

COOP C460 NOTE 2, MODIFICATION

Operations Division
W/OPS12: JD/GLD

SUBJECT: **Primary Surge Protector Agency Stock Number (ASN): C460-6, Logistics Replacement**

PURPOSE: To provide instructions for using and installing new stock item C460-6.

SITES AFFECTED: All Maximum-Minimum Temperature System (MMTS) and Nimbus sites.

AUTHORIZATION: The authority for this note is by National Weather Service Headquarters, OPS11, and OPS22 direction.

ESTIMATED COMPLETION DATE: There is no deadline (as needed).

TIME REQUIRED: Approximately four hours

ACCOMPLISHED BY: National Weather Service (NWS) Data Acquisition Program Managers (DAPM), Observing Program Leader (OPL), or Electronics Technicians (ET) as directed by local Weather Forecast Office (WFO) management.

EQUIPMENT AFFECTED: Used with:

- C450-1, C450-7: MMTS Displays
- C451-N1: Nimbus PL-2 Display
- C450-2: MMTS Thermistor and Shelter

Replaces:

- C450-5: ACMMTS Primary Protector Assembly (PPA)
- C450-6: ACMMTS Stainless Steel Primary Protector
- C460-1: Sensor Line Clamp
- C460-3: Metal Oxide Varistor (MOV) Assembly
- C460-4: Surge Protector, Verite
- C460-5: PPA, Guardian Angel, Comm-Omni

SPARES AFFECTED: Replaced equipment will be canceled as stock is depleted.

PARTS/MATERIALS REQUIRED: See Attachment C.

SOURCE OF PARTS/MATERIALS: National Logistics Support Center (NLSC) and WFO.

DISPOSITION OF REMOVED PARTS/MATERIALS: Disposition of any NLSC item should follow the Source, Maintenance and Recoverability (SMR) code guidance.

TOOLS AND TEST EQUIPMENT REQUIRED: General hand tools (i.e., screwdrivers, wire cutter/stripper, pliers, small wrench, and a drill and bits).

DOCUMENTS AFFECTED: [Surface Equipment Modification Note 1: Primary Surge Protector \(ASN: C460-5\) Circuitry Installation Instructions, dated 9/28/10.](#)

PROCEDURE: The instructions and procedures for installing surge protection are provided in Attachment A.

TECHNICAL ASSISTANCE: For questions or problems pertaining to this note, contact Sterling Field Support Center (SFSC) at (703) 661-1259.

REPORTING INSTRUCTIONS: Report the completed modification using a Cooperative Station Service Accountability (CSSA) site inspection report, and update the site meta-data on the B-44 Station Information Report.

Deirdre Jones
Director, Operations Division

Attachment A – Primary Protector Assembly (PPA) Installation
Attachment B – Ground Identification Guidance
Attachment C – Materials Required for Installation Activity

ATTACHMENT A – Primary Protector Assembly (PPA) Installation

A.1 Overview

This modification note provides the installation instructions for logistics replacement primary protector assembly (PPA) surge protection for NWS temperature display units (TDUs). The PPA will be installed in the sensor line between the thermistor/shelter (beehive) and the various TDUs. The PPA must be installed outside, to stop surges before they enter the facility.

This Logistics Replacement PPA must be installed in accordance with the Service Entrance Panel (SEP) plan defined in this document. The SEP follows the guidelines set by the National Electrical Code (NEC) and NWS Directive [NWSM 30-4106, Lightning Protection, Grounding, Bonding Shielding, and Surge Protection Requirements](#) for the safe connection and grounding of external wiring entering a building.

This SEP specifically defines how to install surge protection on the sensor line of the Maximum-Minimum Temperature System (MMTS) systems as the wiring enters the building.

Effective surge protection requires the existence of an effective grounding system. All facilities and residences in the United States that use alternating current (AC) power are required to have a grounding system. This plan will show how to identify and use that grounding system. If, upon inspection, the proposed monitoring site does NOT have a grounding system, the site will be abandoned.

