Product Manual
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Lineage® 2000 600-Ampere, +24-Volt ECS Minicell Battery Plant

Notice:
Every effort was made to ensure that the information in this document was complete and accurate at the time of printing. However, information is subject to change.

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1 Introduction

General

This product manual (Select Code 167-790-062) describes the H569-420 ECS Minicell Battery Plant, developed by Lucent Technologies to satisfy the growing needs of cellular service providers for a reliable mid-size, +24-volt battery plant.

Application

The H569-420 battery plant supports +24-volt loads between 100 and 600 amperes and -48-volts loads less than 4 amperes. Designed with new wireless hut dimensions in mind, this plant has a small footprint.

Configurations

The H569-420 is a front-access plant and offers you the flexibility needed to plan a cell site. The +24V minicell battery plant has two main configurations:

- The first accommodates two rectifier shelves, a controller, a distribution panel, a +24V/-48V converter shelf, and one string of C&D 600-ampere-hour batteries.
- The second houses either two rectifier shelves or one rectifier shelf and one +24V/-48V converter shelf, as well as a controller, a distribution panel, and up to two strings of Lucent Technologies 2VR375E 375-ampere-hour batteries.

Basics

The H569-420 battery plant is shown in Figures 1-1 and 1-2. This member of the ECS family of battery plants operates from a nominal 208/220/240-volt ac, 50/60-Hz source. It offers a total plant capacity of 600 amperes with a nominal 24-volt dc output in a totally integrated energy system.

The H569-420 plant houses the rectifiers, controller, distribution, and the battery in a single, compact frame. It offers a choice of racks that are mounted on a battery stand. The basic plant has charge and discharge bus bars with optional low voltage disconnect, a distribution panel capable of accepting up to 42 circuit breakers, an ECS controller, space for two rectifier shelves and/or converter assembly. The +24V Lineage® 2000 ECS plant can connect up to six +24-volt, 100-ampere switchmode rectifiers and either two strings of Lineage® 2000 375-ampere-hour VR Series +24-volt batteries or one string of 600-ampere-hour batteries.

The plant's modular, front-access design makes installation, growth and use in confined locations easy. Plant output current capacity is increased by adding Lineage® 2000 100-ampere, +24-volt rectifiers to the rectifier shelf assemblies. Two optional circuit packs are available to enhance the basic controller. One adds microprocessor-based remote features and the second, a datalogger.

Technical Support

Technical support for Lucent Technologies equipment is available to customers around the world.

USA, Canada, Puerto Rico, and the US Virgin Islands

On a post-sale basis, **during the Product Warranty period,** our Technical Support telephone number 1-800-CAL RTAC (1-800-225-7822) provides coverage during normal business hours. Product Specialists are available to answer your technical questions and assist in troubleshooting problems. For out-of-hours EMERGENCIES, the 800 number will put you in touch with a Regional Technical Assistance Center Engineer via our 24 hour a day, 7 day per week Help Desk.

When Technical Support is required in **the Post-Warranty Period**, the service may be billable unless you hold an extended warranty or contractual agreement.

Central and South America

If you need product technical support, contact your local Field Support/Regional Technical Assistance Center or contact your sales representative who will be happy to discuss your specific needs.

Europe, Middle East, and Africa

If you need product technical support, contact your local Field Support/Regional Technical Assistance Center or contact your sales representative who will be happy to discuss your specific needs.

Asia Pacific Region

If you need product technical support, contact your local Field Support/Regional Technical Assistance Center or contact your sales representative who will be happy to discuss your specific needs.

Product Repair and Return

Repair and return service for Lucent Technologies equipment is available to customers around the world.

USA, Canada, Puerto Rico, and the US Virgin Islands

For information on returning of products for repair, customers may call 1-800-255-1402 for assistance.

Central and South America

If you need to return a product for repair, your sales representative will be happy to discuss your individual situation.

Europe, Middle East, and Africa

If you need to return a product for repair, your sales representative will be happy to discuss your individual situation.

Asia Pacific Region

If you need to return a product for repair, your sales representative will be happy to discuss your individual situation.

Customer Service

For customer service, any other product or service information, or for additional copies of this manual or other Lucent Technologies documents, call 1-800-THE-1PWR (1-800-843-1797). Specify the select code number for manuals, or drawing number for drawings. Contact your regional customer service organization or sales representative for information regarding spare parts.

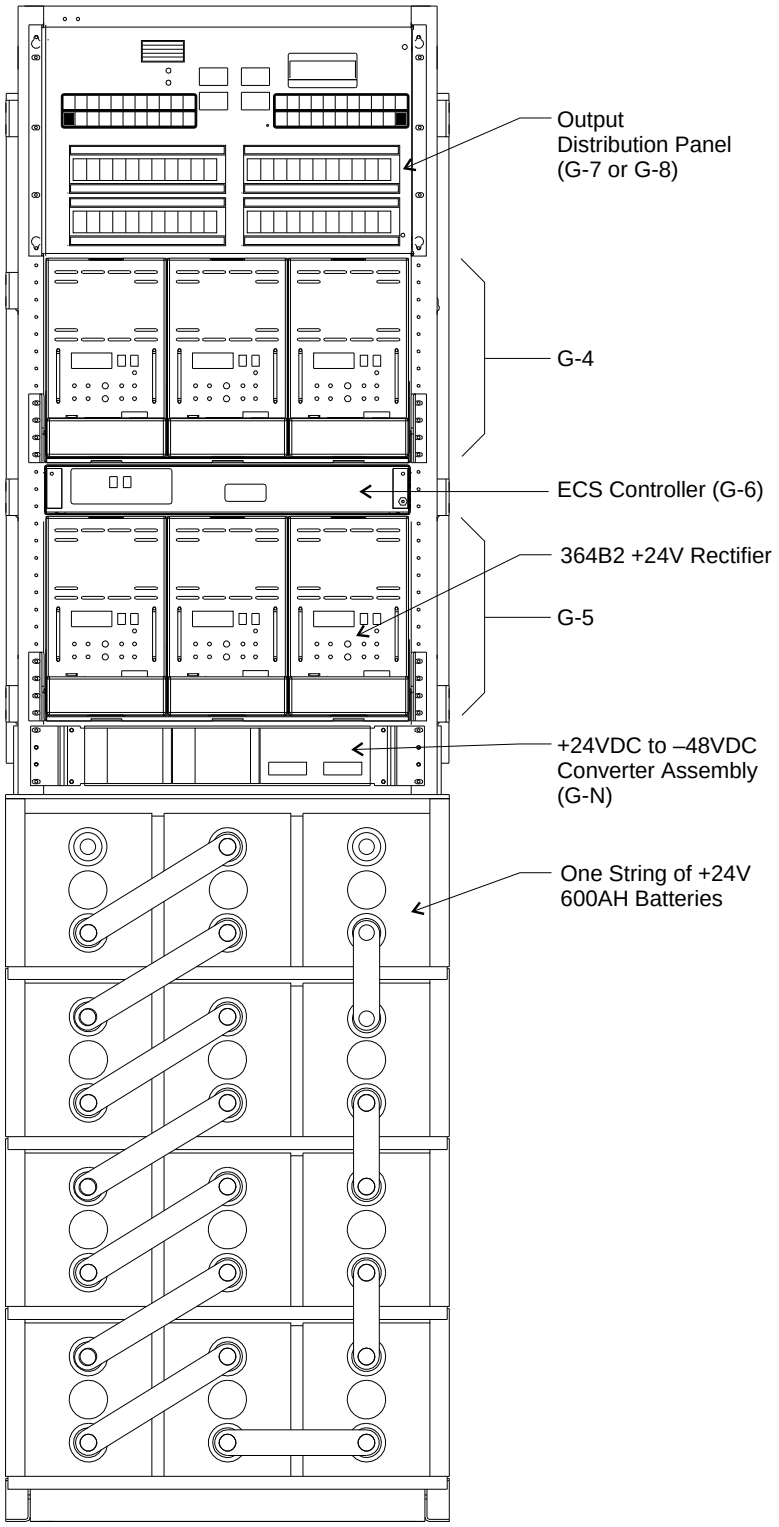

Figure 1-1: +24V Lineage® 2000 ECS Minicell Battery Plant (Model H569-420 Group 1)

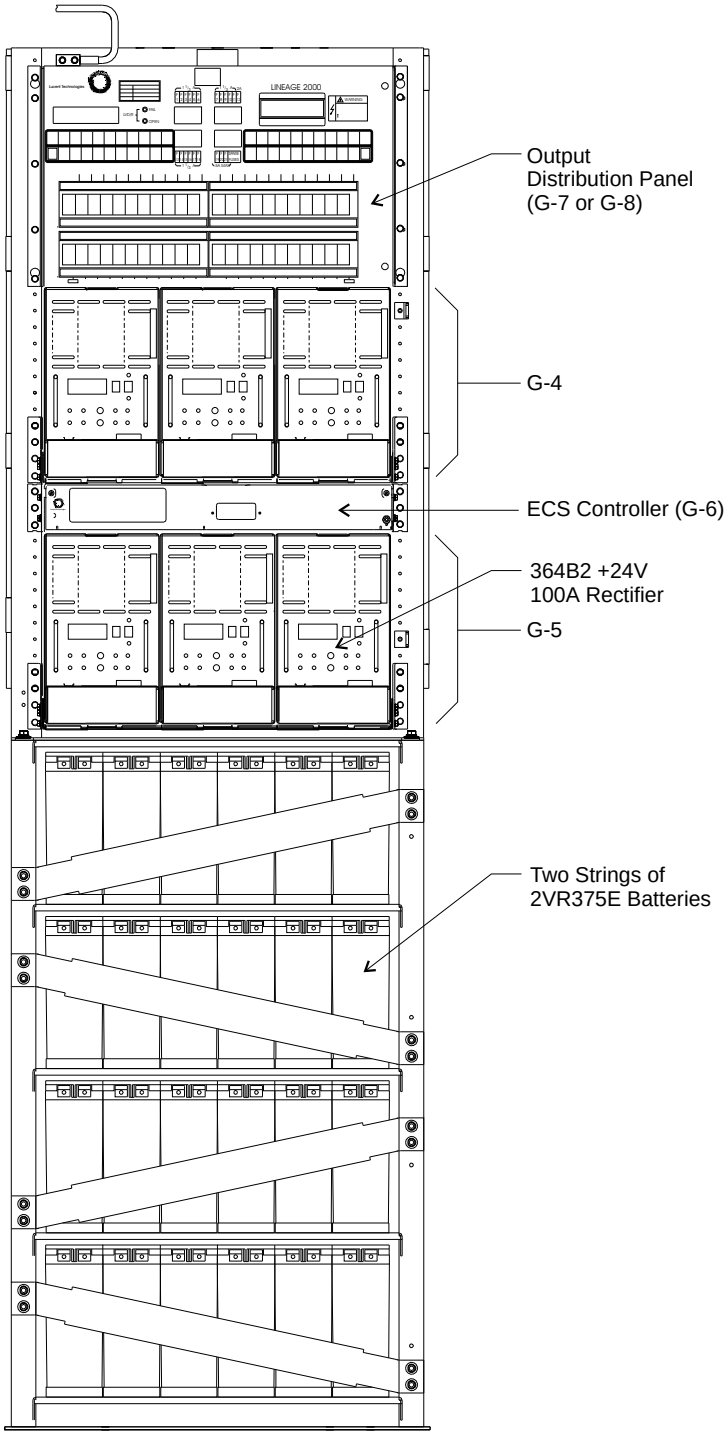

Figure 1-2: +24V Lineage® 2000 ECS Minicell Battery Plant (Model H569-420 G-2 E/W Group 10)

2 Product Description

Specifications

Table 2-A: H569-420 Specifications

Input Voltage	180-264 volts ac (208/220/240 volts ac nominal)
Input Frequency	47-63 Hertz (50/60 hertz nominal)
Operating Voltage	20-30 volts dc (24 volts dc nominal)
Float Voltage	24-29 volts dc (24 volts dc nominal)
Plant current rating (Note 1)	600 amperes
Plant Shunt	600 amperes maximum @ 50 millivolts
Low Voltage Disconnect/Reconnect	20.25 or 21.25 volts dc
Controller	Basic: 113B Microprocessor option circuit pack Datalogger option circuit pack
Rectifier Shelf Assembly	2 maximum; each mounts 3 rectifiers
Rectifiers	Type: 364B Rating: +24V dc nominal, 100 amperes Maximum per plant: 6

Table 2-A: H569-420 Specifications

Converter Shelf Assembly (Note 2)	Type: PECO II
Converters	Type: PECO II Rating: 48V dc nominal, 4 amperes Maximum per shelf: 2
Batteries (Group 1)	Type: C&D, Liberty 2000 Rating: 600Ah Maximum per plant: 1 string
Batteries (Group 2)	Lineage® 2000 2VR375E Rating: 375Ah Maximum per plant: 2 strings
Circuit Breakers	Type: KS23616 Available ratings: 3, 5, 10, 15, 20, 30, 40, 45, 50, 60, 760, 80, 90, 100 amperes Interrupt capacity: 7000 amperes
Temperature	32 to 122° Fahrenheit 0 to 50° Celsius
Altitude (Note 3)	-200 to 13,000 feet -61 to 3962 meters
Framework (Group 1) H x D x W	46" x 16.5" x 26" 1168mm x 419mm x 660mm
Framework (Group 2) H x D x W	42" x 26" x 26" 1067mm x 660mm x 660mm
Vertical Mounting Centers	1.00" (25 mm)
Horizontal Mounting Center	22.32" (567 mm)
Dimensions with battery stand Group 1 (H x D x W)	88" x 16.5" x 26" 2235mm x 419mm x 660mm
Dimensions with battery stand (G-10) Group 2 (H x D x W)	84" x 26" x 26" 2134mm x 660mm x 660mm

Table 2-A: H569-420 Specifications

Weight Group 1	362 lbs (164kg) with 6 rectifiers 1797 lbs (815kg) with 6 rectifiers battery stand and 1 string of C&D batteries
Weight Group 2	337 lbs (153kg) with 6 rectifiers 1636 lbs (742kg) with 6 rectifiers battery stand and two strings of VR batteries
Rectifiers	25 lbs (11 kg)
Batteries Group 1	1 string C&D Liberty 600 Ah: 1435 lbs (651kg)
Batteries Group 2	2VR375E Battery: 78 lbs (35kg) each 1 string: 936 lbs (425.5kg)
Earthquake Group 1	Zone 3 (includes 1 string of batteries)
Earthquake Group 2	Zone 4, upper floors (includes 2 strings of batteries)
Heat Dissipation Group 1 (Full load)	3398 Watts (11595 BTU/hr)
Heat Dissipation Group 2 (Full load)	3328 Watts (11356 BTU/hr)
Heat Dissipation by unit (Full load) (Note 4)	Rectifier: 538 Watts (1836 BTU/hr) Controller, basic + options: 26 Watts (89BTU/hr) Converter: 144 Watts (491 BTU/hr)
Humidity Rating	10% to 95% non-condensing
Audible Noise (Note 5)	65dBa
Electrostatic Discharge	IEC 801-2 Level 5 (15KV) @ 40% relative humidity
Radiated and Conducted Emissions	FCC Level A
Electromagnetic Immunity	10V/m over the range of 20 to 2000MHz

Notes

1. If a panel is expected to operate continuously in an ambient temperature of 40° C to 50° C, the total current draw through the panel cannot exceed 500 amperes.

