 3B from exporting. If the battery charging is not 100% renewable, the configuration may be used with non-export from the battery to the grid.
[20] If the Operating Mode cannot be secured to ensure continued operation in a 3A or 3B compliant manner, as applicable, the facility will require full interconnection review that includes all operating modes that are readily selectable and establish operating restrictions and mitigations to cover all selectable modes.

Electric Storage System (ESS) Details

This declaration covers the following electric storage system in whole or part as identified below:

Interconnection Customer Information:

Name _____

Address _____

City _____ State _____ ZIP _____

ESS Equipment Details

ESS Battery (B) Rating & ESS Inverter (I) Information

(B) Energy Capacity (kWh)	
(B) Real Power, max continuous charge (kW)	
(B) Real Power, recovery charge rate after utility outage (kW)	
(B) Real Power, max continuous discharge (kW)	
(I) Real Power, peak output (kW)	
(I) Peak Output Duration Capability (sec)	
(I) Apparent Power, max continuous for charging (kVA)	
(I) Apparent Power, peak during discharge (kVA)	
(I) Power Factor Output Range (+/- range)	+/-
(I) Power Factor Capability at full rated real power (+/- range)	+/-
(I) Charging: using rectifier or inverter	
(B) Charge Rate kW (Maximum continuous)	
(B) Charge Rate kW (Recovery charge rate)	
(I) Firmware version	
(I) Operating Modes available	
(I) Operating Modes enabled	

Additional ESS Hardware: Description, Model and Part Number and General Specifications

To be used for devices such as the charge controller, external automatic transfer switches, etc.

Model Number(s)	
Model Name(s)	
UL Listing(s)	
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Summary of Energy Storage Programming and Operation

(Include mode selection and specific settings required)

When ESS is transitioning the loads between off-grid and on-grid, the following steps will occur:

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Detail steps taken to reconnect to the grid to meet NEC 702	
Operating Modes available	
Operating Modes enabled	

System Installer:

I, (print name and title of Installer/Developer)_____certify that I have personal knowledge of the facts stated in this declaration and have the authority to make this declaration on behalf of the Interconnection Customer. I further certify that all of the statements and representations made in this declaration are true and correct.

Installer/Developer Signature_____

Date_____

Interconnection Customer:

I, (print name of Interconnection Customer)_____ authorize the above identified Installer/Developer to represent the declarations on my behalf and will operate and maintain the system within the requirements set forth in this declaration for the life of the system in this authorized configuration.

Customer Signature_____

Date_____