This plan is focused on installations at residences, but is applicable to all facilities. It uses the grounding system of the SEP and will hereafter be referred to as a SEP plan. The SEP plan provides maximum protection for the TDUs, the Observer, and the facility. See Figure A-1 for an overview. The entry of the data lines near the SEP enables the best arrangement for grounding the PPA to the facility ground. This optimum grounding provides the least risk of shock, arcing, and surge damage.

NOTE: If the facility AC service entrance power panel does not use an external ground rod or connection to a metal cold water piping system per National Electrical Code® (NEC), effective surge protection cannot be established and this site must be abandoned.

A.1.1 Effectivity

The Logistics Replacement PPA is required at all new sites and at any site that requires replacement of the existing primary protector. Any upgrade of a site using the REPLACED EQUIPMENT identified on page 1 will adhere to the new wiring practice of the SEP.

A.1.2 Reason for Change

The old Comm-Omni International Model Guardian Angel protector, C460-5, is much more expensive than the new L-com arrester. The National Logistics Supply Center (NLSC) stock numbers that reference the Comm-Omni protector will be deleted upon exhaustion.

A.2 Service Entrance Panel Plan Installation

A.2.1 General

All new and upgraded TDU installations are to be installed so the PPA is in close proximity to the facility AC power SEP. The PPA is to be installed **outside** the facility at this location. The PPA is to be grounded to the facility ground. The rigid, buried, cable from the thermistor sensor is terminated on the IN side of the PPA. From the OUT side of the PPA, the flexible indoor cable is routed into and through the facility to the TDU. See Figure A-1 for a typical installation, and Figure A-2 and Figure A-3 for a typical facility entrance hole and PPA wiring.