2. The H569-420 Group 1 can accommodate 2 rectifier shelves and one converter shelf. In the H569-420 Group 2, the converter shelf takes the place of the second rectifier shelf.

3. For altitudes of 5000 to 13,000 feet, derate maximum temperature by 3.6° F per 1000 feet above 5000 feet. For altitudes of 1524 meters to 3962 meters, derate the maximum temperature by 0.656° C per 304 meters above 1524 meters.

4. Specified at 27.25 volts dc, 600 amperes output, and nominal input voltages and frequencies.

5. Measured at 2 feet (0.6 meter) from the rectifiers installed in a plant.

Safety Agency Approvals

The H569-420 bay is Underwriters Laboratories (UL) Listed per Subject Letter 1801, Power Distribution Center for Communications Equipment. Rectifiers are individually UL Recognized (UL1950) and CSA Certified (CSA 22.2234) or equivalent.

Typical Battery Plant

A basic block diagram of a typical dc battery plant is shown in Figure 2-1. The battery plant accepts alternating current from the commercial utility or a standby ac power source and rectifies it to produce dc power for the using equipment. The plant's control and alarm functions interact with the rectifiers and the office. In addition, the plant provides overcurrent protection, charge, discharge, and distribution facilities. Battery reserve automatically provides a source of dc power if the commercial or standby ac fails. This battery reserve is engineered to supply dc power for a specific period of time. In normal practice, battery capacity is sized to provide 3 to 8 hours of reserve time.

Battery Plant Subsystems

AC Input: connects the commercial and/or standby ac power sources to the rectifiers within the plant and provides overcurrent protection. This subsystem is usually supplied by the customer.

Rectifiers: convert an ac source voltage into the dc voltage level required to charge and float the batteries and to power the using equipment.

Controller: provides the local and remote control, monitor and diagnostic functions required to administer the battery plant.

Batteries: provide energy storage for an uninterrupted power feed to the using equipment during loss of ac input or rectifier failure.

DC Distribution: provides overcurrent protection, connection points for the using equipment, and bus bars used to interconnect the rectifiers, batteries, plant shunt, and dc distribution.

Converters: transform 24-volt source voltages into regulated, low noise -45.6 to -50.4 volt dc power sources for use with telecommunications loads.

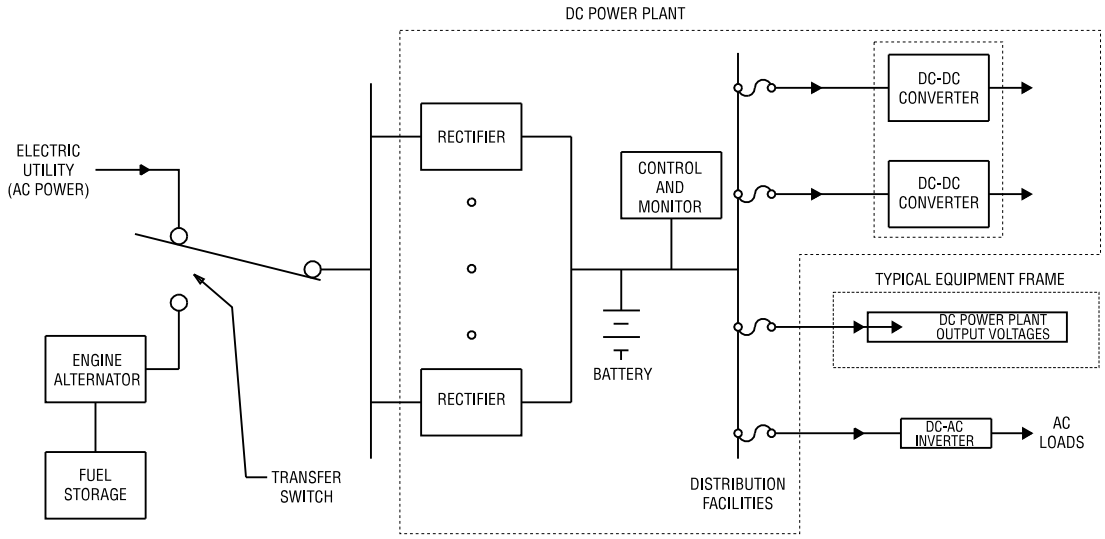

Figure 2-1: Block Diagram of Typical Battery Plant

ECS Battery Plant Physical Description

The H569-420 Lineage® 2000 Evolutionary Control System (ECS) Battery Plant is shown in Figures 1-1 and 1-2. The ECS battery plant provides power for the using equipment as well as float and recharge capability for the battery reserve. The plant operates from a nominal 208/220/240 Vac, 50/60 Hz source. It offers a 600-ampere total plant capacity with a nominal +24 Vdc output. The ECS battery plant per Group 2 is mounted on a battery stand which provides space for two 24-volt strings of VR Series 2VR375E batteries. The Group 1 plant is field-mounted on a C&D battery stand which provides space for one string of +24V batteries. The ECS plant is capable of operating without batteries, making it suitable for those applications where battery backup is not necessary or is provided by an uninterruptible power supply (UPS) or a generator.

The ECS battery plant uses state-of-the-art technology to achieve dramatic equipment size and weight reduction and to minimize maintenance. These advantages are realized by the application of Switchmode Rectifier (SR) and Valve-Regulated (VR) battery technologies and a unique plug-in rectifier and circuit breaker design.

The ECS battery plant is a totally integrated, complete energy system in a compact package. One standard equipment rack accommodates the following:

- a maximum of six +24-volt, 100-ampere rectifiers
- a controller
- circuit breaker distribution panel, accepting breakers from 3 to 100 amperes, with an optional automatic battery low voltage disconnect/reconnect (LVD/R) feature
- a converter shelf assembly with two 4-ampere 24-volt to 48-volt converters
- batteries

The plant has a modular front-access design for ease of installation, growth and maintenance. This power system is ideal for use in confined areas and allows more efficient use of valuable floor space.

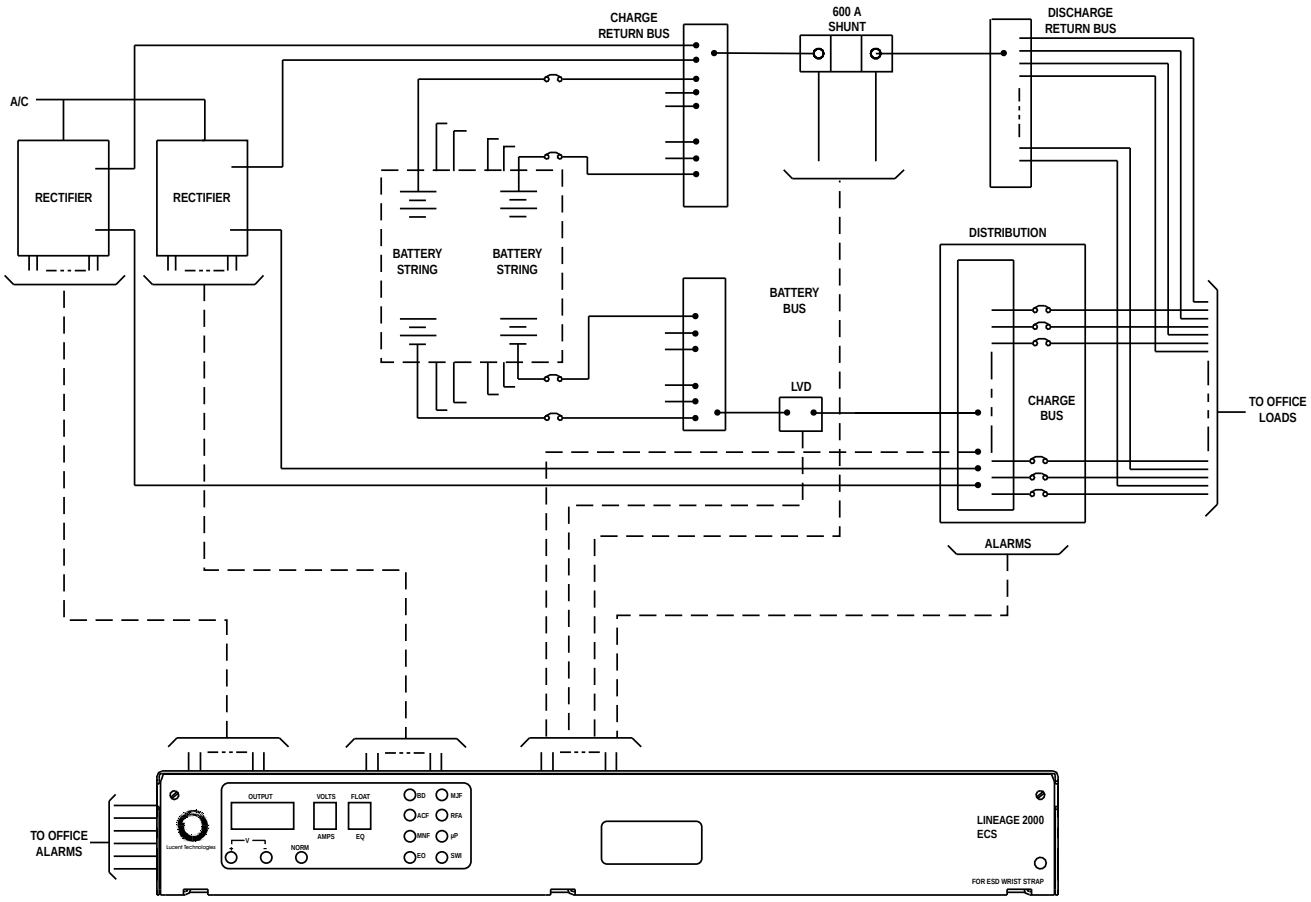

Figure 2-2: ECS Battery Plant Block Diagram

ECS Battery Plant Subsystems

Figure 2-2 illustrates the arrangement and interconnections of the ECS Battery Plant subsystems from the ac input to the dc output.

Rectifier

The Lineage® 2000 SR Series rectifiers are designed specifically for applications where small size, low weight and ease of installation are important. The rectifiers use a combination of switchmode technology and forced air cooling to achieve a significant reduction in size and weight over conventional ferroresonant rectifiers. The plug-in, connectorized design of the rectifiers reduces installation time to minutes, permitting easy growth and maintenance without service interruption.

The Lineage® 2000 SR Series 100-ampere rectifiers operate over 208/220/240 Vac 50/60 Hz nominal single phase input range

without transformer tap changes. A power factor correction circuit incorporated in the design ensures a power factor of 90 percent or greater for loads above 50 percent of the full load rating. The rectifiers provide the ECS controller with a full complement of status and alarm signals. The SR Series 100-ampere rectifier is both UL recognized and CSA certified.

The rectifier status and alarm signals, ac input, and dc output are all connectorized. The rectifiers plug into a rectifier shelf assembly that accommodates a maximum of three individual 100-ampere rectifiers. The ECS plant can be equipped with up to two rectifier shelf assemblies for a total capacity of six SR Series 100-ampere rectifiers. (See the Lineage® 2000 SR Series rectifier product manual for additional information.)

Batteries

The Lineage® 2000 VR Series battery is designed specifically for use in the ECS battery plant. The VR Series battery maximizes space efficiency and provides the benefits of front access, modular growth, ease of installation and maintenance offered by the ECS battery plant system design.

The Lineage® 2000 VR Series battery is a valve regulated design incorporating many of the same technologically advanced features as the highly acclaimed Lineage® 2000 Round Cell battery. It is a compact, totally front access, modular battery based on a unit cell architecture. The VR Series battery is currently available in a 2 volt, 375-ampere hour configuration for use in the Group 2 ECS plant. The compact physical dimensions of the VR battery permit the installation of up to 750 ampere hours of +24 volt battery reserve in a single framework space. (See the Lineage® 2000 VR Series battery product manual for additional information.)

Controller

The ECS controller (H569-420 Group 6) performs the centralized monitoring, control and reporting functions for the ECS battery plant. The basic ECS controller can monitor and control up to six rectifiers. It also provides a single interface point for power alarm and status reporting.

Two optional expansion circuit packs are available to upgrade the ECS controller: a microcomputer board equipped with a powerful 16-bit microprocessor, and a datalogger board. The microcomputer board adds sophisticated firmware features such as remote communications, alarm history, and statistics. The

datalogger board may be used in conjunction with the microcomputer option to provide general purpose ac and dc voltage and current monitoring and control. (See the ECS controller manual for further information.)

DC Distribution

The ECS dc distribution panel (H569-420 Group 7 or 8) has a maximum of 42 circuit breaker positions. The circuit breakers are a plug-in style, available in 3 to 100 ampere ratings (see Figure 2-4). The circuit breakers rated between 3 and 50 amperes occupy one position; those rated between 60 and 100 amperes require two positions on the panel. Each bus bar in the panel is rated at 200 amperes in a 50° C ambient temperature, but the total amperage for the panel cannot exceed 600 amperes. **If a panel is expected to operate continuously in an ambient temperature of 40°C to 50°C, the total current draw through the panel cannot exceed 500 amperes**. The distribution panel contains the plant charge and discharge bus bars, plant shunt, optional low voltage disconnect/reconnect (LVD/R) contactor and associated circuitry (see Figure 2-3).

ECS DC Distribution Panel

The ECS dc distribution elements are shown schematically in Figure 2-2 and pictorially in Figure 2-3. They are located behind the dc distribution cover panel. These elements include the distribution bus bars, the plant shunt and the optional low voltage battery disconnect/reconnect feature.

Distribution Bus Bars

The distribution or plant bus bars include the Charge Return Bus and the Discharge Return Bus (see Figure 2-3). Battery strings are terminated to Battery Bus 1 and the Charge Return Bus. Rectifier output is terminated to Battery Bus 2 and the Charge Return Bus. Power conductors for load circuits are connected, though distribution circuit breakers, to Battery Bus 2. The return conductors for load circuits tie to the Discharge Return Bus. The Discharge and Charge Return Buses are joined via the Plant Shunt. Battery Buses 1 and 2 are interconnected by the LVD/R Contactor.

Plant Shunt

The current shunt in the ECS Battery Plant is connected between the Charge Return Bus and the Discharge Return Bus (see Figure 2-3). It is used to measure the total current supplied to the load from the rectifiers and/or batteries. The shunt has a full scale rating of 50 millivolts at the maximum plant current of 600

amperes. The shunt millivolt signal is sent, via the CP5 Fuse Board, to the controller where it is translated to amperes and displayed on the digital meter.

