Critical Release Notice

Publication number: 297-8361-550
Publication release: Standard 04.02

The content of this customer NTP supports the SN07 (DMS) and ISN07 (TDM) software releases.

Bookmarks used in this NTP highlight the changes between the XPM14 baseline and the current release. The bookmarks provided are color-coded to identify release-specific content changes. NTP volumes that do not contain bookmarks indicate that the XPM14 baseline remains unchanged and is valid for the current release.

Bookmark Color Legend

Black: Applies to content for the XPM14 baseline that is valid through the current release.

Purple: Applies to new or modified content for ISN07 (TDM)/SN07 (DMS) that is valid through the current release.

Attention!
Adobe® Acrobat® Reader™ 5.0 or higher is required to view bookmarks in color

Publication History

December 2004

Standard release 04.02 for software release ISN07 (TDM)/SN07 (DMS).

Modified Chapter 1, Chapter 2 and Chapter 4 for CR Q00945446.

297-8361-550

DMS-100 Family

Outside Plant Module

OPM Maintenance Manual

XPM14 and up   Standard   04.01   September 2000

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DMS-100 Family

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Publication number: 297-8361-550
Product release: XPM14 and up
Document release: Standard 04.01
Date: September 2000

Contents

OPM Maintenance Manual

About this document

When to use this document

This Outside Plant Module Module (OPM) maintenance reference manual provides: overview, signaling, and hardware information for understanding the OPM product and operation; recovery procedure for returning to service an OPM from a completely out-of-service condition; alarm clearing procedures for clearing an OPM alarm condition at the MAP display terminal; card replacement procedures for removing and replacing hardware modules in the OPM as part of maintenance, verification, or acceptance procedures; trouble locating and clearing information for locating and clearing problems beyond the scope of other maintenance procedures; routine maintenance procedures for performing scheduled routine and preventive maintenance tasks. The information in this maintenance manual is intended for operating company personnel engaged in OPM maintenance.

How to check the version and issue of this document

The version and issue of the document are indicated by numbers, for example, 01.01.

The first two digits indicate the version. The version number increases each time the document is updated to support a new software release. For example, the first release of a document is 01.01. In the next software release cycle, the first release of the same document is 02.01.

The second two digits indicate the issue. The issue number increases each time the document is revised but rereleased in the same software release cycle. For example, the second release of a document in the same software release cycle is 01.02.

To determine which version of this document applies to the software in your office and how documentation for your product is organized, check the release information in *Product Documentation Directory, 297-8991-001*.

This document is written for all DMS-100 Family offices. More than one version of this document may exist. To determine whether you have the latest version of this document and how documentation for your product is organized, check the release information in *Product Documentation Directory, 297-8991-001*.

References in this document

The following documents are referred to in this document:

- *DMS-100 Provisioning Manual and Operational Measurements Reference Manual*
- *Operational Measurements Reference Manual*
- *Extended Peripheral Module Translations Reference Manual*

What precautionary messages mean

The types of precautionary messages used in NT documents include attention boxes and danger, warning, and caution messages.

An attention box identifies information that is necessary for the proper performance of a procedure or task or the correct interpretation of information or data. Danger, warning, and caution messages indicate possible risks.

Examples of the precautionary messages follow.

ATTENTION - Information needed to perform a task

> **ATTENTION**
> If the unused DS-3 ports are not deprovisioned before a DS-1/VT Mapper is installed, the DS-1 traffic will not be carried through the DS-1/VT Mapper, even though the DS-1/VT Mapper is properly provisioned.

DANGER - Possibility of personal injury

> **DANGER**
> **Risk of electrocution**
> Do not open the front panel of the inverter unless fuses F1, F2, and F3 have been removed. The inverter contains high-voltage lines. Until the fuses are removed, the high-voltage lines are active, and you risk being electrocuted.

WARNING - Possibility of equipment damage

WARNING
Damage to the backplane connector pins
Align the card before seating it, to avoid bending the backplane connector pins. Use light thumb pressure to align the card with the connectors. Next, use the levers on the card to seat the card into the connectors.

CAUTION - Possibility of service interruption or degradation

CAUTION
Possible loss of service
Before continuing, confirm that you are removing the card from the inactive unit of the peripheral module. Subscriber service will be lost if you remove a card from the active unit.

How commands, parameters, and responses are represented

Commands, parameters, and responses in this document conform to the following conventions.

Input prompt (>)

An input prompt (>) indicates that the information that follows is a command:

```
>BSY
```

Commands and fixed parameters

Commands and fixed parameters that are entered at a MAP terminal are shown in uppercase letters:

```
>BSY CTRL
```

Variables

Variables are shown in lowercase letters:

```
>BSY  CTRL  ctrl_no
```

The letters or numbers that the variable represents must be entered. Each variable is explained in a list that follows the command string.

Responses

Responses correspond to the MAP display and are shown in a different type:

```
FP 3 Busy CTRL 0: Command request has been submitted.
```

```
FP 3 Busy CTRL 0: Command passed.
```

1 OPM maintenance summary

Description

The Outside Plant Module (OPM) is a reconfigured Remote Line Concentrating Module (RLCM) packaged in an environmentally controlled cabinet. The cabinet consists of a main compartment that contains the following components:

- RLCM
- environmental control unit (ECU)
- remote maintenance module (RMM)
- host interface equipment (HIE)
- rectifiers
- ac circuit breakers
- batteries

The cabinet has an end compartment that contains the cable and wire termination, protection and cross-connections.

The OPM contains a line concentrating module (LCM), HIE, RMM and ECU. Like the LCM and the RLCM, the OPM supports all the line features available at the host. These line features include:

- plain old telephone service (POTS)
- party lines
- coin lines
- Meridian Digital Centrex (MDC) stations
- business sets
- data units
- attendant consoles
- Datapath

Optional feature packages for intraswitching NTX156AA and emergency stand-alone (ESA) operation NTX154AA are available with the OPM.

The OPM is available in two configurations. The configurations are as follows:

1. The OPM-640. This configuration has a 640 subscriber line capacity NT8X01AA, AB, AC.
2. The OPM-256. This configuration has a 256 subscriber line capacity NT8X01BA, BB, BC.

The OPM-256 can have optional components for greater flexibility. Optional components include the following:

- a line-size upgrade kit that increases the line size of the OPM-256 to 576 lines
- a channel bank option for special services
- a fiber interface option for fiber-optic connectivity

OPM cabinet

The OPM cabinet provides mechanical protection and a controlled environment for the OPM electronic equipment. The cabinet contains 13-gauge cold-rolled steel. Special parts like the bay frames and base, use thicker materials. The base is galvanized to provide additional corrosion resistance.

The dimensions of the cabinet are 1676 mm wide by 1676 mm high by 660 mm deep (66 in by 66 in by 26 in). An empty cabinet weighs approximately 400 kg (880 lb). A fully-equipped cabinet that includes electronics and batteries, weighs approximately 1000 kg (2200 lb).

Main compartment

The main compartment of the OPM contains the RLCM, ac breakers, rectifiers, batteries and the ECU.

Access the main compartment from the front of the cabinet by a pair of doors that swing. Each cabinet door:

- is hinged with lock pins that are inside and can be padlocked
- opens approximately 120 degrees. A door check holds the door in the open position
- has a door alarm, that is activated when the door is opened

A pair of swing-out, double-latched, hinged bays contain most of the equipment. The hinged bays allow access to the rear of the shelves. The bays also allow access to equipment positioned against the back wall of the cabinet.

Each hinged equipment bay contains three shelves for equipment for a total of six shelves. Four shelves are used for OPM equipment. Refer to the figures “Bay Frame Equipment Configuration, OPM-640 NT8X01AC" and “Bay Frame Equipment Configuration, OPM-256 NT8X01BC". The line concentrating arrays (LCA) that contain the 10 line drawers for the LCM, occupy two shelves. The combined LCM for the OPM-256 is a one-shelf module that contains two LCAs and four line drawers. A single shelf is empty.

Section “OPM-256 optional equipment shelf" describes the optional equipment for the additional shelf. The RMM and HIE occupy two shelves. The two shelves that remain contain a frame supervisory panel (FSP) that includes:

- office repeaters
- a power control unit (PCU) for ac power
- a rectifier system that consists of a pair of switch mode rectifiers and a battery control unit (BCU).

Two ECUs are present. A single ECU is present at the bottom of each bay.

End-access compartment

The left end of the cabinet contains the end-access compartment. A single door that swings provides access to the compartment. The compartment contains equipment required for voice frequency, special service and DS-1 pair termination, protection and rearrangement.

The following components enter the OPM through sealed cable entrance ports at the base of the cabinet:

- Subscriber VF cables
- commercial ac power
- cables that carry host DS-1
- special service pairs

The following sections of this chapter describes the structure and operation of the LCM, HIE and RMM.

OPM-256 optional equipment shelf

Use the empty shelf of the OPM-256 for optional equipment. The following sections describe the three available options. Refer to the figure “Bay Frame Equipment Configuration, OPM-640 NT8X01AC".