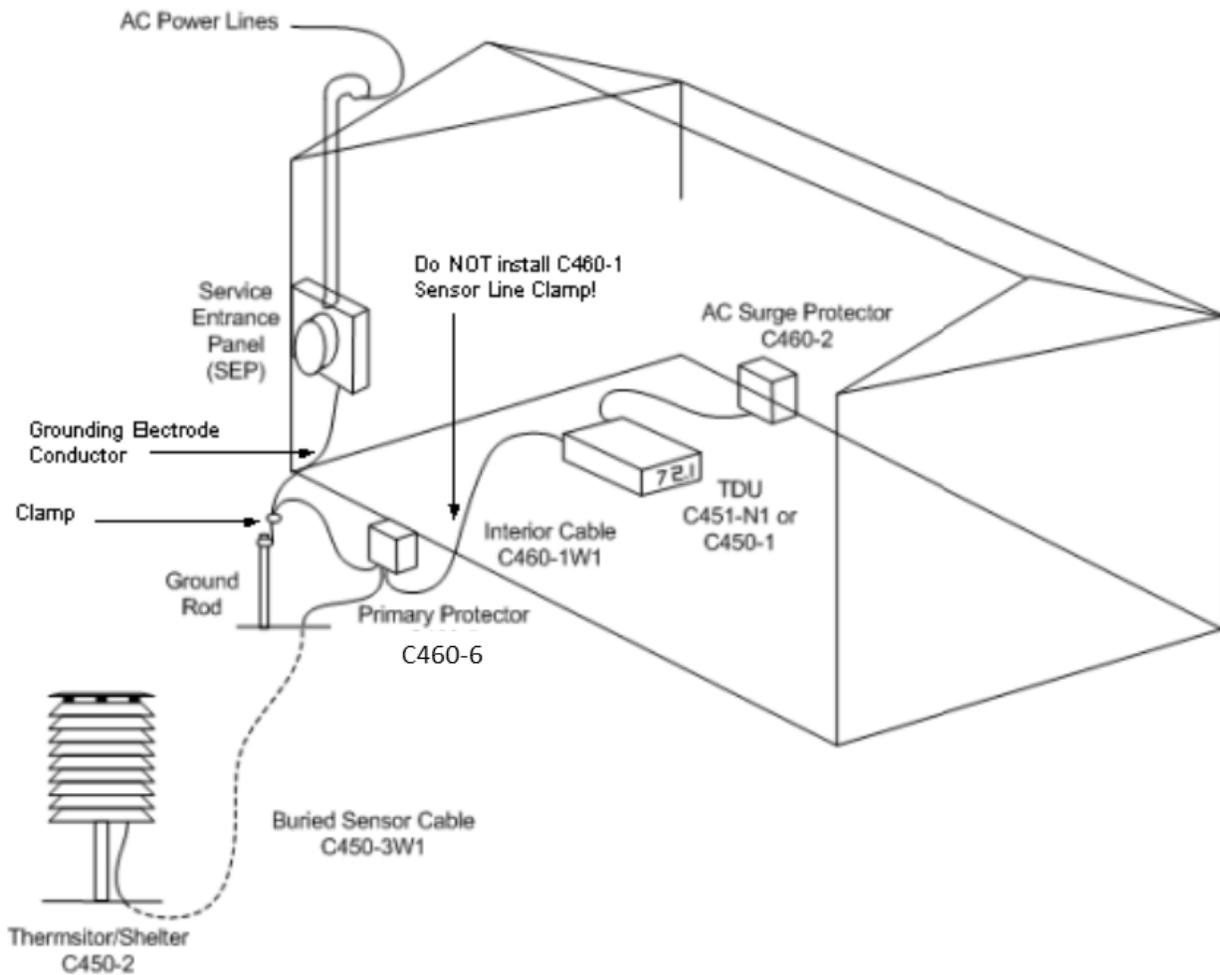


Figure A-1: SEP Installation

WARNING

Under NO circumstances should the NWS technician install a ground rod. This installation must connect to and use the *existing* SEP Grounding Electrode Conductor.