Low Voltage Battery Disconnect/ Reconnect (LVD/R) Feature

In unattended battery plant locations, especially those without automatic ac backup, batteries could be completely discharged during an ac power outage. The ECS Battery Plant may be equipped with an optional automatic battery disconnect to prevent costly battery damage due to unforeseen deep discharge. This disconnect is designed to isolate batteries from the load when the plant voltage reaches the lowest usable battery voltage. The disconnect level is below the operating range of most load equipment, in which case service to the load would already have been lost. The disconnect does not separate the load circuits from the rectifiers, thus enabling the rectifiers to begin powering the load as soon as ac power is restored.

The LVD/R option consists of the LVD/R contactor, circuitry on the CP5 Fuse Board and associated wiring. As shown in Figures 2-2 and 2-3, the LVD/R Contactor is used either to connect or disconnect Battery Bus 1 and Battery Bus 2.

When the battery voltage drops below a preset level, a comparator circuit on the CP5 Fuse Board senses the low voltage condition and removes power to the contactor. This opens the connection between Battery Buses 1 and 2, disconnecting the batteries from the rectifiers and the load. The user has a choice of disconnect threshold voltages (20.25 or 21.25 volts).

When the contactor is open and the rectifiers are not delivering power, the controller is unpowered as well. In this state, the controller displays and LEDs are extinguished and various alarms are issued to the alarm reporting center. (See the Lineage® 2000 Controller manual for further details.)

Red “LVD OPEN” and yellow “LVD FAIL” LEDs are located on the dc distribution panel. The red “LVD OPEN” LED is lit whenever the contactor is open, during a normal disconnect or in the unlikely event of a contactor failure. Once the contactor opens it remains open until the battery voltage exceeds the set threshold voltage. The LVD sensing circuitry is redundant. A failure of either voltage detector circuit lights the yellow “LVD FAIL” LED, but the contactor will stay closed. A Fuse Alarm Minor (MNF) is issued when a LVD circuit fails, lighting a

yellow LED on the controller front panel and sending Power Minor (PMN) alarms to the alarm reporting center.

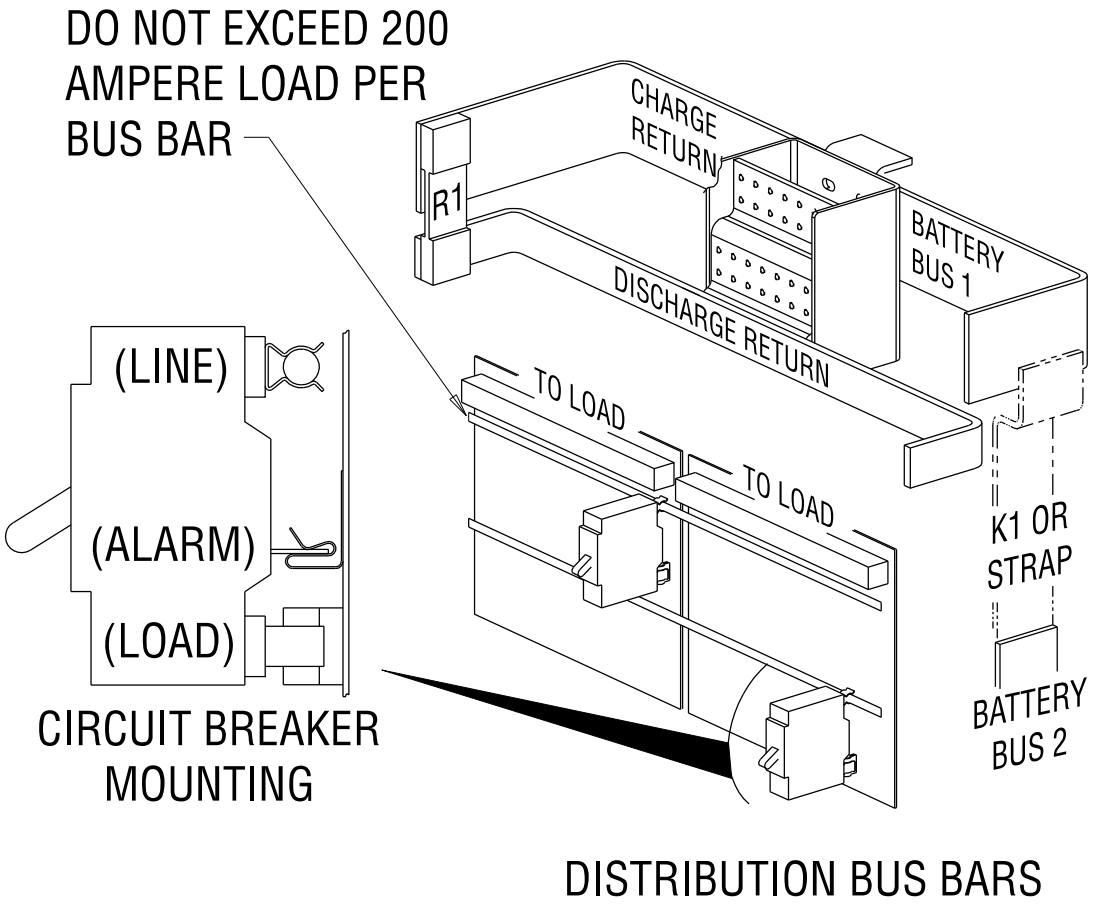

Figure 2-3: ECS Distribution Bus Bars

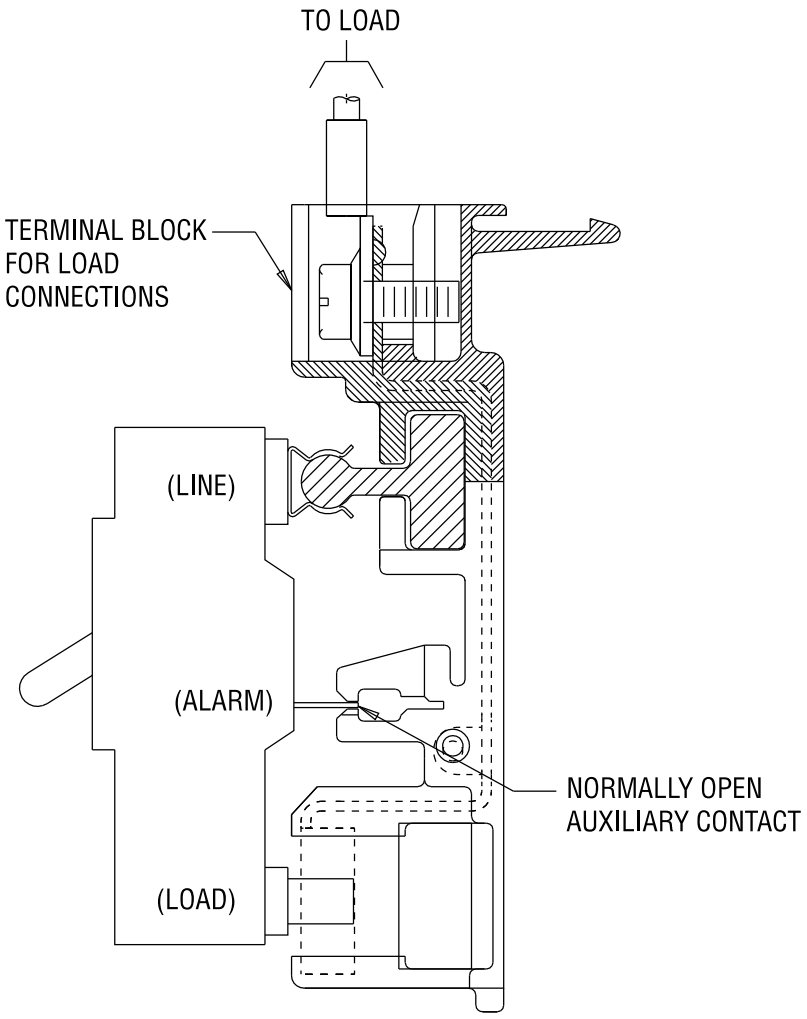

Figure 2-4: Plug-In Circuit Breaker Mounting

Circuit Breakers

The dc distribution panel (Figure 2-5) accommodates a maximum of 42 circuit breakers. The circuit breakers are plug-in style, KS-23616, and are available in 3, 5, 10, 15, 20, 30, 40, 45, 50, 60, 70, 80, 90 and 100 ampere ratings. These breakers have standard curve 2 trip characteristics and an interrupt capacity of 7000 amperes. The circuit breakers rated at 60 amperes and higher require the use of two positions on the panel. A two-position load adapter bus is required for the 60- to 100-ampere breakers.

Note

You may install single-position circuit breakers in any position on the distribution panel; however, do not mount two-position circuit breakers in the bottom positions on the panel. Two-position circuit breakers must not be placed in an end position; leave at least one position empty. Be sure to distribute the circuit breakers as evenly as possible on the panel.

The breakers are mounted vertically with actuators up in the ON position. Each circuit breaker is equipped with an auxiliary switch that indicates, with a closure, when the breaker has tripped due to overcurrent. The circuit breaker handle will move to a center trip position when tripped due to overcurrent. It should be noted here that customers who wish to prewire load circuits for future use may store the breaker in its installed position until service is actually required. Leaving the breaker in the OFF position in an operating battery plant will not produce an alarm condition.

Converter

The 24Vdc to 48Vdc converter plant consists of a shelf assembly, two 4-ampere converter modules, and a distribution circuit breaker panel. The converter plant supports miscellaneous -48Vdc power requirements in the cell site.

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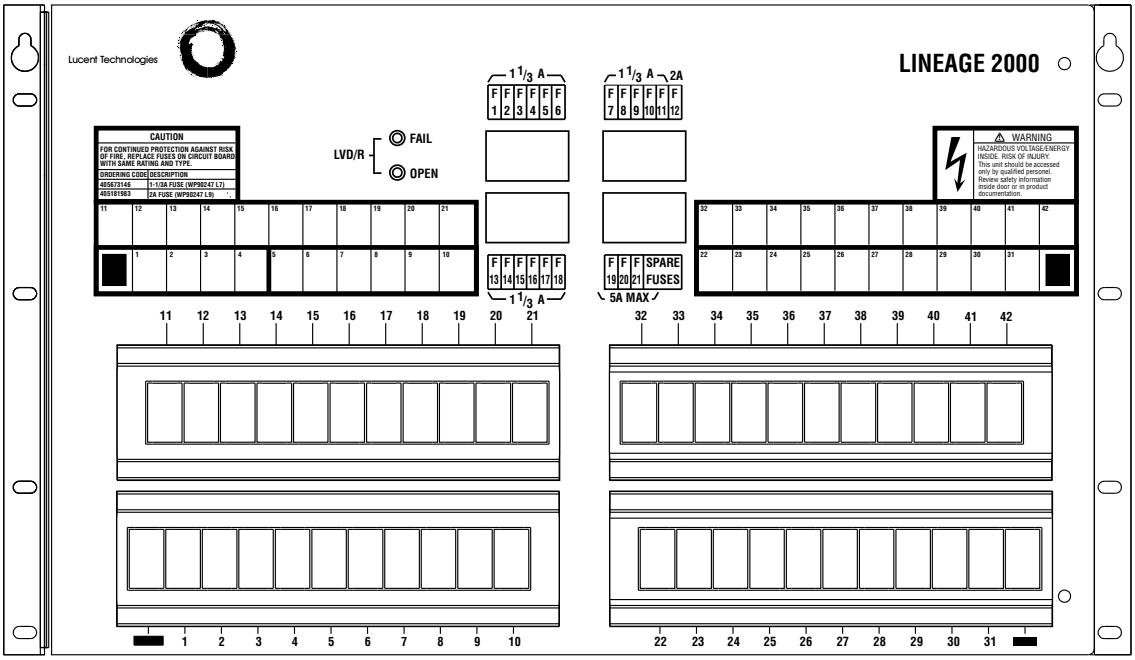


Figure 2-5: ECS Distribution Panel

3 Engineering and Ordering

Sizing a Plant

When ordering a battery plant, the engineer must determine whether the plant is to be redundant or not. The following sections describe both non-redundant and redundant systems.

Non-Redundant Systems

In non-redundant systems, the installed rectifier capacity of the battery plant must be sufficient to provide the current required for the load during normal operation as well as the current required to recharge the battery following ac power outages.

For the telecommunications industry, the system load current is known as the average busy-hour current. Therefore, the minimum installed rectifier capacity (mirc) is the sum of the average busy-hour current (abh) and the required battery recharge current.

mirc = abh x recharge factor

The mirc divided by the individual rectifier capacity determines the number of rectifiers (of equal capacity) required for a non-redundant system.

Redundant Systems

In redundant systems, a spare, on-line rectifier is included so that the loss of any one rectifier will not cause the available plant capacity to fall below the required minimum installed rectifier capacity. Thus, the loss of a rectifier will not affect the normal system operation nor will it cause the batteries to discharge.

In cases where the additional spare rectifier will provide the required battery recharge current, the mirc satisfies the requirements for both non-redundant and redundant systems. In

other cases, additional rectifiers other than the redundant rectifier may be required to provide the battery recharge current.

Plant Sizing Example

The following example illustrates the relationship between mirc, abh current drains, the recharge factor, and battery recharge current.

A battery plant has the following parameters:

- a load current of 276 amperes
- an 8-hour discharge time (reserve time)
- recharge to 95% of battery capacity within 24 hours

From Figure 3-1, the recharge factor is 1.38.

mirc = abh x recharge factor
mirc = 276 x 1.38 = 380.9

Four 100 ampere rectifiers (380.9/100 = 3.8) are required to provide the minimum installed capacity of 380.9 amperes for a non-redundant system. However, if one rectifier fails, the remaining rectifiers are not sufficient to support the abh requirement. Therefore, one additional rectifier must be added to ensure a redundant system.

Other Considerations

Rectifiers having different output capacities should not be mixed in the same battery plant.

Figure 3-1 illustrates several guidelines for choosing the recharge factor.

- A minimum recharge factor of approximately 1.2 is required to recharge the battery effectively.
- As the reserve time increases, the recharge factor required to maintain a given recharge time must also increase.
- Continuing to increase the recharge factor above approximately 1.4 does not significantly reduce the recharge time.

