

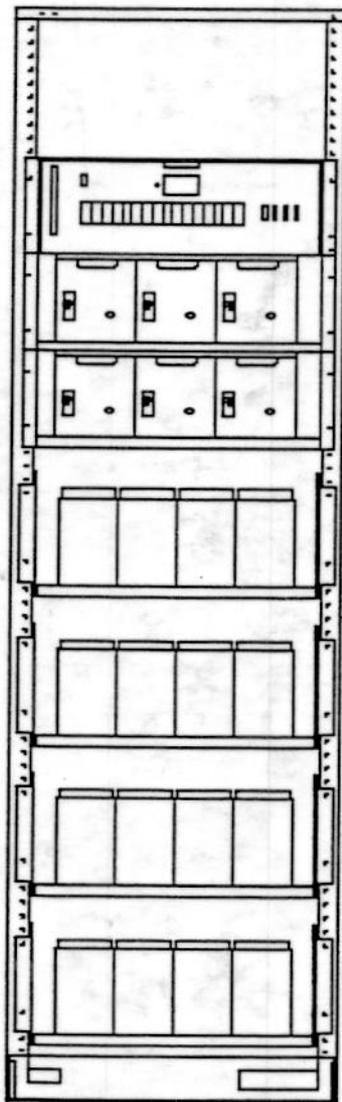
Advanced Power Systems

167-9021-102

MFA150 Modular Front Access Power System

Description, Installation, Operation and
Maintenance Manual

P0728920 Standard 7.0 - December 1995



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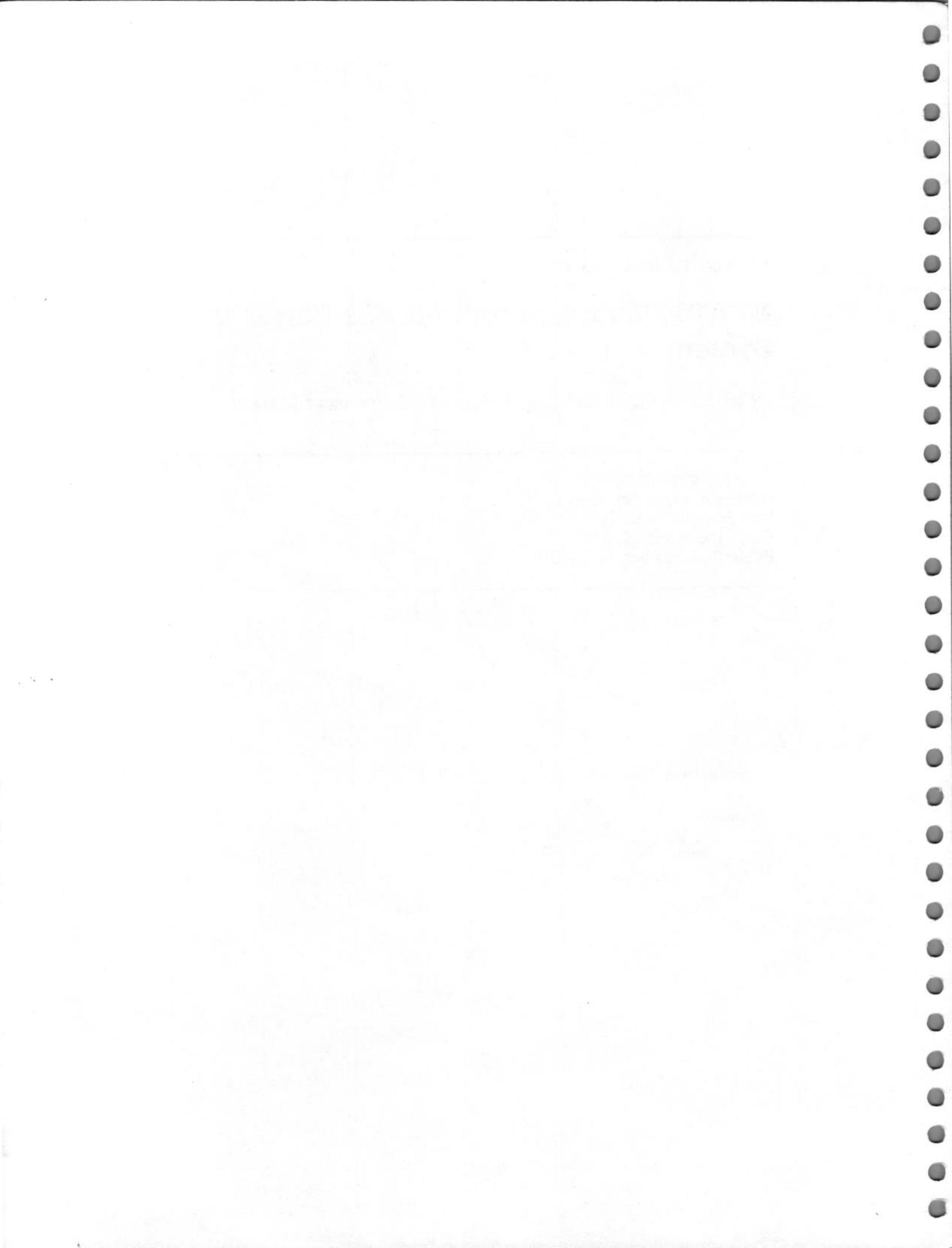
MFA150 Modular Front Access Power System

Description, Installation, Operation and Maintenance Manual

NTP 167-9021-102
Document status: Standard
Document Release: 7.0
Date: December 1995
Publication number: P0728920

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Publication history

June 28, 1991
Standard release 1.0

November 11, 1991
Standard release 2.0

May 29, 1992
Standard release 3.0

December 1994
Standard release 4.0

April 1995
Standard release 5.0

This issue is revised to include information about the LVD Manual Reconnect optional feature.

August 1995
Standard release 6.0

This issue is revised to update the functional description of this NTP.

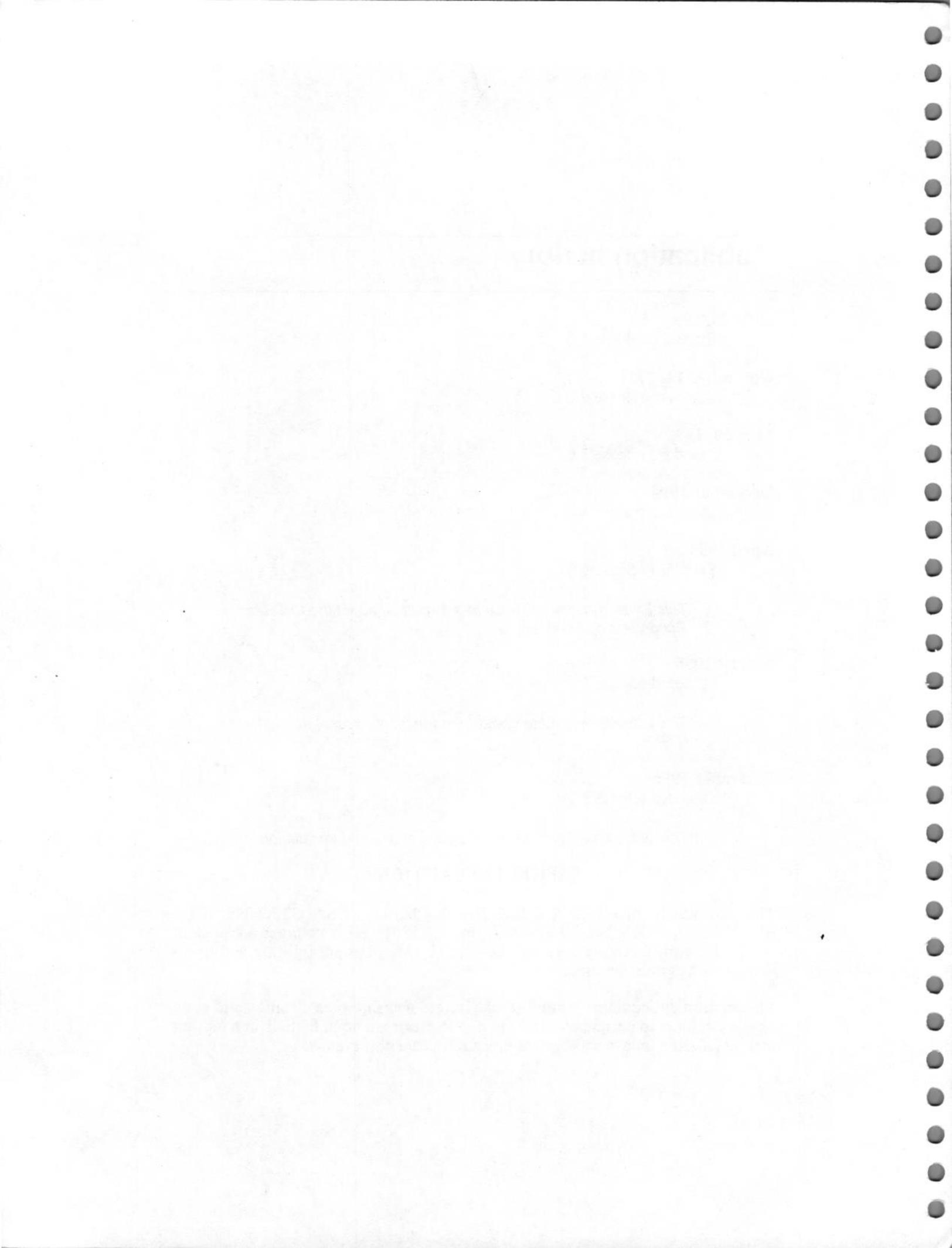
December 1995
Standard release 7.0

This issue is revised to revise specifications and installation.

SAFETY PRECAUTIONS

This equipment meets CSA C22.2 No. 0 - M1982, CSA C22.2 No. 0.4 - M1982, CSA C.22.2 No. 107.1 - M91 and UL1801. High voltages are present inside the unit, therefore insulated tools, eye wear, correct lighting and up to date drawings must be used.

This equipment contains a number of discrete and micro electronic solid state devices subject to permanent damage due to electrostatic potentials in handling and installation unless appropriate precautions are observed.



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Overview

Description

The NT6C28C(X) MFA150 Power System is a positive ground, -48 VDC nominal, 150 A capacity power plant. It mounts on a single 7 ft. high and 24 in. wide frame and consists of an enclosed, front and top access distribution and control panel, rectifier shelves and battery trays as required. Where floor space is limited, a wall mount cabinet NT6C43B is available.

The system utilizes up to six 25 A (NT5C06) or three 50 A (NT5C07) rectifiers as building blocks connected in parallel to reach its maximum charge / discharge capacity of 150 A. The rectifiers operate on single phase 50/60 Hz AC service on either 208 V or 240 V nominal input, and the power system may operate with or without -48 VDC batteries for reserve power capabilities. If batteries are connected, the rectifiers can operate in either the float or equalize mode.

NOTE: If 110 VAC service is used instead of 220 V, only MPR15 rectifiers may be used and the maximum capacity of the plant becomes 90 A.

Although the system provides the option of mounting battery trays in the framework, external batteries can be used instead to suit specific job conditions.

The MFA150 Power Plant is designed as a front and top access power plant, and uses the 6 in. space normally left behind the bay for ventilation purposes and to pull cables that may be required during eventual expansion or maintenance. All controls and connections are however accessible from the top and front of the power plant.

The system provides a variety of monitoring and alarm features, such as low voltage alarms, fuse and breaker alarms, rectifier failure alarms, and low voltage disconnect.

Equipment Identification

This section contains a description of each of the major components and available options for the NT6C28C(X) Power System.

A typical system is illustrated in Fig. 1 and could include the following:

- 1 NT6C40 Relay Rack, 7 ft. x 23 in. standard/seismic
- 1 NT6C14G series Control and Distribution Panel
- 1 or 2 MPS75 NT5C10 Power Shelves
or
1 MPS150 NT5C12 Power Shelf
- 1 to 6 MPR25E NT5C06 25 A Modular Switch Mode Rectifiers
(or MPR15E for 110 V applications)
or
1 to 3 NT5C07 50A Modular Switch Mode Rectifiers
- 0 to 4 NT5C11 Battery Trays

NT6C14G - Control and Distribution Panels (Figures 2 and 3)

NT6C14GA/GM

The NT6C14GA/GM is a front and top access enclosure with common power distribution components (positive and negative busbars, circuit breakers, wiring), along with control circuits for system and rectifier monitoring, and status and alarm indicators. A digital meter is standard within this main panel.

Power distribution consists of a 16 position output circuit breaker panel that can accept breakers rated from 1 to 50 A. In addition, the panel provides four (4) fuse positions for -48 V auxiliary outputs which can accept QFF type fuses rated from 0.18 A to 5 A.

Hole patterns are as follows:

- | | | |
|--|------------------|--|
| - circuit breaker output | 1 stud, 1/4 in. | - 20 Threads per inch |
| - battery return leads | 1 hole, 1/4 in. | - 20 Threads per inch |
| - battery / rectifier cables
(charge busbars) | 2 holes, 1/4 in. | - 20 Threads per inch
1 in. spacing |

Eight (8) concentric punch-out holes for 3/4 in. or 1 1/4 in. conduit are located on the rear of the enclosure plus 4 more 7/8 in. holes for wire connections.

A Low Voltage Disconnect (LVD) feature with automatic reconnect is used to provide automatic load disconnect at low battery voltage (adjustable typically to -43 VDC) after an extended AC power outage, to prevent complete discharge and therefore damage to the batteries. The automatic reconnect feature monitors the battery voltage and ensures that the load will be reconnected as soon as the commercial AC power is restored and the batteries partially recharged, without operator intervention.

NT6C14GE/GP

This distribution panel is equivalent to the NT6C14GA/GM, but without the LVD feature.

NT6C14GC/GN

This distribution panel is similar to NT6C14GA/GM, but it is equipped with the RPM1000C microprocessor based control/monitor. The VOLT/AMP meter is removed since this function is provided by the RPM1000C. This panel provides also the LVD feature.

NT6C14GG/GQ

This distribution panel is equivalent to NT6C14GC/GN, but without the LVD feature.

RPM1000C Option

An optional RPM1000C microprocessor based controller / monitor (NT7C19A/NT7C19B) can be provided in replacement of the NT6C14G panel's basic control and alarm card. The RPM1000C provides enhanced rectifier controls such as remote equalize, high voltage shutdown and sequential restart, in addition to complete monitoring of the power plant's most vital information and remote access. Refer to NTP 167-8001-107 for more information about the features and operation of this monitor / controller.

RPM1000C Option

The above control and distribution panels and RPM100C are available in the following colors

MAPLE BROWN

NT6C14GA

NT6C14GC

NT6C14GE

NT6C14GG

NT7C19A

DOLPHIN GREY

NT6C14GM

NT6C14GN

NT6C14GP

NT6C14GM

NT7C19B

NT5C10 - MPS75 Power Shelf (Figure 5)

The MPS75S is a power shelf providing housing for up to three (3) MPR25 rectifiers. The rectifiers plug into the shelf, which provides interconnection points for AC input, DC output and alarm and control signals.

Power shelf models (NT5C10) are available to accept either a single common AC feed for all three (3) rectifier positions or three (3) individual AC feeds for each one of the positions. The output is connected to the DC charge busbars in the NT6C14G Control and Distribution Panel with 2 #4 AWG wires (battery and battery return). Each rectifier position has its own alarm and control cable (part of the shelf) going back to the Distribution Panel.

Each NT5C10 Power Shelf is factory equipped with one (1) (common AC) or three (3) (individual AC) armoured cable connectors mounted on the rear of the unit. If true front accessibility is required the AC cables can alternately be routed through knock-out holes on the front side of the shelf.

NT5C12 - MPS150 Power Shelf (23") (Figure 6)

The MPS150 is a power shelf housing up to three 50A rectifiers. The rectifiers plug into the shelf, which provides interconnection points for AC input, DC output and alarm and control signals.

Each power shelf requires three AC feeds (one per rectifier). Its output connects to the charge busbar or to the load distribution panel with two cables (minimum 1/0 AWG, battery and battery return). Each rectifier position has its own connectorized alarm and control cable going to the power plant control and monitor unit.

• MPR25 NT5C06 25 A Switch Mode Rectifier (Figure 7)

The MPR25 provides 25 A of isolated, filtered and regulated DC power from a single-phase 220 V nominal AC source, for powering a load while charging a positive grounded battery. Nominal output is adjustable over the range of 46 to 59.5 V for floating a 23 or 24 cell battery string.

NOTE: If 110 VAC service is used instead of 220 V, MPR15 rectifiers must be used, and the individual output capacity becomes 15 A.

Each rectifier simply plugs into the NT5C10 power shelf and does not require any other connections. The rectifier is equipped with a 20 A 2 pole AC input circuit breaker, a 30 A 1 pole DC output circuit breaker, a digital ammeter and a set of LEDs and potentiometers for threshold adjustments and alarm indication. High frequency switching technology and forced air cooling are used. An optional air filter can be added if required.

NT5C07 HELIOS Rectifier 50/48 (Figure 8)

The NT5C07 rectifier provides -48 V / 50 A isolated, filtered and regulated DC power from a single phase AC source, for powering a load while charging a positive grounded battery. The output voltage is adjustable over the range of 46.0 to 59.5 V for floating a 23 or 24 cell battery string.

Each rectifier plugs into the MPS150 power shelf and does not require any other connections. The rectifier is equipped with a 20 A, two pole, AC input circuit breaker, a 60 A, 1 pole DC output circuit breaker, a digital ammeter /voltmeter and a set of LEDs, switches and potentiometers for threshold adjustments and alarm indication. The rectifier uses high frequency switching technology, forced air cooling and can be equipped with an optional air filter.

Figure 1 - NT6C40 (23 in. Mtg.) Relay Rack:

Height: 84 in. (2133 mm)
Width: 24.375 in. (619 mm)
Depth: 15 in. (381 mm)
Weight: 37 lbs. (16.5 kg.) Seismic
51 lbs. (23 kg.) Standard

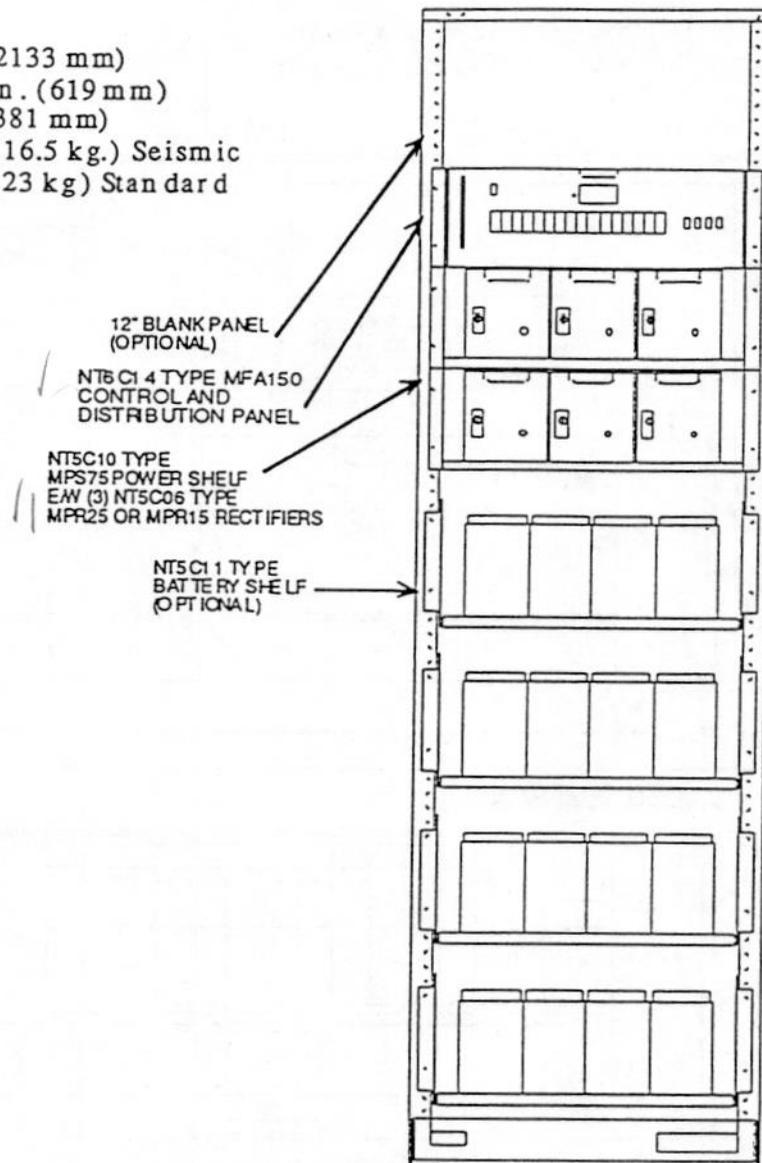


Fig. 2 - NT6C14G(X) Control and Distribution Panel e/w Control & Alarm Circuit Pack:

Height: 6.96 in. (176.8 mm)
 Width: 23 in. (584.2 mm)
 Depth: 12.96 in. (329 mm)
 Weight: 54 lbs. (24.5 kg)

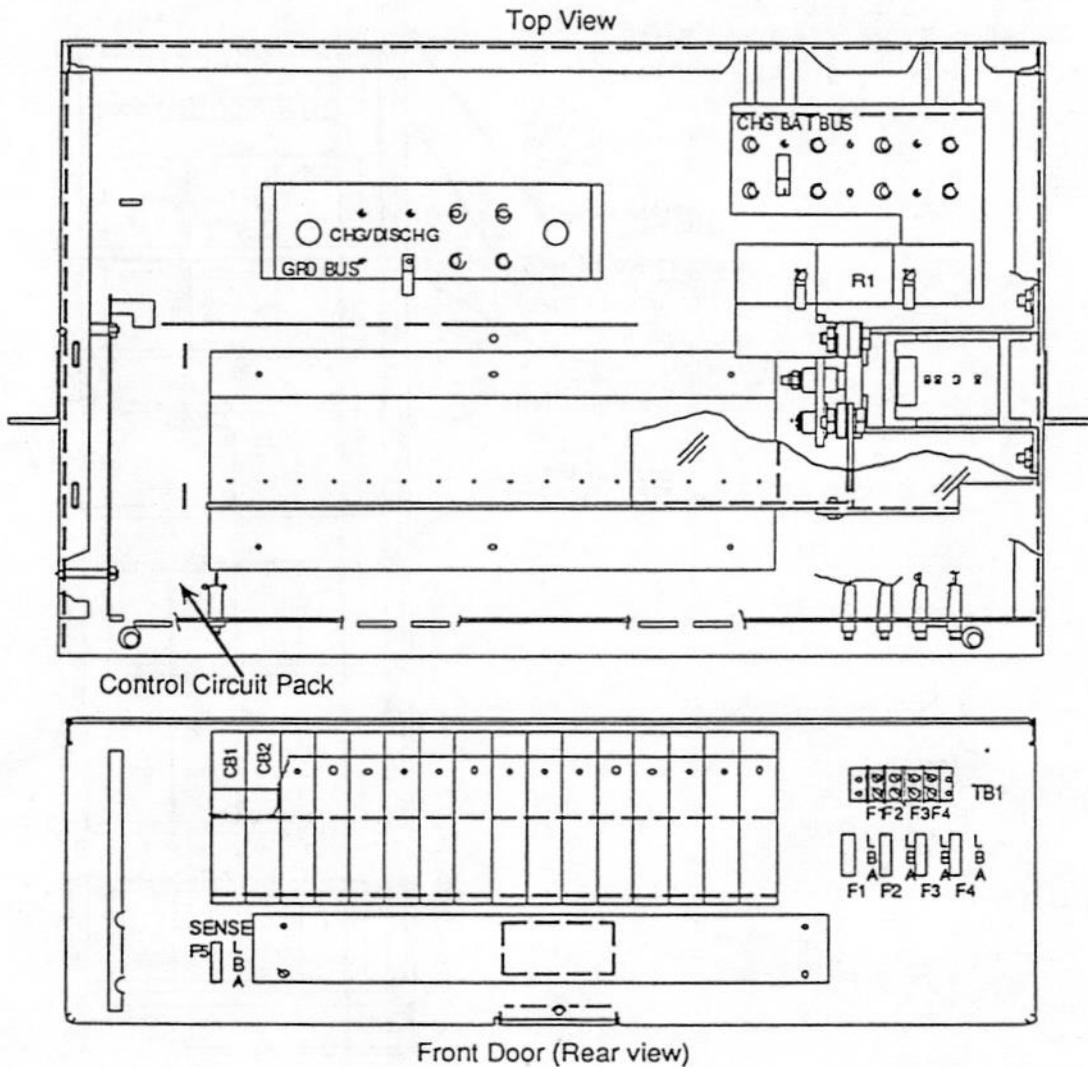
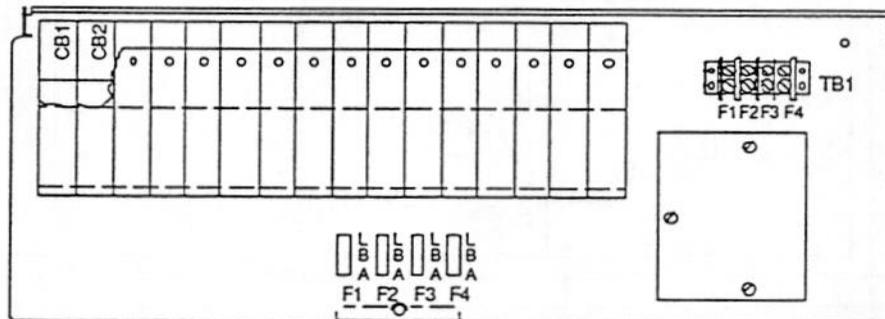
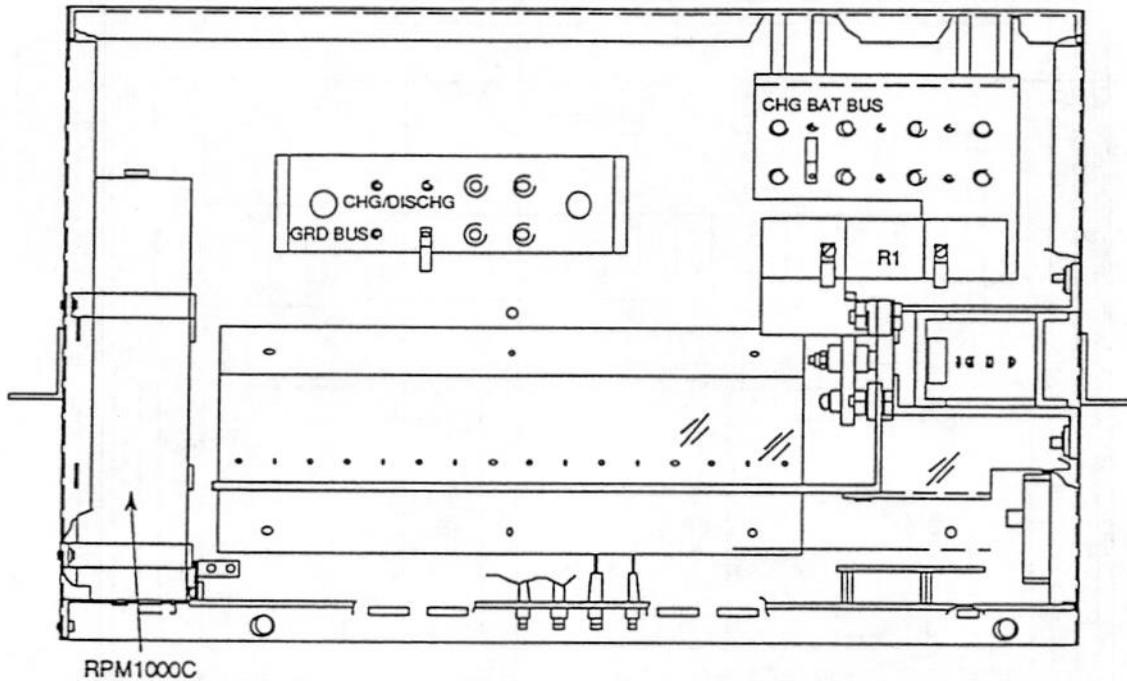


Fig. 3 - NT6C14G(X) Control and Distribution Panel E/W RPM1000C:

Height: 6.96 in. (176.8 mm)
 Width: 23 in. (584.2 mm)
 Depth: 12.96 in. (329 mm)
 Weight: 58 lbs. (26 kg)

Top View (Top Cover Removed)



Front Door (Rear view)

Fig. 4 - NT6C28C(X) Power System - typical configuration

Height: 25.36 in. (644.15 mm)
Width: 24.78 in. (629.4 mm)
Depth: 20.00 in. (508.00 mm)
Weight: 115 lbs. (52 kg)

Top View (Front Cover Removed)

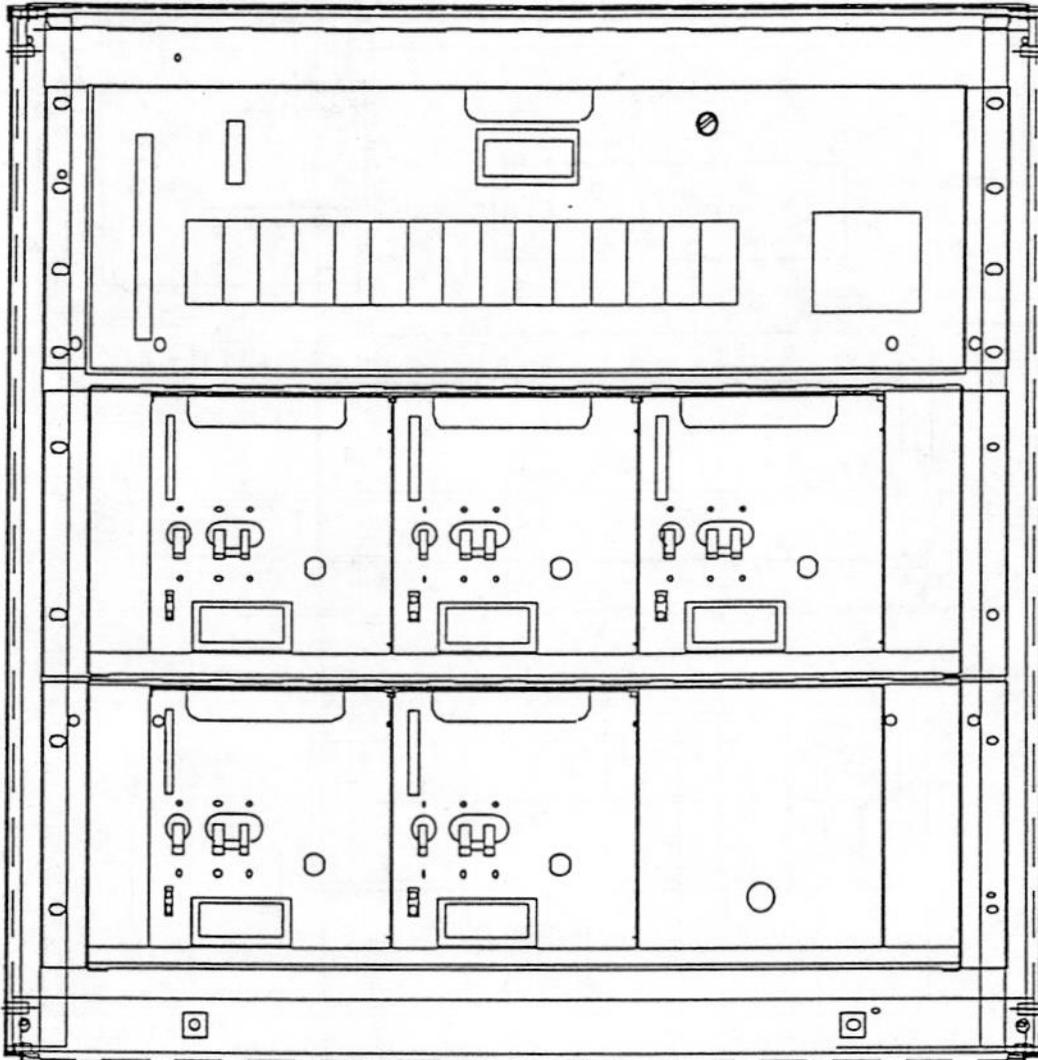
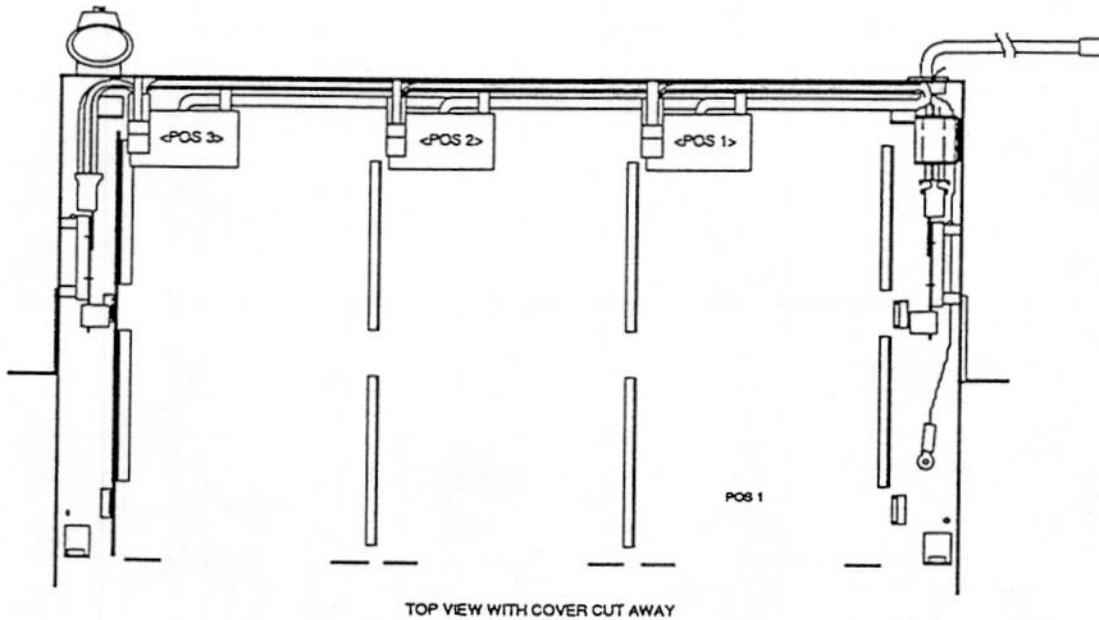


Fig. 5 - MPS75 (NT5C10) Power shelves: (Common AC shown)

Height: 7 in. (178 mm)
 Width: 23 in. (584 mm)
 Depth: 12 in. (305 mm)
 Weight: 23 lb. (10.5 kg)



AC INPUT SIDE

DC OUTPUT SIDE

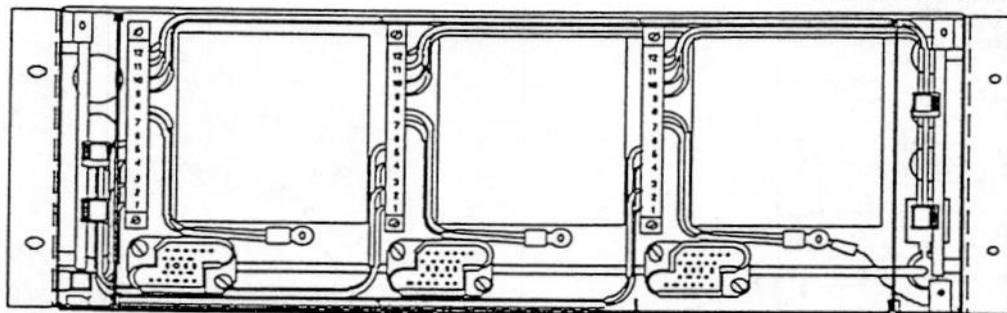


Fig. 6 - MPS150 NT5C12 Power Shelf

Height: 12.96 in. (329.18 mm)
Width: 23.00 in. (584.2 mm)
Depth: 14.30 in. (363.22 mm)
Weight: 31 lbs. (13.8 kg)

Top View (Covers Removed)

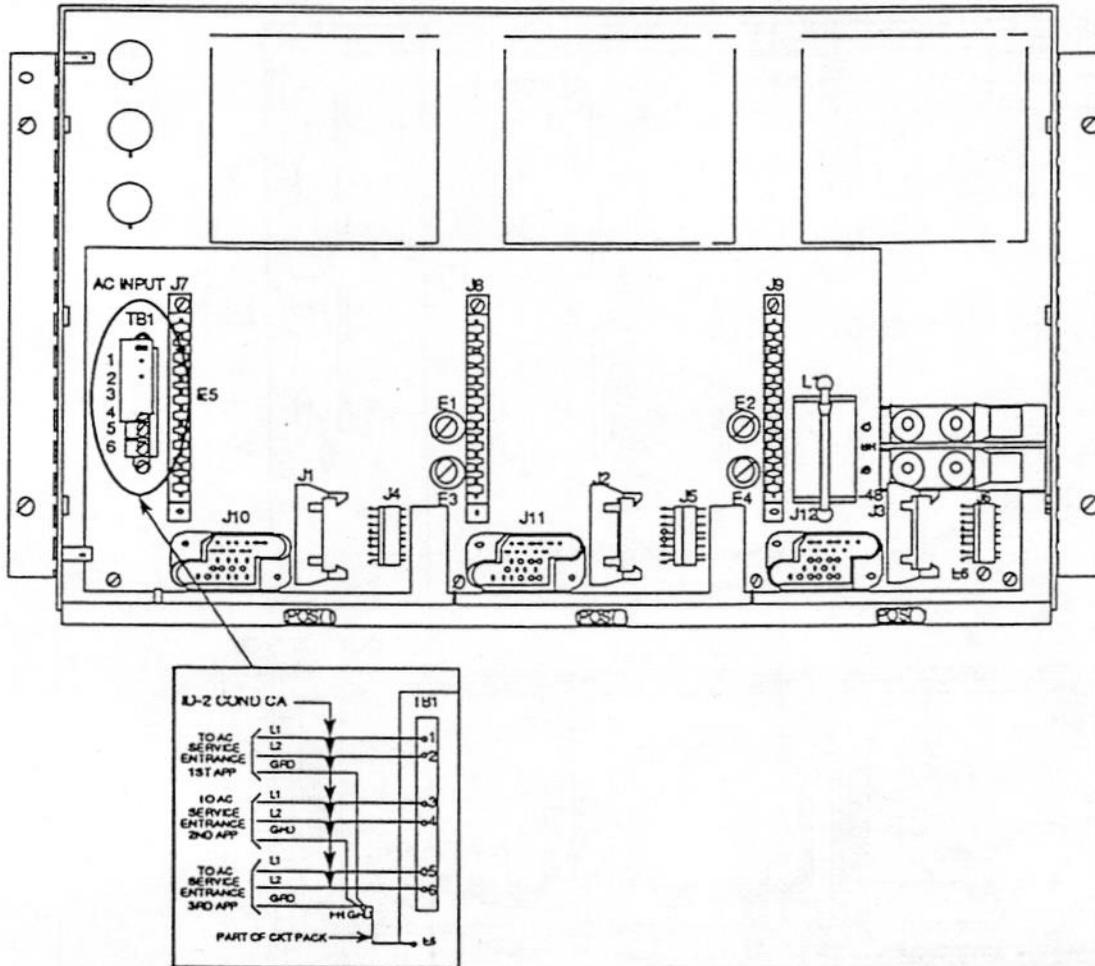


Fig. 7 - MPR25 / MPR15 (NT5C06) Rectifiers: (MPR25 shown)

Height: 6.60 in. (168 mm)
 Depth: 10.25 in. (260 mm)
 Width: 5.85 in. (149 mm)
 Weight: 14.3 lbs. (6.5 kg)

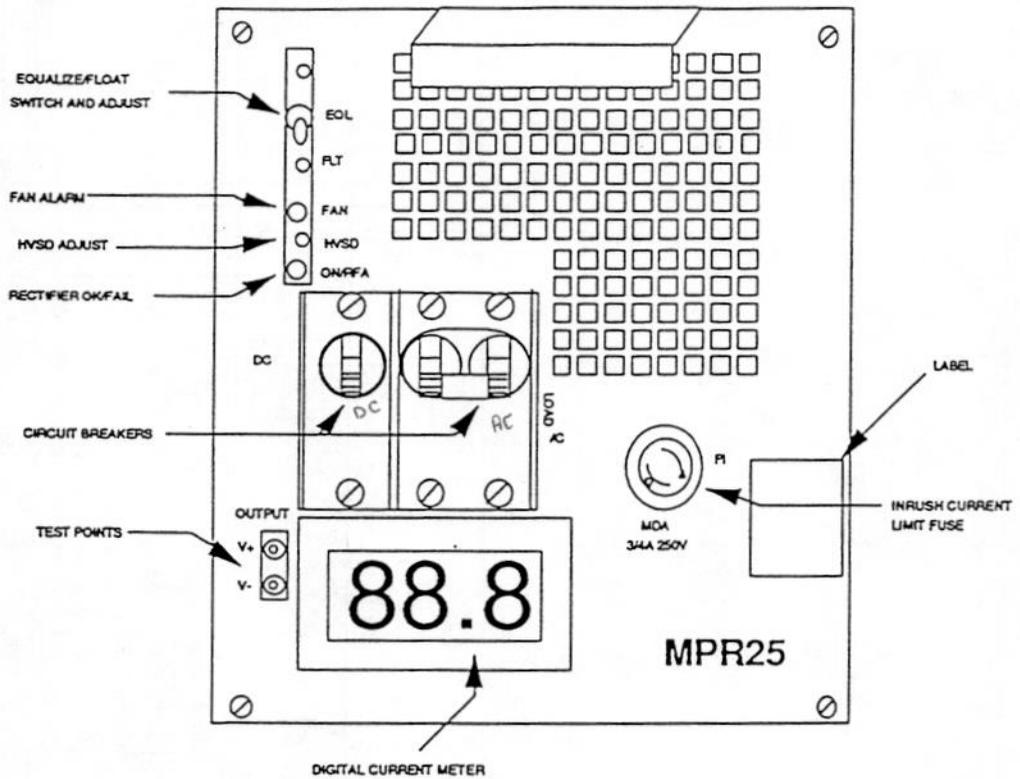
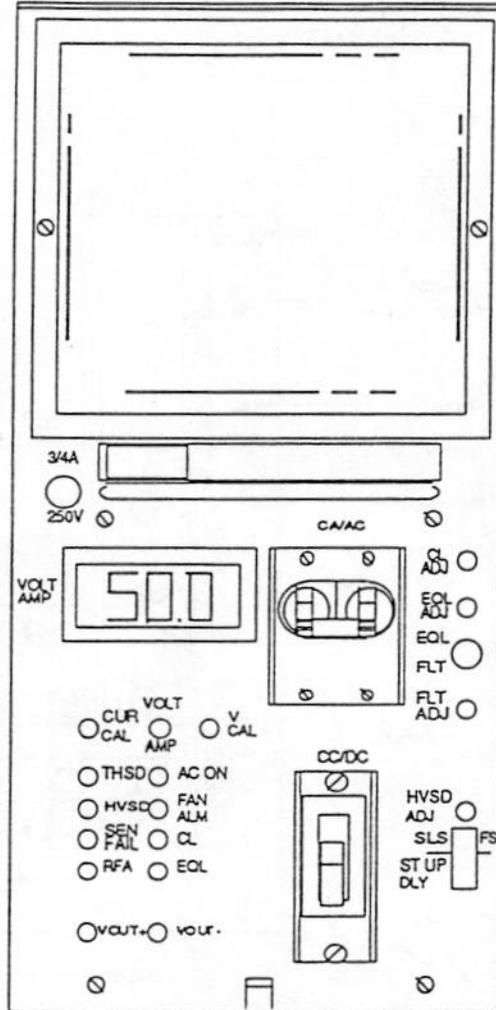


Figure 8 - NT5C07 HELIOS Rectifier 50/48

Height: 12.9 in. (327 mm)
Depth: 12.0 in. (305 mm)
Width: 6.0 in. (152 mm)
Weight: 22 lbs. (9 kg)



Specifications

Electrical Specifications

Note: For detailed specifications, please contact your local representative.

The NT5C06/NT5C07 rectifiers operate with the electrical specifications provided in Tables 1, 2 and 3 respectively.

Table 1
Electrical specifications - NT5C06 (25A) Rectifier

Input Voltage Rating:	Nominal 208/240 VAC single phase. When three phase 208/240 VAC lines are available to power the MFA150 it is preferable to distribute the shelves and rectifiers among the phases
Input Current Rating:	11.5 A nominal at -56.0 VDC output
Recommended AC Service Input Fusing	50A slowblow breaker or fuse per power shelf. (Common AC) 25A breaker or fuse per rectifier. (Individual AC)
Output Voltage Rating	Float: -46 VDC to -59.5 VDC Equalize: -50 VDC to -59.5 VDC
Output Current Rating	25A per rectifier 75A per power shelf 150A per power plant
Input Protection	A two pole circuit breaker opens both AC input lines for 208/240 V service.

Table 2
Electrical specifications - NT5C06 (15A) Rectifier

Input Voltage Rating:	Nominal 110 VAC single phase.
Input Current Rating:	13.0 A nominal at -56.0 VDC output
Recommended AC Service Input Fusing	50A breaker or fuse per power shelf. (Common AC) 25A breaker or fuse per rectifier. (Individual AC)
Output Voltage Rating	Float: -46 VDC to -59.5 VDC Equalize: -50 VDC to -59.5 VDC
Output Current Rating	15A per rectifier 45A per power shelf 90A per power plant
Input Protection	A two pole 20A circuit breaker on the rectifier opens both AC input lines.

Table 3
Electrical specifications - NT5C07 (50A) Rectifier

Input Voltage Rating:	Nominal 208/240 VAC single phase. When three phase 208/240 VAC source is available to power the MPS100 or MPS150 it is preferable to distribute the shelves and rectifiers among the phases
Input Current Rating:	15.0 A nominal at 208 and -56.0 VDC, 50A output
Recommended AC Service Input Fusing	25A circuit breaker or fuse per rectifier. Fuse FRN type or equivalent.
Output Voltage Rating	Float: -46 VDC to -59.5 VDC Equalize: -50 VDC to -59.5 VDC
Output Current Rating	50A per rectifier 150A for NT5C12AA & AB Power Shelves
Input Protection	A two pole circuit breaker opens both AC input lines for 208/240 V service.
Output Protection	The rectifier contains an adjustable output current limiting circuit for protection against damage from overloads. This circuit is factory set to limit the output current to 52.5A, however it is adjustable to less than 25A (50% - 105%). A single pole 60A circuit breaker is connected in series with the negative output lead in the rectifier.

AC Restored After a Power Failure

Upon restoration of AC after a power failure the rectifiers will resume normal operation and all rectifier alarms are automatically reset.

Heat Dissipation

(per rectifier)	25A	512 BTU/hour	(150 watts)
	50 A	1296 BTU/hour	(380 watts)

Acoustic Noise

High frequency switching is inaudible and the noise generated by the plant comes predominantly from the rectifier's fans. The equipment will not produce sound levels above 65 dBA, measured at a peripheral distance of 1.5 m (5 ft.) under all load conditions, in an ambient of 59 dB.

EMI

The equipment contained in the power plant complies with the specifications of FCC Docket, Part 15, Subpart J for class A equipment.

ESD

No equipment damage or malfunction shall occur when electrostatic discharge (ESD) voltages of severity level 2 and 4 as specified by IEC801-2, are applied to exposed parts of the power plant.

Safety

This equipment is certified to UL1801, CSA22.2 and is VED approved to IEC950 and all components used are rated to UL94 V-0 for flammability.

Environmental Specifications

The MFA150 Power system operates with the following environmental specifications.

Operating

Temperature: 32° to 122° F (0° to +50° C)

Transportation

During transportation the equipment may be subjected to the following conditions without damage:

Temperature: -58° to +167° F (-50° to +75° C)

Storage

Temperature: -58° to +167° F (-50° C to +75° C)

Installation

Power Bay Installation

The NT6C28C(X) Power System without rectifiers or batteries can weigh approximately 150 lbs fully equipped. It should therefore be considered as heavy equipment and be handled with proper care.

Installation Overview

This chapter contains detailed installation procedures for installing and commissioning the MFA150 Modular Front Access Power System. The following is a suggested sequence for the Installation and Start-up procedure. The sequence may change according to job and site conditions.

Sequence of Assembly

- 1 Receive, unpack and inspect the equipment.
- 2 Mark the floor and prepare it if required and secure the frame.
- 3 Install the external battery stand and batteries if required.
- 4 Select the various cables, in size and in length.
- 5 Install the AC, DC and ground conductors.
- 6 Install all control and alarm wires.
- 7 Plug in the rectifiers in the MFA150.
- 8 Test the MFA150.
- 9 Connect DC Power to the telecommunication equipment (load).
- 10 Test the complete system.

Tools and Test Equipment

The following tools and test equipment are recommended:

- Screwdriver, flat blade 10 mm (3/8 in.)
- Screwdriver, flat blade 2 mm (3/32 in.)
- Screwdriver, Bourns No. 60, or equivalent
- Cable strippers / electricians knife
- Wire stripper
- Cable cutters (535 MCM)
- Linesmen pliers
- Open and box ended wrenches (set)
- Socket set 13 mm (1/2 in. drive)
- Ratchet Wrench 13 mm (1/2 in. drive)
- Torque limiting torque wrench 13 mm (1/2 in. drive)
- Crimper, T&B 12 or 15 Ton head with 94H die
- Hilti HSD6 and HSD10 anchor setting tools
- 8 mm and 12 mm concrete bits
- Hammer drill
- Digital Multimeter, Fluke 8000A or equivalent
- Vacuum cleaner or manual dust blower
- Load Tension Tester OSA IR 26.6

Precautions and Preparation

The following precautions shall be followed at all times when installing power equipment.

- Protect the floors and walls against damage when handling the equipment.
- Power equipment is heavy (preassembled frames, rectifiers and batteries). Use a dolly truck or forklift or hoist whenever possible when handling and moving the equipment. Power equipment frames can also be top heavy, take the necessary precautions to avoid tilting when moving the frames.

- When cabling the AC input of the rectifiers, ensure that the associated AC breakers in the AC service panel are in the off position and that a warning tag clearly indicates that these breakers are to remain off until AC cabling is completed.
- When working on live equipment, use properly insulated tools and cover any live busbars with a canvas sheet to prevent short circuits caused by falling tools or parts.

Caution: *Always use appropriate material and handling procedures when moving frames and other materials.*

Do not over torque nuts and bolts, over torquing causes the thread to strip or the bolt to break.

Location

The service life of the equipment can be greatly enhanced by selecting the proper location for the equipment. The equipment must be secured to the floor and the location must be maintained in the following conditions:

- Dry
- Well ventilated
- Ambient temperature 32° to 122° F (0° to 65° C)
- No obstructions in front of all ventilation openings
- Free of pests.