Line size upgrade equipment

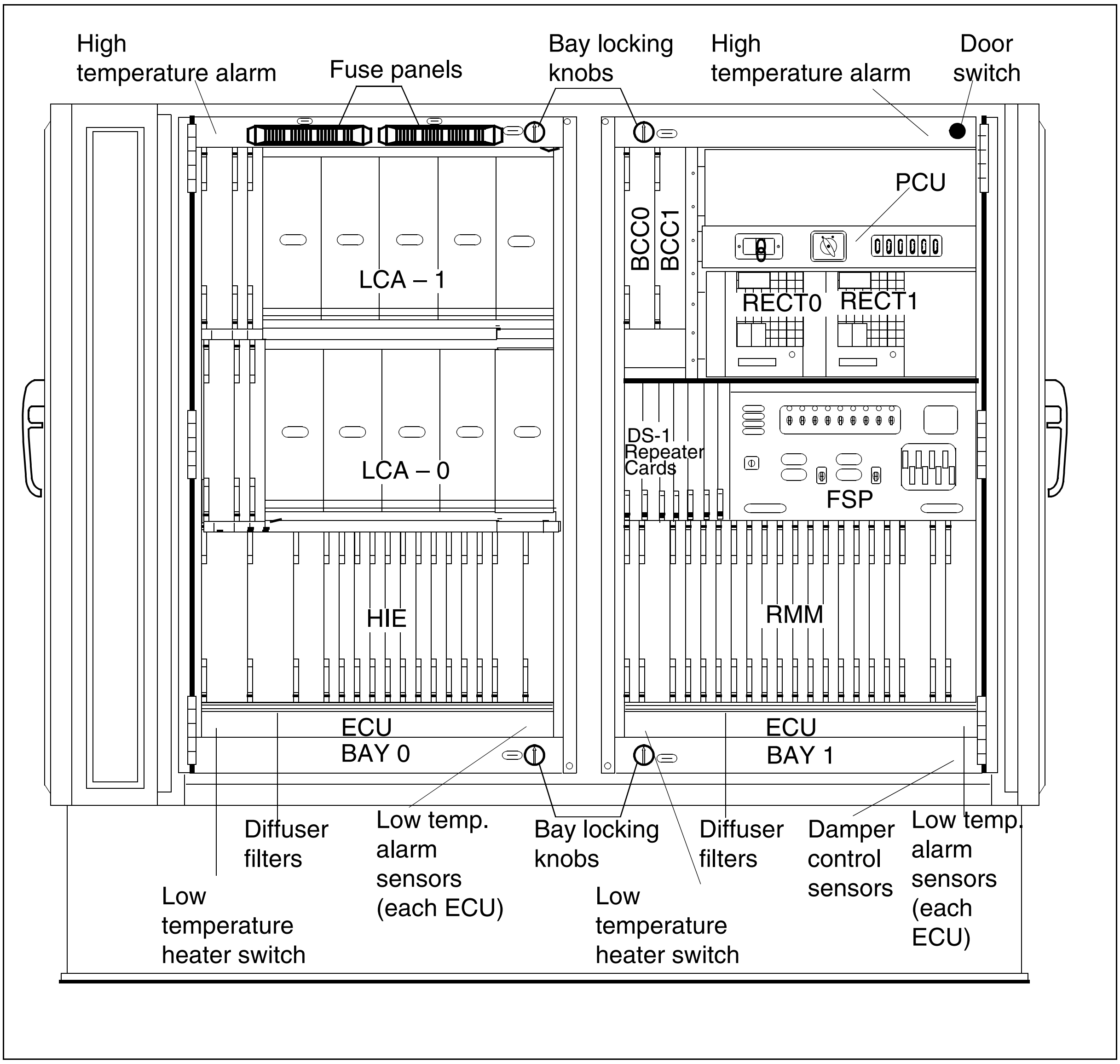
A 320-line upgrade kit NT8X09AB/AC/AD increases the total line size of the OPM-256 to 576 lines. This option is installed without a loss in service. The

OPM will operate in the same way except for the additional line cards that are present. The OPM now requires an additional scan card NT0X10 in the RMM in slot 7.

The 320-line upgrade kits are as follows:

- NT8X09AB. Use this kit with OPMs equipped with the 4-pin protector blocks option.
- NT8X09AC. Use this kit with OPMs equipped with the 5-pin protector blocks with 50 foot cable stub option.
- NT8X09AD. Use with OPMs equipped with the 5-pin protector blocks without the 50 foot cable stub option.

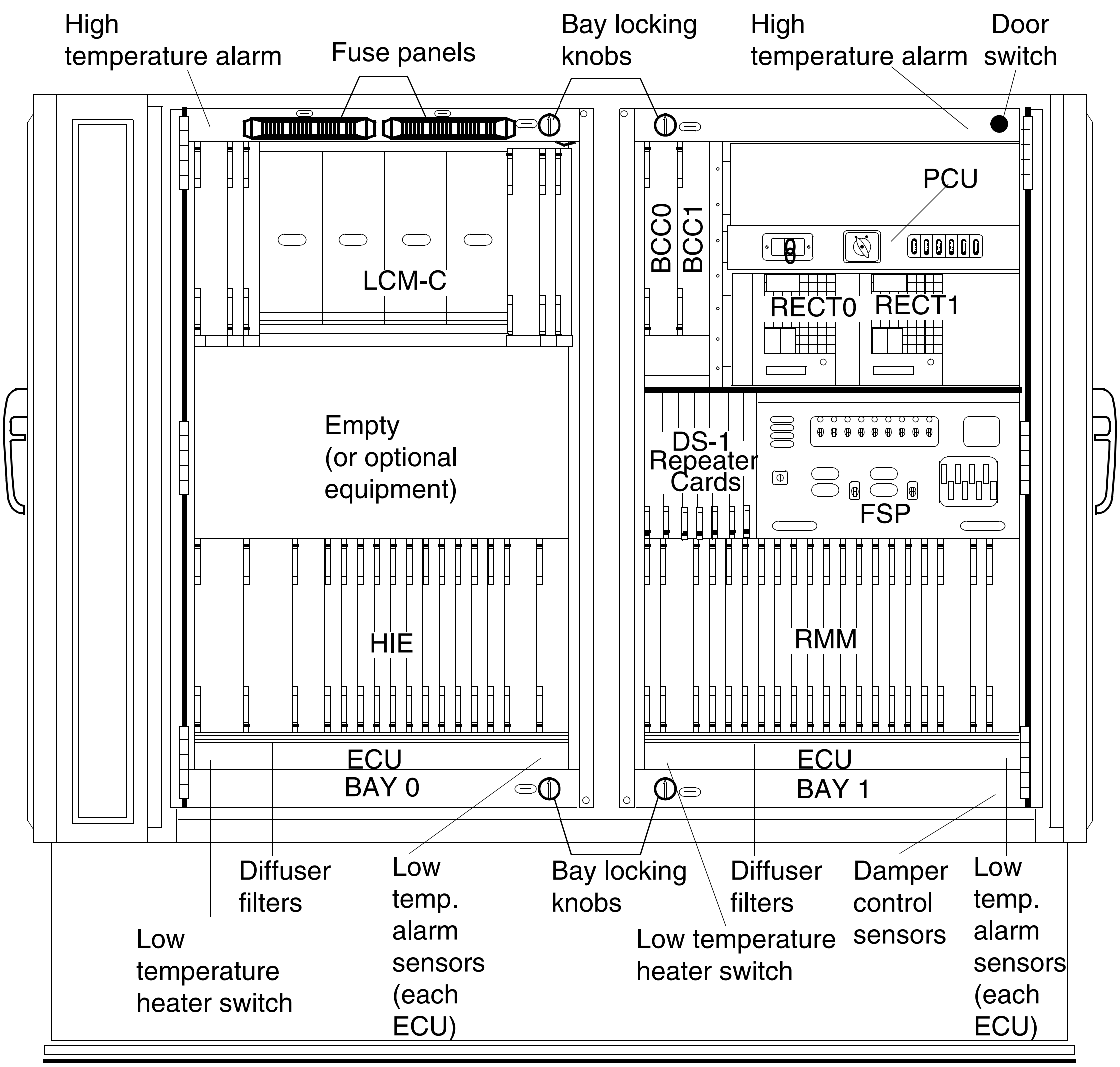
Figure 1 Bay frame equipment configuration, OPM-640 (NT8X01AC)



Fiber multiplexer

Fiber optic connectivity enhances transmission quality and reduces the amount of required repeaters. Two fiber multiplexers are available for use in the OPM. The two fiber multiplexers are the Fiber Multiplex Terminal (FMT)-6 and the FMT-150B. The FMT-150B mounts on the OPM optional equipment shelf. Refer to the *FMT-150 Optical Fiber Digital Transmission System User Guide,* 321-3211-001, for additional information on the FMT-150 system. The FMT-6 mounts on the back wall of the OPM cabinet. Refer to the *FMT-6 User Guide,* 321-3231-290.

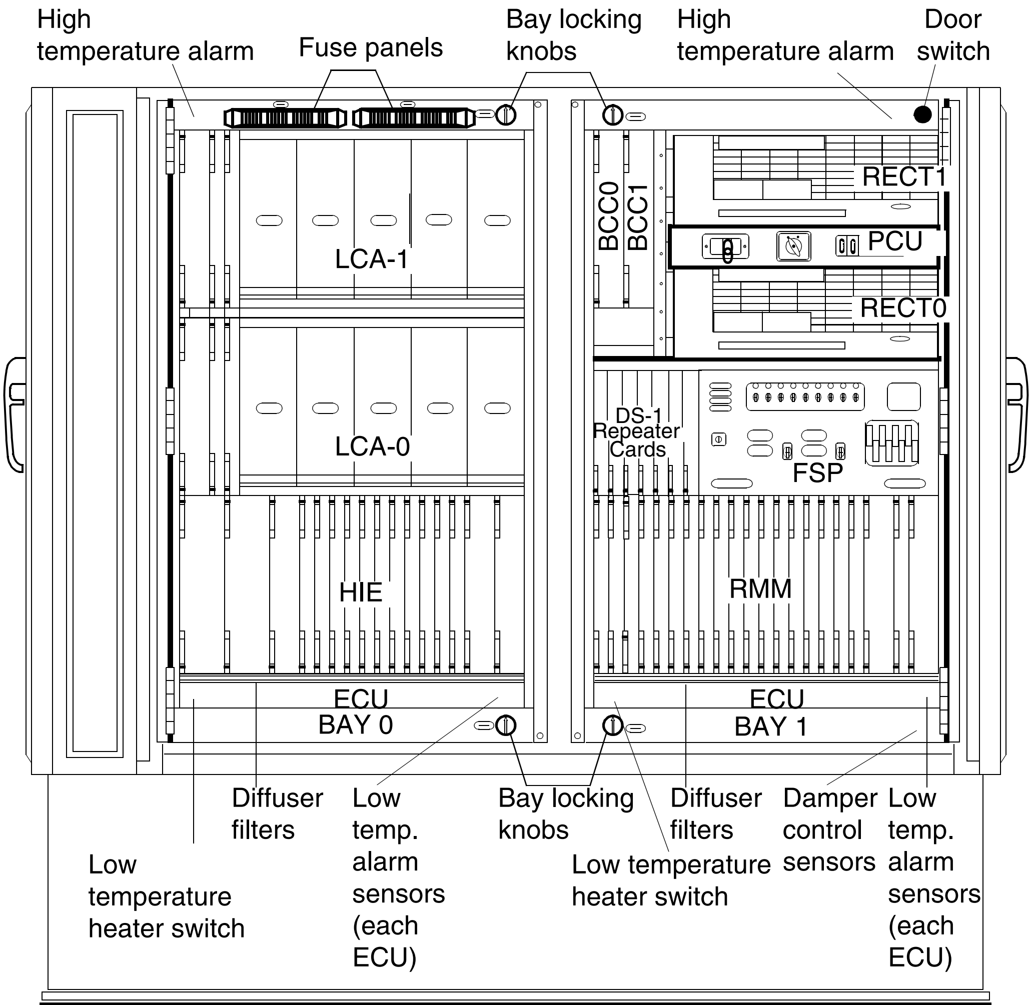
Figure 2 Bay frame equipment configuration, OPM-256 (NT8X01BC)



Channel bank option

A user selected channel bank can be installed to provide special services like foreign exchange, non-switched digital data and off-premises extensions. The channel bank does not share operational functionality with the OPM. The channel bank shares alarms that require the addition of an NT0X10 scan card in the RMM slot 7. The internal environmental and operational restrictions of the OPM apply to the channel bank.

