

**DISCONTINUED
PRODUCT**



POWER PROTECTION

Series 600T™ UPS

**Multi-Module Three Phase
300 kVA to 450 kVA; 60 Hz**

Installation Manual

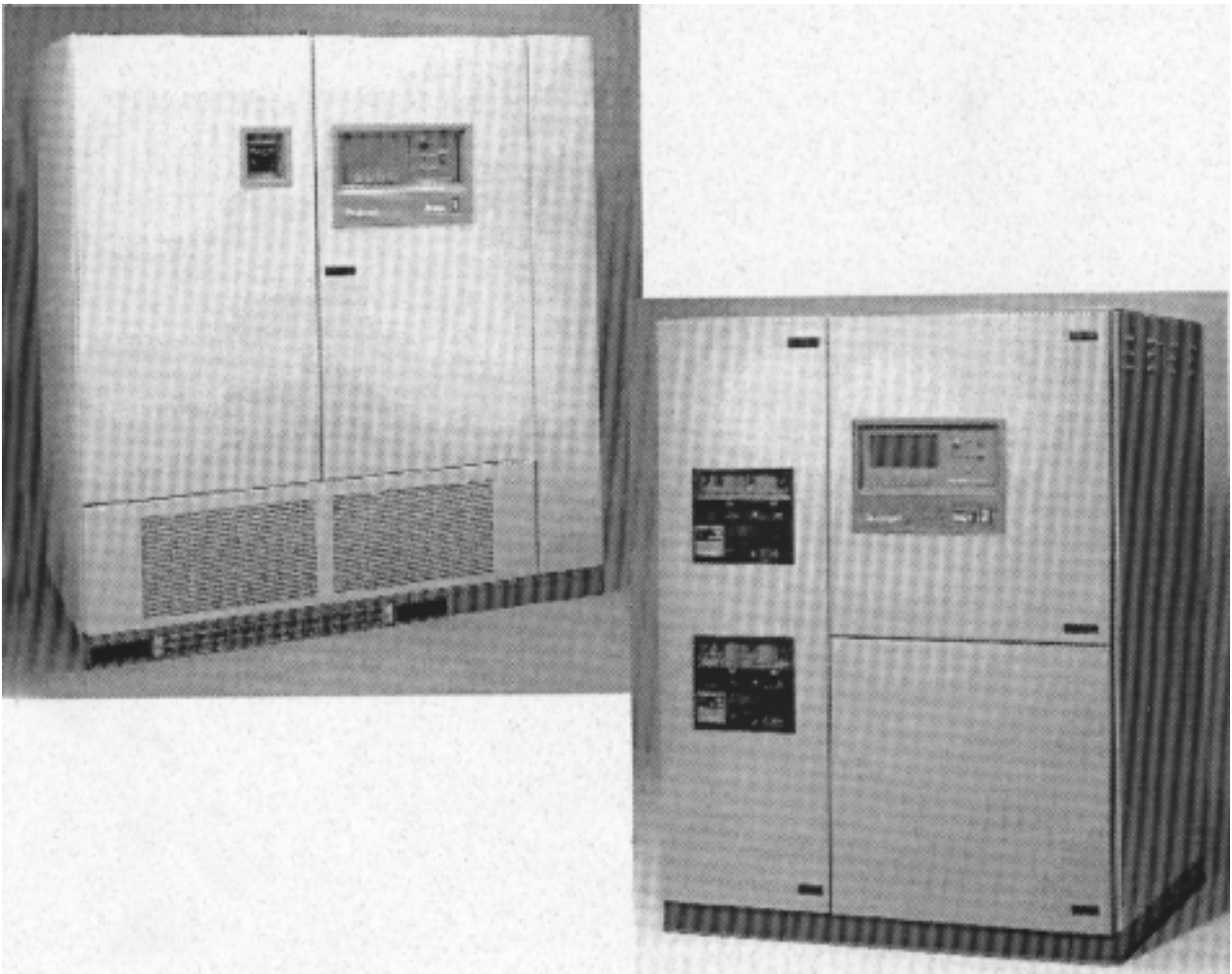


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IMPORTANT SAFETY INSTRUCTIONS

Save These Instructions.

This manual contains important instructions that should be followed during installation of your Series 600T UPS and batteries.



WARNING

EXERCISE EXTREME CARE WHEN HANDLING UPS CABINETS TO AVOID EQUIPMENT DAMAGE OR INJURY TO PERSONNEL. THE UPS MODULE WEIGHT RANGES FROM 4150 POUNDS (1885 KG) TO 9120 POUNDS (4145 KG), INCLUDING TRANSFORMER CABINET. THE BATTERY CABINETS WEIGH BETWEEN 3000 POUNDS (1364 KG) AND 4900 POUNDS (2227 KG).

LOCATE CENTER OF GRAVITY SYMBOLS BEFORE HANDLING EACH CABINET. TEST LIFT AND BALANCE THE CABINETS BEFORE TRANSPORTING. MAINTAIN MINIMUM TILT FROM VERTICAL AT ALL TIMES.

SLOTS AT THE BASE OF THE MODULE AND BATTERY CABINETS ARE INTENDED FOR FORKLIFT LIFT USE. BASE SLOTS WILL SUPPORT THE UNIT ONLY IF THE FORKS ARE COMPLETELY BENEATH THE UNIT.

SYSTEM CONTROL CABINETS (SCC'S) HAVE HOLES INTENDED FOR RIGGING BARS OR CHAINS. PREVENT CHAINS OR CABLES FROM CONTACTING CABINET BY USING SPREADER BAR AND ADEQUATE PADDING.

FOLLOW ALL BATTERY SAFETY PRECAUTIONS WHEN INSTALLING, CHARGING, OR SERVICING BATTERIES. IN ADDITION TO THE HAZARD OF ELECTRIC SHOCK, GAS PRODUCED BY BATTERIES CAN BE EXPLOSIVE AND SULFURIC ACID CAN CAUSE SEVERE BURNS.

IN CASE OF FIRE INVOLVING ELECTRICAL EQUIPMENT, ONLY CARBON DIOXIDE FIRE EXTINGUISHERS, OR THOSE APPROVED FOR USE IN ELECTRICAL FIRE FIGHTING, SHOULD BE USED.

EXTREME CAUTION IS REQUIRED WHEN PERFORMING MAINTENANCE.

BE CONSTANTLY AWARE THAT THE UPS SYSTEM CONTAINS HIGH DC AS WELL AS AC VOLTAGES.

CHECK FOR VOLTAGE WITH BOTH AC AND DC VOLTMETERS PRIOR TO MAKING CONTACT.

**WARNING**

**LOCATE CENTER OF GRAVITY SYMBOLS
AND DETERMINE UNIT WEIGHT
BEFORE HANDLING CABINET.**



If you require assistance for any reason, call the toll-free Liebert Customer Service & Support number; 1-800-543-2378. For CS&S to assist you expediently, please have the following information available:

Part Numbers: _____
Serial Numbers: _____
kVA Rating: _____
Date Purchased: _____
Date Installed: _____
Location: _____
Input Voltage: _____
Output Voltage: _____
Battery Reserve Time: _____

1.0 SAFETY PRECAUTIONS

Read this manual thoroughly, paying special attention to the sections that apply to you, before working with the UPS. **Retain this manual for use by installing personnel.**

Under typical operation and with all UPS doors closed, only normal safety precautions are necessary. The area around the UPS system should be kept free from puddles of water, excess moisture, or debris.

Special safety precautions are required for procedures involving handling, installation, and maintenance of the UPS system or the battery. Observe all safety precautions in this manual before handling or installing the UPS system. Observe all precautions in the **Operation and Maintenance Manual**, before as well as during performance of all maintenance procedures. Observe all battery safety precautions before working on or near the battery.

This equipment contains several circuits that are energized with high voltage. Only test equipment designated for troubleshooting should be used. This is particularly true for oscilloscopes. Always check with an AC and DC voltmeter to ensure safety before making contact or using tools. Even when the power is turned Off, dangerously high potentials may exist at the capacitor banks and at the batteries.

ONLY qualified service personnel should perform maintenance on the UPS system. When performing maintenance with any part of the equipment under power, service personnel and test equipment should be standing on rubber mats. The service personnel should wear insulating shoes for isolation from direct contact with the floor (earth ground).

Unless all power is removed from the equipment, one person should never work alone. A second person should be standing by to assist and summon help in case an accident should occur.

Four types of messages are used throughout the manual to stress important text. Carefully read the text below each Danger, Warning, Caution, and Note and use professional skills and prudent care when performing the actions described by that text.

A **Danger** signals immediate hazards resulting in severe personal injury or death. For example:



DANGER

A DANGER SIGNALS IMMEDIATE HAZARDS WHICH WILL RESULT IN SEVERE PERSONAL INJURY OR DEATH.

A **Warning** signals the presence of a possible serious, life-threatening condition. For example:



WARNING

LETHAL VOLTAGES MAY BE PRESENT SENT WITHIN THIS UNIT EVEN WHEN IT IS APPARENTLY NOT OPERATING. OBSERVE ALL CAUTIONS AND WARNINGS IN THIS MANUAL. FAILURE TO DO SO COULD RESULT IN SERIOUS INJURY OR DEATH. DO NOT WORK ON OR OPERATE THIS EQUIPMENT UNLESS YOU ARE FULLY QUALIFIED TO DO SO!! NEVER WORK ALONE.

A **Caution** indicates a condition that could seriously damage equipment and possibly injure personnel. For example:



CAUTION

Extreme care is necessary when removing shoring braces. Do not strike the cabinet with hammers or other tools.

A **Note** emphasizes important text. If the note is not followed, equipment could be damaged or may not operate properly. For example:



NOTE

If the UPS system has a blown fuse, the cause should be determined before you replace the fuse. Contact Liebert Customer Service and Support.

2.0 INSTALLATION CONSIDERATIONS

Install your Series 600T UPS in accordance with the submittal drawing package and the following procedures.

A Liebert authorized representative must perform the initial system check-out and start-up to ensure proper system operation. Equipment warranties will be voided unless system start-up is performed by a Liebert authorized representative. Contact your local Liebert sales representative or Liebert Customer Service and Support at **1-800-543-2378** to arrange for system start-up.



CAUTION

Read this manual thoroughly before attempting to wire or operate the unit. Improper installation is the most significant cause of UPS start-up problems.

Do not install this equipment near gas or electric heaters. It is preferable to install the UPS in a restricted location to prevent access by unauthorized personnel.

1. Proper planning will speed unloading, location, and connection of the UPS. Refer to **Figure 5** through **Figure 30** and **Appendix A - Site Planning Data**.
2. Refer to information later in this manual regarding the optional Battery Cabinets and Transformer Cabinets. **Observe all battery safety precautions when working on or near the battery.**
3. Use the shortest output distribution cable runs possible, consistent with logical equipment arrangements and with allowances for future additions if planned.
4. Recommended ambient operating temperature is 25°C (77°F). Relative humidity must be less than 95%, non-condensing. Note that room ventilation is necessary, but air conditioning may not be required. Maximum ambient operating temperature is 40°C (104°F) without derating. The batteries should not exceed 25°C (77°F). At elevations above 4,000 feet (1219 meters) derating may be required (consult your Liebert sales representative).
5. Even though your Liebert UPS unit is 92.5 to 94% efficient, the heat output is substantial. For more specific information, see **Appendix A - Site Planning Data**. Be sure environmental conditioning systems can accommodate this BTU load, even during utility outages.
6. The routing (inside the facility) to the installation site, as well as the floor at the final equipment location, must be capable of supporting the cabinet weight and the weight of any moving equipment. The modules weigh between 4150 and 7920 pounds, not including transformer cabinets. The battery cabinets weigh between 3100 and 5100 pounds. The System Control Cabinets weigh between 1000 and 2550 pounds. Refer to **Appendix A - Site Planning Data**.
7. Plan the routing to ensure that the unit can move through all aisleways, doorways, and around corners without risking damage. If the modules and batteries must be moved by elevator, check the size of the door openings and the weight-carrying capacity of the elevator.



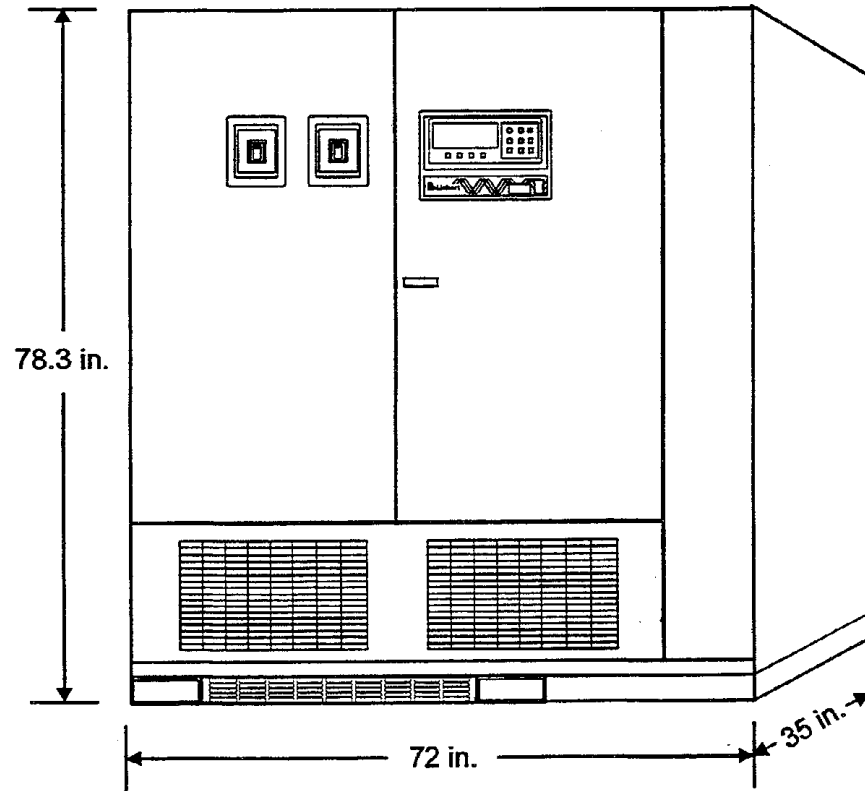
WARNING

LOCATE CENTER OF GRAVITY SYMBOLS AND DETERMINE UNIT WEIGHT BEFORE HANDLING CABINET.



Figure 1 Multi-Module 300 to 450 kVA UPS

Note: The 375 kVA UPS with 208 VAC input measures 96x35x78.3 inches.



3.0 UNLOADING AND HANDLING

The UPS module is shipped in one cabinet to allow easy handling at the site. Because the weight distribution in the cabinet is uneven, use extreme care during handling and transport. Your installation may also include Battery Cabinets and a System Control Cabinet.



WARNING

EXERCISE EXTREME CARE WHEN HANDLING UPS CABINETS TO AVOID EQUIPMENT DAMAGE OR INJURY TO PERSONNEL. THE UPS MODULE WEIGHT RANGES FROM 4150 POUNDS TO 7920 POUNDS, NOT INCLUDING TRANSFORMER CABINETS. BATTERY CABINETS WEIGH BETWEEN 3100 AND 5100 POUNDS.

LOCATE CENTER OF GRAVITY SYMBOLS BEFORE HANDLING CABINET. TEST LIFT AND BALANCE THE CABINET BEFORE TRANSPORTING. MAINTAIN MINIMUM TILT FROM VERTICAL AT ALL TIMES.

SLOTS AT THE BASE OF THE MODULES AND BATTERY CABINETS ARE INTENDED FOR LIFT USE. BASE SLOTS WILL SUPPORT THE UNIT ONLY IF THE FORKS ARE COMPLETELY BENEATH THE UNIT.

SYSTEM CONTROL CABINETS (SCC'S) HAVE HOLES INTENDED FOR RIGGING BARS OR CHAINS. PREVENT CHAINS OR CABLES FROM CONTACTING CABINET BY USING SPREADER BAR AND ADEQUATE PADDING.

To reduce the possibility of shipping damage, cabinets are shored with 2x4 bracing, secured with screw-type nails. This shoring must be carefully removed prior to unloading.



CAUTION

EXTREME CARE IS NECESSARY WHEN REMOVING SHORING BRACES. DO NOT STRIKE CABINET WITH HAMMERS OR OTHER TOOLS.

4.0 INSPECTIONS

4.1 External Inspections

1. While the UPS system is still on the truck, inspect the equipment and shipping container(s) for any signs of damage or mishandling. Do not attempt to install the system if damage is apparent. If any damage is noted, file a damage claim with the shipping agency within 24 hours and contact Liebert Customer Service and Support at 1-800-543-2378 to inform them of the damage claim and the condition of the equipment.
2. Locate the bag containing the keys for the front access door. The bag is attached to the cabinet.
3. Compare the contents of the shipment with the bill of lading. Report any missing items to the carrier and to Liebert Customer Service and Support immediately.
4. Check the nameplate on the cabinets to verify that the model numbers correspond with the one specified. Record the model numbers and serial numbers in the front of this installation manual. A record of this information is necessary should servicing become required.

4.2 Internal Inspections

1. Verify that all items have been received.
2. If spare parts were ordered, verify arrival.
3. Open doors and remove cabinet panels to check for shipping damage to internal components.
4. Check for loose connections or unsecured components in the cabinet(s).
5. Check for installation of circuit breaker line safety shields. There should be no exposed circuit breaker terminals when the cabinet doors are opened.
6. Check for any unsafe condition that may be a potential safety hazard.
7. UPS modules are shipped with internally mounted shipping brackets. The shipping brackets (painted orange) must be removed from the rear (remove rear panels).

5.0 EQUIPMENT LOCATION

1. Handle cabinet(s) in accordance with **WARNINGS** in **3.0 - Unloading and Handling**. Use a suitable material handling device to move cabinet to its final location. Exercise extreme care because of the uneven weight distribution. Carefully lower the cabinet to the floor.
2. Verify that the UPS system is installed in a clean, cool and dry location.
3. Installation and serviceability will be easier if adequate access is provided on all sides of the equipment, but only front access is required.
 - a. Verify that there is adequate clearance to open cabinet doors. See drawings and local codes (4 feet is recommended).
 - b. Verify that there is adequate area in front of circuit breakers to perform maintenance. Check installation drawings for location of breakers. Check with local codes.
 - c. Verify that there is adequate clearance above all cabinets to allow exhaust air to flow without restriction (2 feet minimum, unobstructed).

6.0 BATTERY INSTALLATION

6.1 Battery Safety Precautions

Servicing of batteries should be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.

When replacing batteries, use the same number and type of batteries.



CAUTION

Lead-acid batteries contain hazardous materials. Batteries must be handled, transported, and recycled or discarded in accordance with federal, state, and local regulations. Because lead is a toxic substance, lead-acid batteries should be recycled rather than discarded.

Do not open or mutilate the battery or batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic. Do not dispose of battery or batteries in a fire. The battery may explode.

A battery can present a risk of electrical shock and high short circuit current. The following precautions should be observed when working on batteries

- 1. Remove watches, rings, or other metal objects.**
- 2. Use tools with insulated handles.**
- 3. Wear rubber gloves and boots.**
- 4. Do not lay tools or metal parts on top of batteries.**
- 5. Disconnect charging source prior to connecting or disconnecting battery terminals.**
- 6. Determine if battery is inadvertently grounded. If inadvertently grounded, remove source of ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock will be reduced if such grounds are removed during installation and maintenance.**

Lead-acid batteries can present a risk of fire because they generate hydrogen gas. The following procedures should be followed:

- 1. DO NOT SMOKE when near batteries.**
- 2. DO NOT cause flame or spark in battery area.**
- 3. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.**

Battery Safety Precautions in French Per CSA Requirements

Instructions Importantes Concernant La Sécurité

Conserver Ces Instructions



ADVERTISSEMENT

DES PIÈCES SOUS ALIMENTATION SERONT LAISSÉES SANS PROTECTION DURANT CES PROCÉDURES D'ENTRETIEN. UN PERSONNEL QUALIFIÉ EST REQUIS POUR EFFECTUER CES TRAVAUX.

LES FUSIBLES A C.C. DE LA BATTERIE D'ACCUMULATEURS OPÈRENT EN TOUT TEMPS À LA TENSION NOMINALE. LA PRÉSENCE D'UN FUSIBLE A C.C. BRÛLÉ INDIQUE UN PROBLÈME SÉRIEUX. LE REMPLACEMENT DE CE FUSIBLE, SANS AVOIR DÉTERMINÉ LES RAISONS DE LA DÉFECTUOSITÉ, PEUT ENTRAÎNER DES BLESSURES OU DES DOMMAGES SÉRIEUX À L'ÉQUIPEMENT. POUR ASSISTANCE, APPELER LE DÉPARTEMENT DE SERVICE À LA CLIENTÈLE DE LIEBERT.



