Metering and Control Standards

OFF-PEAK & DUAL FUEL WIRING DIAGRAMS
REVISED FEBRUARY 2016
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Metering Equipment & Installation Standards

All types of electric self-contained metering, single socket, multiple sockets, residential & commercial will be an approved heavy duty, ringless type socket with a lever by-pass, clamping jaw, 200 amp minimum interior.

All CT or current transformer type metering will be purchased and installed by Crow Wing Power. This CT metering will be outside, mounted to the transformer, pedestal or overhead pole top.

All CT services, 600 amps and less will have a circuit breaker type disconnect. (See #5 next page)

THE APPROVED METER BASES MUST HAVE THE FOLLOWING FEATURES:
1. Heavy Duty or HW type, lever by-pass, jaw clamping
2. Insulating safety shield track resistant poly-carbonate
3. Ringless type 3R enclosure [cover must fit over meter]
4. 200 amp minimum – 400 amp maximum self-contained

Note! 200 amp minimum size meter base only

EXCEPTIONS:
1. Apartment type or stacked multiple type metering shall meet all of the requirements above with the exception of the 200 amp minimum ampacity.
2. Temporary Services that will be removed and replaced with an approved meter socket will not be required to have the by-pass lever. These are true temporary services that will be removed within a reasonable time period.
3. Crow Wing Power supplied load management, 30 amp sub-meter water heating package – will not require the lever by-pass.

Crow Wing Power will maintain an inventory of approved type meter bases available for purchase. Please contact the office for any specialty type metering that may not be covered in these equipment standards.

APPROVED METER EQUIPMENT

Durham, Milbank & Square D – Heavy duty lever by-pass (200-400 amp, 1 Phase-3 Phase)
Landis & Gyr – HQ lever by-pass (200-400 amp, 1 Phase-3 Phase)
Metering Equipment & Installation Standards

1. All metering equipment will be of the approved type and be mounted outside and be readily accessible.

2. All LM equipment must be outside and wired adjacent to the metering. Power for controls is derived from load side of Load Management meter. Energy Mgt. equipment shall not contain any other wiring. Utility Controls are mounted in a vertical position.

3. All metering & load management equipment shall be readily accessible and mounted at a height of not less than 3 feet to the bottom & 6 feet to the top of the meter base.

4. All metering & load management equipment shall be supplied with an equipment bonding conductor and grounding to the NEC standards.

5. All direct, self contained, and CT type metering 600 amps and less will have a service rated, weather proof, breaker type disconnect wired and attached to the load side of the meter base, mounted below, to the side, or directly behind the meter base on the pedestal. This includes irrigation equipment.

6. 3-Phase, 120/240v self contained services are required to have the conductor with the higher voltage to ground [wild leg] connected to the right side meter terminal as per the NEC in all 3-phase meter bases [for accurate metering purposes]

PLEASE NOTE:
* CWP must have a copy of the wiring affidavit on file prior to any meter installation. The Affidavit may be mailed, faxed, e-mailed, or hand delivered to CWP prior to scheduling meter installation.
* Any electrical service not meeting these approved equipment & installation standards will not be energized.
* Services energized not meeting the requirements will be subject to disconnection until they have been corrected.
* All metering and associated load management equipment that becomes enclosed or inaccessible will be moved to an outside location at the owners' expense!
* See last page for 'Meter Installation and Control Verification'.
* All wiring according to the National Electrical Code.
* Copper to aluminum connections are not allowed.
Inside Low-Voltage Control Wiring Requirements

- All low voltage wiring will be controlled directly from the outside Utility Box that is connected to the Load Management meter base, wired directly to the electric heating or A/C-HP equipment.

- Electric Furnaces/Plenum Heaters, Boilers, Air Source Heat Pumps-A/C units and listed manufactured low voltage control packages used to control electric heating/gas and air source heat pumps will be allowed, provided that they are factory supplied and connected to the equipment.
Example: Electro-Industries Product # PI-032B020

- The preferred method of all low voltage control of equipment is to utilize manufactures contact point N.O. [normally open contacts] marked LM, Power Company, Utility control points or the “blue” wires.
NOTE: Please mark or tape your control wires BLUE.