Figure 3 Bay frame equipment location, OPM-640, (NT8X01AA, AB)



DE-4E Smart channel bank

The DE-4E smart channel bank NT4S42CA is available from Nortel Networks. The DE-4E smart is a 24 channel digital carrier terminal. The DE-4E is used for two-way transmission of voice and data signals over T1, T1C or T2 compatible carrier systems. The DE-4E can be used with all classes of switched telephone trunks and special service voice frequency applications.

For additional information about this channel bank, refer to the following:

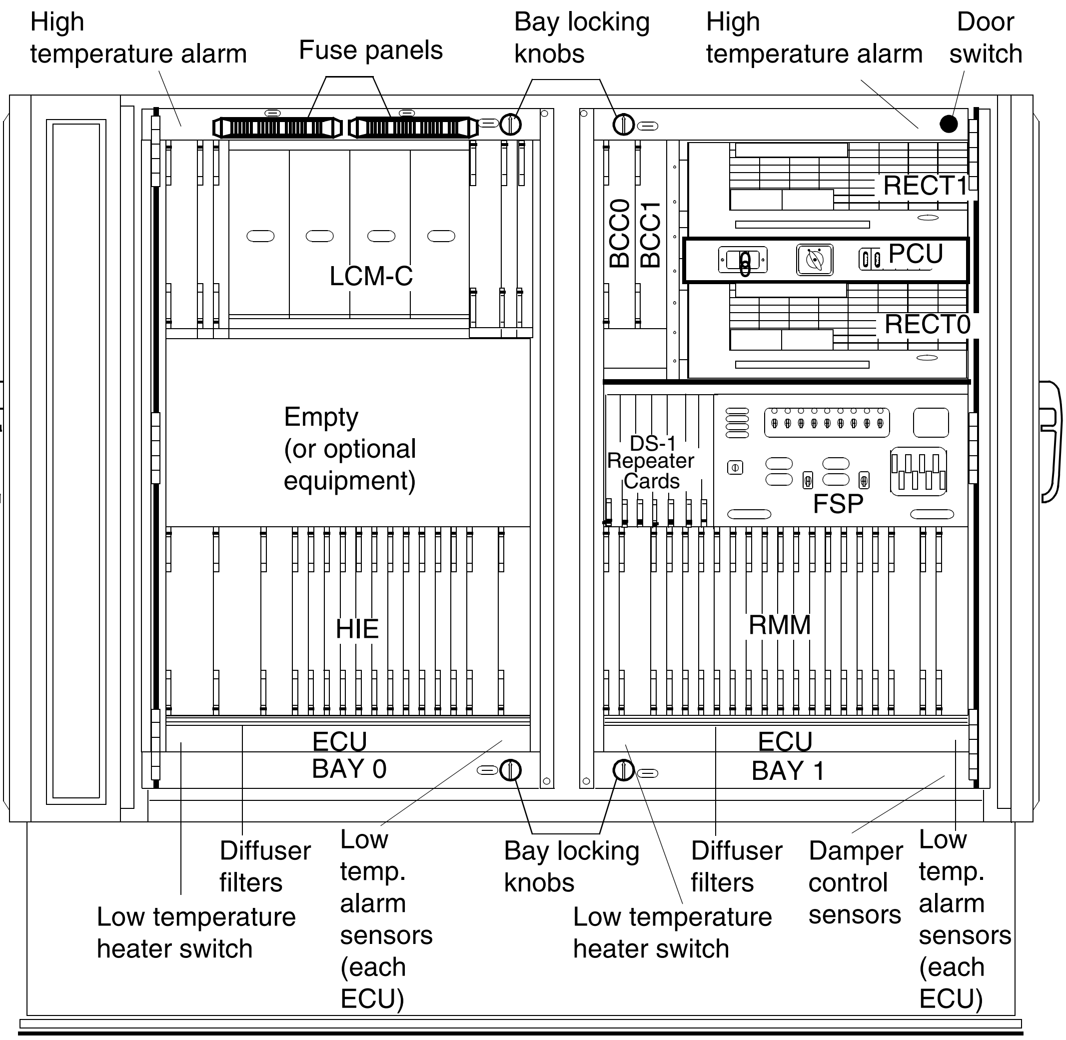
- DE-4E smart *Index to Applicable Publications*, 368-5161-001
- *DE-4 Enhanced PCM Channel Bank Description*, 368-5151-110

Only mount the DE-4E in the optional equipment shelf of the OPM-256. Mounting kits required for the DE-4E Smart channel bank are:

- NT0X1980. Use the NT0X1980 kit with an OPM-256 equipped with 4-pin protector blocks.
- NT0X1981. Use the NT0X1981 kit with an OPM-256 equipped with 5-pin protector block and without a 50 ft cable stub.
- NT0X1982. Use the NT0X1982 kit with an OPM-256 equipped with 5-pin protector block and 50 ft cable stub.

The NT6X60 ringing generators of the OPMs can be used as the ringing source of the DE-4Es for single coded 20 Hz application. For a diagram of the OPM-256 cabinet layout, refer to the figure “Bay Frame Equipment Location, OPM-256 NT8X01BA, BB".

Figure 4 Bay frame equipment location, OPM-256, (NT8X01BA, BB)



Additional OPM components

The following optional components are available for the OPM-640 and OPM-256. The components are installed on the back wall of the cabinet behind the hinged double bays.

Calibration device

The OPM-640 and OPM-256 supports the installation of a device used to calibrate the Digital Remote Test Unit (DRTU). A small compartment contains the calibrating device. The compartment is approximately 76 mm by 114 mm by 36 mm (3 in by 4.5 in by 1.4 in). The compartment is above the utility power breaker. For the location of the calibration device, refer to the figure “Battery Arrangement and Back Wall Components in the OPM Cabinet".

Digital Remote Test Unit

The DRTU, NT0J42AA, Model 3704, allows a full set of accurate and cost-effective line tests to occur. These tests occur over standard DS-1 or fiber-optic facilities at an OPM remote location. The DRTU is mounted on the back wall of an OPM-640 or OPM-256. For the location of the DRTU, refer to the figure “Battery Arrangement and Back Wall Components in the OPM Cabinet".

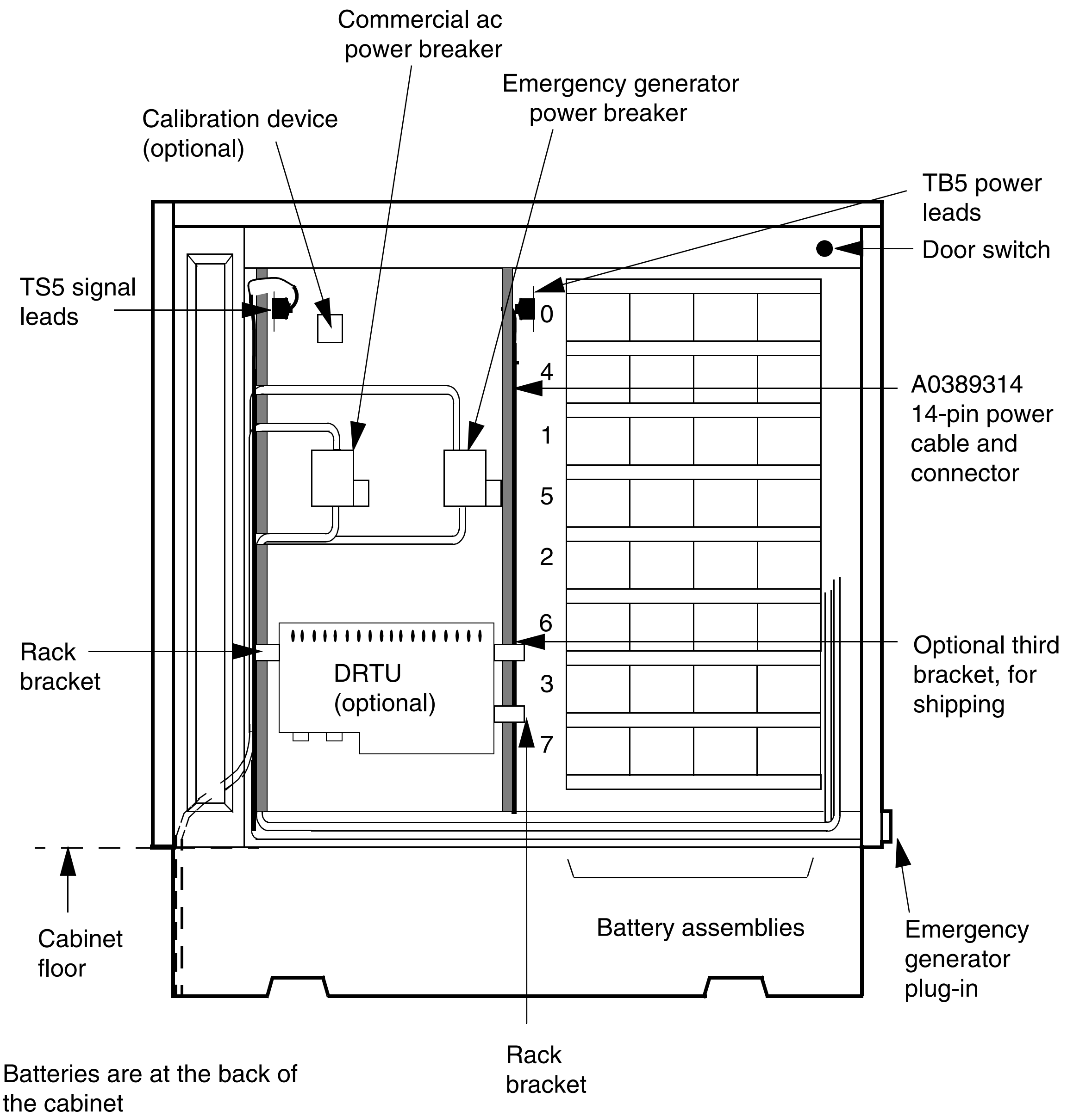
For more information about the DRTU, refer to the following:

- *Model 3704 Digital Remote Test Unit Description and Installation Guide*, 662-5021-233
- *Model 3704 Digital Remote Test Unit /Outside Plant Module Installation Instructions*, 662-5021-235

Fiber Multiplex Terminal-6

The Fiber Multiplex Terminal-6 (FMT-6) is a small stand-alone multiplexer and 6 Mbps light-wave transmission system. This transmission uses a single mode or multimode fiber-optic cable to transport a maximum of four DS-1 electrical signals. The FMT-6 mounts on the back wall of an OPM-640 or OPM-256. For information on how to order, install and operate the FMT-6, refer to the *FMT-6 User Guide*, 321-3231-290.