DANGER

Les accumulateurs plomb-acide contiennent de la matière comportant un certain risque. Les accumulateurs doivent être manipulés, transportés et recyclés ou éliminés en accord avec les lois fédérales, provinciales et locales. Parce que le plomb est une substance toxique, les accumulateurs plomb-acide devraient être recyclés plutôt qu'éliminés.

Il ne faut pas brûler le ou les accumulateurs. L'accumulateur pourrait alors exploser.

Il ne faut pas ouvrir ou endommager le ou les accumulateurs. L'électrolyte qui pourrait s'en échapper est dommageable pour la peau et les yeux.

Un accumulateur représente un risque de choc électrique et de haut courant de court-circuit. Lorsque des accumulateurs sont manipulés, les mesures préventives suivantes devraient être observées:

1. Retirer toutes montres, bagues ou autres objets métalliques.
2. Utiliser des outils avec manchon isolé.
3. Porter des gants et des bottes de caoutchouc.
4. Ne pas déposer les outils ou les pièces métalliques sur le dessus des accumulateurs.
5. Interrompre la source de charge avant de raccorder ou de débrancher les bornes de la batterie d'accumulateurs.
6. Déterminer si l'accumulateur est mis à la terre par erreur. Si oui, défaire cette mise à la terre. Tout contact avec un accumulateur mis à la terre peut se traduire en un choc électrique. La possibilité de tels chocs sera réduite si de telles mises à la terre sont débranchées pour la durée de l'installation ou de l'entretien.

Les accumulateurs plomb-acide présentent un risque d'incendie parce qu'ils génèrent des gaz à l'hydrogène. Les procédures suivantes devront être respectées.

1. NE PAS FUMER lorsque près des accumulateurs.
2. NE PAS produire de flammes ou d'étincelles près des accumulateurs.
3. Décharger toute électricité statique présente sur votre corps avant de toucher un accumulateur en touchant d'abord une surface métallique mise à la terre.



DANGER

L'électrolyte est un acide sulfurique dilué qui est dangereux au contact de la peau et des yeux. Ce produit est corrosif et aussi conducteur électrique. Les procédures suivantes devront être observées:

1. Porter toujours des vêtements protecteurs ainsi que des lunettes de protection pour les yeux.
2. Si l'électrolyte entre en contact avec la peau, nettoyer immédiatement en rinçant avec de l'eau.
3. Si l'électrolyte entre en contact avec les yeux, arroser immédiatement et généreusement avec de l'eau. Demander pour de l'aide médicale.
4. Lorsque l'électrolyte est renversée, la surface affectée devrait être nettoyée en utilisant un agent neutralisant adéquat. Une pratique courante est d'utiliser un mélange d'approximativement une livre (500 grammes) de bicarbonate de soude dans approximativement un gallon (4 litres) d'eau. Le mélange de bicarbonate de soude devra être ajouté jusqu'à ce qu'il n'y ait plus apparence de réaction (mousse). Le liquide résiduel devra être nettoyé à l'eau et la surface concernée devra être asséchée.

Figure 2 UPS Multi-Module Unit Block Diagram

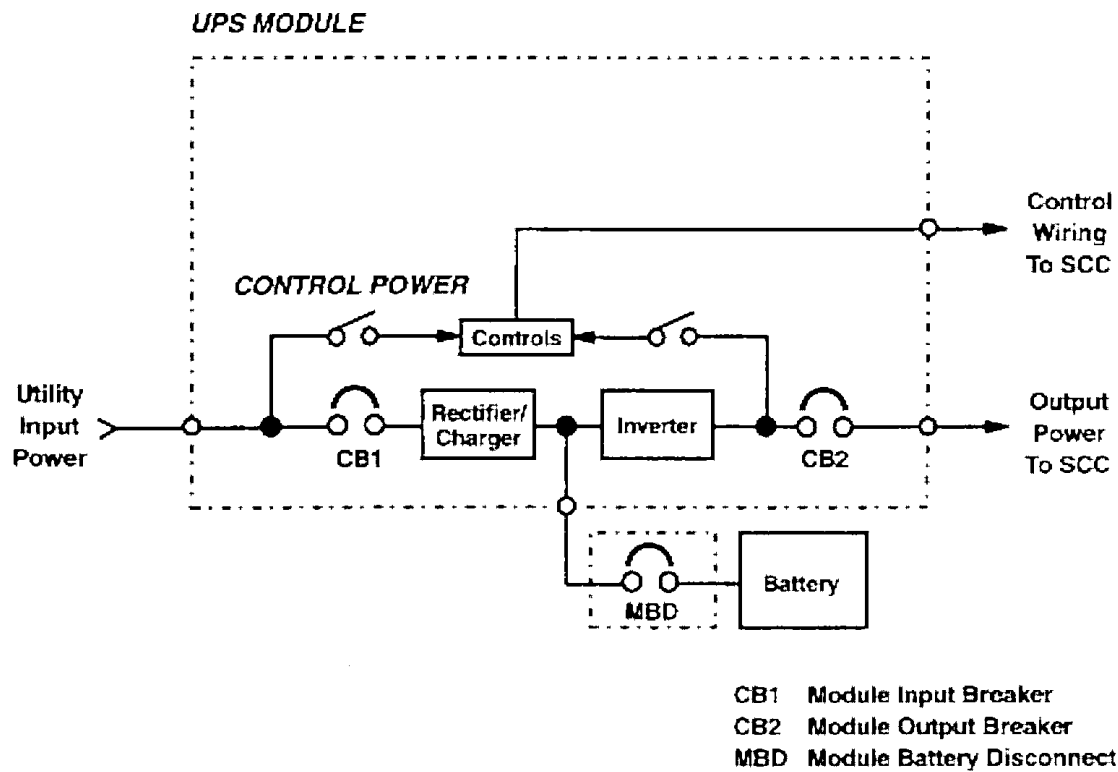
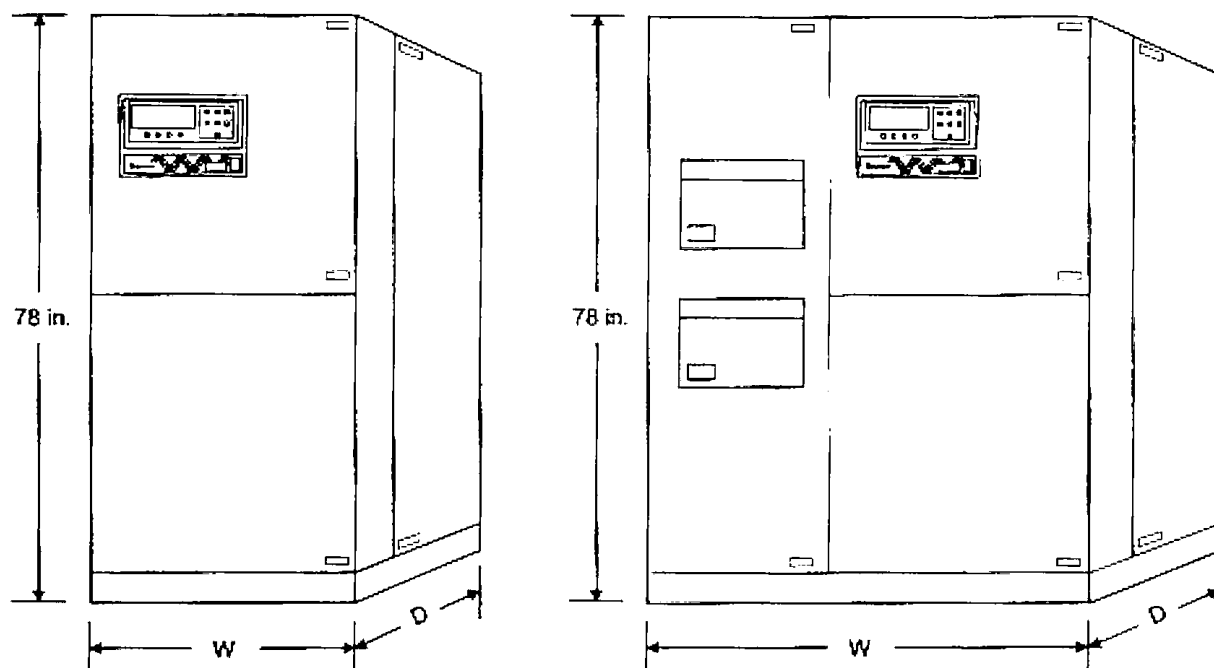


Figure 3 System Control Cabinets



SCCP Dimensions

	W x D	Weight
Amps	(Inches)	(lbs.)
2000	37 x 50	1400
1120-1600	37 x 50	1250
560-960	37 x 37	1000
200-480	37 x 33	1000

SCCB Dimensions

	W x D	Weight
Amps	(Inches)	(lbs.)
4000	132 x 60	4880
2000-3000	61 x 50	2370
1280-1600	60 x 50	2000
640-800	37 x 37	1100

TYPES OF SYSTEM CONTROL CABINETS (SCC)

- SCCB** A stand **alone** cabinet containing system control logic for up to six UPS modules, static bypass switch, manually operated disconnects for static bypass switch, and two motor operated system circuit breakers.
- SCCC** An integrated configuration (like SCCI) with the static bypass switch rated for **continuous** duty.
- SCCI** System control logic and static bypass switch are **integrated** into a switchboard cabinet manufactured by others, which also includes the system circuit breakers.
- SCCP** A stand alone cabinet similar to SCCB except smaller in and designed for two UPS modules (a **pair**). Current range is 200 to 2000 amperes.

6.2 Battery Cabinets

Two sizes of optional battery cabinets are available. Refer to **Figure 19** through **Figure 21**. The battery cabinet cells range from 90 to 150 Ampere-hours. The same model battery cabinet may be paralleled in multiple cabinet strings for additional capacity. Battery capacity (in minutes) at your installation will depend on cabinet model, number of cabinets, and amount of critical load on the UPS.



NOTE

Battery cabinets are 33 inches deep, compared to 35 inches deep for the 300-450 kVA UPS modules. They may be installed adjacent to the UPS module, but will not be an exact bolt-up match, as would be the case with 150-225 kVA modules.

1. **Handling.** The Battery Cabinet weighs 3100 to 5100 pounds. Forklift slots are provided for easy handling.
2. **Cabinet Inspection.** Remove all panels and visually inspect the batteries, bus connections, and cabinet for any damage. **Exercise caution; voltage is present within the Battery Cabinet even before installation.** If there are signs of damage, do not proceed. Call Liebert Customer Service and Support at 1-800-542-2378.
3. **Battery Storage.** The batteries used in the Battery Cabinet have an excellent charge retaining characteristic. The batteries can be stored for up to six months without any appreciable deterioration. Self-discharge rate of the batteries is approximately 3% per month when the batteries are stored in temperatures of 45°C to 45°C (59°F to 77°F). If the Battery Cabinet is planned to be stored for longer than six months, contact Liebert Customer Service for recommended action.
4. **Installation.** The Battery Cabinet(s) can be located conveniently next to each UPS module. The front-access-only-design eliminates side and rear service clearance requirements.
 - **Environment.** Locate the Battery Cabinet in a clean, dry environment. Recommended temperature range for optimum performance and lifetime is 20°C (68°F) to 25°C (77°F).
 - **Service Clearance.** Allow front access to the Battery Cabinet at all times for maintenance and servicing. Electrical codes require that the Battery Cabinet be installed with no less than 3 feet (1 meter) of clearance at the front of the cabinet when operating. Side and rear panels do not require service clearance.
 - **Side Panels.** Remove protective side panels to connect cabinets together. Panels are retained at the bottom with three screws.
 - **Shield Plate.** The shield plate in each Battery Cabinet should be on the side toward the UPS module for proper UPS ventilation. Move the shield if required by your Battery Cabinet location.
 - **Cables.** Cables may be run between the cabinets through cutouts in the top of the cabinet, eliminating the need for external conduit runs. **Route cables before moving cabinets into final position for bolting together.** Remove top panels for access, if required. No top or bottom entry cables are required, except for remotely located cabinets which require conduits. Refer to **Figure 19** through **Figure 21**.

6.3 Non-Standard Batteries

When batteries other than a matching Battery Cabinet are used, a remote battery disconnect switch with overcurrent protection is required per the National Electrical Code. Refer to **Figure 28** and **Figure 29**. Contact your Liebert sales representative regarding this option.

1. Install battery racks/cabinets and batteries per manufacturer's installation and maintenance instructions.
2. Verify battery area has adequate ventilation and battery operating temperature complies with manufacturer's specification.

If you have any questions concerning batteries, battery racks, or accessories, contact Liebert Customer Service and Support at **1-800-543-2378**.

7.0 OPTIONAL TRANSFORMER CABINET

The optional transformer cabinet is a free-standing enclosure that must be bolted to the right side of the UPS module. Forklift slots are included in the cabinet base for easy handling. Power and control cables for UPS system interconnections are provided with each cabinet. Refer to **Figure 6** and **Figure 7**.

The optional Transformer Cabinet (**Figure 7**) encloses the Rectifier Isolation Transformer and the optional Bypass Isolation Transformer. The cabinet is cooled by fans, with a disposable filter at the bottom.

8.0 WIRING CONSIDERATIONS



WARNING

ALL POWER CONNECTIONS MUST BE COMPLETED BY A LICENSED ELECTRICIAN THAT IS EXPERIENCED IN WIRING THIS TYPE OF EQUIPMENT. WIRING MUST BE INSTALLED IN ACCORDANCE WITH ALL APPLICABLE NATIONAL AND LOCAL ELECTRICAL CODES. IMPROPER WIRING MAY CAUSE DAMAGE TO THE EQUIPMENT OR INJURY TO PERSONNEL.

VERIFY THAT ALL INCOMING HIGH AND LOW VOLTAGE POWER CIRCUITS ARE DE-ENERGIZED AND LOCKED OUT BEFORE INSTALLING CABLES OR MAKING ANY ELECTRICAL CONNECTIONS.

Refer to **Appendix A - Site Planning Data** and installation drawings (**Figure 5** through **Figure 30**). Determine AC currents for your system (kVA, voltage, and options). Also refer to equipment nameplate for the model number, rating, and voltage. Refer to **Table 1** and **Table 2** for wire termination data.



NOTE

*Use 75°C copper wire. Select wire size based on the ampacities in **Table 3** of this manual, a reprint of Table 310-16 and associated notes of the National Electrical Code (NFPA 70).*



CAUTION

The weight of power cables must be adequately supported to avoid stress on bus bars and lugs. In addition to weight support, the following restraining method is recommended to control cable movement during external fault conditions. Wrap line cables together at 6 inches and 12 inches from the terminals with 5 wraps of 3/8 inch nylon rope or equivalent (tensile strength of 2000 pounds). Support remainder of cable with 5 wraps every 6 inches or 1 wrap every 1 inch.

8.1 Power and Control Wiring

1. Power wiring must be run in individual, separate conduits or cable trays. Control wiring must be stranded and run in individual separate steel conduits.



CAUTION

Power and control wiring must be separated!

2. Observe local, state and national electrical codes. Verify utility power and its overcurrent protection rating will accommodate the UPS input rating, including battery recharging.
3. A safety ground wire must be run from building ground to ground point in the UPS Module Cabinet and Battery Cabinet. The grounding conductor shall comply with the following conditions of installation:
 - a. An insulated grounding conductor that is sized in accordance with the NEC and local codes and is green (with or without one or more yellow stripes) is to be installed as part of the branch circuit that supplies the unit or system.
 - b. The grounding conductor described above is to be grounded to earth at the service equipment or, if supplied by a separately derived system, at the supply transformer or motor-generator set.
 - c. The attachment-plug receptacles in the vicinity of the unit or system are all to be of a grounding type, and the grounding conductors serving these receptacles are to be connected to earth ground at the service equipment.
4. When possible, input to the UPS and bypass should be four wire plus ground. When input is straight delta, the UPS artificial neutral kit should be ordered. When input is corner-grounded delta, the isolated neutral kit should be ordered.
5. Observe clockwise phase rotation of all power wiring. Phase A leads Phase B leads Phase C. A qualified electrician should check the phase rotation.
6. NEC Class I wiring methods are required for control and communication Class 2 circuits.

8.2 Battery Wiring

Power wiring to the Battery Cabinet connects positive, negative, and ground power cables from the Battery Cabinet to the associated UPS. Connection of the UPS to the Battery Cabinet serves to both charge and discharge the batteries (when needed). The battery disconnect (circuit breaker) requires a control cable. Power and control cables are field supplied. Refer to **Figure 19** through **Figure 21**.



DANGER

A BATTERY INTERCELL CONNECTION ON EACH TIER IS DISCONNECTED FOR SAFETY DURING SHIPMENT. DO NOT COMPLETE THESE CONNECTIONS. THE LIEBERT CUSTOMER SERVICE REPRESENTATIVE WILL COMPLETE THESE CONNECTIONS AS PART OF START-UP. AN IMPROPERLY INSTALLED UNIT CAN RESULT IN INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT.



CAUTION

Be sure polarity is correct when wiring the Battery Cabinet to the connected equipment (positive to positive; negative to negative). If polarity is not correct, fuse failures or equipment damage can result.

Call Liebert Customer Service and Support to schedule installation check-out, final battery inter-cell connections, and start-up.



NOTE

A Liebert Battery Specialist can perform a detailed inspection of the entire battery system to ensure it meets current IEEE standards. This inspection service is recommended because batteries are a very critical part of the UPS system.