- Contractor supplied or manufactured control packages, relays, daisy chained or interconnected systems, or any other controls mounted inside will not be allowed on the program.
Please note: The new 11-pin 240 volt relay has the capability of 3 sets of N.O. contact points, with two relays there are 6 sets of contacts.
ENERGY MANAGEMENT CONTROLS: **Off-Peak & Dual Fuel Heat Systems**

NOTE: **Blue** leads rated @ 5 amp/ 125 Vac: **Orange** leads @ 30 amp/240VAC

[Storage heat, plenum heaters, boilers, or other low voltage controlled sources]

Control Wiring Only, Service Wiring NOT shown

Utility Approved Meter Socket with By-pass Lever

Connect Wires Under Load Side Lugs

CAUTION: Do not mix copper & aluminum wires.

PVC CONDUIT BETWEEN UTILITY BOX & METER BASE

**Blue** wires minimum #14 AWG copper.

**Orange** wires min. #10 AWG copper.

Minimum #12 copper

LOW VOLTAGE CONTROL CIRCUIT

WATER HEATER OPTION #1

(See Page #11)
Connect Wires Under Load Side Lugs

Control Wiring Only, Service Wiring NOT shown

200 amp Utility Approved Meter Socket with By-pass Lever

Blue wires minimum #14 AWG copper.
Orange wires minimum #10 AWG copper.

Supply Side Equipment Grounded by the Neutral.

Minimum #10 AWG Cu. or #6 AWG Al.

LOW VOLTAGE CONTROL CIRCUIT

30 AMP SERVICE RATED DISCONNECT

Note: Orange wires, #6 minimum AL “USE” rated, must be connected to separate 30 amp fused disconnect or service per NEC. (See Option #2 on page 11)
ENERGY MANAGEMENT CONTROLS: ALL ELECTRIC HOME ENERGY RATE – 14

Maximum Size 30 Amp 240 Volt 2-Pole Circuit Breaker.

Re-identify white wire in NM cable when used in 240 volt circuit.

10/2 NMB Cable (typical)

Inside Building

Outside Wall

Low Voltage A/C or CONTROL CIRCUIT

To Water Heater RATED DISCONNECT
(Option #2 on Page #11)
ENERGY MANAGEMENT CONTROLS: Combination Heating & Cooling Loads

NOTE: 240V I-Relay rated @ 10 amp/ 125 Vac:
Orange leads @ 30 amp/240Vac

For Dual Fuel Systems where up to 6 single systems are used.

Control Wiring Only, Service Wiring NOT shown

Blue wires minimum #14 AWG copper.
Orange wires min. #10 AWG copper.

Utility Approved Meter Socket with By-pass Lever

N.O. Contacts:
# 1 - # 3
# 6 - # 7
# 9 - # 11

Minimum #12 AWG Cu.

Connect Wires Under Load Side Lugs

Not intended for Baseboard or Unit type heating systems with line voltage control.

(See Option #2 on page 11)
Directly From 200 Amp Off-Peak Meter Socket - Load side lugs

ENERGY MANAGEMENT CONTROLS:
Dual Fuel 100/200 Amp Contactor - DIRECT METERING

Contactor Assembly

1 Amp In-Line Fuses

Blue wires minimum #14 AWG copper.

Orange wires min. #10 AWG copper.

To 30 Amp Service Rated Disconnect

To Dual Fuel Heating Service Panel

Storage Water Heating option #2 (orange wires)
(See Page 11)
ENERGY MANAGEMENT CONTROLS: Dual Fuel 100/200A Contactor – SUBTRACTIVE METERING

- Power from 200 Amp Subtractive Meter Socket [load side lugs] fed from General Service Panel

- **REMOVE FACTORY JUMPER IN METER BASE BETWEEN NEUTRAL & GROUND**

- 1 Amp In-Line Fuses
  - Blue wires minimum #14 AWG copper.
  - Orange wires min. #10 AWG copper.

- To Dual Fuel Heating Panel
- To Water Heater (See page #11)
- From Water Heater Circuit Breaker

See page marked Water Heater Connection Options. (Page #11)

(See page #11 option #1)
ENERGY MANAGEMENT CONTROLS: **Storage Water Heating**

**Option #1**

*Note:* Power for the Water Heater is derived from the 30 amp breaker in the Off-Peak or Dual Fuel Heating Panel. ORANGE WIRES ARE NOT CONNECTED TO LUGS IN THE CONTACOR ASSEMBLY.