Figure 5 Battery arrangement and back wall components in the OPM cabinet



Note: Battery strings 3 and 7 are not provisioned for OPM-256. Battery strings 3 and 7 are not provisioned when Eagle-Picher batteries are provisioned.

Environmental control equipment

The ECU contains equipment that provides a controlled environment for the OPM. The equipment includes the following items:

- air inlets
- air filters
- fans
- heaters
- air outlets

The ECU consists of the following:

- one booster fan unit (BFU)
- one ECU for each bay
- cabinet insulation
- incoming air filters and diffusers
- incoming air dampers
- thermostats and temperature sensors

The BFU is above LCA 1 in bay zero. The BFU consists of three circulation fans and a fan alarm card (FAC). The FAC activates an alarm if the fans fail.

The ECUs are at the bottom of row A, bay zero and row A, bay one. Each ECU consists of an air damper, air heater, air filter and four circulation fans.

The components of the ECU maintain the temperature and relative humidity in the OPM within acceptable limits. The thermostat controls the dampers and closes open dampers when an extreme drop in temperature occurs. Heaters under thermostat control heat the air that circulates in the cabinet. The heaters work when the thermostat closes the dampers and the close does not maintain a high temperature in the cabinet. Exhaust air ports are located at the top of the cabinet.

Incoming air filters are located in the floor of the cabinet and in the ECU on each bay.

Temperature sensors detect extremely high or low temperatures in the OPM cabinet and raise an alarm.

Environmental control operation

The OPM operates at an outside ambient temperature of -40°C to +45°C (-104°F to 113°F). The following services control the cabinet temperature of the OPM:

- fans, heaters, and dampers in the ECU
- fans in the BFU
- insulation

For a view of the ECU equipment, refer to the figure OPM Thermal Control System.

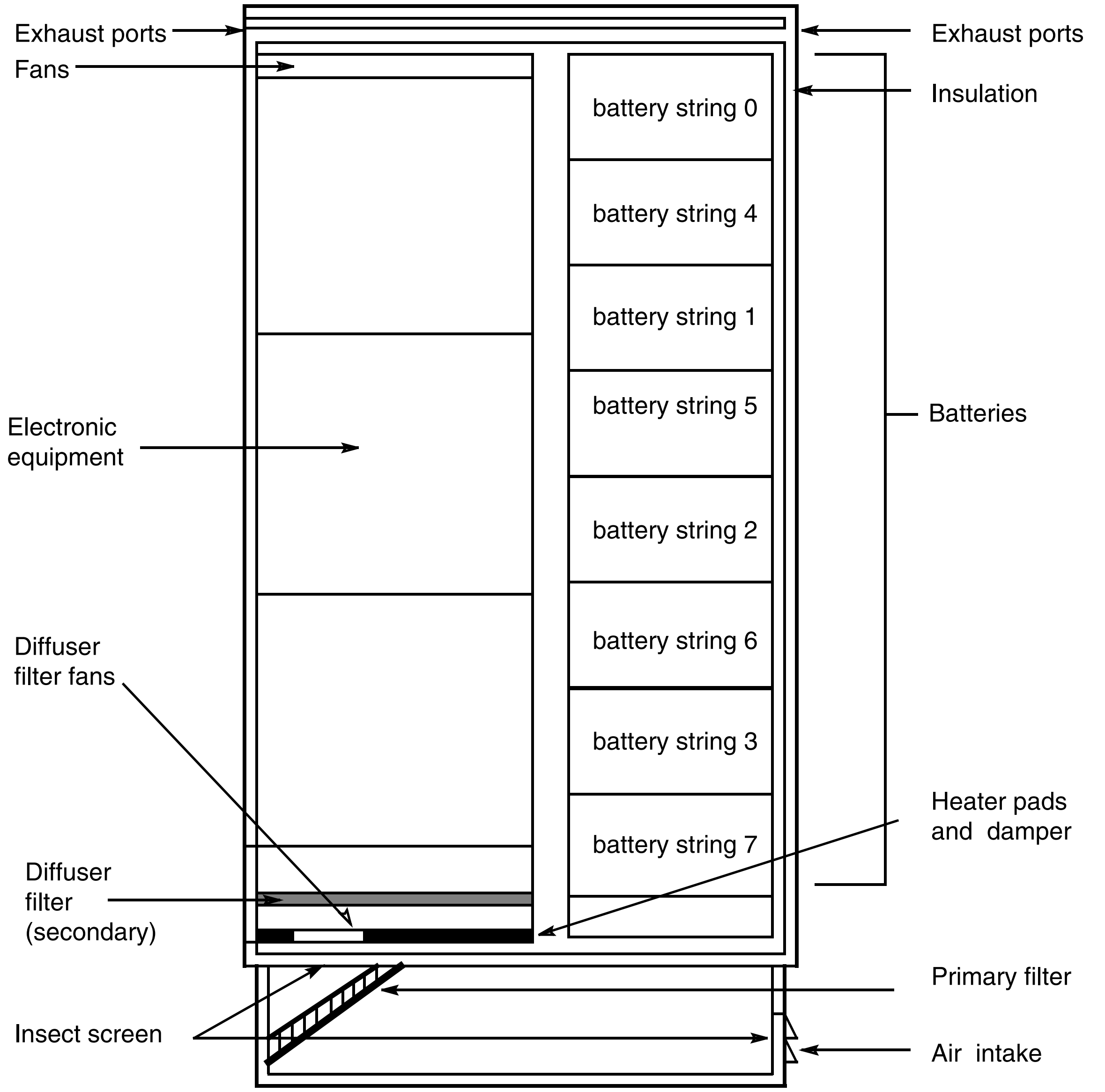
1. When the outside ambient temperature exceeds 15°C ± 2.8°X (59°F ± 5°Φ), τηε δαμπερσ οπεν. The fans in the ECU pull cooler outside air into the cabinet while the BFU fans expel hot air. The fans direct the air vertically through the electronic equipment bays. The air is partially recirculated along the back portion of the cabinet. The fans expel most of the air through exhaust ports at the top of the cabinet.
2. When the outside ambient temperature drops below 5°C ± 2.8°X (41°F ± 5°Φ), τηε δαμπερσ ιν τηε EXY χλοσε. The fans recirculate the air in the cabinet.
3. When the ambient temperature in the ECU drops to 5°C ± 2.8°X (41°F ± 5°Φ), τωο 120 ς αχ 400 Ω φλατ ηεατινγ ελεμεντσ ιν τηε EXY τυρν ON. The heating elements turn OFF at 15°C ± 2.8°X ορ 59°F ± 5°Φ.

Seven thermostats inside the cabinet control the low temperature alarm, high temperature alarm, ventilation system and heaters.

To control humidity, incoming air mixes with warmer cabinet air.

The fans direct incoming air through a primary filter, an insect screen and a diffuser filter to control dust. The filters do not allow particles of dust and sand to enter the cabinet. Closed cell neoprene gaskets seal the cabinet against rain and snow.

Figure 6 OPM thermal control system



Note: Strings 3 and 7 are not provisioned when Eagle-Picher batteries are used.

Electrical system

The electrical system for the OPM cabinet consists of the following components:

- power distribution equipment
- ac power entrance panels
- cable connecting compartment

- power control unit (PCU)
- battery control unit (BCU)
- rectifiers
- batteries
- FSP
- OPM grounding network

The cabinet requires a standard 30A, single-phase, 208V commercial ac supply. The battery reserve of the OPM consists of: eight strings of Yuasa A037761 or six strings of Eagle-Picher A0386201 batteries. The OPM-256 has 6 strings. When the batteries are installed and at 100% capacity, this reserve corresponds to 178 Ah Yuasa and 162 Ah Eagle-Picher. Batteries calculated at 80% capacity, which corresponds to 142 Ah Yuasa and 129.6 Ah Eagle-Picher reserve power, are at the end-of-life.

When the external temperature is -40°C (104*o*F), the battery reserve for the OPM-640 and OPM-256 is at 80% capacity. At 80% capacity the batteries provide 8 h of backup power at a call rate of 300 call seconds (CCS). During extended power outages, an emergency generator connected to the emergency power generator port can supply ac power.

Cable-connecting compartment

The cable-connecting compartment is in the end-access compartment. This compartment provides outside plant cable protection and termination and cross-connection with the following:

- entrance for buried incoming ac power and ground cable
- entrance for ground rod or cable from ground rod
- entrance for buried incoming subscriber pairs
- entrance for buried pairs of incoming DS-1 lines
- entrance for buried pairs incoming special service lines
- the cabinet ground bar
- one gas or solid state protector for each subscriber pair
- 12 gas tube or solid state protectors for DS-1 lines
- 88 gas tube or solid state protectors for special service lines
- BIX terminals to connect subscriber pairs, DS-1 lines and special service lines

Power distribution equipment

The power distribution equipment includes the following:

- two ac breaker panels
- one ac distribution panel or PCU
- one dc power FSP.

ac entrance panels

Two ac entrance panels are on the interior back wall row B, bay zero, of the main compartment. The left-hand ac panel contains a circuit breaker and lightning arrestors. The left-hand ac panel is used for commercial ac power. The right-hand ac panel contains a circuit breaker and lightning arrestors. The right-hand ac panel is used as an alternate feed of ac power if commercial ac interruption occurs. This panel is used for power fed into the OPM cabinet. The power is fed through a port on the right-hand end of the cabinet. The power is from an emergency source like a fuel-powered generator.