Figure 4 Typical Multi-Module Configurations

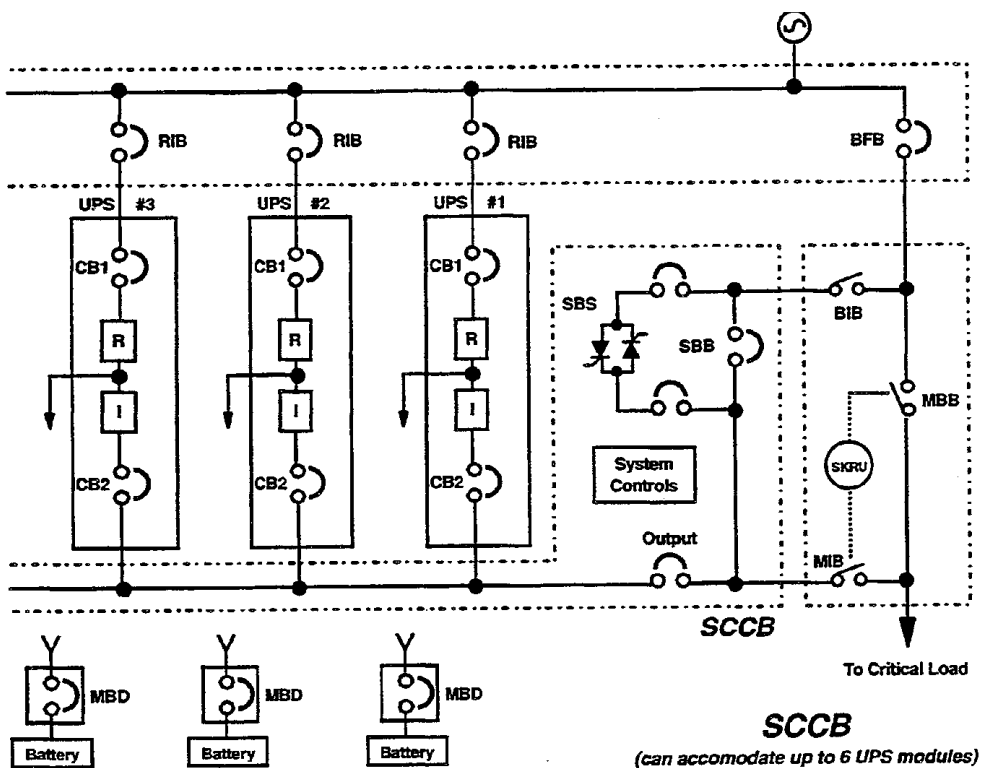
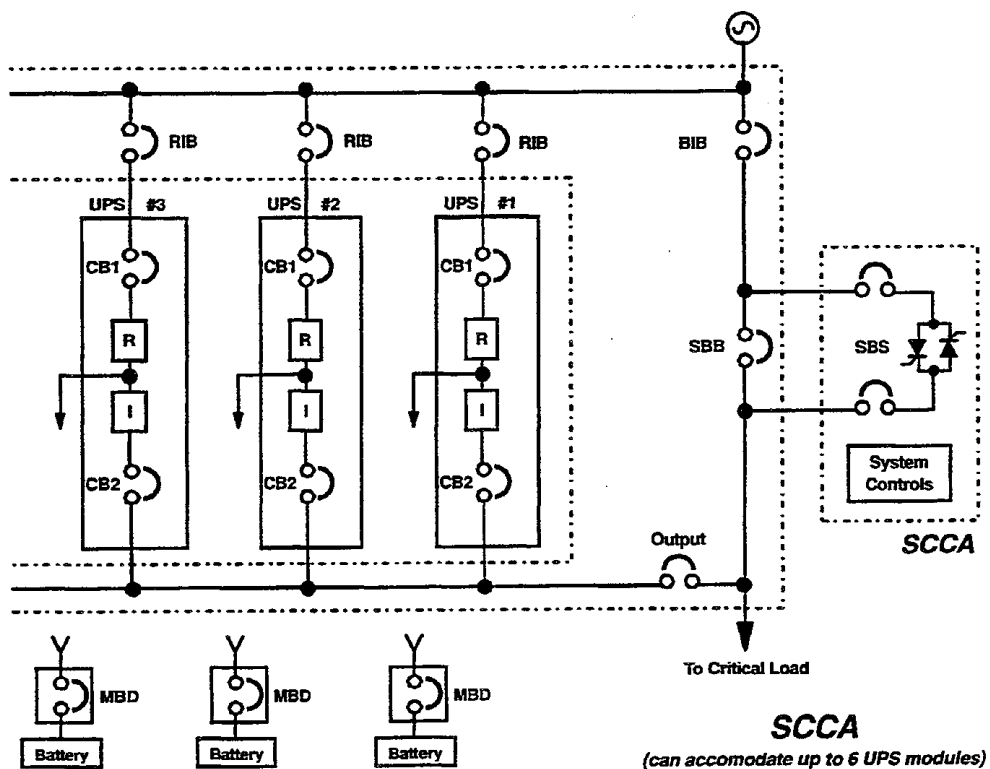
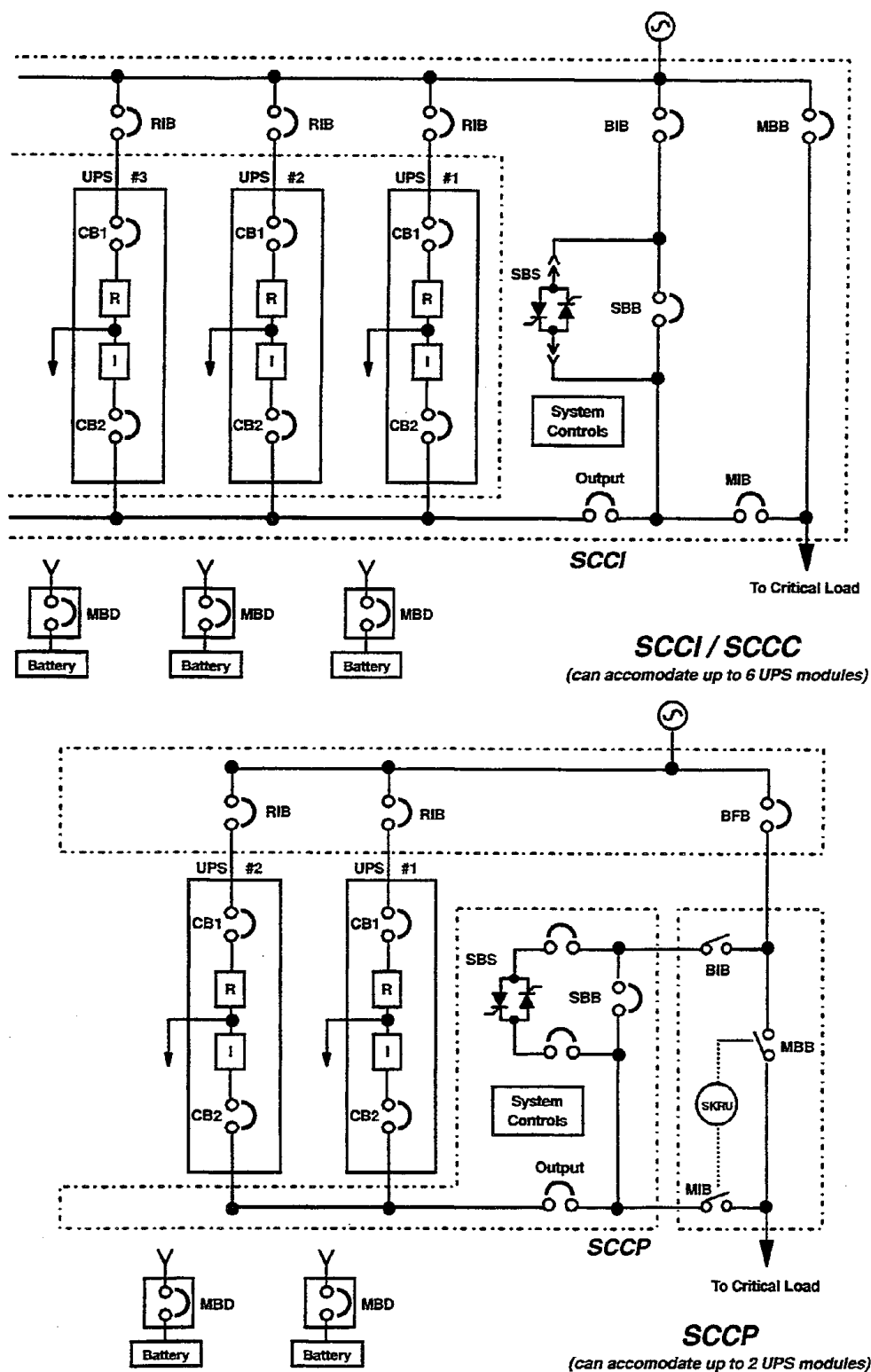


Figure 4 Typical Multi-Module Configurations (continued)



9.0 WIRING CONNECTIONS



DANGER

VERIFY THAT ALL INCOMING HIGH AND LOW VOLTAGE POWER CIRCUITS ARE DE-ENERGIZED AND LOCKED OUT BEFORE INSTALLING CABLES OR MAKING ELECTRICAL CONNECTIONS.

ALL POWER CONNECTIONS MUST BE COMPLETED BY A LICENSED ELECTRICIAN EXPERIENCED IN WIRING UPS EQUIPMENT, AND IN ACCORDANCE WITH ALL APPLICABLE NATIONAL AND LOCAL ELECTRICAL CODES.

IMPROPER WIRING MAY CAUSE DAMAGE TO THE UPS OR INJURY TO PERSONNEL.



CAUTION

All shielded cables, non-shielded cables, non-shielded control wires, non-shielded battery breaker control wires, and non-shielded remote control wires must be housed in individual, separate, steel conduits. Placing multiple cables in the same conduit with other control or power wiring may cause system failure.

Refer to the drawings in this manual and any other drawings provided by Liebert for this installation. Make all of the following connections:

1. AC power cables from input power source circuit breaker (RIB) to UPS Module Input. Observe phase rotation.
2. AC power cables from bypass power source circuit breaker (BIB) to UPS system bypass input at System Control Cabinet (SCC). Observe phase rotation.



CAUTION

If there are line-to-neutral loads connected to the UPS output, the bypass input source must be wye connected and have three phases plus neutral plus ground. If the specified input is not available, an isolation transformer is required.

3. AC power cables from UPS Module Outputs to SCC or to switchgear for critical load bus. Observe phase rotation.



NOTE

Make sure all required wiring between each UPS module and the optional cabinet(s) is completed. Observe phase rotation.

Abbreviations for Circuit Breakers	
BFB	Bypass Feeder Breaker
BIB	Bypass Input Breaker
CB1	Module Input Breaker
CB2	Module Output Breaker
MBB	Maintenance Bypass Breaker
MBD	Module Battery Disconnect
MBFB	Maintenance Bypass Feeder Breaker
MIB	Maintenance Isolation Breaker
RIB	Rectifier Input Breaker
SBB	System Bypass Breaker
SBS	Static Bypass Switch

-
4. Each UPS Module Output Neutral to SCC or to switchgear for critical load bus.
 5. The UPS System Output Neutral is connected to one common point and solidly grounded per requirements of the National Electrical Code. The ground connection inside the UPS SCC cabinet may be required by the power wiring configuration at your site.

**CAUTION**

UPS bypass and system output neutral must be connected to only one common point in the UPS system. This neutral line must be grounded at the source.

6. For Battery Cabinets:
DC power cables (and ground) from Battery Cabinet to UPS Module, and between Battery Cabinets. Observe polarity.

**NOTE**

DC power and battery circuit breaker control cables are provided with the matching Battery Cabinet.

**DANGER**

DO NOT MAKE ANY CONNECTIONS BETWEEN BATTERY TIERS IN THE BATTERY CABINET. THESE CONNECTIONS WILL BE MADE BY THE LIEBERT CUSTOMER SERVICE REPRESENTATIVE DURING START-UP.

7. For remote battery:
DC power cables (and ground) from battery to Module Battery Disconnect, and then to UPS Module DC bus. Observe polarity.
8. Module Battery Disconnect control wiring to UPS Module, and between Battery Cabinets.
9. Control wiring from System Control Cabinet (SCC) to UPS modules. Wiring must be run in individual separate steel conduit.
10. Power and control connections required for the Maintenance Bypass.
11. Power connections from SCC to critical load bus. Observe phase rotation.
12. Control wiring to Remote Monitor Panel, if used. Selected alarm messages are also available for customer use through a set of contacts on a separate terminal board. Wiring must be run in individual separate steel conduit.
13. Emergency Power Off control wiring (to SCC) must be run in separate steel conduit.
14. Communications wiring (to SCC) for terminals, site monitoring or for modem must be run in separate steel conduit.
15. Any additional special wiring required at your site.

10.0 WIRING INSPECTION

1. Verify all power connections are tight.
2. Verify all control wire terminations are tight.
3. Verify all power wires and connections have proper spacing between exposed surfaces, phase-to-phase and phase-to-ground.
4. Verify that all control wires are run in individual, separate, steel conduit.

Table 1 Power Wiring Terminals - Factory Supplied

Connection Type					
UPS Module Rating kVA	AC Input	Battery	AC Output	Neutral	Ground
300-450 kVA	Bus bars for connecting hardware (3/8" on 1-3/4" centers) are provided for all power wiring terminations. A field-supplied lug is required.				Stud 5/16" - 18

Use 75°C copper wire. Select wire size based on the ampacities in **Table 310-16** (see **Table 3** of this manual) and associated notes of the National Electrical Code (NFPA 70).

Use commercially available solderless lugs for the wire size required for your application. Connect wire to the lug using tool and procedure specified by the lug manufacturer.

Table 2 Torque Specifications

Nut and Bolt Combinations				
Bolt Shaft Size	Grade 2 Standard		Electrical Connections with Belleville Washers	
	Lb-in	N-m	Lb-in	N-m
1/4	53	6.0	46	5.2
5/16	107	12	60	6.8
3/8	192	22	95	11
1/2	428	48	256	29

Circuit Breakers With Compression Lugs (For Power Wiring)		
Current Rating	Lb-in	N-m
400 - 1200 Amps	300	34

Terminal Block Compression Lugs (For Control Wiring)		
AWG Wire Size or Range	Lb-in	N-m
#22 - #14	3.5 to 5.3	0.4 to 0.6

Use the values in this table unless the equipment is labeled with a different torque value.

Table 3 Table 310-16
Allowable Ampacities of Insulated Conductors Rated 0-2000 Volts, 60° to 90°C (140° to 194°F)¹

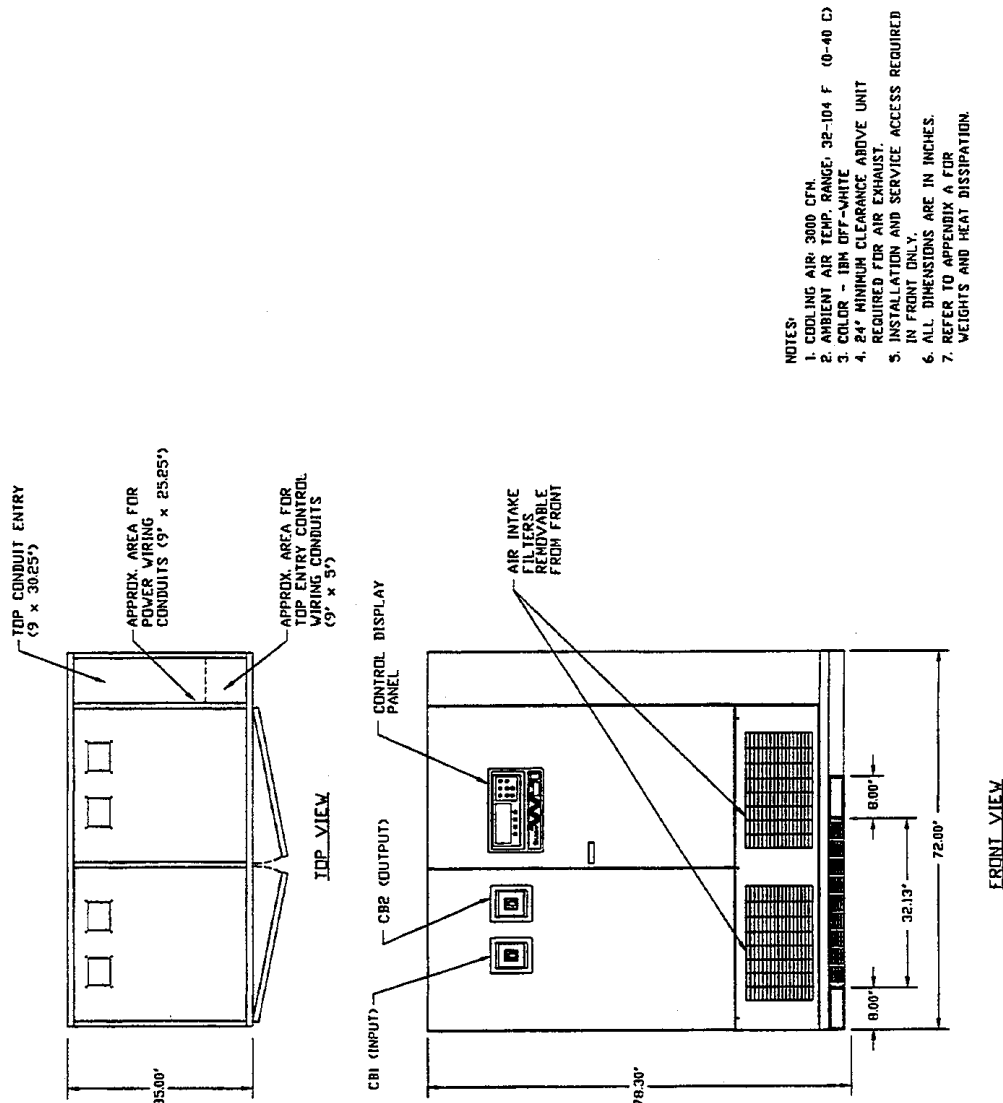
Not More than Three Conductors in Raceway or Cable or Earth (Directly Buried), based on Ambient Temperature of 30° (86°F)

Size	Temperature Rating of Conductor. See Table 310-13.						Size
AWG kcmil	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	AWG kcmil
	Types TW† UF†	Types FEPW†, RH,RHW†, THHW†, THW†, THWN†, XHHW†, USE†, ZW†	Types TBS, SA, SIS,FEP†, FEPB†,MI, RHH†, RHW-2 THHN†,THHW†, THW-2,THWN-2, USE-2, XHH, XHHW† XHHW-2,ZW-2	Types TW† UF†	Types RH†, RHW†, THHW†, THW†, THWN†, XHHW†, USE†	Types TBS, SA,SIS, THHN†, THHW†, THW-2, THWN-2, RHH†, RHW-2, USE-2, XHH, XHHW†, XHHW-2, ZW-2	
	Copper			Aluminum or Copper-Clad Aluminum			
18 16 14 12 10 8 20† 25† 30 40 20† 25† 35† 50	14 18 25† 30† 40† 55 20† 25 30 20† 30† 40 25† 35† 45 12 10 8
6 4 3 2 1	55 70 85 95 110	65 85 100 115 130	75 95 110 130 150	40 55 65 75 85	50 65 75 90 100	60 75 85 100 115	6 4 3 2 1
1/0 2/0 3/0 4/0	125 145 165 195	150 175 200 230	170 195 225 260	100 115 130 150	120 135 155 180	135 150 175 205	1/0 2/0 3/0 4/0
250 300 350 400 500	215 240 260 280 320	255 285 310 335 380	290 320 350 380 430	170 190 210 225 260	205 230 250 270 310	230 255 280 305 350	250 300 350 400 500
600 700 750 800 900	355 385 400 410 435	420 460 475 490 520	475 520 535 555 585	285 310 320 330 355	340 375 385 395 425	385 420 435 450 480	600 700 750 800 900
1000 1250 1500 1750 2000	455 495 520 545 560	545 590 625 650 665	615 665 705 735 750	375 405 435 455 470	445 485 520 545 560	500 545 585 615 630	1000 1250 1500 1750 2000
Correction Factors							
Ambient Temp °C	For ambient temperatures other than 30°C (86°F), multiply the allowable ampacities shown above by the appropriate factor shown below.						Ambient Temp °F
21-25 26-30 31-35 36-40 41-45 46-50 51-55 56-60 61-70 71-80	1.08 1.00 .91 .82 .71 .58 .41	1.05 1.00 .94 .88 .82 .75 .67 .58 .33	1.04 1.00 .96 .91 .87 .82 .76 .71 .58 .41	1.08 1.00 .91 .82 .71 .58 .41	1.05 1.00 .94 .88 .82 .75 .67 .58 .33	1.04 1.00 .96 .91 .87 .82 .76 .71 .58 .41	70-77 78-86 87-95 96-104 105-113 114-122 123-131 132-140 141-158 159-176

† Unless otherwise specifically permitted elsewhere in this Code, the overcurrent protection for conductor types marked with an obelisk (†) shall not exceed 15 amperes for No. 14, 20 amperes for No. 12, and 30 amperes for No. 10 copper; or 15 amperes for No. 12 and 25 amperes for No. 10 aluminum and copper-clad aluminum after any correction factors for ambient temperature and number of conductors have been applied.

¹ Reprinted with permission from NFPA 70-1993, the National Electrical Code®, Copyright 1996, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

Figure 5 Outline Drawing, 300 to 450 kVA Multi-Module UPS, 480 or 600 VAC Input



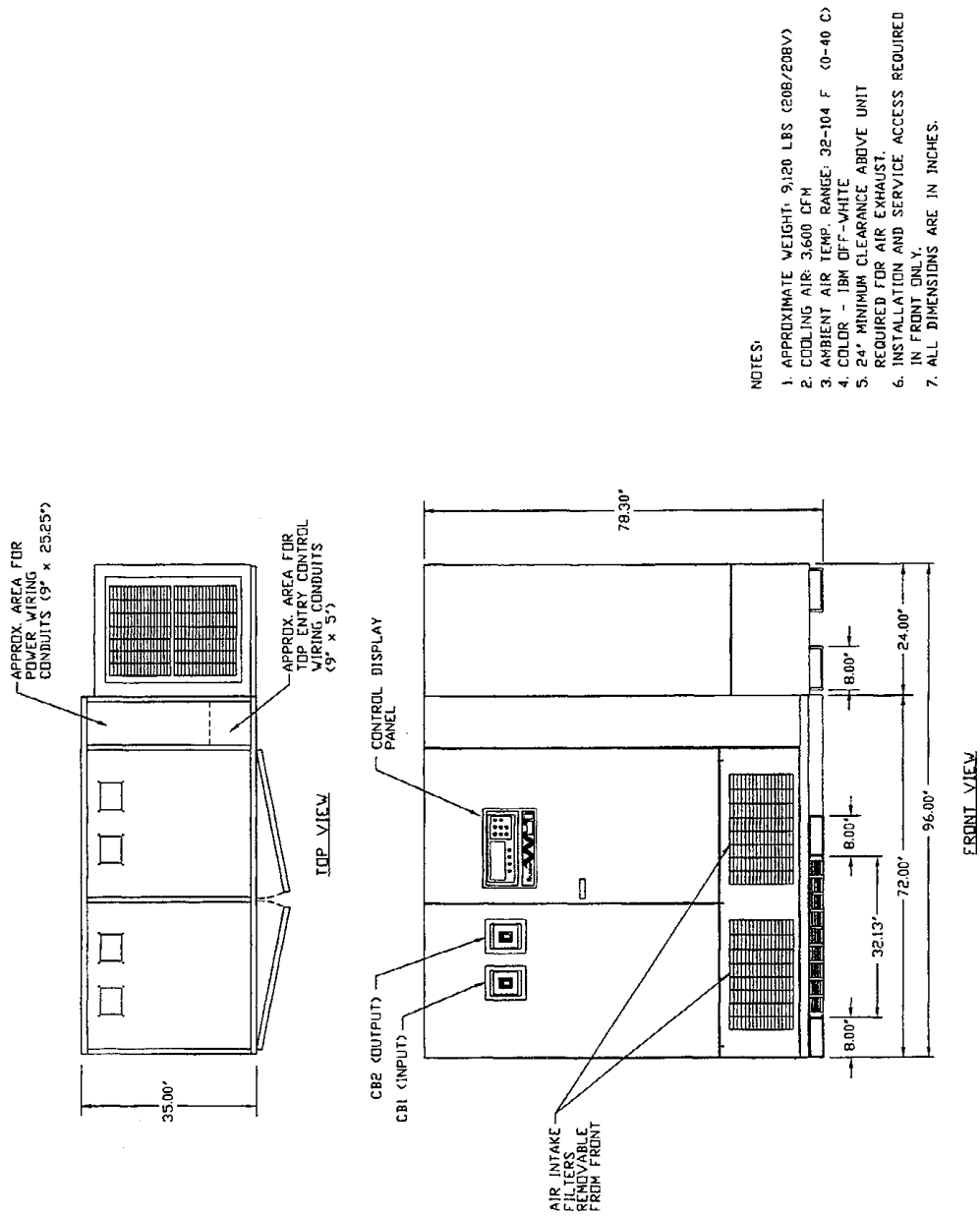
- NOTES:
1. COOLING AIR: 3000 CFM.
 2. AMBIENT AIR TEMP. RANGE: 32-104 F (0-40 C)
 3. COLOR - IBM OFF-WHITE
 4. 24" MINIMUM CLEARANCE ABOVE UNIT REQUIRED FOR AIR EXHAUST.
 5. INSTALLATION AND SERVICE ACCESS REQUIRED IN FRONT ONLY.
 6. ALL DIMENSIONS ARE IN INCHES.
 7. REFER TO APPENDIX A FOR WEIGHTS AND HEAT DISSIPATION.

