

**BUS BAR AND CABLING ARRANGEMENTS
111A, 302A, 303A, 702C, AND 708A POWER PLANTS
EQUIPMENT DESIGN REQUIREMENTS
POWER SYSTEMS**

1. GENERAL

Scope

1.01 This specification, together with the supplementary information listed herein, covers the equipment design requirements to be used in the engineering, manufacture, and installation of bus bars and cabling between the power board, batteries, and charging units for 111A, 302A, 303A, 702C, and 708A power plants. It also covers the cabling for the ac service supply between the house serviceboard, plug-in bus duct, power service cabinet, and charging units associated with the above plants.

1.02 This specification is reissued to add 111A, 303A, and 708A plants and to bring the specification up to date.

Description

1.03 In general, the interconnections of these power plants are bus bars or cables on cable rack supported from the individual equipment units. Power service distributing leads are run as bus duct or as armored cable on racks or in conduit. In the large plants, bus bar may be required between the power board and the charging units or machines. The bus bars are supported from power board frameworks and battery stands supplemented by low-type auxiliary framing. The type of construction used in these power plants permits them to be installed in buildings having a 9 foot 0 inch power room ceiling height.

1.04 Bus bars, clamps, supports, framing, and other details forming parts of the supporting equipment shall follow as closely as possible the general arrangement used in central offices for auxiliary framing and cable rack.

2. SUPPLEMENTARY INFORMATION

- 802-000-000 - Power Systems Index
- AA128.002 - Checking List - Equipment Design Requirements
- AA128.006 - Checking List - General Equipment Requirements
- 802-005-180 - Plant Bus Bar and Wiring
- E-1378 - List of Engineering Requirements Specifications Used by Outside Suppliers for Manufacturing Bell System Equipment
- J86260 (Mfr Disc.) - 302A Charging Equipment
- J86261 (Mfr Disc.) - 302A Charging Equipment
- J86284 (802-156-150) - 702C Charging Equipment

- J86322 (802-185-150) - Battery Control Board - 302A Plants
- J86323 (802-175-150) - Main Control Board - 302A Plants
- J86325 (802-185-151) - Battery Control Board - 702C Plant
- J86326 (802-175-152) - Main Control Board - 702C Plants
- J86327 (802-185-153) - 303A Power Plant
- J86470 (802-659-160) - 111A Power Plant
- J86827 (802-874-150) - 708A Power Plant
- J87115 (802-126-151) - Battery Equipments - 302A Plants
- J87120 (802-125-150) - 702C Battery Equipment
- J87121 (802-126-152) - 303A Battery Equipments
- Power Data Book
- Floor Plan Data Book

3. DRAWINGS

Cabling - General

- ED-81632-01 - Cable and Bus Bar Layouts - 302A Plants
- ED-81635-01 - Bus Bar and Cabling at Rectifiers
- ED-82019-01 - Cabling 303A Plants
- ED-82022-01 - Cabling 111A Plants

Miscellaneous

- ED-80708-01 - Conductor Equipment Details
- ED-81763-01 - Bus Duct - Frank Adams
- ED-81764-01 - Bus Duct - BullDog
- ED-81969-() - Bus Bar Supports

Associated Drawings Showing Cabling and Bus Bar

- ED-81306-() - +130 Volt Battery Control Board - 702C
- ED-81328-() - +130 Volt Battery Control Board - 702C
- ED-81985-01 - Cabling and Bus Bar - 302A Plants
- ED-81986-01 - Cabling and Bus Bar - Large 302A Plants

Note: In addition to the ED drawings listed, the various codes of the WECO manufacturing drawings under the J-numbers specified in Part 2 give information related to interconnections between equipments.

4. REQUIREMENTS FOR CONDUCTORS

Power Service

- 4.01 Combination switch and fuse units are provided for the ac supply to

24-, 48-, and 130-volt motor-generator sets, rectifiers, and other miscellaneous loads. These switch and fuse units shall be mounted on bus duct near the charge unit, or in a power service distributing fuse cabinet depending on the size of the power plant.