Power control unit

The PCU is near the top of row A, bay one, between the two rectifiers for NT8X01AA, AB, BAand BB. The PCU is above the two rectifiers for NT8X01AC and BC. This unit contains the following:

- one 120 ac 15A duplex service receptacle with GFI protection
- one 30A, 120/240V 3-PDT switch. This switch selects the source of input power from the local utility, position 1 or emergency power generator option, position 2.
- six ac circuit breakers (CB) are assigned as follows:
  - four 15A, double-pole 240V circuit breakers. These circuit breakers connect to the rectifiers, CB1, 2, 5, 6.
  - one 10A, single-pole 120V circuit breaker. This breaker feeds the two heaters located in each ECU.
  - one 15A, single-pole 120V circuit breaker. This breaker feeds the duplex ground fault receptacle/dual service receptacle.

Note: The trip handles of CB1 and CB2 connect to form a two-pole breaker. The CB5 and CB6 connect in the same way.

Battery control unit

The BCU is at the top left hand corner of row A, bay one. The BCU consists of two battery charge controllers, BCC 0 and BCC 1. If batteries are not used, the BCU is optional.

Rectifiers

The NT8X01AA, AB, BA, BB cabinets have two J2427B-1, 25A, -48V dc switched-mode rectifiers. The NT8X01AC, BC cabinet has one NT5C90DB

50A rectifier assembly. This assembly contains one NT5C10BA shelf and two NT5C06CA modular switched mode rectifiers. The rectifiers power the OPM equipment and fans and charge the batteries. Voltage is adjustable from -44V to -56V. The voltage is normally adjusted to -52V for Yuasa A037761 and Eagle-Picher A0386201 batteries. A current limit of a maximum of 25A is available.

Batteries

The OPM batteries consist of a maximum of eight strings of Yuasa A037761. The batteries also consist of a maximum of six strings of Eagle-Picher A0386201 batteries. Each battery string consists of 24 cells, four six-packs. These battery strings connect to the OPM load or charge bus through the two BCCs in the BCU. The BCC 0 and BCC 1 each control a maximum of four battery strings as follows:

BCC	Battery Strings
0	0 1 2 3
1	4 5 6 7

The BCU controls the BCC cards and the associated battery strings. The battery strings move in pairs from bus-to-bus. The battery string pairs are as follows:

Battery Strings	Battery String Pair
0 and 4	0
1 and 5	1
2 and 6	2
3 and 7	3 (Yuasa only)

Note 1: Battery strings 3 and 7 are not equipped when Eagle-Picher A0386201 batteries are used.

Note 2: For major retrofits of Yuasa batteries, Northern Telecom recommends that you convert to Eagle-Picher batteries. Eagle-Picher batteries have an extended life expectancy.

Battery string pairs can connect to the load bus or charge bus open-circuit. Moves from the load to charge bus or charge to load bus must occur through the open-circuit state. Power and environmental system (PES) software enforces this condition. Battery string pairs normally connect to the load bus. A minimum of one battery string pair remains on the load bus at all times to prevent a loss-of-service.

Frame supervisory panel (NT6X25BB)

The FSP NT6X25BB in the NT8X01AA and NT8X01BA contains the following:

- nine dc circuit breakers to control power distribution to each electronic unit. Refer to the following table for breaker assignments.
- eight QFF-type fuses to fuse dc links to alarms, fans and SD circuit packs

The FSP NT6X25BC in the NT8X01AB, AC, BB and BC contains two additional 4A circuit breakers. These circuit breakers are CB10 and CB11. The CB10 and CB11 can connect to optional equipment like fiber units and channel banks.

Table 1 Circuit breaker assignment for FSP in OPM

Circuit breaker	Shelf type	Shelf position, slot, and equipment
CB1	HIE	Row A Bay 0 Sh 05 Slot 25
CB 2	RG 0	Row A Bay 0 Sh 05 Slot 01
CB 3	RG 1	Row A Bay 0 Sh 05 Slot 05
CB 4	HIE	Row A Bay 0 Sh 05 Slot 22
CB 5	RMM	Row A Bay 1 Sh 05 Slot 19
CB 6	LCA 0	Row A Bay 0 Sh 19 Slot 01 (OPM-640) Row A Bay 0 Sh 33 Slot 01 (OPM-256)
CB 7	LCA 1	Row A Bay 0 Sh 33 Slot 01 (OPM-640) Row A Bay 0 Sh 33 Slot 23 (OPM-256)
CB 8	T1	Row A Bay 1 Sh 19 Slots 01-04
	RMM	Row A Bay 1 Sh 05 Slot 18
	LCA 0	Row A Bay 0 Sh 19 Slot 03 (OPM-640) Row A Bay 0 Sh 33 Slot 03 (OPM-256)-
CB 9	T1	Row A Bay 1 Sh 19 Slots 05-07
	LCA 1	Row A Bay 0 Sh 33 Slot 03 (OPM-640) Row A Bay 0 Sh 33 Slot 26 (OPM-256)

Table 1 Circuit breaker assignment for FSP in OPM

CB10	Optional	Optional equipment shelf (only in the NT8X01AB, AC, BB and BC)
CB11	Optional	Optional equipment shelf (only in the NT8X01AB, AC, BB and BC)

The FSP NT6X25BC in the NT8X01AB, AC, BB and BC contains the following:

- nine dc circuit breakers to control power distribution to each electronic unit and two additional circuit breakers. These circuit breakers are CB10 and CB11. The CB10 and CB11 can connect to optional equipment like the fiber units and channel banks. Refer to the previous table for breaker assignments.
- eight QFF-type fuses to fuse dc links to alarms, fans and SD circuit packs

OPM grounding network

The cabinet ground bar in the end-access compartment connects to the OPM principal GND. The user provides the GND according to local utility codes and operating company requirements. Maximum recommended ground-to-earth resistance is 25 Ω.

Refer to the following figures:

- OPM Main Ground Bar Terminations NT8X01AA OPM-640/NT8X01BA OPM-256
- OPM Grounding Network NT8X01AB OPM-640/NT8X01BB OPM-256
- OPM Grounding Network NT8X01AC OPM-640/NT8X01BC OPM-256

Figure 7 OPM main ground bar terminations (NT8X01AA OPM-640/NT8X01BA OPM-256)

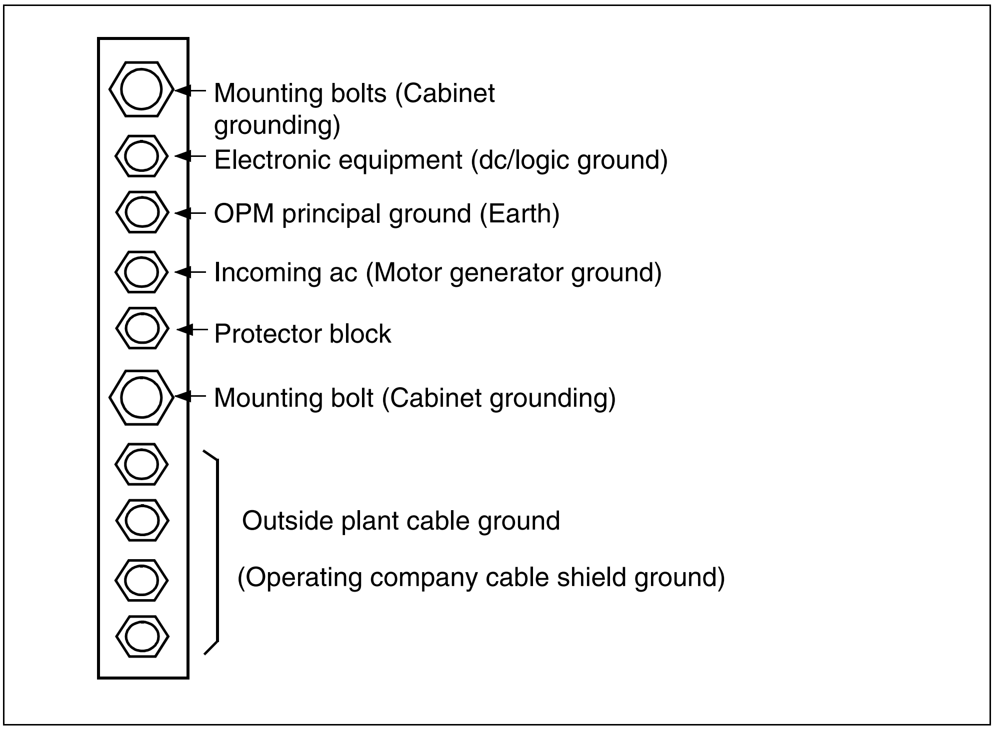


Figure 8 OPM grounding network (NT8X01AB OPM-640/NT8X01BB OPM-256)