DRAWN BY T. NGUYEN	SHEET NO. 1 OF 1	TITLE OUTLINE DRAWING 300 - 450 KVA MULTI - MODULE UPS SERIES 600T	DWG. NO. 88-797601-10	DATE 04/10/96
			REV. NO. 1	ORDER NO.
CHK BY J CAMPBELL	ECN NO.			
DES' APVL IN70110	REF. DWG. IN70110			

FILE NAME: IN70110.DWG

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IRVINE, CALIFORNIA 92718

Figure 6 Outline Drawing, 375 kVA with 208 VAC Input, or All Other 300 to 450 kVA UPS With Optional Transformer Cabinet



- NOTES:
- 1. APPROXIMATE WEIGHT: 9,120 LBS (208/208V)
 - 2. COOLING AIR: 3,600 CFM
 - 3. AMBIENT AIR TEMP. RANGE: 32-104 F (0-40 C)
 - 4. COLOR - IBM OFF-WHITE
 - 5. 24" MINIMUM CLEARANCE ABOVE UNIT REQUIRED FOR AIR EXHAUST.
 - 6. INSTALLATION AND SERVICE ACCESS REQUIRED IN FRONT ONLY.
 - 7. ALL DIMENSIONS ARE IN INCHES.


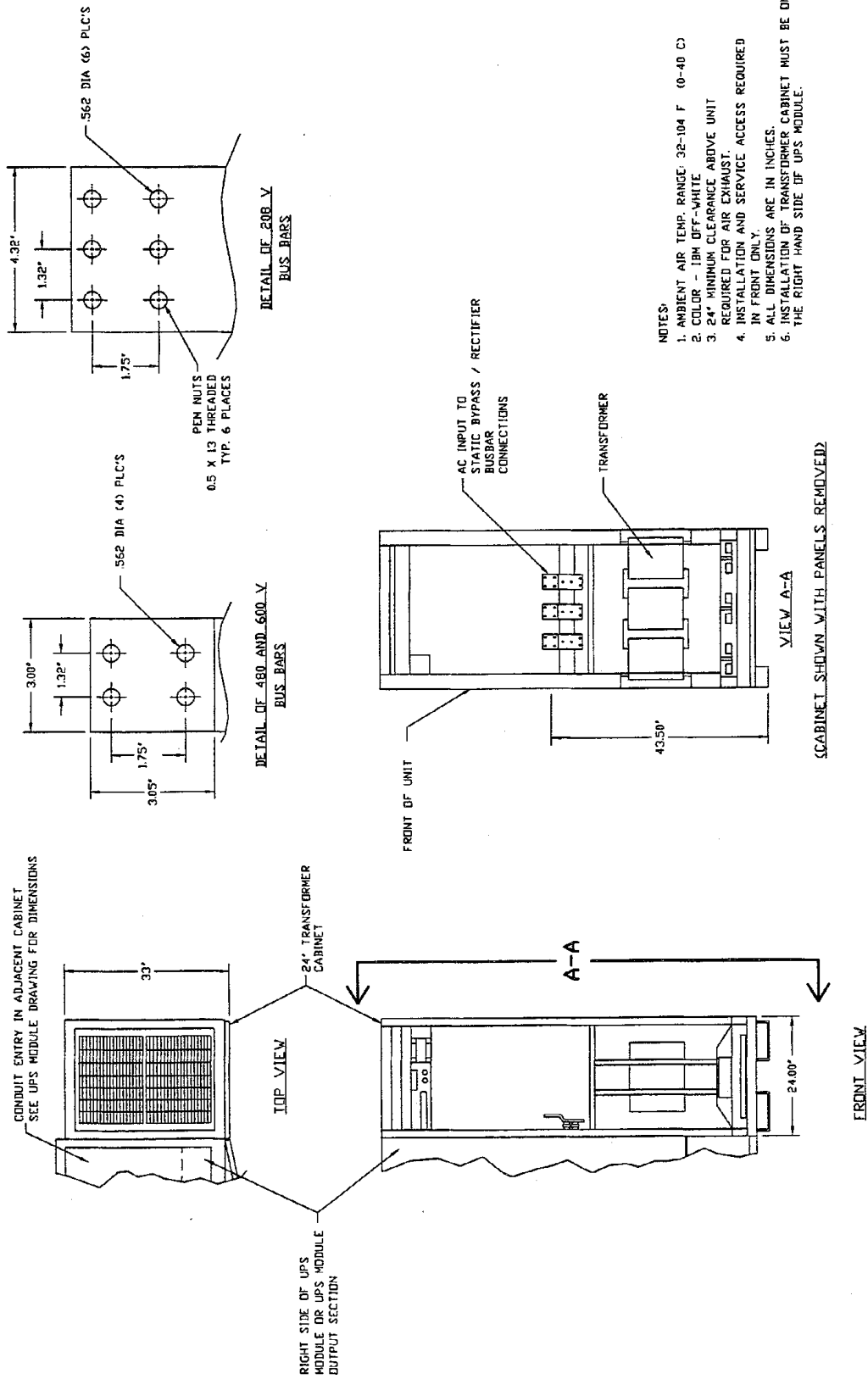

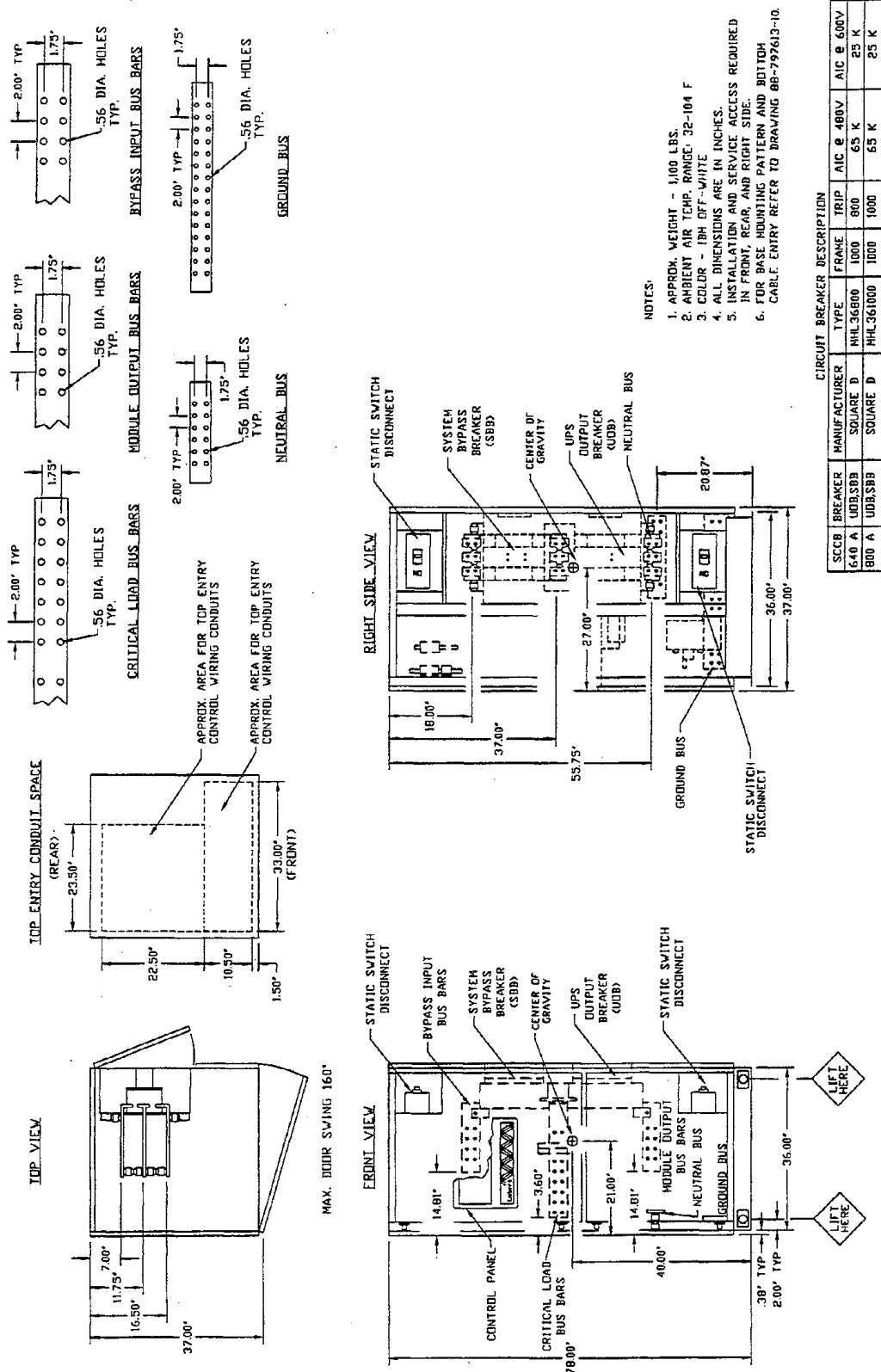
DRAWN BY T. NGUYEN		SHEET NO 1 OF 1	TITLE OUTLINE DRAWING 375 KVA MULTI - MODULE UPS 208 V INPUT - 208 / 120 V OUTPUT SERIES 600T	DWG. NO. 88-797646-81	DATE 06/05/96
CHK BY J CAMPBELL		ECN NO		REV. NO. 2	ORDER NO.
DES APVL IN74681		REF. DWG. IN74681		 Liebert 9450 JEROME RD. IRVINE, CALIFORNIA 92718	

Figure 7 Outline Drawing, Optional Transformer Cabinet



DRAWN BY T HECKMAN		SHEET NO 1 OF 1		TITLE OUTLINE DRAWING 300 - 450 KVA 24' TRANSFORMER CABINET (OPTIONAL) SERIES 600T			
CHK BY J CAMPBELL		ECN NO		DWG. NO. 88-797611-05		DATE 04/18/96	
DES APVL IN71105		REF. DWG. IN71105		REV. NO. 1		ORDER NO.	
 Liebert 9650 JERONIMO RD. IRVINE, CALIFORNIA 92718						FILE NAME: IN71105.DWG	

ED
-10.



CIRCUIT BREAKER DESCRIPTION						
SCCB	BREAKER	MANUFACTURER	TYPE	FRAME	TRIP	
640 A	UB3.SB3	SQUARE D	MHC-36600	1000	800	AIC @ 480V 25 K
800 A	UB3.SB3	SQUARE D	MHC-361000	1000	65 K	AIC @ 600V 25 K


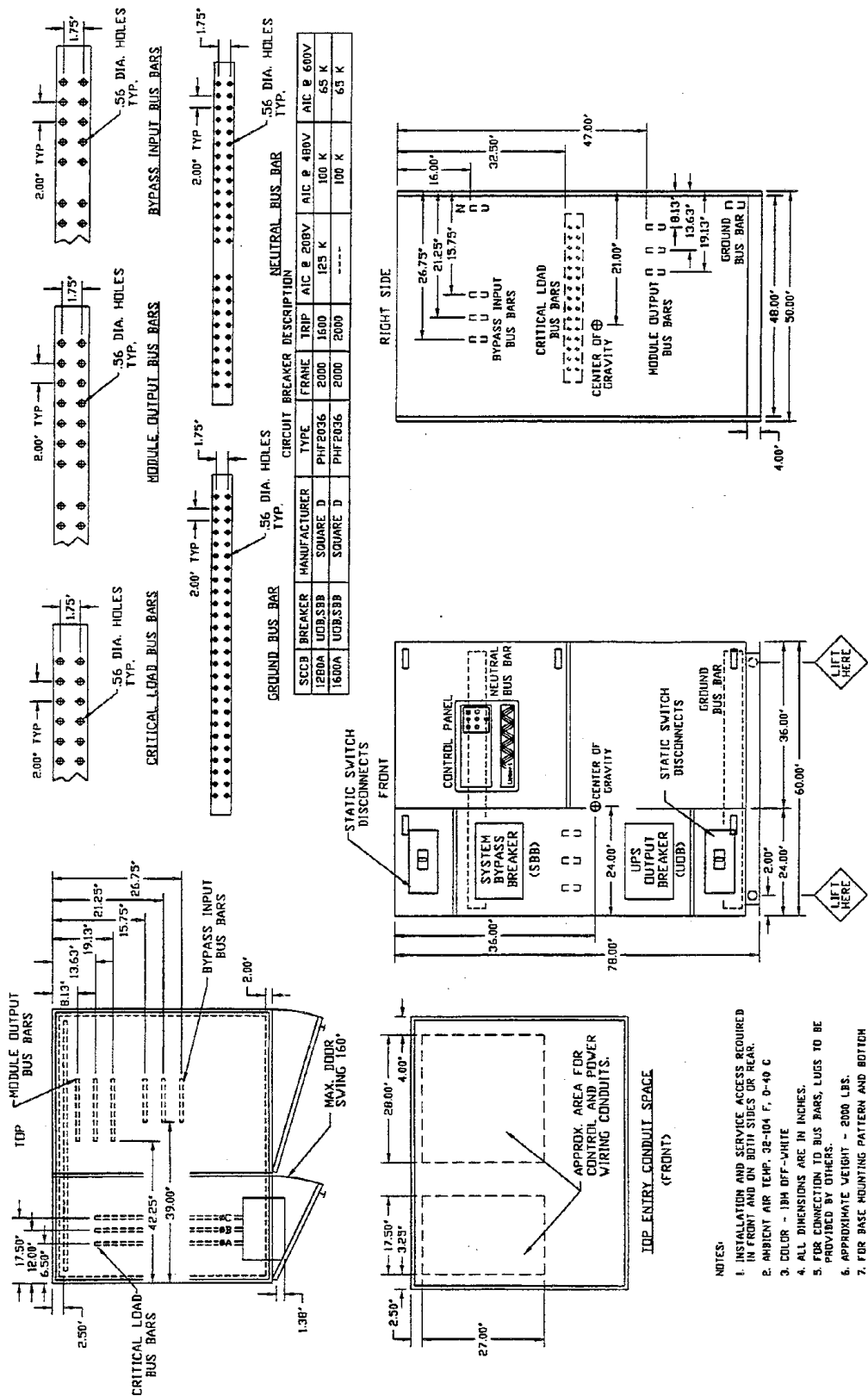
DRAWN BY B FISH		SHEET NO 1 OF 1	OUTLINE DRAWING SYSTEM CONTROL CABINET (SCCB) 640 - 800 AMP SERIES 600T	DWG. NO. 88-797614-23 REV. NO. 2	DATE 09/07/95 ORDER NO.
CHK BY J CAMPBELL		ECN NO			
DES APVL		REF. DWG. IN71423			
 Liebert 9539 JEFFERSON RD IRVINE, CA 92618-3271A					

Figure 9 Outline Drawing, System Control Cabinet (SCCB) 1280 to 1600 Amps

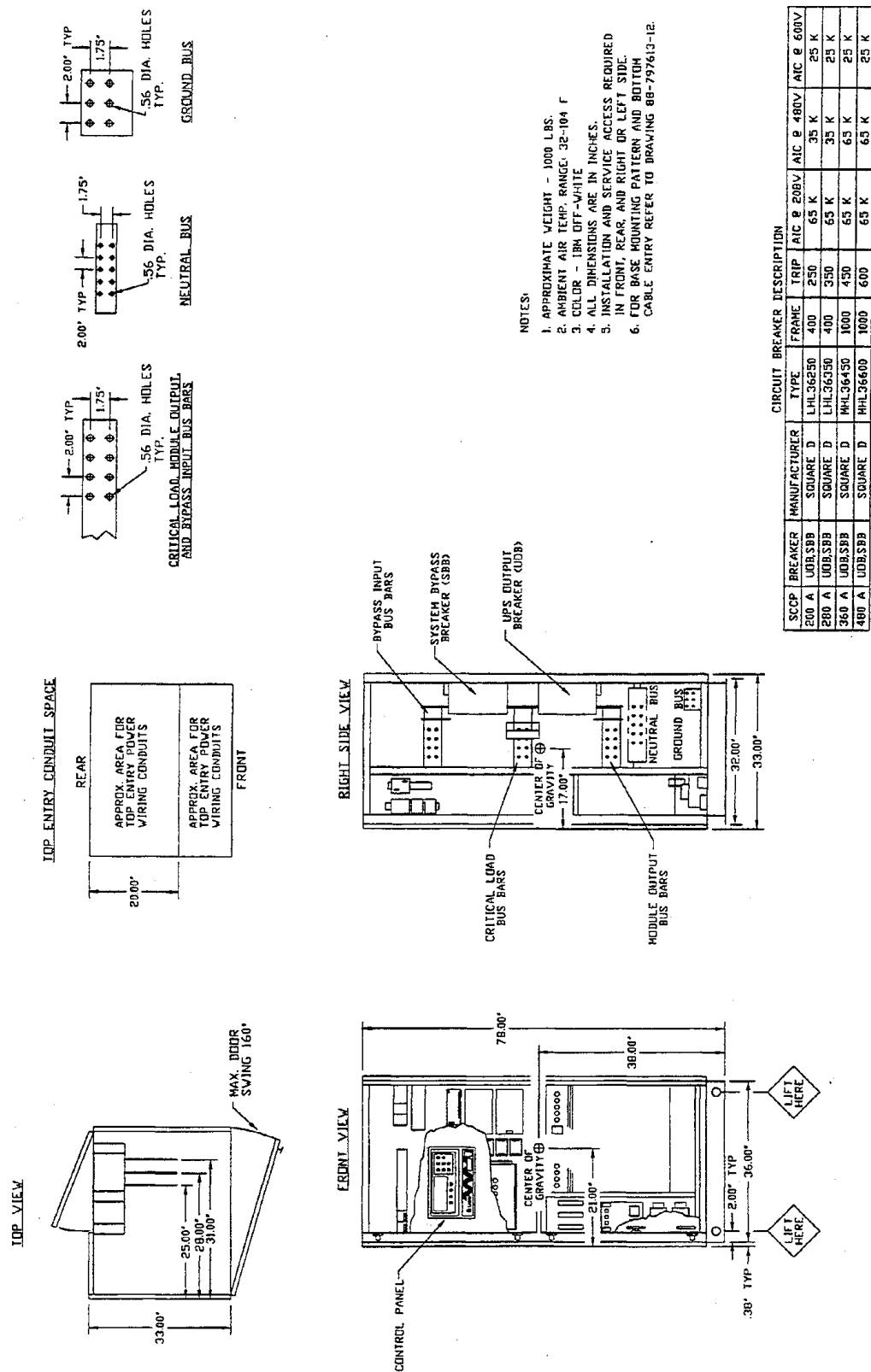


DRAWN BY B FISH		SHEET NO 1 OF 1		TITLE OUTLINE DRAWING SYSTEM CONTROL CABINET (SCCB) 1280 - 1600 AMP SERIES 600T	
CHK BY J CAMPBELL		ECN NO		DWG. NO. IN71424	
DES APVL		REV. NO. 2		DATE 09/07/95	
				ORDER NO.	

FILE NAME: IN71424.DWG

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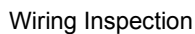
Figure 10 Outline Drawing, System Control Cabinet (SCCP) 200 to 480 Amps



DRAWN BY B FISH		SHEET NO 1 OF 1	TITLE OUTLINE DRAWING SYSTEM CONTROL CABINET (SCCP) 200 - 480 AMP SERIES 600T	
CHK BY J CAMPBELL	ECN NO	DWG. NO. 88-797614-27	DATE 09/07/95	Liebert 9650 JERONIMO RD. IRVINE, CALIFORNIA 92718
DES APVL	REF. DWG. IN71427	REV. NO. 2	ORDER NO.	