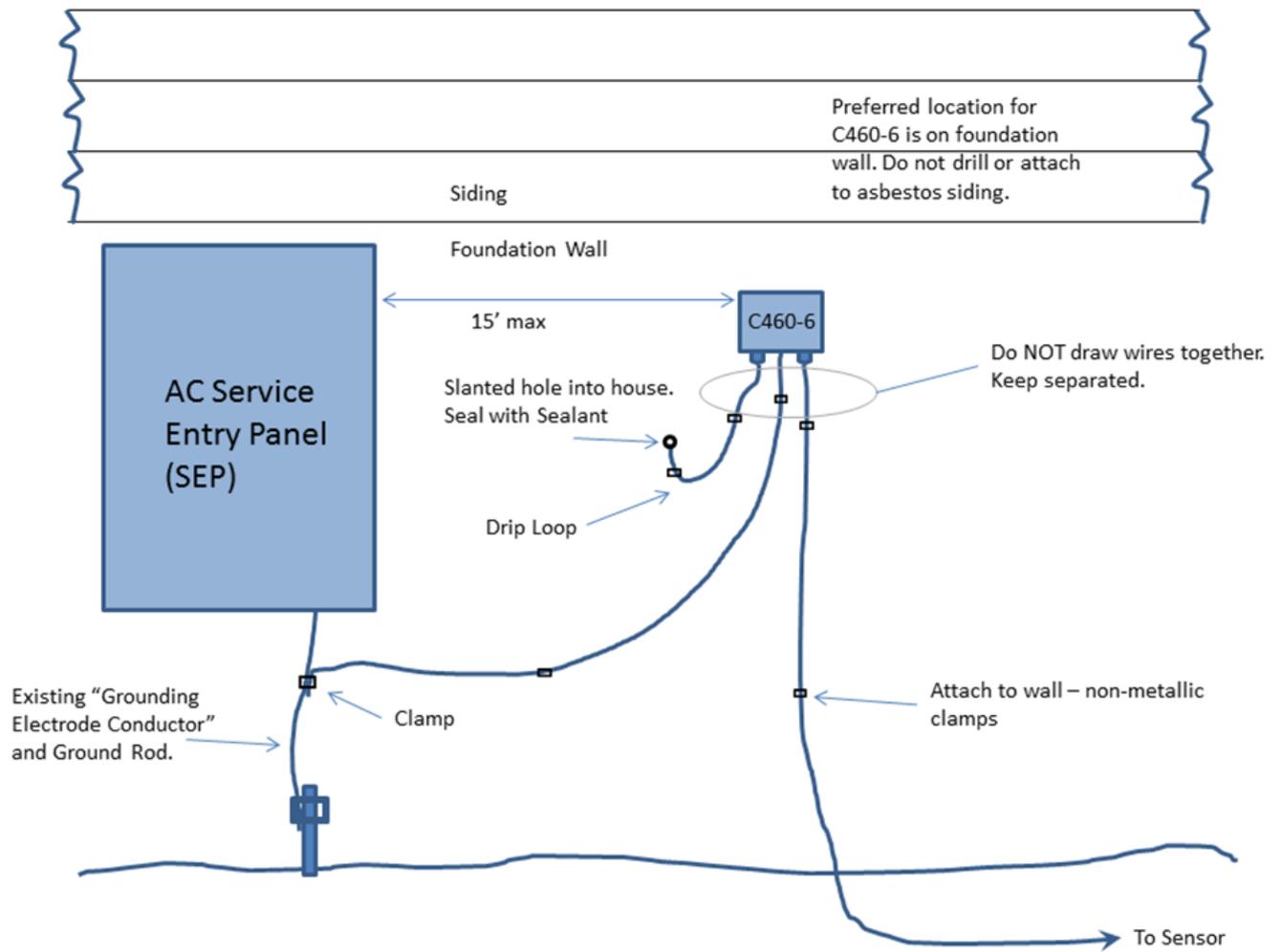


Figure A-2: Cable Entrance Details

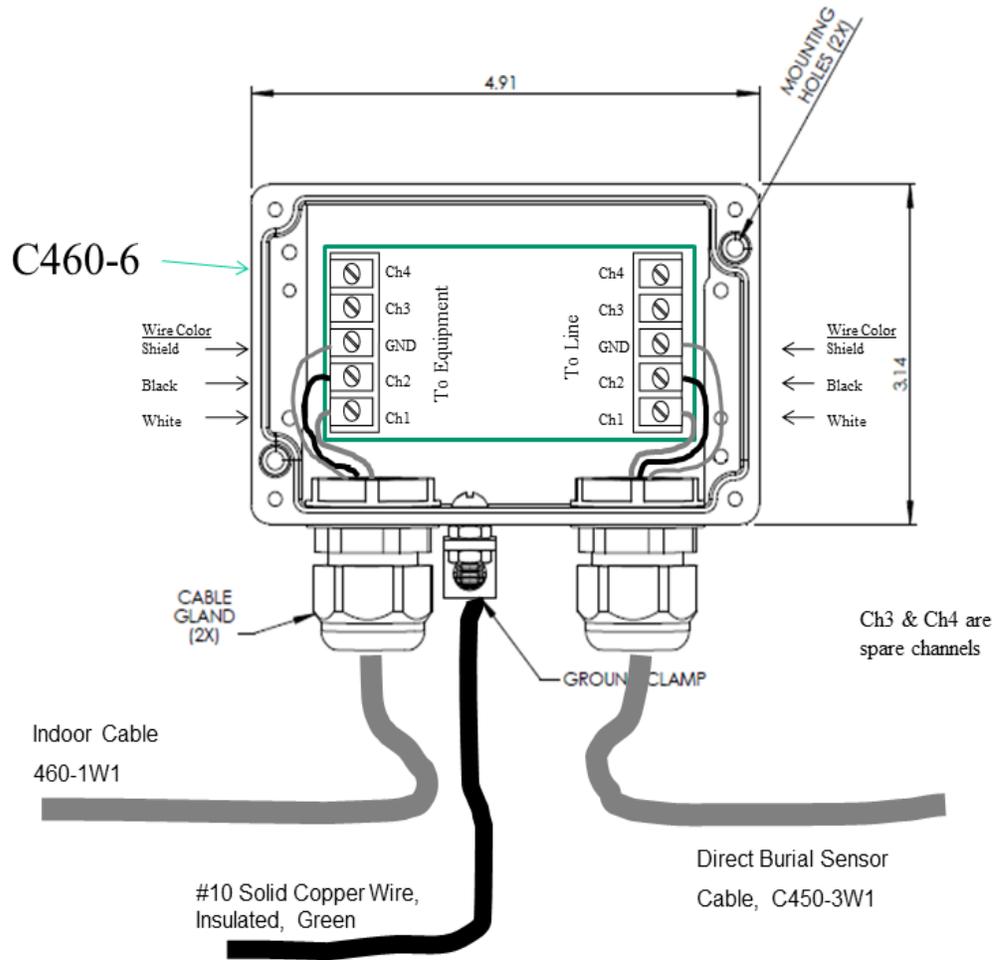


Figure A-3: Primary Protector Wiring

The remainder of this instruction provides the details of the installation. The installation list of materials (LOM) in Attachment C should be reviewed to ensure that all necessary materials are available. Some materials are site-specific and cannot be identified until the site has been visited and the installation details determined.

NOTE: The protector installed by the telephone company on the phone lines is similar to the installation of the PPA on the TDU sensor lines. If the installation of the phone service wiring at a site has been done by a commercial company, it could serve as a reliable overview of the installation of the PPA.

Installation of other similar systems such as cable television, satellite dishes and television antennas should not be used as examples.

A.2.2 References

The NEC, 1987, was used extensively in developing this plan. While the NEC does not expressly cover this particular type of installation, this plan complies with the intent of all appropriate sections. The following references are to aid in answering questions regarding code compliance:

- The section of the NEC that best applies to this application is Article 800, *Communication Circuits*.
- Grounding system, bonding, and connections to grounding system are covered in Article 250. Of particular importance to this installation are Section G, *Bonding*; Section H, *Grounding Electrode System*; and Section K, *Grounding Conductor Connection*.

See Attachment B for more clarification on NEC coverage.

A.3 Primary Protector Assembly Installation

A.3.1 Installation

1. Identify the ground point for the protection system. Care in identifying the proper ground point is the best way to assure trouble-free and effective PPA operation.