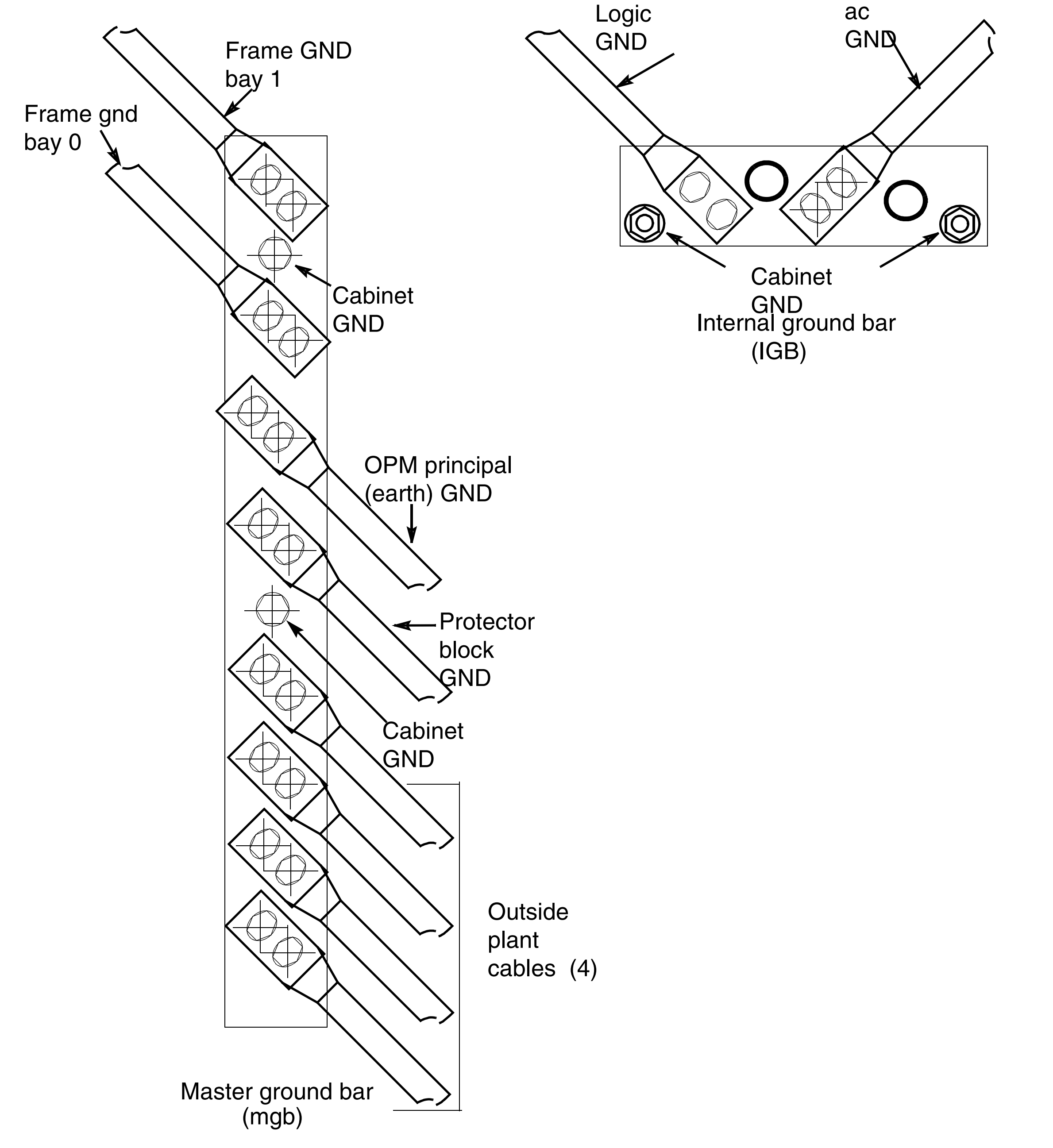
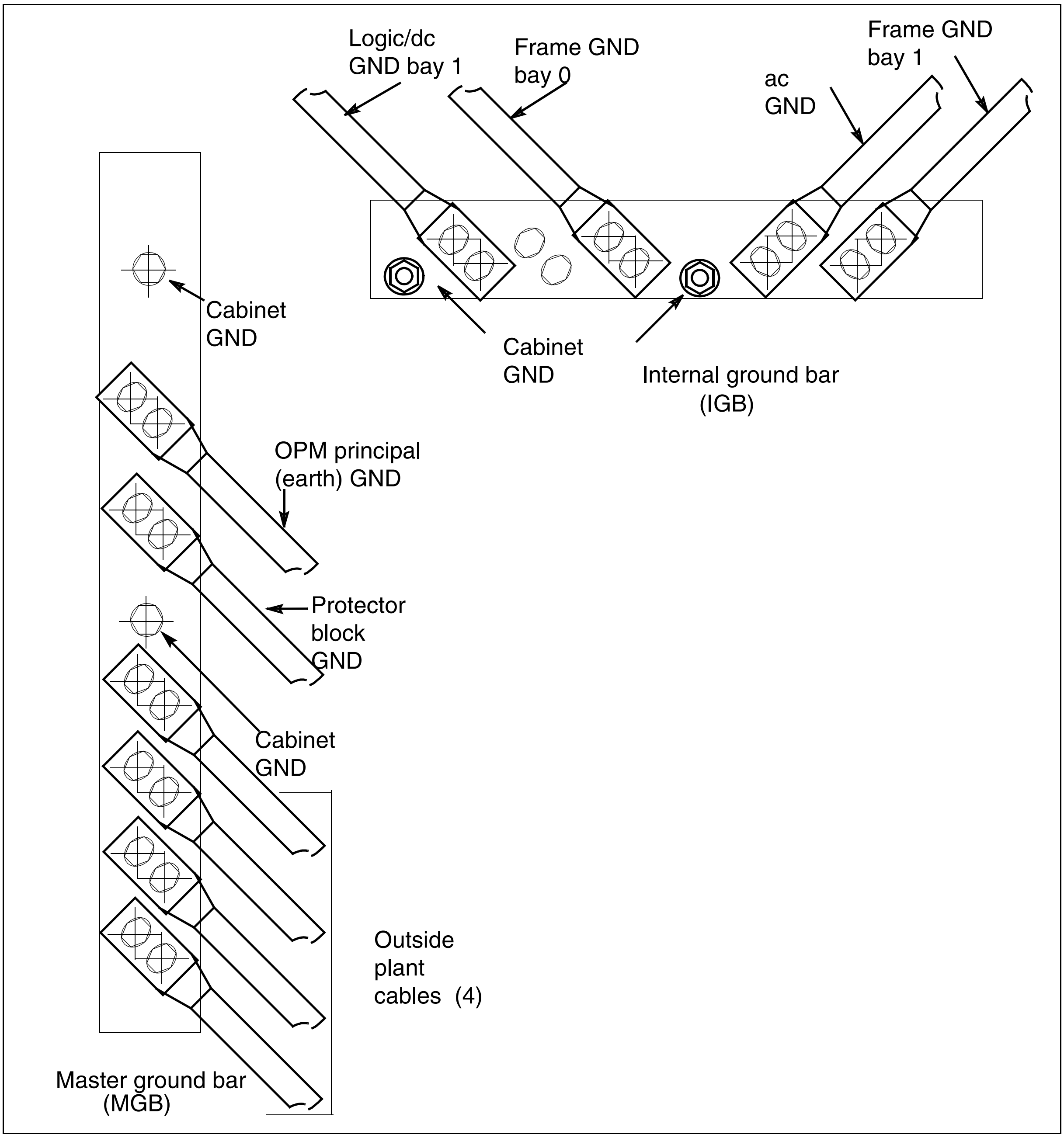


Figure 9 OPM grounding network (NT8X01AC OPM-640/NT8X01BC OPM-256)



OPM power and environmental system maintenance

Maintenance and user interface commands for the OPM are the same as the RLCM, with the addition of the PES. The OPM maintenance that includes PES maintenance is the PES and involves the following:

- table control for the PES data, in table OPMINV
- MAP display support for the PES that consists of:
  - — remote control of battery-string switching to:
    - – cause an open circuit, remove a battery string pair from the load bus or the charge bus
    - – put a battery string pair on the load bus
    - – put a battery string pair on the charge bus
  - — commands for the circuits to control battery string switching and detect the alarm or the state conditions of an PES
  - — displays to identify the shelves and bay and to give the circuit location information. The QUERYPM command provides circuit location information.
- alarm detection and automatic battery switching occurs when the following conditions are present:
  - — ac power failure
  - — BCC fuse 0 or 1 failure
  - — rectifier 0 or 1 failure
  - — extremely high temperature (EHT)
- log reports to reflect changes or failures that occur in the PES system
- hourly audits on the PES to verify the condition of the PES that the software views

  Note: The batteries are set to a software state. The software state of the PES alarms is set to the hardware state of the PES. The system can detect a mismatch between software and hardware. If this detection occurs, the audit restores the hardware to the current condition of the software. The audit generates a log message that indicates the action of the hardware.

- reflections of the state of the RMM in the state of the PES circuits

OPM battery backup system

The OPM provides a maximum of four pairs of battery strings for backup power when an ac failure occurs. The amount of backup time provided depends on the following conditions:

- number of battery strings installed
- condition of the battery strings
- number of line drawers and line cards installed
- number of subscriber lines off-hook
- length of the subscriber loops

The OPM has Yuasa A037761 or Eagle-Picher A0386201 batteries. Calculated battery backup times for the OPM-640 and OPM-256 are as follows:

- OPM-640 equipped with:
  - — ten line drawers and 640 line cards
  - — four pairs, eight strings of Yuasa batteries or three pairs, six strings, of Eagle-Picher batteries
  - — a call rate of 3.0 CCS, 8.3% of lines off-hook
  - — calculated battery backup time = 8.2 h, Yuasa, or 7.5 h, Eagle-Picher
- OPM-256 equipped with:
  - — four line drawers and 256 line cards
  - — three pairs, six strings, of Yuasa or Eagle-Picher batteries
  - — a call rate of 3.0 CCS, 8.3% of lines off-hook
  - — calculated battery backup time of 9.4 h, Yuasa, or 8.6 h, Eagle-Picher.

The following power matrix of the OPM calculates backup time for different configurations.

OPM power matrix and example current demand

For the OPM-640 and OPM-256 that do not have line drawers installed, the electric current demand is 52V dc. The OPM frame includes:

- frame support hardware:
  - two NT8X06AB ECUs
  - one NT8X06BA BFU
  - two NT8X02 BCC
- HIE shelf:
  - two NT6X60 ringing generators
  - two NT2X70AE power converters
  - two NT6X73AA LCC
  - two or three NT6X50AA,AB DS-1 interface cards
  - one NT6X75AA ESA clock and tone card
  - one NT6X45AF ESA processor card
- RMM shelf:
  - one NT2X59 tone pad card
  - one NT6X74 processor card
  - one NT2X09 power converter
  - one NT2X06 power converter
  - one NT2X10AC/2X11AC LTU pair
  - one NT2X10BA/2X11BA MTU pair
  - one 3X09BA metallic test access (MTA) card
  - one 3X09AA MTA card
  - one 0X10AA scan card
  - three 2X48AB digitone receiver (DTR) cards
  - two 2X90AD test trunk cards
- LCM with two units. Each unit includes:
  - one 6X53AA power converter
  - one 6X51AB/AC XLCM processor
  - one 6X52AA digroup control card (DCC).

The total frame current for the base OPM that does not have line drawers installed is 9.0A.

Line drawer current demand with all lines on-hook

The following table shows the base current demand for the OPM with line drawers, line cards and all lines on-hook:

Table 2 Frame current with line drawers supplied

Drawers	Line cards	Frame current demand (A)
0	0	9.0
1	64	9.38
2	128	9.76
3	192	10.14
4	256	10.88
5	320	11.26
6	384	11.64
7	448	12.02
8	512	12.40
9	576	12.78
10	640	13.16

Current demands with line off-hook

The amount of current drawn by an off-hook line depends on the length of the loop.

For these calculations, an NT6X17AA line card has the following parameters:

- line card battery feed resistors = 440 Ω
- telephone resistance = 200 Ω
- assumed short loop resistance = 50 Ω
- assumed average loop resistance = 800 Ω

Use the above values to calculate the off-hook line power requirements. For example:

- off-hook current for short loop = 77 mA
- off-hook current for average loop = 40 mA.