FILE NAME: IN71427.DWG

30



**DISCONTINUED
PRODUCT**


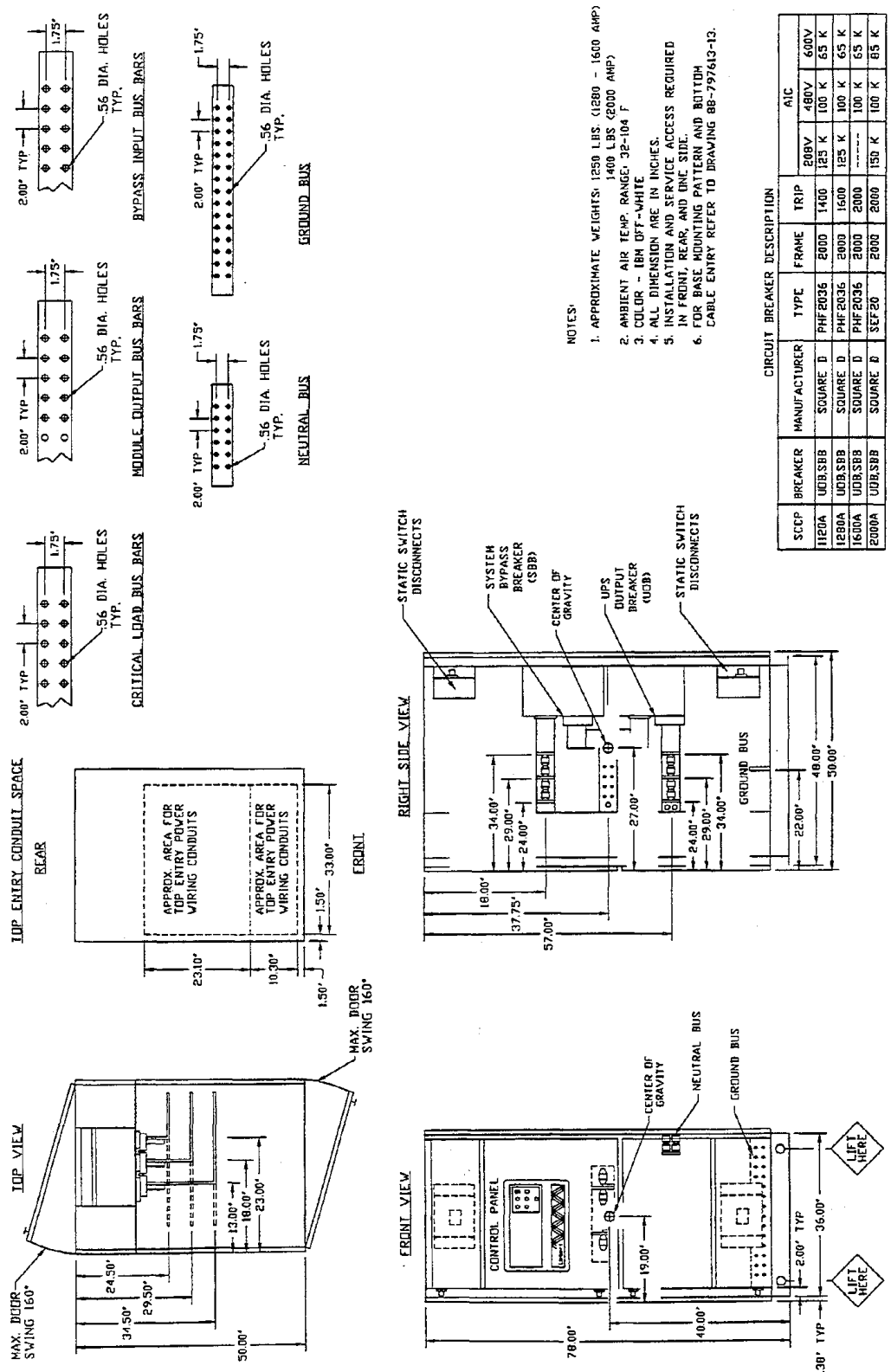
DRAWN BY B FISH		TITLE OUTLINE DRAWING SYSTEM CONTROL CABINET 560 - 960 AMP SERIES 6001	DWG. NO. 88-297614-28 REV. NO. 2	DATE 09/07/95 ORDER NO.	 Liebert 9650 JERONIMO RD. IRVINE, CALIFORNIA 92718
CHK BY J CAMPBELL					
DES APVL					
SHEET NO 1 OF 1					
ECN NO					
REF. DWG. IN71428					

Figure 12 Outline Drawing, System Control Cabinet (SCCP) 1120 to 2000 Amps

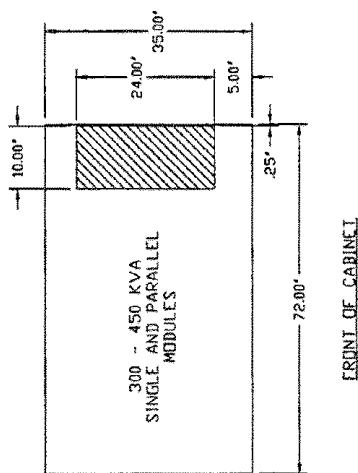


DRAWN BY B FISH		SHEET NO 1 OF 1		TITLE OUTLINE DRAWING SYSTEM CONTROL CABINET (SCCP) 1120 - 2000 AMP SERIES 600T	
CHK BY J CAMPBELL		ECN NO		DWG. NO. 88-797614-29	
DES APVL		REF. DWG. IN71429		DATE 09/07/95	
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FILE NAME: INT429EWDG

Liebert
9650 JERONIMO RD
IRVINE, CALIFORNIA 92718

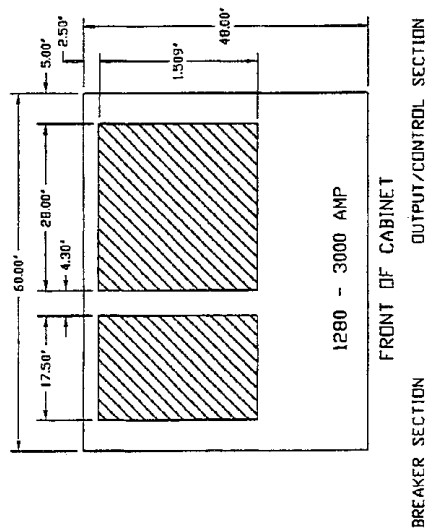
Figure 13 Base Mounting Patterns, 300 to 450 kVA UPS Modules



- NOTES:
1. SHADED AREAS (REMOVABLE PLATES) INDICATE LOCATIONS FOR BOTTOM ENTRY OF CUSTOMER'S CABLES IF DESIRED.
 2. THE REMOVABLE PLATES SHOWN ARE LOCATED APPROXIMATELY 4.00 INCHES FROM THE CABINET BASE MOUNTING SURFACE (e.g. CONCRETE FLOOR).
 3. TOLERANCE ON ALL DIMENSIONS IS $\pm 25'$.
 4. ALL DIMENSIONS ARE IN INCHES.
 5. ALL PATTERNS ARE TOP VIEW ONLY.

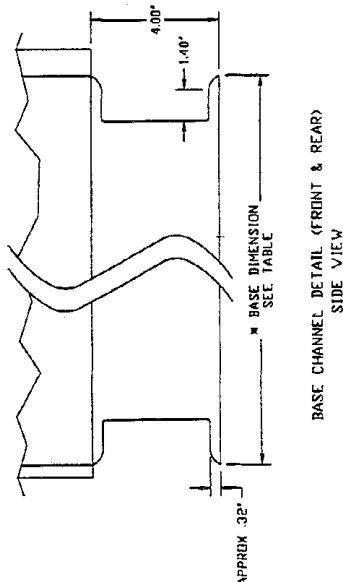
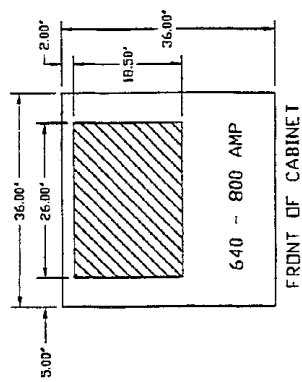
DRAWN BY T. HECKMAN	SHEET NO 1 OF 1	TITLE BASE MOUNTING PATTERNS 300 - 450 KVA MODULES SERIES 600T		DWG. NO. 88-797613-15	DATE 06/06/96
CHK BY J. CAMPBELL	ECN NO			REV. NO. 3	ORDER NO.
DES. APVL	REF. DWG. DM71315			Liebert 9650 JERICHO RD. IRVINE, CALIFORNIA 92718	

Figure 14 Base Mounting Patterns, System Control Cabinet (SCCB) 640 to 3000 Amps



AMP	BASE DEPTH
640 THRU 800	36"
2000 THRU 3000	48"

- NOTES:
1. SHADED AREAS (REMOVABLE PLATES) INDICATE LOCATIONS FOR BOTTOM ENTRY OF CUSTOMER'S CABLES IF DESIRED.
 2. THE REMOVABLE PLATES SHOWN ARE LOCATED APPROXIMATELY 4 INCHES FROM THE CABINET BASE MOUNTING SURFACE (e.g. CONCRETE FLOOR).
 3. TOLERANCE ON ALL DIMENSIONS IS $\pm .25$
 4. ALL DIMENSIONS ARE IN INCHES.

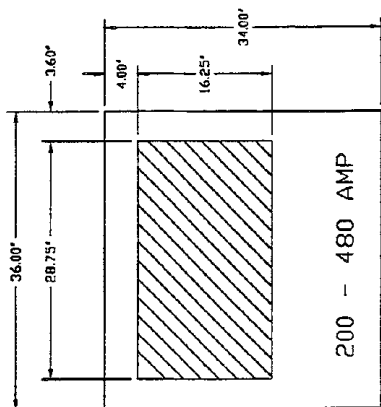


DRAWN BY B FISH		SHEET NO 1 OF 1	TITLE BASE MOUNTING PATTERNS SYSTEM CONTROL CABINETS (SCCB) 640 - 3000 AMP SERIES 600T	
CHK BY J CAMPBELL		ECN NO	DWG. NO. DM71310	DWG. NO. 88-797613-10
DES APVL		REF. DWG.	REV. NO. 2	DATE 09/07/95
			ORDER NO.	

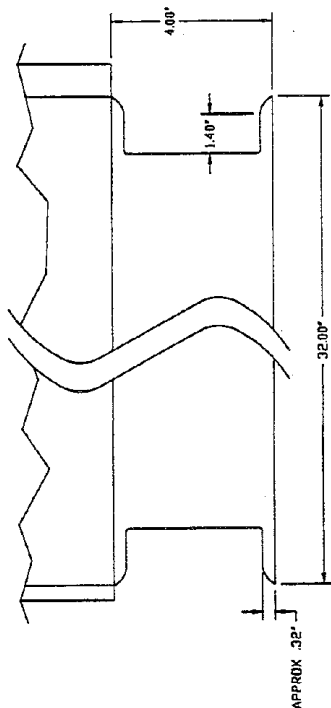
9650 JERONIMO RD.
IRVINE, CALIFORNIA 92718

FILE NAME: 8871312.DWG

Figure 15 Base Mounting Patterns, System Control Cabinet (SCCP) 200 to 480 Amps



FRONT OF CABINET



BASE CHANNEL DETAIL (FRONT & REAR)
SIDE VIEW

NOTES:

1. SHADED AREAS (REMOVABLE PLATES) INDICATE LOCATIONS FOR BOTTOM ENTRY OF CUSTOMER'S CABLES IF DESIRED.
2. THE REMOVABLE PLATES SHOWN ARE LOCATED APPROXIMATELY 4 INCHES FROM THE CABINET BASE MOUNTING SURFACE (e.g. CONCRETE FLOOR).
3. TOLERANCE ON ALL DIMENSIONS IS $\pm .25$ ".
4. ALL DIMENSIONS ARE IN INCHES.


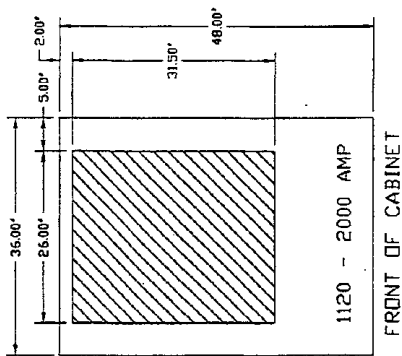
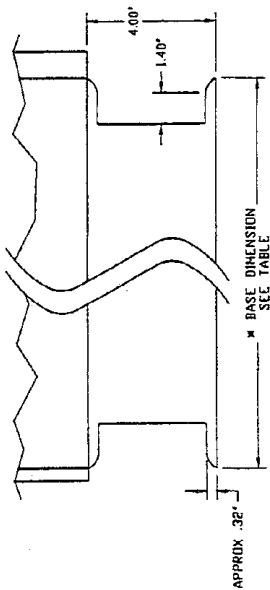
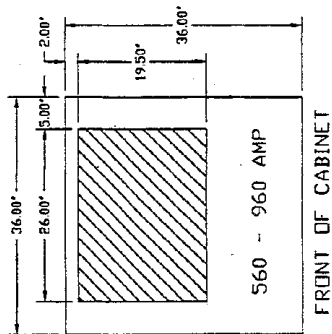
DRAWN BY		SHEET NO		TITLE	
B FISH		1	OF 1	BASE MOUNTING PATTERNS SYSTEM CONTROL CABINET (SCCP) 200 - 480 AMP SERIES 600T	
CHK BY		ECN	NO		
J CAMPBELL					
DES APVL		REF.	DWG.	DM71312	
		DWG. NO.	88-797613-12	DATE	09/07/95
		REV. NO.	2	ORDER NO.	
		FILE NAME: B71D12E2.DWG			
		 Liebert 9650 JERDINE RD. IRVINE, CALIFORNIA 92718			

Figure 16 Base Mounting Patterns, System Control Cabinet (SCCP) 560 to 2000 Amps



AMP	BASE DEPTH
560 THRU 960	36"
1120 THRU 2000	48"

- NOTES:
1. SHADED AREAS (REMOVABLE PLATES) INDICATE LOCATIONS FOR BOTTOM ENTRY OF CUSTOMER'S CABLES IF DESIRED.
 2. THE REMOVABLE PLATES SHOWN ARE LOCATED APPROXIMATELY 4 INCHES FROM THE CABINET BASE MOUNTING SURFACE (e.g. CONCRETE FLOOR).
 3. TOLERANCE ON ALL DIMENSIONS IS $\pm .25$.
 4. ALL DIMENSIONS ARE IN INCHES.



BASE CHANNEL DETAIL (FRONT & REAR)
SIDE VIEW


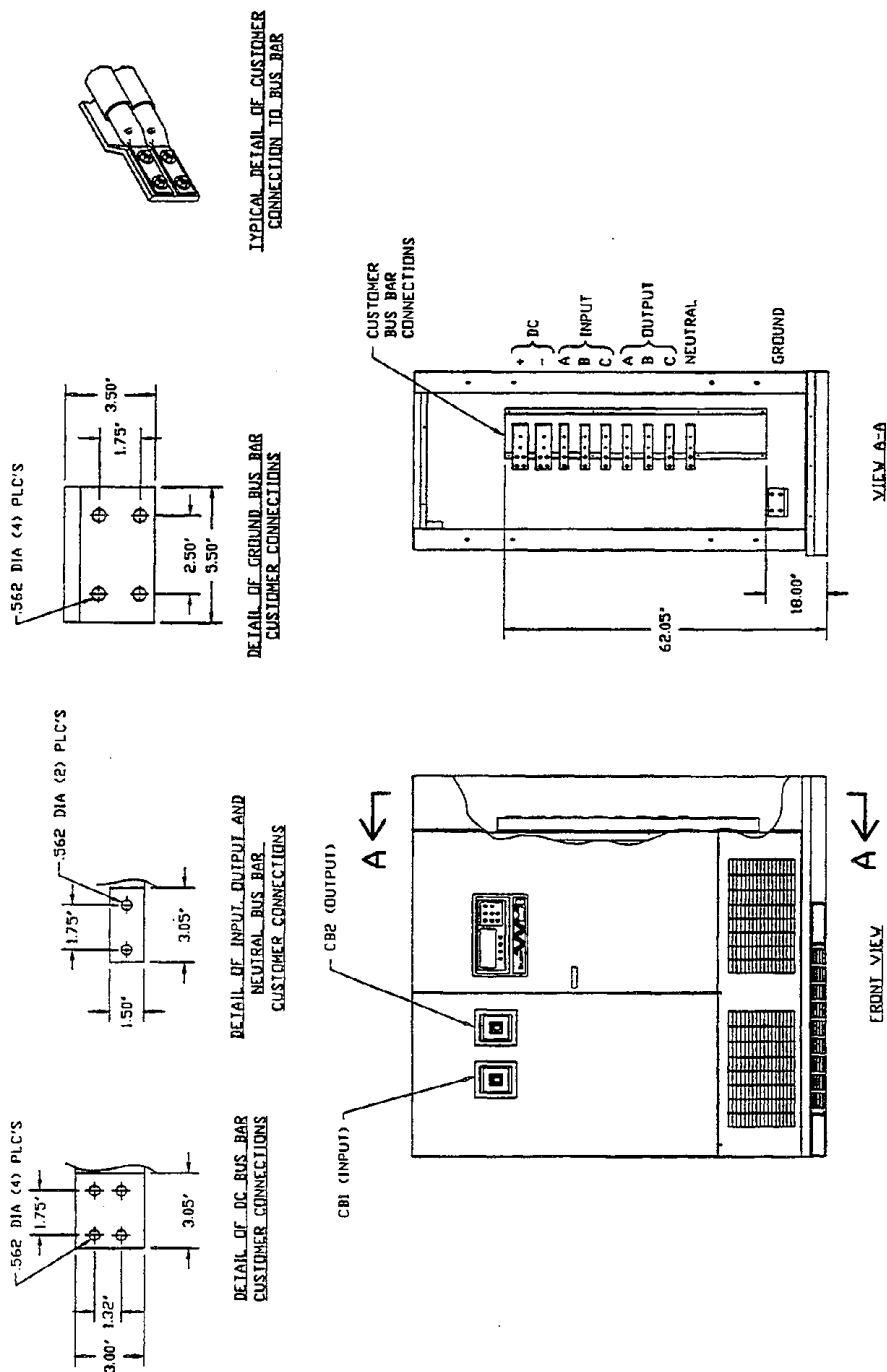
DRAWN BY B FISH	SHEET NO 1 OF 1	TITLE BASE MOUNTING PATTERNS SYSTEM CONTROL CABINETS (SCCP) 560 - 2000 AMP SERIES 600T	
CHK BY J CAMPBELL	ECN NO	DWG. NO. 88-797613-13	DATE 09/07/95
DES APVL	REF. DWG.	REV. NO. 2	ORDER NO.
		FILE NAME: DM71313.DWG	
		 9650 JERONIMO RD. IRVINE, CALIFORNIA 92718	

Figure 17 Bussing Details, Modules With 480 and 600 VAC Output



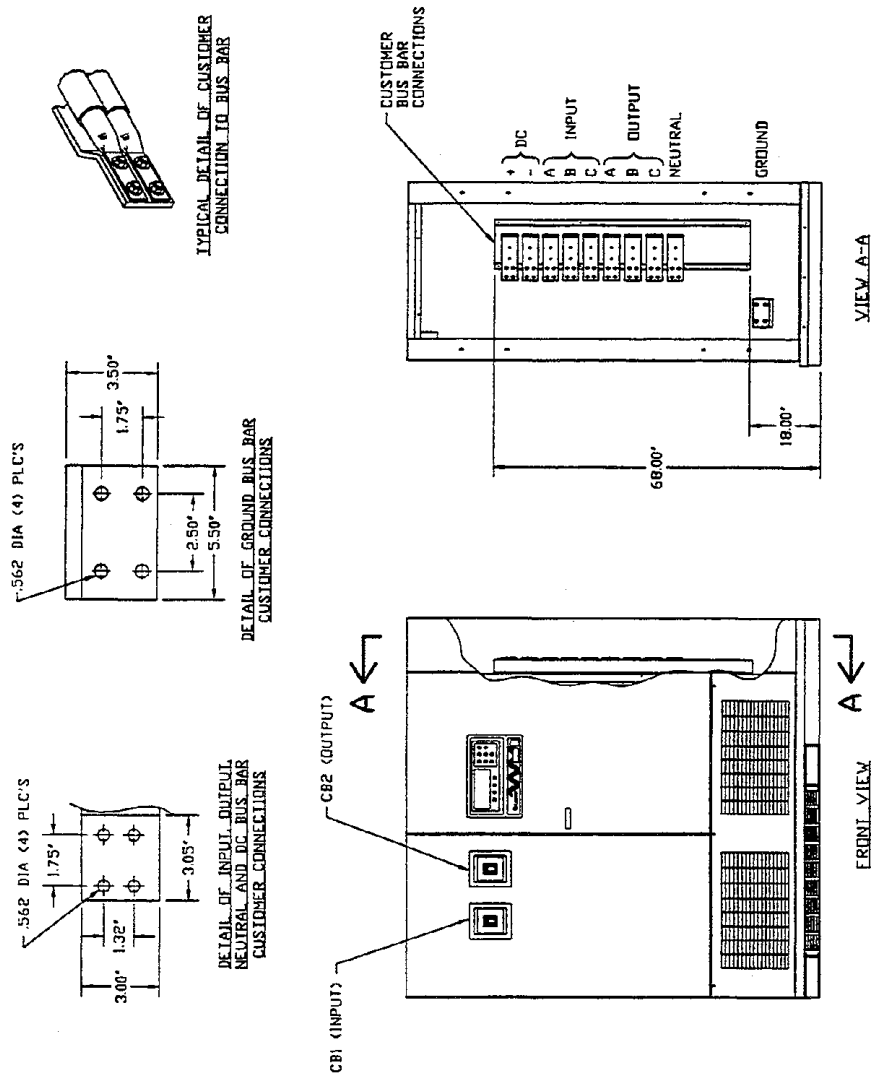
NOTES:
1. FOR CONNECTION TO BUS BARS LUGS TO BE PROVIDED BY OTHERS.
2. ALL DIMENSIONS ARE IN INCHES.