NOTE: The PPA must be grounded to the facility or building grounding electrode system. The grounding electrode system is basically the building ground or ground system. The electrical service panel will, in all cases, be connected to the grounding electrode system by a grounding wire, called the *grounding electrode conductor*. In most residences, the grounding electrode system or house ground is connected to an external ground rod or a metal cold water piping system. A thick bare ground wire (the grounding electrode conductor) connected between the service panel and the external ground rod, or cold-water piping, will confirm the existence of a grounding electrode system.

CAUTION

If a pre-existing grounding electrode conductor cannot be found, the site will be abandoned. The ground lead from the PPA must connect to the grounding electrode conductor of the facility. Do not connect the ground lead from the PPA directly to the cold water piping or the ground rod. Do not, under any circumstances, install a second ground rod.

NOTE: The NWS technician should NOT install the facility grounding electrode conductor. If available, it will have been previously installed by the certified electricians that wired the facility. The NWS technician should NOT install any connection inside or to the circuit breaker panel or the service entrance panel. The NWS technician should NOT install a ground rod.

If the building grounding electrode *conductor* cannot be positively identified, or if there is reason to doubt the quality of the ground, the advice of a qualified electrician (licensed for the county) must be obtained.

If a ground rod and a cold water ground are found at the facility, connect the PPA grounding conductor to the grounding electrode conductor going to the ground rod. If at all possible, make the ground connection OUTSIDE of the facility.

2. Select a PPA installation location within 15 feet of the ground point. Install the PPA to provide the shortest straight line grounding cable run to the grounding point selected in the previous step. It is preferable to run the sensor cable all the way around the facility (not through) versus using a grounding cable longer than 15 feet.