Ventilation

Since the MFA150 uses forced air cooling, a minimum clearance of 6 in. should be left at the rear of the relay rack. This 6 in. space will also allow cables to be fished through during addition or replacement of battery trays or rectifier shelves.

Detailed Installation

Material Handling

A forklift truck or large dolly should be used to transport equipment on the premises.

When a forklift truck is used the shipping package should not be removed until the equipment is delivered to the installation site.

When the shipping package is removed inspect the equipment for any damage that may have occurred during transport.

When a four-wheel dolly is used to transport the material in the premises:

1. Remove the shipping package and inspect the material for any damage that may have occurred during transport.
2. Place the equipment on the dolly and move it to the desired location.
3. Remove the equipment from the dolly and place it near its final location such that it will not interfere with other work in progress. Take steps to ensure that the floor covering is not damaged.
4. For the MFA150 wall mount unit check that the Anchor Kit P0734838 is included in the shipping package.

NOTE: This section has been prepared to reflect the sequence in which the power plant should be assembled. However, the actual sequence should reflect job site conditions. For the wall mount unit installation procedure please refer to the end of this section .

MFA150 Equipment Frame Installation

Before installing the frame the floor must be marked.

NOTE: If the floor is waterproofed, use a fastening method that is approved by the local telephone company.

If the room has concrete flooring proceed as follows:

Step	Action
1	Use the floor plan to determine the distance from the wall to the front of the lineup.
2	Mark two points on the floor using the measurements from Step 1, then draw a straight line through these points (ref. line "X").
3	Use the floor plan to determine the distance from the wall to the side of the first frame in the lineup.
4	Mark one point on line "X" using the measurements from Step 3.
5	Slide the equipment frame over its final position, aligning the front of the frame with line "X" and the side with the mark specified in Step 4.
6	Mark the floor holes using the frame's holes (see Fig. 10). The holes are slotted in case a reinforcement rod interferes with an anchor bolt.
7	Slide the equipment frame away from the installation area.
8	Drill the floor using a 15/32 in. (12 mm) concrete bit and appropriate hammer drill. The holes must be the length of the anchor plus the thickness of the floor covering (if any) plus 1/8 in. (3 mm) in depth. Note that the anchors can be installed in a bottomless hole.
9	Clean the holes using a vacuum cleaner or a manual dust blower.
10	Set the floor anchors in the drilled holes. Use a setting tool (Hilti HSD10 or equivalent). For standard installations, the anchors are 10 mm (3/8 in.). For seismic installations, the anchors are 13 mm (1/2 in.).
NOTE:	Do not expand the anchor by hand before tapping it into the hole.
11	Slide the frame back into position over the anchoring holes.
12	Verify that the frame is level. If the frame is not level use appropriately sized shims made from incompressible materials to level the frame
13	Fasten the frame to the floor then torque the bolts to 25 lb. ft.

14 As a general practice for rack installations, it is recommended that 50% of the anchor bolts shall be load tested in tension at the job site to 3344 lbs., in accordance with OSA IR 26.6. If any one anchor fails, all the expansion anchors should be tested.

If the office has **wooden flooring**, fasten the frame to the floor using the lag bolts provided with the frame then tighten the bolts.

For through holes in thin or raised-floor installations, a machine bolt should be used in conjunction with a nut and locking washer.

NOTE: Zone 4 seismic rating of the power system cannot be guaranteed on floors other than concrete.

Fig. 9 - Frame Isolation Kit .

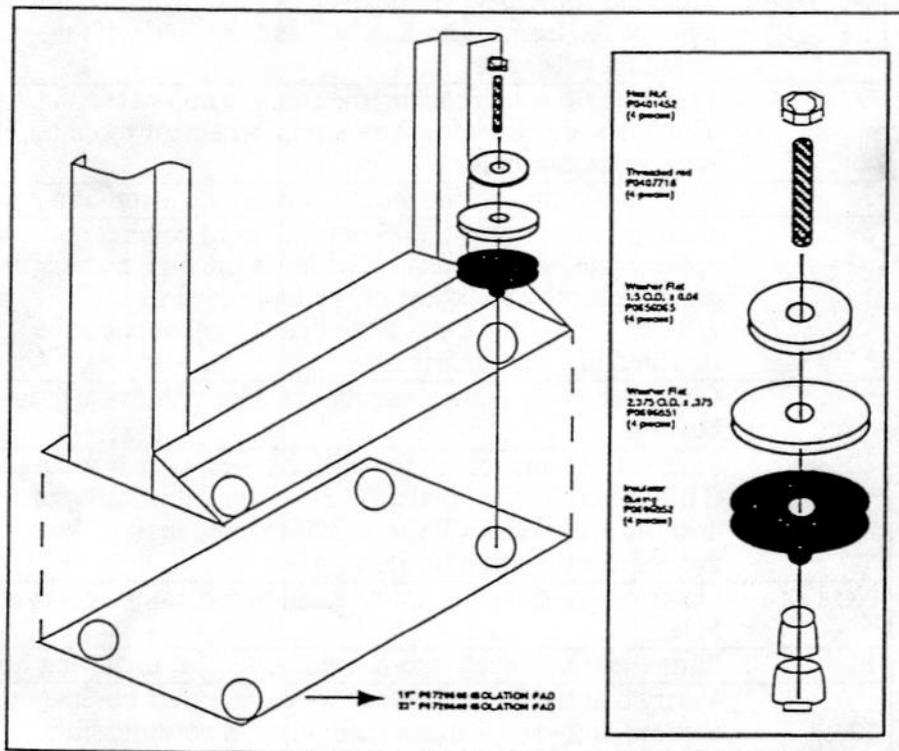
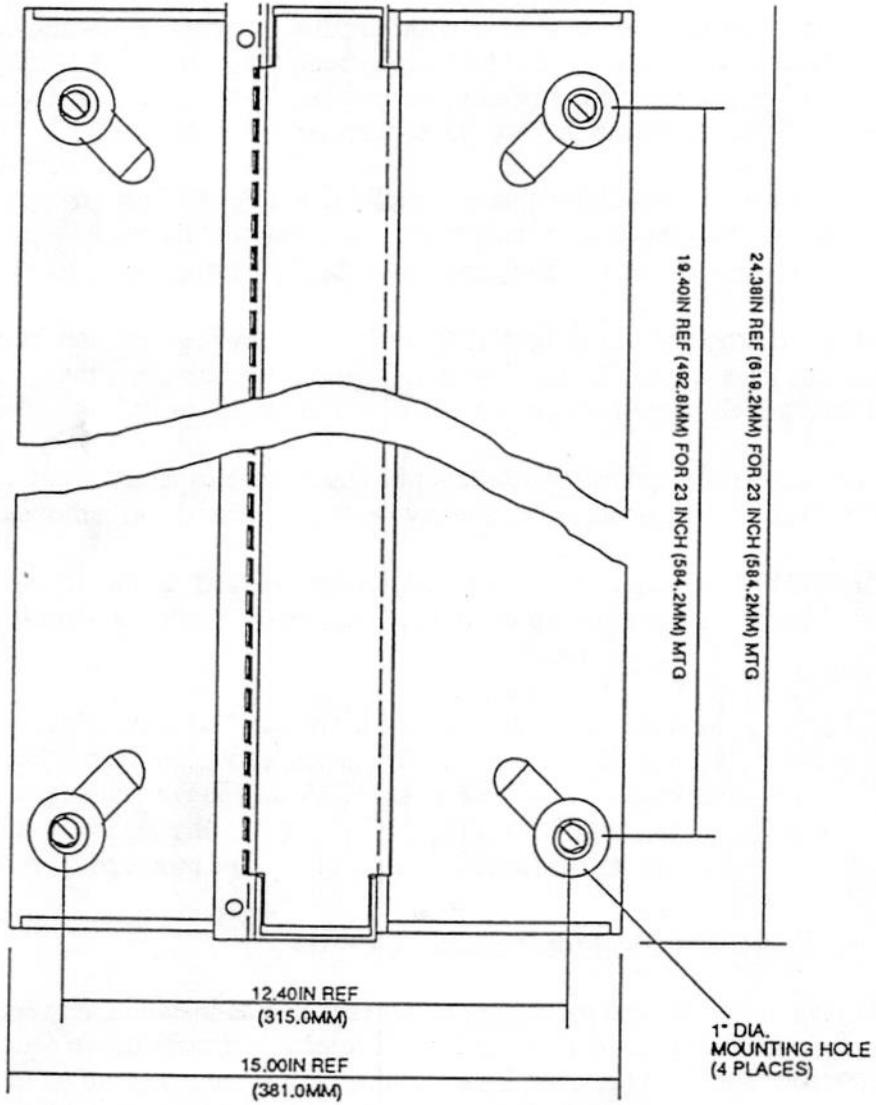


Fig. 10 - Relay Rack base detail, top view



Batteries and Battery Stand Installation (if required)

The MFA150 can operate with or without batteries without modification to the Control and Distribution Panel being required. Sense leads are factory installed inside the panel, and do not need to be extended to the actual battery string, as long as the battery terminals are closer than 10 ft. away.

Batteries may be installed either externally to the Power System or on NT5C11 Battery Trays mounted on a relay rack. Up to four (4) trays can be installed in the initial MFA150 Power Bay, and up to six (6) per supplementary bay.

A detailed procedure to add a NT5C11 Battery Tray is given later in the maintenance section. To install external batteries proceed per the manufacturer's documentation supplied with the equipment.

When installing large cells use a hoist of appropriate capacity to lift the cells on to the rack. A platform type hoist may be used to install and remove cells.

CAUTION: *Do not actually connect the battery leads to the MFA charge busbars before being instructed to do so in the installation documentation.*

NOTE: In applications where the batteries are to be installed further than 10 ft. away, new #16 AWG sense leads shall be run from terminals TB3-7 (VR+) and TB3-8 (VR-) on the control and alarm card of the NT6C14G panel, and the old leads going to the charge busbars within the panel shall be removed.

Conductor Sizes and Minimum Requirements

It is very important that the proper conductor size be installed between the AC source, power plant, batteries and load. Protective circuits in the equipment, the performance and the overall safety of the equipment depend on the proper amperage and an acceptable DC voltage drop. To select the appropriate conductor size for each application refer to Drawing IS6C28CA.

Conductor Materials must meet a 94 V-0 rating when tested according to Underwriters Laboratories standard UL 94. This implies that cable materials must not sustain flaming after an open flame source is removed.

Power Plant Wiring

Once the frame and equipment are firmly secured proceed with the system wiring and configuration as described in the following Sections.

WARNING: The power plant wiring should be installed by qualified personnel in accordance with the local electrical codes.

Input voltage to the rectifier and the power shelf has a dangerous level. Ensure that the associated breakers are in the OFF position at the AC cabinet before attempting to work on the power plant. Dangerous voltages may still be present at the terminals even if the rectifiers are OFF. Use a voltmeter to verify the presence or absence of voltage.

Improper wiring can cause personal injury and equipment damage. Verify proper polarity of the battery leads before connecting them to the power plant, by clearly identifying the positive lead and the negative lead.

All internal wiring between equipment on the MFA150 Power Bay is done at the factory, including DC and control wires of the installed power shelves to the NT6C14G Control and Distribution Panel. Cables to the AC supply, the external batteries and the telecommunications equipment must be installed on site. The NT5C06 or NT5C07 rectifiers are plug-in units and do not require external wiring.

AC Power Installation

The AC power cables are connected to the power shelves. The NT5C10 power shelf offers the option of providing power to the rectifiers from a single AC feed or from three individual AC feeds. The NT5C12 power shelf accepts only three individual AC feeds.

CAUTION: *Do not insert fuses or operate circuit breakers (switches) to ON until the entire system is assembled and you are instructed to do so by the appropriate documentation.*

DC and Ground Conductors Installation

CAUTION: *The conductors from the batteries to the positive and negative charge busbars should be connected only after all other conductor installation on the MFA150 Power Bay and verification has been completed. Before connecting the batteries to the NT6C14G Control and Distribution unit, ensure that all output fuses or circuit breakers at the rectifiers, distribution bays and control bays are OFF, and that the rectifiers are physically removed or pulled away from their connectors by at least 2 in.*

Refer to Fig. 19, the Interconnection Schematic (IS6C28CA) and Wiring Diagram (WD6C14GA + GC) documents for wiring illustrations.

Permanent connection of the MPS75 and MPS150 Power Shelves to the NT6C14G Control and Distribution Panel is done using 2 # 4 AWG conductors for the MPS75 and 1/0 for the MPS150, one black for battery return and one red for battery -48 V dc. The length of the conductor is minimized to reduce interference. A detailed shelf addition and replacement procedure is given in the maintenance section.

A separate # 6 AWG safety ground conductor is always required to minimize hazards (e.g. from lightning transients) and to minimize the effects of stray grounds during normal operation. When cabling the AC to the power shelves, make sure that each corresponding safety ground wire is properly connected to the terminal (FR GRD) located inside the power shelf, near the L1 and L2 terminals. The MFA150 frameworks, supplementary bays and battery stands, if any, should also be connected to the AC equipment ground as shown in Fig. 13.

All cables must be run, screened and supported as required by local regulations and conditions. They should not be allowed to sag as sagging indicates that the cable has not been sufficiently supported.

Fig. 11 A - Rectifier shelf MPS75, inside left side view, AC connections, common AC

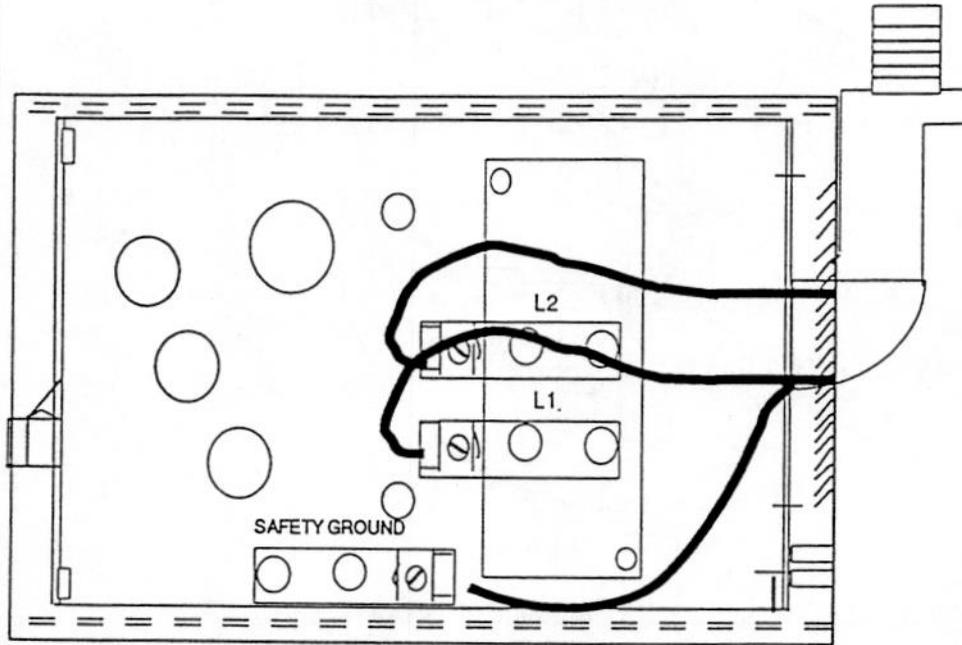


Fig. 11 B - Rectifier shelf MPS75, inside right side view, DC connections

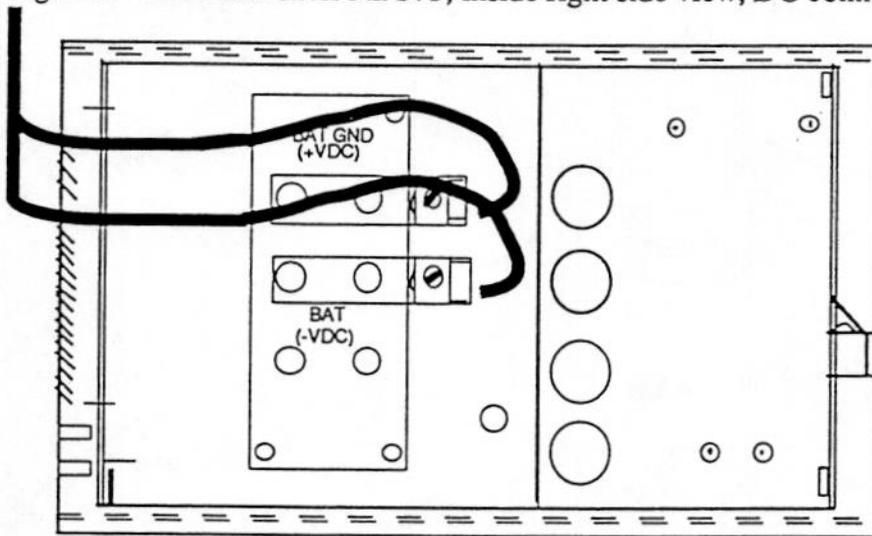
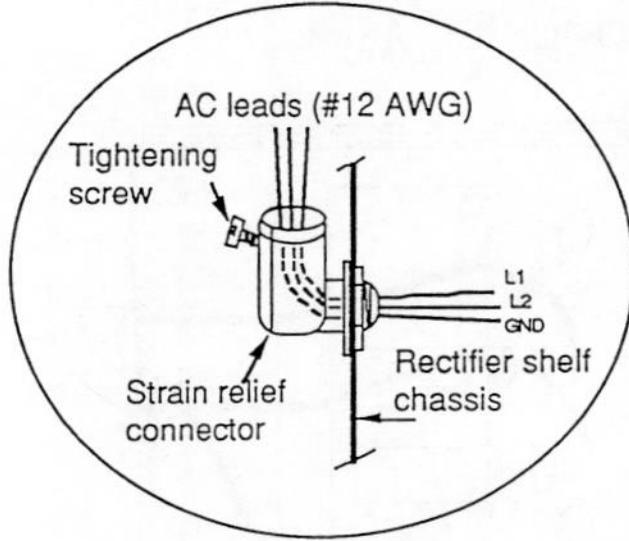


Fig. 12 A - AC cabling (direct to power shelves)



ENLARGED VIEW

Fig. 12 B - Back Panel of MPS150 Shelf for 50A Rectifiers

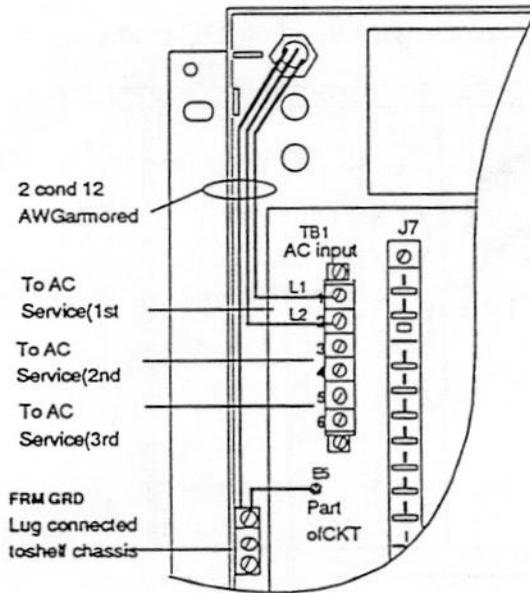
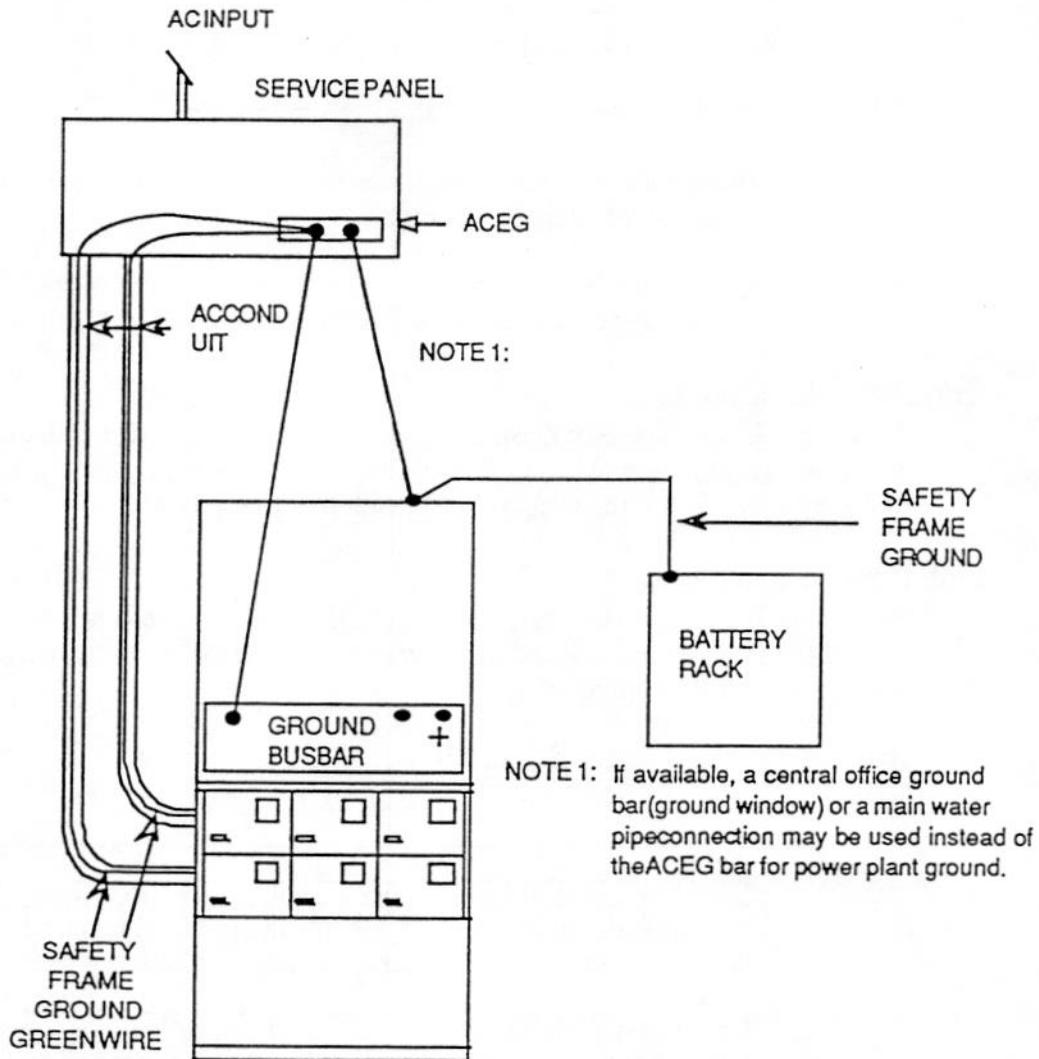


Fig. 13 - Safety ground and Power Plant ground reference



MFA150 Wall Mount Equipment Installation

Before installing the cabinet the wall must be marked.

NOTE: Anchors will be used on solid concrete walls.

If the wall is waterproofed, use a fastening method that is approved by the local telephone company.

Consult the building plans to be certain that no services (water, electrical etc.) are in the wall at the installation site wall location.

Concrete Block Walls

If the wall is concrete block use the toggle bolts supplied. The bolts must be disassembled, the lock washer, flat washer and insulating bushing placed on the bolt, see Fig. 15, and the toggle re-assembled onto the bolt.

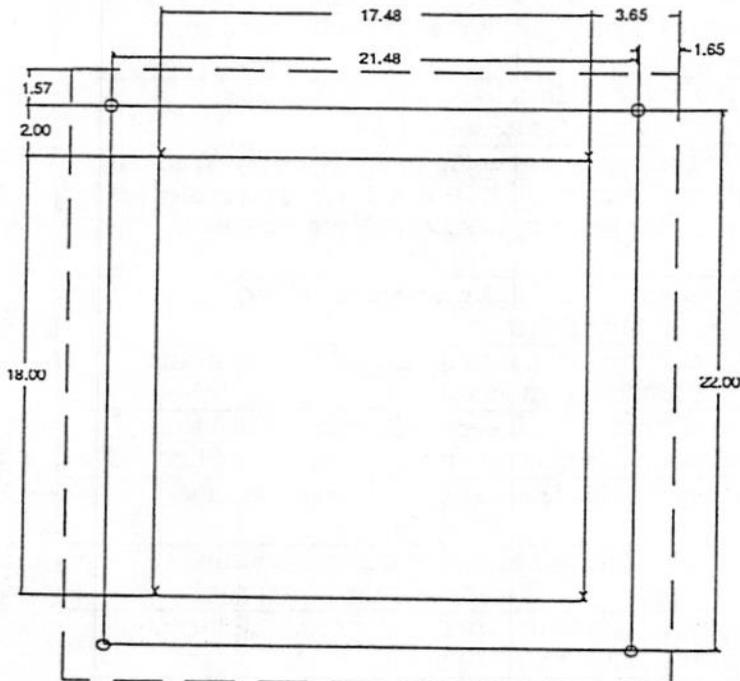
Wall Board/Stud Walls

If the wall is a wall board/stud type, a 3/4 in. plywood sheet shall be installed. The plywood shall be attached to the wall studs in a manner that will provide support for a 300 lb. total load.

Installation will be performed as follows:

Step	Action
1	Mark the anchor locations according to the pattern in Fig. 14. Note that the dotted outline defines the outer edges of the cabinet. Use a level to ensure that the installation will be plumb.
2	Drill the wall using an appropriate bit and drill. The holes must be the length of the anchor plus the thickness of any wall covering (if present) plus 1/8 in. (3 mm) in depth. Note that anchors can be installed in a bottomless hole.
3	Clean the holes using a vacuum cleaner or manual dust blower.

Fig. 14 - Mounting Holes Pattern



NOTES:

1. ANCHOR HOLE DIA:

- CONCRETE = 5/8
- CONCRETE BLOCK = 3/4 TO 1.0

2. ANCHOR TYPE:

- CONCRETE = EXPANSION TYPE
- CONCRETE BLOCK = TOGGLE BOLT
- STUD WALL WITH PLYWOOD = TOGGLE BOLT

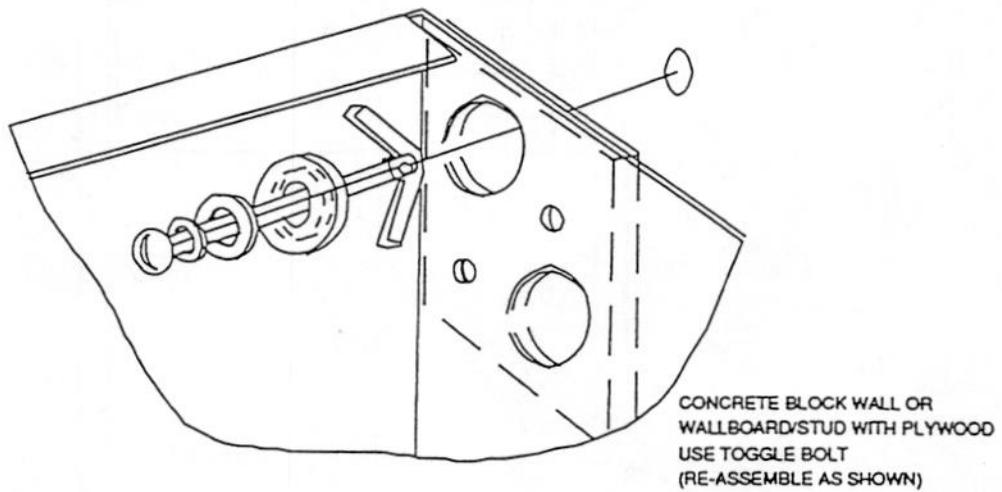
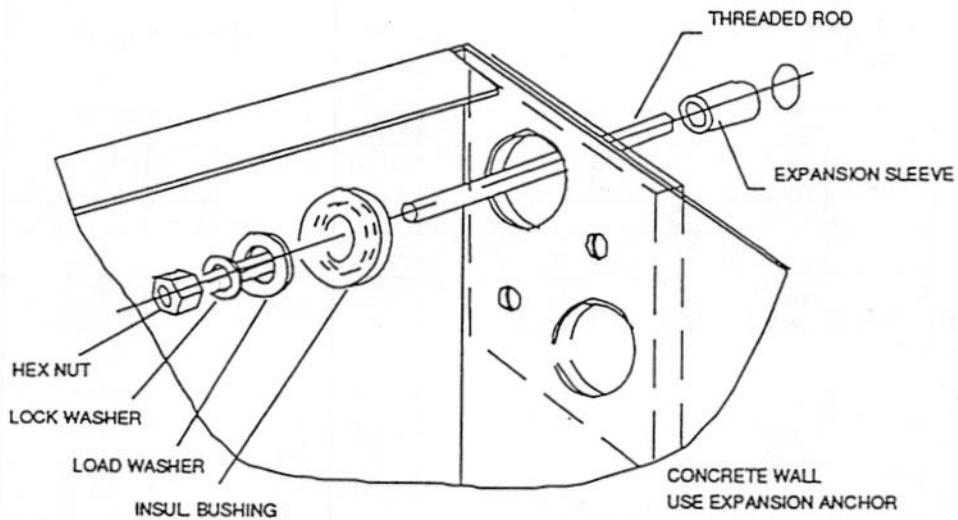
SYMBOLS

- O PRIMARY ANCHOR HOLE
- X SECONDARY ANCHOR HOLE

DOTTED LINE INDICATES
THE OUTLINE OF THE CABINET
(LOCATE TOP OF CABINET 1/2 IN ABOVE FLOOR)

Step	Action
4	The top, bottom and front cover of the cabinet should be removed for installation access to the anchors and for subsequent cabling.
5	Raise the cabinet to its installation height in close proximity to the wall installation location.
NOTE:	If no power shelves are mounted in the MFA150 Wall Mount Cabinet, go to step 13. If one or two power shelves are mounted in the cabinet, as received, proceed as follows:
6	Rotate the cabinet on the lifting device to expose the rear access cut out of the cabinet.
7	Pass the AC cabling into the shelf, from above or from below, as job conditions dictate.
8	Strip the outer conduit back about 457 mm (18 in.) to expose the insulated AC leads and the bare ground lead.
9	Form a 90° bend in the leads as they emerge from the conduit.
10	Remove the rear plate of the shelf mounted conduit connector and pass the AC leads into the power shelf.
11	Replace the rear plate of the conduit connector tightening the screw firmly (do not over tighten)
12	Rotate the cabinet to place its back towards the wall.
13	Using a hammer, tap each of the anchors into the wall such that the expansion shield is even with the outer surface of the wall.
	NOTE: Do not expand the anchor by hand before tapping it into the hole.
14	Prepare the anchors: (see Fig. 15)
15	Move the cabinet towards the wall, aligning the mounting holes with the anchor holes.
16	Place the anchors finger tight initially. Verify that the cabinet is straight and level. Torque the anchor nuts to 20 +/- 5 lb-ft.

Fig. 15 - Anchor Assemblies

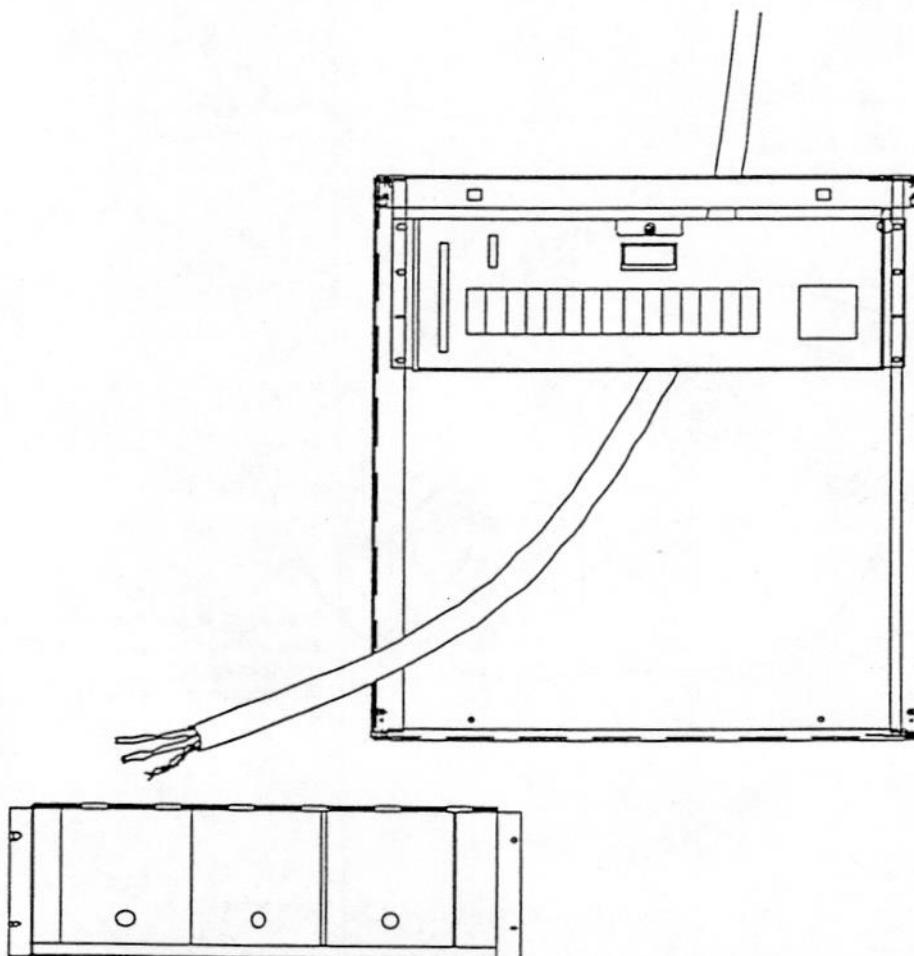


°Installation of the Power Shelves (mechanical)

The power shelf may be shipped loose, to be installed at the job site. To install a power shelf proceed as follows:

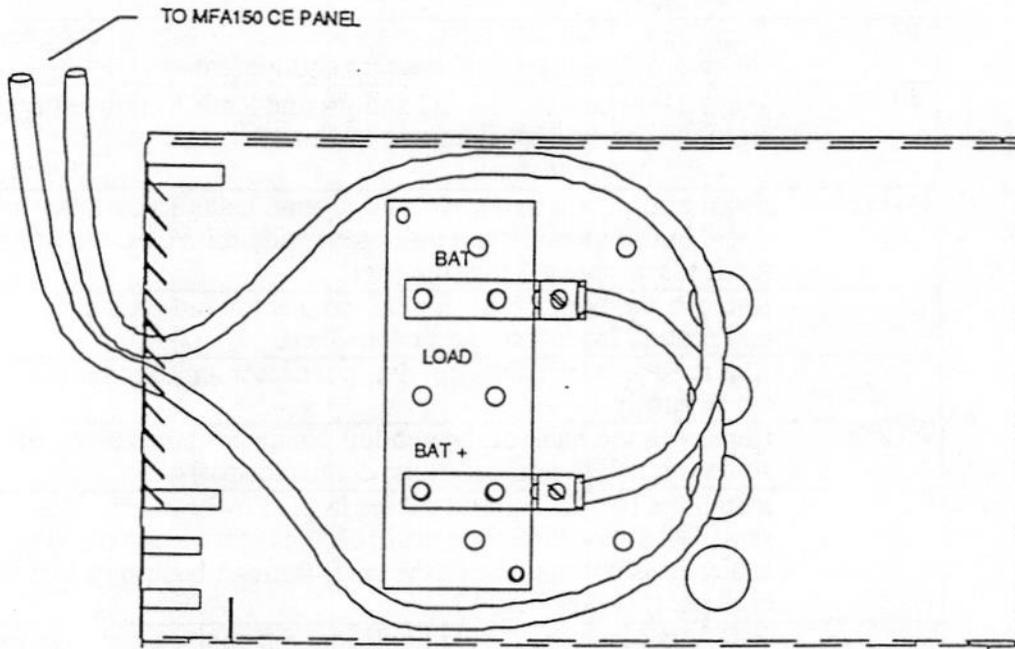
Step	Action
17	Pass the AC flexible conduit from the top down or bottom up, as required by job site conditions, into the Wall Mounted Cabinet. When the direction is top down, the AC conduit passes behind the NT6C14G Control and Distribution Panel.

Fig. 16 - AC Conduit Entry



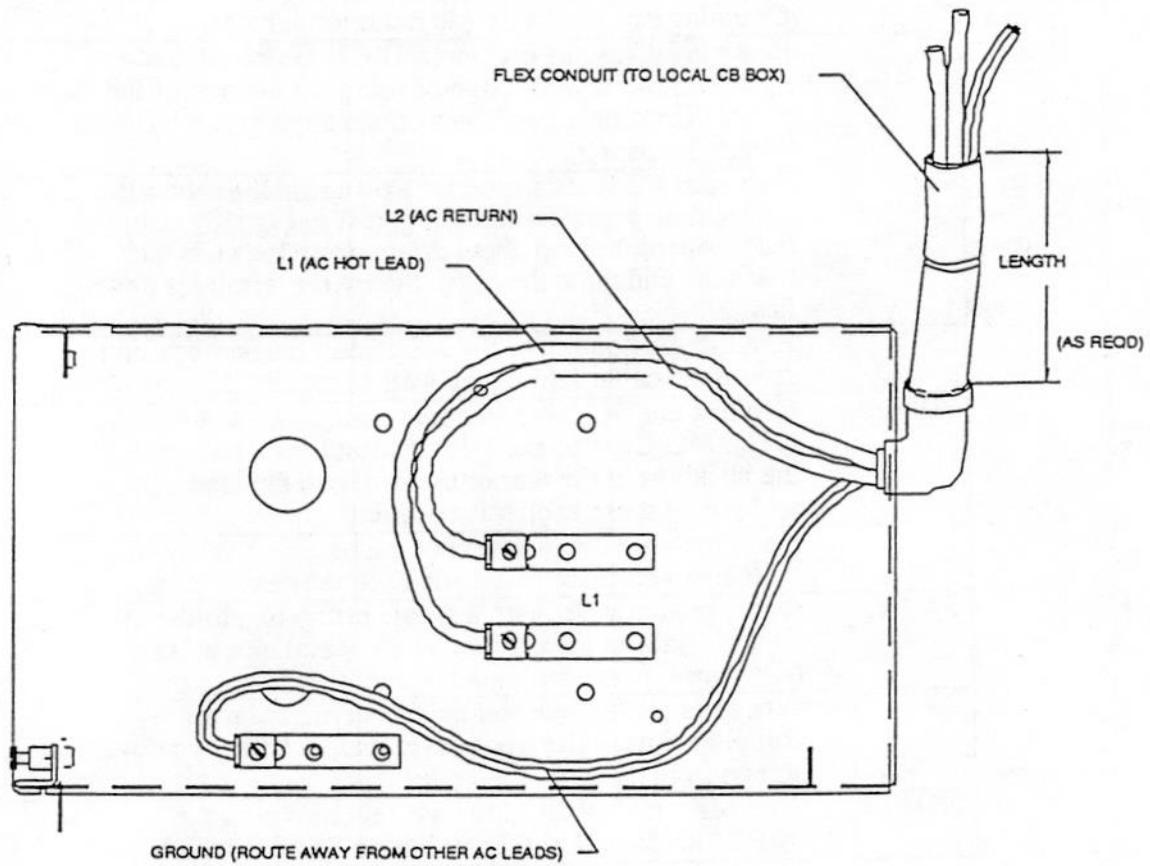
Step	Action
18	Bring the conduit out the front of the cabinet to the rear of the Power Shelf.
19	Strip back about 18 inches of the conduit covering, exposing the two AC insulated conductors and the ground lead.
20	Form a 90° bend in the AC and ground leads as they emerge from the conduit cover so that the leads will lie properly in the conduit connector.
NOTE:	Form a slight arc in the AC and ground leads so that they will avoid butting against the insulator inside the Power Shelf as the leads are passed into the shelf.
21	Remove the back of the conduit connector and pass the AC and ground leads into the Power Shelf.
22	Replace the back of the conduit connector and tighten the screw firmly.
NOTE:	Replacing the back of the conduit connector takes care and some force. Do not distort the connector parts.
23	Install the two DC output cables in the Power Shelf. The shelf DC connections are made on the right hand side. The cables pass out the rear of the shelf through bushings, one for each polarity, see Fig. 17.
24	Carefully place the Power Shelf into the cabinet, dressing the cables at the same time to avoid trapping them.
25	Place the two upper mounting screws finger tight initially to take the weight off the shelf. Verify that the shelf is straight and level, add the other two screws and tighten all screws firmly. (do not over tighten)
NOTE:	The bottom right hand screw takes an external tooth lock washer to ensure ground continuity between the shelf and the cabinet.

Fig. 17 - Power Shelf (DC Cabling)



Step	Action
26	After ensuring that the shelf is centered, tighten the mounting screws firmly (do not over tighten).
27	Pass the DC cables into the NT6C14G Control and Distribution Panel through bushings in the rear of the panel. Terminate the cables on the appropriate bus bars within the panel.
28	Form the AC leads inside the Power Shelf to enter the appropriate screw terminal lug, (ref to Fig. 18). Cut the leads to length, strip about 3/8 in. from the ends and place the ends into the lugs. Screw the terminals down firmly.
29	Run the AC conduit to the AC circuit breaker box and secure the cable against the wall as required.
30	Connect the DC cables from the circuit breakers in the NT6C14G Control and Distribution Panel, out through the bushings at the rear of the panel, to the load. Dress and secure these cables as required.
31	Continue with the insertion of the rectifiers and setting up the power plant as described in the next section.
32	Run a ground wire, with a 2 hole crimp lug, to the upper right (inside) of the cabinet where metal tape and two holes provide grounding attachment.
33	When the installation, set up and verification are complete, install the front cover and lock the two cover screws in place.
NOTE:	The MFA150 (Wall Mount) is received with the MFA150 Control and Distribution Panel installed.

Fig. 18 - Power Shelf (AC Cabling)



Office Alarm Cabling

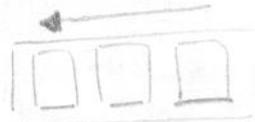
Refer to NTP 167-8001-107 for Office Alarm connections to the standard control and alarm card when the RPM1000C controller is used.

Verification

After completing the wiring of the MFA150 perform the following:

1. Verify that all mechanical systems are properly fastened using the correct hardware.
2. Verify that all wiring performed by the installer is correct by using a voltmeter.
3. Verify that all connections are mechanically correct (i.e.. tight, correct connector etc.).

1. Rectifier Installation



(A) MPR25/MPR15, NT5C06 Rectifier

NOTE: It is recommended that the rectifiers be inserted in the shelf from right to left, starting in position 1. Always ensure that the AC and DC cabling is installed in a shelf before inserting a rectifier.

1. Release the clamping bar - the two (2) screws are captive.
2. Place a finger in the blank panel hole and lift up dislodging the lower tabs from the bottom of the shelf.
3. Pull the bottom of the panel out until it clears the shelf bottom.
4. Lower the panel dislodging the upper tabs from the shelf top.

NOTE: The blank panel may be stored in the shelf under the rectifier.

5. Make certain that the circuit breakers of the rectifier about to be plugged-in are OFF (down position).
6. Slide the rectifier firmly into the shelf resting it on top of the stored blank panel.
7. Proceed with this procedure for all rectifiers to be installed.
8. Close the clamping bar and tighten the screws.

(B) NT5C07 HELIOS Rectifier 50/48

An 50A rectifier may be added in service without power interruption to the load (hot insert).

To add a new rectifier to an existing shelf or to install the power shelf refer to the Installation and Start-up Procedure in NTP 169-2071-501.

2. Rectifier Start-up and Verification

Factory settings

Rectifier output voltage (Float)	52.0 VDC
Rectifier output voltage (equalize)	53.5 VDC
Rectifier high voltage shutdown	56.5 VDC
Rectifier output current limiting	110% +/-10%

Note: the above voltage levels are a general reference, for exact settings, please refer to the battery manufacturer installation guide.

Step	Action
1 see note 3	Turn on the DC breaker on the rectifier to adjust, and open its associated "sense" DIP switch on the front panel of the NT6C14G Panel. (Refer to fig. 21)
2 see note 3	Turn the AC supply ON by closing the AC service panel breaker at the AC service panel and the AC breaker on the unit. Wait until the 'RFA' indicator on the front panel turns green before proceeding. If the indicator remains red after 15 seconds, verify that the rectifier inrush fuse F1 is good and that the input AC voltage falls within the specified range.
3	Measure the rectifier's output floating voltage from the V+/- test points on the front of the rectifier unit using a digital voltmeter, or use the MFA150 volt/amp meter switched to the VOLT position. Use the rectifier FLT float potentiometer if a re-adjustment is necessary.
4	Hold the Float / EQL momentary switch on the rectifier to EQL for local equalize and measure the equalize voltage from the same test points, as per Step 2. Adjust the EQL voltage from the EQL potentiometer if required. Release the Float / EQL switch.

NOTE: To ensure a proper start-up of the rectifier, the DC circuit breaker must be turned-on before the AC circuit breaker. The opposite sequence might cause the rectifier to shutdown inadvertently and send an RFA (Rectifier Failure Alarm)

V_{float}
V_{equal}

DC *leugo* AC

Step	Action
5	Switch OFF the DC breaker, and increase the float voltage from FLT potentiometer until a High Voltage Shutdown condition appears. To adjust the HVSD threshold, lower the float voltage of the unit and reset it by cycling its AC input breaker. Adjust the HVSD threshold by turning the HVSD potentiometer clockwise to raise it, or counterclockwise to lower it, and repeat this step until the requirement is obtained. Bring the float voltage back to the factory setting or to the system requirements. Switch on the DC breaker, and confirm that the unit operates normally.
6	Turn OFF the AC and DC breakers, set the "sense" DIP switch to the ON position and proceed back to Step 1 for the next rectifier. (Refer to fig. 21)

NOTE: The actual load sharing of the rectifiers should be adjusted after the power system is connected and put into service, as follows:

Verify that all rectifiers are sharing the load in both Float or Equalize Mode by checking that all the rectifiers ammeters read approximately the same current. Should adjustments to the float voltage be required slightly raise the voltage of the rectifier with the lowest current in the float or equalize mode. The FLT potentiometer is very sensitive.

Verify that the sense fuse on the front of the NT6C14G panel is good and properly inserted and that the "sense" DIP switches are properly closed on the front control circuit pack.

NOTE 1: To adjust the HVSD of the rectifiers the rectifier must be in local sensing and the DC circuit breaker OFF. To change from remote sensing to local sensing, open the corresponding sense switch (located on the control PCB) or remove the sensing fuse from the RPM1000C. Close the sense switch or re-insert the sensing fuse after the procedure is completed.

NOTE 2: Difficulty in achieving load sharing among all rectifiers is an indication that one or more rectifiers have open sensing leads.

NOTE 3: The MPR25 rectifier will issue an RFA if its output current is lower than 0.1A.

3. - Power Plant Adjustment and Verification

Factory Settings:

Float voltage:	54.0 V DC
Equalize voltage:	55.5 V DC
High Voltage Shutdown:	56.5 V DC
Low Voltage Alarm:	49.5 V DC
Low Voltage Disconnect:	43.5 V DC

NOTE: The following procedure applies to the basic MFA150 system only. For the equivalent procedure when the RPM1000C option is equipped, refer to NTP167-8001-107.

1. With all rectifiers ON, verify that the digital meter on the door of the NT6C14G panel displays the correct value of float voltage as set on the rectifiers.
2. Turn ON all distribution circuit breakers and confirm that the FA alarm is canceled. Sequentially cycle (OFF and ON) all distribution breakers on the NT6C14G panel and confirm that the FA alarm appears and disappears. Turn all breakers back to OFF.
3. Activate the EQL switch on the NT6C14G panel, confirm that the "EQL" yellow LED next to the switch lights, and that the voltage displayed on the digital meter on the door of the panel corresponds to the equalize voltage set previously on the rectifiers. Release the EQL switch, and confirm that the voltage returns to the float level.
4. Turn the rectifier in position 1 OFF and confirm that the yellow LED "RFA MIN" lights, then turn the unit back on and confirm that the alarm disappears. Repeat the sequence for all rectifiers.

5. If equipped, turn two (2) rectifiers OFF and confirm that the red LED "RFA MAJ" lights. Turn ON one of the rectifiers and confirm that the red LED "RFA MAJ" extinguishes and the yellow LED "RFA MIN" lights. Turn ON the second rectifier, and confirm that the "RFA MIN" LED extinguishes.
6. Set the LVD BYPASS/NORMAL switch to the TEST position. The BYPASS LED should be illuminated.

7. Connect a meter at the test jacks on the control card.

NOTE: See Rectifier Start-up and Verification for voltage limits.

8. Turn the TEST potentiometer slowly counterclockwise and monitor the voltage at the test jacks.
9. Verify the LVA operation. If required adjust the LVA potentiometer.
10. Continue to turn the TEST potentiometer counterclockwise.
11. Verify the LVD operation. If required adjust the LVD potentiometer.
12. Turn the TEST potentiometer clockwise and verify the cancellation of the LVA alarm.
13. Continue to turn the TEST potentiometer clockwise and verify the operation of the LVD LED.
14. The LVD LED should go OFF between the limits specified in the NTP. If not adjust the LVDR potentiometer.
15. Set the LVD BYPASS/NORMAL switch to the NORMAL position.
16. Switch off all the rectifiers and proceed to connect the battery leads to the MFA150 charge busbars. Charge the batteries per the manufacturer's requirements. Ensure that all recommended readings are taken and recorded on the appropriate forms for future reference.

Operation

NT6C14G Control and Distribution Panel

(Standard Control and Alarm Card)

Visual indications

- Single Rectifier Failure	RFA MIN	yellow lamp
- Multiple Rectifier Failure	RFA MAJ	red lamp
- Fuse Failure Alarm	FA	red lamp
- Low Voltage Alarm	LVA	red lamp
- Low Voltage Disconnect	LVD	red lamp
- LVD Test	TEST	red lamp
- Equalize Activated	EQL	yellow lamp

Transmitted Alarms

Refer to Fig. 19 for connections.