DRAWN BY T. NGUYEN	SHEET NO 1 OF 1	TITLE BUSSING DETAILS 375 KVA MULTI - MODULE UPS 480 V INPUT - 480 / 277 V OUTPUT 600 V INPUT - 600 / 346 V OUTPUT SERIES 600T		DWG. NO.	DATE
				88-797646-94	04/11/96
CHK BY J. CAMPBELL	ECN NO			REV. NO.	ORDER NO.
DES. APVL	REF. DWG.			2	

Liebert
9650 JERONIMO RD.
IRVINE, CALIFORNIA 92718

FILE NAME: 887469.DWG

Figure 18 Bussing Details, Modules With 208 VAC Output



NOTES:
1. FOR CONNECTION TO BUS BARS LUGS TO BE PROVIDED BY OTHERS.
2. ALL DIMENSIONS ARE IN INCHES.


DRAWN BY TINGUYEN	SHEET NO 1 OF 1	TITLE BUSSING DETAILS 375 KVA MULTI - MODULE UPS 480 DR 600 V INPUT 208 / 120 V OUTPUT SERIES 600T	DWG. NO. 88-797646-93	DATE 04/11/96
CHK BY J CAMPBELL	ECN NO		REV. NO. 2	ORDER NO.
DES APVL	REF. DWG. DB74693			
		 Liebert 9630 JERDING RD. IRVINE, CALIF. 92718		

Figure 19 Outline Drawing, Battery Cabinet, Size A

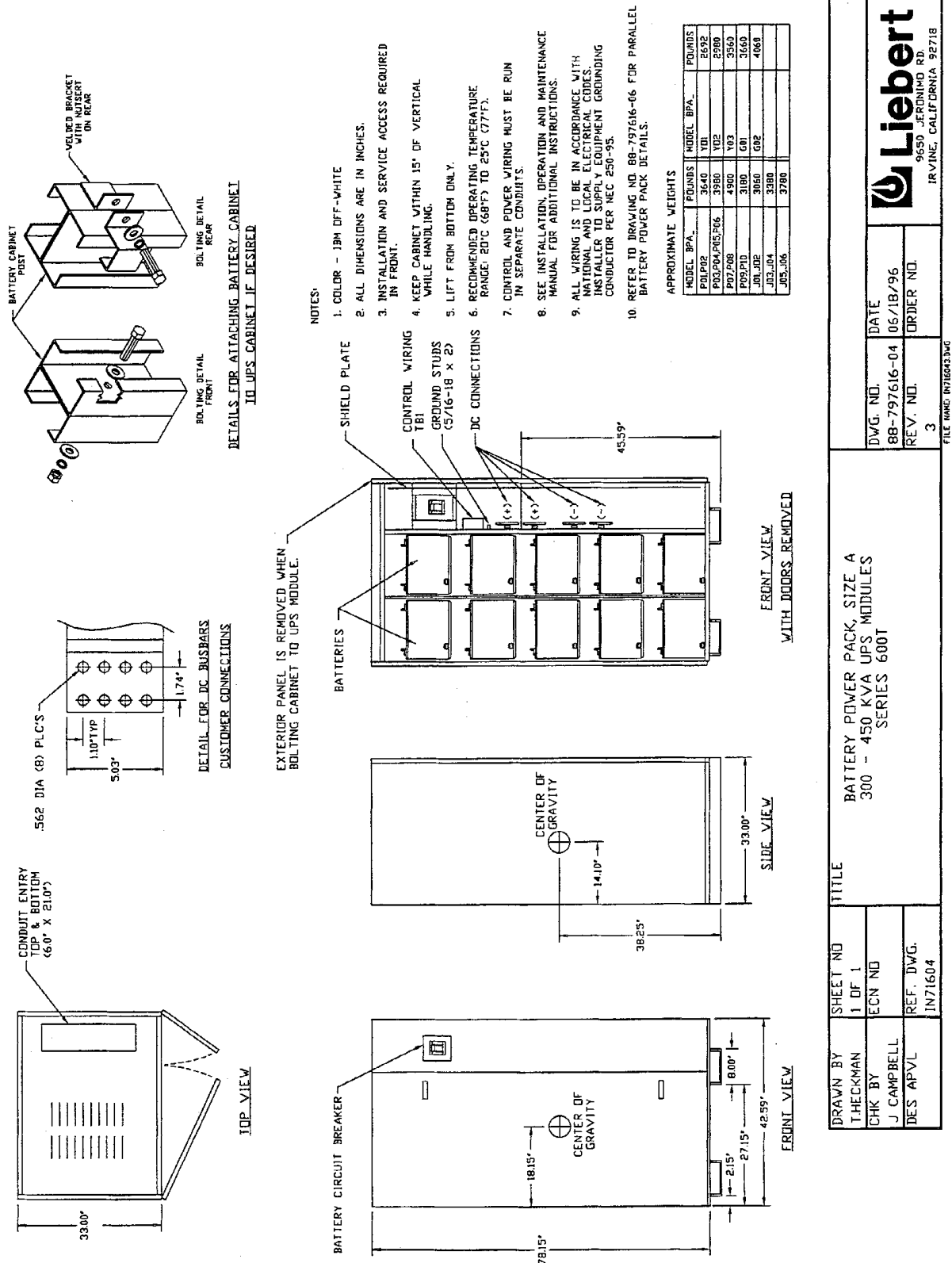


Figure 20 Outline Drawing, Battery Cabinet, Size B

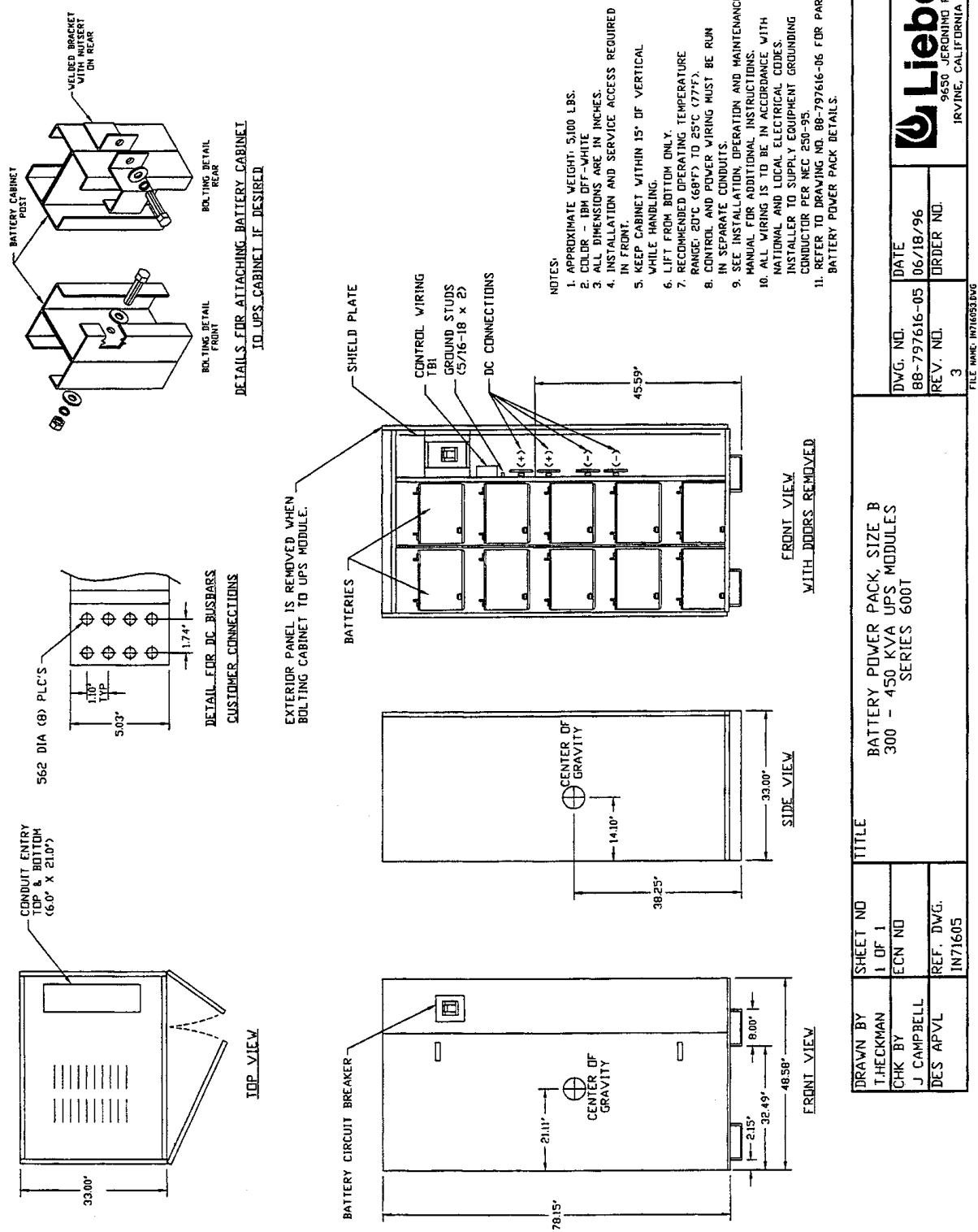


Figure 21 Installation Drawing, Parallel Battery Cabinets

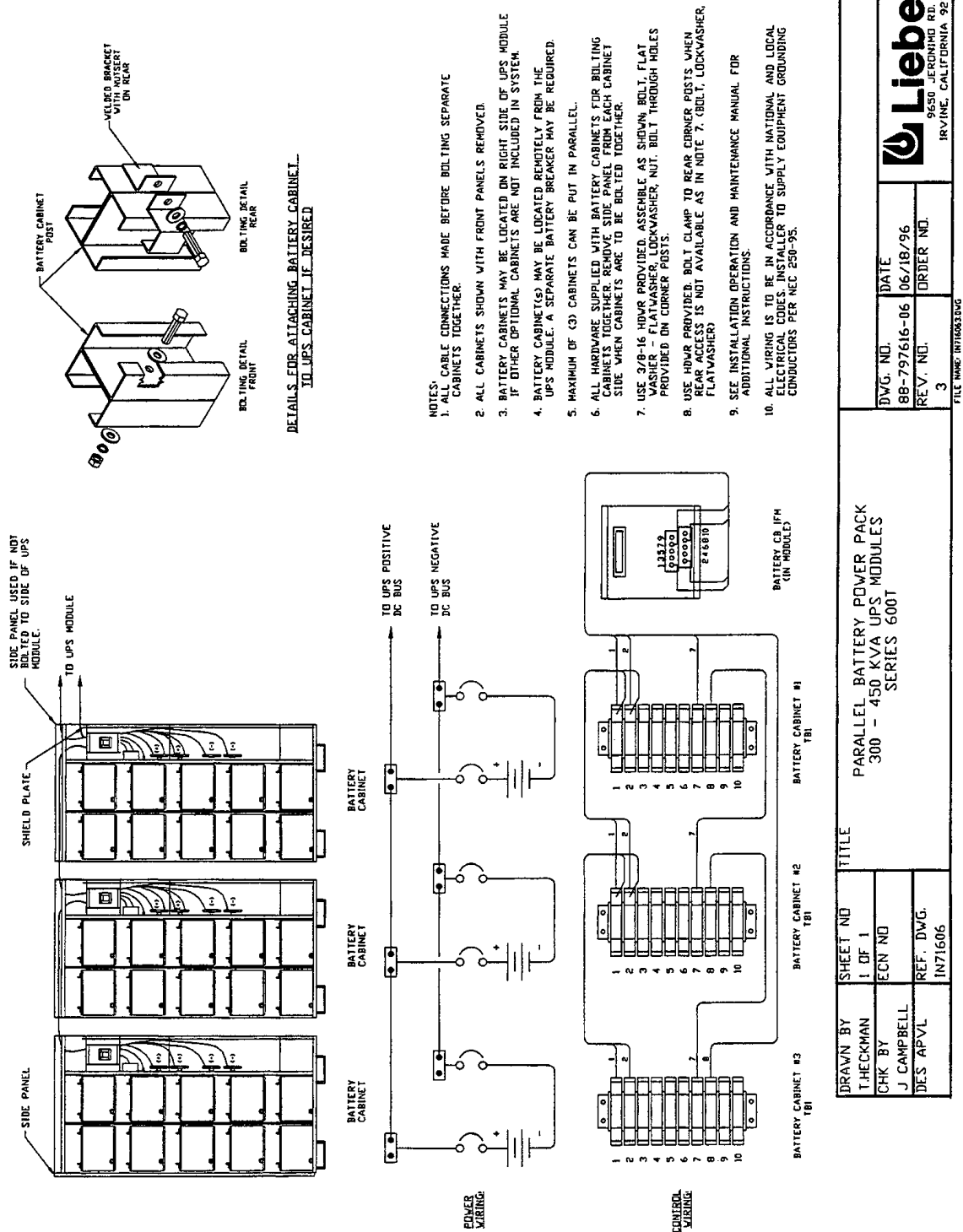
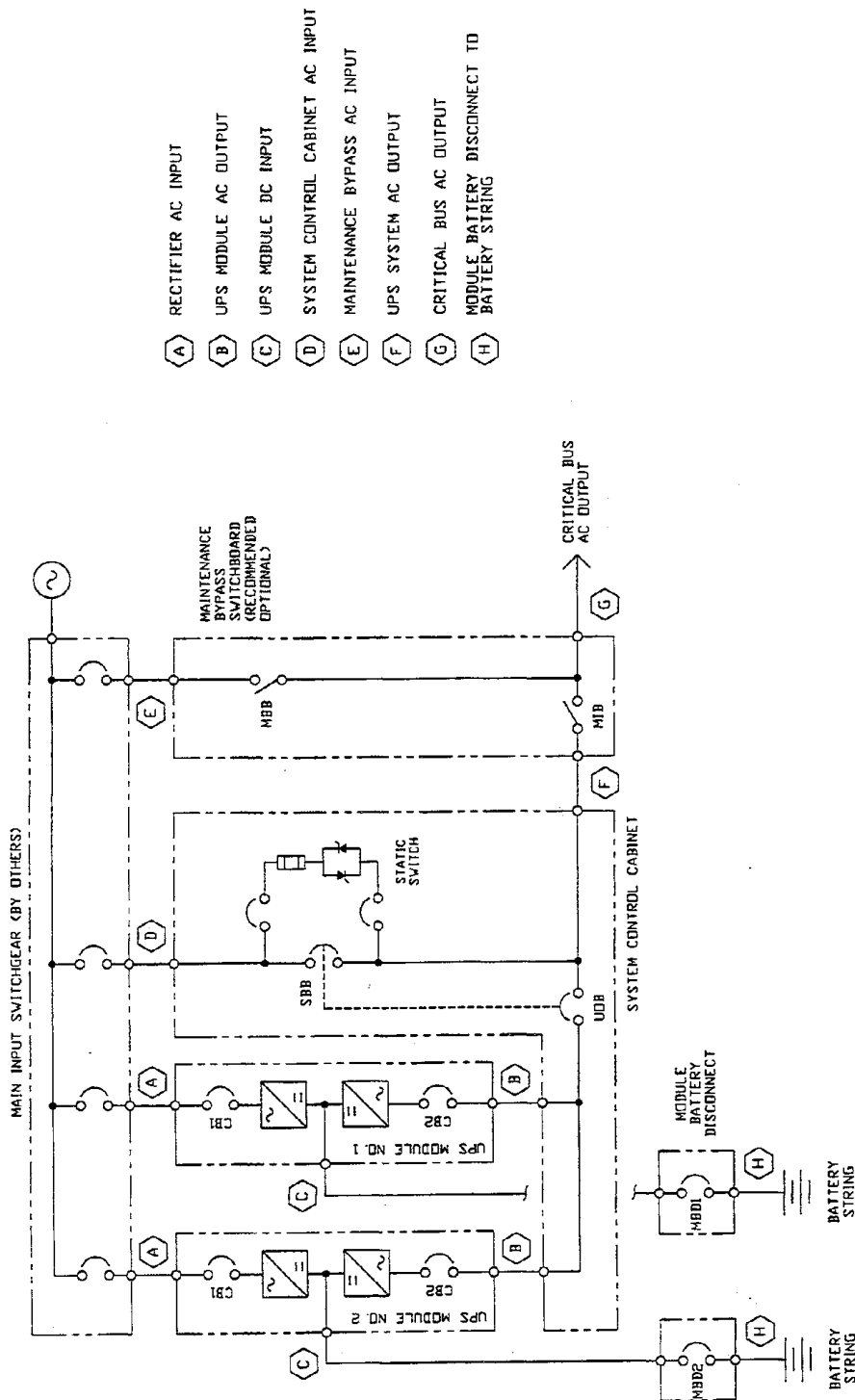



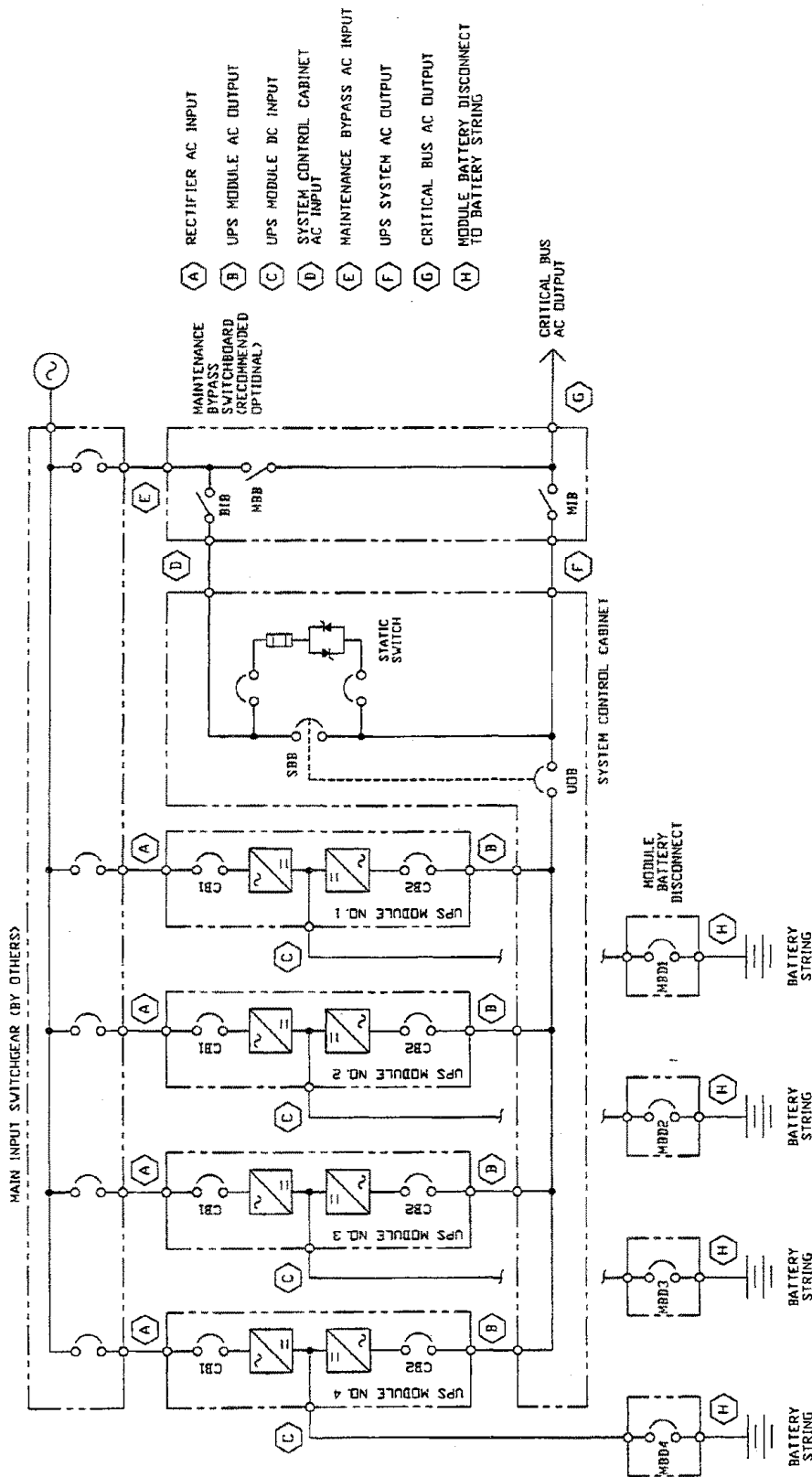
Figure 22 One-Line Diagram, 2-Module Parallel System With 2-Breaker Maintenance Bypass