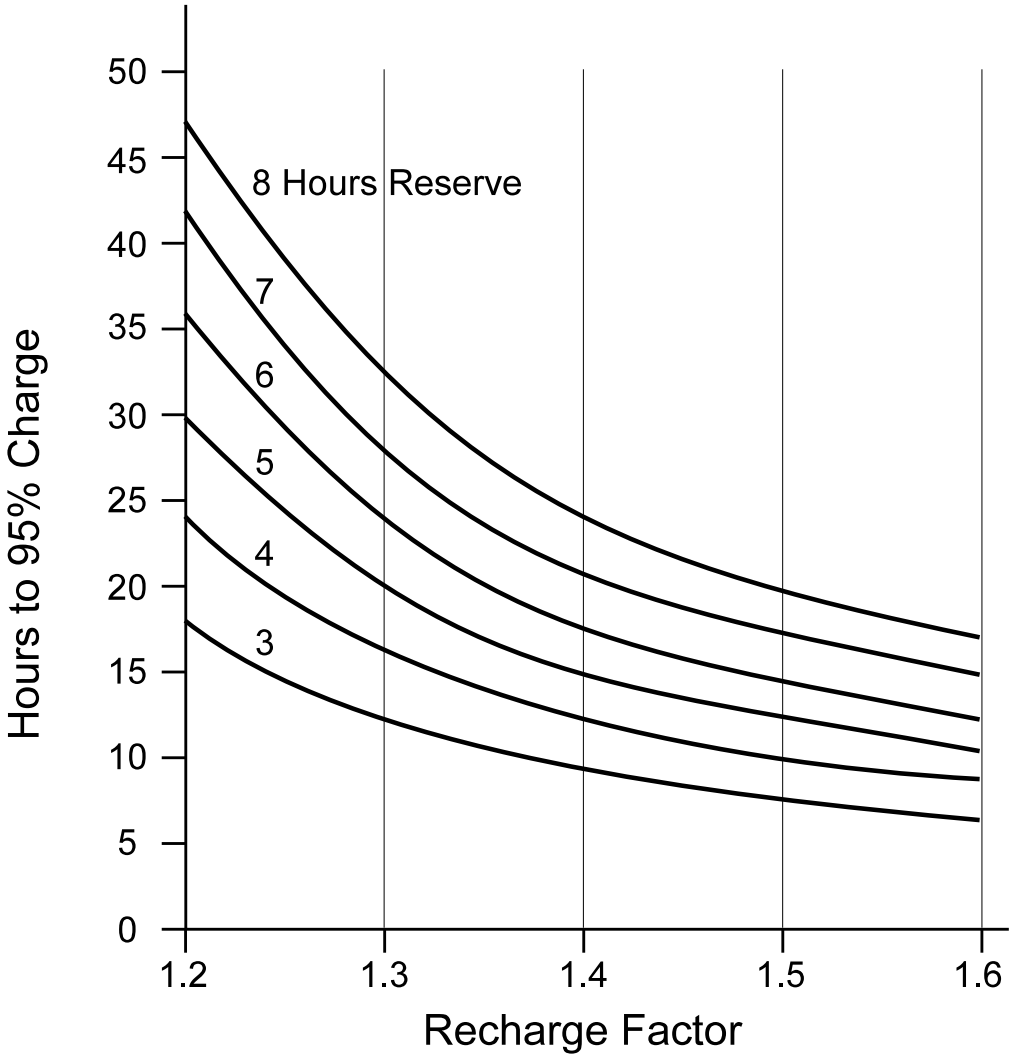


Figure 3-1: Recharge Time vs. Recharge Factor

Ordering Information

The +24V minicell Lineage® 2000 ECS battery plant is ordered using the Group (G) numbers on the H569-420 drawing and has two main groups. Group 1 provides a 46-inch bay framework which is field-mounted on top of a battery stand and a string of C&D 600 ampere-hour batteries. The batteries and stand are ordered as separate items.

Group 2 is the other main group; it is a 42-inch framework and can be mounted on top of different types of batteries and stands. The Group 2 framework is factory mounted on the battery stand. The initial product offers 2VR375E batteries. Future plant developments will include other types of batteries.

Other groups on the H569-420 drawing are ordered as "Equipped With (E/W)" items. This means that they are ordered in addition to a main group and will be installed in the factory. If these groups are ordered as separate items, they will be shipped to you in separate containers to be assembled during installation. Some items such as circuit breakers and mounting hardware are always ordered separately.

The following table provides a summary of the H569-420 group structure. Please read all of the notes carefully before ordering.

Table 3-A: +24V Minicell Battery Plant (H569-420)

Group Number	Description
1	46.0" framework assembly arrange for use with 24V, 600AH batteries and stand. See notes 5, 28, and 29.
2	42.0" framework assembly for mounting on a four-shelf battery stand. See Group 10 and notes 5, 28, 29, and 30.
3	Reserved for future use.
4	Equipment, wiring, and hardware for one +24V 300 ampere rectifier shelf assembly (RSA 1)with 208/240volt ac input. Order Group 4 in addition to either Group 1 or Group 2. See notes 5, 20, and 26.
5	Equipment, wiring, and hardware for one +24V 300 ampere rectifier shelf assembly (RSA 2) with 208/240volt ac input. Order Group 5 in addition to either Group 1 e/w Group 4 or Group 2 e/w Group 4. See notes 20 and 27.
6	Assembly, wiring, and equipment for one ECS controller. Always required in addition to either Group 1 or Group 2.
7	Assembly, wiring, and equipment for one +24V, 600 ampere output distribution panel equipped with low voltage disconnect/reconnect feature (600 ampere). NOTE: One Group 7 or one Group 8 always required in addition to either Group 1 or Group 2.
8	Assembly, wiring, and equipment for one +24V, 600 ampere output distribution panel. NOTE: One Group 7 or one Group 8 always required in addition to either Group 1 or Group 2.
9	Reserved for future use.
10	Four-shelf battery stand for two strings of Lucent 2VR375E 24V batteries.See notes 20, 29, and 30.
A	Optional equipment in addition to Group-6 (plant controller) provides microprocessor circuit pack (CP2). CP2 provides remote/local monitoring and control functions. See note 21.
B	Same as Group A (CP2) equipped with voice response feature. See note 22.

Table 3-A: +24V Minicell Battery Plant (H569-420)

Group Number	Description
C	Optional equipment for plant controller in addition to Group 6 to provide a datalogger circuit pack (CP3). CP3 is a data acquisition circuit pack that always requires a CP2 (Group A or Group B). See note 23.
D	Same as Group C (CP3) with remote termination panel. The remote termination panel allows external connection to the CP3 circuit pack. See note 24.
E	Same as Group A with 24V X.25/TL1 feature. See note 12.
F	Same as Group B with 24V X.25TL1 feature. See note 12.
G	Optional equipment for Groups 1 or 2 provides battery thermal compensation unit. See note 14.
N	Optional equipment, wiring, and hardware for Group 1 or 2 for one +24VDC to -48VDC converter shelf assembly equipped with two 4 ampere converters and output distribution with two 3 ampere circuit breakers. See note 13.

Notes:

1. Spare parts and miscellaneous equipment are listed below as well as in a separate section. Order 1 each of the following on a per-office basis.

Table 3-B: Recommended Spares

Quantity	Description	Comcode
1	Fan for +24V, 100 ampere rectifier	406418491
1	CP1 (113B Controller Unit)	106395064
1	LVD/R Fuse Board ((BCB4)	106394489
1	364B2 +24V, 100 ampere rectifier	107306599
1	24V to 48V Converter Module	407346022

Table 3-C: Miscellaneous Parts

Quantity	Description	Comcode
1	1-1/3 ampere fuse (WP90247 L-7)	405673146
1	2 ampere fuse (WP90247 L-9)	405181983)
1	5 ampere fuse (WP90247 L-13)	406159061
1	Backup Battery for CP2 (Panasonic BR2032)	406526079
1	Adapter Kit	846638575

2. Order rectifiers, fuses and fuse holders, circuit breakers, terminal lug kits, and certain X.25/TL1 equipment as separate items. Ordering tables follow appropriate notes.

3. Floor plan and heat release data are as follow:

Table 3-D: Floor Plan and Heat Release Data

	H5690420 G-1 E/W 4, 5, 6, 7, N, 1 string of batteries with stand, and six rectifiers	H5690420 G-2 E/W 4, 5, 6, 7, 10, 2 strings of batteries with stand, and six rectifiers
Physical Data		
Height	7” 4” 46” Rack 42” Stand	7’ 0” 42” Rack 42” Stand
Depth	1’ 4-1/2”	2’ 2”
Width	2’ 1-7/8”	2’ 1-7/8”
Weight with Batteries	1797 lbs.	1636 lbs.
Floor Load (Lbs./ft^2) = Load in Pounds/Floor Area in Square Feet		
Weight with Batteries	1797 lbs.	1636 lbs.
Floor Load *	599	348
Frame Outline (ft^2)	3.0	4.7
Heat Release in Watts**		
Nominal with Full Load	3398	3254
Nominal with Half Load	1699	1627

***** The floor load for this stand equipped with VR batteries is computed by averaging the load over the floor area bounded by the stand sides. Special precautions (such as increasing aisle widths or adding space between adjacent equipment) must be taken to ensure that this equipment does not overload the floor.

****** Heat release values are given for ECS battery plants equipped with six switch mode rectifiers. To calculate heat release values, for ECS battery plants equipped with fewer than six rectifiers, use the following formula:

Heat Release (W) = (5.28 W per rectifier x number of rectifiers) + 26 W + 144 W

where:

26 Watts represents the heat release value for the ECS Controller equipped with the 113B2 control unit, CP2, and CP3.
144 Watts represents the heat release value for the converter shelf equipped with two converters.)

4. A Group 1 or Group 2 plant equipped with a Group 7 distribution panel is factory configured for a +21.25 volt low voltage disconnect threshold. You can change this threshold to +20.25 volts by adding jumpers J505.1 and J505.2 on the BCB4 circuit pack (CP5) across pins 2 and 3 of both P505.1 and P505.2.

Table 3-E: Low Voltage Disconnect Settings for CP5 (BCB4)

Header	Jumper Pins	LVD/R Threshold
P505.1 P505.2	1 & 2	+21.25 Volts
P505.1 P505.2	2 & 3	+20.25 Volts

5. A Group 1 or 2 plant equipped with one rectifier shelf (Group 4) may not be field upgraded to add a second rectifier shelf (Group 5). Lucent does not recommend this upgrade since the plant would have to be shut down in order to protect the installer from exposure to hazardous voltages.

6. Circuit breakers are not factory mounted.

7. Specify circuit breaker positions on the distribution panel. These positions are numbered from left to right.

8. Cable congestion makes circuit breaker position assignment critical. Start at the bottom of the circuit breaker panel and expand upwards.

9. The battery bus bars accept direct termination of 4/0 AWG wire for battery terminations. (See note 29.) Use “H” taps for larger wire sizes. System ground connection will accommodate the cable and lug sizes in the table below.

(All sizes are for 1/4" bolt.) Use "taps" for larger wire size requirements.

Table 3-F: Cable and Lug Sizes

Cable	Lug
KS5482 L28FR 6 AWG	WP91412 L-3
KS5482 L28FR 4 AWG	WP91412 L-5
KS5482 L28FR 2 AWG	WP91412 L-54
KS5482 L28FR 1 AWG	WP91412 L-8
KS20921 6 AWG	WP91412 L-3
KS20921 4 AWG	WP91412 L-54
KS20921 2 AWG	WP91412 L-8

10. For systems ground applications larger than those listed above, order an adapter kit, comcode **846638575**. The adapter kit will accommodate the cable and lug sizes in the table below. All are sized for a 3/8" bolt.

Table 3-G: Cable and Lug Sizes

Cable	Lug
KS5482 L28FR 1/0 AWG	WP91412 L-56
KS5482 L28FR 2/0 AWG	WP91412 L-57
KS5482 L28FR 3/0 AWG	WP91412 L-77
KS5482 L28FR 4/0 AWG	WP91412 L-59
KS20921 1/0 AWG	WP91412 L-57
KS20921 2/0 AWG	WP91412 L-77
KS20921 3/0 AWG	WP91412 L-59
KS20921 4/0 AWG	WP91412 L-27

11. Order the appropriate kit based on lug wire size for use with the distribution panel.

Table 3-H: Terminal Lug Kits for 3 - 50 Ampere Circuit Breakers

Wire Size	Comcode	Kit Contents	Die
10 -12 AWG	847301660	(1) WP91412 L-73 Double Hole Term (1) WP91412 L-93 Single Hole Term (1) 10-32x7/16 Screw (2) WP91767 L-3 1/4 Tubing 2 in.	R-5473-5
8 AWG	847301678	(1) WP91412 L-52 Double Hole Term (1) WP91412 L-1 Single Hole Term (2) 10-32x7/16 Screw (2) WP91767 L-4 3/8 Tubing 2 in.	Red

Table 3-H: Terminal Lug Kits for 3 - 50 Ampere Circuit Breakers

Wire Size	Comcode	Kit Contents	Die
6 AWG	847301686	(1) WP91412 L-102 Double Hole Term (1) WP91412 L-2 Single Hole Term (2) 10-32x7/16 Screw (2) WP91767 L-5 1/2 Tubing 2 in.	Blue
4 AWG	847301694	(1) WP91412 L-5 Double Hole Term (1) WP91412 L-4 Single Hole Term (2) 10-32x7/16 Screw (2) WP91767 L-5 1/2 Tubing 2 in.	Grey

Table 3-I: Terminal Lug Kits for 60 - 100 Ampere Circuit Breakers

Wire Size	Comcode	Contents	Die
6 AWG	847301702	(1) Two-position Adapter Bar (1) WP91412 L-3 Double Hole Term (1) WP91412 L-111 Double Hole Term (2) 10-32x7/16 Screw (2) WP91767 L-5 1/2 Tubing 2 in. (2) 375-16 Nut (2) 375 Flat Washer (2) 375 Lock Washer	Blue
2 AWG	847301447	(1) Two-position Adapter Bar (1) WP91412 L-54 Double Hole Term (1) WP91412 L-121 Double Hole Term (2) 10-32x7/16 Screw (2) WP91767 L-5 1/2 Tubing 2 in. (2) 375-16 Nut (2) 375 Flat Washer (2) 375 Lock Washer	Brown
1/0 AWG	847301710	(1) Two-position Adapter Bar (2) WP91412 L-57 Double Hole Term (2) 10-32x7/16 Screw (2) WP91767 L-5 1/2 Tubing 2 in. (2) 375-16 Nut (2) 375 Flat Washer (2) 375 Lock Washer	Black

12. The equalize function of the J85501D-2 L-2 controller is disabled in the factory. The default alarm settings are as follow

Table 3-J: J85501D-2 Controller Default Settings

Alarm Function	Voltage Threshold
Battery on Discharge (BD)	+26.5 Volts
High Voltage Float (HV)	+28.25 Volts
High Voltage (Equalize)	+29.25 Volts (Disabled)

Refer to J85501D-1 for other settings.

13. Both Groups E and F provide a microprocessor circuit pack (CP2) with X.25/TL1 functions. CP2 is a plug-in board and is shipped separately. Groups E and F include CP2, its backup battery, wiring, RS485 to RS232 converter, and a product manual. X.25/TL1 is a different protocol that may be used to access the controller. See the table below for additional information on optional X.25/TL1 equipment.