- RFA Minor	(1 - Form C contacts)
- RFA Major	(1 - Form C contacts)
- LVA	(1 - Form C contacts)
- LVD	(1 - Form C contacts)
- EQL	(Auxiliary Switch contacts)
- FA	(1 - Form C contacts)

Switches

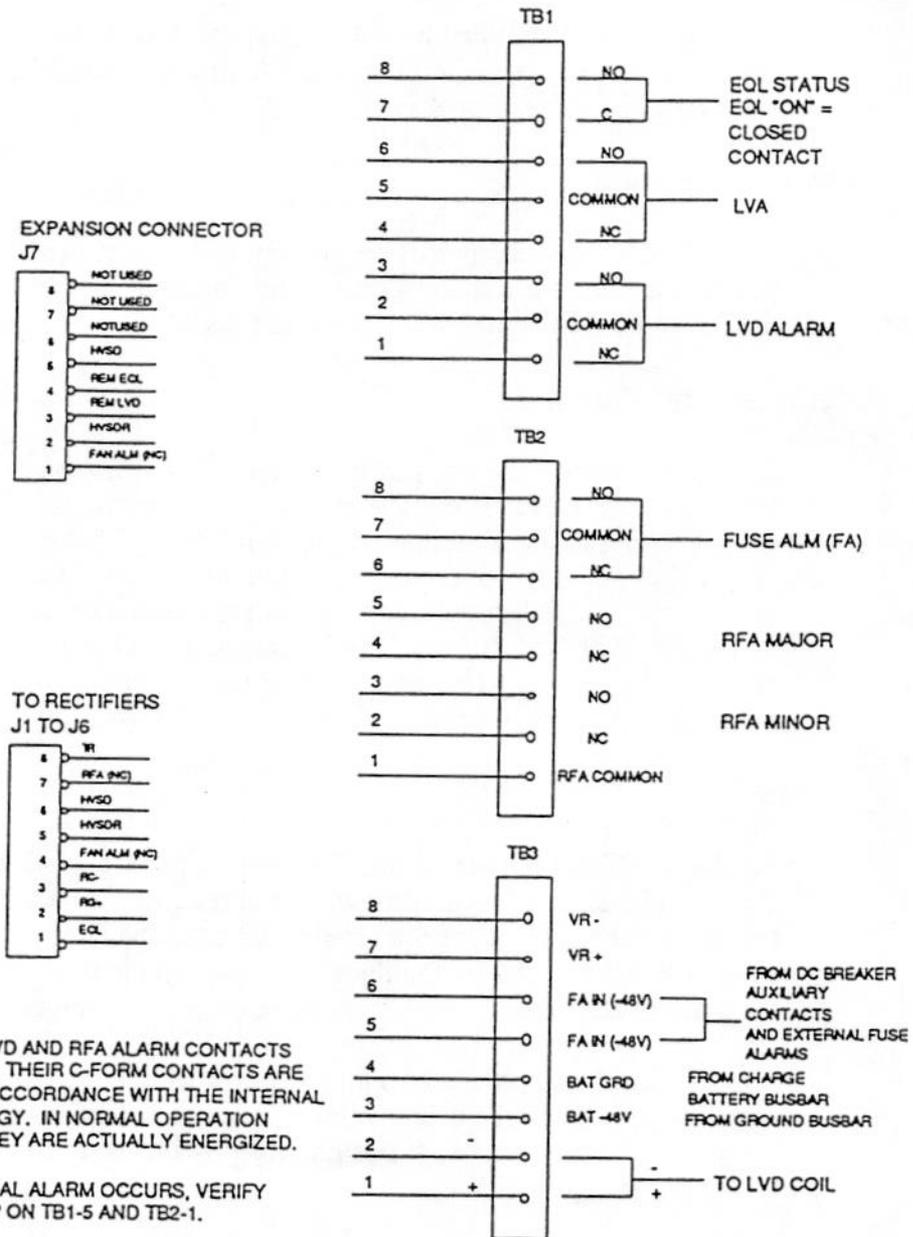
- GLOBAL EQL	Global Equalize
- TEST/BYPASS	This switch inhibits the operation of the low voltage disconnect contactor. It should be used when adjusting the LVD limits, by setting it to the "BYPASS" position.

NT6C14G Control and Distribution Panel E/W RPM1000C

When the NT6C14G panel is equipped with the RPM1000C microprocessor based control/monitor unit, the VOLT/AMP meter is removed since this function is provided by the RPM1000C. Refer to NTP 167-8001-107 for detailed information about the RPM1000C.

This distribution panel is equipped with an LVD contactor and an interface circuit pack which provides power to the LVD contactor, has a status LVD LED and an LVD Normal/Bypass switch. The purpose of this circuit pack is to maintain the contactor closed even with the RPM1000C removed. The Normal/Bypass switch, when placed in the BYPASS position, prevents accidental release of the LVD contactor during maintenance. When the bypass switch is in the NORMAL position it requires a BAT RTN signal from the RPM1000C to be released.

Fig. 19 - Interfacing the standard Control and Alarm card of the Panel



CAUTION

NOTE 1: LVA, LVD AND RFA ALARM CONTACTS ARE FAIL SAFE. THEIR C-FORM CONTACTS ARE DISPLAYED IN ACCORDANCE WITH THE INTERNAL RELAY TOPOLOGY. IN NORMAL OPERATION (NO ALARM), THEY ARE ACTUALLY ENERGIZED.

NOTE 2: IF INITIAL ALARM OCCURS, VERIFY GROUND STRAP ON TB1-5 AND TB2-1.

Auxiliary Fuses

The MFA150 is equipped with 4 auxiliary fuse positions (0-5 A) to be used as required. They are monitored by the FA circuit on the NT6C14G panel, and can accept QFF fuses rated from 0.18 A to 5 A.

Power Distribution

Up to 16 circuit breakers may be provisioned as required from 1 to 50 A DC capacity and installed in the Control and Distribution panel. The total discharge load must however not exceed 150 A.

Batteries and Rectifiers

The battery strings are charged by the rectifiers which sense their voltage, thus the battery float voltage may be maintained constant. One RC fuse protects the -48 V sensing leads of all the rectifiers and the "sense" dip switch (basic system only) allows opening of the individual rectifier sense leads. The battery charge voltage must be set according to the battery manufacturer's requirement as detailed in NTP 167-7011-010 and an equalizing charge can be provided manually by activating the equalize feature or automatically and remotely when the RPM1000C is equipped.

Meters

The basic NT6C14G Alarm and Distribution panel's 3 1/2 digit meter monitors the total plant discharge current while the rectifier ammeters indicate individual charge currents. The controller meter can also display the battery voltage, using a switch located beside the plant meter on the door of the panel. The accuracy of the meter is ± 0.1 V on voltage and ± 1 A on current measurement.

The RPM1000C controller/monitor features its own meter which can sequentially display the actual value of each of the analog channels monitored using the S1 push-button. A flashing display indicates a value in alarm.

Low Voltage Alarm (Basic system only)

When the discharge (or battery) voltage decreases below the predetermined LVA alarm threshold, the LVA red LED lights and an alarm is transmitted to the Office Alarm System.

Rectifier Failure Alarm

Rectifier failures are indicated by the corresponding RFA LED on the Control and Distribution panel and by the local RFA LED on the rectifier. In the presence of a single RFA alarm the yellow RFA MIN LED on the control card of the NT6C14G panel lights. In the presence of multiple (two or more) rectifier failures the red RFA MAJ LED on the control card of the NT6C14G panel lights. Alarm signals are transmitted by the control card to the Office Alarm System.

Low Voltage Disconnect (Optional)

When the battery voltage drops below a preset limit the control circuitry inside the Control and Distribution panel forces the LVD contactor to open thus disconnecting the load from the batteries. The LVD red LED lights and an alarm is transmitted to the Office Alarm System. The LVD monitoring circuit is set to reconnect the LVD contactor automatically, when the battery voltage rises to a preset level, typically 7.0 V above the disconnect threshold. A provision also exists to activate the LVD function remotely via a connector input.

LVD Manual Reconnect option

When this option is provided the LVD's circuit board (NT6C14PA) has been modified as follow:

- a strap stamped as " Manual reconnect jumper " has been added between pin 3 and 9 on the "TB-1" connector.

With this jumper the LVD will not reconnect after disconnectig due to a low voltage condition. To reconnect cycle the "BYPASS" switch to the "BYPASS" position and then to the normal position (Stamped "MANUAL RECONNECT")

Testing procedure:

Step	Action
1	Bring the voltage down below 43.5 V. The LVD contactor should operate and disconnect the load.
2	Bring the voltage back to the normal operating level. The LVD contactor should not reconnect the load.
3	By cycling the LVD "BYPASS" switch to the bypass and back to normal, the load should reconnect.

WARNING

IF THE BYPASS SWITCH IS LEFT IN THE BYPASS POSITION, THE LVD WILL NOT DISCONNECT IF THE BATTERY VOLTAGE GOES BELOW THE DISCONNECTION LEVEL.

MAINTENANCE

IF THE NT6C14PA CIRCUIT CARD NEEDS TO BE REPLACED, THE MANUAL RECONNECT JUMPER SHALL BE REMOVED PRIOR TO THE REMOVAL OF THE CARD.

NT5C06 25/15 A Rectifier (MPR25/25)

Indicated Alarms

- Rectifier Failure Alarm RFA red lamp
- Normal operation ON the RFA lamp changes to green colour.

- Fan Alarm FAN red lamp

Switches

- Float / Equalize EQL (momentary only)

NT5C07 50 A Rectifier (HELIOS Rectifier 50/48)

Indicated Alarms

- Rectifier Failure Alarm	RFA	red lamp
- AC Present	AC ON	green lamp
- High Voltage Shutdown	HVSD	red lamp
- Current Limit	CL	yellow lamp
- Fan Alarm (one fan fail two fans fail)	FAN ALM	red lamp
- Sensing Fuse Open	SEN FAIL	red lamp

Switches

- Float / Equalize	FLT/EQL
- Start-up Delay	ST UP DLY
- Volt / Ammeter	VOLT/AMP
- Slope / Forced Slope Share	SLS/FS

Mid-Trip Circuit Breakers

The power plant may be equipped with Standard trip or Mid trip circuit breakers. (See IS6C28CA, Sheet A3, Note 305).

The Standard trip circuit breakers generate a FA alarm when the circuit breaker is OPEN (switched OFF), manually or due to overload, and the handle of the breaker moves from the top position to bottom.

The Mid trip circuit breakers generate a FA alarm only if they are tripped due to overload condition and the circuit breaker handle will stay in the middle position. Manually operating the handle will not produce a FA.

Maintenance

Routine Maintenance

The following table indicates the general maintenance procedures and the recommended intervals at which they should be performed to ensure proper system operation.

Routine maintenance procedures

Procedure	Interval
Clean ventilation openings	1 year
Tighten all electrical connections	1 year
Check alarms and alarm thresholds	6 months, or upon occurrence of alarms
Check rectifier float and equalize voltage settings	6 months

The recommended maintenance and adjustment procedures of the rectifiers are described in NTP 169-2071-500 (NT5C06 - 25/15 A) and NTP 169-2071-501 (NT5C07 - 50 A) provided with each unit. These manuals should be referred to for more detailed information.

The following tools and test equipment are required to adjust equipment in the power plant:

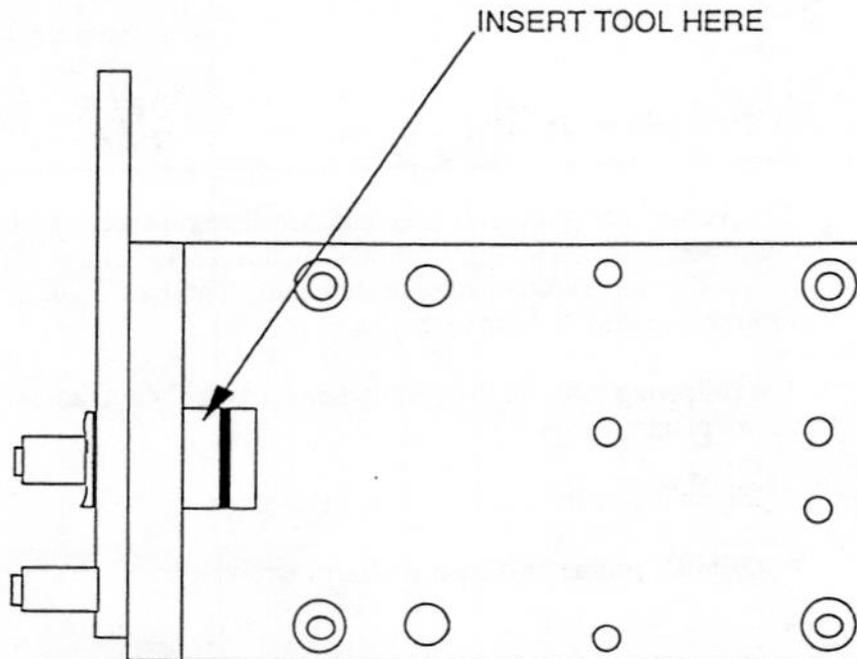
- Screwdriver Bourns No. 60, or equivalent.
- Digital Voltmeter, Fluke 8000A or equivalent.

Troubleshooting

The following table indicates possible reasons for the majority of fault conditions. Blown fuses and tripped circuit breakers should always be investigated before utilizing the following table. Consult the appropriate Rectifier and/or Controller NTP for more detailed information.

WARNING: Precautions shall be taken to assure delivery of the load current. When working on the control card inside the Control and Distribution panel the Low Voltage Disconnect contactor should be prevented from tripping. This can be done by inserting an electrically isolated tool 1/4 in. (3 mm) wide (preferably plastic) in the small side opening of the contactor assembly to lock it closed (see Fig. 20). A QFF3A dummy fuse or any taped QFF fuse can be used for this operation.

Fig. 20 - Low Voltage Disconnect Contactor, side view



Fault Diagnosis

FAULT SYMPTOM	POSSIBLE CAUSES
No output current:	AC supply open or AC fuse open Open DC circuit breaker Faulty connection between rectifier and power plant Low voltage disconnect open
Incorrect indication of output current:	Incorrect meter calibration Shunt leads connection loose
Low Discharge voltage	Verify float voltage Discharge load greater than rectifier capacity
Low Float voltage	Faulty rectifier(s) Shorted battery cell Prolonged power failure Verify Float adjustment
High Discharge voltage	Faulty rectifier(s) Verify Float/Equalize adjustment
High Float voltage	Faulty rectifier Verify Float/Equalize adjustment
Failure to generate alarms during alarm conditions	Verify connections between the controller, rectifiers and Interconnection and Distribution unit
Failure to generate RFA alarm under appropriate conditions	Faulty rectifier Faulty wiring Faulty RFA LED
Failure to generate FA	Faulty wiring (Alarm wire not connected on "NC" pin of breaker, BAT strap missing on 'C' pin Faulty fuse or circuit breaker Faulty FA LED

LVA lamp lit or extended LV alarm	See low discharge voltage Wrong LVA threshold setting
FA lamp lit or extended FA alarm	Blown fuse or Tripped circuit breaker Alarm wire connected on wrong pin "NO" on circuit breaker
MAJ RFA lamp lit or extended MAJ RFA alarm	Two or more rectifiers failed
MIN RFA lamp lit or MIN RFA alarm extended	One rectifier failed
EQL lamp lit or extended EQL signal	The equalize has been activated
Rectifiers not load sharing	Incorrect float adjustment on one of the rectifiers Sense fuse blown or DIP switch open (basic system).
LVD contactor does not reconnect load	Verify battery voltage 7.0 V above disconnect threshold Verify "F1" fuse on control card Faulty control and alarm card Faulty contactor

Addition / Replacement Procedures

Addition or Replacement of an MPR25/MPR15 Rectifier

MPR25/MPR15 rectifiers may be added in service without power interruption to the load (hot insert).

To add one or more rectifiers, proceed as detailed previously in Rectifier Installation Procedures, and continue with step 9.

To replace a rectifier proceed as follows:

Step	Action
1	Notify the Alarm center of incoming alarms during this procedure.
2	Turn 'OFF' the AC and DC circuit breakers on the unit to be replaced.
3	Flip the "sense" DIP switch associated to this rectifier to 'OFF'. It is located on the front of the control circuit pack, and accessible with the door closed, of the NT6C14G Control and Distribution panel or remove the "sense" F1 fuse (RPM1000C).
4	Remove the clamping bar by loosening the 2 screws.
5	Slide the rectifier out of the shelf carefully, and use the packing carton from the new rectifier for storage and or shipping.
NOTE:	At this point if only the cooling fan is defective, it may be replaced according to the replacement procedure given in NTP 169-2071-500.
6	Make certain that the new rectifier's circuit breakers are 'OFF' (down position), and slide the unit firmly into the shelf, resting it on top of the stored blank panel.
7	Replace the clamping bar.
8	Flip the associated "sense" DIP switch back to 'ON'.
9	Turn the DC circuit breaker into the 'ON' (up) position, then the AC breaker in the 'ON' (up) position to power the rectifier.

10	Verify that the replacement rectifier is sharing the load by observing its ammeter. It should display approximately the same value as the ammeter on the other rectifiers. If not, adjust its Float and Equalize voltage as detailed in the Rectifier Start-up and Verification procedure.
11	Verify that the sense leads are firmly connected inside the NT6C14G panel, that the sense fuse at the front of the NT6C14G Control and Distribution panel is firmly and properly inserted and that the "sense" DIP switches are properly closed on the control circuit pack. Difficulty in achieving load sharing amongst all rectifiers is an indication that one or more rectifiers have their sense leads open.
12	Notify Alarm Center of end of procedure.

Addition or Replacement of an HELIOS Rectifier 50/48

The NT5C07 rectifier can be added in service without power interruption to the load (hot insert).

To replace a rectifier proceed as follows:

Step	Action
1	Switch OFF the AC and DC circuit breaker of the rectifier to be replaced.
2	Open the clamping bar which holds the rectifier in position by loosening the captive screw.
3	Verify that the AC and DC circuit breakers of the new rectifier are in the OFF position and insert the new rectifier in the power shelf.
4	Close the holding bar and tighten the captive screws.
5	Switch ON the AC circuit breaker. Set the rectifier's VOLT/AMP switch to the VOLT position.
6	Verify that the voltage reading on the new rectifier's meter is equal to the other rectifiers. If it is not, adjust it by the FLT potentiometer. Refer to NTP 167-2071-501 for final adjustments.

Addition or Replacement of a Power Shelf

WARNING: The power plant should be upgraded or repaired by qualified personnel in accordance with the local electrical codes.

Input voltage to the rectifier and the power shelf has a dangerous level. If the Power Shelf is installed or replaced on an operational MFA150, precautions must be taken to avoid electrical safety hazards, damage or interruption to the system, due to short circuits. Use a meter to monitor all voltages and clearly identify the locations of all connections before proceeding with the work.

Improper wiring may cause personal injury and equipment damage.

The following procedure explains how to replace an existing or add a new Power Shelf on a MFA150 Power System.

For additions only start at step 14. In this case new AC, DC and control cabling must be installed, whereas the same may be reused for replacements.

a) Removal of Existing Shelf

NOTE: Replacement of a shelf involves turning off all rectifiers in it. Always ensure that the remaining rectifiers in the power plant have sufficient capacity to carry the full office load, or that batteries of sufficient capacity are connected. Rectifiers may also be temporarily relocated to the other power shelf if it is equipped, and space is available.

Step	Action
1	Notify the Alarm Center of incoming alarms during this procedure.
2	Turn OFF the DC and AC circuit breakers on each rectifier mounted in the power shelf.

3	Flip the "sense" DIP switches associated with these rectifiers to 'OFF', on the front left hand side of the NT6C14G panel or remove the 'sense' fuse on the RPM1000C.
4	Release the clamping bar by loosening the captive screws on the rectifiers.
5	Pull out the rectifiers and temporarily store them in a safe location.
6	Turn 'OFF' the AC breaker that feeds the shelf in the main AC service panel.
7	Remove the top cover of the NT6C14G panel, and then disconnect and insulate both DC leads (-48 V BAT and BAT RTN) coming from the shelf to be replaced.
8	Remove both the AC and DC area metal faceplates and both red insulator plates, and temporarily store them.
9	Proceeding one at a time, carefully unscrew the L1 and L2 wires in the AC area (left side of the shelf facing front), as well as the chassis ground wire, and insulate the leads with electrical tape.
10	Remove the AC conduit fitting on the shelf and pull the cables completely outside the shelf.
11	Proceeding one at a time, carefully unscrew the BAT and BAT GND DC wires in the DC area (right side of the shelf facing front) completely out of the shelf.
12	Unplug the rectifier control cables on connectors J1, J2, J3 (for top shelf) or J4, J5, J6 (for bottom shelf) located on the alarm and control card in the NT6C14G panel, and pull them out. It will be necessary to cut and later reinstall the tie-raps that hold them in place. Connections J1, J2, J3.... correspond to JE1, JE2, JE3, JE4, JE5 and JE6 on the RPM1000C.
NOTE:	Connectors J1 and J4 correspond to the right rectifier position in the shelf, J2 and J5, the center, and J3 and J6 the left one.
13	Remove the mounting screws which fasten the shelf to the relay rack and pull out the power shelf. Reuse the packing material provided with the new shelf.

b) Installation of a New Power Shelf

Step	Action
14	Install the new power shelf in the space vacated by the removed one, or directly below the existing one in the case of an addition, and screw it to the framework. Make sure that one of the screws is equipped with a star washer to ensure a proper chassis ground continuity.
15	Reconnect the new shelf and reinstall the rectifiers by reversing steps 1 to 12. New AC conduit and cabling must be installed at this time as well as BAT-Red and BAT RTN-Black for output to the charge bars (refer to IS6C28CA). Control cables are supplied with the new shelf. A detailed procedure for connecting AC to the power shelf is given in the initial installation procedure.
16	Verify that the rectifiers are working properly by checking their ammeter. They should all display approximately the same value, if not adjust the float and equalize levels as required, as detailed previously in the initial installation procedure.
17	Notify Alarm Center of end of procedure.

Addition or Replacement of a Battery Tray and String

a) Removal of old string/shelf

NOTE: This procedure implies that all or part of the batteries will be momentarily taken out of service. This work should then be completed during off or reduced traffic hours, or with a diesel generator available to ensure no loss of service during an eventual AC outage. If more than one string / tray is to be replaced, proceed one string at a time, and do not disconnect the next string before the previous one is reconnected.

outage = απογών

Step	Action
1	Notify Alarm Center of incoming alarms during this procedure.
2	Open the NT6C14G front door and top cover.
3	Locate, disconnect and insulate the 2 charge leads coming from the battery string to be replaced to the busbar terminals on the right side of their tray.
4	Disconnect the wiring harness from the individual battery cells, and insulate each exposed terminal.
5	If required, the wiring harness, the battery tray and the charge cables can now be removed and replaced.
6	Dispose of the removed batteries in accordance with local environmental legislation.

b) Installation of new string / shelf

Step	Action
7	Install the new battery tray in the space vacated by the one just removed. If a new tray is to be installed, leave a gap of 1 in. (50 Ah batteries) or 4 in. (100 Ah batteries) between the bottom of the equipment above and the top of the mounting bracket of the new battery shelf.
8	Install the new batteries in the tray, and use a new or reuse the old harness provided to interconnect them.
9	Complete the initial charge of this new battery string according to the battery manufacturer's specifications using an external power supply connected to the leads going to the busbar terminals on the side of the tray.
10	If required, install 2 new battery charge leads from the tray busbar terminals to the charge busbars inside the NT6C14GA panel. Recommended size is #0 AWG, red for -48 V BAT and black for BAT RTN.
11	Close the front door and reinstall the top cover on the NT6C14GA panel.
12	Notify Alarm Center of end of procedure.

Addition or Replacement of a Distribution Circuit Breaker

For new installations, start at step 5. For replacements, proceed from step 1 as follows:

a) Removal of an old circuit breaker.

Step	Action
1	Notify the Alarm Center of incoming alarms during this procedure.
2	Turn the circuit breaker to be replaced to "OFF" (down).
3	Open the front door and remove the top cover of the NT6C14G panel.
4	Carefully remove its alarm lead (red #22 AWG wire) from its bottom NC contact, and unscrew it from the busbar and the red insulating support. Also remove the short #22 AWG red strap connecting the top "Common" pin to the BAT DSCH busbar.

b) Installation of a new circuit breaker

Step	Action
NOTE:	Make sure that the new breaker is "OFF" before installing it.
5	Install the new circuit breaker in place of the removed unit, or in the next available position at the right of the last breaker equipped.
6	Connect its input to the busbar, and install the output kit on the red insulating support, similar to the ones already installed. The red #22 AWG strap going to the "Common" pin should be connected on the mounting screw on the BAT DSCH busbar.
7	Connect (or reconnect) the alarm lead to the bottom NC pin on the back of the circuit breaker, using the next connector available on the red daisy chain.

8	Snap off the blank cover on the inside of the door for each breaker installed in step 5 and stamp the circuit breaker rating and designation on the inside of the door.
9	Before connecting the load, make sure that the alarm is transmitted correctly by cycling the circuit breaker to 'ON' and 'OFF' a few times.
10	Close the front door and reinstall the top cover.
11	Notify Alarm Center of end of procedure.

Replacement of the RPM1000C

Refer to NTP167-8001-107

Replacement of the NT6C14PF Alarm and Control Card in the NT6C14G Panel

WARNING: Precautions shall be taken to assure delivery of the load current. When working on the control card inside the Control and Distribution panel the Low Voltage Disconnect contactor should be prevented from tripping. This can be done by inserting an electrically insulated tool 1/4 in. (3 mm) wide (preferably plastic) in the small side opening of the contactor assembly to lock it closed (see Fig. 20). A QFF3A dummy fuse or any taped QFF fuse can be used for this operation.

Step	Action
1	Notify the Alarm Center of incoming alarms during this procedure.
2	If possible use the "TEST" mode to record the existing alarm settings on the power plant.
3	Remove the top cover and open the front door of the NT6C14G panel.
4	Insert an electrically insulated tool in the LVD contactor opening or install a #00 bypass strap, as described in the warning above.

Note:	IF THE NT6C14PF CIRCUIT CARD NEEDS TO BE REPLACED, THE MANUAL RECONNECT JUMPER SHALL BE REMOVED PRIOR TO THE REMOVAL OF THE CARD.
5	Remove the "SENSE" fuse on the door of the NT6C14G panel, and open the connector going to the Alarm and Control card.
6	Disconnect and insulate the red lead coming from TB3-4 on the battery (-) charge busbar.
7	Remove and tag the power leads on the Alarm and Control card on TB3-3 and 4, as well as all other alarm and control leads on terminals TB1, TB2 and TB3.
8	Unplug the rectifier and power plant alarm cable assemblies from connectors J1 to J7.
9	Remove the existing Control and Alarm card, by removing the four (4) mounting screws.
10	Reinstall the new card in replacement of the old one.
11	Reconnect the cables by reversing steps 6, 7 and 8.
12	Test and adjust as required, the alarm and control thresholds as described in the "Power Plant Adjustment and Verification" section of the "Initial Installation" procedure.
13	Reinsert the "SENSE" fuse, and close the connector.
14	Remove the insulated tool or the bypass strap from the LVD contactor.
15	Close the front door and replace the top cover.
16	Notify the Alarm Center of end of procedure.

Optional Low Voltage Disconnect Contactor Replacement Procedure

Step	Action
1	Notify Alarm Center of incoming alarms during this procedure.
2	Open the door and remove the top cover of the NT6C14GA panel.
3	Install a #0 AWG strap to bridge out the contactor from the negative charge busbar to the negative discharge busbar. The gauge of this strap may be reduced according to the discharge load.
4	Unplug all connectors on the coil of the contactor.
5	Remove the busbar and mounting bolts and remove the contactor assembly itself.
6	Reinstall the new contactor by reversing steps 2 to 5.
7	Notify Alarm Center of end of procedure.

Substitution of Circuit Packs NT6C14PF + PG

Information contained within is relevant to substitution of the NT6C14PC by NT6C14PF, and NT6C14PD by NT6C14PG circuit pack.

The NT6C14PF circuit is form and fit equivalent to NT6C14PC with some additional interface connectors required for other applications. The NT6C14PG is equivalent in form to NT6C14PD but enhanced for field calibration.

The MFA150 power system code is now renamed as NT6C28(X) in which the specific interconnection and distribution panel NT6C14G(X) is equipped.

NT6C14PF Control Circuit Pack

All the installation, operational and verification procedures described in this manual for an NT6C14G controller equipped with an NT6C14PC are applicable to a controller equipped with an NT6C14PF.

NT6C14PG Meter Display Circuit Pack

The NT6C14PG is an upgrade of the NT6C14PD and can be calibrated in the field. Follow the instructions given in "Meter Verification" and "Replace the NT6C14PG Meter Display Pack" sections.

Meter Verification

The meter is factory set to measure the correct voltage and current of the power system. It is located behind the door of the NT6C14G(x) control and distribution panel.

When the meter requires to be calibrated, proceed as follows:

Step	Action
1	Set the VOLT/AMPS switch to AMPS position.
2	Open the front door of the NT6C14G(x) panel. Locate the potentiometer R34 (left of display) and potentiometer R30 (right of the display).
3	With a digital meter measure the voltage across the shunt (located inside the NT6C14G(x) panel at the point where the brown and yellow wires are connected to NT6C14PG (E1 & E2 terminals).
4	Multiply the measured voltage (millivolts) across the shunt by 5 (one millivolt is equal 5 amperes) to find how much current the meter should read.

5	Verify the meter reading. If the reading is within $\pm 1\%$ of what measured in step #4, proceed to next step.
6	To adjust the meter reading, turn potentiometer R30 clockwise (to increase) or counterclockwise (to decrease).
NOTE:	Readjustment of the R30 will affect the accuracy of the voltage reading.

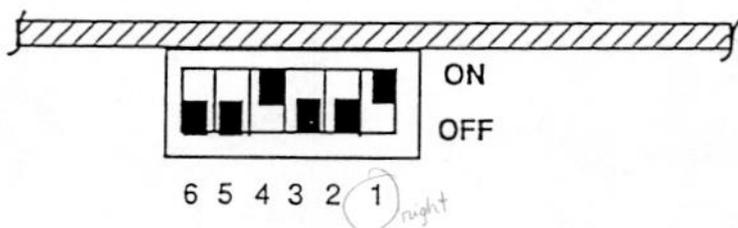
Replacement of the NT6C14PG Meter Display Circuit Pack

To install the new NT6C14PG pack, proceed as follows:

Step	Action
1.	Open the front door of the NT6C14G(x) panel.
2.	Locate the NT6C14PD circuit pack. It is installed behind the door and is held in position with 4 screws.
CAUTION:	Proceed to following steps with caution. The power system is live and the wires to be cut and spliced carry power. Use insulated tools and cut and insulate one wire at the time. The possibility of replacing this circuit pack in the field is very remote, but if it has to be done all safety precautions should be taken.
3.	Cut the brown, yellow, black and red color wires connected to terminals E1, E2, E3 and E4 approximately 4 inches long and place electrical insulating tape over each individual wire on the side going inside the NT6C14G(x) panel.
NOTE:	When the new circuit pack is not equipped with wires at terminal E1, E2, E3 and E4, cut the wires of the old circuit pack half (0.5) inch long and solder them on the new circuit pack.
4.	Remove 4 screws that hold the circuit pack. Remove the nut that holds the VOLT/AMPS switch and remove the circuit pack.
5.	Install the new circuit pack. Cut the brown, yellow, black, and red wires approximately 6 inches long from the circuit pack.

6.	Strip the insulation at the end of both brown wires and splice them together. Put electrical tape over the splice to protect it from making contact with the chassis.
7.	Strip the insulation at the end of both yellow wires and splice them together. Put electrical tape over the splice to protect it from making contact with the chassis.
8.	Strip the insulation at the end of both black wires and splice them together. Put electrical tape over the splice to protect it from making contact with the chassis.
9.	Strip the insulation at the end of both red wires and splice them together. Put electrical tape over the splice to protect it from making contact with the chassis.
10.	Verify the position of the S3 switches. Switches in position 1 and 4 must be ON and switches in position 2,3,5 and 6 must be OFF (refer to Fig. 21).
11.	Calibrate the meter. See "Meter Verification".

Fig. 21 - S3 switch on Meter Display Circuit Pack, NT6C14PG



Abbreviations

ACEG	AC Electrical Ground
AD	Assembly Drawing
BAT RTN	Battery Return
EQL	Equalize
ESD	Electrostatic Discharge
FA	Fuse / Circuit Breaker / (open) Failure Alarm
HVSD	High Voltage Shutdown
HVSDR	High Voltage Shutdown Restart
IS	Interconnect Schematic
LED	Light Emitting Diode
LVA	Low Voltage Alarm
LVD	Low Voltage Disconnect
LVDR	Low Voltage Disconnect Reconnect
MFA	Modular Front Access
MPR	Modular Power Rectifier
PLT	Plant
RFA	Rectifier Fail Alarm
REQ	Remote Equalize
RPM	Remote Power Monitor
TR	Temporary Release
WD	Wiring Diagram

References

For additional information on ordering, assembly and installation, wiring, maintenance and troubleshooting of the plant and the common equipment, consult the following documents:

MS6C28	Modular Structure
AD6C28CA	Assembly and Installation
IS6C28CA	Interconnect Schematic
WD6C14G(X)	Wiring Diagram of Control and Distribution unit
AD5C10	Assembly of Power Shelf for MPR25/15 rectifier
AD5C12	Assembly of Power Shelf for NT5C07-50 Rectifier

Associated Documents

NTP 169-2071-500	NT5C06 Switch Mode Rectifier
NTP 169-2071-501	NT5C07 Switch Mode Rectifier
NTP 167-8001-107	RPM1000C Controller / Monitor
NTP 167-7011-010	Power Plant, Rectifier and Controller Voltage Level Limits

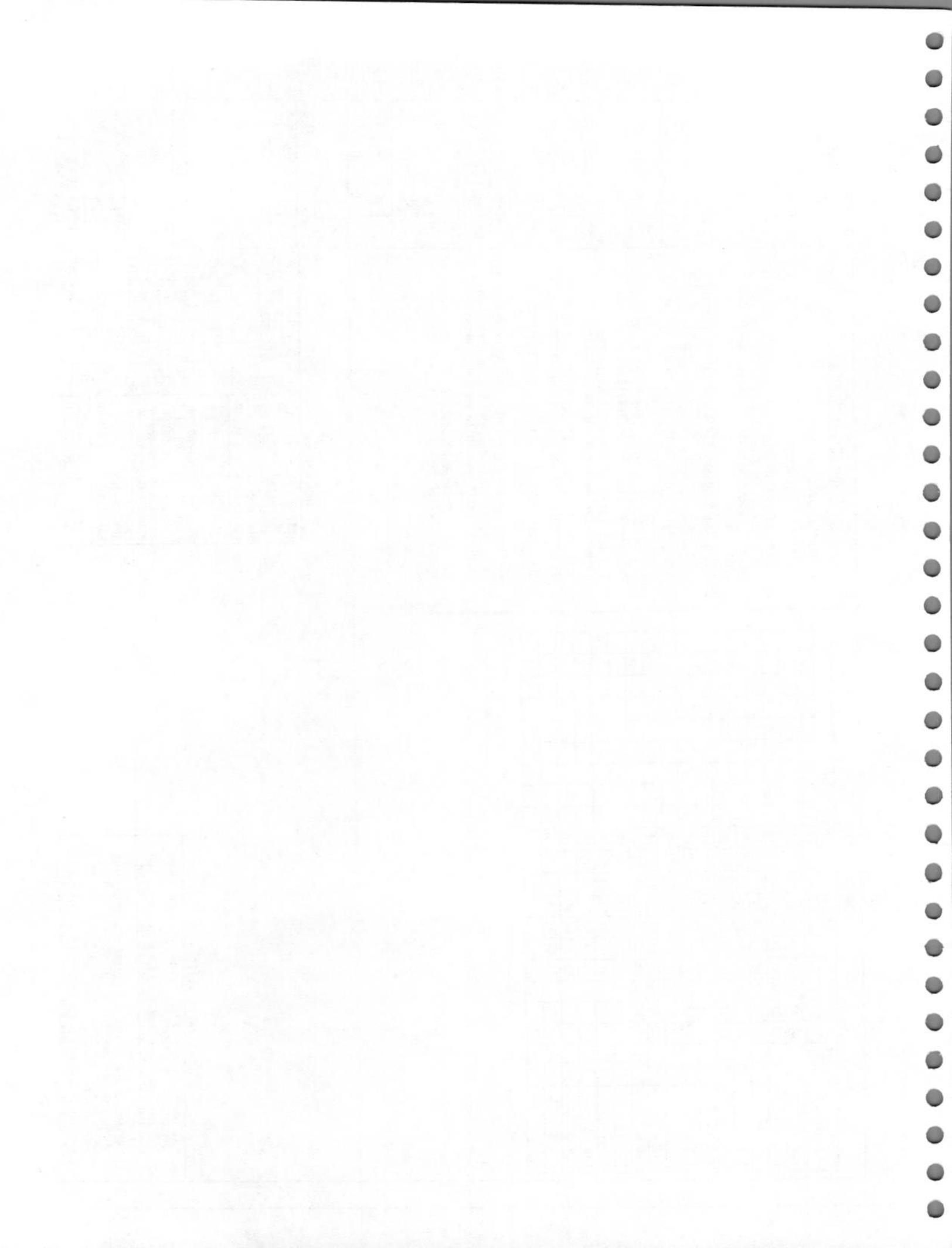
Schematics

AD6C28CA

IS6C28CA

WD6C14GA

WD6C14GC



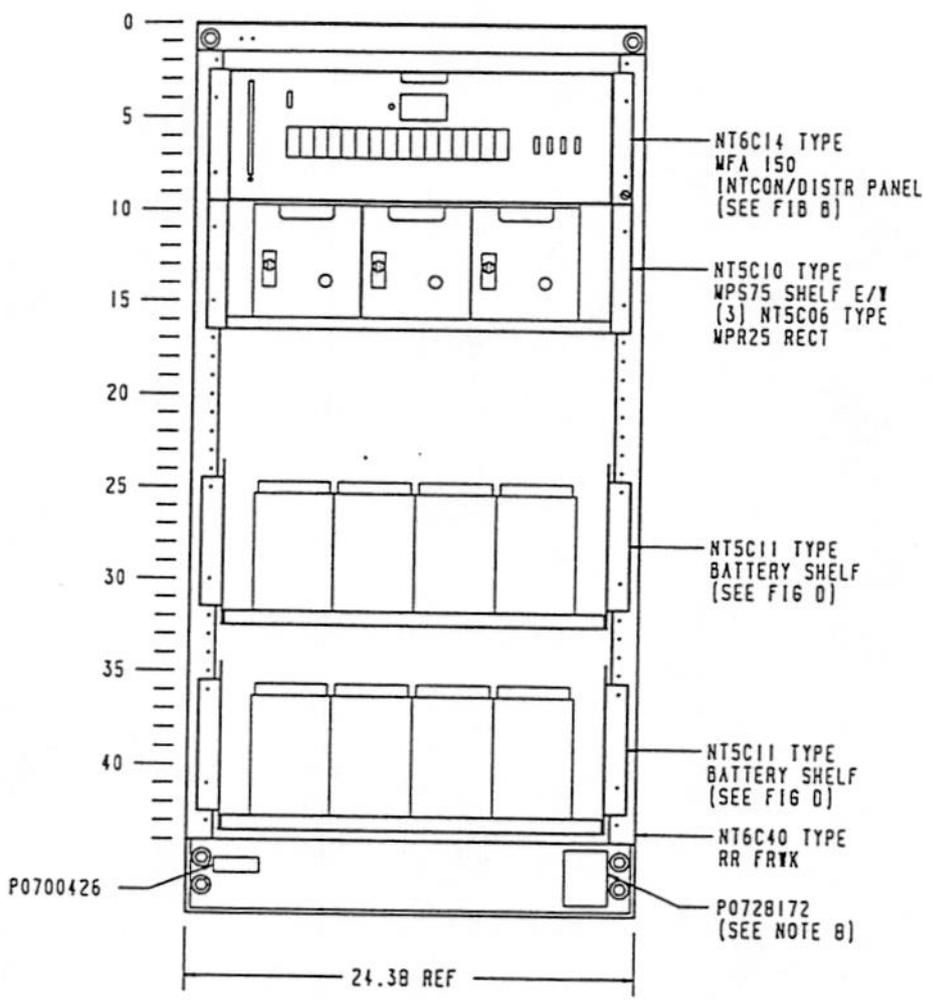
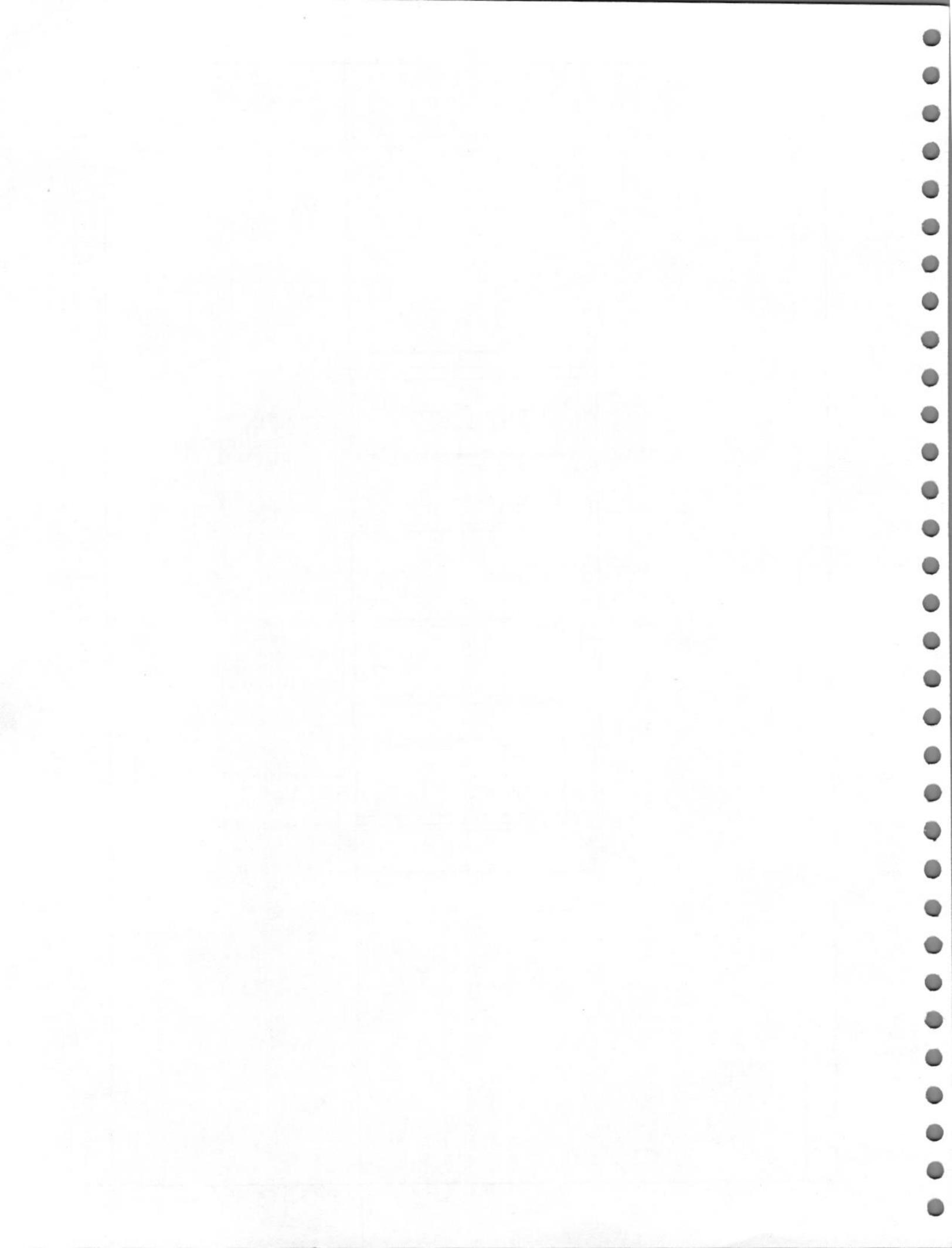


FIG 1
TYPICAL POWER PLANT
48.00 INCH HIGH RELAY RACK



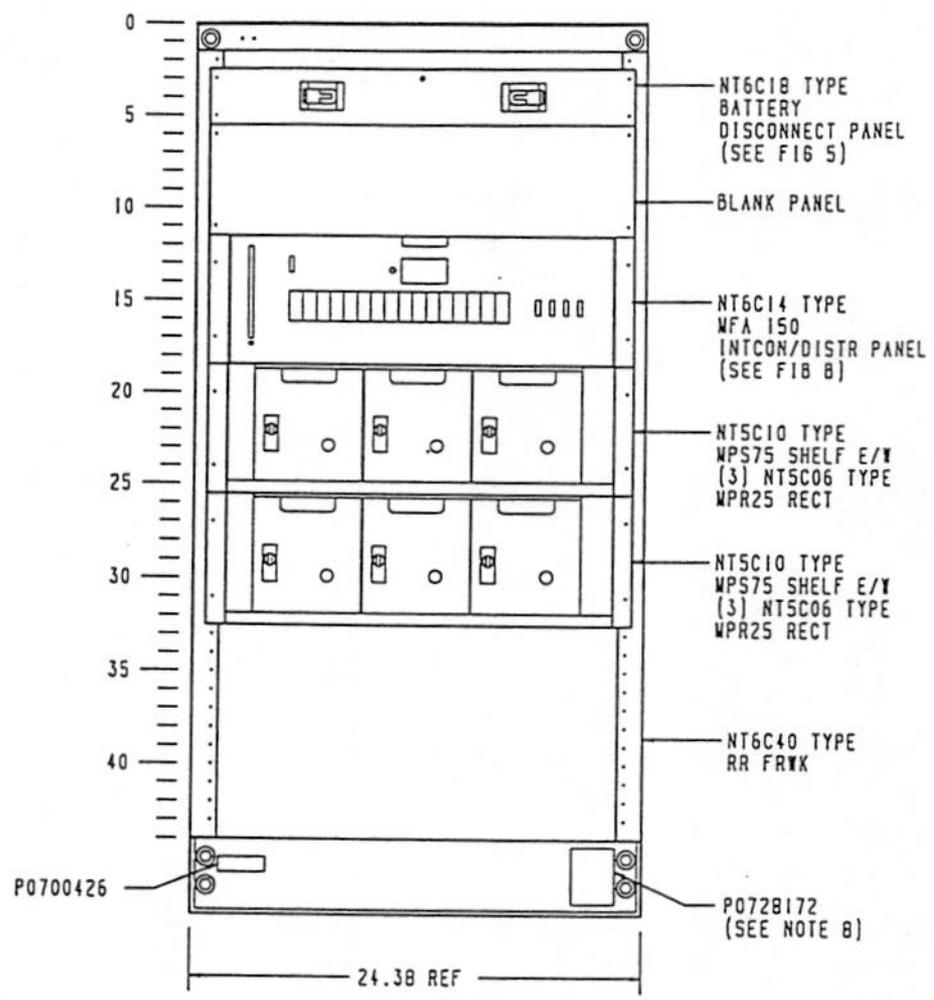
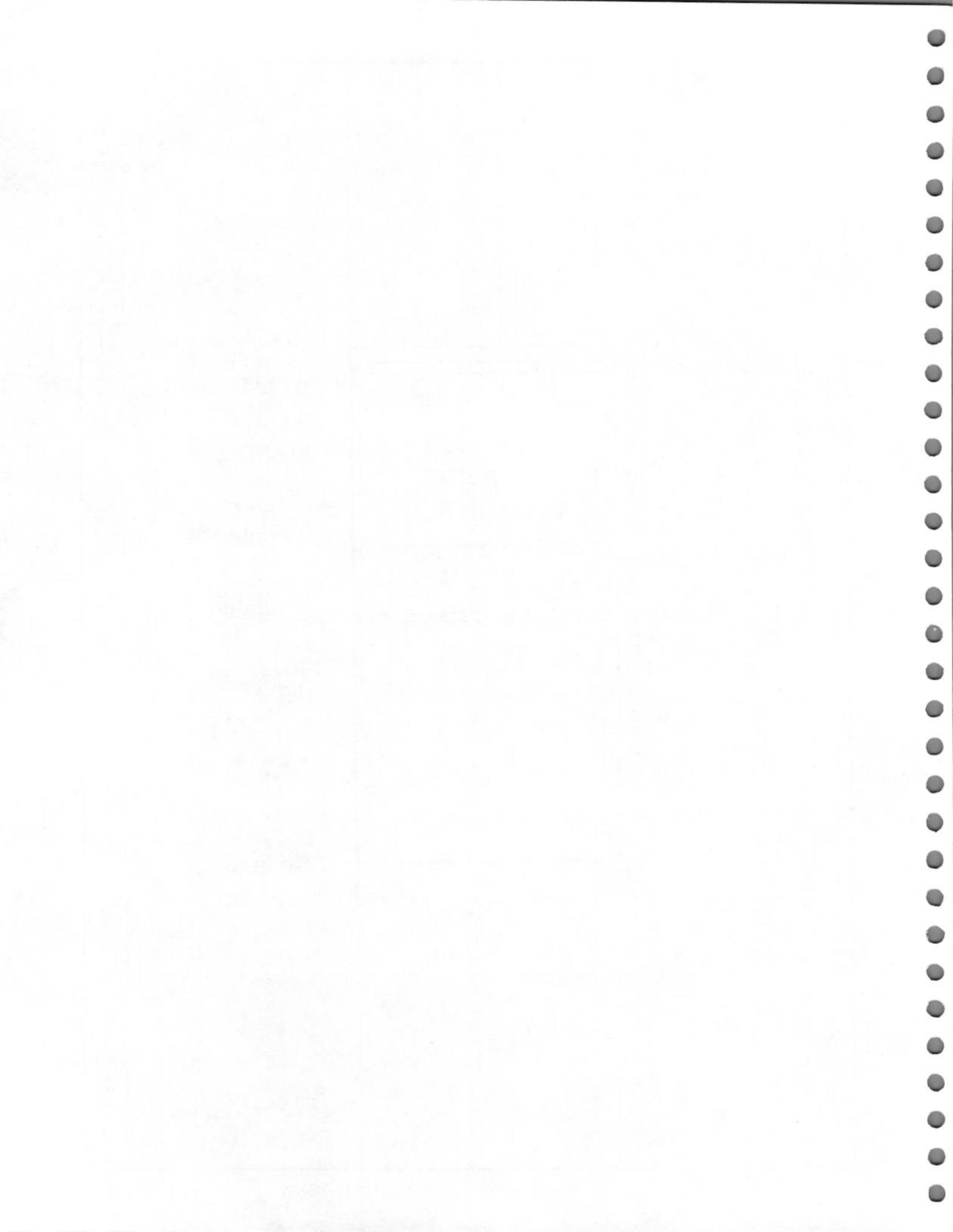