DRAWN BY B. FISH	SHEET NO. 1 OF 1	CHK. BY J. CAMPBELL	DES. APVL.	REF. DWG. SL61437	TITLE ONE-LINE DIAGRAM TWO MODULE PARALLEL SYSTEM SCCB WITH TWO BREAKER MAINTENANCE BYPASS SERIES 600	DWG. NO. 97-791614-37		DATE 06/09/95	
						REV. NO. 1	ORDER NO.		
						 Liebert 9650 JERONIMO RD. IRVING, CALIFORNIA 92718			

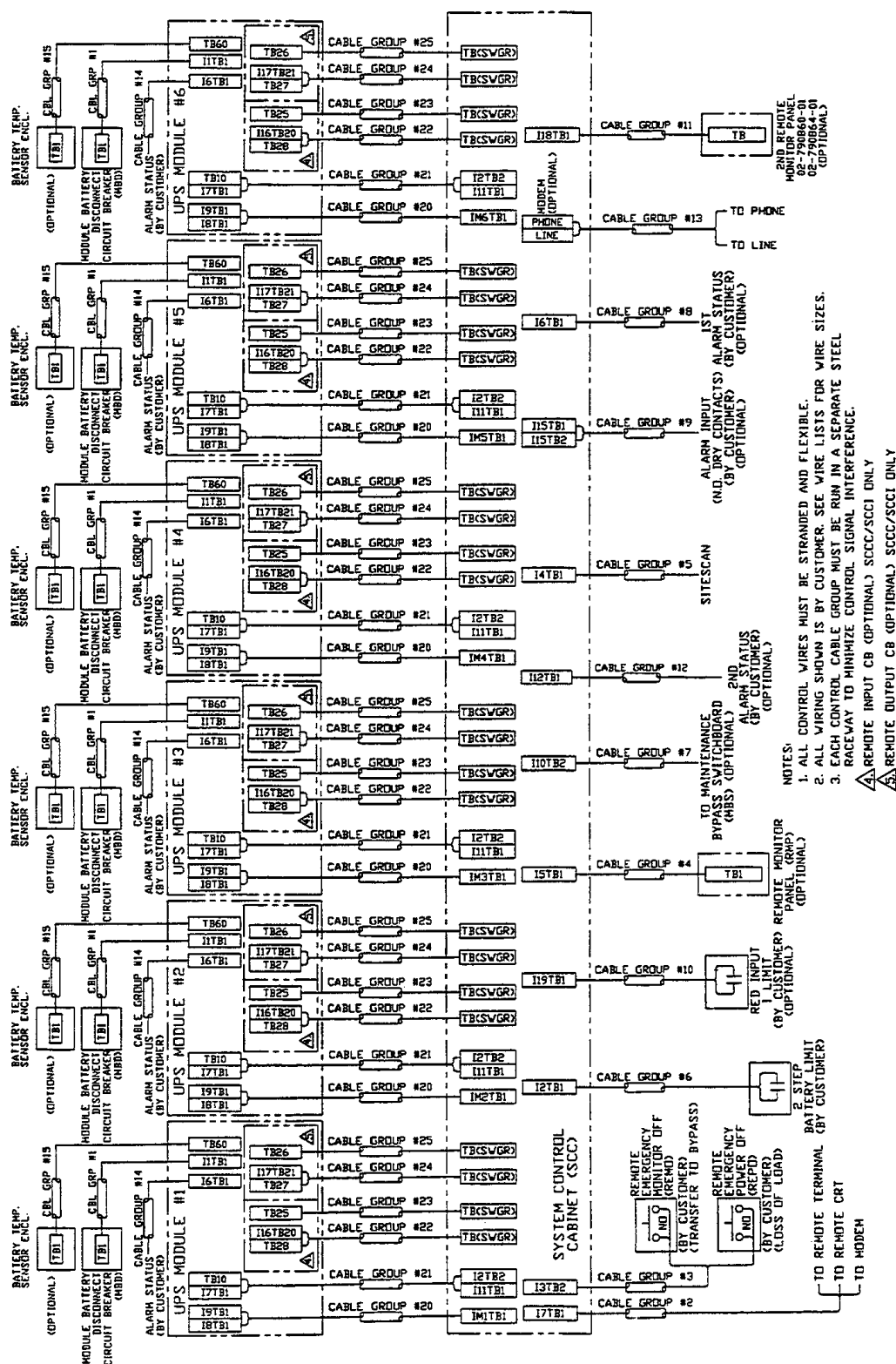
FILE NAME: SL61437.DWG

Figure 23 One-Line Diagram, 4-Module Parallel System With 3-Breaker Maintenance Bypass



DRAWN BY B FISH		SHEET NO 1 OF 1		TITLE ONE-LINE DIAGRAM FOUR MODULE PARALLEL SYSTEM SCCB WITH THREE BREAKER MAINTENANCE BYPASS SERIES 600		DWG. NO. 97-791614-44		DATE 06/09/95		REV. NO. I		ORDER NO.	
CHK BY J CAMPBELL		ECN NO		REF. DWG. SL61444		FILE NAME 3181441.DWG		Liebert		9650 JERONIMO RD. IRVINE, CALIFORNIA 92718			

Figure 24 Control Wiring Interconnect Diagram




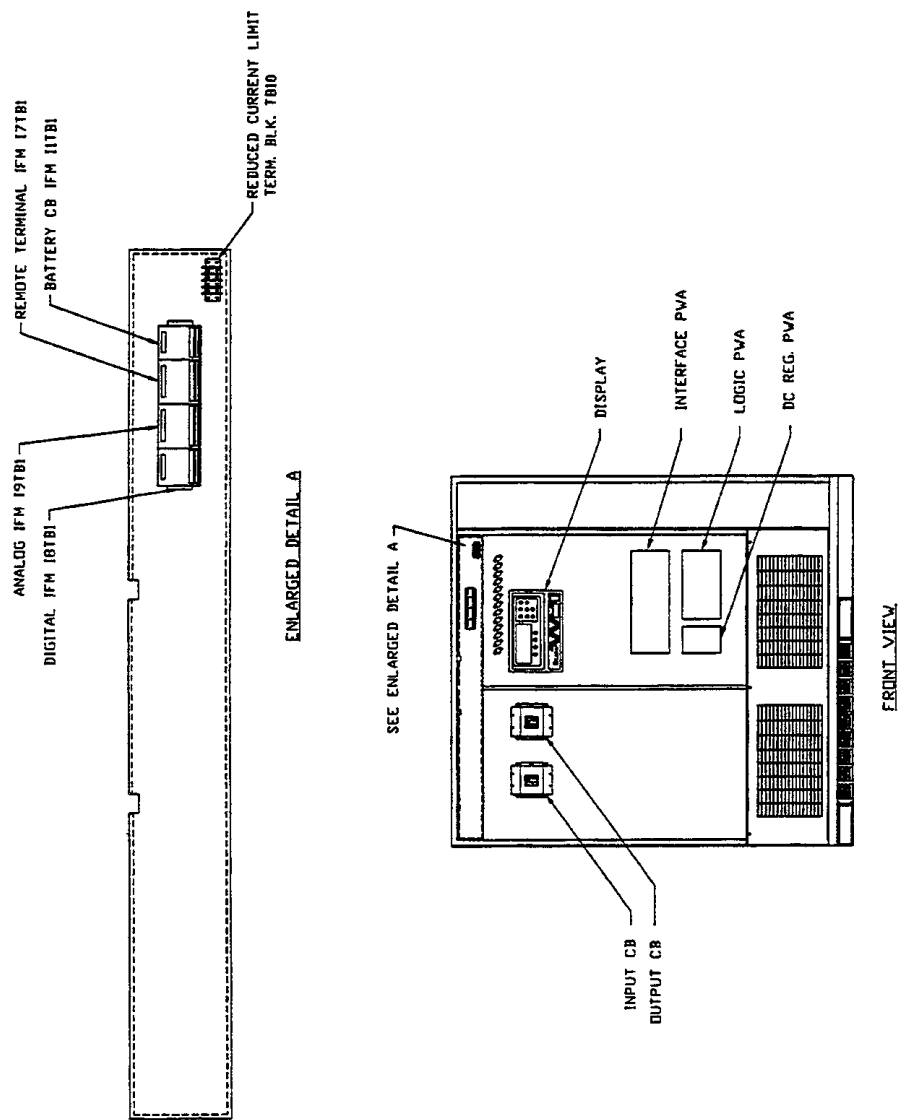
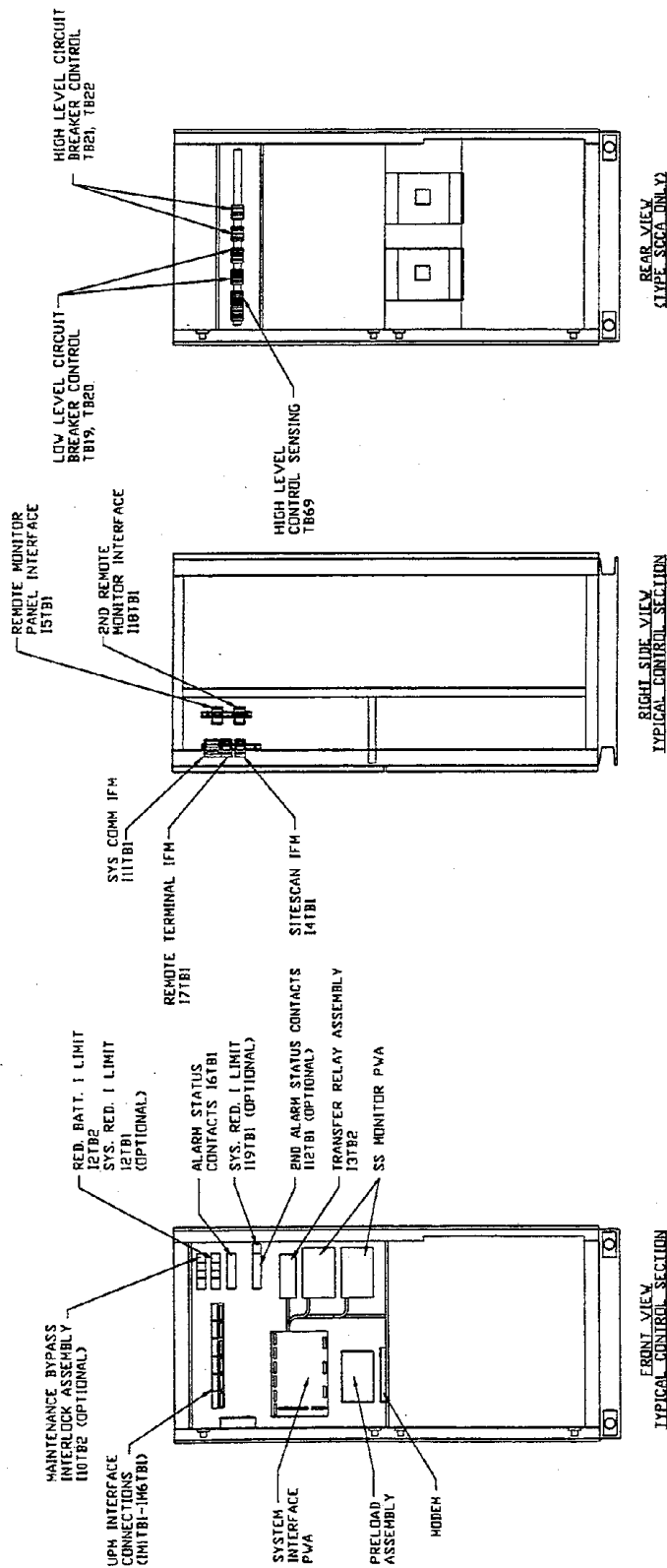
DRAWN BY I HECKMAN		SHEET NO 1 OF 1	TITLE CONTROL WIRE LIST INTERCONNECT DIAGRAM MULTI - MODULE UPS SYSTEM 300 - 450 KVA SERIES 600T
CHK BY		ECN NO	
DES APVL		REF. DWG.	
		W071951	
Z532-REPAIR-1 CB (OPTIONAL) S00073001 ONLY			
DWG. NO. 96-797619-51		DATE 03/29/96	 Liebert 8625 HERRING RD IRVING, CA 92614-1821
REV. NO. 1		ORDER NO.	

Figure 25 Control Connection Location Diagram, Multi-Module Unit



DRAWN BY T. HECKMAN	SHEET NO. 1 OF 1	TITLE CONTROL CONNECTION MULTI-MODULE SYSTEM LOCATION DIAGRAM 300 - 450 KVA SERIES 600T		DWG. NO. 96-797619-46	DATE 05/28/96	Liebert 9650 JEROME RD. IRVINE, CALIFORNIA 92718
CHK. BY J. CAMPBELL	ECN NO.			REV. NO. 1	ORDER NO.	
DES. APVL	REF. DWG. CC71946					

Figure 26 Control Connection Location Diagram, System Control Cabinet



DRAWN BY B FISH	SHEET NO 1 OF 1	TITLE CONTROL CONNECTION LOCATION DIAGRAM MULTI - MODULE SYSTEM CONTROL CABINET SERIES 600T		DWG. NO. 96-797619-18	DATE 05/26/96
				REV. NO. 3	ORDER NO.
CHK BY J CAMPBELL	ECN NO			FILE NAME: C271918.DWG	
DES APVL DES APVL	REF. DWG. CC71918				

Figure 27 Video Display Terminal Wiring

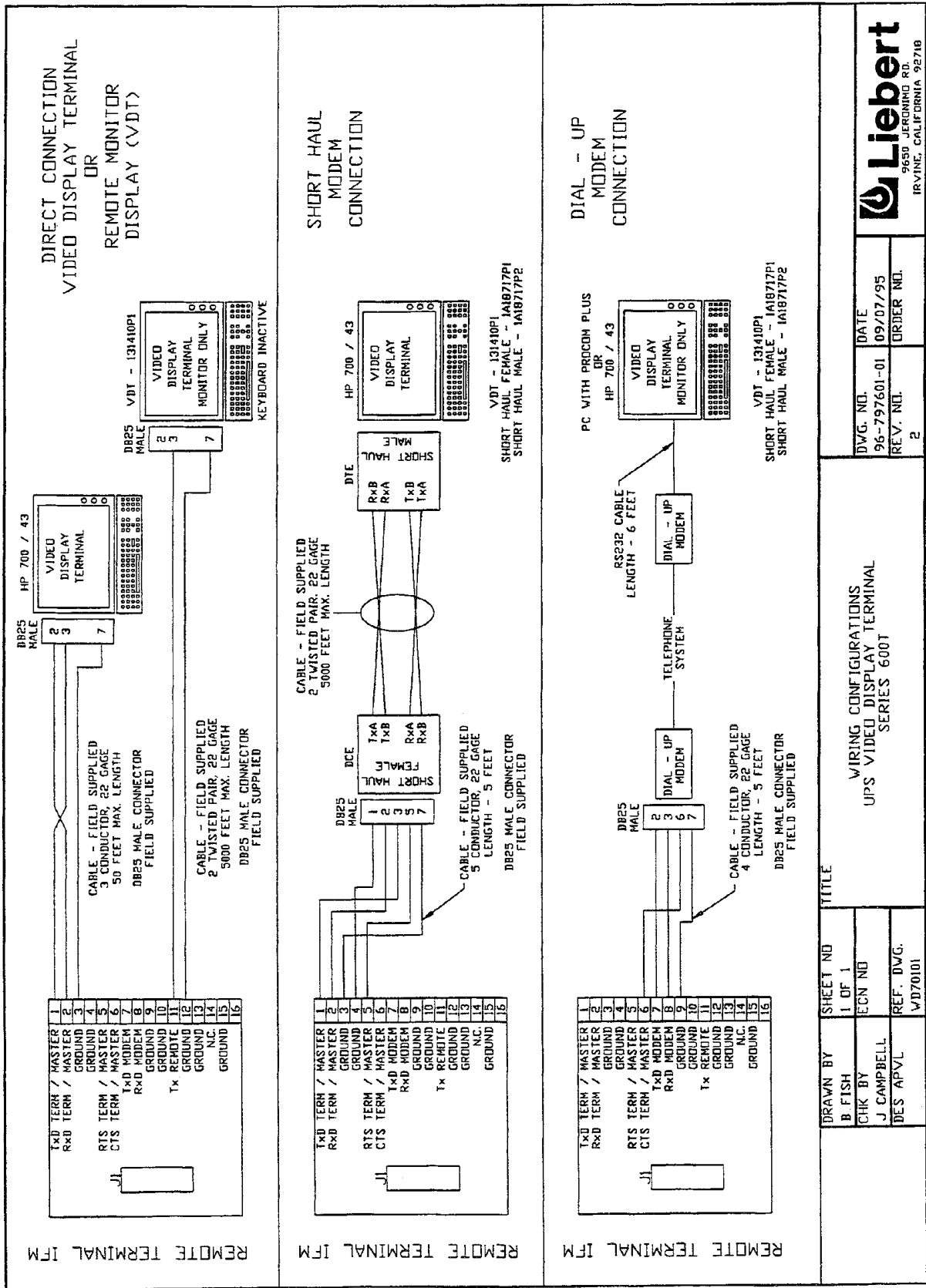
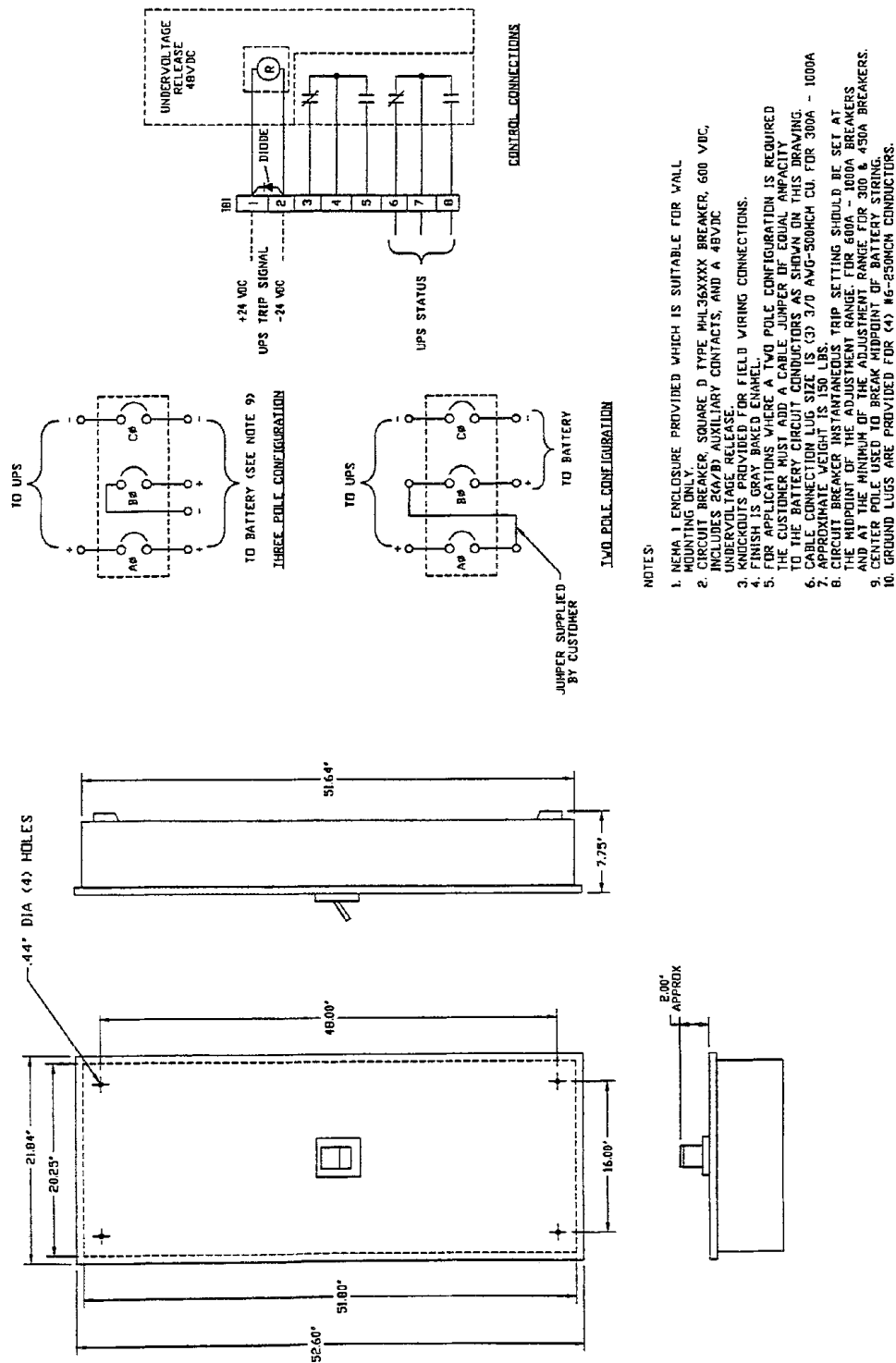
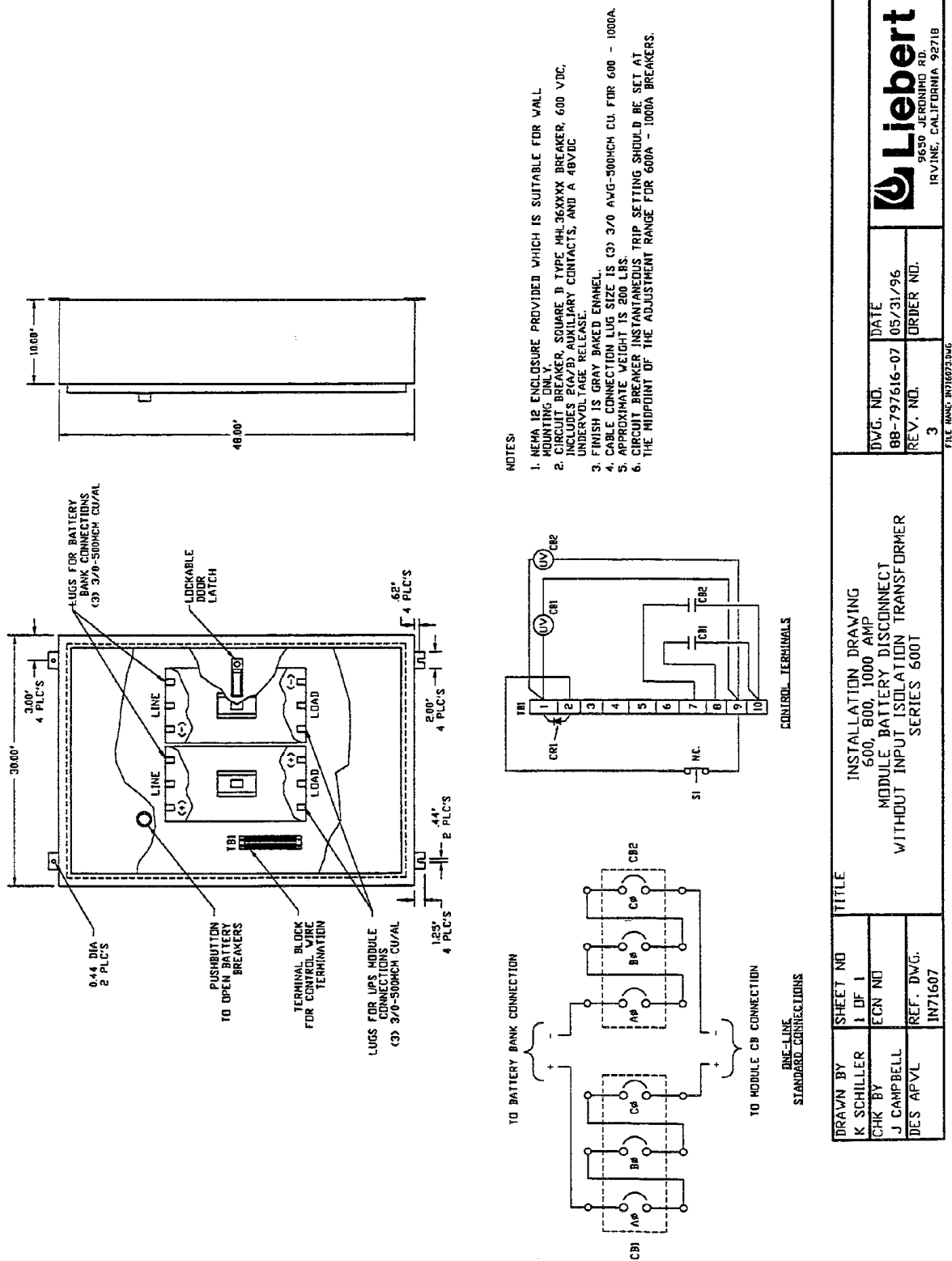