**Option #2**

*Note:* Power for the Water Heater Service is derived from the CONTACTOR ASSEMBLY Lugs (see page #9) or 30 amp fuses in the Utility Box (see pages 6 & 7) and are service entrance conductors.
ENERGY MANAGEMENT CONTROLS:

**Sub-Meter for Water Heater or Space Heating - A/C**

**NOTE:** DO NOT MODIFY FACTORY WIRING IN METER BASE.

**GENERAL SERVICE PANEL**

- Inside Building
- Outside Wall

**Re-identify white wire in NM cable when used in 240 volt circuit.**

**To the back or bottom of the meter base.**

**10/2 NMB Cable (typical)**

**Maximum Size 30 Amp 240 Volt 2-Pole Circuit Breaker.**

**To Controlled Load**

**10/2 NMB Cable inside PVC conduit (typical)**

**Sub Meter Kit**

**Blue wires not used.**
Optional Disconnect
[required if water heater is not in sight of main service panel]

Off-Peak Water Heater

Note:
120 gallon tank set at 140°F Maximum.
or
80 Gal. Tank must have mix valve installed & thermostats at 160°F Max.

240V 10/2 NMB Cable [typical]

30 Amp 240 Volt 2-Pole Circuit Breaker (max.)

All exposed wiring must be protected by PVC conduit.

Grade Level

Inside Building

Outside Wall

Sub Meter Control

6 ft. Max.

3 ft. Min.
Plumb Water Heaters in Series as shown for Maximum Capacity: Set Thermostats at 140°F Max or Set at 160°F Max with a mixing valve.

For Field Wiring Use 10/2 NMB (Mark White wire as Red) & 30 Amp Fuses [typical].

For Current Transfer Switch for a 2-Water Heater System.
ENERGY MANAGEMENT CONTROLS: Sub-Meter for Low-Voltage A/C or Heat Pump

Blue wires must be copper, either 18 AWG or 14 AWG.

Power from the General Service Panel to the Existing Disconnect for the A/C or Heat Pump.

Make connections to the load side of the disconnect.

Size conductors to the fused capacity of the circuit. Maximum 60 amp 240 volts.

240V to A/C or Heat Pump Compressor

To Low-Voltage A/C or HP Compressor Control

Note: low voltage only NOT line voltage

Barrier to separate Line & Low voltages
Required Circuit Breaker Disconnect

Off-Peak & Dual Fuel Systems
(See page #5)

Blue wires to PL Signal Injector in PVC conduit

Outside temperature sensor mounted in a location not affected by sunlight or other heat sources.

General Service Panel

Off-Peak Panel

Power Line Signal Injector

240 volt 15 amp with 14/2 NMB cable

4” x 4” J-box mounted behind heater.

240V line wiring sized to each room unit over-current device.

Steffes Room Unit

Steffes Room Unit

Steffes Room Unit

LINE DIAGRAMS: 2100 Series Steffes Room Heaters [Power Line Carrier Controlled]
Required Circuit Breaker Disconnect

General Service Panel

Off-Peak Panel

240V line wiring sized to each furnace element load.

Customer supplied thermostat with 18/6 wire A/C & H.P.

Steffes Storage Furnace

Blue wires to Off-Peak controls RP & P

Check with CWP for A/C - H/P control metering.

14/2 or 14/3 NM Cable

Outside temperature sensor mounted in a location not affected by sunlight or other heat sources.

Fan Circuit:
Series Cable
4100 14/2 15A
5100 14/3 15A
120V circulating pump on Series 5100 only. Must have a neutral conductor.
Required Circuit Breaker Disconnect

Off-Peak & Dual Fuel Systems (See page #5)

14/2 NMB [typical]

Additional Baseboard or Line Voltage Control for Heating must use the Electro-Industries #PI-032B020 And run two Low-voltage control wires. Refer to page #9

240V line wiring sized to each heating element overcurrent device.
LINE DIAGRAMS: Plenum Heater Subtractive Metered
[CONTACTOR CONTROLLED W/LINE VOLTAGE BREAK]

- Required Circuit Breaker Disconnect

200 Amp Meter Base

General Service Panel

See Storage Water Heater Options.
(See page #11)

240V line wiring sized to each heating element, baseboard or unit heater overcurrent device.