FIG 1A
TYPICAL POWER PLANT
48.00 INCH HIGH RELAY RACK



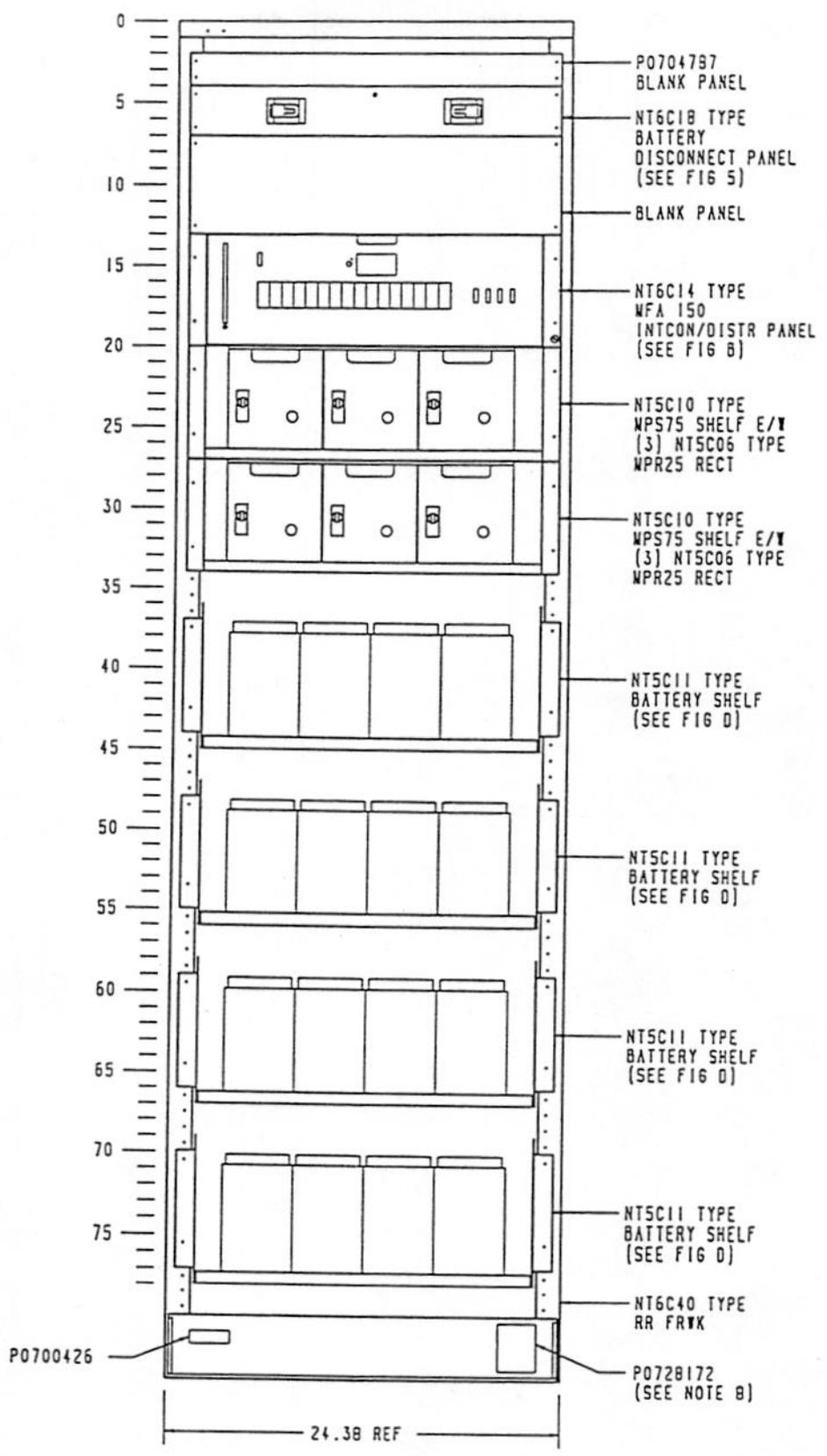
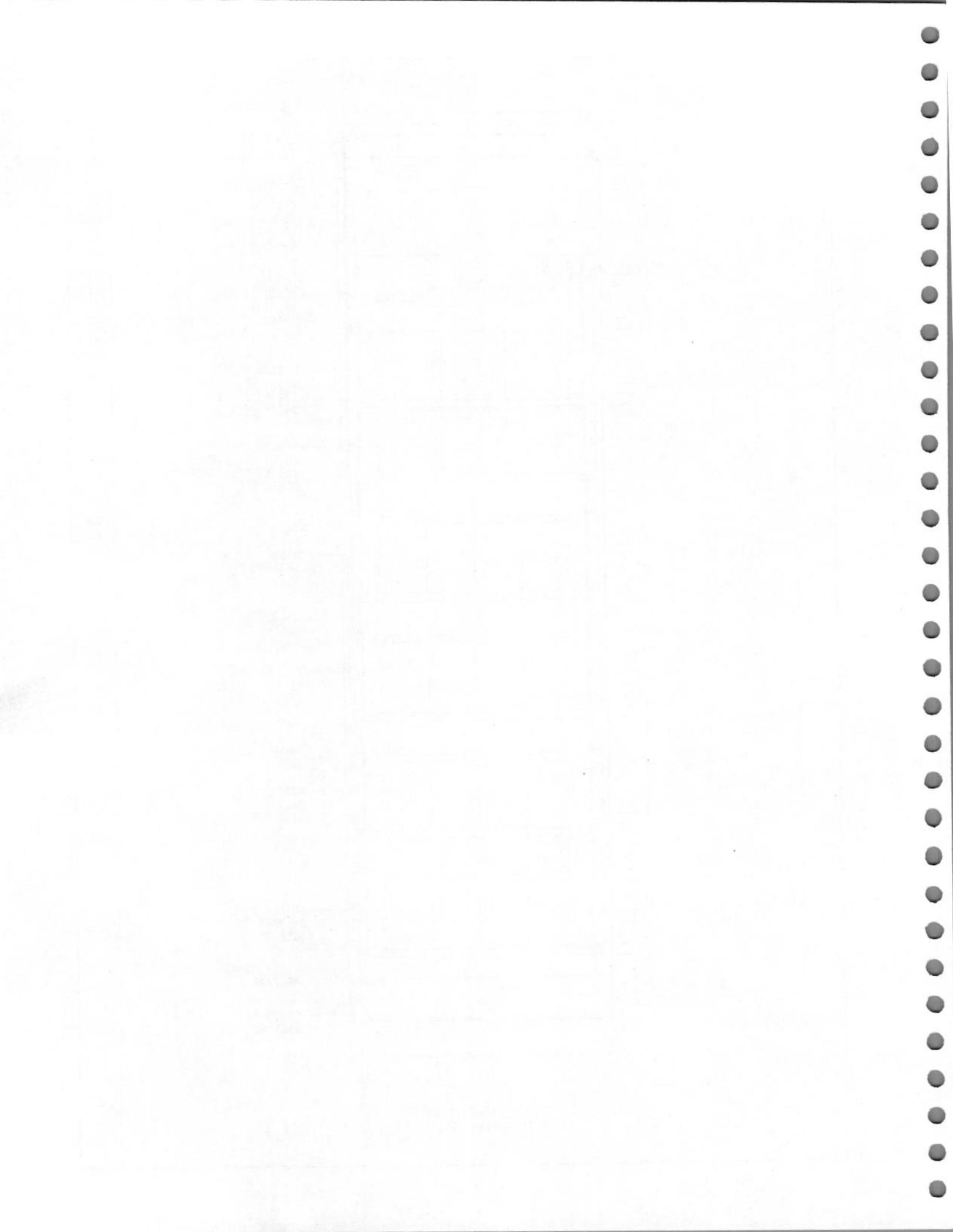


FIG 2
TYPICAL POWER PLANT
84.00 INCH HIGH RELAY RACK



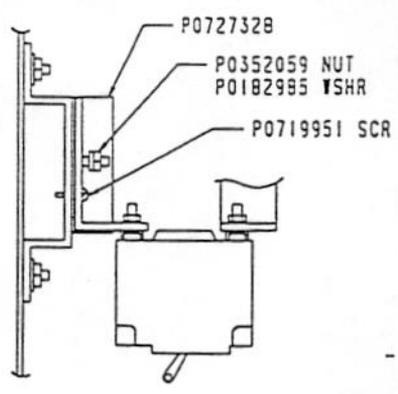


FIG C
METHOD OF ASSEMBLING
CIRCUIT BREAKER KIT
(A & M)

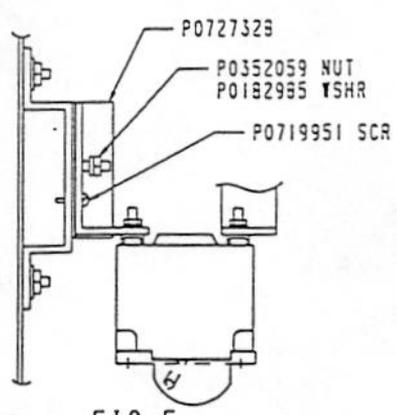
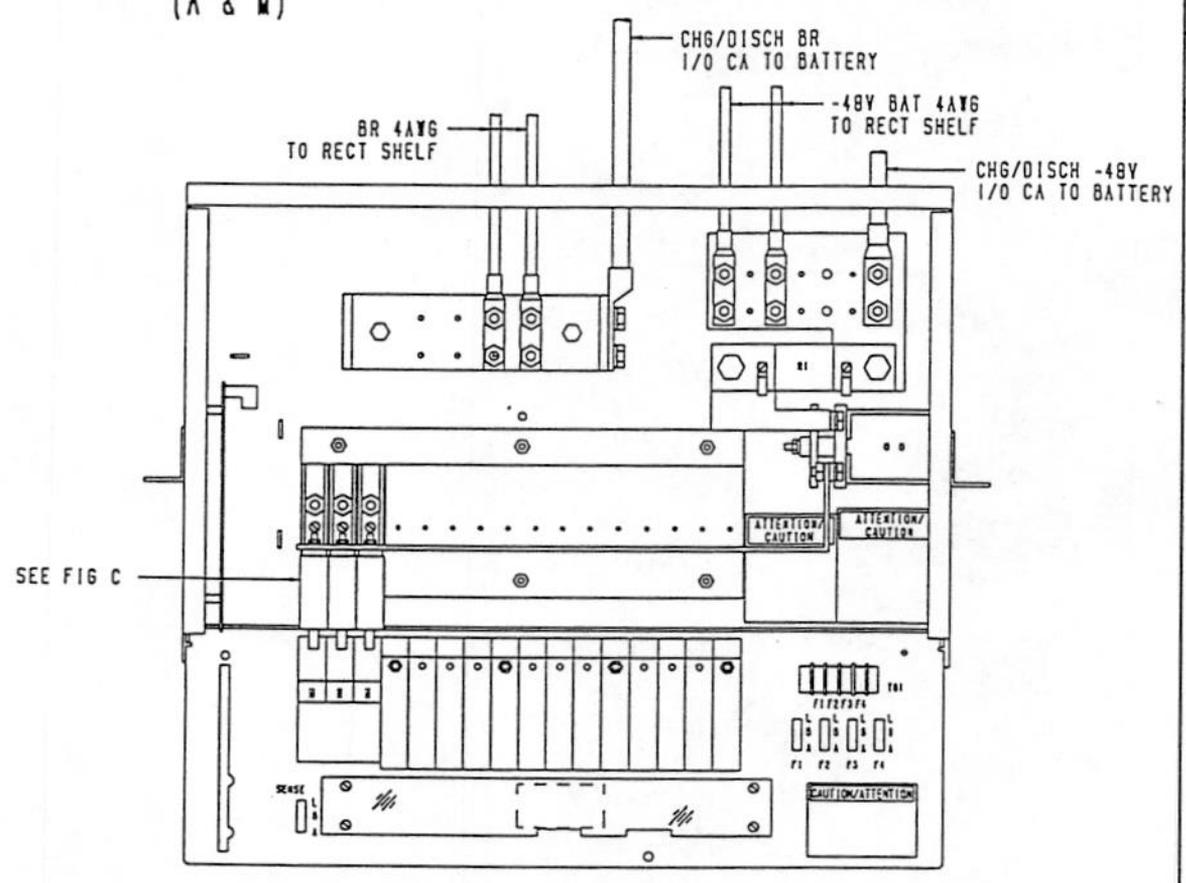


FIG E
METHOD OF ASSEMBLING
CIRCUIT BREAKER KIT WITH GUARD



TOP VIEW
WITH COVER OFF AND DOOR OPEN

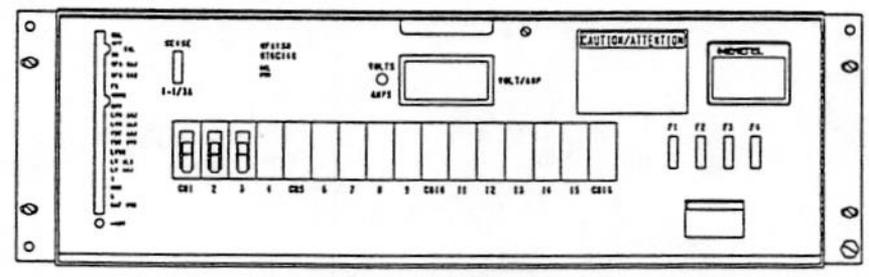
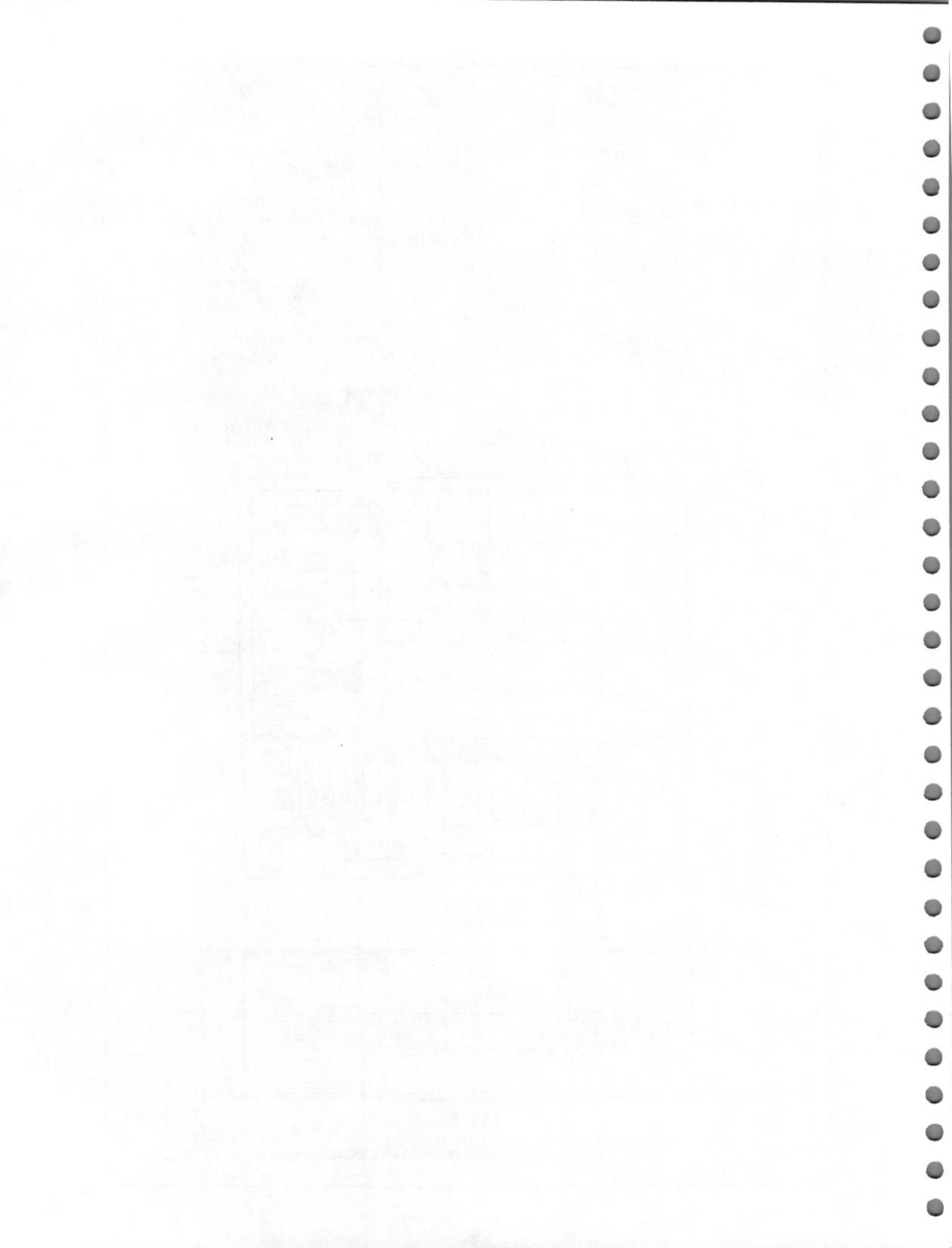
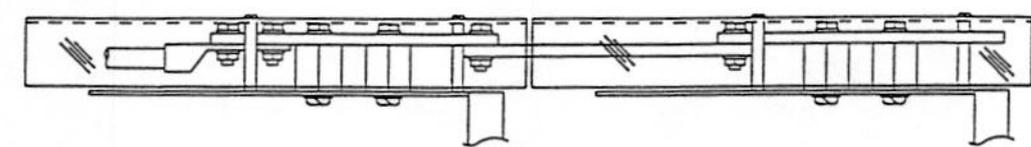
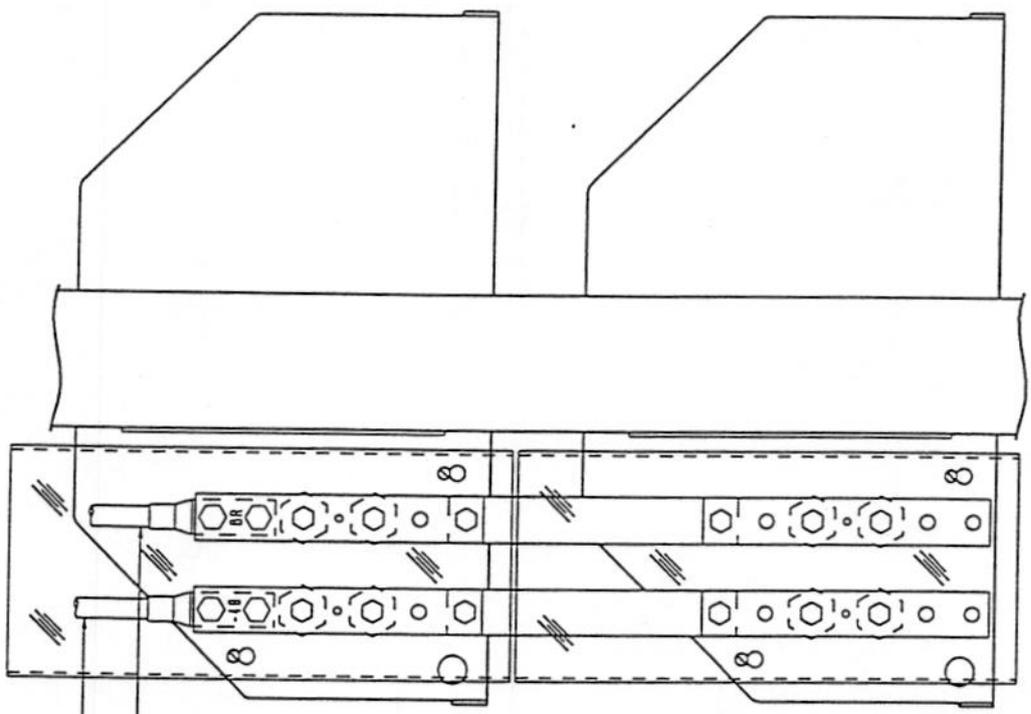


FIG B
NT6C14GA OR NT6C14GB TYPE
INTERCONNECT AND DISTRIBUTION PANEL SHOWN





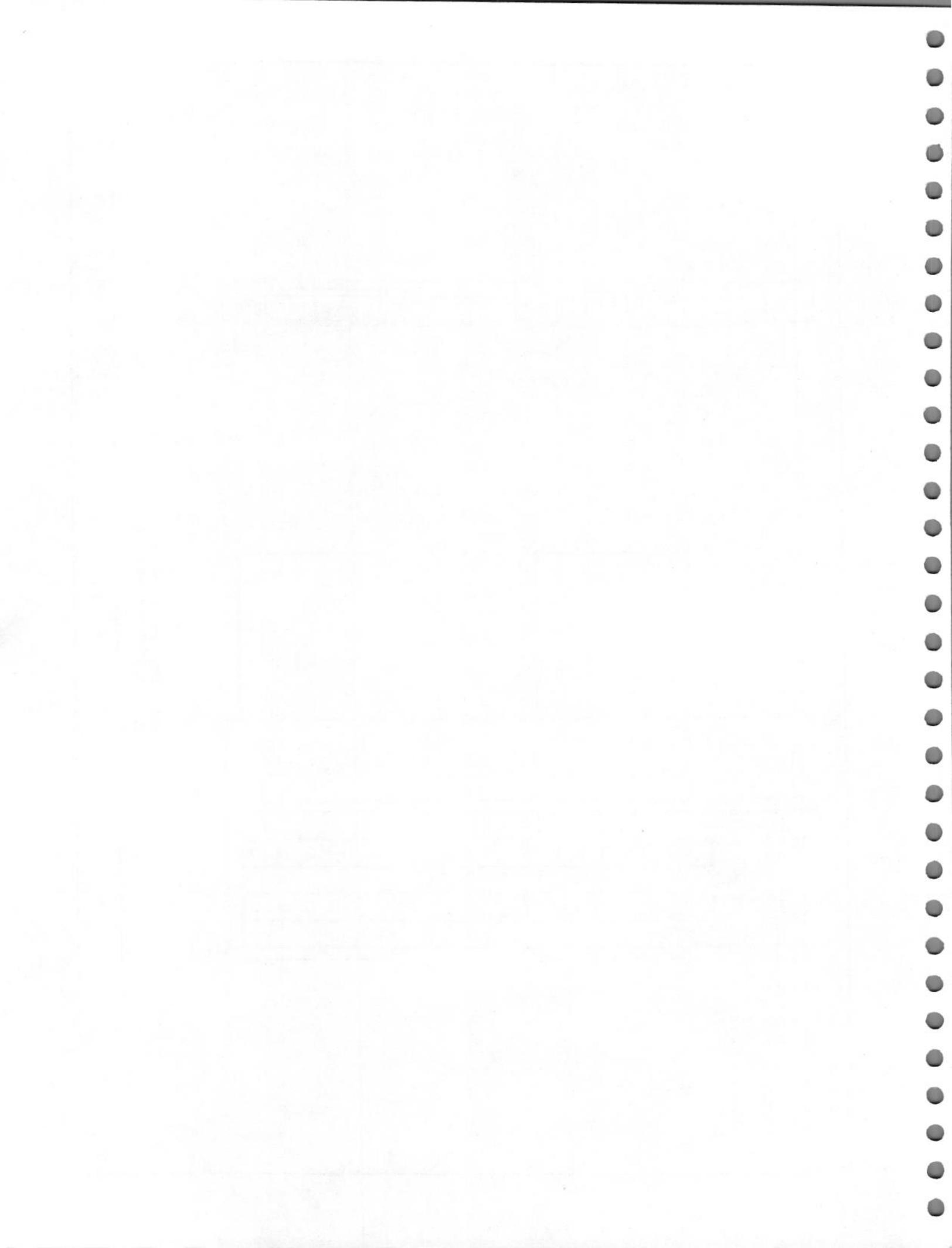
PARTIAL
FRONT VIEW

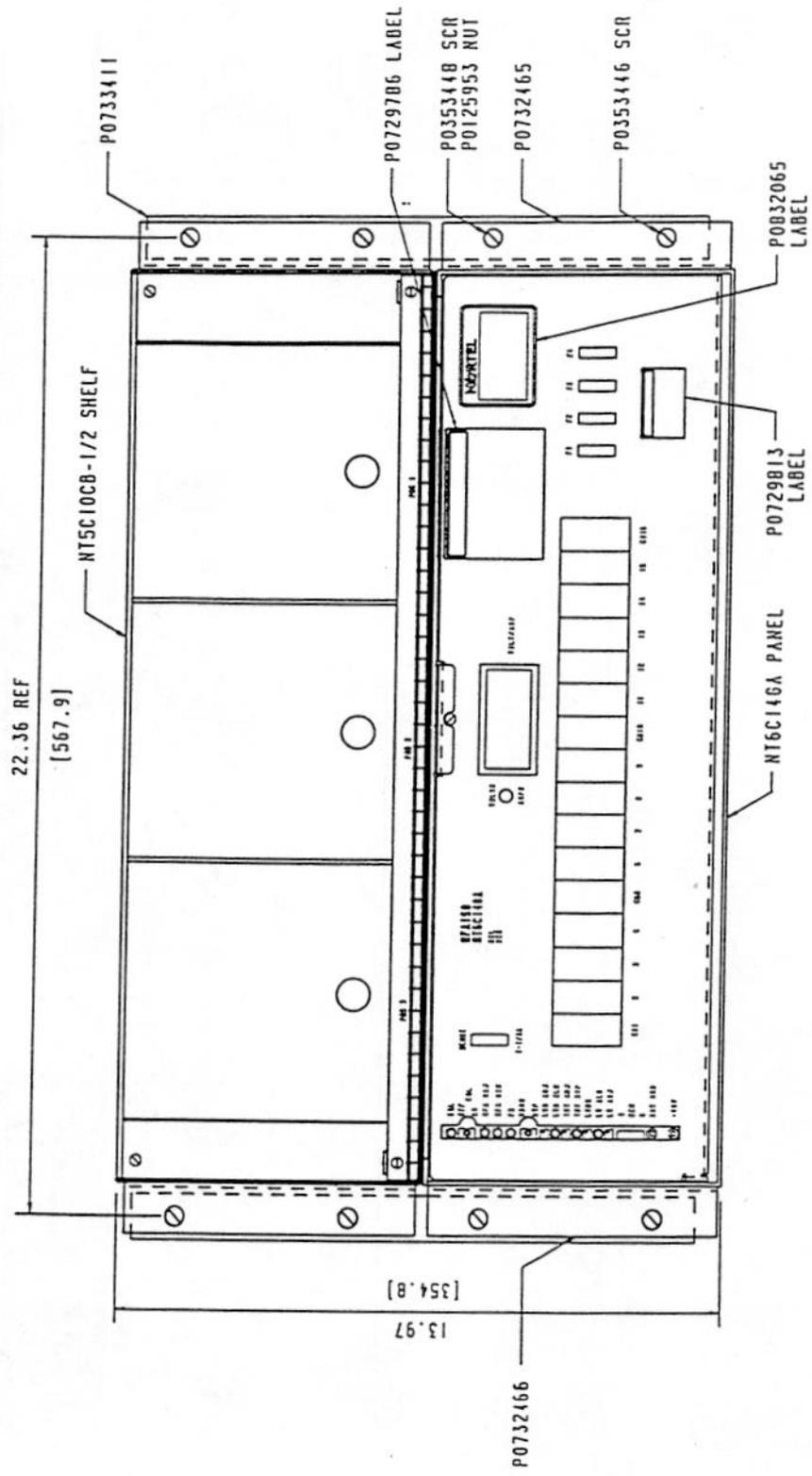


RIGHT SIDE VIEW

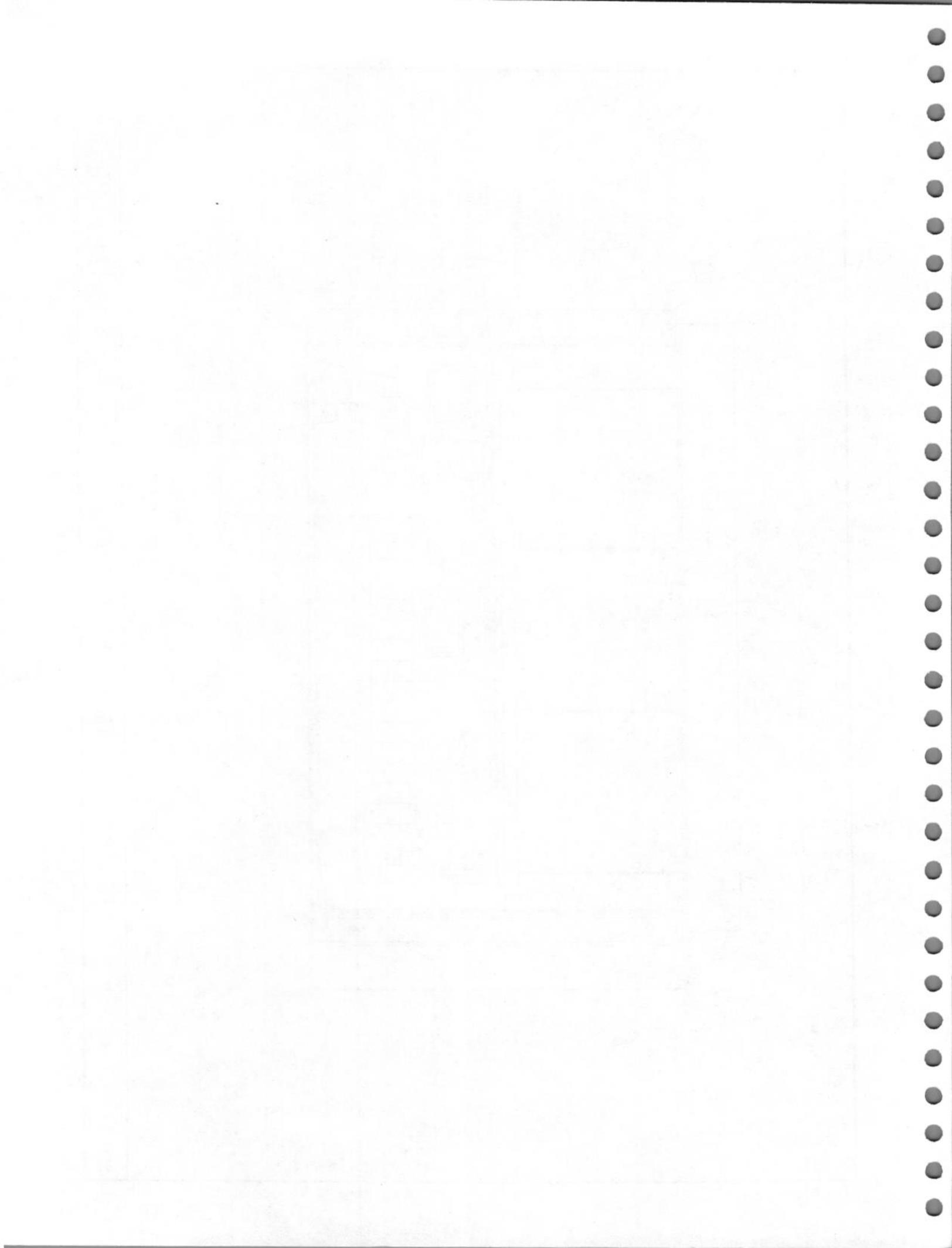
-48V LEAD TO
INTCON & DISTR PANEL
BR LEAD TO
INTCON & DISTR PANEL

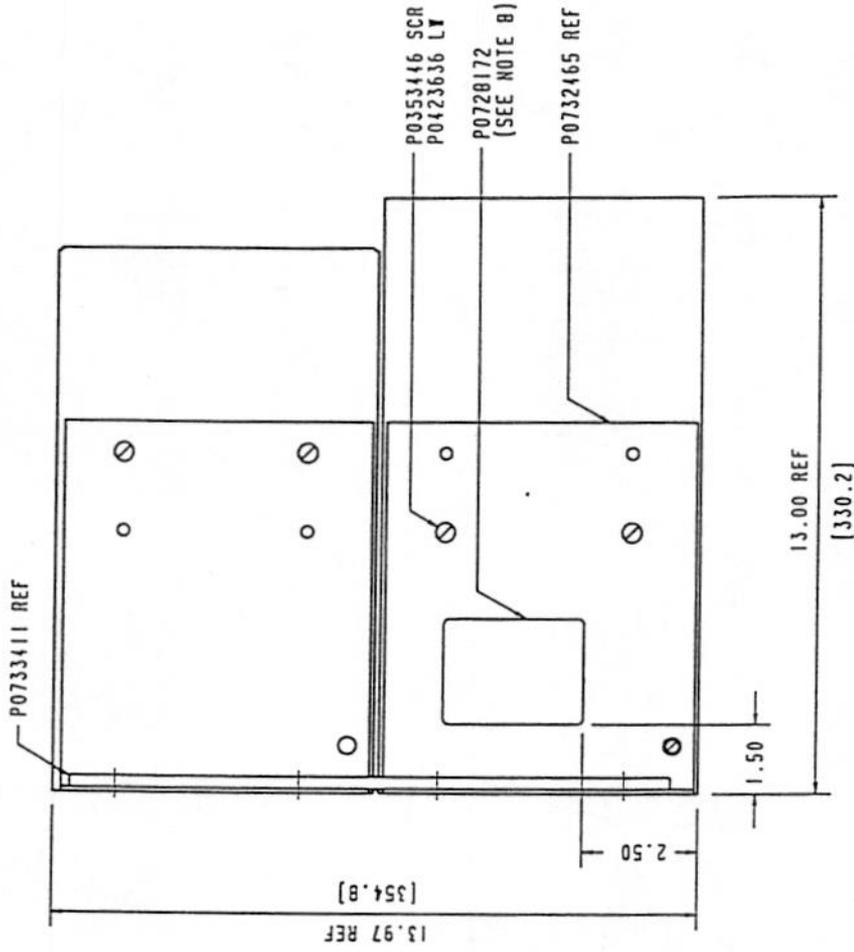
FIG D
TYPICAL METHOD OF CONNECTING NT5C11 TYPE BATTERY SHELVES
ALL PARTS SHOWN PROVIDED PER NS5C11





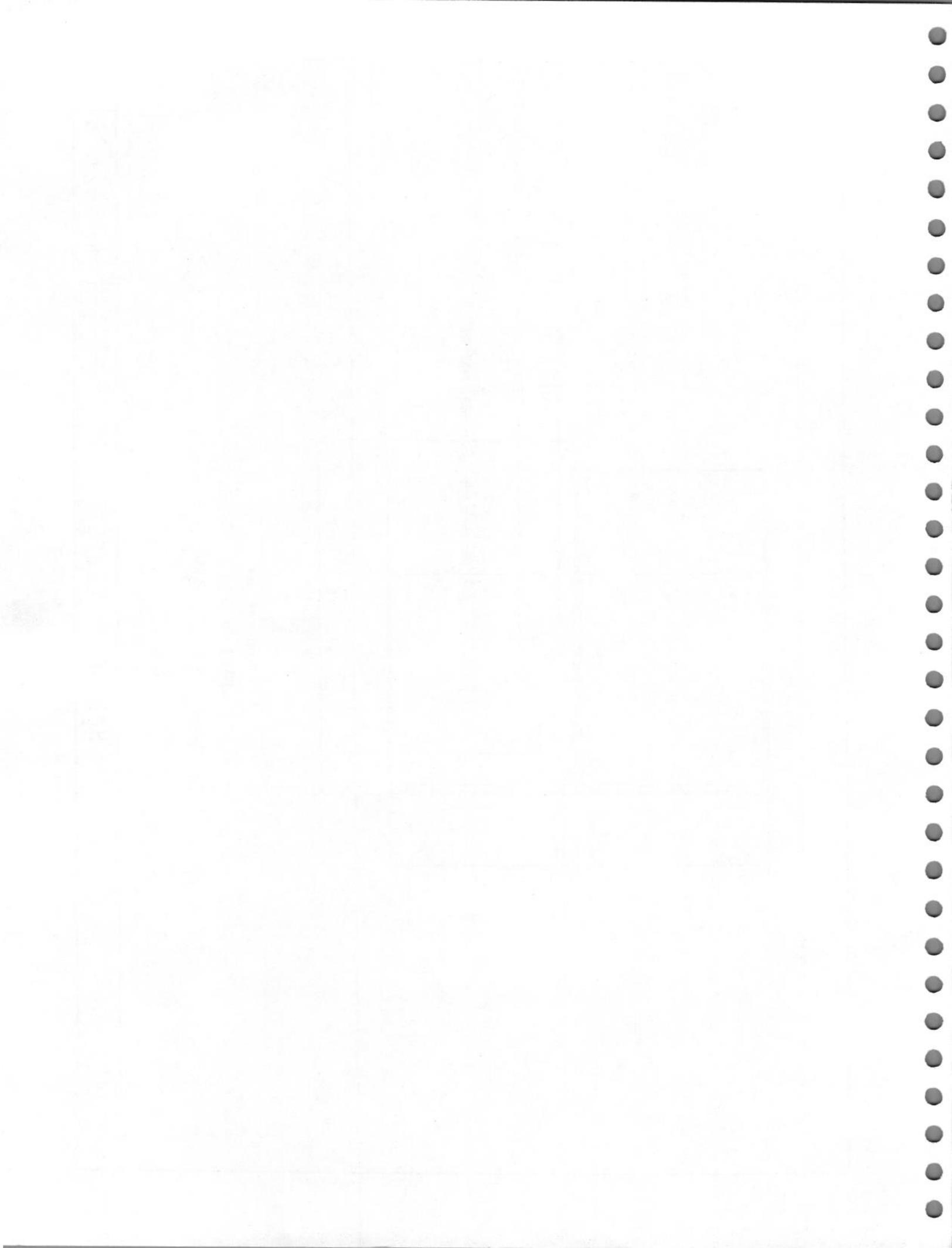
FRONT VIEW
 PART OF FIG 3
 TYPICAL POWER PLANT
 BAP APPLICATION

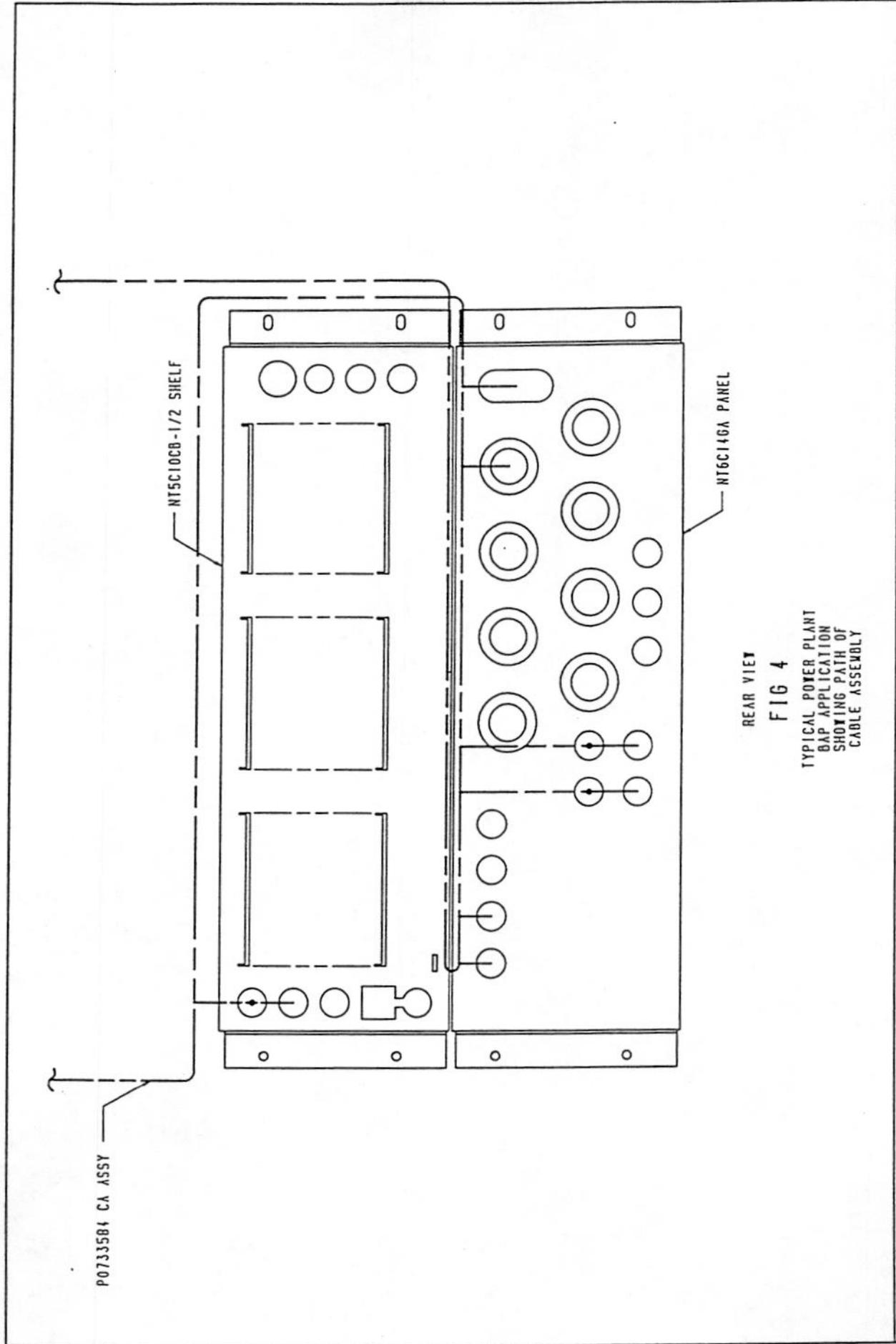




RIGHT SIDE VIEW
PART OF FIG 3
TYPICAL POWER PLANT
BAP APPLICATION

SC/ 1/4	NORTHE TELECOM	STREAM	ISSUE	SHEET
		01	10	8
		AD6C2 3A		

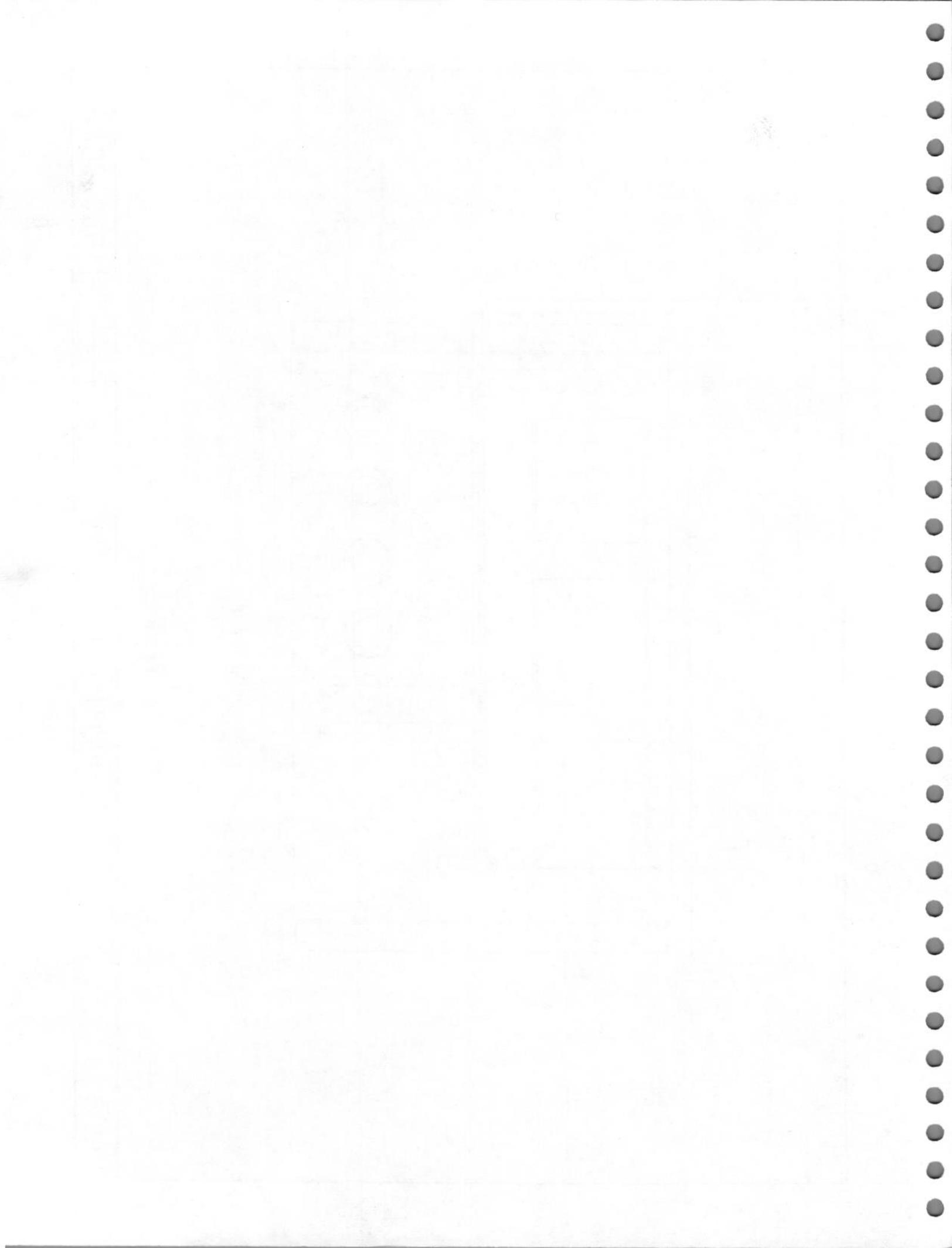


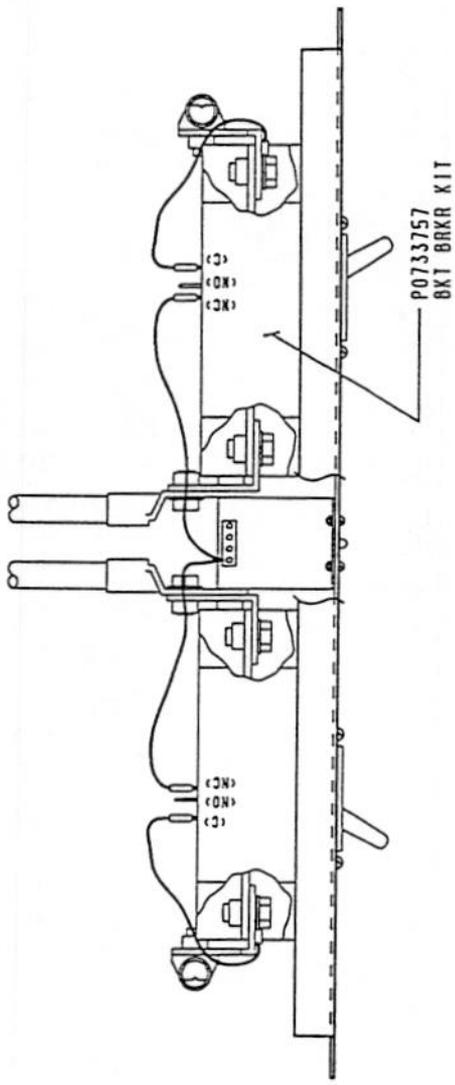


REAR VIEW

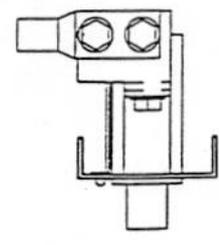
FIG 4

TYPICAL POWER PLANT
BAR APPLICATION
SHOWING PATH OF
CABLE ASSEMBLY

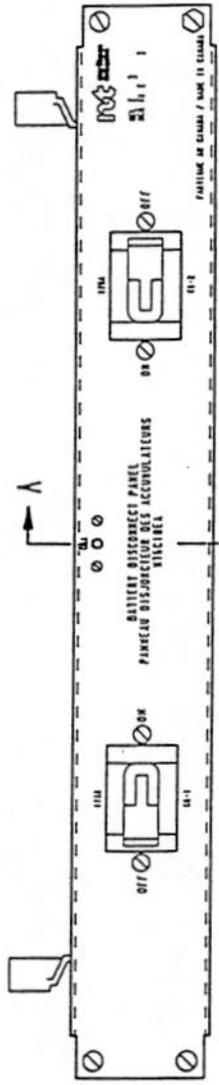




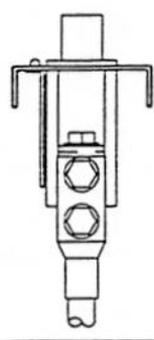
TOP VIEW



SIDE VIEW



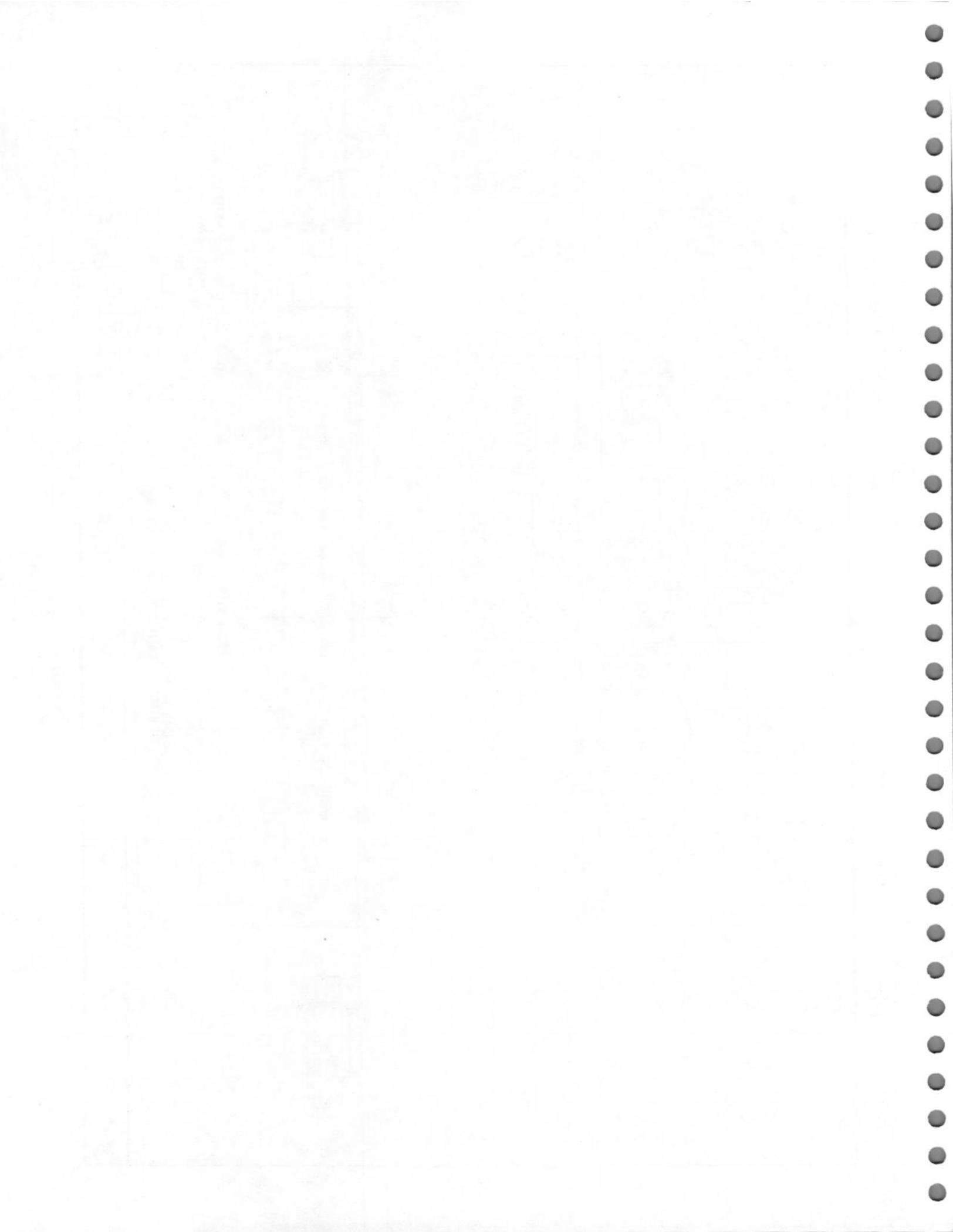
FRONT VIEW

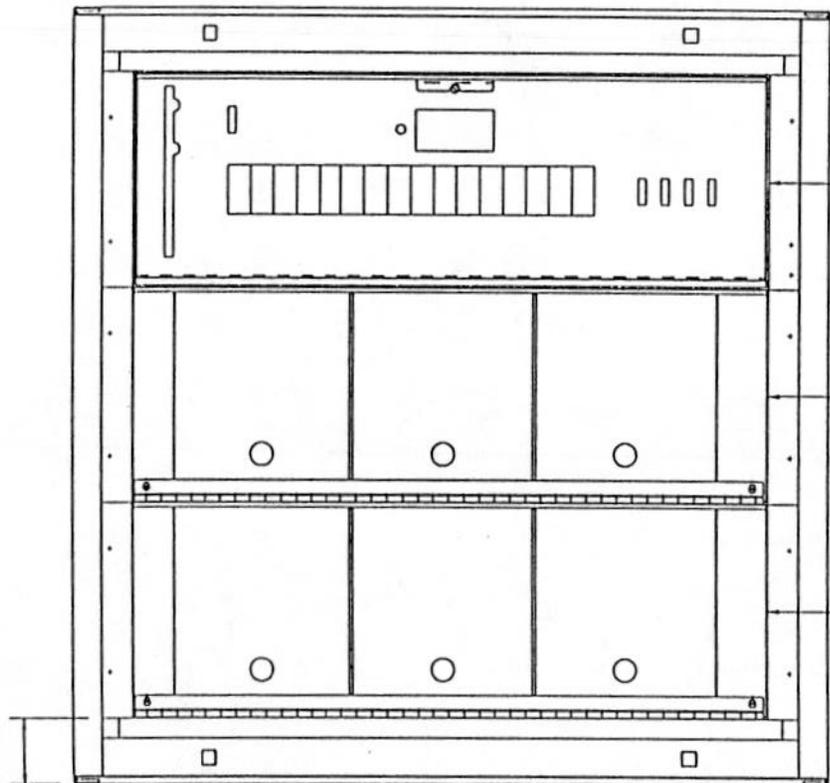


SECT A-A

FIG 5
METHOD OF ASSY OF P0733757 CXT BRKR KIT
ON NT6C18EA BATTERY DISCONNECT PANEL

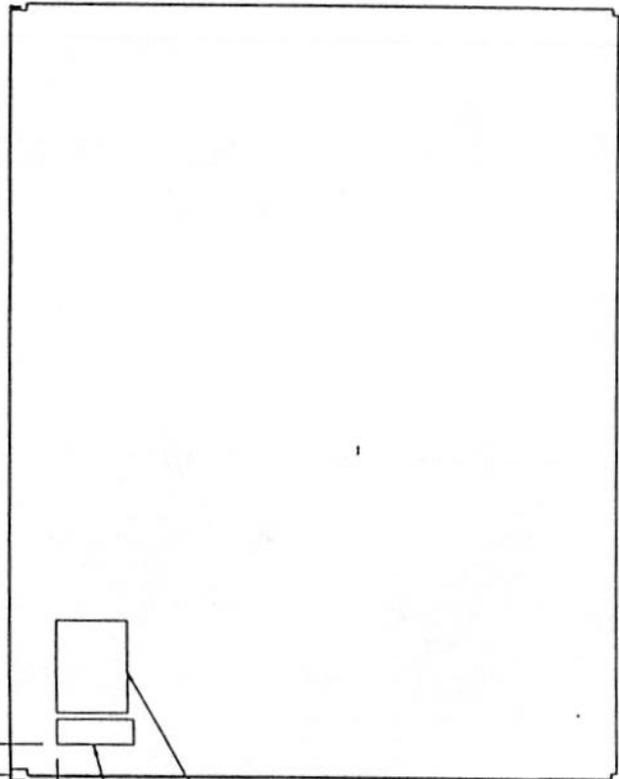
SCALE	4	NORTHER TELECOM		STREAM	ISSUE	SHEET
				01	10	10
				AD6C28		