Figure 28 Module Battery Disconnect, Systems With Isolation Transformer

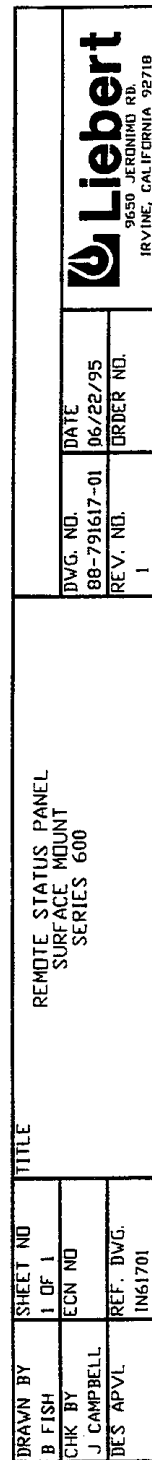


DRAWN BY K. SCHILLER		SHEET NO 1 OF 1	TITLE INSTALLATION DRAWING 300, 450, 600, 800, 1000 AMP MODULE BATTERY DISCONNECT WITH INPUT ISOLATION TRANSFORMER SERIES 600T	
CHK BY J CAMPBELL	ECN NO	REV. NO. 2	DWG. NO. 98-797616-09	DATE 05/31/96
DES APVL	REF. DWG. IN71609	ORDER NO.	Liebert 5650 JERONIMO RD. IRVINE, CALIFORNIA 92718	

Figure 29 Module Battery Disconnect, Systems Without Isolation Transformer

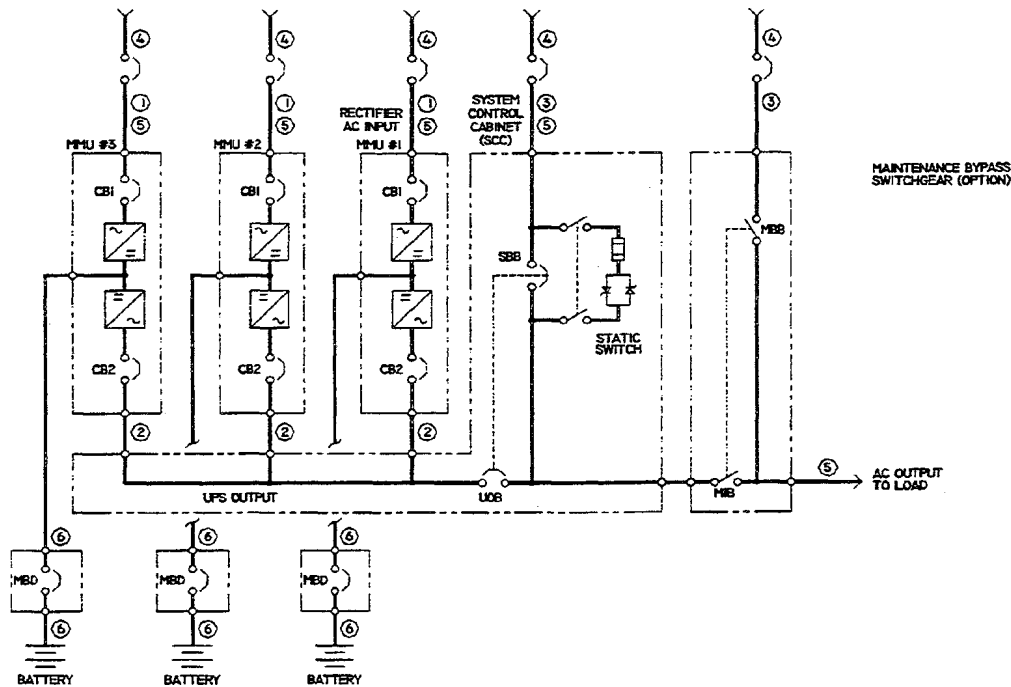


Win **DISCONTINUED PRODUCT** 49



11.0 APPENDIX A - SITE PLANNING DATA

300-450 kVA Multi-Module Systems



11.1 Notes

1. Nominal rectifier AC input current (considered continuous) is based on full rated output load. Maximum current includes nominal input current and maximum battery recharge current (considered noncontinuous). Continuous and noncontinuous current limit are defined in NEC 100. Maximum input current is controlled by current limit setting which is adjustable. Values shown for maximum setting are 125% of nominal input current. Standard factory setting is 115%.
2. Nominal AC output current (considered continuous) is based on full rated output load. Maximum current includes nominal output current and overload current for 10 minutes.
3. Bypass AC input current (considered continuous) is based on full rated output load.
4. Feeder protection (by others in external equipment) for rectifier AC input and bypass AC input is recommended to be provided by separate overcurrent protection devices.
5. UPS output load cables must be run in separate conduit from input cables.
6. Power cable from module DC bus to battery should be sized for a total maximum 2.0 volt line drop (measured at the module) at maximum discharge current.
7. Grounding conductors to be sized per NEC 250-95. Neutral conductors to be sized for full capacity—per NEC 310-16, Note 10—for systems with 4-wire loads and half capacity for systems with 3-wire loads. NOTE: A neutral conductor is required from each Module Unit output to the System Control Cabinet.
8. Rectifier AC Input: 3-phase, 3-wire, plus ground
AC Output to Load: 3-phase, 3 or 4-wire, plus ground
Bypass AC Input: 3-phase, 3 or 4-wire, plus ground
Module DC Input from Battery: 2-wire, (positive and negative)
9. All wiring is to be in accordance with National and Local Electrical Codes.
10. Minimum overhead clearance is 2 feet above UPS.
11. Top or bottom cable entry through removable access plates. Cut plate to suit conduit size.
12. Control wiring and power cables must be run in separate conduits. Control wiring must be stranded tinned conductors.
13. 7% maximum input harmonic current and 0.92 lagging input power factor at full load with optional input filter. 30% maximum input harmonic current and 0.85 lagging input power factor at full load without optional input filter.
14. Dimensions and weights do not include the System Control Cabinet required for Module Systems.

Table 4 Series 600T Multi-Module Systems - 208 Volt Input

UPS Rating		AC Output Voltage	Options		Rectifier AC Input Current		Inverter or Bypass AC Output Current		Required Battery Disconnect Rating	Maximum Battery Current at End of Discharge	Maximum Heat Dissipation BTU/hr.	Dimensions Inches	Approx. Weight Lb.	Floor Loading Lb./ Sq.Ft.
kVA	kW		Input Filter	Input Transformer	Nom	Max	Nom	Max	Amperes	Amperes	Full Load	(WxDxH)	(Un-packed)	(Distributed Loading)
300	240	208	NO	NO	847	1059	833	1041	600	628	66,425	72x35x79	5,350	306
300	240	208	YES	NO	783	979	833	1041	600	628	66,425	72x35x79	5,520	315
300	240	208	NO	YES	857	1071	833	1041	600	628	81,000	96x35x79	7,450	319
300	240	208	YES	YES	791	989	833	1041	600	628	81,000	96x35x79	7,620	327
375	300	208	NO	YES	1071	1346	1041	1301	800	785	101,250	96x35x79	8,950	384
375	300	208	YES	YES	989	1243	1041	1301	800	785	101,250	96x35x79	9,120	391
Applicable Notes:		—	13	—	1,4,5,7,8, 9,11,12		2,3,5,7,8, 9,11,12		6	6,8,9, 11,12	—	—	—	—

For explanation of notes, see referenced numbers in **11.1 - Notes****Table 5 Series 600T Multi-Module Systems, 300-450 kVA - 480 Volt Input**

UPS Rating		AC Output Voltage	Options		Rectifier AC Input Current		Inverter or Bypass AC Output Current		Required Battery Disconnect Rating	Maximum Battery Current at End of Discharge	Maximum Heat Dissipation BTU/hr.	Dimensions Inches	Approx. Weight Lb.	Floor Loading Lb./ Sq.ft.
kVA	kW		Input Filter	Input Transformer	Nom	Max	Nom	Max	Amperes	Amperes	Full Load	(WxDxH)	(Un-packed)	(Distributed Loading)
300	240	480	NO	NO	361	452	361	451	600	625	52,275	72x35x79	4,150	237
300	240	480	YES	NO	334	417	361	451	600	625	52,275	72x35x79	4,320	247
300	240	480	NO	YES	367	459	361	451	600	625	66,400	96x35x79	6,050	259
300	240	480	YES	YES	339	424	361	451	600	625	66,400	96x35x79	6,220	267
300	240	208	NO	NO	363	454	833	1041	600	628	56,950	72x35x79	4,400	251
300	240	208	YES	NO	336	420	833	1041	600	628	56,950	72x35x79	4,570	261
300	240	208	NO	YES	369	461	833	1041	600	628	71,225	96x35x79	6,500	279
300	240	208	YES	YES	341	426	833	1041	600	628	71,225	96x35x79	6,670	286
375	300	480	NO	NO	452	565	451	564	800	781	65,350	72x35x79	4,850	277
375	300	480	YES	NO	417	522	451	564	800	781	65,350	72x35x79	5,020	287
375	300	480	NO	YES	459	574	451	564	800	781	83,025	96x35x79	6,750	289
375	300	480	YES	YES	424	530	451	564	800	781	83,025	96x35x79	6,920	297
375	300	208	NO	NO	454	568	1041	1301	800	785	71,180	72x35x79	5,100	291
375	300	208	YES	NO	420	524	1041	1301	800	785	71,180	72x35x79	5,270	301
375	300	208	NO	YES	461	577	1041	1301	800	785	89,025	96x35x79	7,200	309
375	300	208	YES	YES	426	533	1041	1301	800	785	89,025	96x35x79	7,370	316
450	360	480	NO	NO	542	677	541	677	1000	938	78,426	72x35x79	5,050	216
450	360	480	YES	NO	501	626	541	677	1000	938	78,426	72x35x79	5,220	224
450	360	480	NO	YES	551	688	541	677	1000	938	99,623	96x35x79	6,950	298
450	360	480	YES	YES	509	636	541	677	1000	938	99,623	96x35x79	7,120	305
Applicable Notes:		—	13	—	1,4,5,7,8, 9,11,12		2,3,5,7,8, 9,11,12		6	6,8,9, 11,12	—	—	—	—

For explanation of notes, see referenced numbers in **11.1 - Notes**

Table 6 Series 600T Multi-Module Systems, 600 Volt Input

UPS Rating		AC Output Voltage	Options		Rectifier AC Input Current		Inverter or Bypass AC Output Current		Required Battery Disconnect Rating	Maximum Battery Current at End of Discharge	Maximum Heat Dissipation BTU/hr.	Dimensions Inches	Approx. Weight Lb.	Floor Loading Lb./ Sq.ft.
kVA	kW		Input Filter	Input Transformer	Nom	Max	Nom	Max	Amperes	Amperes	Full Load	(WxDxH)	(Un-packed)	(Distributed Loading)
300	240	600	NO	NO	289	361	289	361	600	625	52,275	72x35x79	4,550	260
300	240	600	YES	NO	267	334	289	361	600	625	52,275	72x35x79	4,720	270
300	240	600	NO	YES	294	367	289	361	600	625	66,425	96x35x79	6,450	276
300	240	600	YES	YES	271	339	289	361	600	625	66,425	96x35x79	6,620	284
300	240	208	NO	NO	291	363	833	1041	600	628	56,950	72x35x79	4,750	271
300	240	208	YES	NO	268	336	833	1041	600	628	56,950	72x35x79	4,920	281
300	240	208	NO	YES	295	369	833	1041	600	628	71,225	96x35x79	6,850	294
300	240	208	YES	YES	273	341	833	1041	600	632	71,225	96x35x79	7,020	301
375	300	600	NO	NO	361	452	361	451	800	781	65,350	72x35x79	5,350	306
375	300	600	YES	NO	334	417	361	451	800	781	65,350	72x35x79	5,520	315
375	300	600	NO	YES	367	459	361	451	800	781	83,025	96x35x79	7,250	311
375	300	600	YES	YES	339	424	361	451	800	781	83,025	96x35x79	7,420	318
375	300	208	NO	NO	363	454	1041	1301	800	785	71,175	72x35x79	5,550	317
375	300	208	YES	NO	336	420	1041	1301	800	785	71,175	72x35x79	5,720	327
375	300	208	NO	YES	369	461	1041	1301	800	785	89,025	96x35x79	7,650	328
375	300	208	YES	YES	341	426	1041	1301	800	785	89,025	96x35x79	7,820	335
Applicable Notes:		—	13	—	1,4,5,7,8,9,11,12	2,3,5,7,8,9,11,12	6	6,8,9,11,12	—	—	—	—	1	—

For explanation of notes, see referenced numbers in 11.1 - Notes

Table 7 Battery Pack

kVA	Time (Min.) 100% Load	Cabinets in Parallel	Overall Dimensions WxDxH (Inches)	Overall Weight (Lb.)
300	6	2	85x33x79	6,760
300	13	3	127x33x79	10,140
300	17	3	127x33x79	11,340
375	5	2	85x33x79	7,560
375	12	3	127x33x79	11,340
375	16	3	127x33x79	14,700
450	7	3	127x33x79	11,340
450	12	3	127x33x79	14,700

NOTE: Battery cabinet depth is approximately two inches less than UPS module depth

Table 8 UPS Efficiency, All kVA / kW Ratings

Input Voltage	Output Voltage	Efficiency @ 50% Load	Efficiency @ 75% Load	Efficiency @ 100% Load
208	208	93	92.5	92.5
480	208	93	93.5	93.5
480	480	93	94	94
600	208	93	93.5	93.5
600	600	93	94	94

1. For all input/output voltages, subtract approximately 1.5% from full load efficiency for units with input isolation transformer
2. All efficiencies measured with non-linear load at 0.8 power factor

System Control Cabinets

Multi-Module Systems are provided with a system control cabinet. Cabinets are available to match load current.

Table 9 System Control Cabinets

Type	Amps	Overall Dimensions WxDxH (Inches)	Weight (Lb.)
SCCB	800	37.5x37.5x78	1,100
SCCB	1280	61x50x78	2,000
SCCB	1600	61x50x78	2,000
SCCB	2000	61x50x78	2,370
SCCB	2500	61x50x78	2,370
SCCB	3000	61x50x78	2,370
SCCP	200-960	37x37x78	1,000
SCCP	1120-1600	37.5x50x78	1,250
SCCP	2000	37.5x50x78	1,400

12.0 APPENDIX B - FIELD SUPPLIED LUGS

Table 10 One-Hole Lugs

	T & B¹ Lug Style	Wire Size	Bolt Size (Inches)	Tongue Width (Inches)	T & B¹ P/N	Liebert P/N
1	Stak-On	1/0 AWG	3/8	0.88	J973	12-714255-56
2		2/0 AWG	3/8	1.00	K973	12-714255-66
3		3/0 AWG	3/8	1.10	L973	12-714255-76
4		4/0 AWG	3/8	1.20	M973	12-714255-86
5	Color-Keyed Aluminum/ Copper	1/0 AWG	3/8	0.93	60130	—
6		2/0 AWG	3/8	0.97	60136	—
7		3/0 AWG	3/8	1.06	60142	—
8	Color-Keyed Copper Cable Long Barrel	1/0 AWG	3/8	0.75	54909BE	—
9		2/0 AWG	3/8	0.81	54910BE	—
10		3/0 AWG	1/2	0.94	54965BE	—
11		4/0 AWG	1/2	1.03	54970BE	—
12		250MCM	1/2	1.09	54913BE	—
13	Narrow-Tongue Copper Cable	350MCM	1/2	1.09	55165	—
14		500MCM	1/2	1.20	55171	—

¹ NOTE: Manufacturer Thomas & Betts (T & B), 1-800-862-8324



Series 600T™ UPS

Multi-Module Three Phase

300 kVA to 450 kVA; 60 Hz

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