WARNING

The PPA should not be installed on a conductive surface to prevent flashover in the event of a direct lightning strike.

3. Mount the PPA with the cable seals facing down by performing the following:

WARNING

Asbestos containing materials (ACM) may be present in some older facilities, including residences (e.g., siding, floors, etc.). Drilling through the structure/materials containing ACM is NOT permitted. Only an Environmental Protection Agency certified and licensed contractor can do the work that involves disturbance of asbestos. Use an alternative location for drilling if ACM presence is suspected or confirmed.

- a. Use a saddle clamp and securely clamp the PPA ground wire to the facility's grounding electrode *conductor*. The end of the PPA ground wire should point toward the ground, away from the SEP.
 - b. Dress the PPA ground wire so there are no right-angle bends and no loops, striving to make any required bends no tighter than a 1-foot radius (larger is better).
 - c. Secure the PPA ground wire to the facility wall with NON-metallic cable clamps. Use fasteners appropriate for the mounting wall.
4. Make a slanted opening in the facility structure at the cable entrance point. Slant the opening to prevent entry of water from the outside, installing the insulating bushing, if required.
 5. Extend the indoor cable from the display location, through the entry hole, and to the vicinity of the PPA.
 6. Seal the entry hole on the outside and inside with caulk. Install caulk so the cable is not touching the entry points to reduce possible cable chaffing.
 7. Support the cable run with the appropriate clamps. Do NOT use any clamp on the sensor or display cables that encircles the wire with metal – not even a half turn (i.e., metal staples).
 8. Route the display, sensor and ground cables to the bottom of the PPA by performing the following.
 - a. Do not run the display, sensor, or grounding cables together or parallel for any distance. Fan them out as they exit the PPA. Maintain the required 1-foot minimum spacing between the sensor and display cables right up to the entrance of the PPA.
 - b. The ground cable run is critical. The run must be short, as straight as possible and without tight bends.

- c. The next most critical is the sensor cable. Route it to the PPA without sharp bends without crossing the ground cable or display cable.

NOTE: The display cable can have sharp bends, must be routed away from the other two cables and must not cross the other two cables.

- d. Fasten all cables to the wall with non-metallic clamps to maintain their positions.
9. Connect the display cable from inside the house by performing the following (see Figure A-3):
 - a. Strip 1/4 inch from the two conductors, feed the cable through the left cable seal, and bind one each in the first two screw clamp connections of the EQUIPMENT SIDE terminal block.
 - b. Strip, if necessary, the drain wire, and attach to the center screw clamp connection of the EQUIPMENT SIDE terminal block.
 - c. Leave no loops of wire inside the box and tighten the cable seal so it clamps the cable. It may be necessary to build up the diameter of the cable with tape to get a good seal. Fasten the cable to the wall with a clamp near the PPA.
 10. Connect the sensor cable from the field by performing the following (see Figure A-3):
 - a. Strip 1/4-inch from the two conductors, feed the cable through the right cable seal, and matching the order used on the display cable (black to black, etc.), bind one each in the first two screw clamp connections, of the LINE SIDE terminal block.
 - b. Strip, if necessary, the drain wire, and attach to the center screw clamp connection of the LINE SIDE terminal block. The drain wire connection is not optional. Fasten the cable to the wall with a clamp near the PPA. Do not run the display cable near the sensor cable (minimum of 1-foot separation).
 11. Connect the ground wire to the external ground lug.

A.4 Technical Information

NOTE: Channels 3 and 4 are spares and may be used in the event Channel 1 or Channel 2 burns out. This arrestor is designed to stop a lot of energy from a lightning surge (a near-by strike), but it will not stop a direct strike – very few things will.

The following is a test procedure to check for a burned out channel:

1. Remove all wires from both the Equipment side and the Line side terminals.
2. Measure the resistance between a Ch# and the GND terminal using the following guidance:
 - Above 10 meg-ohms – channel is good
 - Below 10 meg-ohms – use a different channel

NOTE: The resistance between the Equipment and Line side terminals of the SAME channel is typically 3.3 ohms. This is normal and will not affect the temperature reading.