FRONT VIEW
FRONT COVER REMOVED

- NT6C43 TYPE
WALL MOUNT FRWK
- NT6C14 TYPE
WFA150
INTER/DISTR PANEL
(SEE FIG B)
- NT5C10 TYPE
WPS75 SHELF E/Y
(3) NT5C06 TYPE
WPR25 RECT
- NT5C10 TYPE
WPS75 SHELF E/Y
(3) NT5C06 TYPE
WPR25 RECT



- 1.00 APPROX
- 1.50 APPROX
- P0728172
(SEE NOTE 8)
- P0700426

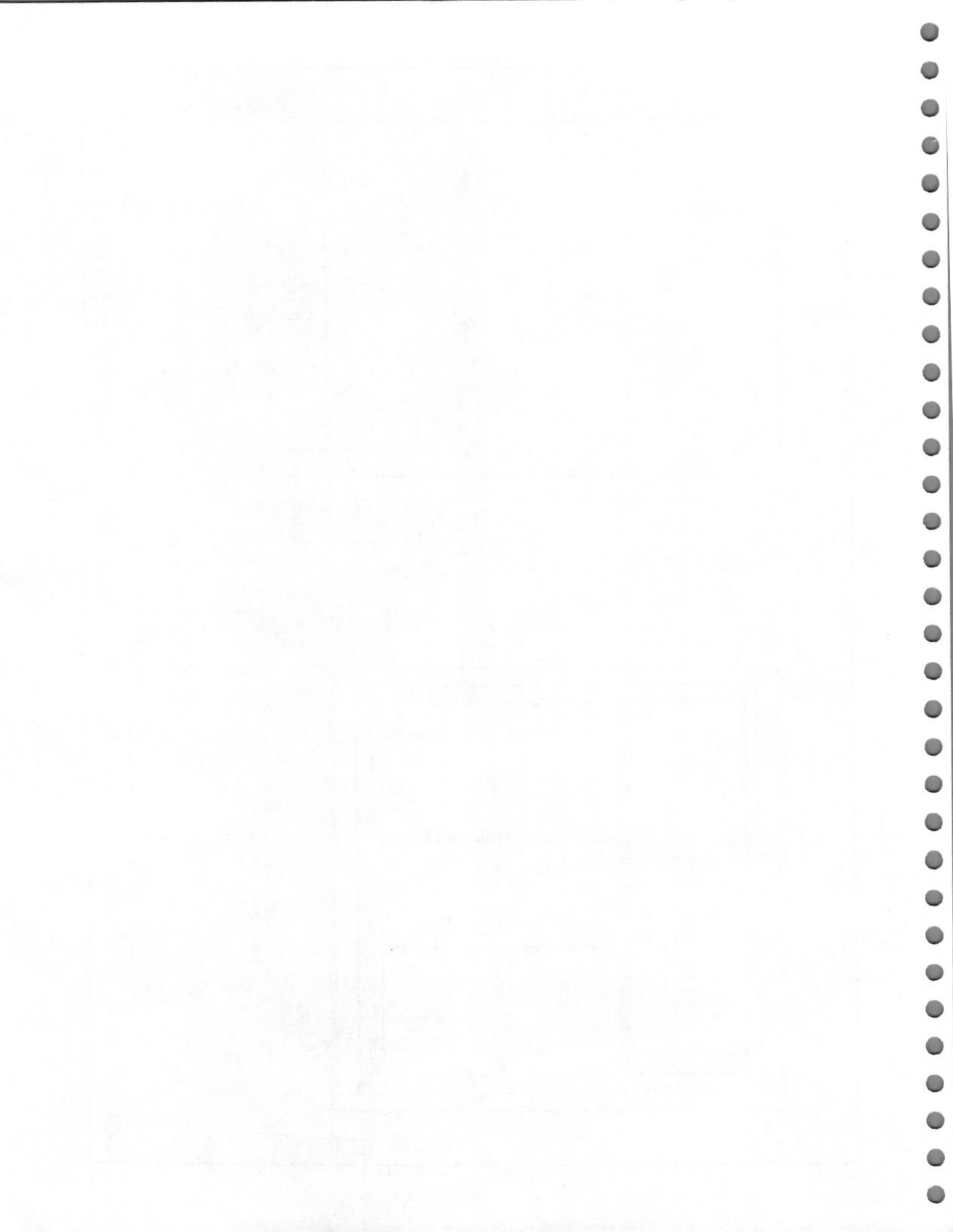
RIGHT SIDE VIEW

FIG 6
TYPICAL POWER PLANT
ON WALL MOUNTED FRAMEWORK

SCALE 1/6

NORTHERN TELECOM

STREAM	ISSUE	AD6C28CA	SHEET
01	10		11



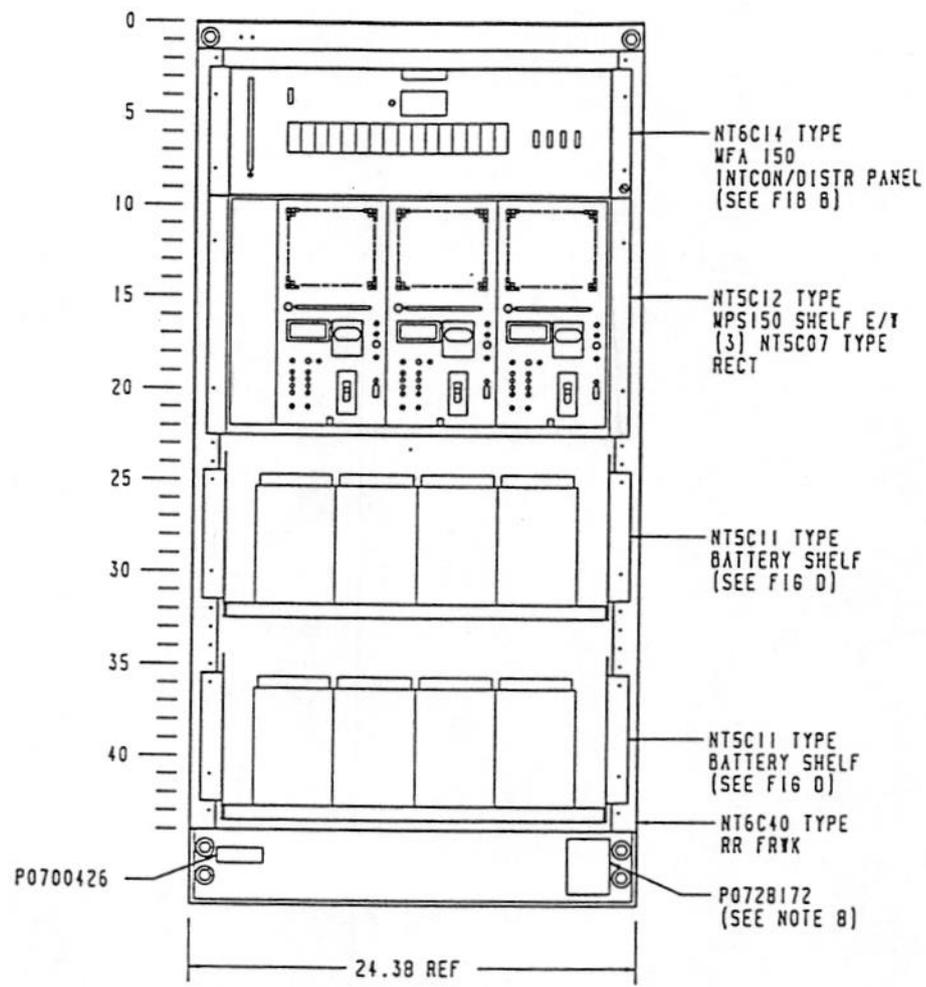
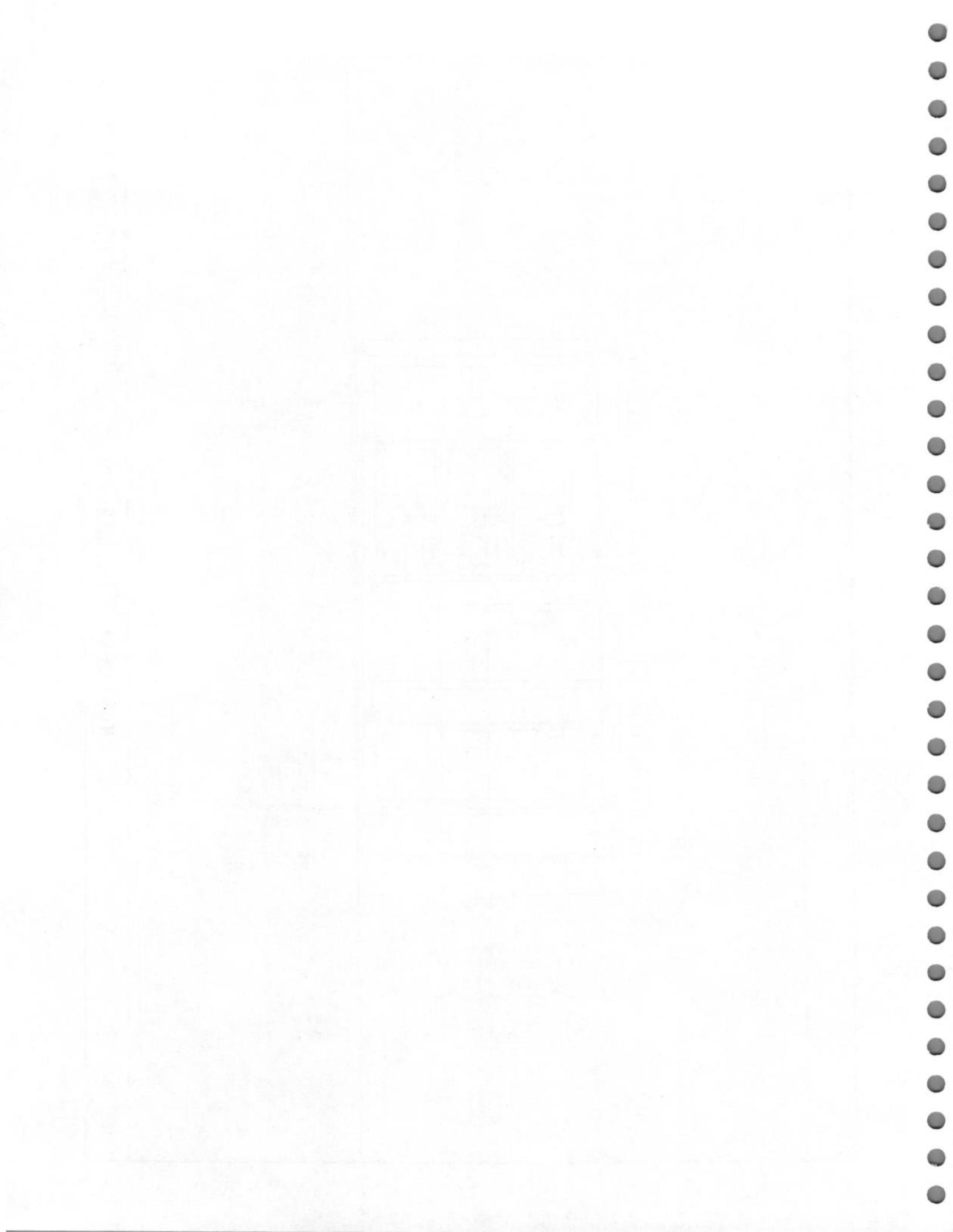


FIG 7
TYPICAL POWER PLANT
48.00 INCH HIGH RELAY RACK



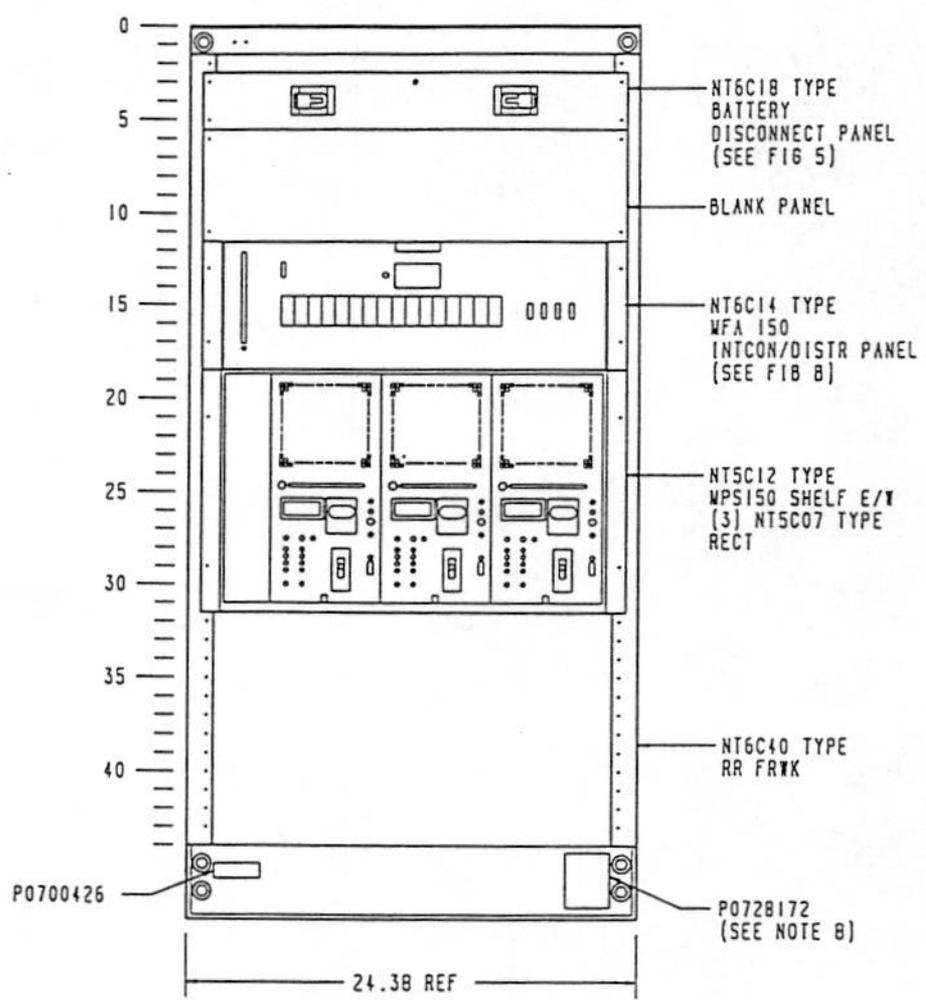
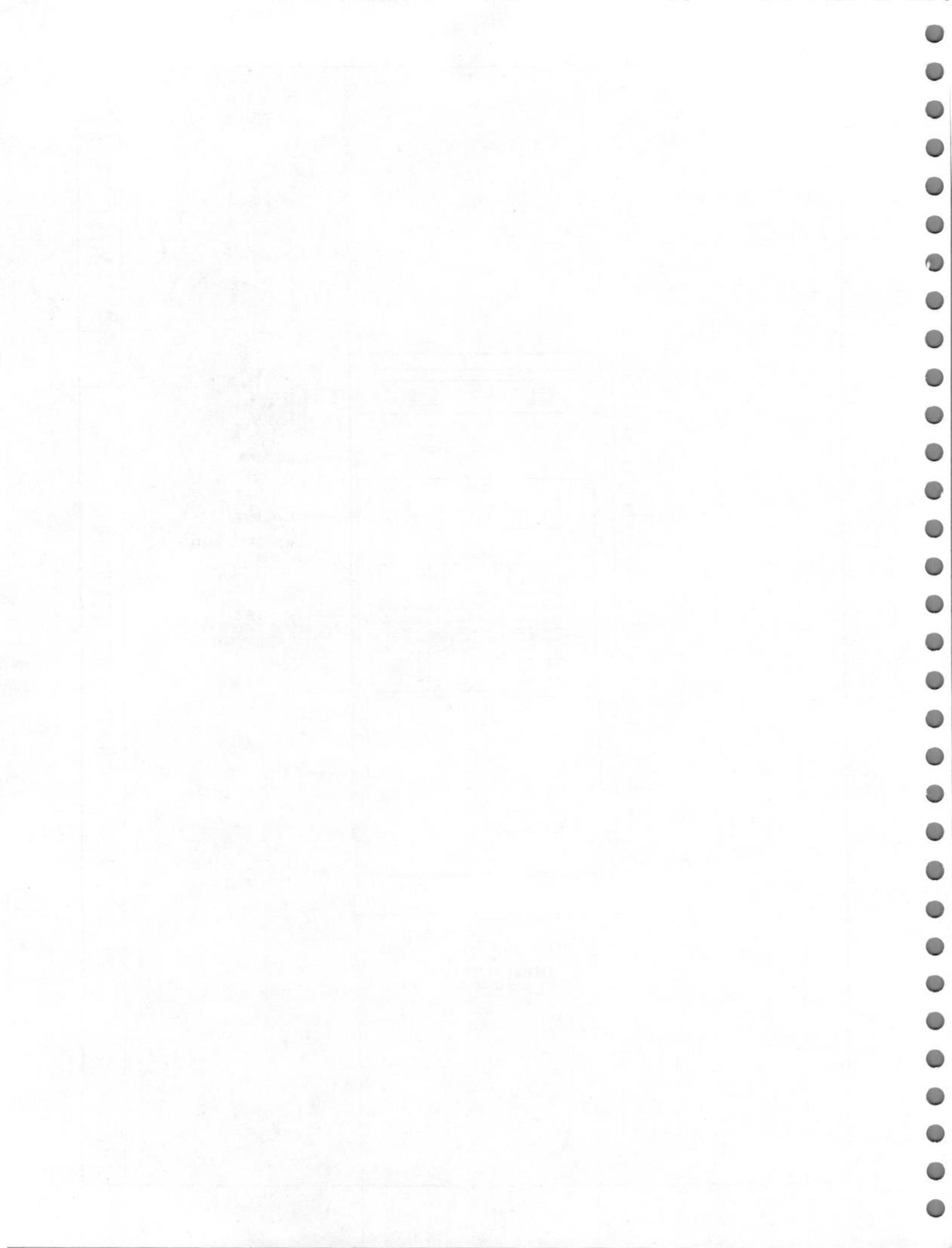


FIG 7A
TYPICAL POWER PLANT
48.00 INCH HIGH RELAY RACK



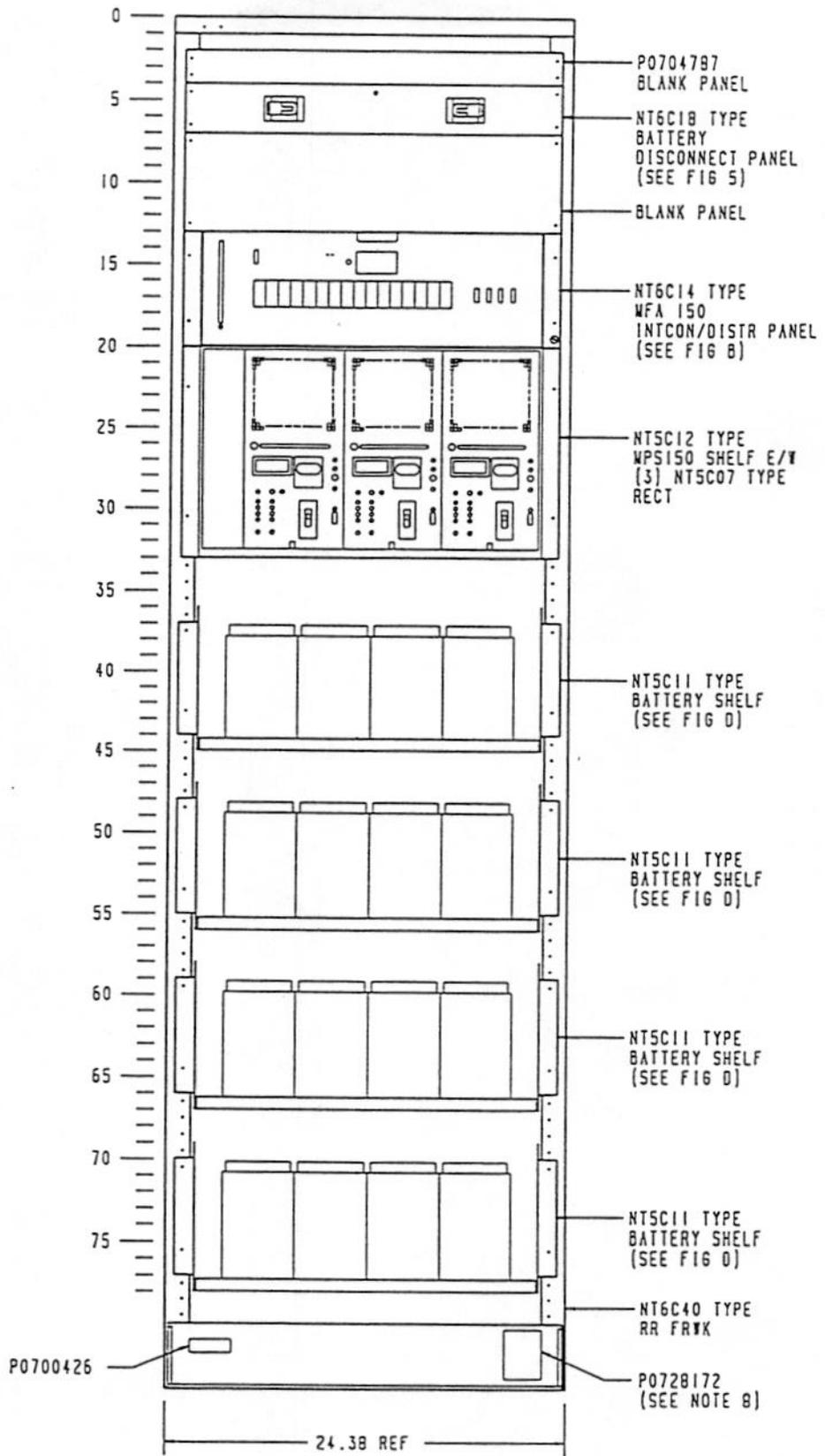
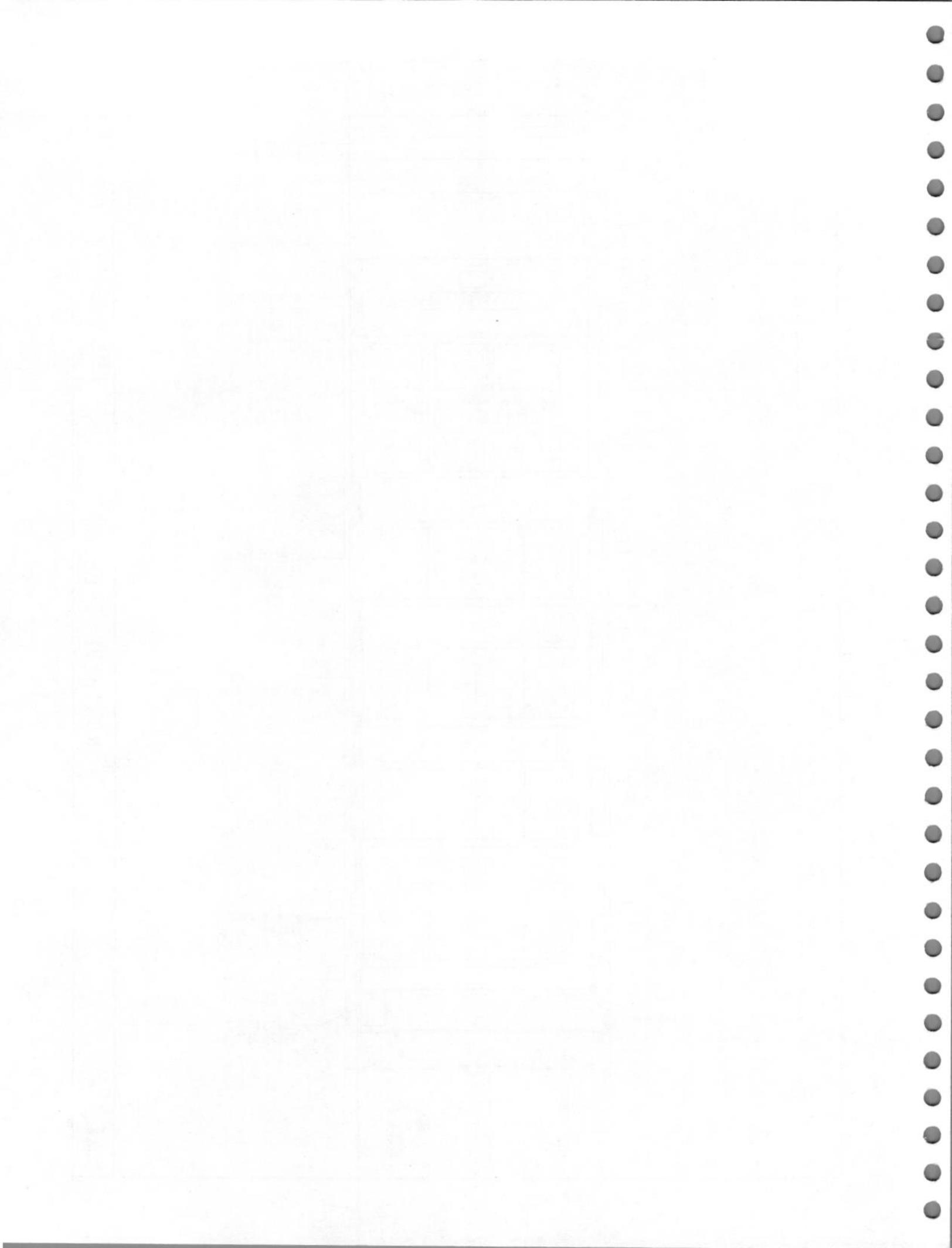
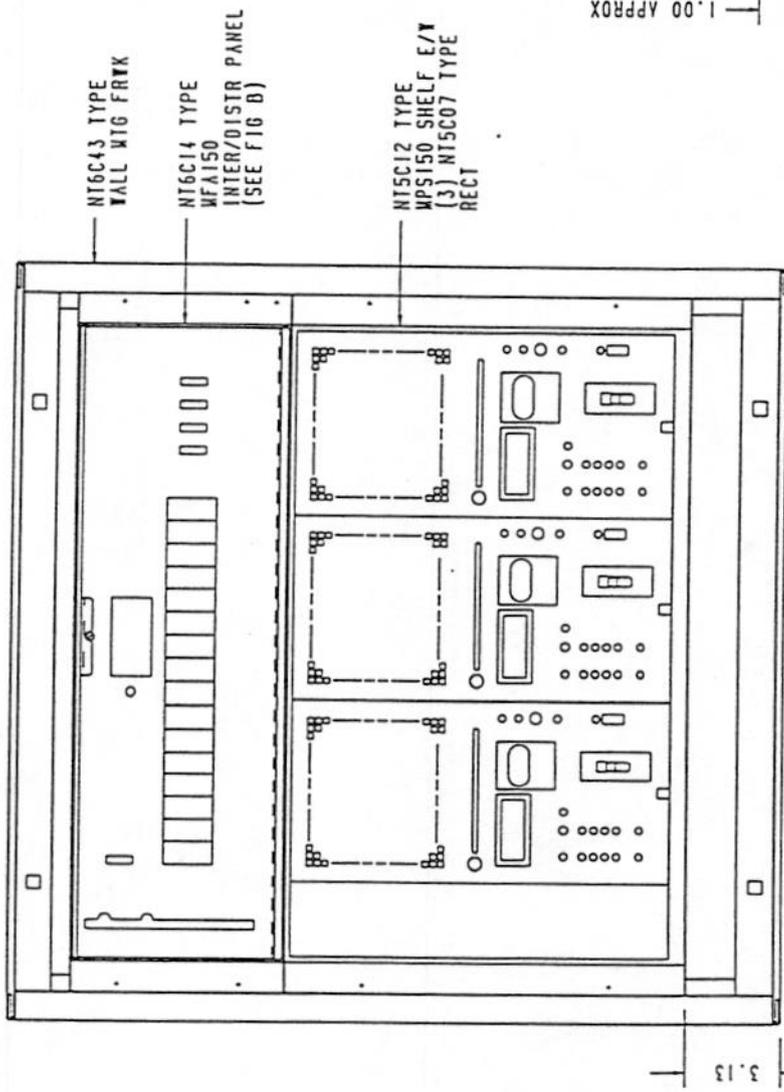
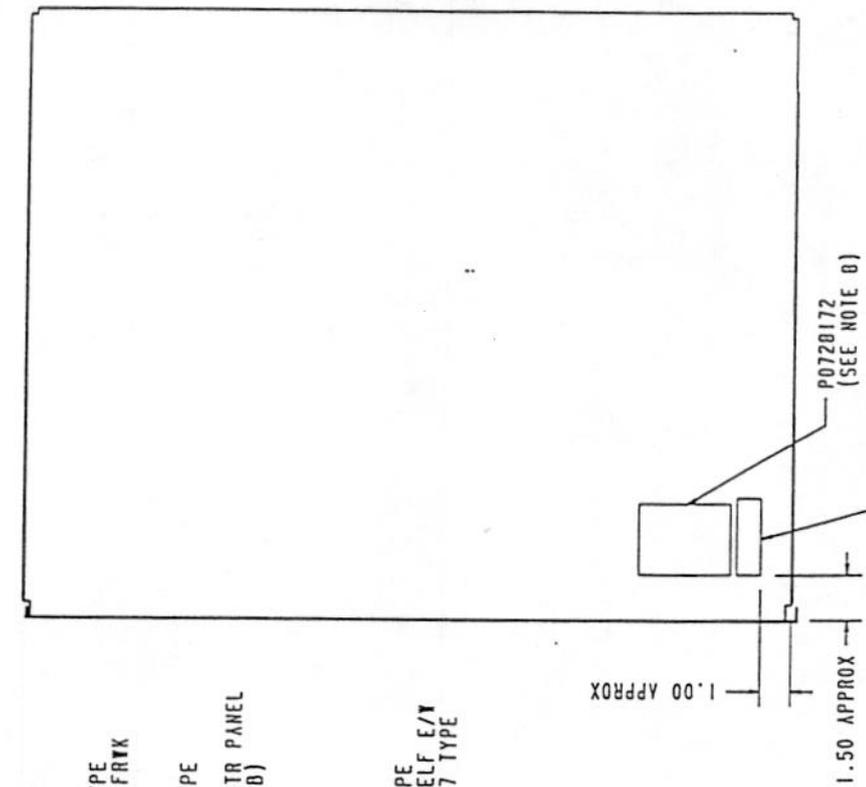


FIG 8
TYPICAL POWER PLANT
84.00 INCH HIGH RELAY RACK



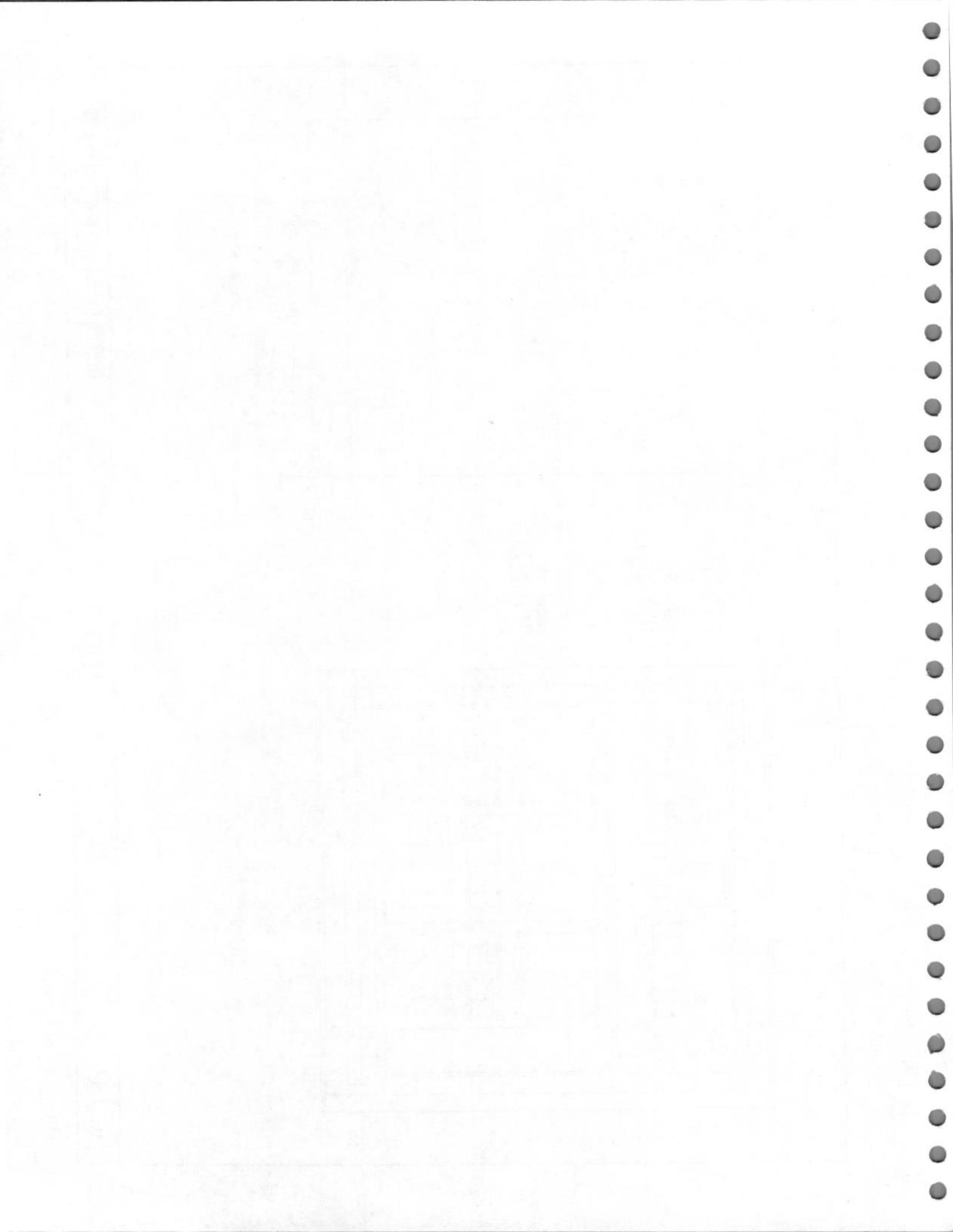


FRONT VIEW
FRONT COVER REMOVED



RIGHT SIDE VIEW

FIG 9
TYPICAL POWER PLANT
ON WALL MOUNTED FRAMEWORK



SHEET INDEX

CONTENTS	SHEET NO.	STREAM 01 DRAWING ISSUE									
		01	02	03	04	05	06	07			
SHEET INDEX	A1	01	02	03	04	05	06	07			
CIRCUIT NOTES	A2	01	02	03	04	05	06	07			
CIRCUIT & INFO NOTES	A3	01	02	02	04	04	06	07			
		01	01	01	04	05	06	07			
IS1 INTCON & DISTR CXT NT6C146A, 60, 6E OR GF	B1	01	02	02	04	05	05	07			
IS2 (J) POS SHELF, COW AC	B2	01	02	02	04	04	04	07			
IS3 (J) POS SHELF, INDIV AC	B3	01	02	02	04	04	04	07			
IS4 BATTERY SHELF	B4	01	01	01	04	04	04	07			
IS5 INTCON & DISTR CXT NT6C146A (BAP APPLICATION)	B5	01	02	02	04	04	04	07			
IS6 FUSE PANEL (BAP APPLIC)	B6		02	03	04	05	05	07			
IS7 CABINET (BAP APPLIC)	B7		02	02	04	04	04	07			
IS8 BATTERY DISCONNECT PANEL	B8		02	02	02	02	02	07			
IS9 WPS150 SHELF	B9		02	02	02	02	02	07			
IS10 INTCON & DISTR CXT NT6C146C, 60, 6G OR GH	B10		02	02	04	04	04	07			
IS1 INTCON & DISTR CXT NT6C146 TYPE (E/W NT6C146PF)	B11				04	04	04	07			
	B12				04	04	04	07			
	B13				04	04	04	07			
	B14					05	05	07			

SUPPORTING DOCUMENTATION

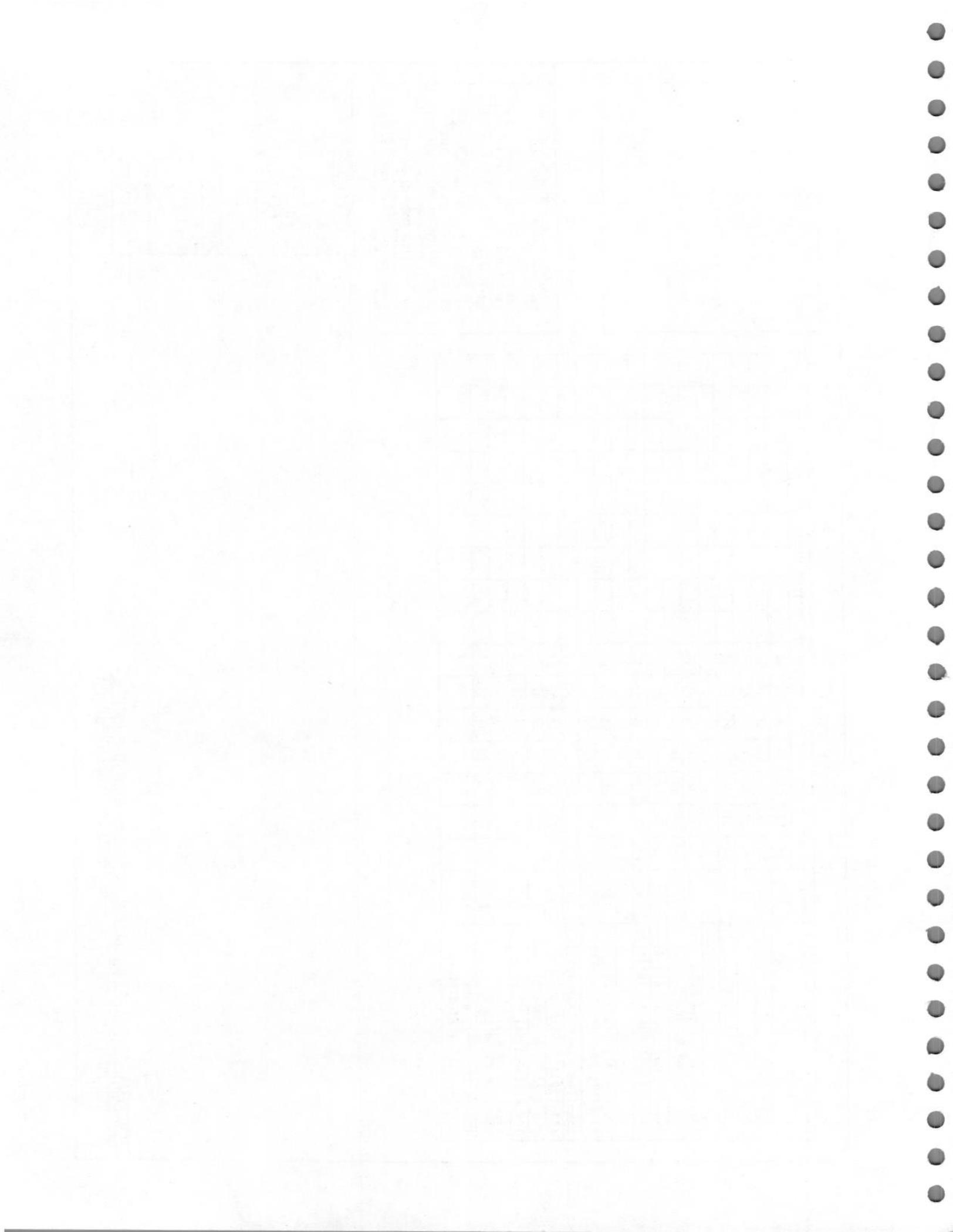
NTPI67 9021 102	(GENERAL)
NTPI67 9021 104	(MERIDIAN)
WS6C28	MODULAR STRUCTURE
AD6C28CA	ASSEMBLY DRAWING
Y06C28CA	WIRING DIAGRAM

SHEET INDEX NOTES

1. WHEN CHANGES ARE MADE IN THIS DRAWING, ONLY THOSE SHEETS AFFECTED WILL BE REISSUED.
2. THIS SHEET INDEX WILL BE REISSUED AND BROUGHT UP TO DATE EACH TIME ANY SHEET OF THE DRAWING IS REISSUED, OR ANY NEW SHEET IS ADDED.
3. THE ISSUE NUMBER ASSIGNED TO A CHANGED OR NEW SHEET WILL BE THE SAME ISSUE NUMBER AS THAT OF THE SHEET INDEX.
4. SHEETS THAT ARE NOT CHANGED WILL RETAIN THEIR EXISTING ISSUE NUMBER.
5. THE LAST ISSUE NUMBER OF THE SHEET INDEX IS RECOGNIZED AS THE LATEST ISSUE NUMBER OF THE DRAWING AS A WHOLE.

POWER SYSTEMS	
TITLE	
-48 VOLT, 150 AMP FRONT ACCESS POWER PLANT	
DATE: 95-12-14	UCH 141205
DESIGN APPROVALS	
SERVICES	CONTROL
RS	AH
DRAWING NUMBER	51HW 155
IS6C28CA	01 07
NORT	PAGE 01
TELE	A1 17

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CIRCUIT NOTES

101.

FEATURE OR OPTION TABLE

FEATURE OR OPTION		NT CODE	OPTION	FIGURE	NOTE
INTERCONNECT AND DISTRIBUTION CIRCUIT E/Y LVD AND ALARM CIRCUIT		NT6C146A NT6C146W		1S1	
INTERCONNECT AND DISTRIBUTION CIRCUIT E/Y ALARM CIRCUIT		NT6C146E NT6C146P			
RECTIFIER SHELF FOR (3) -48V, 25 AMP NT5C06 TYPE PLUG-IN SWR RECTIFIERS	COMMON AC	NT5C10 TYPE		1S2	
	INDIVIDUAL AC			1S3	
BATTERY SHELF		NT5C11 TYPE SHELF BATTERIES PER W56C28		1S4	
INTERCONNECT AND DISTRIBUTION CIRCUIT E/Y LVD AND ALARM CIRCUIT (BAP APPLICATION)		NT6C146A		1S5	
FUSE PANEL (BAP APPLICATION)		QPA119A-1		1S6	
DWS 1 CABINET (BAP APPLICATION)		NT4P49AA		1S7	
BATTERY DISCONNECT PANEL		NT6C18EA/EB		1S8	
WPS150 RECTIFIER SHELF FOR (3) -48V, 50AMP NT5C07 TYPE PLUG-IN RECTIFIERS		NT5C12 TYPE		1S9	
INTERCONNECT AND DISTRIBUTION CIRCUIT E/Y RPW1000C, LVD AND ALARM CIRCUIT		NT6C146C NT6C146N		1S10	
INTERCONNECT AND DISTRIBUTION CIRCUIT E/Y RPW1000C CIRCUIT		NT6C146G NT6C146O			

102. UNASSIGNED.

103. UNASSIGNED.

104. THE CABLE SHALL BE RATED 75° C OR HIGHER.
(FOR WALL MOUNTED UNIT USE CABLE ASSEMBLIES
P0736416 [RED] AND P0736417 [BLACK].)

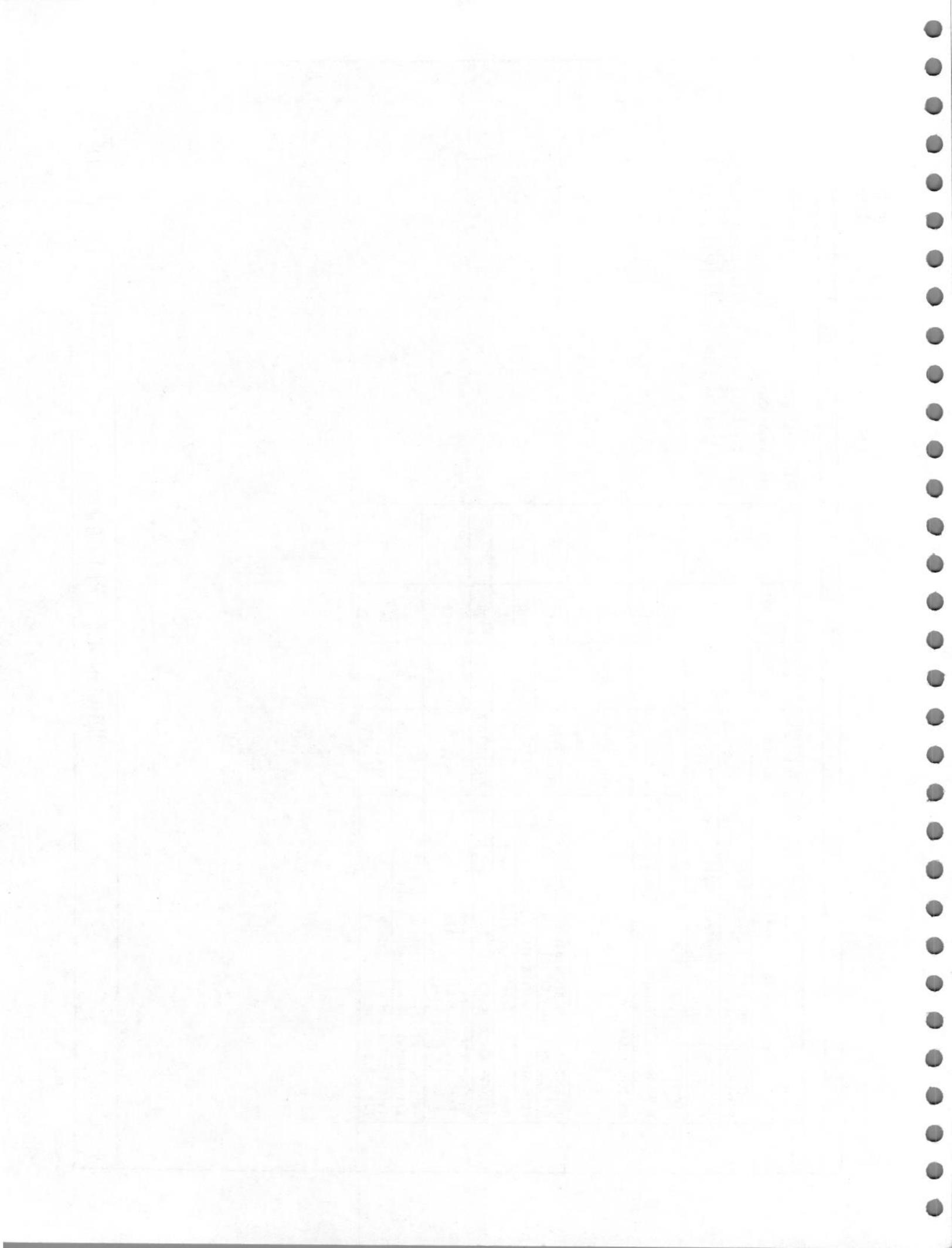
SCALE 1/1

NORTHERN TELECOM

STREAM	ISSUE
01	07

1S6C28CA

SHEET
A2



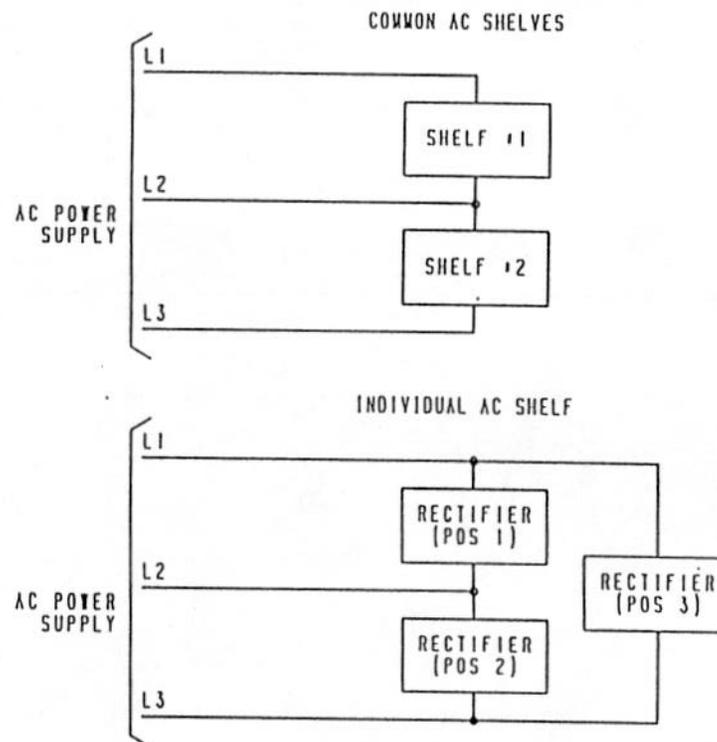
CIRCUIT NOTES: (CONTINUATION)

105. THE TABLE BELOW SHOWS FULL LOAD OUTPUT, CORRESPONDING INPUT CURRENTS, FUSE CAPACITY AND LEAD SIZES FOR EACH RECTIFIER.