The call rate of 3.0 CCS or about 8.3% of the installed lines off-hook determines the calculated percentage of installed lines that are off-hook. For the OPM-640, 8.3% of the lines is 54. To calculate the total frame power demand, use the following equation:

(No. of lines off-hook) * (current per line) + base PWR demand

For the OPM-640 with 54 lines off-hook and 50 Ω loops

- base frame current with 10 line drawers = 13.16A
- total off-hook line current = (54 lines) * (77 mA/line) = 4.16A
- total frame current = 17.32A.

OPM power requirements

The following table lists the power requirements for the OPM-640 and OPM-256 at a call rate of 3.0 CCS:

Table 3 OPM-640 and OPM-256 power requirements at 3.0 CCS

Drwrs	Lines	Idle frame current demand (A)	Off-hook line demand (A) short: average loops	Total frame demand (A) short: avg loops
0	0	9.0		
1	64	9.38	0.46:0.24	9.84:9.62
2	128	9.67	0.85:0.44	10.61:10.20
3	192	10.14	1.23:0.64	11.37:10.78
4	256	10.88	1.69:0.88	12.57:11.76
5	320	11.26	2.08:1.08	13.34:12.34
6	384	11.64	2.46:1.28	14.10:12.92
7	448	12.02	2.92:1.52	14.94:13.54
8	512	12.40	3.31:1.72	15.71:14.12
9	576	12.78	3.70:1.92	16.48:14.70
0	640	13.16	4.16:2.16	17.32:15.32

Calculating battery backup time

Use these values to calculate the battery backup time for the different configurations.

1. Calculate the total battery power reserve.
   a. A Yuasa A037761 battery at a 10-hour discharge rate = 22.3 Ah capacity, 22.3 Ah/string * 8 strings = 178.4 Ah total backup power. The end-of-life capacity of the batteries is 80%. Reduce the amount of reserve power to provide a worst event scenario as follows:

      178.4Ah * 0.80 = 142.72Ah backup power

   b. A Eagle-Picher A0386201 battery at a 10-hour discharge rate = 27.0 Ah capacity. (27.0 Ah/string)*6 strings = 162.0 Ah total backup power. The end of life capacity of the batteries is 80%. Reduce the amount of reserve power to provide a worst event scenario as follows:

      162.0 Ah * 0.80 = 129.6 Ah backup power.

2. Divide the total backup power by the power of the frame demand to obtain the calculated backup time. The following example shows these calculations:
   a. 8 strings of Yuasa batteries at 80% = 142.72 AhOPM-640 at 3.0 CCS = 17.32 AEstimated backup time = (142.72 Ah/17.32 A) = 8.2 h
   b. 6 strings of Eagle-Picher at 80% = 129.6 Ah OPM-640 at 3.0 CCS = 17.32A. Estimated backup time = (129.6 Ah /17.32 A) = 7.5 h

The following table shows the calculated backup times for OPMs with 142 Ah of reserve power available and a call rate of 3.0 CCS:

Table 4 Reserve power estimates for 3.0 CCS call rate

Drwrs	Lines	Total frame demand (A) short: average loops	Calculated backup time hours short loops: avg loops
0	0	:9.0	:15.8
1	64	9.84:9.62	14.5:14.8

Note 1: The above values are not exact but provide a good estimate of backup power and times, add or subtract 15%.

Note 2: Factors not considered in the above calculations include:

- line card types other than NT6X17AA, most other line cards draw less power
- increase in battery current drawn by system packs as the battery voltage drops from -52V dc down through -42V dc
- decrease in loop current drawn by lines as the battery voltage drops from -52V dc down through -42V dc

Table 4 Reserve power estimates for 3.0 CCS call rate

Drwrs	Lines	Total frame demand (A) short: average loops	Calculated backup time hours short loops: avg loops
2	128	10.61:10.20	13.4:14.0
3	192	11.37:10.78	12.5:13.2
4	256	12.57:11.76	11.3:12.1
5	320	13.34:12.34	10.7:11.5
6	384	14.10:12.92	10.1:11.0
7	448	14.94:13.54	9.5:10.5
8	512	15.71:14.12	9.1:10.1
9	576	16:48:14.70	8.6:9.7
0	640	17.32:15.32	8.2:9.3
9	576	16.48:14.70	8.6:9.7
0	640	17.32:15.32	8.2:9.3

Note 1: The above values are not exact but provide a good estimate of backup power and times, add or subtract 15%.

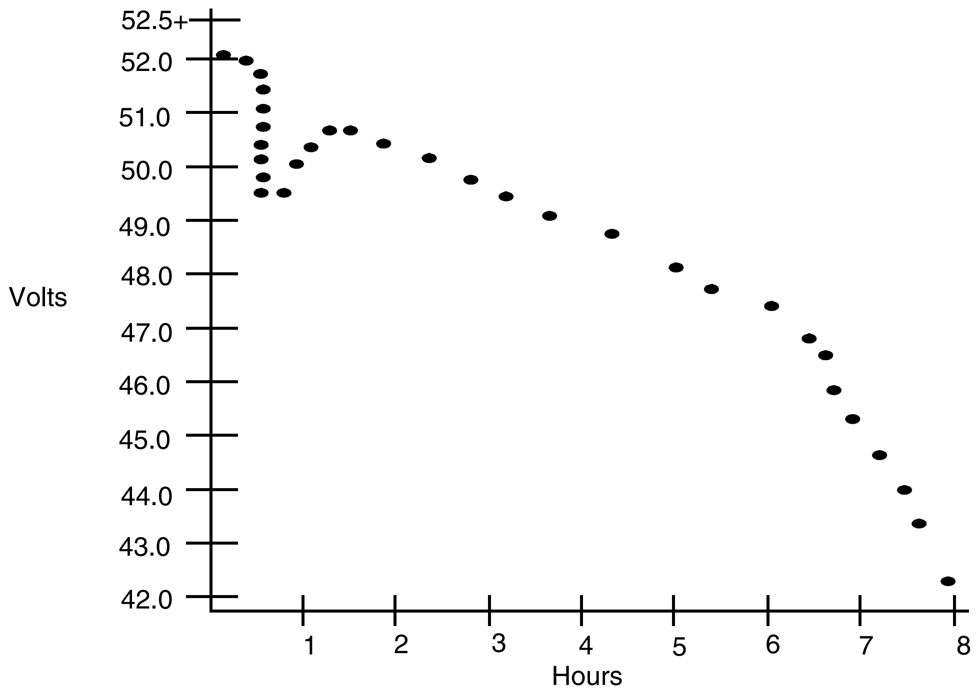
Note 2: Factors not considered in the above calculations include:

- line card types other than NT6X17AA, most other line cards draw less power
- increase in battery current drawn by system packs as the battery voltage drops from -52V dc down through -42V dc
- decrease in loop current drawn by lines as the battery voltage drops from -52V dc down through -42V dc

Standard discharge curve and charge time

The following figure shows the battery discharge curve over 8 h when both rectifiers fail. When the system restores ac power after a deep battery discharge, the OPM load bus recharges the batteries. The OPM load bus recharges the batteries to 90% of the available capacity in 24 h. The system recharges the batteries to 100% of available capacity in 48 h.

Figure 10 Battery discharge in 8 hours (OPM-640)



Fault conditions

The Maintenance Overview chapter provides information about fault conditions that are generic to the RLCM components of the OPM.. The fault conditions include:

- defective central-side (C-side) and peripheral-side (P-side) links
- defective circuit cards
- defective line drawers

The PES and the RMM use a system of alarms and audits to monitor OPM fault conditions.

PES description

The PES controls the power and environmental conditions of the OPM cabinet and the OPM internal components.

The PES has the following two functions:

- the alarm system that monitors fault conditions
- the battery control and testing system that is an automatic maintenance feature

Alarm system

The NT0X10AA scan card in slot 8 of the RMM monitors alarms. The NT0X10AA appears as PESALRM at the PES MAP level. The monitored alarms listed in the following table indicate possible fault conditions.

Table 5 PESALRM indicators

Alarm	Functions monitored
AC	common ac power failure
BCCF0, BCCF1	NT8X02 battery control charger fuse alarms
CL0	rectifier 0 current limit
CL1	rectifier 1 current limit
ECU	ECU or booster fan unit
EHT	extremely high temperature
ELT	extremely low temperature
FL0	rectifier 0 failure to sense output
FL1	rectifier 1 failure to sense output
FSP	a fuse or converter failure FSP
FRNT	front door open
HBT	high battery temperature (HBT)
SIDE	side door open
Note: The CL0 and CL1 alarms are present on the NTJ2427B rectifiers in the NT8X01AA, AB, BA and BB OPM frames. The NT0X10AA scan card does not monitor the ac alarm. The ac alarm is a logical alarm that is set when the FL0 and FL1 alarms are set during AC recovery.	

The group of alarm states and circuit card states reflect the condition of the PES. All detected alarm changes and changes of circuit states cause a condition change.

All alarms terminate in the RMM. The cabinet alarm system consists of four alarms:

- low or high temperature
- door open

- fan operation
- rectifier

PES cards

The PES cards are:

BCC
card NT8X02

BCCDVR
battery charger controller driver (BCCDVR) card

NT3X09AA

PESALRM
PES alarm (PESALRM) detector card NT0X10AA

The following list describes the OPM alarm conditions, the priority and causes of each alarm:

- Red - The system detects a minimum of one serious problem. The detection causes a major alarm at the peripheral module (PM) level if other PM alarms are not present. The following are the alarms that the system detects:
  - — AC failure
  - — FL0 detected
  - — FL1 detected
  - — CL0 detected associated J2427B-1 Rectifiers
  - — CL1 detected associated J2427B-1 Rectifiers
  - — EHT detected
  - — EHL detected
  - — FSP detected
  - — FRNT door open
  - — SIDE door open
- Yellow - The system detects a minimum of one problem that can be serious. When an equipped battery string is not on the load bus, a minor

alarm occurs. The minor alarm is at the PM level if other PM alarms are not present. The following are the alarms that the system detects:

- — BCCF0 detected
- — BCCF1 detected
- — ECU detected
- — HBT detected

The Yellow condition occurs if the BCCDVR and the PESALRM cards are in the any of the following states:

- peripheral-side busy (PBsy)
- system busy (SysB)
- manual busy (ManB) state

The battery rotation audit is disabled, or a battery string is marked F because of weekly test failures.

- Green - Alarms are not present. All cards and facilities are in-service (InSv) or normal.
- OFFL - Both the BCCDVR and PESALRM cards are offline (OFFL). This condition does not affect the PM command OFFL. The detected alarms are ignored because these alarms are for information only.

Load bus low voltage alarm

During a power failure, the system forces all battery strings on the load bus. The system locks the strings for the duration of the outage. The OPM power backup provides battery power for a minimum of 8 h.