Table 3-K: Optional TL1/X.25 Equipment

Description	Comcode
48V Pad Kit	847074507
24V Pad Kit	847074515
Digital Service Unit Kit	847074531
Shelf Kit	847074549

14. The dc-dc converter assembly (comcode 407303114) consists of the following:

DC-DC Converter Assembly (Group N)

Quantity	Description
2	4 ampere 24/48V, dc-dc converters
1	Converter shelf assembly equipped with
2	3 ampere output circuit breakers
2	15 ampere KS23616 L-34 circuit breakers
1	Cable assembly and associated hardware
1	Documentation package

The output of each dc-dc converter is 4 amperes at -48VDC.The converter shelf supports a 4 ampere, -48V load with 4 amperes of redundancy.

In a Group 1 plant, the converter shelf is factory mounted in the bottom of the framework, just above the battery

stand. The Group 1 plant accommodates up to two rectifier shelves as well as a converter shelf.

A Group 2 plant can accommodate only one rectifier shelf (Group 4) if it is equipped with a converter shelf assembly (Group N).

15. Group G provides a thermal compensation unit which monitors the temperature of a battery string and provides an isolated contact closure when the battery exceeds 42°C. The Battery Thermal Management product manual (select code 157-010-200, comcode 107224445) provides additional information.

16. Each distribution module has a maximum of 42 positions. Circuit breakers rated between 3 and 50 amperes occupy one position. Breakers rated from 60 to 100 amperes occupy two positions. Two-position circuit breakers should only be installed in the top row (positions 12-21 and 32-41).

17. Refer to the table below for ordering information for the plug-in circuit breakers used in the distribution modules (Groups 7 and 8). Tables 3-H and 3-I contain ordering information for termination lugs and hardware which are not provided with the circuit breakers.

Table 3-L: Circuit Breakers for Groups 7 and 8

Description	Comcode	KS23616 L#
3 ampere circuit breaker	407098417	31
5 ampere circuit breaker	407098425	32
10 ampere circuit breaker	407098433	33
15 ampere circuit breaker	407098458	34
20 ampere circuit breaker	407098474	36
25 ampere circuit breaker	407098482	37
30 ampere circuit breaker	407098490	38
40 ampere circuit breaker	407245448	48
45 ampere circuit breaker	407098516	40
50 ampere circuit breaker	407098524	41
60 ampere circuit breaker*	407098532	42
70 ampere circuit breaker*	407098540	43
80 ampere circuit breaker*	407098557	44
90 ampere circuit breaker*	407098565	45
100 ampere circuit breaker*	407098573	46

- ***** Circuit breakers rated between 60 and 100 amperes require two positions on the distribution panel. Two-position circuit breakers should only be installed in the top row (positions 12-21 and 32-41). Distribute 60 to 100 ampere circuit breakers on the panel.

18. Circuit breakers rated between 60 and 100 amperes require a two-position adapter bus bar. This bus bar is provided with the 6, 2, and 1/0 AWG lug termination kit. See Table 3-I.

19. Do not exceed 200 amperes loading (List 2 current drain) per circuit breaker bus bar leg. There are four legs in each Group 7 or 8. The Group 7 and Group 8 distribution panels accept a maximum of 600 amperes. Do not exceed 600 amperes.

20. Refer to the table below for plug-in fuse and fuse holder ordering information. The fuse holder is not provided with the termination lugs or hardware. Order the required lug termination kit from Table 3-I for each fuse holder.

Table 3-M: Fuse Holder and Fuses for Groups 7 and 8

Description	Comcode	Amperage
15900-AT Fuse Holder	406980797	N/A
TPA-5 Fuse	407006329	5
TPA-10 Fuse	407006337	10
TPA-15 Fuse	407006345	15
TPA-20 Fuse	407006352	20
TPA-30 Fuse	407006378	30

21. Use the table below when ordering rectifiers. Each rectifier shelf accommodates a maximum of three rectifiers.

Table 3-N: Rectifiers for Groups 4 and 5

Description	Apparatus Code	Comcode
+24V, 100 Ampere Rectifier	364B2	107306599

22. Group A includes CP2 circuit pack (without speech synthesis), battery backup, and a product manual.

23. Group B includes CP2 circuit pack with voice response (speech chip), battery backup, and a product manual.

24. Group C includes CP3 circuit pack, a set of current limiting resistor assemblies, and a product manual.

25. Group D includes CP3 circuit pack, a remote termination panel with a cable set, a set of current limiting resistor assemblies, and a product manual.

26. Current limiting resistor assemblies are required to install CP3 and are calibrated into the datalogger. Analog channel readings will not be accurate without these resistors. In addition, these resistors ensure that field wiring to CP3 meets NEC Class 2 limits.

27. Group 4 rectifier shelf is mounted in the top position, below the output distribution panel (Group 7 or 8) and houses rectifiers 1 through 3.

28. The Group 5 rectifier shelf is mounted directly below the ECS controller (Group 6) and houses rectifiers 4 through 6.

29. Order battery stand and batteries for Group 1 framework and the batteries for Group 10 battery stand from the table below. The 12-RHD 600 includes battery stand and one string of 24V 600AH batteries. For the 2VR375E battery, 12 batteries equals one string.

Table 3-O: Battery Stand and Batteries

Framework	Description	Apparatus Code	Comcode
Group 1	Battery String and Stand	12-RHD 600	407271824
Group 2 e/w 10	Battery	2VR375E	406020347

30. Order battery cable kits from the table below. The C&D batteries and stand for Group 1 will require two cable kits. The Group 10 battery stand requires one cable kit per battery string.

Table 3-P: Battery Cable Kits

Framework	Quantity	Description	Comcode
Group 1	2	Battery Cable Kit	846481240
Group 2 e/w 10	1	Battery Cable Kit	846481240

31. Order battery terminal plate assembly for Group 10 from the table below. Each battery string requires one battery terminal plate.

Table 3-Q: Battery Terminal Plate Assembly

Description	Comcode
Battery Terminal Plate Assembly	601372550

32. Refer to H569-407 for anchor bolt kit ordering information. These kits are used to secure the battery plant to the floor. The following table lists the recommended anchor bolt kits based upon earthquake certification testing information. The ordering information applies to both the Group 1 and Group 2 bays.

Table 3-R: Anchor Bolt Kits

Earthquake Zone	H569-407	Comcode
0, 1, 2	Group 2	847135662
3, 4	Group 4	847315668

Sample Orders

The following sample order corresponds to Figure 1-1 in Section 1. The bay consists of a 46” top hat equipped with two rectifier shelves, an ECS controller, a distribution panel with low voltage disconnect, and a 24/48V converter shelf assembly.

Sample Order, Figure 1-1

Item	Quantity	Description
1	1	H569-420 G-1 46” Framework E/W
	1	Distribution Panel
	1	G-6 ECS Controller
	1	G-4 Rectifier Shelf Assembly 1
	1	G-5 Rectifier Shelf Assembly 2
	1	G-N Converter Shelf Assembly
2	6	107306599 +24V Rectifiers
3	1	407271824 1 String of 600AH Batteries and Stand
4	2	846481240 Battery Cable Kit
5	20	407098490 30 amp Circuit Breaker
6	10	407245448 40 amp Circuit Breaker
7	10	847301686 6 AWG Term. Lug Kit
8	20	847301678 8 AWG Term. Lug Kit

The following sample order corresponds to Figure 1-2 in Section 1. This bay is a 42" top hat mounted on top of a VR battery stand. It has two rectifier shelves, an ECS controller, a distribution panel with low voltage disconnect.

Sample Order, Figure 1-2

Item	Quantity	Description
1	1	H569-420 G-2 42" Framework E/W
	1	G-10 Battery Stand
	1	Distribution Panel
	1	G-6 ECS Controller
	1	G-4 Rectifier Shelf Assembly 1
	1	G-5 Rectifier Shelf Assembly 2
2	6	107306599 +24V Rectifiers
3	24	406020347 2 Strings of 2VR375 Batteries
4	2	846481240 Battery Cable Kit
5	20	407098490 30 amp Circuit Breaker
6	10	407245448 40 amp Circuit Breaker
7	10	847301686 6 AWG Term. Lug Kit
8	20	847301678 8 AWG Term. Lug Kit
9	2	601372550 Battery Term. Plate Assembly

Documentation References

The following documents provide the engineering, ordering, and installation information for the Lucent +24V Lineage® 2000 ECS battery plant.

Battery Plant

Battery Plant

Assembly and Ordering Drawing	H569-420
Wiring Diagram	T-83260-30
Schematic Drawing	SD-83260-01
Product Manual Select Code	167-790-062

Supplementary information on the ECS controller, Lineage® 2000 SR series rectifier and Rectifier Shelf Assembly (RSA), and the Lineage® 2000 VR series battery may be found in the following documents:

Controller

ECS Controller

Assembly and Ordering Drawing	J85501D-2
Wiring Diagram	None
Schematic Drawing	SD82669-02
Product Manual Select Code	167-790-033
Optional Circuit Pack Product Manual Select Code	167-790-108

Rectifier and RSA

SR Series 100A Rectifier and Rectifier Shelf Assembly

Assembly and Ordering Drawing	J85702C-1
Wiring Diagram	T82668-30
Rectifier Sequence Circuit Connecting Drawing	T81081-30
Schematic Drawing	SD82668-01
Product Manual Select Code	167-790-115

Battery

VR Series Battery

Assembly and Ordering Drawing	J85504C-1
Wiring Diagram	T83119-30
Schematic Drawing	SD83119-01
Product Manual Select Code	157-622-010

Battery Thermal Management

Battery Thermal Management

Assembly and Ordering Drawing	J85501X-2
Battery Thermal Control Circuit	T83199-30
Schematic Drawing	SD83199-01
Product Manual Select Code	157-010-200

4 Safety

Safety Statements

Please read and follow all safety warnings before installing, maintaining, or repairing the +24V Lineage® 2000 battery plant.

1. The H569-420,+24V Minicell Lineage® 2000 ECS Battery Plant, is to be used in controlled environments. Install only in restricted access areas (dedicated equipment rooms, equipment closets, or the like) in accordance with articles 110-16, 110-17, and 110-18 of the U.S. National Electric Code (NEC), ANSI/NFPA No. 70, and pursuant to applicable local codes.

2. UL listed compression connectors should be used to terminate UL listed field-wire conductors where required. The listed connector should be applied only to the appropriately sized conductors as specified by the connector manufacturer using only the connector manufacturer's recommended tooling or tooling approved for that connector.

3. The H569-420, +24V Minicell Lineage® 2000 ECS Battery Plant, was evaluated for use in ambient temperatures up to 50° Celsius.

4. Make all electrical connections using the proper crimping tools and dies. Torque to values specified on H569-420.

5. Insulation on field-wired conductors should be rated no less than 90° Celsius. Wire conductor size should be no less than allowed by electrical codes for 60° Celsius wire (regardless of insulation temperature rating used) and based on the ampacity of the associated protection device.

6. The short circuit current capability of the battery input to the distribution panel should not exceed 7000 amperes.

7. Alarm contact on the distribution panel are not fused within the distribution panel. Therefore, current limiting protection for these contacts must be provided by external circuits. Maximum ratings for alarm connections are 60Vdc and 0.5 amperes. Exceeding these maximum ratings could result in fire or damage to the unit.

8. Order circuit breakers, fuse holders, fuses, and termination kits separately. See notes 10, 16, and 19 in section 2. Use only these fuses and circuit breakers. Circuit breakers and fuse holders do not come with terminating lugs or hardware. Order the appropriate kit for each circuit breaker or fuse holder.

9. Fuse and/or circuit breaker loads must **not** exceed 80% of the fuse and/or circuit breaker current rating. The maximum rating per position is 50 amperes. (Fuses are not to exceed 30 amperes.) The maximum rating per dual position is 100 amperes. The maximum load current of the distribution panel must not exceed 600 amperes. **If a panel is expected to operate continuously in an ambient temperature of 40° C to 50° C, the total current draw through the panel cannot exceed 500 amperes**. (There is a maximum of 200 amperes on any rail.) Distribute loads across the panel.

10. The maximum cable sizes for the distribution panel are as follow: Lugs for these cables must be ordered separately.

Maximum Cable Sizes

Lead	Gauge
Input Battery and Return	4/0
Output Load and Return	4 AWG

11. AC branch circuits must be protected with either fuses or circuit breakers sized as required by the National Electric Code (NEC) and/or local codes. Overcurrent protection to the rectifier must not exceed 30 amperes.

12. An ac disconnect protection device to remove ac power from the rectifiers in the event of an emergency must be provided.

Warning Statements

WARNING

Hazardous voltage/energy inside. Risk of injury. This unit must be accessed only by qualified personnel.

Explanation: This unit must be installed, serviced, and operated only by skilled and qualified personnel who have the necessary knowledge and practical experience with electrical equipment and who understand the hazards that can arise when working on this type of equipment.

The H569-420 battery plant is normally powered by multiple ac inputs (possibly one per rectifier). Ensure that the appropriate circuit protection device for each ac input being serviced is disconnected before and during servicing the equipment.

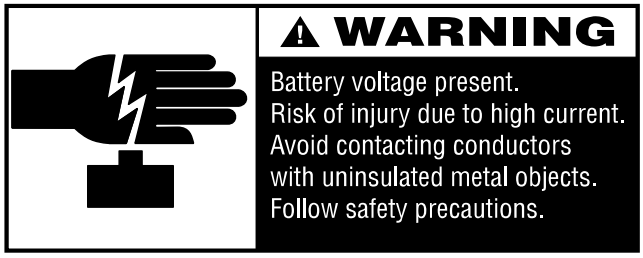
WARNING

Inserting fuses into live plant will cause arcing and sparks. Risk of eye injury. Always wear safety glasses.

Explanation: For situations where fuses are used with the distribution panel and the loads are capacitive, arcing will occur and sparks will exit from the back of the fuse holder. Sparks may exit the front when the fuse disconnect head is inserted into the fuse holder base while power is still applied to the circuit. Arcing may be more severe at times due to the discharge state of any downstream capacitors and the amount of charged capacitance in parallel with the circuit. Therefore, follow all appropriate safety precautions when inserting fuses.

- Wear safety glasses.
- Make sure other personnel are clear from the front and back of the unit.
- Do not stand directly in front of the holder when inserting.
- Try to insert fuse disconnect head into the fuse holder base quickly to reduce the amount of arcing.

The symbol below identifies the presence of rectifier and battery voltages.



Explanation: Batteries may be connected in parallel with the rectifiers. Turning off the rectifiers will not necessarily remove power from the bus. Make sure the battery power is also disconnected. Follow safety procedures while working on any equipment that contains hazardous energy/voltage.

5 Installation

General

Lucent Technologies offers complete engineering and installation service that result in “turnkey” plant operation. Contact your Lucent Energy Systems Account Executive for further information on the complete range of installation services available from Lucent. Customers may, however, choose to install the battery plant based upon the information supplied here.