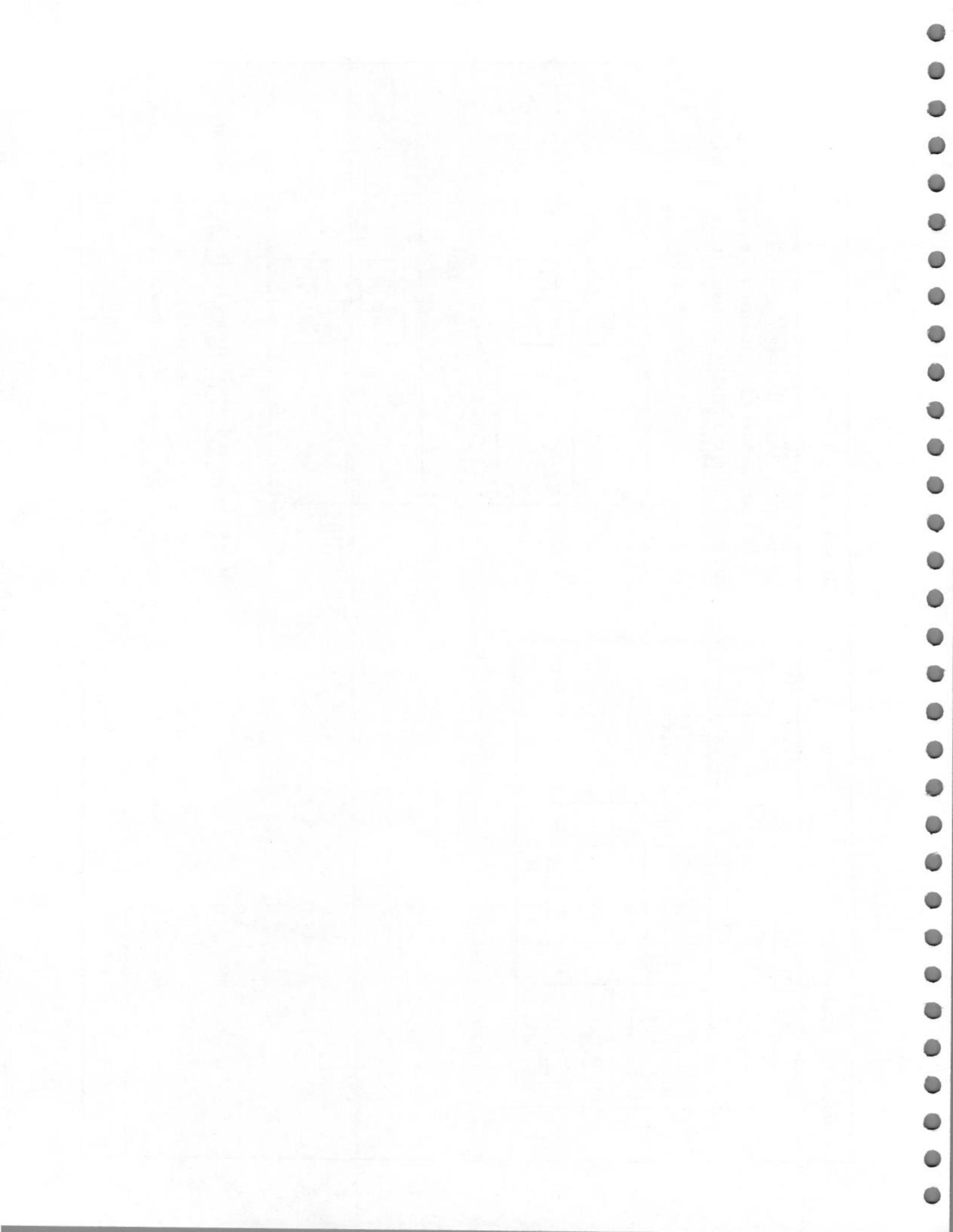
RECTIFIER		INPUT				OUTPUT
		VOLTS	AMPS	FUSE CAP	LEAD SIZE "A"	LEAD SIZE "B"
NTSC10 SHELF WIRED FOR INDIVIDUAL AC -48V, 25 AMP NTSC06 TYPE RECTIFIERS	(3) POS	110	12.5	20	12-2 COND	4GA
		208				
		240	11			
NTSC10 SHELF WIRED FOR COMMON AC -48V, 25 AMP NTSC06 TYPE RECTIFIERS	(3) POS	110	37.5	60	6-2 COND	4GA
		208				
		240	33			

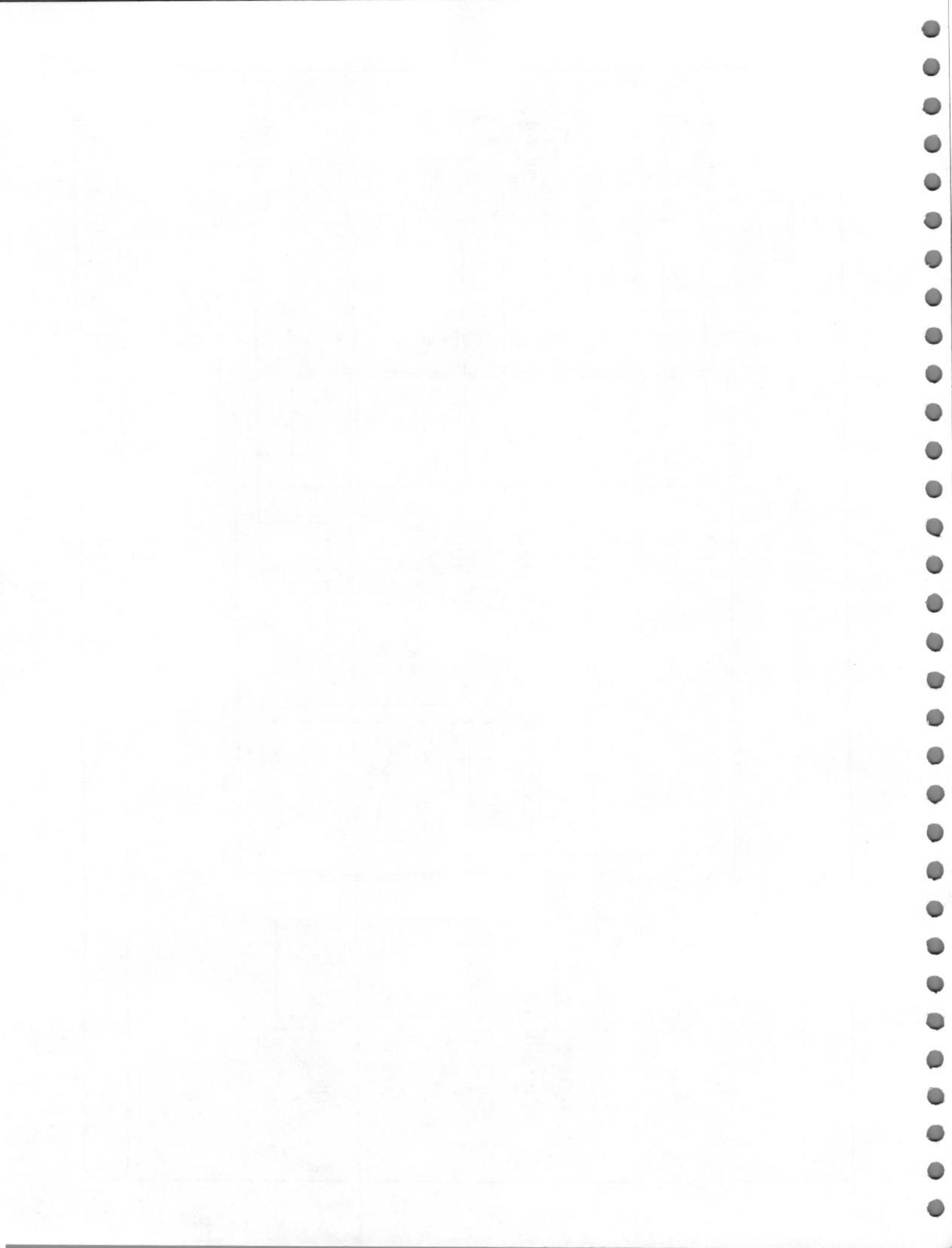
INFORMATION NOTES:

301. UNLESS OTHERWISE SPECIFIED RESISTANCE VALUES ARE IN OHMS. CAPACITANCE VALUES ARE IN MICROFARADS. VALUES PRECEDED BY THE SYMBOL + (PLUS) OR - (MINUS) ARE IN VOLTS.
302. THIS LEAD SHALL BE RUN AS REQUIRED PER SYSTEM GROUNDING NTP.
303. WHEN 208/240VAC 3 PHASE IS AVAILABLE, CONNECT THE POWER SHELVES AS FOLLOWS:

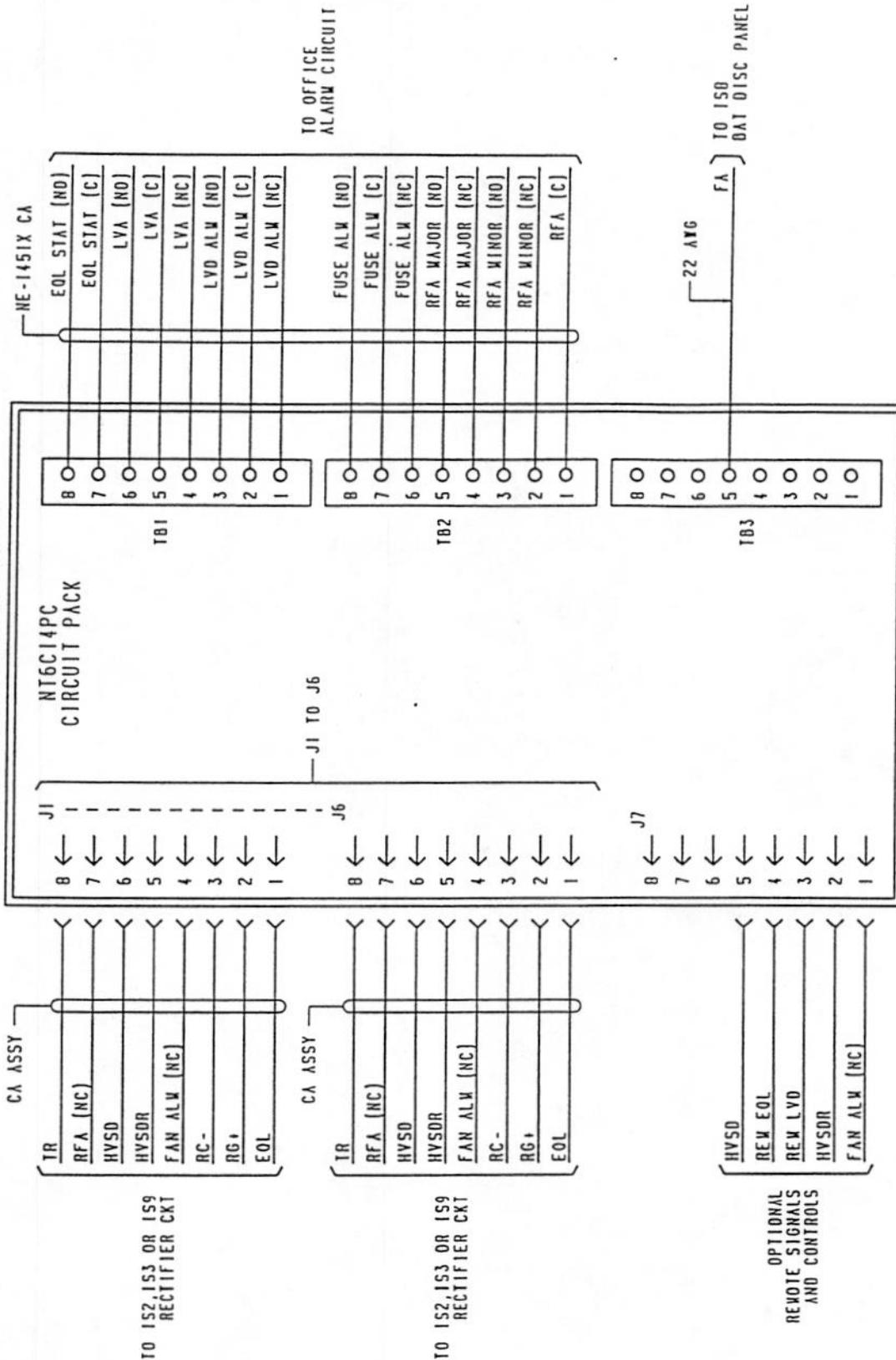


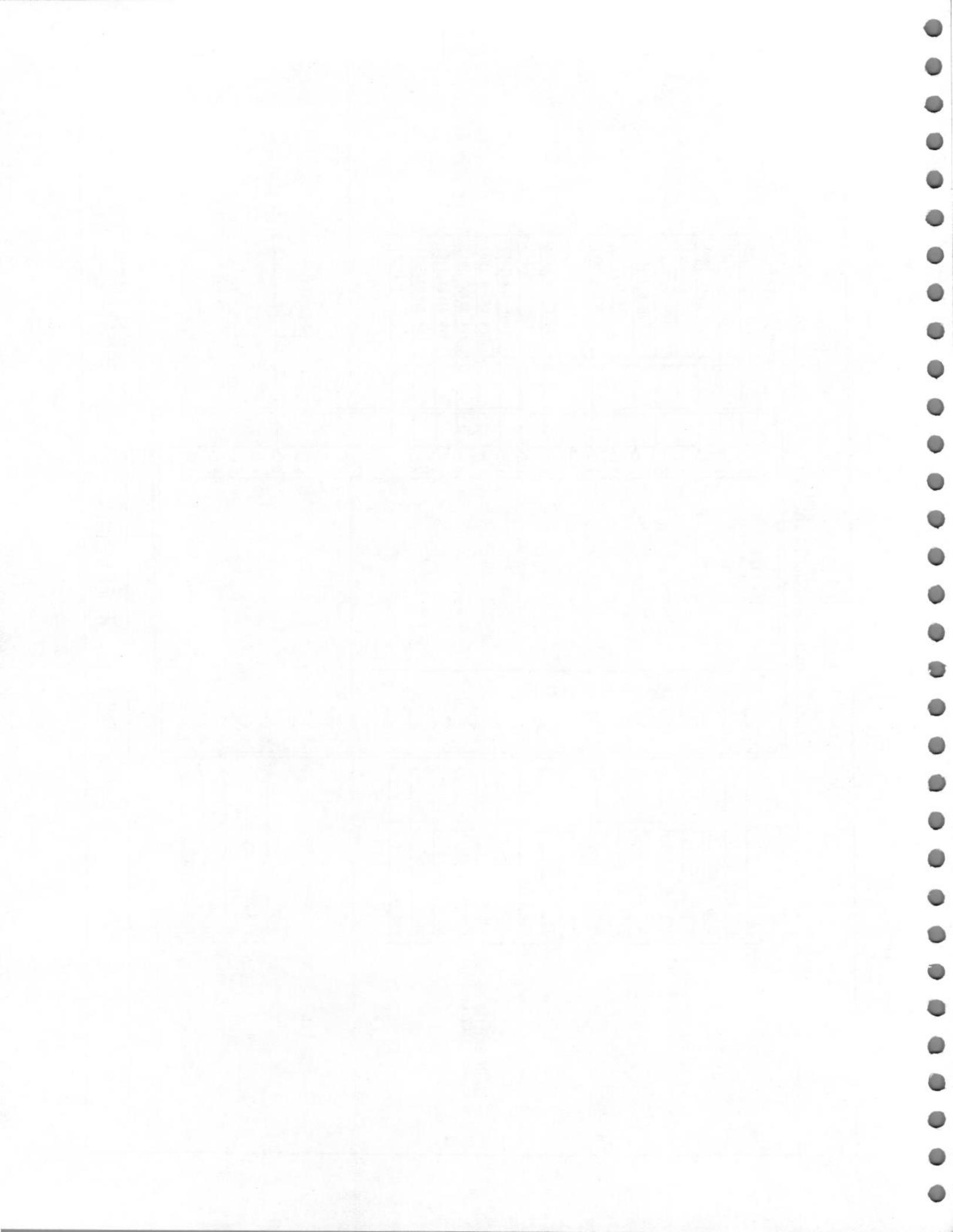
304. WHEN MORE THAN 4 BATTERY STRINGS IN PARALLEL ARE REQUIRED CONTACT BATTERY SUPPLIER FOR MORE INFORMATION.
305. FOR STD TRIP CIRCUIT BREAKER, CONNECT THE ALARM LEAD TO NC CONTACT.
FOR WID TRIP CIRCUIT BREAKER, CONNECT THE ALARM LEAD TO NO CONTACT.



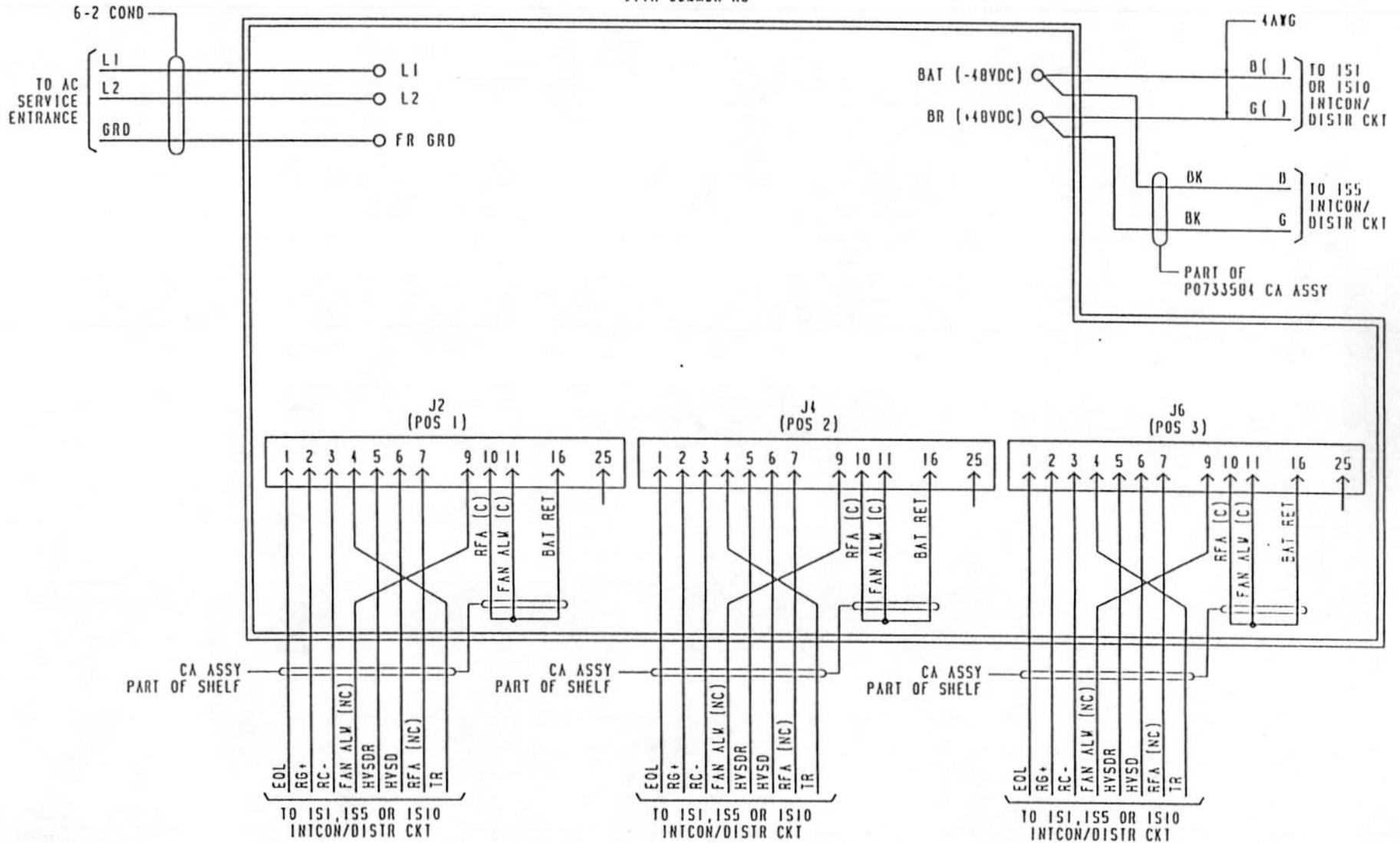


PART OF ISI
INTERCONNECT & DISTRIBUTION CIRCUIT
NT6C146A, NT6C146B, NT6C146E OR NT6C146F





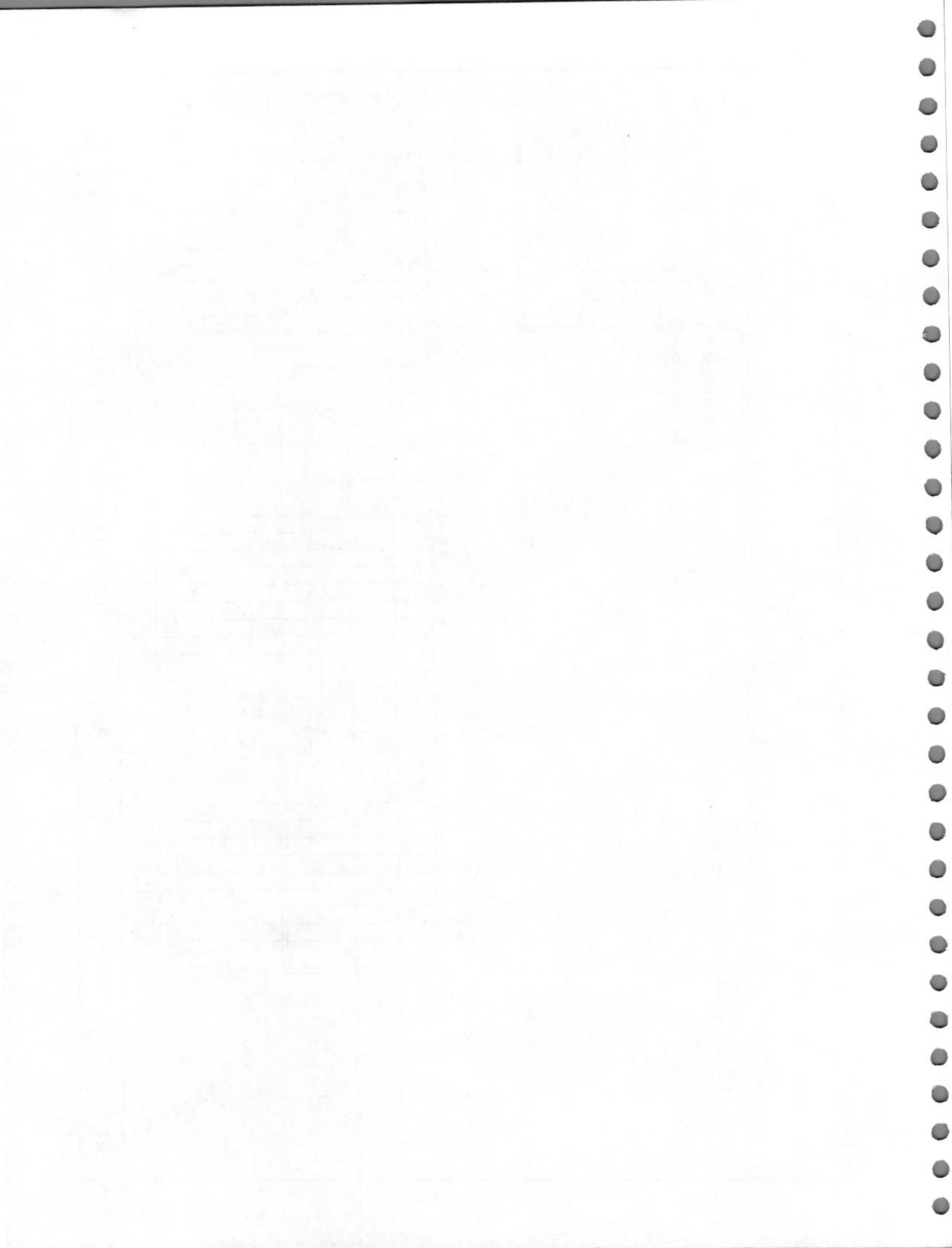
1S2
RECTIFIER SHELF CIRCUIT
(3 POS) NT5C10 TYPE
WITH COMMON AC



SCALE 1/1

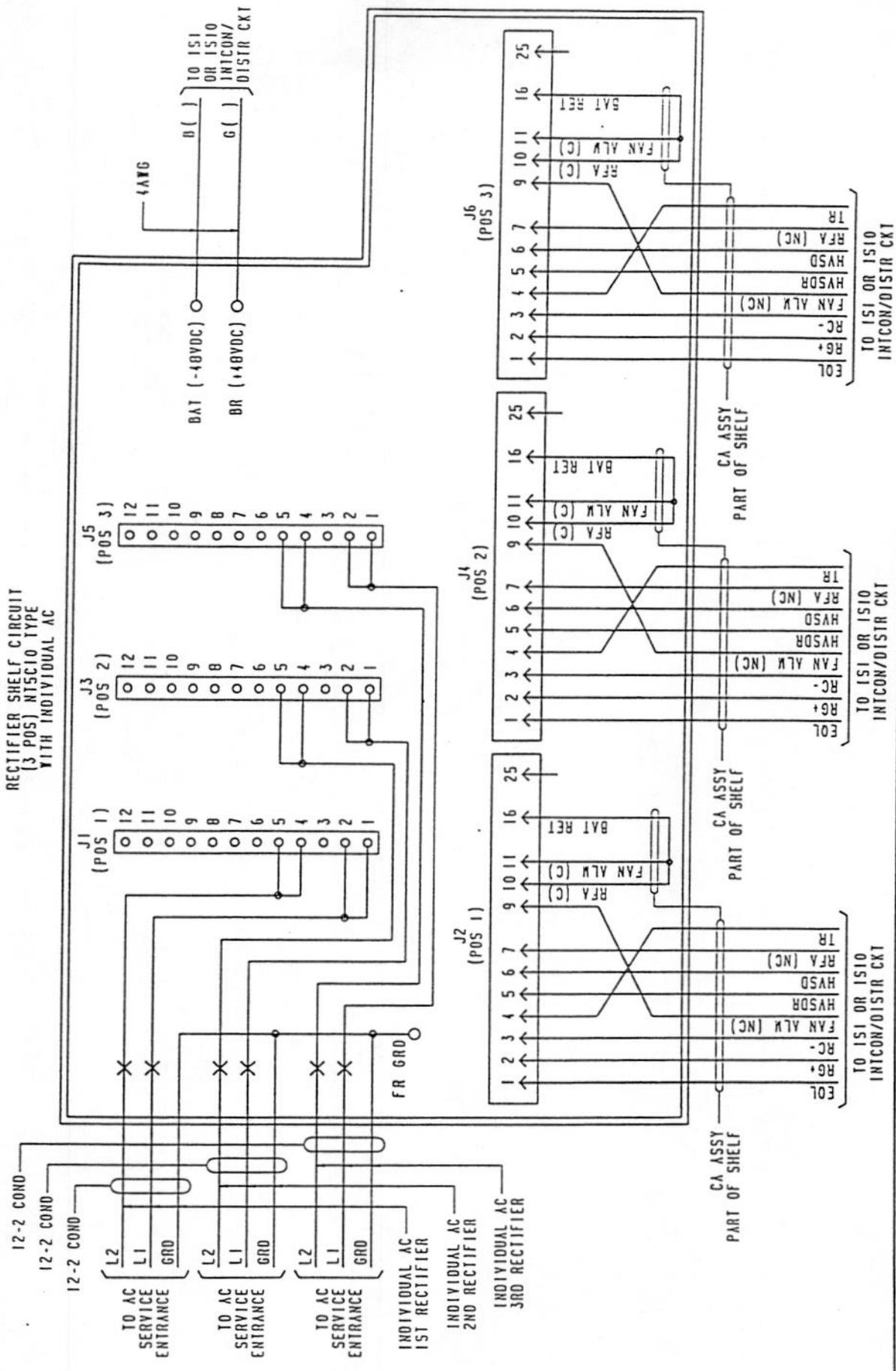
NORTHERN TELECOM

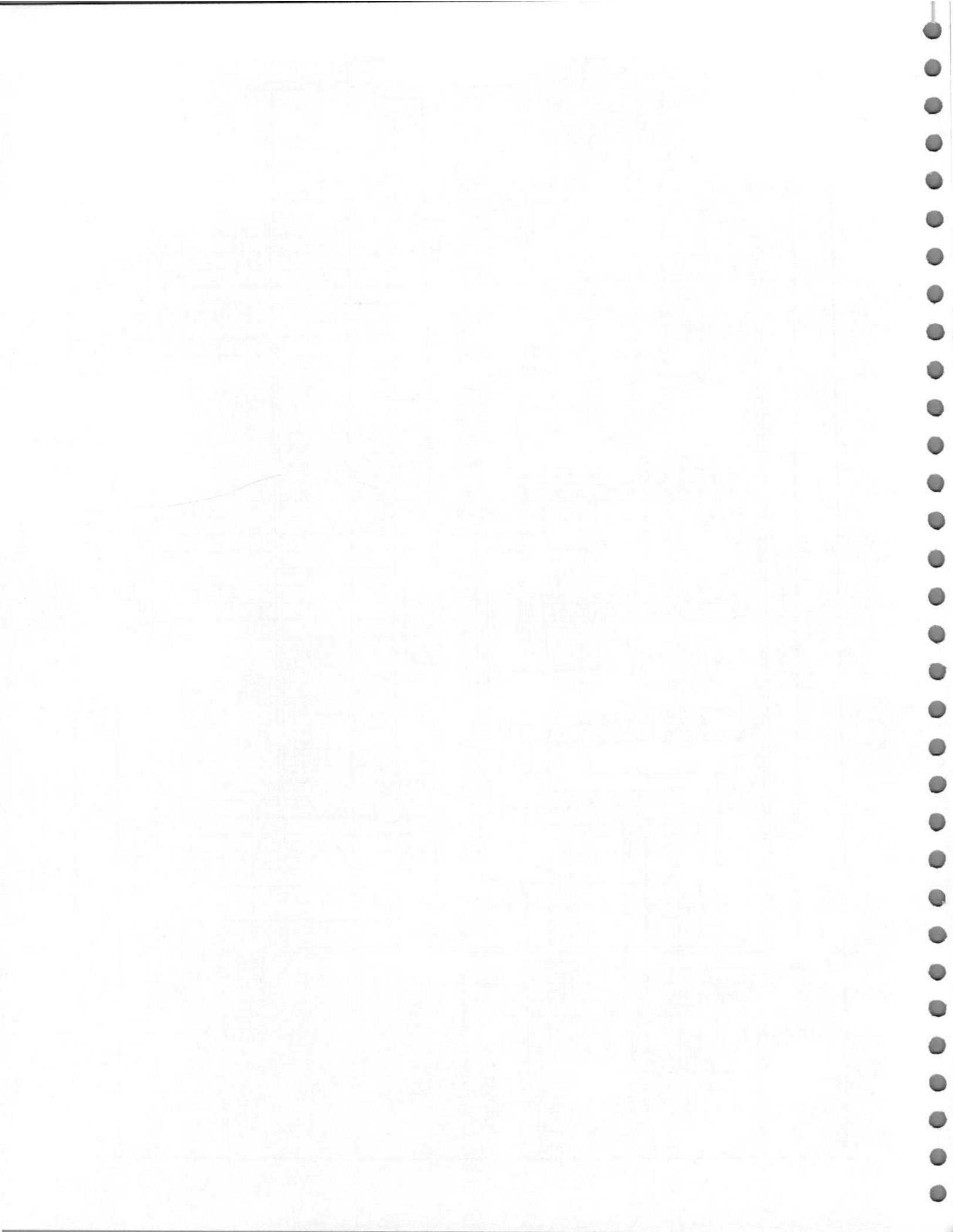
STREAM	ISSUE	1S6C28CA	SHEET 83
01	07		



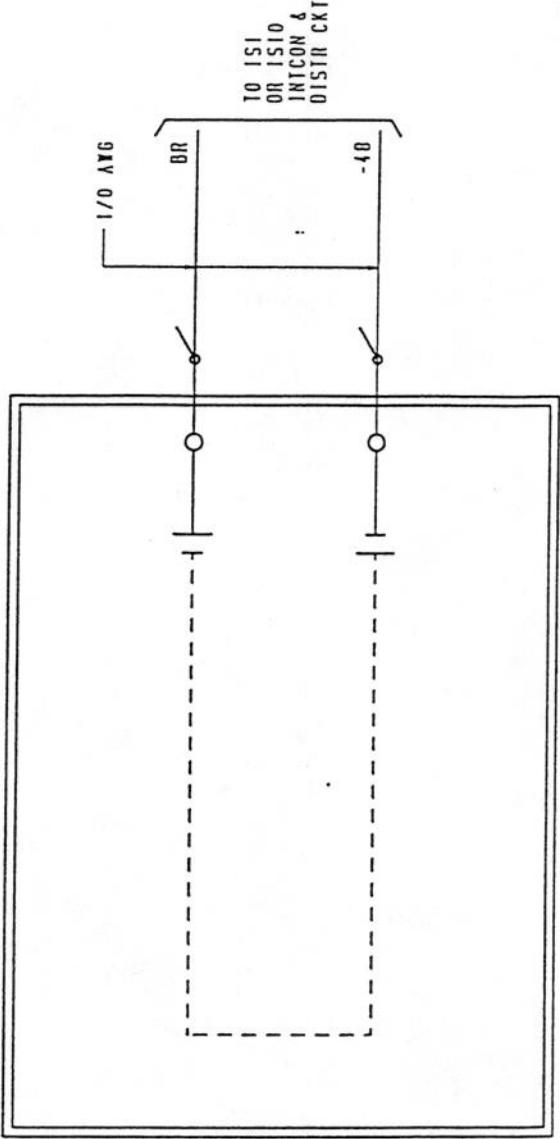
IS3

RECTIFIER SHELF CIRCUIT
(3 POS) NTSC10 TYPE
WITH INDIVIDUAL AC





154
 BATTERY SHELF
 N15C11 TYPE
 (SEE W56C28 FOR BATTERIES)



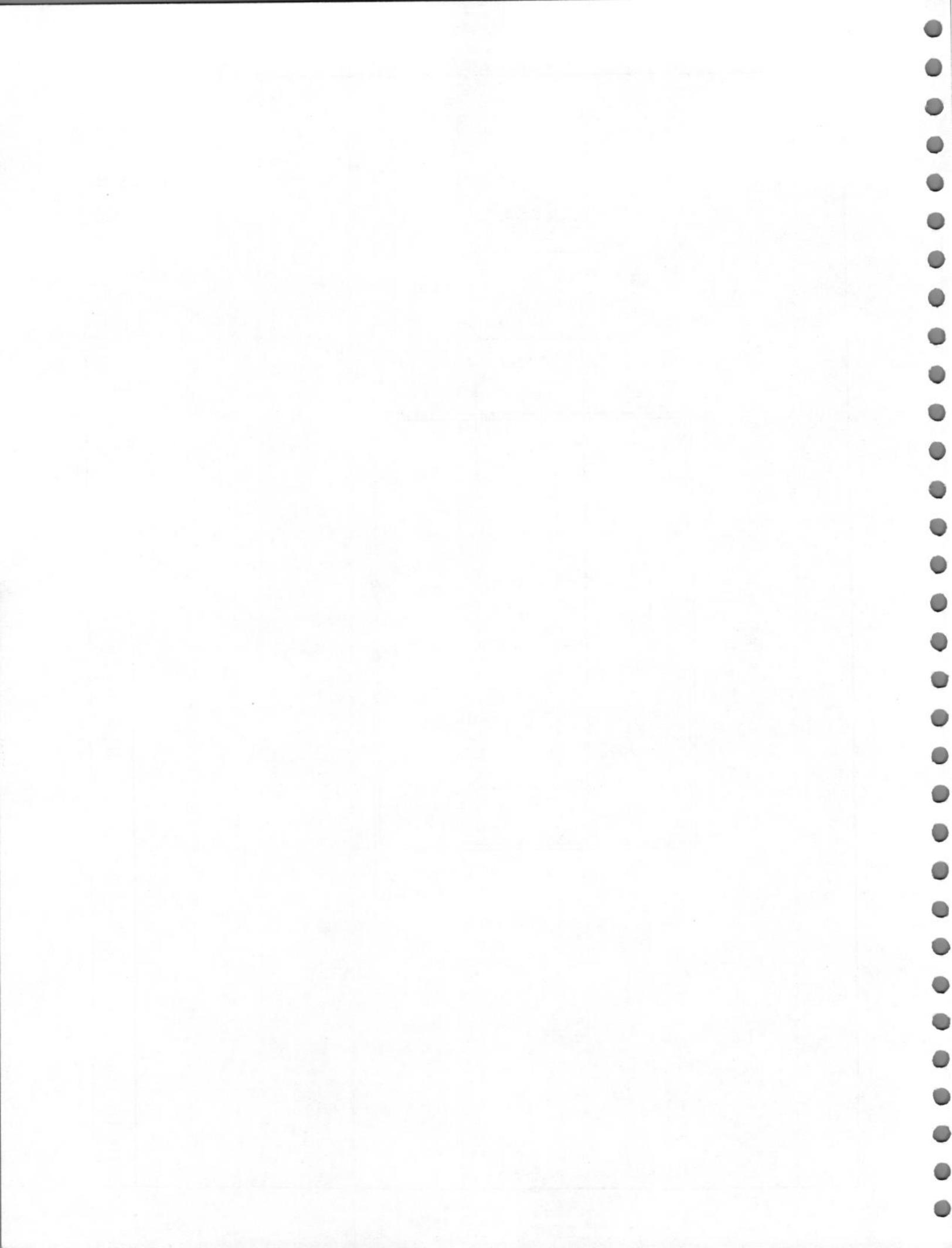
SCALE 1/1

NORTHERN TELECOM

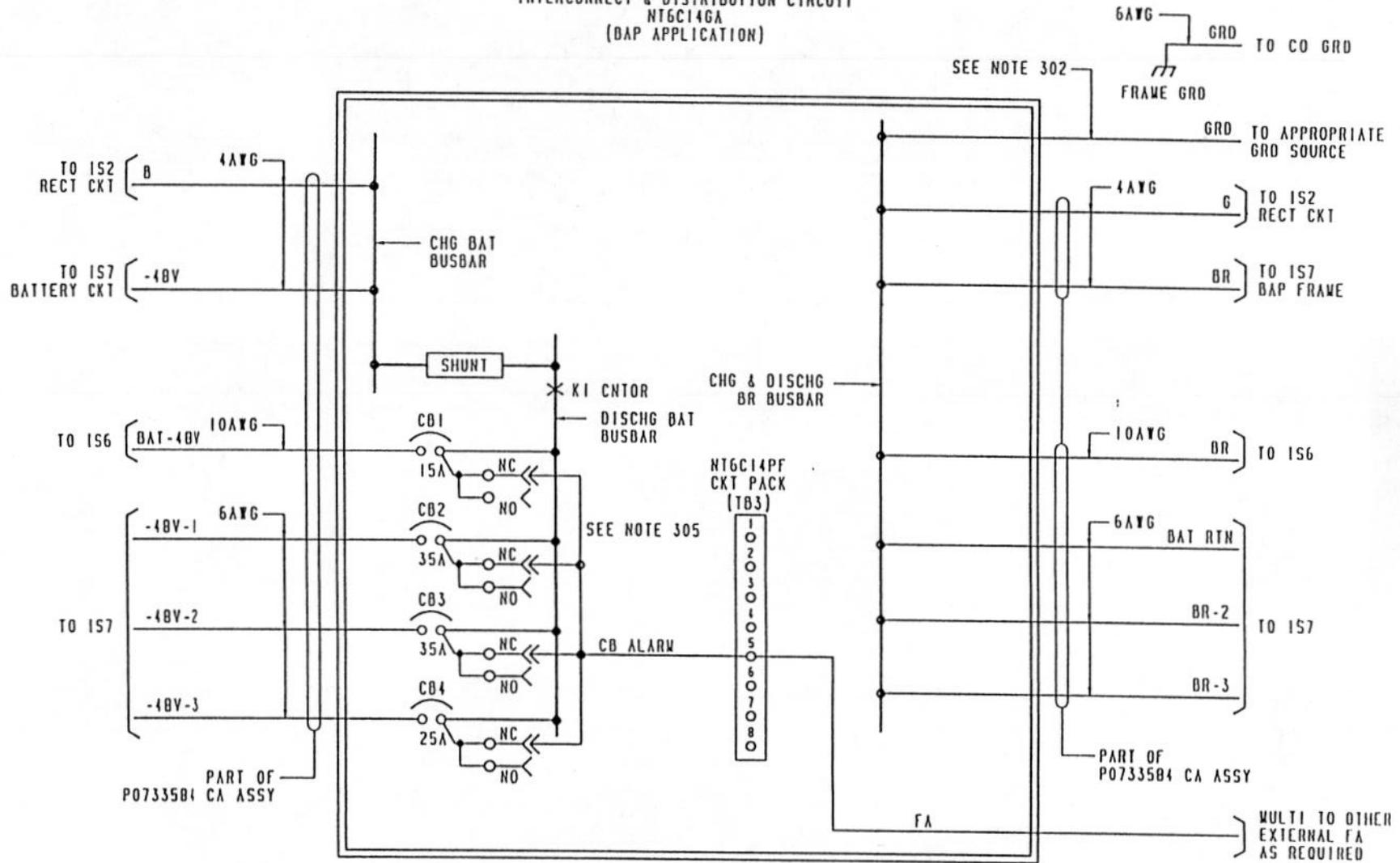
STREAM	ISSUE
01	07

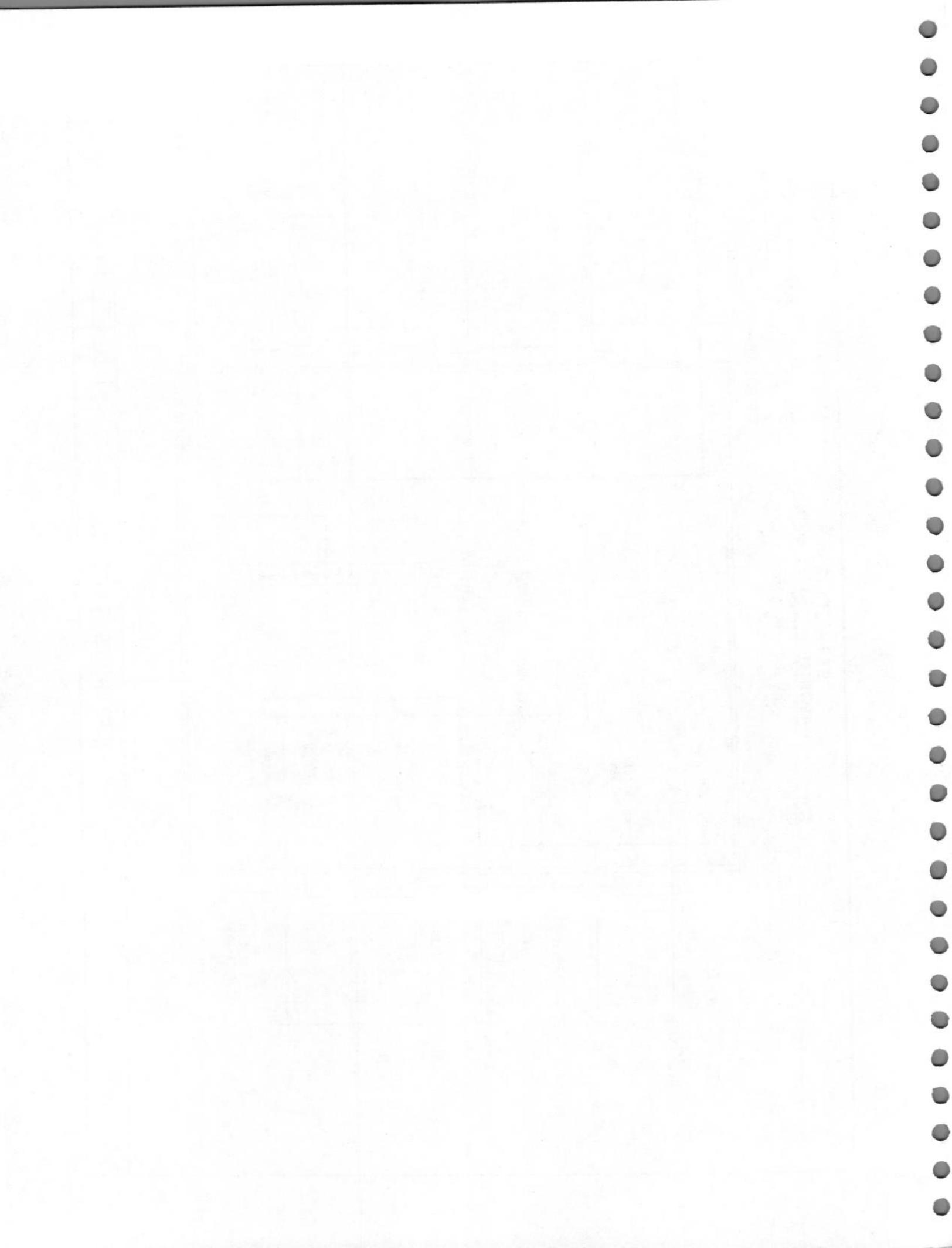
156C28CA

SHEET
85

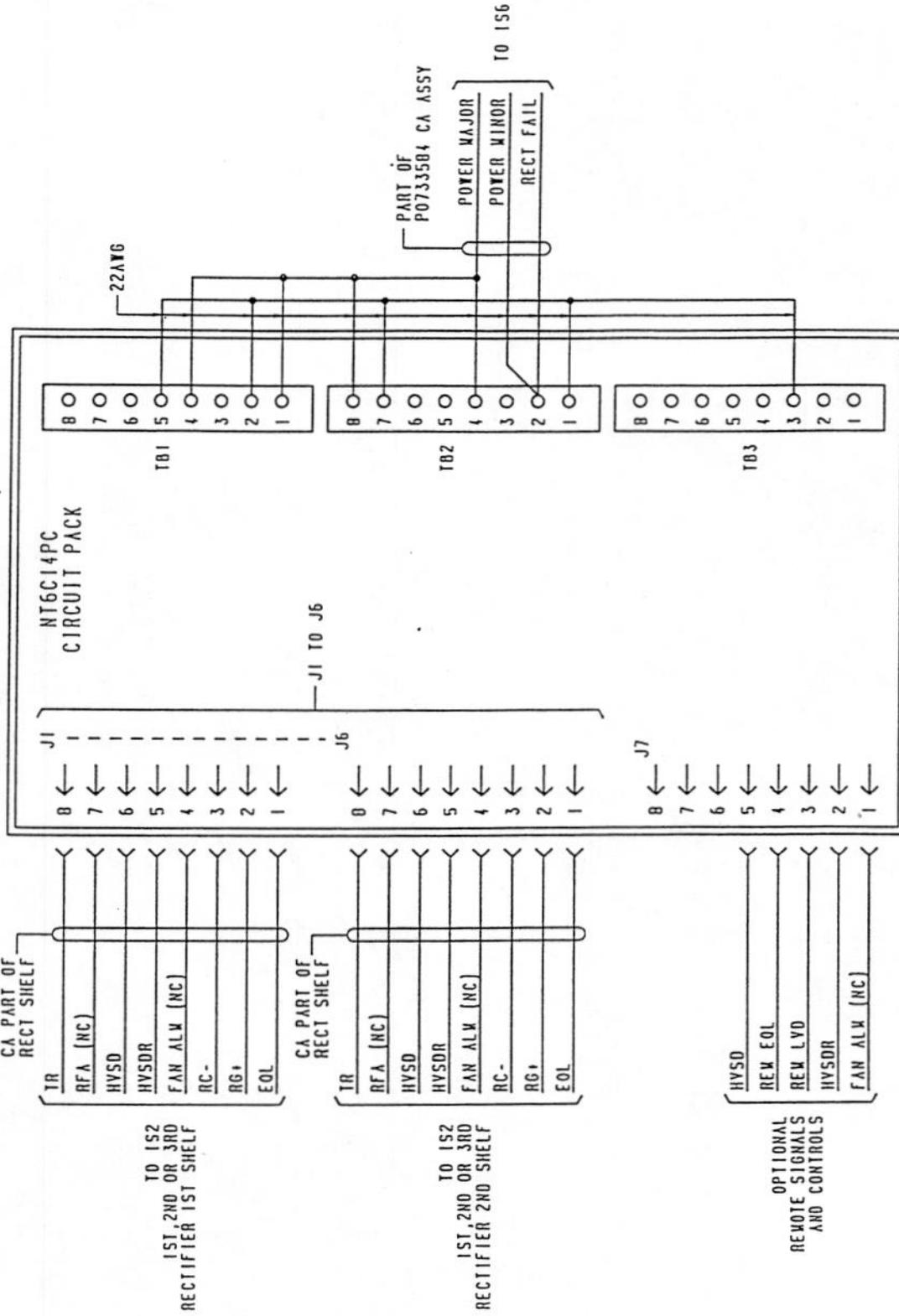


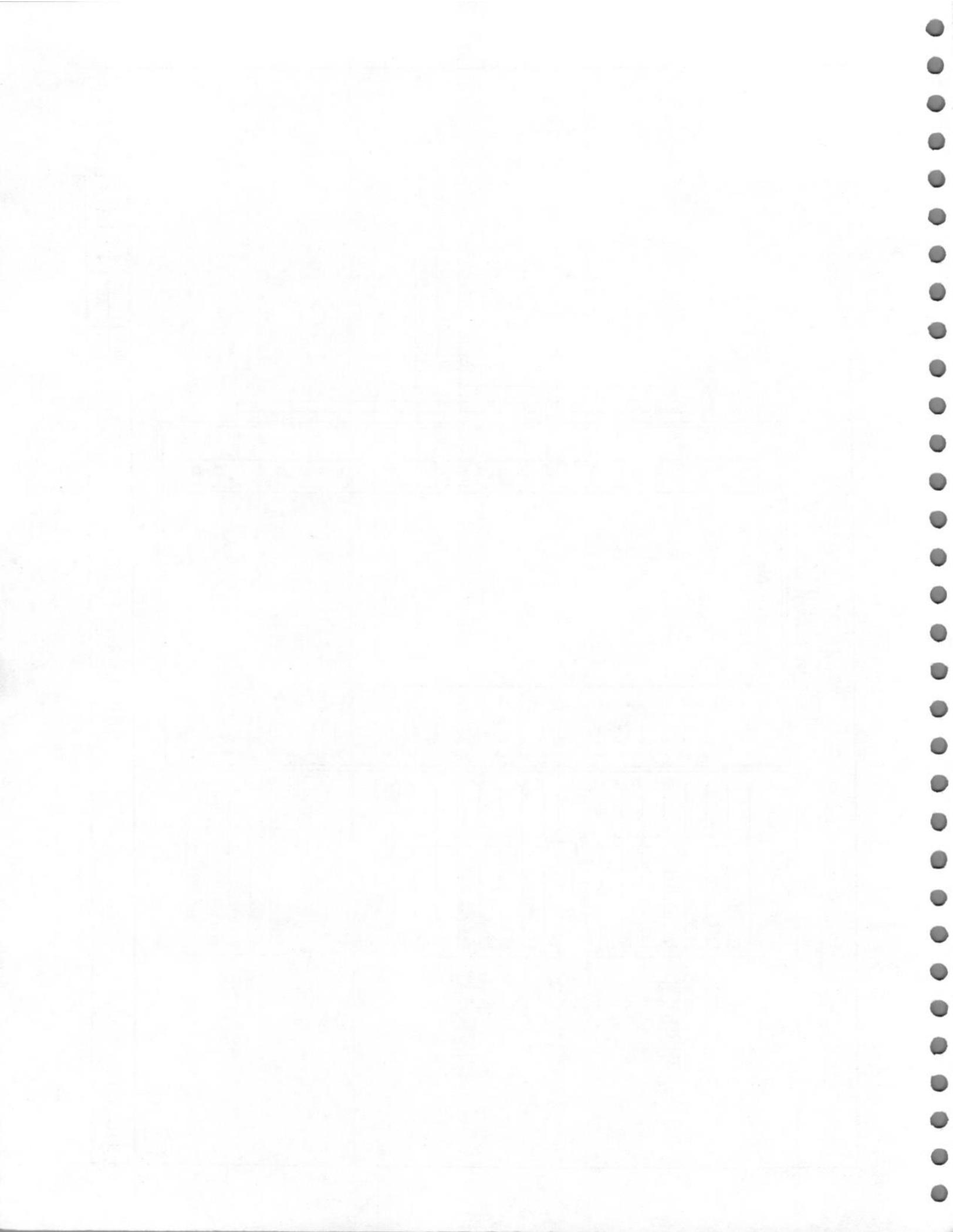
PART OF 155
 INTERCONNECT & DISTRIBUTION CIRCUIT
 NT6C14GA
 (BAP APPLICATION)