4.02 If a single power supply circuit is being furnished and it feeds three or fewer motor-generator sets or floor-mounted rectifier units in the ultimate (trickle and power board mounted charge units excepted), the switch and fuse units shall be mounted in a KS-15697 or KS-15699 front-connected switchboard, and the connections between this switchboard and the motor starters or rectifiers shall be armored cable run on cable rack. Where the local code prohibits the use of armored cable and it is so specified in the telephone company specification, these leads shall be run in conduit. This service cabinet shall also mount the ac fuses for supplying the main control board, emergency cell trickle charge rectifiers, ringing machines, etc.

4.03 On plants having more than three charging units in the ultimate, a plug-in bus duct per KS-15696 or KS-15698 shall be provided over the charging units with a plug-in switch and fuse unit mounted on the bus duct adjacent to each charging unit. The ac connections between the switch and fuse unit and the motor starter or rectifier shall be leads run in flexible conduit as shown on the various charging unit assembly drawings.

4.04 When bus duct is used for supplying the ac service to the charging units, the ac supply from the house serviceboard shall connect to the bus duct. An ac power service distributing cabinet shall be provided and supplied from a switch and fuse unit mounted on the bus duct. This cabinet shall mount the ac fuses for supplying the main control board, trickle charging rectifiers, ringing motor, etc. If the load on this cabinet does not require more than a 200-ampere supply fuse and the cabinet is not more than 66 inches long nor required to mount fuses over 100-ampere capacity, it shall be a wall-mounted type and mounted on the power room wall or column. In the event that the requirements exceed those listed above and the supply fuse does not exceed 400 amperes, a front connected switchboard per KS-15697 or KS-15699, equipped with combined switch and fuse units, should be provided and mounted against the wall together with any power factor correction equipment which may be required. This ac service bay shall not be mounted in the power board line-up. If the supply fuse is larger than 400 amperes, the front connected switchboard shall be used as above and a separate feeder shall be provided directly from the house serviceboard. If single-phase grounded circuits are required, the supply to the power service

distributing cabinet or switchboard shall be provided from the house serviceboard.

4.05 When the machines are all in one line and the load does not exceed 1000 amperes, the ac connection to the bus duct shall be made at the nongrowing end, using an end tap box if possible. If there are more than three cables per phase, it will be necessary to use a plug-in cable tap box located at the end of the run. The bus duct shall have a capacity equal to the load. If the load exceeds 1000 amperes but does not exceed 2000 amperes, a plug-in cable tap box shall be used and so located that the load does not exceed 1000 amperes in any part of the run. A 1000-ampere bus duct shall be used. If the load exceeds 2000 amperes, two plug-in cable tap boxes shall be provided and so located that the capacity of the 1000-ampere bus duct is not exceeded. If the single plug-in cable tap box does not require more than three cables per phase lead and for the two cable tap box arrangement with four or five cables per phase lead, it will be possible to use the plug-in cable tap box having a capacity of three cables per phase lead.

4.06 When the machines are located in two or three lines, a plug-in cable tap box having a capacity of five cables per phase shall always be used. These shall be located at the nongrowing end of the line if no row of bus duct requires more than 1000 amperes; otherwise, they shall be located toward the center of the run so that the load does not exceed 1000 amperes in any part of the run. Bus duct shall have a capacity equal to the total load in the row up to 1000 amperes. Above 1000-ampere load, 1000-ampere duct shall be used. No portion of any duct shall have a capacity less than 1/3 of the size of the supply fuse.

4.07 Run all of the service leads in the same conduit if possible. If they are too large to be run in the same conduit, each lead shall be divided into not more than five conductors of equal size and approximately equal length. Any one conduit shall contain at least one conductor of each phase lead. Rigid conduits shall connect to bus duct through a 3-foot section of flexible conduit.

4.08 Provide cable or wire in rigid conduit from engine alternator to the power service cabinet or bus duct except for the short flexible section at the bus duct. AC service conductors shall not be run open on cable rack.

302A Plants

4.09 Charge conductors shall be run as either cables per KS-5482-01 or bus bars in accordance with the following arrangement.