Baseboard or Unit Heater

Contactor

Dual Fuel Sub Panel

Off-Peak & Dual Fuel Heat Systems
(See page #9)

ELECTRO EE 5056 Module 240v Relay

240V to Contactor

To LM Controls in Heater

Note: 240V Relay may be required to control unit low voltage and lights

PLENUM HEATER or BOILER
* Customer supplies wiring from the load side of the meter equipment and it must be sized in accordance with the 2008 NEC. (See charts below.)
* Red warning ribbon is placed at least 12 inches above underground service wiring.
* All 120/240 volt feeder wiring [after the service disconnect] must include an equipment grounding conductor [4-wire].

Table 310.15(B)(6) - **THIS CHART IS ONLY FOR DWELLING UNIT, GENERAL SERVICE PANELS:** [NOT OFF-PEAK OR DUAL FUEL]

<table>
<thead>
<tr>
<th>Service Rating (Amps):</th>
<th>Alum. Wire:</th>
<th>Copper Wire:</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Amp</td>
<td># 2 AWG</td>
<td># 4 AWG</td>
</tr>
<tr>
<td>150 Amp</td>
<td># 2/0 AWG</td>
<td># 1 AWG</td>
</tr>
<tr>
<td>200 Amp</td>
<td># 4/0 AWG</td>
<td># 2/0 AWG</td>
</tr>
<tr>
<td>225 Amp</td>
<td>250 kcmil</td>
<td># 3/0 AWG</td>
</tr>
<tr>
<td>400 Amp</td>
<td>600 kcmil</td>
<td>400 kcmil</td>
</tr>
</tbody>
</table>

Table 310.16 - **THIS CHART MUST BE USED FOR ALL NON-DWELLING GENERAL LOADS INCLUDING:** OFF PEAK & DUAL FUEL SERVICES & FEEDERS [Direct Metered and Sub-Metered Loads].

<table>
<thead>
<tr>
<th>Service Rating (Amps):</th>
<th>Alum. Wire:</th>
<th>Copper Wire:</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Amp</td>
<td># 1 or 1/0 AWG</td>
<td># 3 or # 2 AWG</td>
</tr>
<tr>
<td>150 Amp</td>
<td># 3/0 or 4/0 AWG</td>
<td># 1/0 AWG</td>
</tr>
<tr>
<td>200 Amp</td>
<td>*250 kcmil</td>
<td># 3/0 AWG</td>
</tr>
<tr>
<td>225 Amp</td>
<td>300 kcmil</td>
<td># 4/0 AWG</td>
</tr>
<tr>
<td>400 Amp</td>
<td>2 x 250 kcmil</td>
<td>2 x 3/0 AWG</td>
</tr>
</tbody>
</table>

* If 4/0 Aluminum is used for a 200 Amp Service or Feeder a calculated load must be provided to CWP & the electrical inspector.
METER INSTALLATIONS AND CONTROL VERIFICATION

All Load Management Meter installations are considered complete only after the installing Electrician/Owner Installer has completed all of the necessary wiring and a Crow Wing Power Electrician has verified that the control wiring is correct.

It is the responsibility of the Electrician/Owner Installer to schedule an appropriate time within reason for the Crow Wing Power Electrician to inspect the installation for the following:
* All metering equipment & control wiring mounted outside must be completed.
* All control wires must be buried & terminated, in an approved junction box or panel, at the CWP control box & in the building. This wiring must be inspected for compliance with the National Electrical Code.
* All heating equipment & water heating equipment intended to be served by the Load Management meter to be installed, must be wired & ready for use.
* Only approved type heating equipment designed for and factory wired for an inter-connection type control of other heating equipment [Daisy Chained] will be allowed. (Please contact CWP for equipment approval)
* All Load Management electrical panels for heating, A/C, and water heating must be wired for approved loads only and completed with the covers installed. These panels will be sealed with a CWP panel cover seal.

NOTE: The metering will be installed upon completion of the above criteria.

* All Load Management Rebates will be based on meeting the above criteria and filing the proper forms.
* Requests for installation of a Load Management meter, before all of the above criteria are met, will result in a $50.00 per return trip charge. This charge may be waived under certain conditions.
* Only approved Load Management type equipment, supplied by Crow Wing Power will be installed. Any other control equipment installed inside or outside WILL NOT BE CONNECTED.
* Exception to CWP supplied equipment: For Storage Electric Floor Cable Heating, the Electro-Industries PI-DC coil, 30 amp relay panel with sequencing will be purchased by the installer.

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