This section outlines an efficient sequence of battery plant installation steps that minimizes the installer's exposure to live circuits. A suggested test sequence is also provided to check the integrity of the installation effort. Upgrades, retrofits and replacement of equipment in the controller, rectifier and battery subsystems are covered in their respective manuals.

The framework, rectifier, controller, and dc distribution subsystems, described in Section 2, are factory tested as a system. The controller and distribution subsystems are shipped assembled to the framework, ready for use. To improve shipping and handling, the rectifiers are packaged separately and must be plugged into their shelf assemblies during the plant installation process. The battery subsystem must also be assembled by the installer. The battery plant installation sequence that follows refers to the rectifier, controller, and battery manuals for details for those subsystems. Read this section and the referenced sections in other subsystem manuals completely before starting any work.

Installation Tools and Test Equipment

The following tools and test equipment are required for battery plant installation and testing.

- Equipment to handle shipping containers, remove framework from shipping containers, and erect framework into final position. Minimum lifting capacity: 500 lbs
- Common electrician's hand tools
- Proper crimping tools and dies for connectors used
- Common mechanic's hand tools
- 3/4-inch drill to bore holes for floor anchors
- DMM (Digital Multimeter) with at least 0.05% accuracy on the dc scale
- DC dummy load bank rated for 150 amperes minimum at 27 volts dc
- Power supply, variable from zero to 27 volts dc at 4 amperes. Supply should have both coarse and fine output controls (for LVD/R option only)
- Six clip leads, each capable of carrying 3 amperes
- ESD wrist strap

Suggested Installation Sequence

Before beginning the installation sequence, please review all safety warnings and the general information below.

1. The plant may be wired with ac from the left side or the right side. Typical routing of ac, dc and control cabling is shown on the plant assembly drawing, H569-420. Connection points and wire types are indicated on the plant wiring diagram, T-83260-30.

2. When running dc cable, ensure that all non-protected leads are run in a separate cable rack from protected leads. (“Protected,” in this sense, refers to overcurrent protection by a fuse or circuit breaker.) Battery leads are usually the only unprotected leads.

3. All dc leads should be separated wherever possible from ac leads to minimize electrical noise transmitted to the load.

4. Pair the battery potential lead with the associated return lead of a given circuit for as much of the run as possible.

5. All control leads and other small gauge wiring should be separated from the ac and dc power leads to prevent physical damage. (Routing of control leads within the controller is described in the controller manual.)

6. All bolts making electrical connections should be torqued per the values in Table 5-A; all bolts for mechanical connections should be torqued per values in Table 5-B.

Installation Sequence

Table 5-C lists the drawings, manuals and other documentation that are necessary to complete the following Sequence of Tasks.

Unpacking, Handling, and Frame Installation

1. Before opening the packaging, carefully inspect the outside, in the presence of shipping personnel, for signs of damage. If damaged, follow the shipping carrier's procedure for filing a damage claim.

2. To ensure personnel safety and equipment protection use appropriate equipment during handling of crates and uncrated equipment. Use the equipment weights and dimensions given in Section 2 as a guideline for choosing material handling tools. Move crated equipment to an area with adequate space and tools for unpacking and handling.

3. Carefully open the packaging to verify that the contents are complete and undamaged. If the equipment must be returned, it should be repacked in the original shipping crate.

Battery Stand Assembly

Warning

Do not connect batteries to the system at this time.

Assemble battery stands per the battery manual. Install the batteries onto their stands.

Table 5-A: Minimum Torque for All Electrical Connections

Screw Size	Torque - lb-in or lb-ft					
	Wire Connections		Head Tightened		Nut Tightened	
	Slotted Machine	Hex or Socket Cap	Slotted Machine	Hex or Socket Cap	Slotted Machine	Hex or Socket Cap
8-32	15	15	19	19	19	23
10-24	21	21	27	27	27	33
1/4-20	50	50	65	65	65	80
5/16-18	-	100	-	135	135	165
3/8-16	-	180	-	240	240	290
7/16-14	-	280	-	385	385	465
1/2-13	-	500	-	585	585	710
5/8-11	-	(71)	-	(97)	(97)	(118)
3/4-10	-	(125)	-	(172)	(172)	(209)

Notes

1. Slotted machine screws should be pan-head type.
2. Slotted machine and hex cap screws should be SAE Grade 2 steel or equivalent.
3. Socket cap screws should have 100,000 psi minimum tensile strength.
4. Steel flat washers should be furnished under heads of socket cap screws.
5. Ferrous screws and washers should have a corrosion protective finish.
6. Locking means is required only for connections subject to vibration. Belleville-type washers or jam nuts are the preferred means.
7. For less than 1/4 inch thick tapped copper bars, use No. 8, No. 10, or 1/4 inch machine screws to minimize applicable torque. When larger size screws are required, provide captive-type steel nuts or reduce torques.
8. Torque recommendations are also suitable for all non-ferrous fasteners, except aluminum.
9. Where application permits, hex cap screws should be used.

Table 5-B: Torque and Minimum Yield Strength for Mechanical Connections using Hex Head Cap Screws

Cap Screw Diameter	Minimum Yield Strength (PSI)	Torque (ft-lb) UNRC
1/4	57,000	6
3/16	57,000	12
3/8	57,000	22
7/16	57,000	35
1/2	57,000	54
9/16	57,000	77
5/8	57,000	107
3/4	57,000	190
7/8	36,000	193
1	36,000	290
R1-1/8	36,000	410
1-1/4	36,000	580
1-3/8	36,000	760
1-1/2	36,000	1010

Table 5-C: Installation Reference Documents

Procedure	Reference Document
Unpacking	H569-420 Product Manual
Battery Stand Assembly	H569-420 Product Manual and J85504C-1 Product Manual or C&D Battery Product Manual
Cable Support and Ground System	Job Application Drawings
Controller Setup and LVD Test	Controller Product Manual
AC Wiring, Rectifier Installation, and Rectifier Test	H569-420, Rectifier Product Manual, and T83260-30 Wiring Diagram
Battery Connections	Battery Manual
Load Wiring	H569-420 and T83260-30
Initial Battery Charge	Battery Product Manual and Rectifier Product Manual
Controller Test	Controller Manual
Load Turn Up	Load Equipment Documentation

Cable Support and Ground System

Hang all cable support systems, as well as any auxiliary ground bus bars, as dictated by the job application drawings.

Controller and LVD Setup

Follow the controller setup procedure given in the Controller manual to complete the steps below.

1. Wear ESD wrist strap and ground properly.
2. Enable/disable equalize charge setup
3. Enable/disable rectifier restart setup
4. Set HV shutdown level(s)
5. Set BD alarm level
6. Run office alarm wiring
7. Run other controller wiring
8. Set up other optional circuit packs

Check and set the low voltage disconnect/reconnect, if provided, at the desired voltage level. See Figure 5-4 for the location of the disconnect voltage select jumpers, J505.1 and J505.2 on LVD/Fuse Board. Plug these jumpers across pins 1 and 2 of their respective connectors to provide a disconnect voltage of 21.25±0.5 volts. To provide a disconnect voltage of 20.25±0.5 volts, plug the jumpers across pins 2 and 3 of their respective connectors. Refer to the ECS controller manual for acceptance testing procedures for the LVD/Fuse circuit pack and the associated LVD/R option.

Wiring, Rectifier Installation, and Test

Refer to the installation and start-up procedure in the Rectifier manual for the following steps.

- Wire ac
- Set up
- Plug in
- Test

Note

It is recommended that ac be wired during the initial installation for all rectifier positions that may be used in the future. If ac is prewired in this way, growth in rectifier capacity is as simple as plugging in an additional rectifier.

Before proceeding, verify that all rectifier output circuit breakers are in the **OFF** position.

Battery Connections

Remove all fuses from LVD/Fuse Board.

Confirm that the output circuit breakers of all rectifiers are open.

DANGER

- The next step in this procedure will apply battery power to the battery plant. Before contacting any uninsulated conductor surfaces, always use a voltmeter to ensure that no voltage, or the expected voltage, is present.
- When working with battery leads, always insulate all exposed cable ends. Uncover them only when securing them to the correct battery bus.

Run all cables from the battery and return bus bars to the battery strings by first connecting them to the batteries. The last connection should be made on the bus bars in the dc distribution.

Replace the dc distribution cover panel on the plant framework after all connections have been made at the plant bus bars.

Reinsert all fuses in LVD/Fuse Board. Match the fuse ratings and positions as indicated on the distribution cover panel.

Note

The white indicators on F1 through F11 represent a 1-1/3 ampere rating; the orange indicator on F12 represents a 2 ampere rating.

DANGER

Battery voltage is present behind the distribution cover. Remove all jewelry before working in this area. Use insulated tools only.

Load Wiring

Open the dc distribution cover panel by turning the two 1/4 turn fasteners located on the front of the panel.

Run paired leads (supply and return) to each load from a dc distribution circuit breaker and from the discharge return bus. The load supply leads are terminated at the battery plant end on the distribution panel. The load return leads are terminated at the battery plant end on the discharge return bus, directly above the load supply lead termination. The termination points for the load leads are numbered 1 to 42, from left to right. Distribution breaker positions are also numbered 1 to 42, from left to right.

To install a circuit breaker, first verify that the circuit breaker is in the **OFF** position. Plug in the circuit breaker and visually verify that the line, load, and alarm connections are properly mated. (See Figure 2-4). Remove the plastic knockout from the associated position on the front cover. Mark the new circuit on the distribution front cover label. Spare circuit breakers may or may not be provided with the dc distribution panel, as ordered. Spare circuit breakers may be stored in the distribution panel if in the **OFF** position. Leads may be run to spare circuit breaker positions in anticipation of future growth (similarly to prewiring rectifier ac input in Step E, above).

Before proceeding, verify that all load circuit breakers are in the **OFF** position.

Initial Charge

Batteries may undergo initial charging at this time, according to the manufacturer's recommendations. One of the rectifiers may be used for initial charging. Refer to the procedures given in the Battery and Rectifier manuals.

Controller Test

Follow the controller test procedure given in the ECS controller manual to complete the steps below.

1. Test Enable/disable equalize charge feature.

2. Test Enable/disable rectifier restart feature.
3. Test HV shutdown level(s).
4. Test BD alarm levels.
5. Test other optional circuit packs.

Turn-up Turn on and adjust all rectifiers for normal operation according to the Rectifier manual.

Warning

Before applying power to any individual load, follow the turn up instructions provided in the associated load equipment manual.

Connect all loads, one at a time, by turning on the load circuit breakers. If a circuit breaker trips immediately when turned on, this may be due to inrush current and does not necessarily indicate a fault condition. Attempt to close the circuit breaker a second time. If the breaker trips again, check the wiring to the load circuit and the instructions for powering up that load.