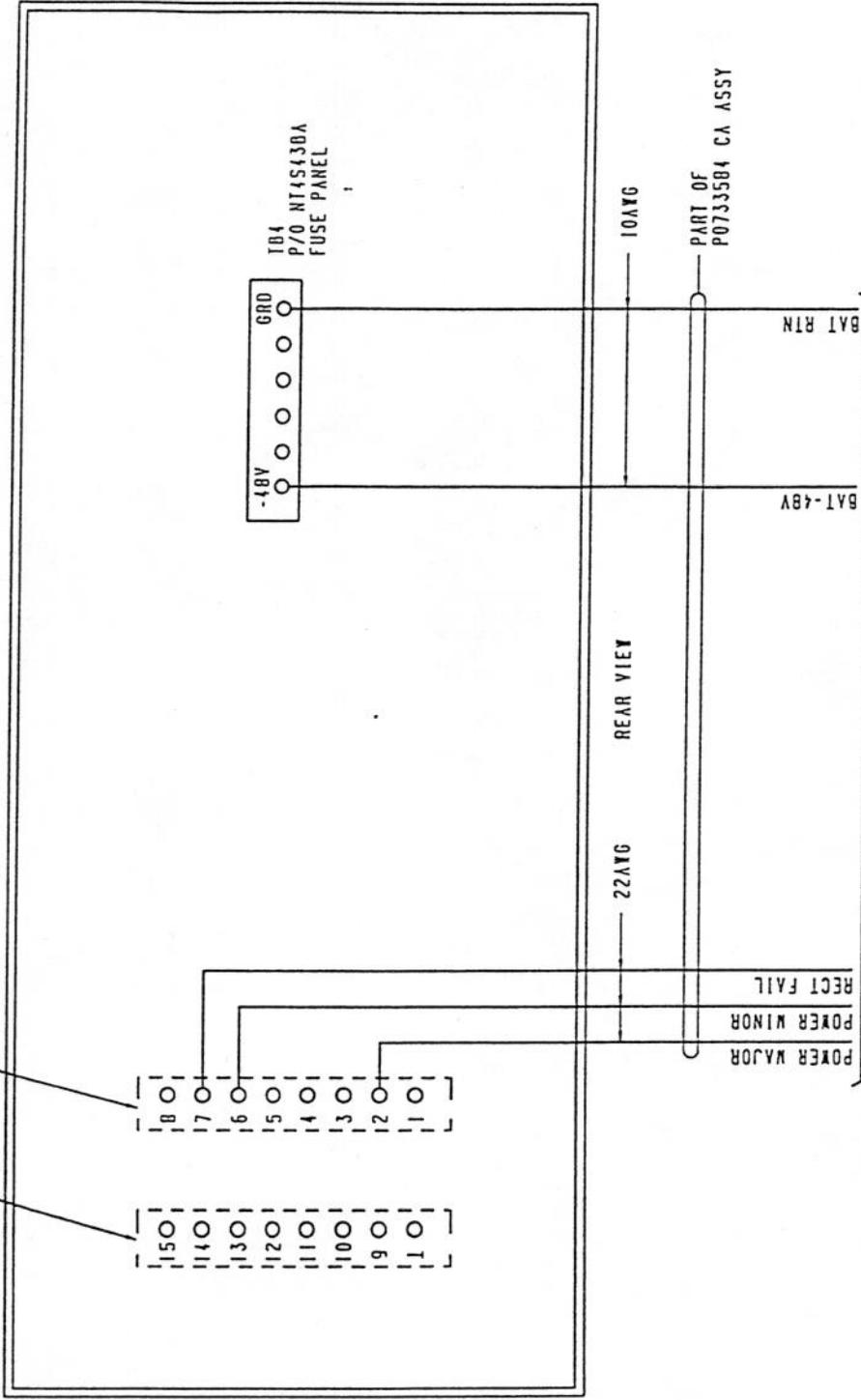
PART OF 155
INTERCONNECT & DISTRIBUTION CIRCUIT
NT6C14GA (BAP APPLICATION)



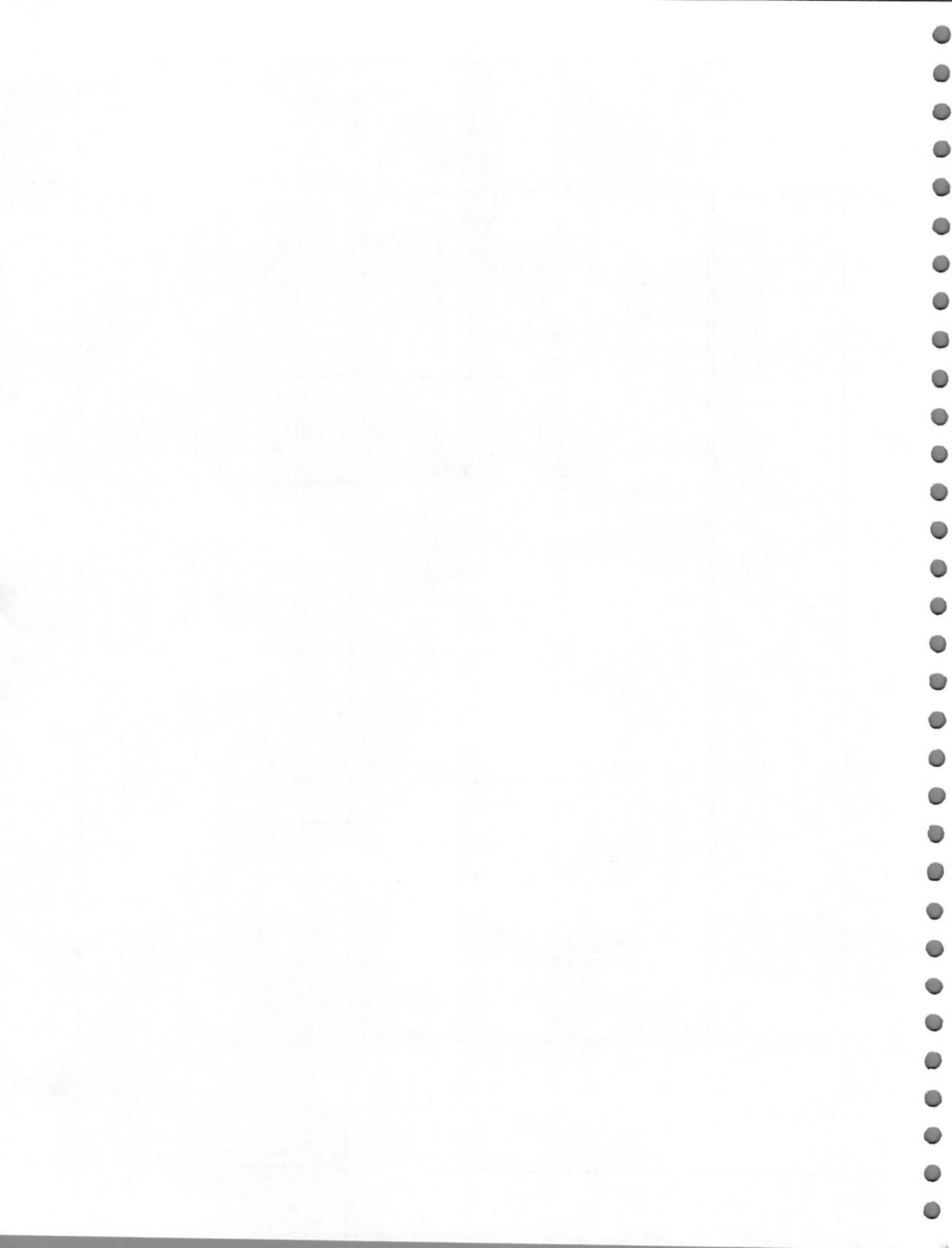


156
 FUSE PANEL
 P/O NT4P49AA
 (BAP APPLICATION)

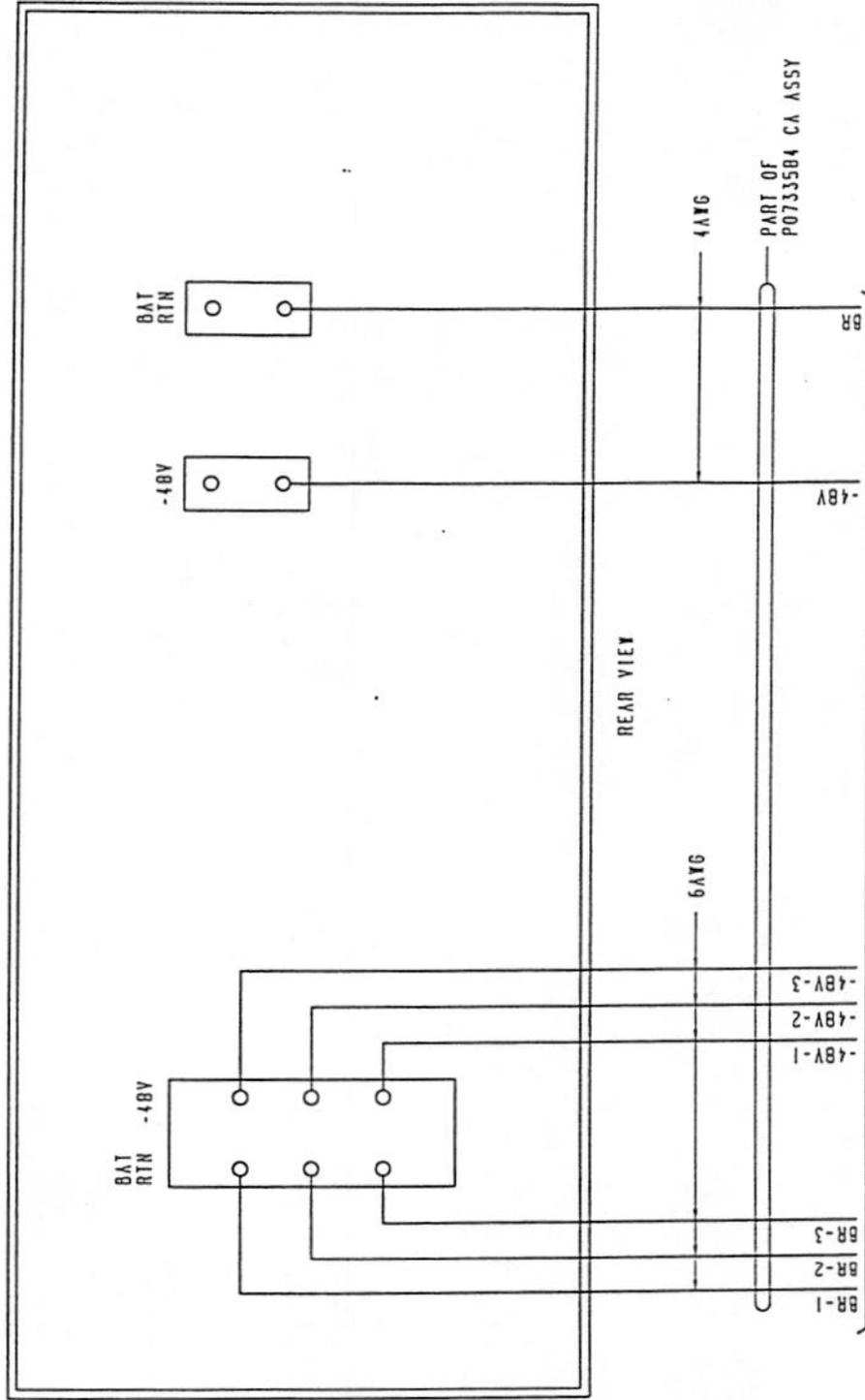
ALARM TO
 LOCATED AT THE
 FRONT OF UNIT
 (NT4P41AA)



TO 155



157
BAP FRAME
P/O NT4P49AA

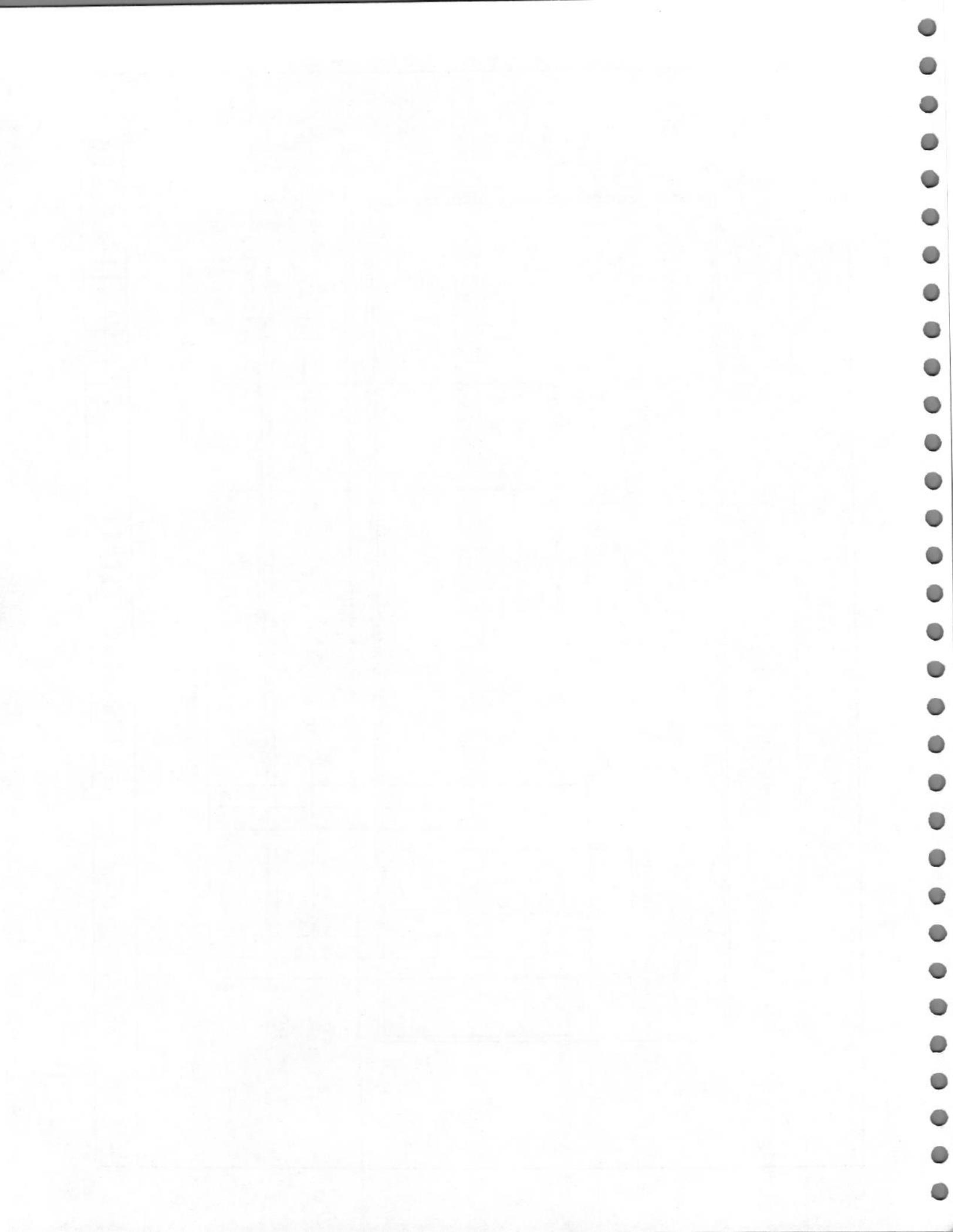


SCALE 1/1

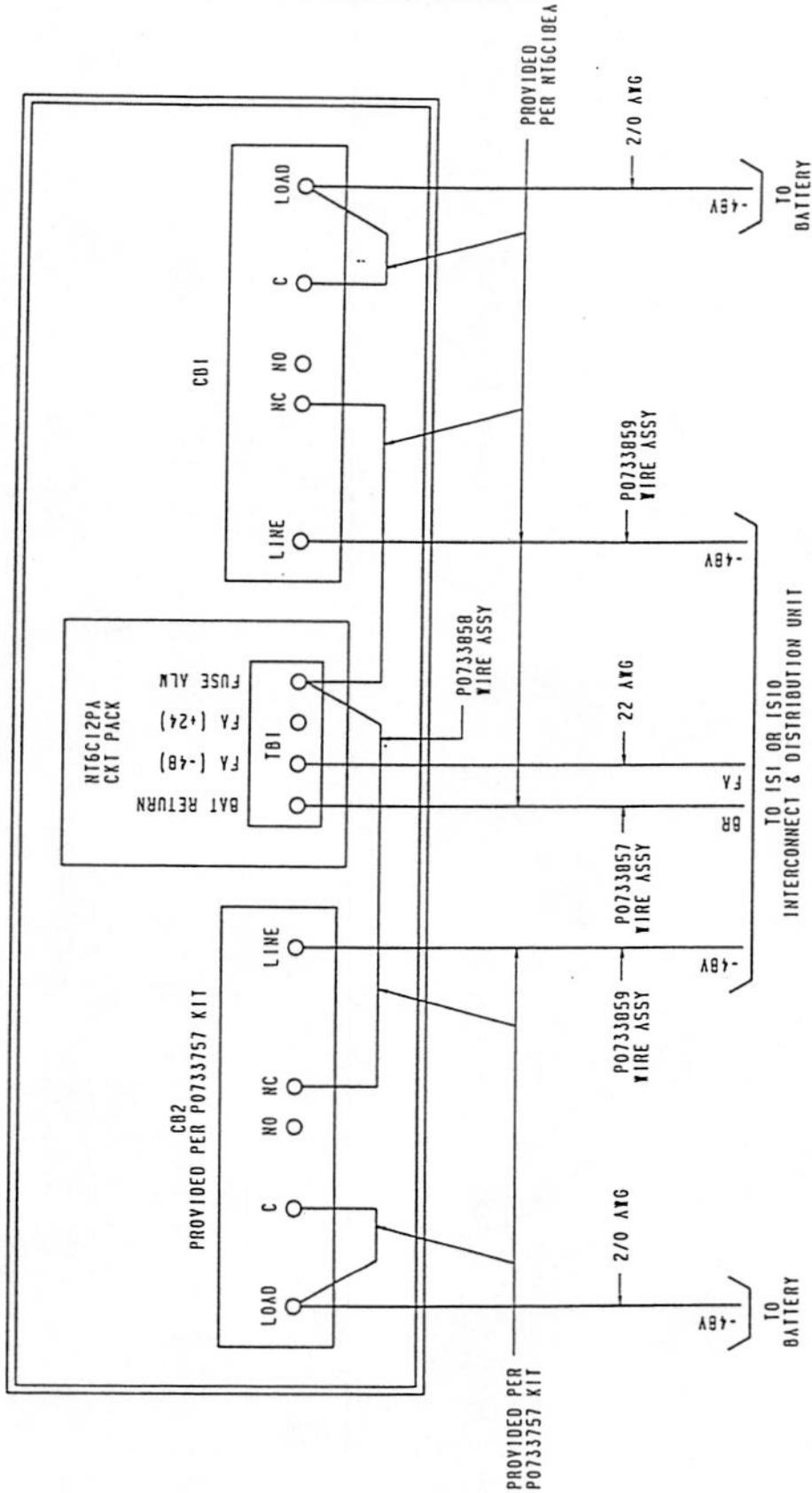
NORTHERN TELECOM

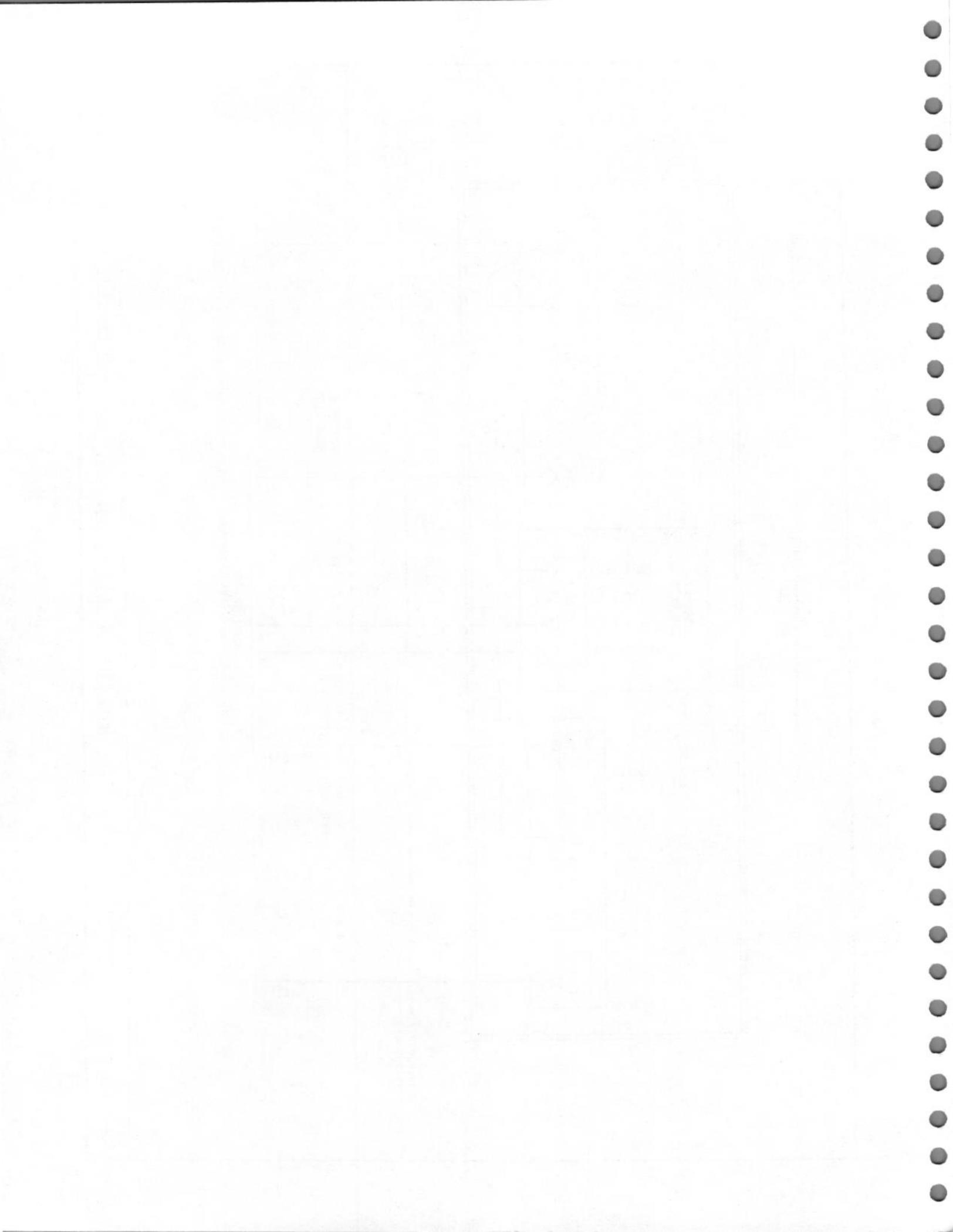
STREAM	ISSUE	SHEET
01	07	B9

156C28CA



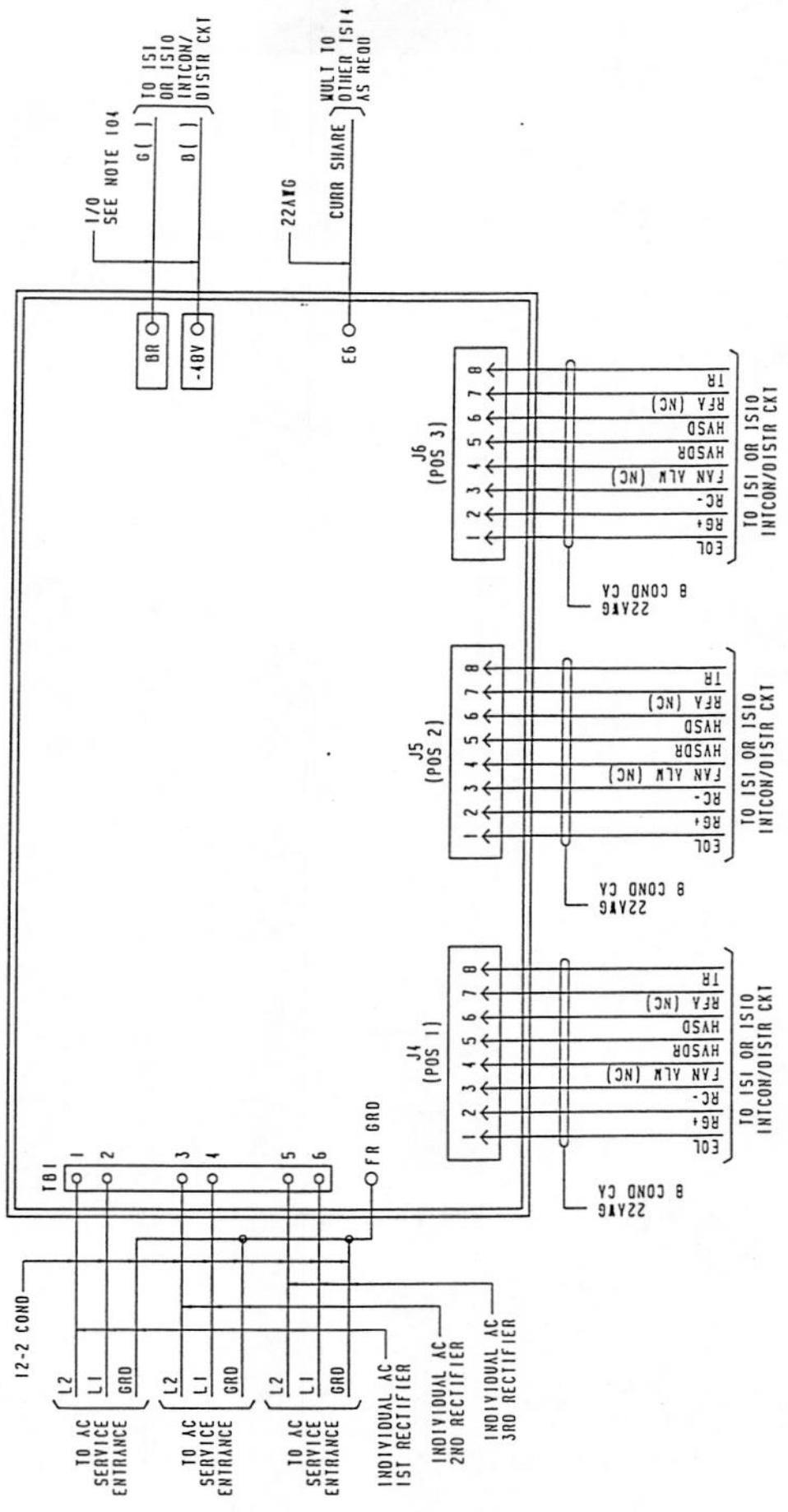
ISB
BATTERY DISCONNECT CIRCUIT
NT6C18EA





159

MPS150 RECTIFIER SHELF CIRCUIT
 (3 POS) NT5C12 TYPE WITH INDIVIDUAL AC
 FOR -48V, 50A NT5C07 TYPE PLUG-IN RECTIFIERS



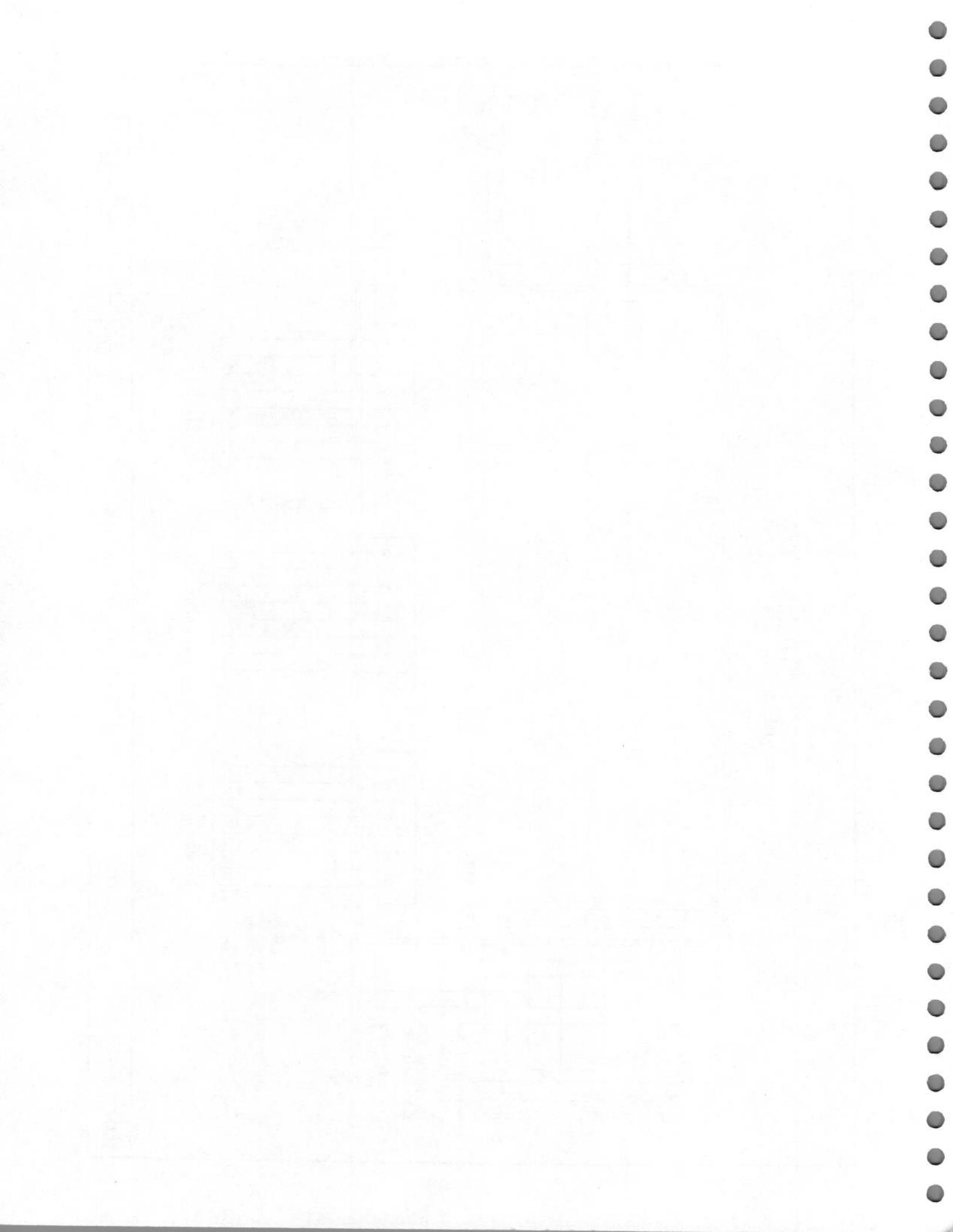
SCALE 1/1

NORTHERN TELECOM

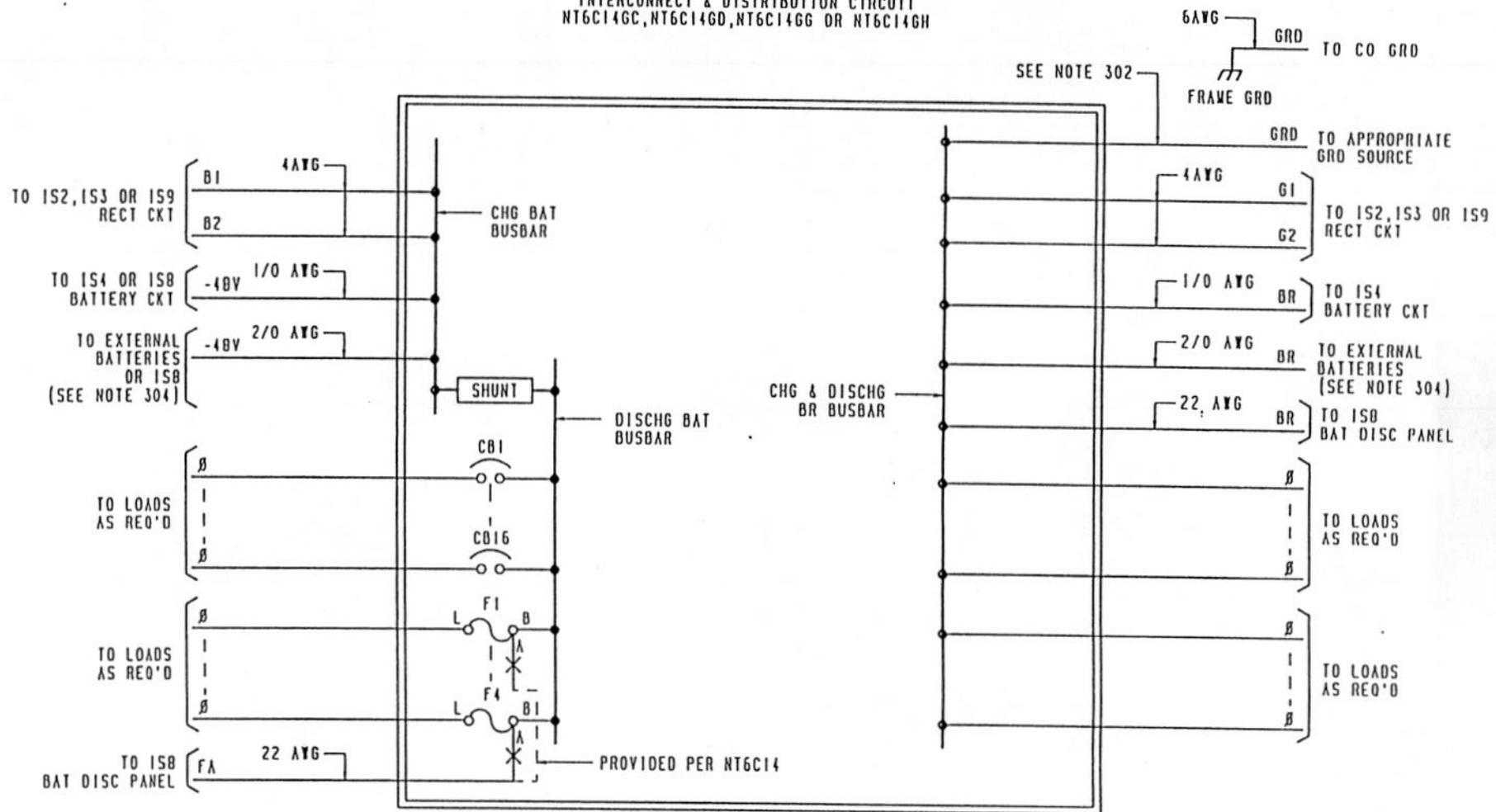
STREAM ISSUE
01 07

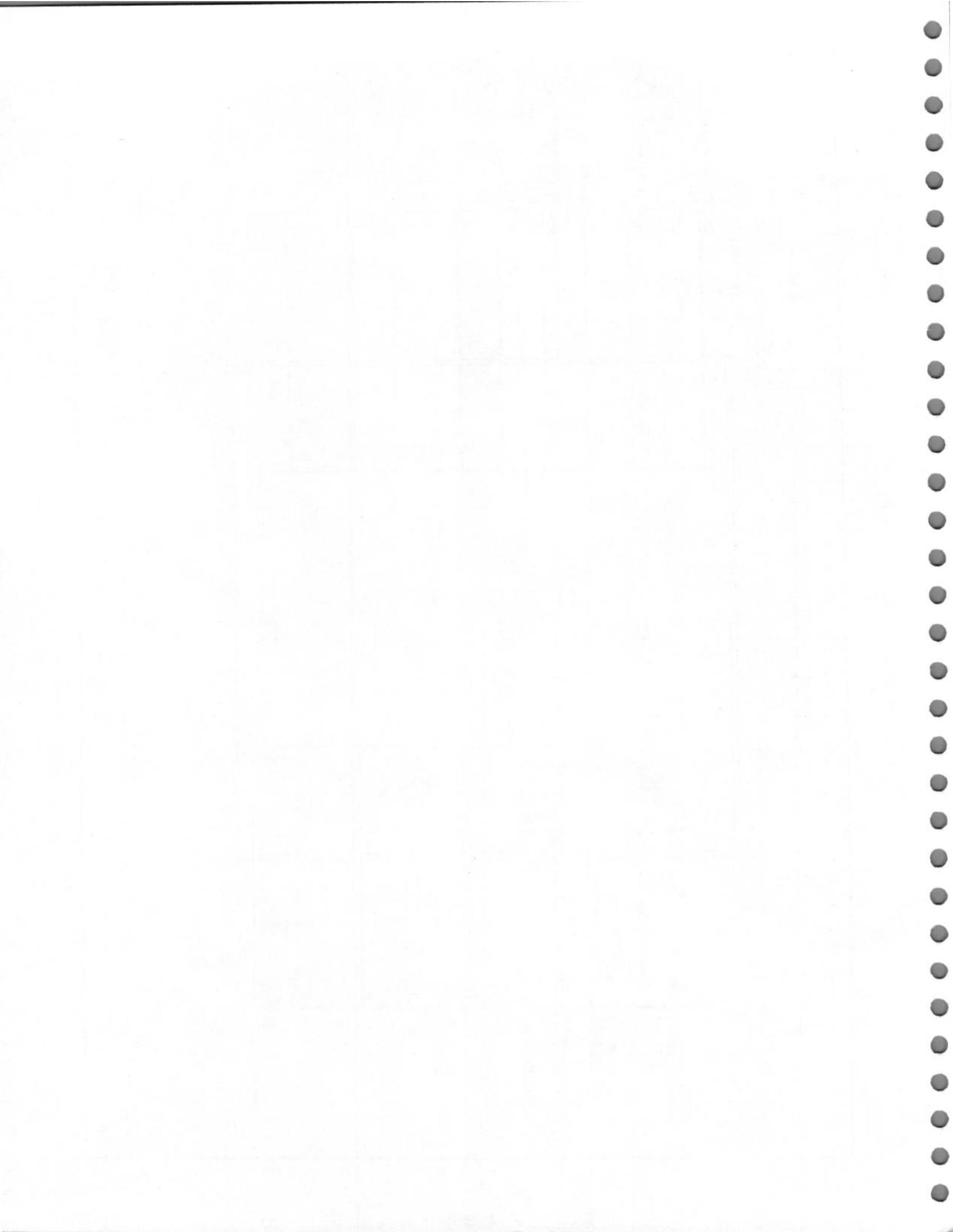
SHEET
B11

IS6C28CA

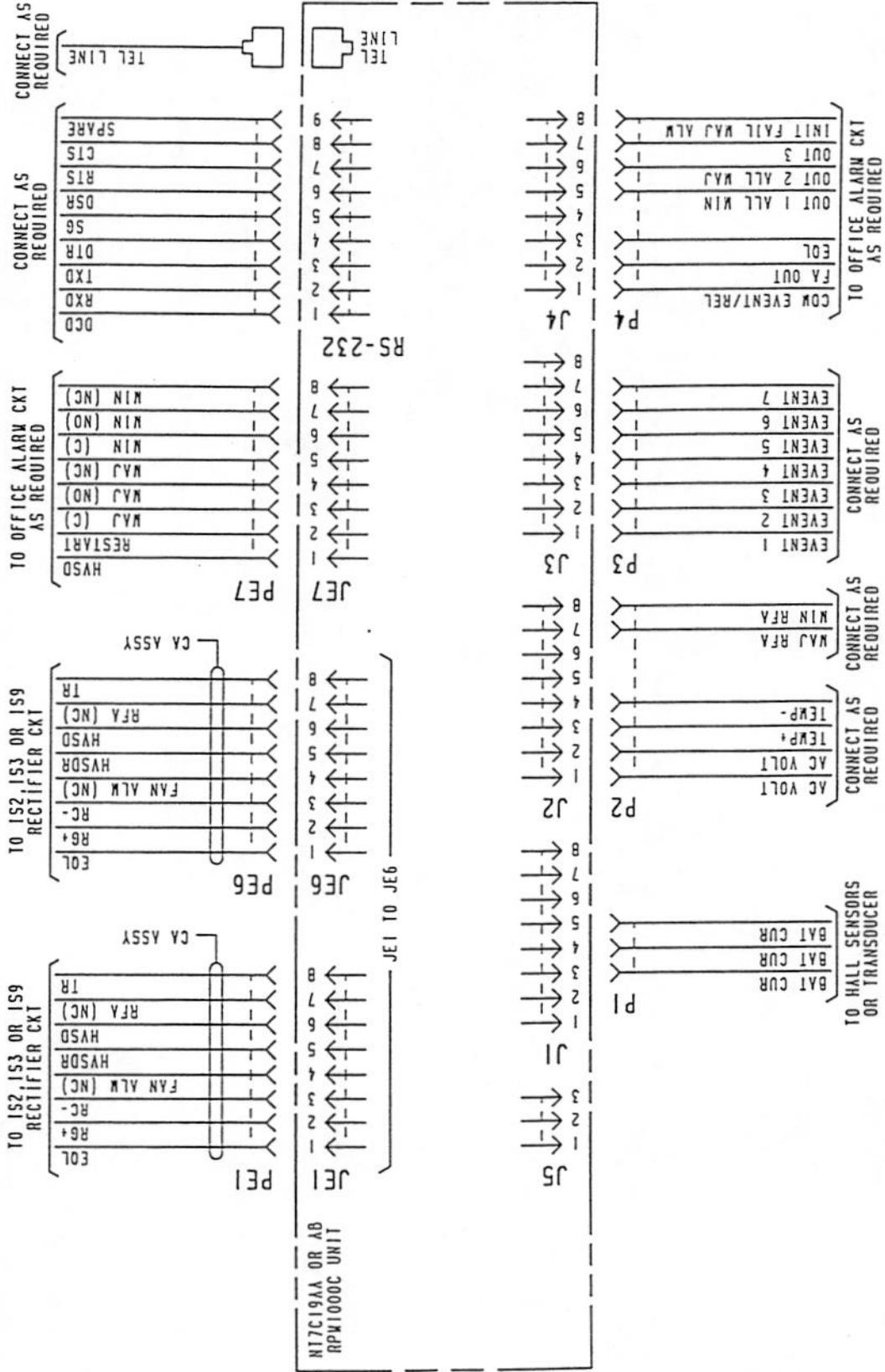


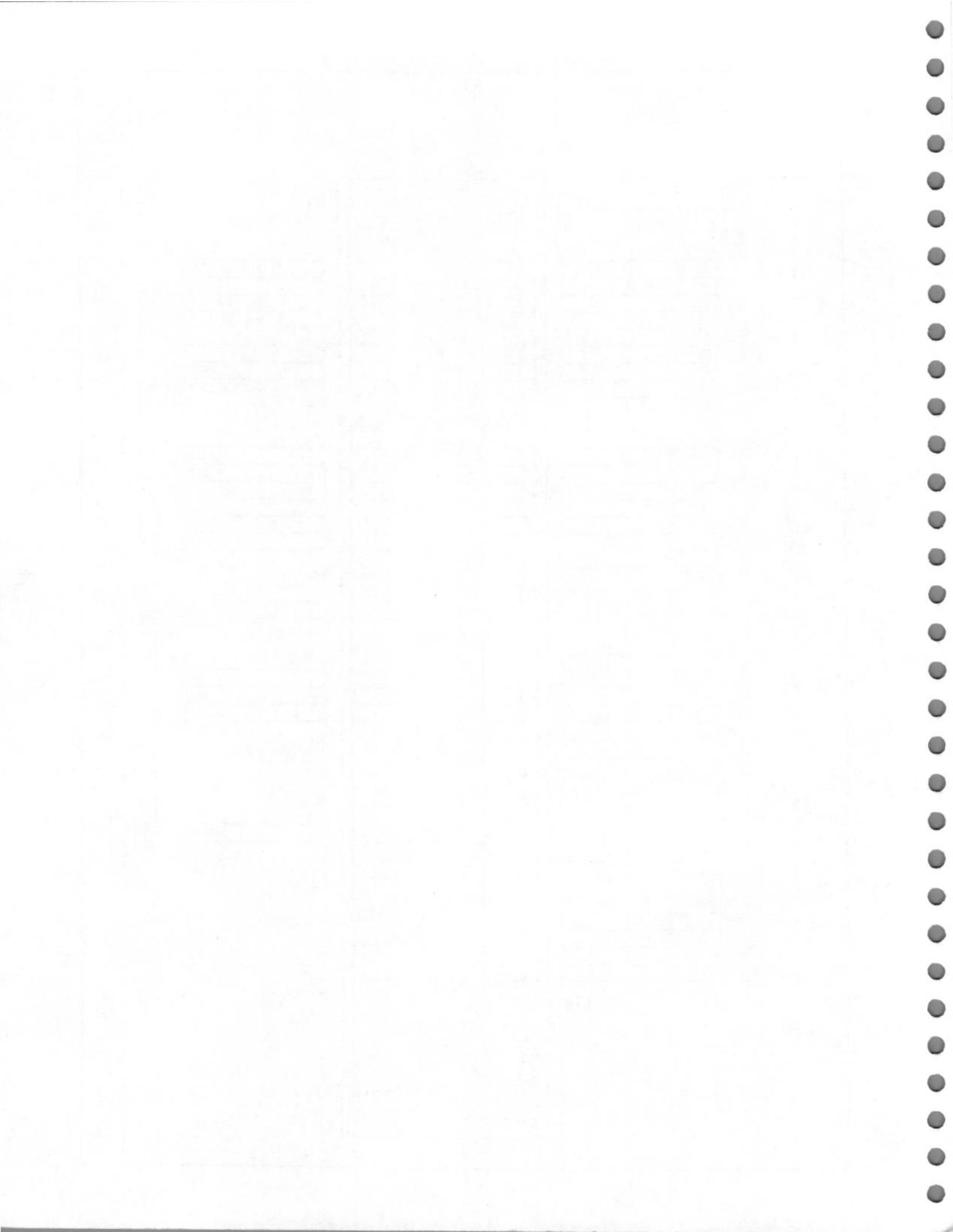
PART OF IS10
 INTERCONNECT & DISTRIBUTION CIRCUIT
 NT6C14GC, NT6C14GD, NT6C14GG OR NT6C14GH