- (a) For 24- or 48-volt plants of 1200-ampere capacity or less, use leads for conductors. Use separate charge leads between each charging unit and power board, and separate charge and discharge leads between power board and each string of batteries.
- (b) For 24- or 48-volt plants above 1200-ampere capacity, use bus bars between the charging units and power board or batteries.
- (c) On combined 24- and 48-volt plants using separate controls where the charging units of both voltages are mounted in the same line, if the capacity of each plant is 1200 amperes or less, use leads for both plants. If the capacity of either plant exceeds 1200 amperes, use bus bars for conductors over the charging units of both voltages. The conductors between these bus bars and the power board and batteries for the voltage whose capacity is 1200 amperes or less shall be leads and those for the voltage whose capacity exceeds 1200 amperes shall be bus bar.
- (d) On combined 24- and 48-volt plants using separate controls where the charging units for 24- and 48-volt plants are located in separate lines, treat as separate plants and follow requirements covered in (a) and (b).
- (e) When 24- and 48-volt charging units are mounted in separate lines and the capacity of both voltages exceeds 1200 amperes, a common ground charge bus bar may be provided between the batteries and both lines of charging units.
- 4.10 Battery conductors between the power board and the batteries shall be either cable per KS-5482-01 or bus bars in accordance with the following arrangement.
- (a) On plants of 1200-ampere capacity or less, the conductors shall be leads, a separate set being provided for each string of cells. Leads for future strings shall not be installed initially but provisions shall be made initially so that they can be installed at a later date without rearrangement of the initial leads. No other conductors shall be run on the cable rack which carries these leads.
- (b) On plants exceeding 1200-ampere capacity, the conductors between the power board and batteries shall be bus bar. Bus bars for the ultimate capacity shall be installed initially.
- 111A, 303A, 702C, and 708A Plants
- 4.11 The separate charge and discharge conductors for these plants shall always

be cables per KS-5482-01. Use separate charge leads between each charging unit and power board.

4.12 Battery conductors for these plants shall always be cables per KS-5482-01, a separate set being provided for each string of cells. Leads for future strings of cells shall not be installed initially but provisions shall be made initially so that they can be installed at a later date without rearrangement of the initial leads. No other conductors shall be run on the cable rack which carries these leads.

All Plants

4.13 Charge and battery conductors between the charging units, control board, and the batteries shall be selected from the following table which takes some advantage of the higher currents permitted by the Underwriters' Laboratories for leads run in the open when only a few of the conductors in a bank carry the maximum current.

Charge and Battery Leads
Currents and Maximum Fusing

<u>Cable Size</u>	<u>Capacity (amperes)</u>
2	143
0	190
00	220
0000	295
350,000	408
500,000	500
750,000	630

4.14 Discharge conductors between the battery control board and the loads shall be run in accordance with the requirements of Section 802-005-180. The sizes of the conductors shall not be selected from 4.13 but should adhere to the values listed in the Power Data Book and the National Electric Code for leads in conduit.

4.15 Provide paired cable on cable rack for 130-volt signal and telegraph and teletypewriter discharge conductors when decentralized filters are used.

4.16 The equipment in general, particularly for the larger plants, should be arranged to permit short and direct cable runs since both the length and the size (because of voltage drop) of conductors increase with longer runs.

4.17 The conductors shall be arranged to meet the pairing and separation requirements covered in 802-005-180. Talk and signal cable and wire on cable rack are to be paired and spaced as given, and the bus bars arranged on two levels and run as covered on the typical bus bar and cabling drawings to obtain proper pairing and separation.

4.18 Provide switchboard cable run open on cable rack for alarm leads and for the smaller control, signal, and miscellaneous leads as specified.

5. BUS BARS

5.01 For 302A plants, provide aluminum bus bars, when required, for overhead horizontal runs. Except for drop conductors to batteries, it is permissible to use aluminum for vertical and horizontal runs on emergency cell stands.

5.02 Provide epoxy glass or phenolic insulators with associated bolts and studs. Use sleeves and clips for up to two bars and bus bar support details per ED-81969-() for more than two laminated bars.

5.03 Where bus-bar clamps are indicated, specify corrosive, protective, malleable iron clamps for either aluminum or copper bars.

5.04 Bolts, screws, nuts, and washers for bus bars shall be steel with cadmium, or zinc with chromate, finish.

5.05 Provide 1/4-inch thick bus bars on 1/2-inch centers for laminated bars.

5.06 Bus bar joints shall be based on 200 amperes per square inch contact surface. The lugs, studs, joints, shunts (including laminations indicated as required by the shunt design), etc, are designed for proper carrying capacity and it is not necessary to make calculations of the generally used connections.

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