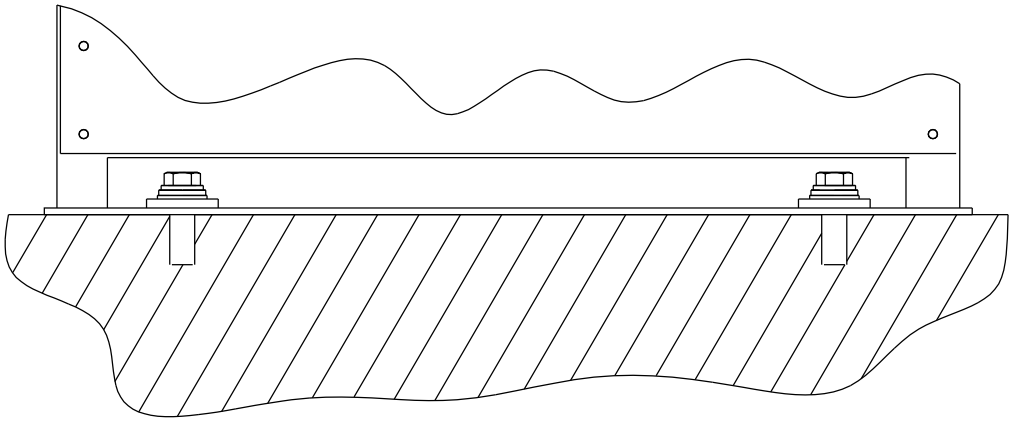


Figure 5-1: Typical Floor Mounting Detail for Battery Stands

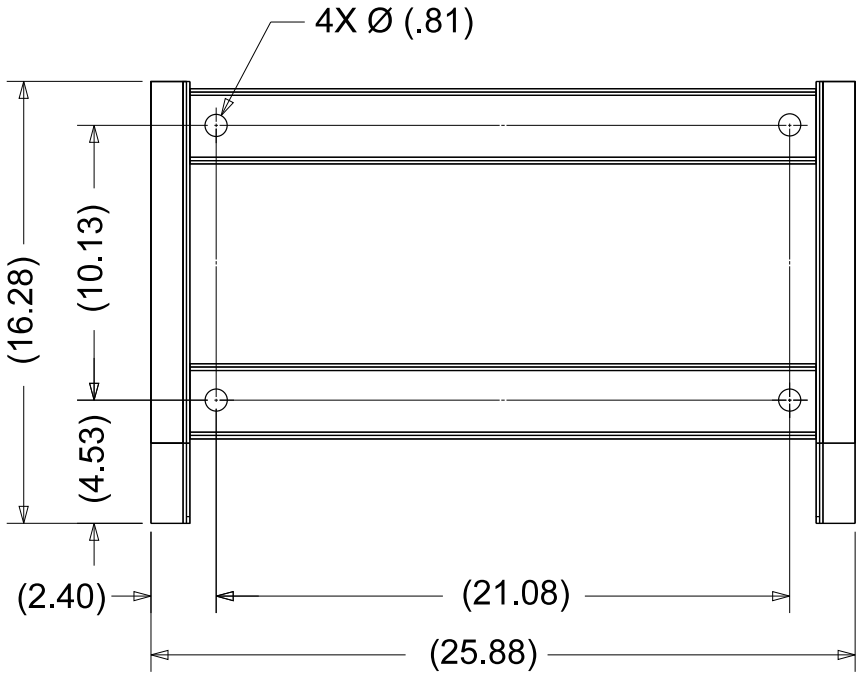


Figure 5-2: Floor Mounting Hole Pattern for Group 1 Battery Stand

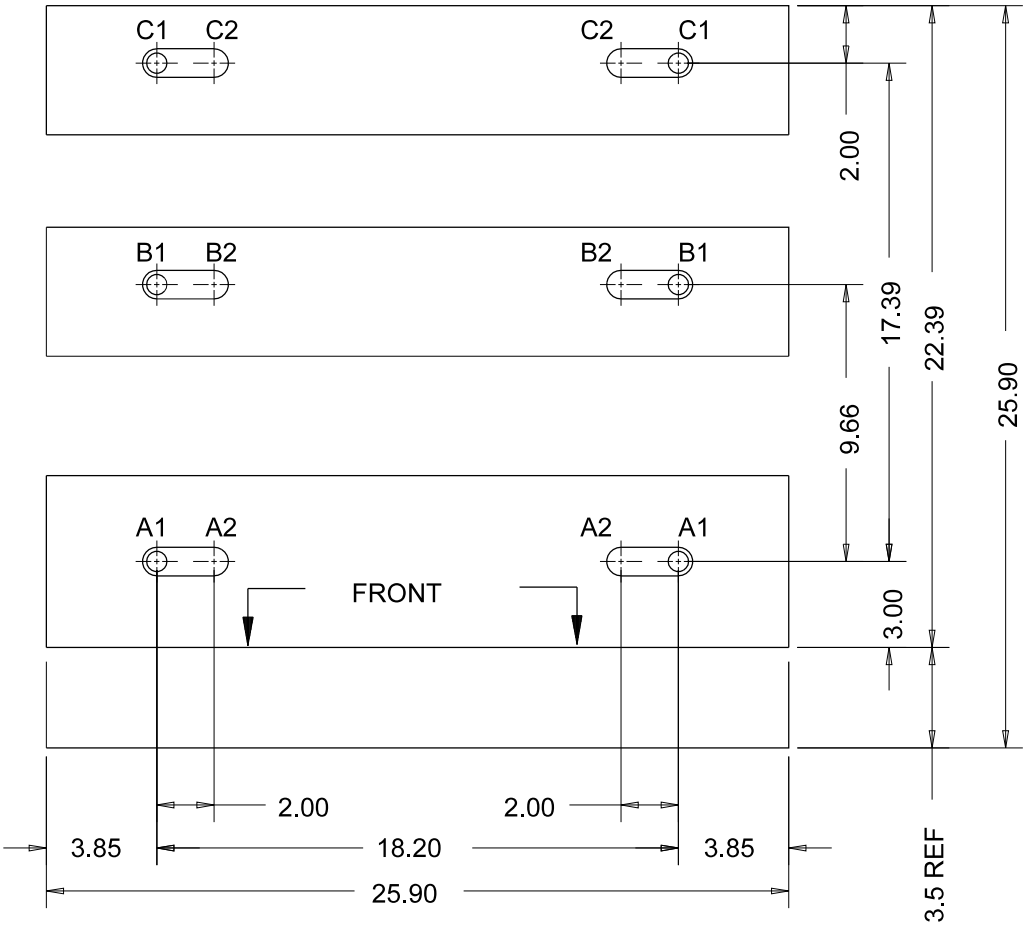


Figure 5-3: Floor Mounting Hole Pattern for Group 10 Battery Stand

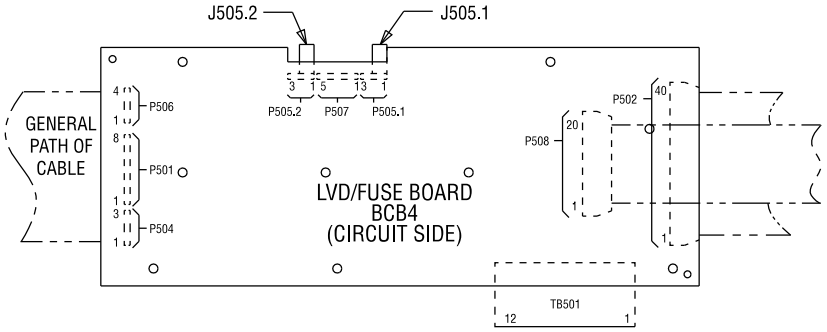


Figure 5-4: LVD/Fuse Board (CP5) Jumper Locations

Installation Procedures for Plant Growth

As your power needs evolve, equipment may be easily added to the battery plant to provide any of the following.

- Expanded controller features
- Additional rectifier capacity
- Increased battery capacity
- Additional load circuits

Procedures for adding controller features, rectifiers and batteries to an operating plant are described in the installation sections of the associated subsystem manuals. The procedure to add load circuits is described below.

Adding a Load Circuit

Warning

Procedures in this section may cause power alarms to be issued temporarily. Notify the alarm reporting center before starting any installation procedure on a battery plant while it is in service.

The following procedure provides the steps to add a new load circuit to an operating battery plant.

1. See Section 3 note 19 for details on obtaining additional circuit breakers.

2. Alarms may be issued during the installation process (e.g. by a new circuit breaker in the **OFF** position). Notify the alarm reporting center of that alarms may be received.

3. Open the dc distribution cover panel, taking care not to disturb any load-carrying circuit breakers.

DANGER

Battery voltage is present behind the distribution cover panel. Remove all jewelry before working in this area. Use insulated tools only.

Caution

Accidentally or intentionally turning a circuit breaker off may affect service to load equipment. Take care not to disturb load-carrying circuits.

4. Locate the intended new breaker position. Spare circuit breakers may or may not already be in place on the dc distribution panel, as ordered. Alternatively, spare distribution leads may or may not have been run to the new load location.

   If a spare circuit breaker is already plugged in the next available position, verify that the breaker is **OFF**.

DANGER

Do not plug a closed circuit breaker into a circuit which may be connected. Arcing may result in injury and equipment damage.

   If a new breaker must be added, switch it to the **OFF** position. Plug in the new breaker. If possible, visually verify that line, load and alarm connectors are properly mated. (See Figure 2-4).

5. If leads have NOT already been run to the intended load from a spare circuit breaker position (e.g., during the initial plant installation), install these leads by following the sequence under “Load Wiring” above.

6. Remove knockout in front panel and mark the new circuit on the distribution cover panel label.

7. For safety, close the dc distribution front cover before proceeding to the next step.

Warning

Before applying power to any individual load, follow the turn up instructions provided in the associated load equipment manuals.

8. Turn on the load circuit breaker. If the circuit breaker trips immediately when turned on, this may be due to inrush

current and does not necessarily indicate a fault condition. Attempt to close the circuit breaker a second time. If the breaker trips again, check the wiring to the load circuit.

6 Installation Tables

The tables below provide additional information. Many of them appear in other manuals and are duplicated here for your convenience. In them, a “0” indicates an open switch setting and a “1” indicates a closed switch setting.

Controller

Table 6-A: Controller Dip Switch Settings

SW 101 HV/EQ	SW 102 HV/FL	SW103-BD	Switch Setting					
			-1	-2	-3	-4	-5	-6
+25.75V	+24.75V	+24.00V	1	0	1	1	1	1
+26.25V	+25.25V	+24.50V	0	0	1	1	1	1
+26.75V	+25.75V	+25.00V	1	1	0	1	1	1
+27.25V	+26.25V	+25.50V	0	1	0	1	1	1
+27.75V	+26.75V	+26.00V	1	0	0	1	1	1
+28.25V	+27.25V	+26.50V	0	0	0	1	1	1
+28.75V	+27.75V	+27.00V	1	1	1	0	1	1
+29.25V	+28.25V	+27.50V	0	1	1	0	1	1
+29.75V	+28.75V	+28.00V	1	0	1	0	1	1
+30.25V	+29.25V	+28.5V	0	0	1	0	1	1

Table 6-B: Controller Factory Default Settings

Jumper Settings										
Board	**Header**	**Jumper Pins**	**Function**							
Backplane 846575280	P602.1	1 & 2	+24 Volts							
	P602.2	1 & 2								
	P602.3	1 & 2								
	P602.4	1 & 2								
CP1	P105	1 & 2	Restart Enabled							
	P106	1 & 2	Equalize Disabled							
	P108	1 & 2	For SR Series Rectifiers							
CP4 (113B) Display	P401 or SW409	1 & 2	Shunt size less than 1000 amperes							
CP3	P302	1 & 2	+24 Volts							
Switch Settings										
Board	Switch	Function	Switch Settings							
			-1	-2	-3 -	-4	-5	-6	-7	-8
CP1	SW101	HV/EQ +29.25 V	0	1	1	0	1	1	N/A	N/A
	SW102	HV/FL 29.25V	0	1	1	0	1	1	N/A	N/A
	SW103	BD +26.50 V	0	0	0	1	1	1	N/a	N/A
	SW109	Meter Shunt 600 amps	1	0	0	0	0	0	N/A	N/A
CP2	SW202	See Table 6-3	0	0	0	1	1	1	0	0

Table 6-C: CP2 Dip Switch Settings

SW202	Function	Option	Switch Setting		
-1	Remote TR	Enabled	0		
		Disabled	1		
			-2	-3	-4
-2	Shunt Size	600 amperes	0	0	1
-3					
-4					
-5	Reserved				
-6	Maximum # of rectifiers	6 Rectifiers	1		
-7	Nominal Battery Plant Voltage	+24 Volts	1		
-8	Local Port	Terminal	0		
		Printer	1		

Rectifier

Table 6-D: SW701 Settings for SR100/+24V Rectifier

Internal Selective High Voltage Shutdown (Volts)					Load Share	
					Enable	Disable
	-1	-2-	3-	4-	-5	
+25.0V	1	1	1	1	1	0
+25.5V	1	1	1	0	1	0
+26.0V	1	1	0	1	1	0
+26.5V	1	1	0	0	1	0
+27.0V	1	0	1	1	1	0
+27.5V	1	0	1	0	1	0
+28.0V	1	0	0	1	1	0
+28.5V	1	0	0	0	1	0
+29.0V	0	1	1	1	1	0

Wiring Diagram T-83260-30

Table 6-E: Figure/Feature Cross-Reference

T83260-30 Figure	Feature	H569-420 Group #	Figure Option
1, H9	LVD/Fuse Board (CP5) BCB4	-	Z
2, B, H1, H2, HA, HB	600 Ampere Output Distribution Panel E/W Low Voltage Disconnect	7	Y
2, A, H1, H2, HA, HB	600 Ampere Output Distribution Panel	8	Y
3, H3	Control Unit (J85501D-2)	6	R
4, 5	Rectifier Shelf Assembly #1 (J85702C-1)	4	X
4, 5	Rectifier Shelf Assembly #2 (J85702C-1)	5	W
6	+24VDC to -48VDC Converter with Output Distribution	N	T
H4	+24VDC, 100 ampere Rectifier (386B2)	-	S
H5	CP2 Microprocessor Circuit Pack	A	N
H5	CP2 Microprocessor Circuit Pack E/W Voice Response	B	M
H5	CP2 Microprocessor Circuit Pack E/W X.25/TL1 Feature	F	F
H6	CP3 Datalogger Circuit Pack	C	K
H7	CP3 Datalogger Circuit Pack E/W 9A Termination Panel	D	J
H9	Commercial 208/220/240 VAC Supply	-	-

Alarm Leads

Table 6-F: T83260-30 Figure H3 Alarm Lead Designation

Terminal Block-Pin Designation	Lead	Meaning
101-8	ABS	Alarm Battery Supply
102-7	ACFE C	AC Fail External; alarm causes closure.
102-8	ACFE R	AC Fail External; return
102-9	ACFE O	AC Fail External; Alarm Causes Open.
102-1	BDE C	Battery On Discharge external; alarm causes closure.
102-3	BDE O	Battery On Discharge External; alarm causes open.
102-2	BDE R	Battery On Discharge External; return.
101-1	DG	Discharge Ground
103-7	MNFE C	Fuse Alarm Minor External; alarm causes closure.
103-8	MNFE R	Fuse Alarm Minor External; return.
103-9	MNFE O	Fuse Alarm Major External; alarm causes open.
104-10	MJFE C	Fuse Alarm Major External; alarm causes closure.
104-11	MJFE R	Fuse Alarm Major External; return
104-12	MJFE O	Fuse Alarm Major External; alarm causes open
102-4	HVE C	High Voltage External; alarm causes closure
102-5	HVE R	High Voltage External; return.
102-6	HVE O	High Voltage External; alarm causes open.
102-12	LVO	Low Voltage Contactor Open
102-11	LVR	Low Voltage Contactor Return
102-10	LVC	Low Voltage Contactor Closed

Table 6-F: T83260-30 Figure H3 Alarm Lead Designation

Terminal Block-Pin Designation	Lead	Meaning
103-4	PMNE C	Power Minor External; alarm causes closure
103-5	PMNE R	Power Minor External; return.
103-6	PMNE O	Power Minor External; alarm causes open
103-1	PMNA C	Power Minor Audible; alarm causes closure
103-2	PMNA R	Power Minor Audible; return
103-3	PMNA O	Power Minor Audible; alarm causes open
103-10	PMNV C	Power Minor Visual; alarm causes closure.
103-11	PMNV R	Power Minor Visual; return.
103-12	PMNV O	Power Minor Visual; open.
104-4	PMJE C	Power Major External; alarm causes closure
104-5	PMJE R	Power Major External; return
104-6	PMJE O	Power Major External; alarm causes open
104-1	PMJA C	Power Major Audible; alarm causes closure
104-2	PMJA R	Power Major Audible; return
104-3	PMJA O	Power Major Audible; alarm causes open
104-7	PMJV C	Power Major Visual; alarm causes closure.
104-8	PMJV R	Power Major Visual; return
104-9	PMJV O	Power Major Visual; alarm causes open.
101-5	RMN	Ringer Minor
101-4	RMJ	Ringer Major
101-6	TEQ	Timer Equalize
101-7	TFL	Timer Float
101-2	TF/ER	Timer Float/Equalize Return

Table 6-F: T83260-30 Figure H3 Alarm Lead Designation

Terminal Block-Pin Designation	Lead	Meaning
101-9	TR1	Transfer Shutdown from Engine
101-10	TR2	
101-11	TR3	
101-12	TR4	

AC Fittings

Table 6-G: Recommended AC Fittings

Cable Type	Fitting	
	1/2" Cable	3/4" Cable
Conduit	8130 (T&B)	8131 (T&B)
Armored	3132 (T&B)	-
Flexible	2251 (T&B)	-

7 Maintenance

Controls and Indicators

Operating controls and indicators on the battery plant are listed below.

- Controller LEDs and switches (see Controller Manual)
- Rectifier LEDs and switches (see Rectifier Manual)
- LVD/Fuse Board LEDs and fuses

Note

Review all safety statements and warnings in Section 4 before performing any maintenance.

LVD/R LEDs

Two LEDs on the LVD/Fuse Board are used to indicate the status of the low-voltage disconnect/reconnect circuit.

1. The red “LVD OPEN” LED indicates that the disconnect/reconnect contactor is open and, therefore, that batteries are disconnected from the rest of the battery plant.

2. The yellow “LVD FAIL” LED indicates that only one of the two redundant low-voltage detectors has directed the contactor to open and that the disconnect circuit may have failed. The contactor, however, is still closed.

Fuses

Fuses F1 through F12 (see Figure 7-1) are also located on the LVD/Fuse Board and provide power for controller functions and rectifier regulation. When a fuse blows the colored indicator (white or orange) pops up and an alarm signal is transmitted to the controller. The fault should be cleared before replacing a blown fuse. See “Troubleshooting” below for details on replacing blown fuses.

DC Circuit Breakers

Circuit breakers CB1 through CB42 are located in the DC distribution.