ATTACHMENT B – Ground Identification Guidance

The following is paraphrased from the NEC (1987) and is provided as guidance in the identification and selection of a grounding point. If a grounding point cannot be positively identified, assistance from a qualified electrician (licensed for the county) must be sought; otherwise the site must be abandoned.

Building or Structure Grounding Electrode System: The grounding electrode system, in general, consists of the following items (when available) bonded together by jumpers: metal underground water pipe, grounded metal frame of building, concrete-encased electrode, or ground ring. These bonded items will be connected to the SEP box by a grounding electrode conductor. In a residence, all of this normally reduces to the metal cold water piping system or ground rod, which is connected to the service entrance panel by a grounding electrode conductor. Of the previous items, when it is certain that they are part of the grounding electrode system, ONLY the grounding electrode conductor is suitable as the grounding point connection for the PPA. For example, if the cold water piping system is the grounding electrode system as indicated by its connection by grounding electrode conductor to the SEP, a point on the grounding electrode conductor nearest the PPA is the proper grounding point.

The “power service accessible grounding point” defined by the NEC refers to a cable or connection point that is external to the enclosure. The NEC (Section 250-71b) specifies that for dwellings, a provision for externally connecting grounding conductors to the enclosures is to be provided. In addition to the metallic power service raceway and the grounding electrode conductor covered in the NEC text, provisions for other approved ground points must be available. An example of the approved means is a #6 American Wire Gauge (AWG) copper conductor bonded to the service equipment and made accessible on the outside wall of the dwelling. See NEC Section 250-71b (3). This auxiliary ground point is not typically available in a residence, regardless, if the facility wiring complies with NEC, a grounding electrode conductor will be available for use. Connect the PPA ground to the SEP grounding electrode conductor ONLY.

Metallic Power Service Raceway: This is not normally used in a residence. Do not connect to a raceway. A reliable surge protection ground connection to a raceway cannot be legally made without the services of a licensed electrician.

Grounding Electrode Conductor or the Grounding Electrode Conductor Enclosure: The conductor enclosure is not normally used in residences. Connect to the grounding electrode conductor ONLY.

Service Entrance Enclosure: Do not connect to the service entrance enclosure. Under NO circumstances should a connection be made INSIDE the service entrance enclosure.

If a grounding electrode conductor cannot be found, the site may not have an effective ground and NWS electrical or electronic equipment will NOT be installed on the premises. Do not make connections to grounded metal structures, underground metal gas piping, steam or hot water pipes. Although some of these connections are allowed in the NEC, NWS does not provide the training or equipment to determine the effectiveness of these items as a ground, nor does NWS have the resources to execute a complete site survey (search of building plans/records, utility records, county construction permits/inspections, etc.) to make a determination in lieu of on-site measurements.

ATTACHMENT C – Materials Required for Installation Activity**Table C-1: Materials Available at National Logistics Support Center**

DESCRIPTION	AGENCY STOCK NUMBER (ASN)	NOTES
Primary Protector	C460-6	
Indoor cable	C460-1W1	Flexible cable for indoor use. Do not bury.
Direct Burial Cable	C450-3W1	Outdoor, burial and UV rated cable.
AC Surge Protector	C460-2	To protect the Nimbus/MMTS on the AC side.

Table C-2: Materials Obtained Locally by Weather Forecast Office

ITEM	NOTES
Copper wire, #10 AWG, solid insulated, green or green with yellow stripe	Standard house wiring is acceptable. (PPA ground conductor.)
Cable clamps	i.e., Radioshack White Single-Cable Nail-In Coax Clips Model # 278-1659
Ground clamp, split bolt type	Sized for the grounding electrode conductor and #10 AWG wire. If the grounding electrode conductor is aluminum, the clamp must be suitable for both aluminum and copper.