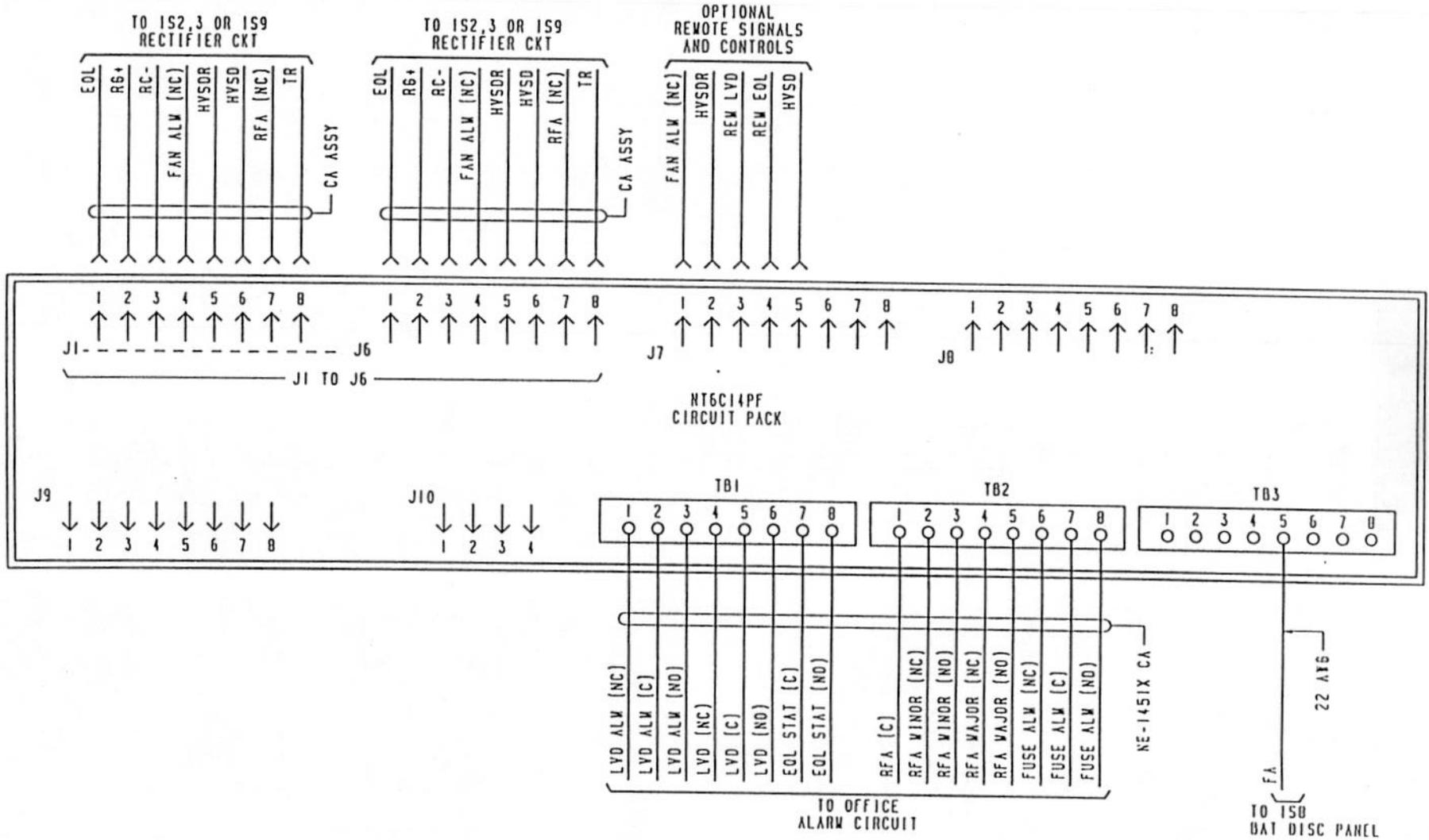


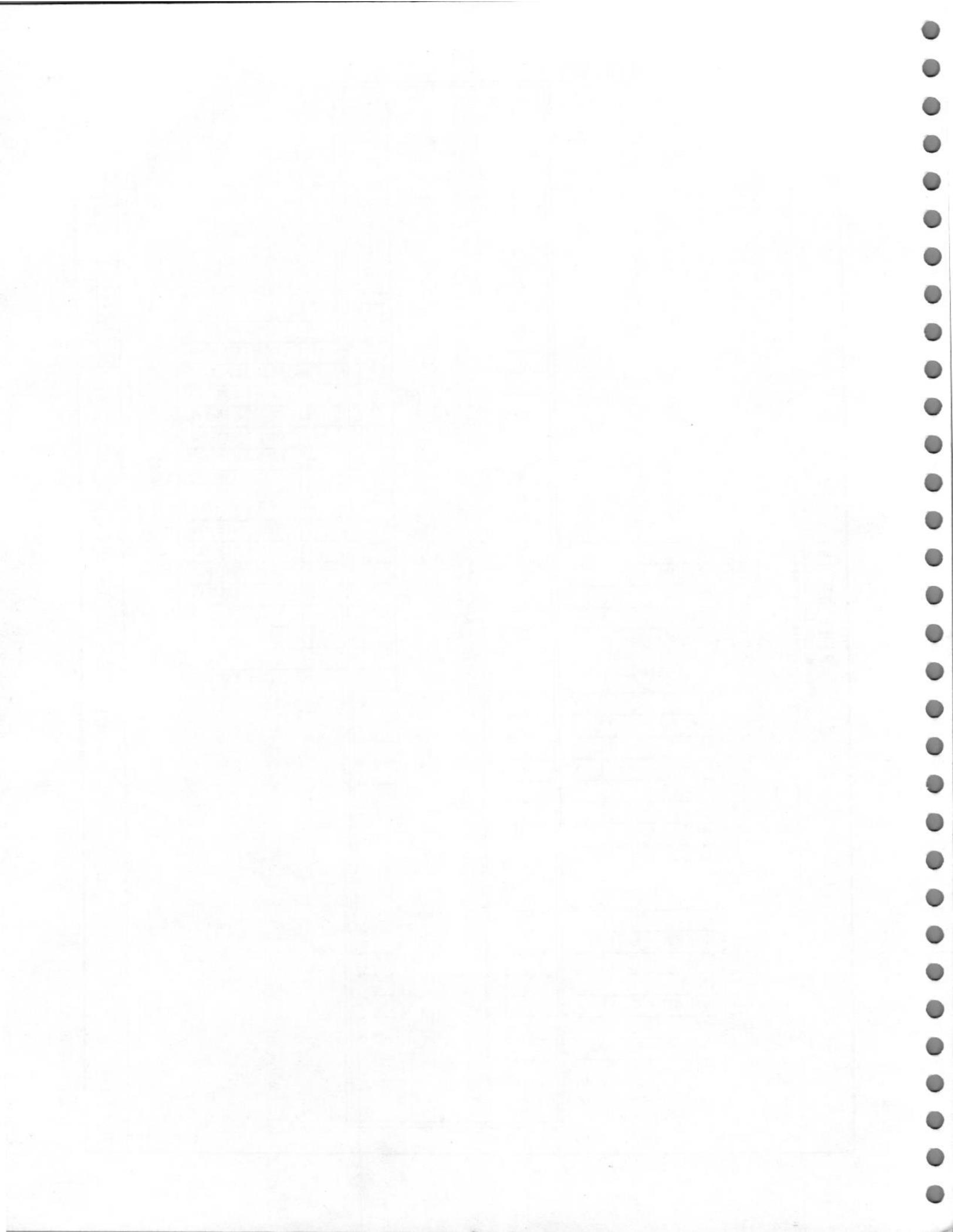
PART OF IS10
INTERCONNECT & DISTRIBUTION CIRCUIT
NT6C146C, NT6C146D, NT6C146G OR NT6C146H

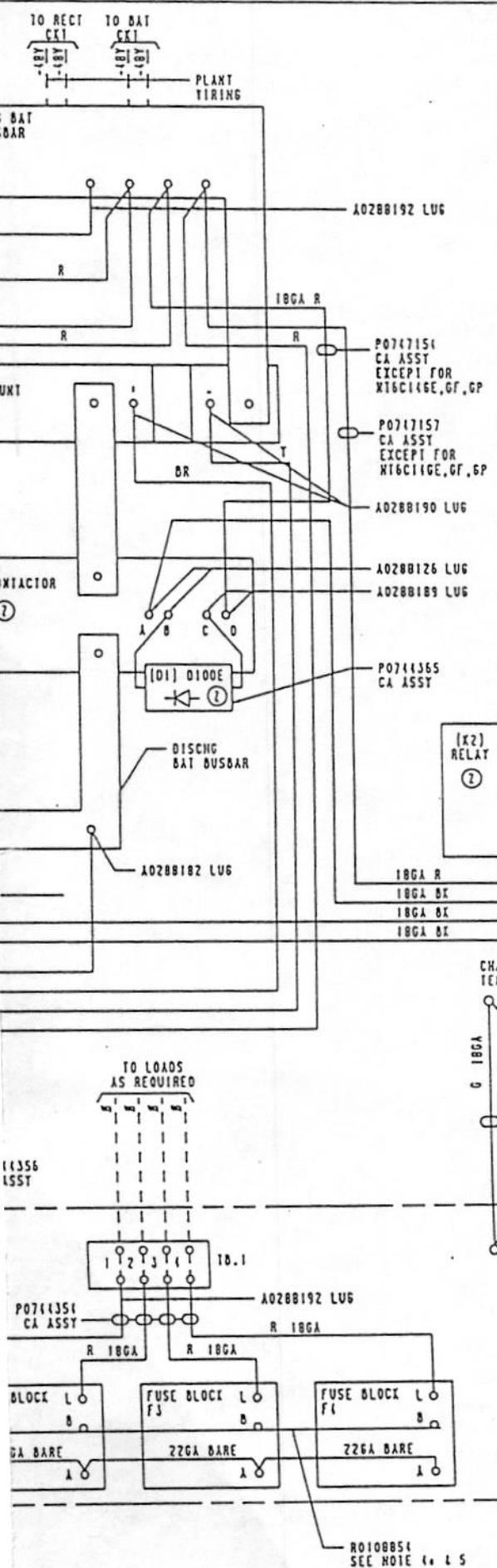




PART OF IS1
DISTRIBUTION AND CONTROL CIRCUIT
NT6C14G TYPE







MANUFACTURING NOTES AND CONVENTIONS

- DIVISION OF GENERAL TIRING YIELDS
- - - - - DEVOTES PLANT OR INSTALLER TIRING.
- SUPPORTING DOCUMENTATION:
 VODULAR STRUCTURE VS6C11
 ASSEMBLY DTG A06C146A STOCKLIST SL6C146A
 ASSEMBLY DTG A06C146B/GV STOCKLIST SL6C146B
 ASSEMBLY DTG A06C146B/GV STOCKLIST SL6C146X
 ASSEMBLY DTG A06C146E STOCKLIST SL6C146E
 ASSEMBLY DTG A06C146F/GP STOCKLIST SL6C146F
 ASSEMBLY DTG A06C146F/GP STOCKLIST SL6C146F
 - LEADS SHOWN TERMINATED IN COMPONENTS WITHOUT TERMINALS ARE FURNISHED WITH COMPONENTS.
 - THIS LEAD IS ASSOCIATED WITH ALARY TERMS OF CIRCUIT BREAKERS AND SHOULD BE CONNECTED AS REQUIRED PER PLANT APPLICATION.
 - TIRING SHALL BE AS FOLLOWS:
 [ALL CABLE ASSEMBLY SHALL BE IDENTIFIED IN THE SHOP AID.]
 - a) 72 X 36 GA BRAIDED FLAT CABLE 8661 (BLODCK) - R0108851
 - b) 116A RED - R0114809
 186A BLACK - R0109536
 186A RED - R0113254
 186A GREEN - R0113978
 226A RED - R0106510
 226A BLACK - R0106512
 - c) 22GA BARE TIRE - R0002096
 - ADD P0723166 ISOLATION MATERIAL OVER BRAIDED TIRE AT F1 TO F4 TERMINAL 8.

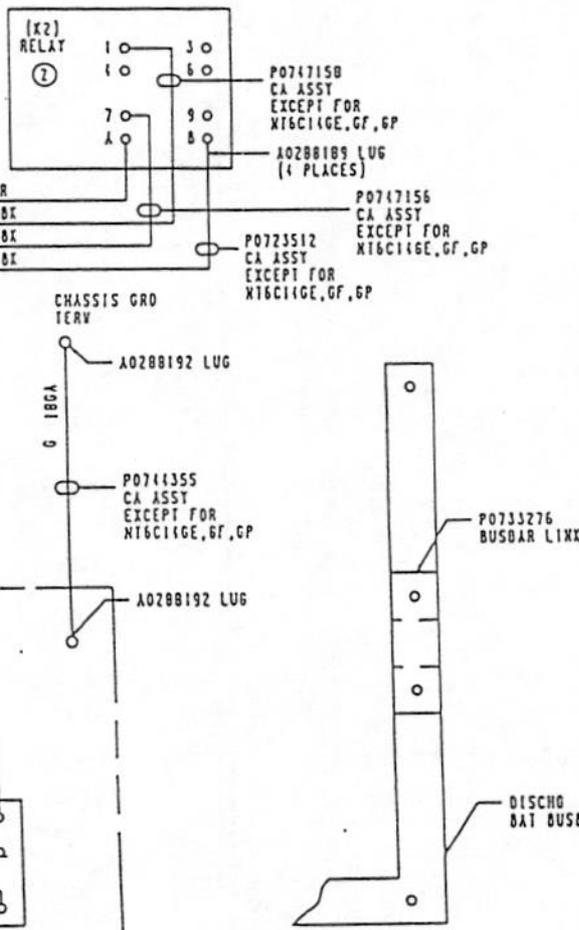
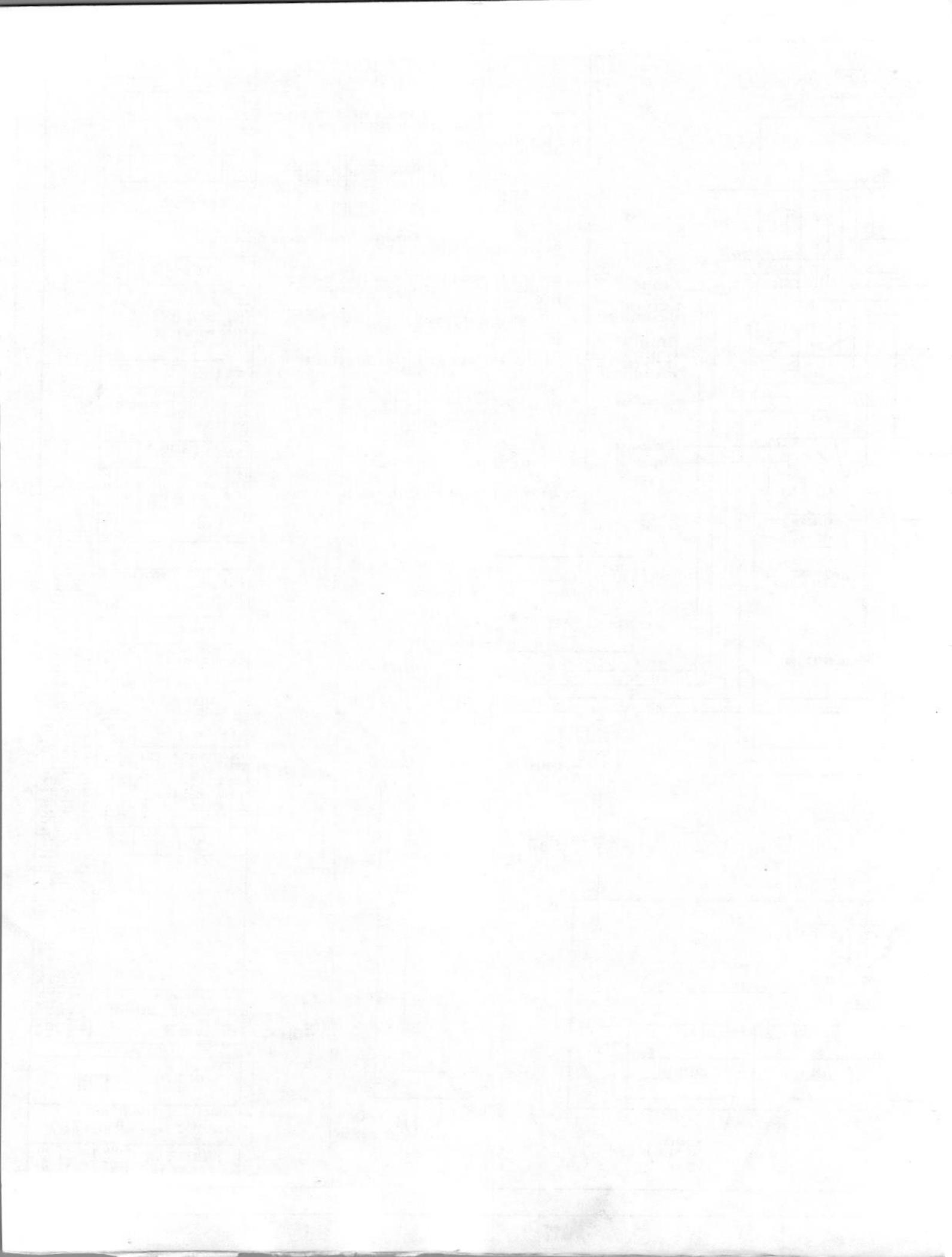
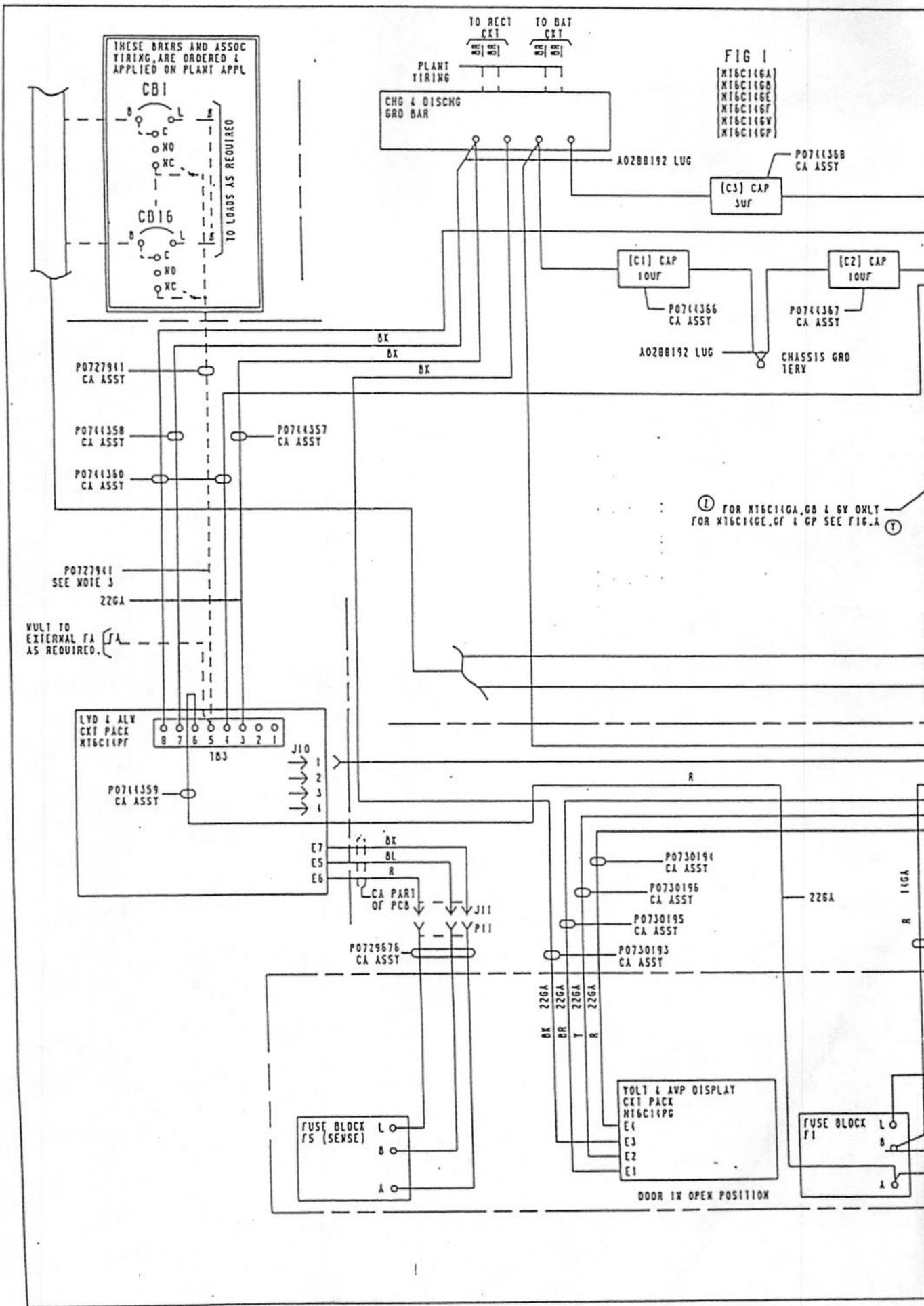


FIG A (T)
FOR NT6C146,GF & GP ONLY

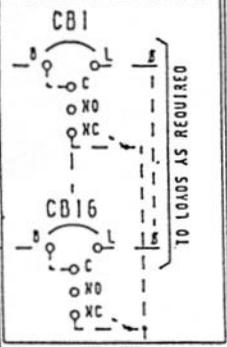
DRAWING NUMBER WD6C14GA			
91-03-19		DCMP10207	
RDC GDC	VD	STACAX	ISSUE
		01	01
D1 DIODE ADDED. DCN P10501 91-05-09			
RDC	J.S	STACAX	ISSUE
		01	02
NT6C146,GF & FIG.A ADDED. FS FUSE BLOCK, LEADS 8 & L INTCHG. "GRD BAR" READ "BR BUSBAR". VODIFT EXISTING STOCK. DCN P10811 91-08-23			
RP	J.S	STACAX	ISSUE
		01	03
Z AND Y OPTIONS CLARIFIED. CK1 BREAKER INFO AND 101 PLANT LEADS SHOWN FOR INFORMATION ONLY. EXISTING STOCK NOT AFFECTED. DCN P1205 92-02-14			
RDC	V.D	STACAX	ISSUE
		01	04
SHUNT CABLES P0730195 AND P0730196 INTERCHANGED. VODIFT EXISTING STOCK. DCN P020911-E 92-10-29			
RDC	V.D	STACAX	ISSUE
		01	05
C3 CAPACITOR ADDED. AT "K1" CONTACTOR, REF TO A0288189 READ A0351559 LUG. CK1 PACK NT6C146P READ NT6C146P. DCN P30511 93-08-27			
RP	AV	STACAX	ISSUE
		01	06
183-J, (,) & B 22GA TIRE READ 20GA. DCN P30509 93-11-00			
RDC	AV	STACAX	ISSUE
		01	07
NT6C146P CHGD TO NT6C146P. DOLPHIN BRET MODELS ADDED. RELAY X2 ADDED. J11 & P11 READ JB & PB RESP. NOTE 5 ADDED. DCN P31207 91-03-20			
VP	AV	STACAX	ISSUE
		01	08
NT6C146V & GP ADDED FOR OPTION Z & Y RESP. NOTE 1 CHNG. NOTE 1 REF TO UL & CSA RWY. REF TO CA ASSY ADDED THRU-OUT DTG. DCN E10505 91-11-01			
JO	RY	STACAX	ISSUE
		01	09
INITIAL APPLICATION INTERCONNECT & DISTRIBUTION UNIT NT6C146A,GB,GE DR GF			
POWER SYSTEMS			
INTERCONNECT & DISTRIBUTION MODULE TIRING DIAGRAM			
SCALE	DRAWING NUMBER		
1/1	WD6C14GA		
NORTHERN TELECOM		SIZE	PAGE
		6S	1 OF 1

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 SHALL USE SAME ONLY FOR OPERATING AND MAINTENANCE PURPOSES ONLY.





THESE BKRS AND ASSOC TIRING, ARE ORDERED & APPLIED ON PLANT APPL



TO RECT CXT
TO BAT CXT

FIG 1
NT6C11GA
NT6C11GB
NT6C11GE
NT6C11GF
NT6C11GP

P0727911 CA ASSY

P0711358 CA ASSY

P0711360 CA ASSY

P0711357 CA ASSY

[C1] CAP 10UF
P0711366 CA ASSY

[C2] CAP 10UF
P0711367 CA ASSY

[C3] CAP 3UF
P0711368 CA ASSY

P0727911
SEE NOTE 3

MULT TO EXTERNAL FA AS REQUIRED.

LYD & ALV CXT PACK NT6C11PF

8 7 6 5 4 3 2 1

P0711359 CA ASSY

E7
E5
E6

P0729676 CA ASSY

P0730191 CA ASSY

P0730196 CA ASSY

P0730195 CA ASSY

P0730193 CA ASSY

FUSE BLOCK FS (SENSE)

L
B
A

TOLT & AVP DISPLAY CXT PACK NT6C11PG

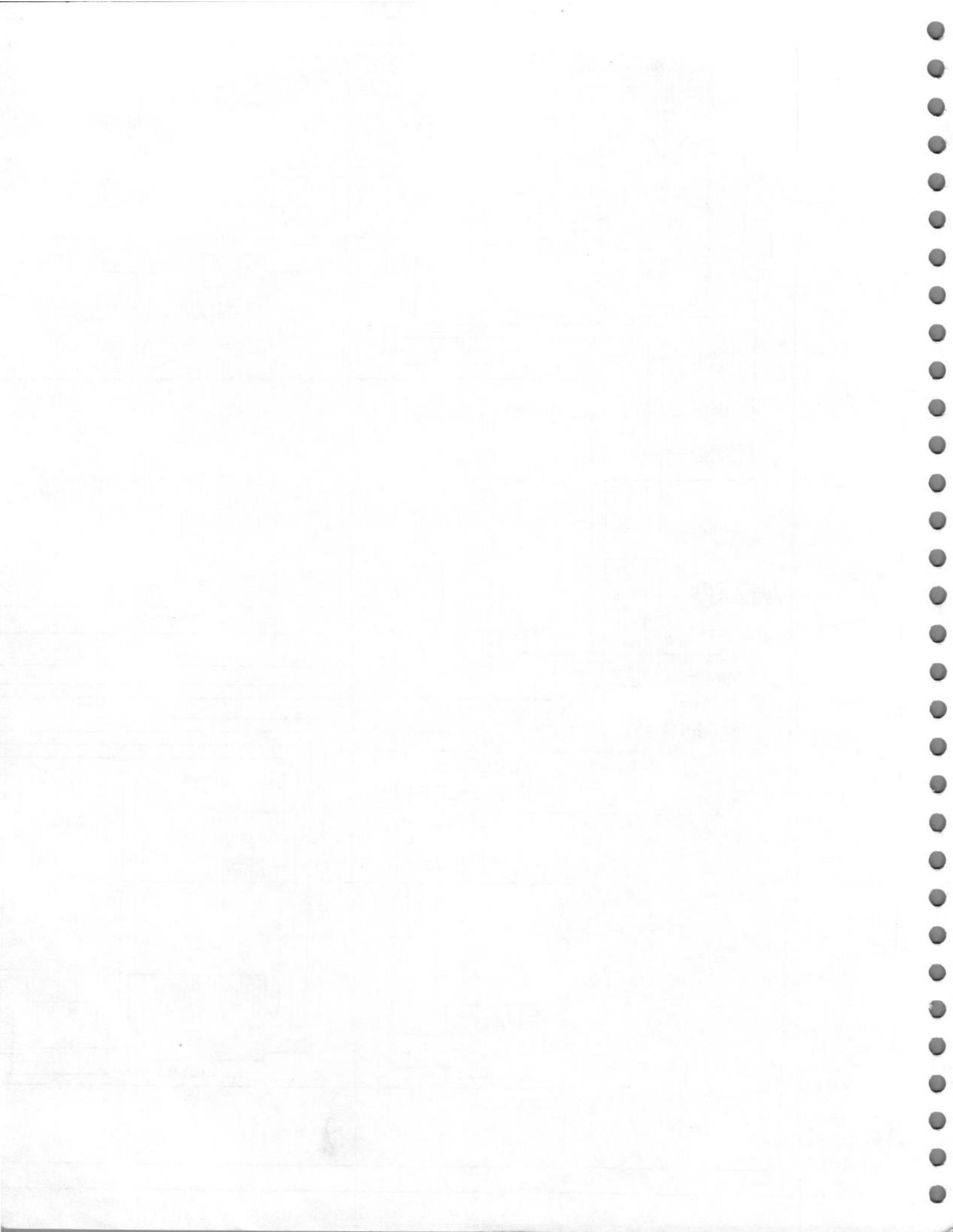
E4
E3
E2
E1

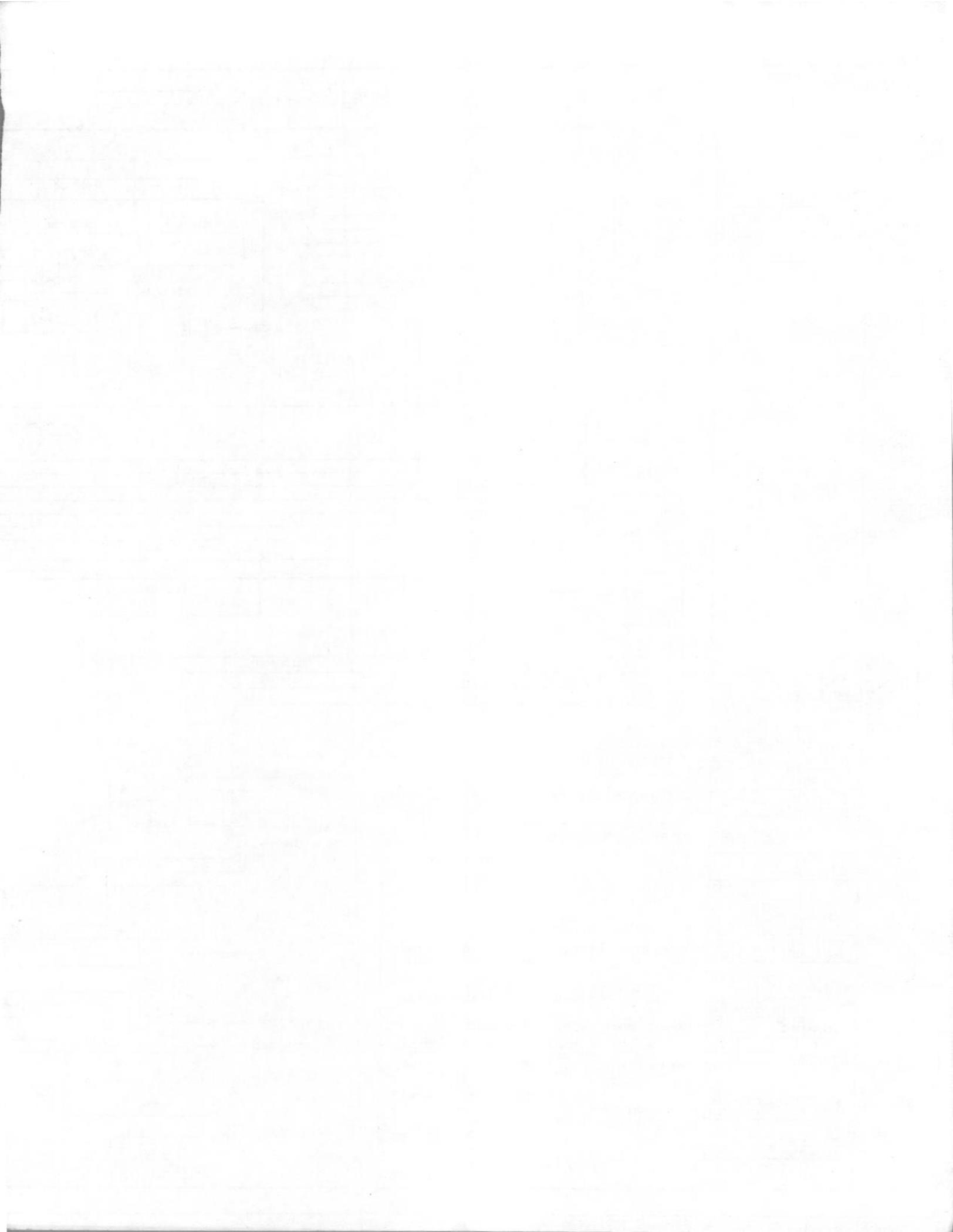
DOOR IX OPEX POSITION

FUSE BLOCK FI

L
B
A

② FOR NT6C11GA, GB & BY ONLY
FOR NT6C11GE, GF & GP SEE FIG. A ①





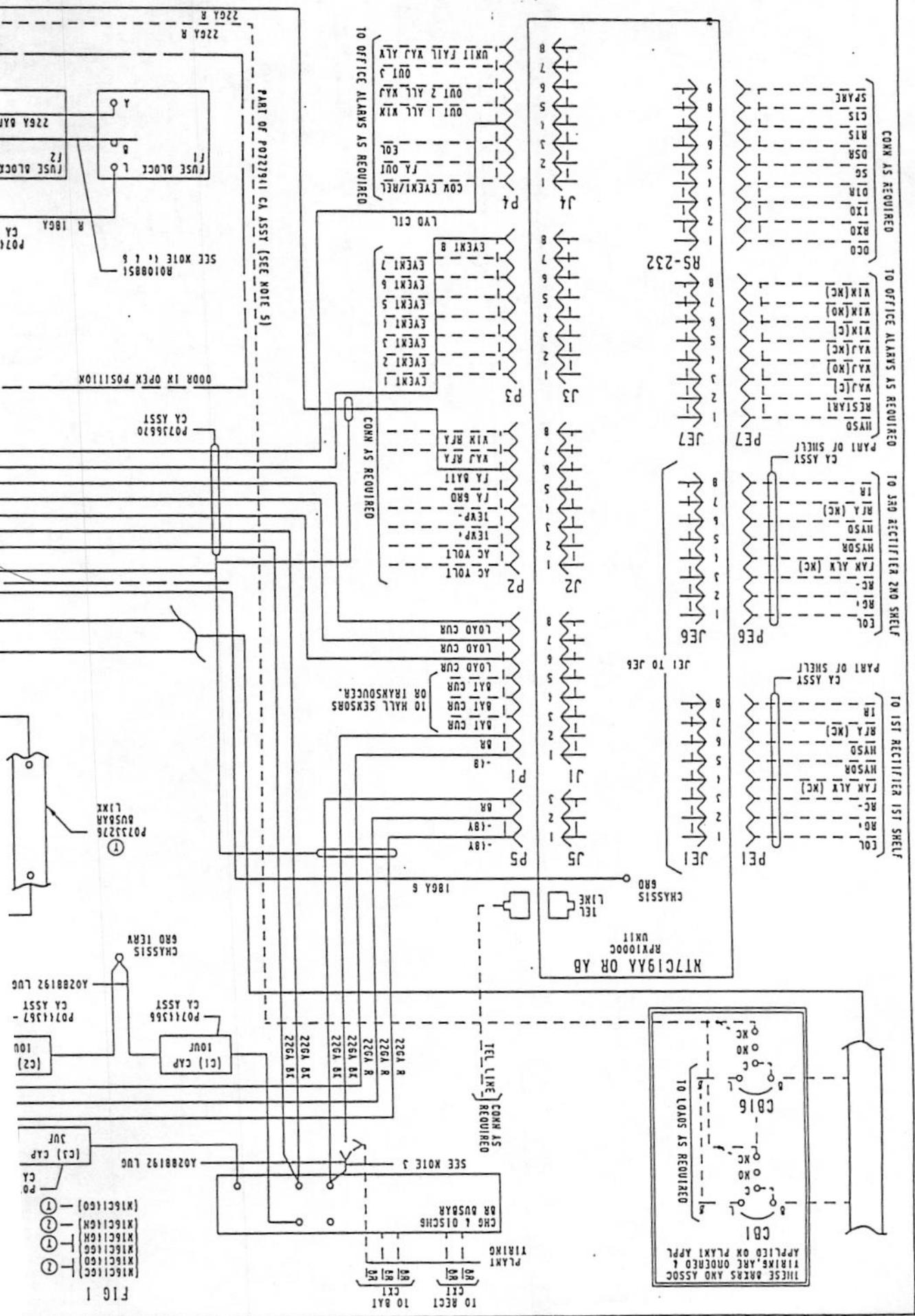
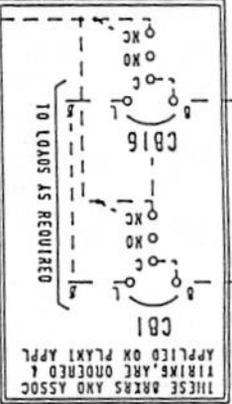


FIG 1



- ① [X1C1160]
- ② [X1C1160]
- ③ [X1C1160]
- ④ [X1C1160]
- ⑤ [X1C1160]
- ⑥ [X1C1160]
- ⑦ [X1C1160]
- ⑧ [X1C1160]

PO
CA
3UF
[C3] CAP
A0288192 LUG

PO71367-
CA ASST
A0288192 LUG
10UF
[C1] CAP
PO71366
CA ASST

CHASSIS
GND TERM
A0288192 LUG

PO73276
RUSBAR
LIXX

PO73670
CA ASST

SEC NOTE 1 & 6
R010851

FUSE BLOC L
F1
FUSE BLOC L
F2
226A BK

226A R
226A R

PART OF PO727911 CA ASST (SEE NOTE 5)

TO OFFICE ALARMS AS REQUIRED

CONV EXEM/REL
FA OUT
EOL
OUT 1 ALL WIX
OUT 2 ALL WIX
OUT 3
UNIT FAIL WYJ ALY

LVD CTL

EVENT 8
EVENT 7
EVENT 6
EVENT 5
EVENT 4
EVENT 3
EVENT 2
EVENT 1

CONN AS REQUIRED

VIA RTA
FA BATT
FA GND
TEMP
TEMP
AC VOLT
AC VOLT

LOAD CUR
LOAD CUR
LOAD CUR
BAT CUR
BAT CUR
BAT CUR
10 HALL SENSORS
OR TRANSUCER

BR
-18V
-18V

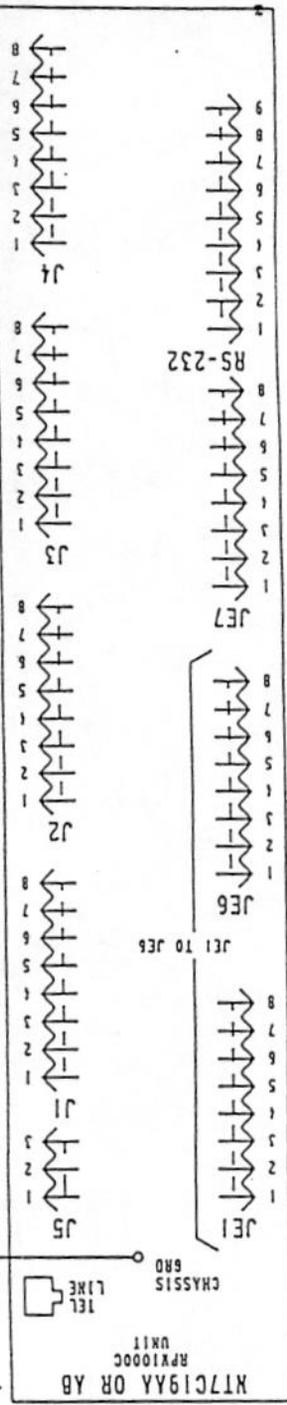
18GA S

226A R
226A R
226A BK
226A BK
226A BK

10 RECT
10 BAT
PLANT
TIRING

SEE NOTE 3

CHG & DISCHG
BR BUSBAR



CONN AS REQUIRED

DCO
RXD
TXD
DTH
SC
DSR
RTS
CTS
SPARE

TO OFFICE ALARMS AS REQUIRED

HYSD
RESTAAT
VJA [C]
VJA [X]
VJA [NO]
VJA [KC]

TO 3RD RECTIFIER 2ND SHELF

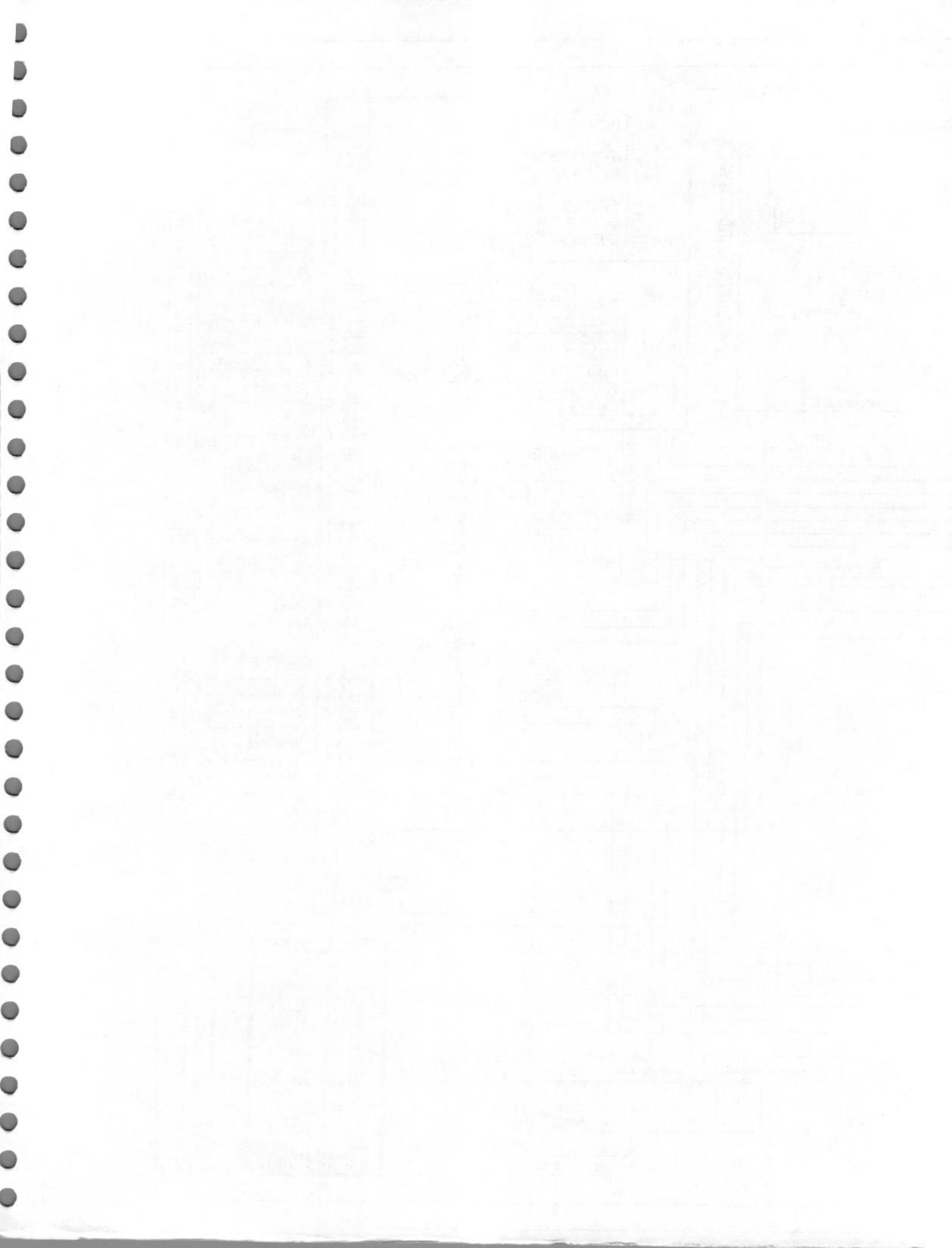
PART OF SHELF
CA ASST

EOL
RC
RC
FAN ALY [KC]
HYSD
HYSD
RTA [KC]
IR

TO 1ST RECTIFIER 1ST SHELF

PART OF SHELF
CA ASST

EOL
RC
RC
FAN ALY [KC]
HYSD
HYSD
RTA [KC]
IR



Recommended Replaceable Parts

ITEM	CPC
Fuse MSL2A	A0285632
LVD and Alarm Circuit Pack NT6C14PF	A0400370
Display Circuit Pack NT6C14PG	A0403327
Fuse F1 3/4 A for MPR25	A0351850
Fan Assembly for MPR25/15	P0710139
Fan Assembly for 50A Rectifier	P0734037
Sense Fuse QFF1A (1-1/3 A)	A0205202

Customer Service

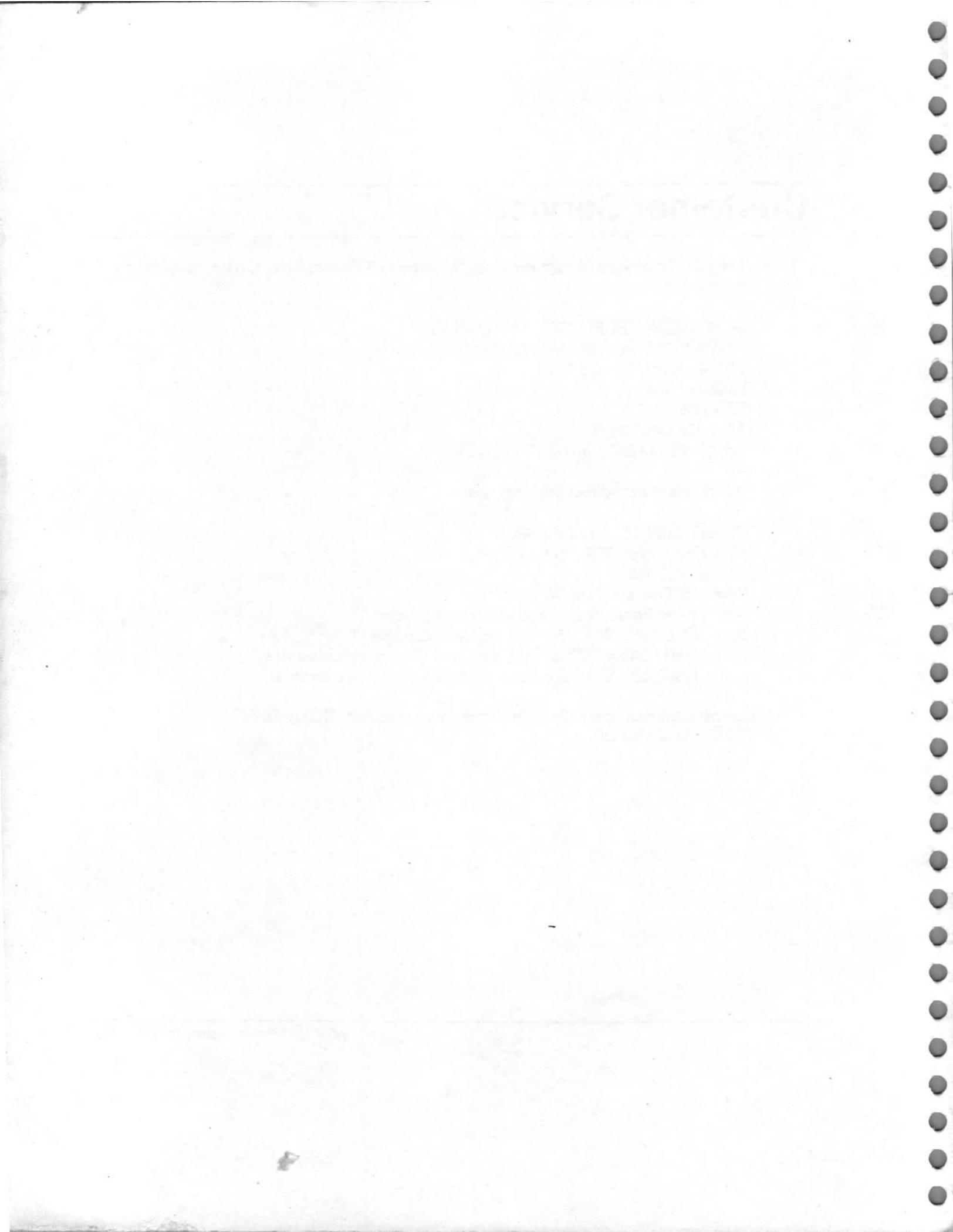
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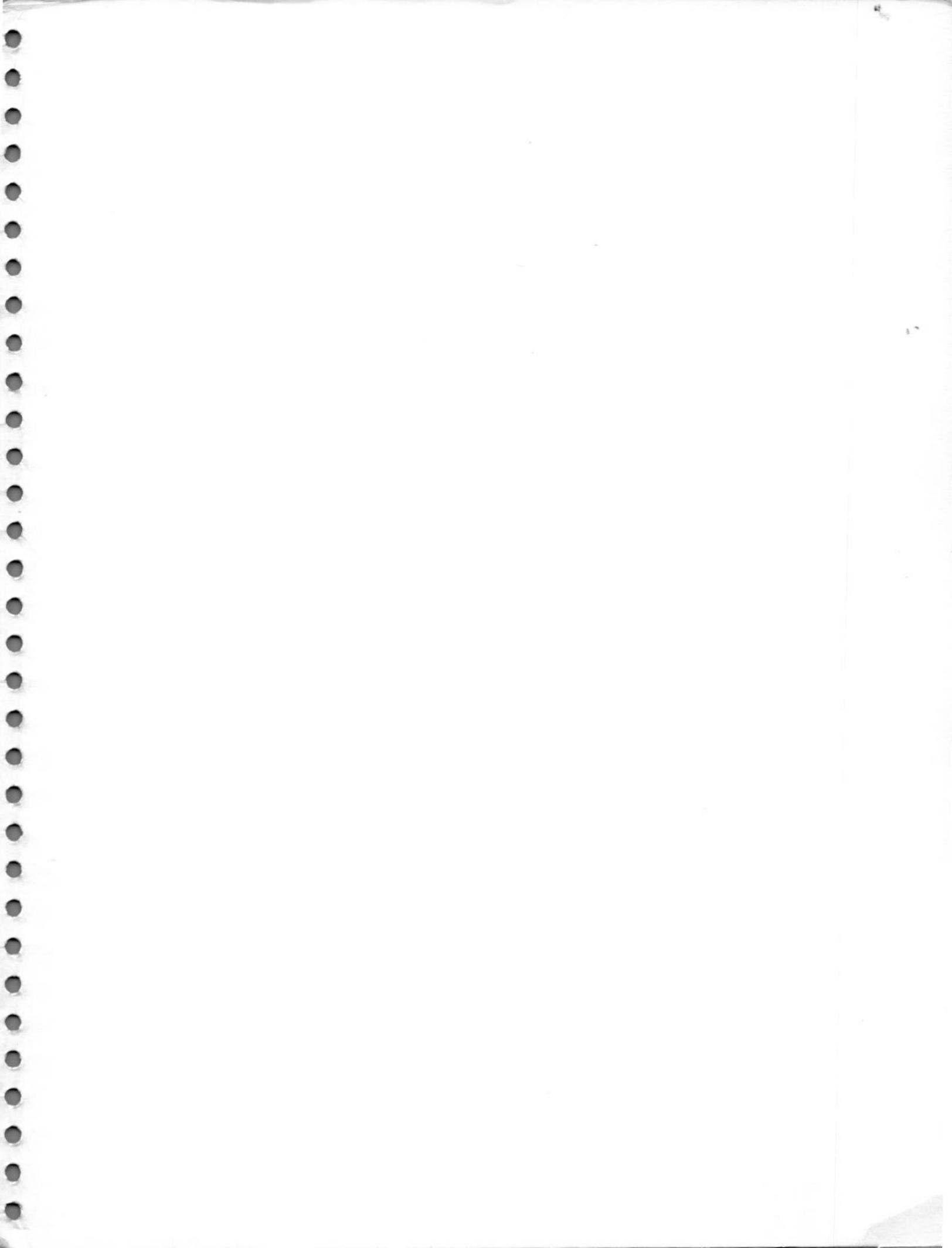
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NT6C28C

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or

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NTP: 167-9021-102

Issue: Standard 7.0

Date: December 1995

Printed in Canada

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