Any circuit breaker in the battery plant is ON (or closed) when the handle is in the Up position, and OFF (or open) in the Down position. A circuit breaker which is supplying a load may be turned off manually, but this may affect service to the load. If a breaker has tripped off (the handle will be between the ON and OFF positions), the overcurrent problem should be cleared before restoring power to the load and resetting the breaker. See "Troubleshooting" below for information on tripped breakers.

Troubleshooting

Table 7-A provides a list of observable trouble conditions, their possible causes and the recommended corrective action for each cause. The table is organized by the subsystem in which the trouble is observed.

Table 7-A: Troubleshooting

Condition	Probable Cause	Corrective Action
Controller		
Red or yellow LED is lit No LEDs or display lit Meter inaccuracy Office alarms issued False alarms issued Blown fuse on LVD/Fuse board	See "Troubleshooting" in Controller Manual.	
Rectifier		
Red or yellow LEDs lit No LEDs or display lit No output/low output Oscillation Open output breaker	See "Troubleshooting" in Rectifier Manual.	
DC Distribution Subsystem		
Open distribution breaker	1. manually turned off 2. overcurrent trip 3. breaker failed	See "Open Distribution Breaker" section that follows.
LVD OPEN Led lit	1. failed LVD contactor 2. low voltage 3. faulty wiring 4. LVD circuit failure	See "Red LVD OPEN LED Lit" section that follows.
LVD FAIL LED lit	1. low voltage 2. LVD circuit failure	See "Yellow LVD FAIL LED Lit" section that follows.

FUSE DESIGNATIONS	
F1	REG LEAD RECTIFIER 1
F2	REG LEAD RECTIFIER 2
F3	REG LEAD RECTIFIER 3
F4	REG LEAD RECTIFIER 4
F5	REG LEAD RECTIFIER 5
F6	REG LEAD RECTIFIER 6
F7	133B METER
F8	CP2 AND CP3
F9	CP1 RECTIFIER INTERFACE POWER
F10	RECTIFIER CP1 INTERFACE POWER
F11	ALARM BATTERY SUPPLY
F12	CP1
F13	SPARE
F14	SPARE
F15	SPARE
F16	SPARE
F17	SPARE
F18	SPARE
F19	LOW POWER DISTRIBUTION
F20	LOW POWER DISTRIBUTION
F21	LOW POWER DISTRIBUTION

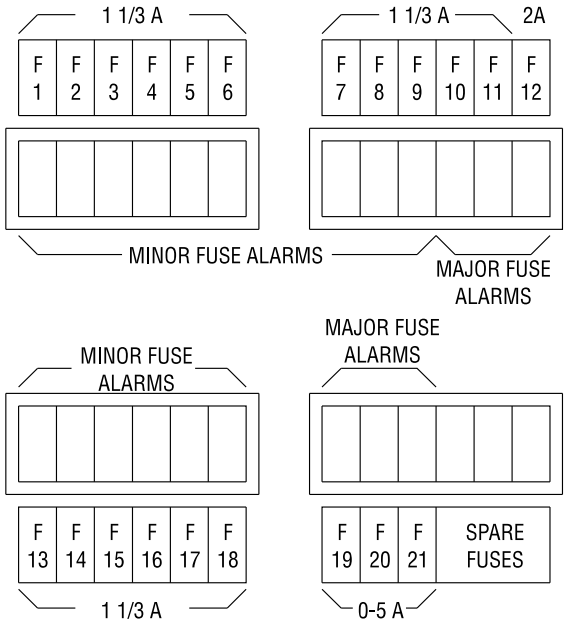


Figure 7-1: Fuse Designation and Function for LVD/Fuse Board (CP5)

Open Distribution Breaker

A distribution breaker which should be closed may be in the open position for one of three reasons.

1. A distribution breaker may have been inadvertently turned off manually. If this is the case, follow the proper procedure to restore power to the load equipment. If a distribution breaker is no longer needed, it may be unplugged from the panel or left in the OFF position.

2. A distribution breaker may trip due to a short circuit in the load equipment or wiring. The fault must be cleared before resetting the breaker, except when the trip is suspected to be caused by inrush current during equipment start up. The handle will be between the ON and OFF positions when the breaker has tripped due to overcurrent.

3. A circuit breaker may fail such that it cannot be reset. Replace a failed distribution breaker per procedure on page 7-5.

Red LVD OPEN LED Lit

The Red LVD OPEN LED indicates that the LVD Contactor is de-energized, i.e., open. The contactor may be open due to one of four reasons:

1. Plant voltage is below the disconnect threshold.

2. The contactor has failed and must be replaced. See procedure in this section on page 7-6.

3. There is an open circuit in the wiring that powers the contactor. Check the cable assembly from the LVD/Fuse Board to the contactor. (See drawing T-82670-30 figures 1 and B.)

4. Both redundant LVD sensing circuits have failed. The LVD/Follow the procedure for replacing fuse circuit pack described in this section on page7-7.

Yellow LVD FAIL LED Lit

The Yellow LVD FAIL LED indicates that one or both of the LVD circuits has attempted to open the contactor, but the contactor is closed. This may occur in two situations.

1. The plant voltage is right at the disconnect level and is within tolerances of the redundant detector circuits, but only one detector has operated. No action is required.

2. The LVD circuit has partially failed. Replace the LVD/Fuse circuit pack per procedure 4.3.3.

Blown Fuse on LVD/Fuse Board

Refer to ECS controller manual for troubleshooting procedures.

Caution

Replace with fuse of same rating only.

Repair and Replacement

Note

Procedures in this section may cause power alarms to be issued temporarily. Notify the alarm reporting center before starting any repair procedure.

Load Circuit Breaker Replacement

Obtain a replacement circuit breaker. See Section 8.

1. Verify that the faulty breaker is in the **OFF** position.
2. Loosen the 1/4 turn fasteners and open the dc distribution cover.
3. Measure the voltage on the distribution module at the load connection associated with the faulty breaker, to verify that the breaker is truly open. The voltage on the distribution module relative to the battery bus bars or circuit breaker bus bar should be approximately the float voltage of the plant.

If the faulty breaker is still closed, the load equipment which it powers must be shut down so that no current flows through the breaker.

DANGER

Do not attempt to unplug a circuit breaker which may be carrying current. Arcing may result in injury or equipment damage.

4. Unplug the faulty breaker from the distribution module.
5. Switch the new circuit breaker to the **OFF** position before plugging it in.
6. Plug in the new breaker, ensuring that line, load and alarm connectors are properly mated (see Figure 2-4).
7. For safety, close the dc distribution door before proceeding to the next step.

Warning

Before applying power to any individual load, follow the turn up instructions provided in the associated load equipment documentation.

8. Turn on the load circuit breaker. If the circuit breaker trips immediately when turned on, this may be due to inrush current and does not necessarily indicate a fault condition. Attempt to close the circuit breaker a second time. If the breaker trips again, check the wiring to the load circuit.

9. After the circuit breaker is turned on again, the Fuse Alarm Major (MJF) and its associated alarms should be retired.

LVD/R Contactor Replacement

The procedure below assumes the following:

- Contactor coil has failed.
- The contactor is open.
- The rectifiers are carrying the load (off battery) with excess capacity available for charging the batteries.
- Battery string(s) are at a voltage below the rectifier voltage in a state of partial or complete discharge.
- LVD OPEN LED is lit on the distribution front panel.

To replace the LVD contactor, you'll need the following equipment:

- socket wrench with insulated handle
- 1/2 inch socket

Refer to Figure 2-3 (page 2-7) and T-83260-30 drawing throughout this procedure.

1. Remove rectifier in position directly beneath LVD/R contactor (position 1), if present.

Note

The battery plant must have sufficient redundant capacity in order to remove one rectifier without shutting the plant down.

2. Open distribution panel and unplug connector P501 from J501 on LVD/Fuse board (CP5). Leave cable dressed.

3. Disconnect and label the 5 quick connects from the contactor coil and auxiliary switch.

4. Unbolt and remove contactor.

5. Reconnect quick connect leads to the new contactor (406545442 JFA-4011B Contactor) and then mount the contactor using the hardware from Step 4.

6. Plug P501 into J501 on LVD/Fuse board and verify that contactor closes.

7. Replace rectifier and turn on.

8. Close distribution panel and verify that LVD FAIL and LVD OPEN lights are not lit.

LVD/Fuse Board (CP5) Replacement

Refer to Figure 5-4 and T-83260-30 drawing throughout this procedure.

1. Open distribution panel.

2. Unplug the following connectors from the LVD/Fuse Board. Leave the cables dressed.

   - P502 from J502
   - P506 from J506
   - P501 from J501
   - P504 from J504
   - TB501

Note

The contactor will open.

3. Remove the cover over the LVD/Fuse Board and then remove the insulated standoffs to free the board.

4. Set jumpers J505.1 and J505.2 on replacement LVD/Fuse Board per H569-420 drawing for desired disconnect voltage.

5. Mount the replacement board to the distribution panel using the hardware from Step 3.

6. Reconnect the following connectors:

- P502 to J502
- P506 to J506
- P501 to J501
- P504 to J504
- TB501

7. Close distribution panel.

8 Spares

Spare parts and miscellaneous equipment are listed below as well as in a separate section. Order 1 each of the following on a per office basis.

Table 8-A: Recommended Spares

Quantity	Description	Comcode
1	Fan for +24V, 100 ampere rectifier	406418491
1	CP1 (113B Controller Unit)	106395064
1	LVD/R Fuse Board ((BCB4)	106394489
1	364B2 +24V, 100 ampere rectifier	107306599
1	24V to 48V Converter Module	407346022

Table 8-B: Miscellaneous Parts

Quantity	Description	Comcode
1	1-1/3 ampere fuse (WP90247 L-7)	405673146
1	2 ampere fuse (WP90247 L-9)	405181983)
1	5 ampere fuse (WP90247 L-13)	406159061
1	Backup Battery for CP2 (Panasonic BR2032)	406526079
1	Adapter Kit	846638575

Refer to the Controller and Rectifier product manuals for details on sparing information.

9 *Product Warranty*

A. Seller warrants to Customer only, that:

1. As of the date title to Products passes, Seller will have the right to sell, transfer, and assign such Products and the title conveyed by Seller shall be good;

2. Upon shipment, Seller's Manufactured Products will be free from defects in material and workmanship, and will conform to Seller's specifications or any other agreed-upon specification referenced in the order for such Product;

3. With respect to Vendor items, Seller, to the extent permitted, does hereby assign to Customer the warranties given to Seller by its vendor of such Vendor Items, such assignment to be effective upon Customer's acceptance of such Vendor Items. With respect to Vendor items recommended by Seller in its specifications for which the vendor's warranty cannot be assigned to Customer, or if assigned, less than Sixty (60) days remain of the vendor's warranty or warranty period when the Vendor's items are shipped to Customer or when Seller submits its notice of completion of installation if installed by Seller, Seller warrants that such Vendor's Items will be free from defects in material and workmanship on the date of shipment to Customer. In such an event, the applicable Warranty Period will be sixty (60) days.

B. The Warranty Period listed below is applicable to Seller's Manufactured Products furnished pursuant to this Agreement, unless otherwise stated:

Warranty Period		
Product Type	New Product	Repaired Product or Part*
Central Office Power Equipment**	24 Months	6 Months

* The Warranty Period for a repaired Product or part thereof is as listed or, in the case of Products under Warranty, is the period listed or the unexpired term of the new Product Warranty Period, whichever is longer.

** The Warranty Period for Products ordered for Use in Systems or equipment Manufactured by and furnished by Seller is that of the initial Systems or equipment.

C. If, under normal and proper use during the applicable Warranty Period, a defect or nonconformity is identified in a Product and Customer notifies Seller in writing of such defect or nonconformity promptly after Customer discovers such defect or nonconformity, and follows Seller's instructions regarding return of defective or nonconforming Products, Seller shall, at its option attempt first to repair or replace such Productwithout charge at its facility or, if not feasible, provide a refund or credit based on the original purchase price and installation charges if installed by Seller. Where Seller has elected to repair a Seller's Manufactured Product (other than Cable and Wire Products) which has been installed by Seller and Seller ascertains that the Product is not readily returnable for repair, Seller will repair the Product at Customer's site.

   With respect to Cable and Wire Products manufactured by Seller which Seller elects to repair but which are not readily returnable for repair, whether or not installed by Seller, Seller at its option, may repair the cable and Wire Products at Customer's site.

D. If Seller has elected to repair or replace a defective Product, Customer shall have the option of removing and reinstalling or having Seller remove and reinstall the defective or nonconforming Product. The cost of the removal and the reinstallation shall be borne by Customer. With respect to Cable and Wire Products, Customer has the further responsibility, at its expense, to make the Cable and Wire

Products accessible for repair or replacement and to restore the site. Products returned for repair or replacement will be accepted by Seller only in accordance with its instructions and procedures for such returns. The transportation expense associated with returning such Product to Seller shall be borne by Customer. Seller shall pay the cost of transportation of the repair or replacing Product to the destination designated by Customer within the Territory.

E. The defective or nonconforming Products or parts which are replaced shall become Seller's property.

F. If Seller determines that a Product for which warranty service is claimed is not defective or nonconforming, Customer shall pay Seller all costs of handling, inspecting, testing, and transportation and, if applicable, traveling and related expenses.

G. Seller makes no warranty with respect to defective conditions or nonconformities resulting from actions of anyone other than Seller or its subcontractors, caused by any of the following: modifications, misuse, neglect, accident, or abuse; improper wiring, repairing, splicing, alteration, installation, storage, or maintenance; use in a manner not in accordance with Seller's or vendor's specifications or operating instructions, or failure of Customer to apply previously applicable Seller modifications and corrections. In addition, Seller makes no warranty with respect to Products which have had their serial numbers or month and year of manufacture removed, altered, or with respect to expendable items, including, without limitation, fuses, light bulbs, motor brushes, and the like.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND ARE IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. CUSTOMER'S SOLE AND EXCLUSIVE REMEDY SHALL BE SELLER'S OBLIGATION TO REPAIR, REPLACE, CREDIT, OR REFUND AS SET FORTH ABOVE IN THIS WARRANTY.

10 Glossary

Ampere Hour (Amphour, AH)	Ampere hour is a rating for batteries that specifies duration of a discharge for a given load. It is a convention for expressing "drain (or load) current" multiplied by time.
Battery on Discharge (BD)	Battery on discharge occurs when the rectifier plant voltage is below a preset threshold. Typically, the ac service voltage to the plant is low or missing and the batteries are providing power to the load. This condition results in a BD alarm.
Busy-Hour Current	The average busy-hour current drain during the busy season with the plant operating at the normal voltage
ECS	Evolutionary Control System
ESD	Electrostatic Discharge
LED	Light-Emitting Diode
List 2 Current Drain	Highest drain; worst case
Low Voltage Disconnect/Reconnect (LVD/R)	Preset voltage threshold at which the load is disconnected from the battery

HV High voltage

NEC National Electric Code

RTAC Regional Technical Assistance Center (1-800-CAL-RTAC)