When the power failure occurs:

- The system triggers a major alarm.
- If the measurement of the load bus voltage reveals a low level that is not acceptable, one of the following occurs:
  - — The system generates a log that indicates the low voltage in the load bus.
  - — A major alarm appears at the PM level of the MAP display.
  - — The command QUERYPES displays the status for the failure after the system posts the affected OPM.

During a power outage if the load bus measures 47V or less, the system triggers a low voltage alarm. The load bus is normally 52V. Use an LTU or MTU to test equipment.

The discharge rate of the battery strings varies with the OPM load. The OPM has a minimum of 8 h of backup for the following reserve power and load conditions:

- eight strings of Yuasa A037761 batteries at 80% or greater capacity
- six strings of Eagle-Picher A0386201 batteries at 80% or greater capacity
- an OPM call rate of 3.0 CCS or less

The sequence of events that are easy to see are as follows:

- power failure occurs, load bus and batteries are at 52V
- in the first 90 s, voltage drops to about 49V
- in the next hour, voltage rises to about 50V because of battery characteristics
- the voltage drops. At 47V the system triggers the load bus voltage alarm.
- when the batteries are at 47V, a minimum of 1.5 hours of backup power remain

During the power outage, the OPM hardware audit runs in 15-minute intervals and tests the load bus voltage. The load bus test can fail because the voltage of the load bus is less then 47V. fails. If the load bus test fails, the following events occur

- The system generates a log.
- A major alarm status appears at the PM level of the MAP display.
- The system records the trouble for the QUERYPES command.

Automatic maintenance

The OPM provides a maximum of four pairs of battery strings for backup power in the event of an ac failure. Feature package NTX147AB provides automatic maintenance for the PES batteries and power system. Feature package NTX147AB includes the following components to keep the batteries charged with an acceptable level of energy:

- automatic battery testing
- charge bus diagnostics
- automatic battery rotation

Battery control and testing system

The battery control and testing system has three sections:

1. BCC — The BCC consists of two NT8X02AA, or AB cards. The NT8X02AB is the UL-approved version of the NT8X02AA. The NT8X02AB is backward compatible with the NT8X02AA. The NT8X02

contains the OPM charge bus. The charge bus is a dc-to-dc converter with output to a maximum of 5V higher than the load bus, rectifier voltage. For example, if the load bus voltage is set to -52.0V dc, the maximum charge bus voltage is -57.0V dc ± 2%. Refer to the figure “OPM with Strings 0 and 4 on the Charge Bus; all others on Load Bus".

The charge bus is a current taper charger where output current drops as the voltage increases. For example, assume the load bus rectifiers are set to 52.0V dc. When a battery string moves from the load bus to the charge bus, the charge bus voltage changes. The voltage adjusts to a higher voltage than the load bus and supplies approximately 3A to the battery string. As the voltage of the battery string increases, the charge bus output current drops. When the battery string reaches the maximum charge bus voltage of 57.0V, the output current of the charge bus is approximately 0A.

The NT8X02 contains a discharge resistor that is the discharge test bus. The NT8X02 also contains the circuitry that moves the battery strings between the following:

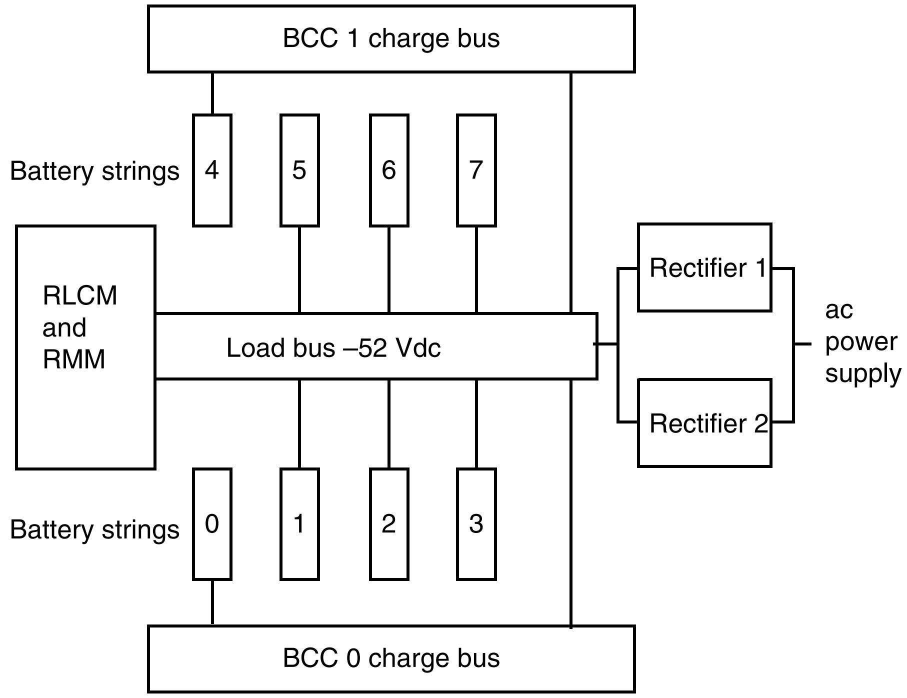
- load bus
- charge bus
- discharge test bus
- open circuit state

The OPM has the BCC 0 and BCC 1 cards. The BCC 0 card controls battery strings 0, 1, 2 and 3. The BCC 1 card controls battery strings 4, 5, 6 and 7.

BCCDVR— The BCCDVR is the NT3X09AA in RMM slot 6. This card relays battery control commands from system software to the NT8X02 BCC card to move the battery strings. The BCCDVR moves the battery strings between the open circuit state, load bus, charge bus and discharge bus. The card appears as BCCDVR at the PES MAP display.

Test access card — The test access card is the NT3X09BA MTA card in RMM slot 5. This card provides the LTU or MTU with access to the LCM line circuits. This card also provides the LTU or MTU with access to each battery string and the charge buses.

Figure 11 OPM with strings 0 and 4 on the charge bus; all others on load bus



Note: Battery strings 3 and 7 are not provisioned with Eagle-Picher batteries.

Hardware audit

A hardware audit is performed on the PES each hour. This audit checks four systems:

- NT0X10AA PESALRM card
- NT3X09BA BCCDRVR card
- NT8X02AA/AB BCC charge bus voltage
- OPM load bus voltage

NT0X10AA PESALRM card

Each hour the hardware audit polls the PESALRM card and compares the reported data with alarm data stored in software. If the reported data does not match the stored data, the system generates a PES102 log. This message appears: `HW battery or alarm state not = sw state`. The system updates the PES MAP display to reflect the setting or clearing of the new alarm.

Note: The PESALRM card must report the setting or clearing of alarms immediately. This audit polls the PESALRM card to make sure that system software did not lose alarms in the last hour.

NT3X09AA BCCDRVR card

Each hour the hardware audit polls the BCCDVR card and compares the reported data with relay data stored in software. If the reported data matches the stored data, the system generates a PES102 log. The PES102 report indicates that the hardware battery or alarm state does not equal the software state. This report indicates the software attempts to set the relays of the BCCDVR card to the correct state.

NT8X01AA/AB BCC charge bus voltages

Each hour the hardware audit measures the charge bus voltage on BCC 0 and BCC 1. If the voltage on a BCC is lower or higher than expected the following occurs:

- The system reports a minor alarm at the PM top level of the MAP display.
- If the OPM state is green, the state changes to yellow.
- The system generates a PES105 log to identify the BCC that failed.
- The system generates a PES116 log to report the measured voltages.

Note: This test does not run during ac failure mode.

OPM load bus voltage

During normal OPM operation, this section of the hardware audit does not run. When an ac failure occurs, the hardware audit frequency is increased to run in 15 min intervals instead of each hour. The OPM load bus voltage is checked in addition to polling the PESALRM and BCCDRVR cards. The MTU or LTU measures the load bus voltage in the RMM in 15 min intervals. When the voltage drops to 47V or below, the system generates a PES104 log. This message appears: `load bus low voltage`. When this condition occurs the batteries have from 1.5 to 2 h of reserve power that remains. The amount of reserve power that remains depends on the load conditions.

Battery rotation and testing audit

The OPM battery rotation and testing audit controls and monitors the OPM automatic battery rotation. This audit runs each hour. During an ac failure, the audit frequency is increased to 15 min intervals. The increase does not affect the battery rotation. The system does not allow rotation in the ac failure mode.

Intermittent charging design

The OPM uses an intermittent charging design that the battery rotation and testing audits implements. Do not confuse the OPM intermittent charging design with the float or cyclic charging designs. Other battery application manuals refer to the float or cycle charging designs.

A float charging design applies a constant voltage to the batteries to:

- keep the batteries completely charged
- completely recharge the batteries after discharge
- prevent the accumulation of sulfate deposits on the internal battery plates

During cyclic charging, the batteries are discharged between each charging cycle. The OPM batteries are deep discharged during an extended ac outage.

The OPM intermittent charging design operates in the following way. The batteries are held on the system load bus at a voltage above the open circuit voltage of the battery. The voltage is -52V dc for the Yuasa A037761 and Eagle-Picher A0386201 battery. The voltage can maintain the batteries in a completely charged state. This voltage also recharges the batteries to between 90% and 100% after a discharge. The voltage cannot prevent the accumulation of sulfate deposits on the battery plates. The batteries are regularly moved from the load bus to the charge bus for a short period of time. The charge bus voltage makes sure that the batteries are charged to full capacity. The charge bus voltage also forces sulfates that have accumulated on the battery plates, back in the liquid.

The OPM intermittent charging design, is more complicated than the easy float charging design. The OPM intermittent charging design offers the following advantages:

- Extended battery life

  Tests show that battery life can lengthen by 50% to 100% when intermittent charging is used instead of float charging. Lead-acid batteries are sensitive to temperature. Each 7°C to 10°C (45°F to 50°Φ) τεμπερατυρε ινχρεασε αβοϖε 25°C (77°F) reduces the battery life by 50%. The OPM internal temperature is an average of 12°C to 15°X (54°F to 59°Φ) αβοϖε ουτσιδε αμβιεντ τεμπερατυρε.

Intermittent charging reduces the following to increase battery life:

- load bus voltage
- battery-charging current
- battery internal temperature rise
- rate of battery-positive grid corrosion

A battery like the Yuasa A037761 has an expected life of 4 to 5 years at 25°C or 77°F. For float charging, the Yuasa A037761 can have an expected life of approximately 1.5 to 2 years in the OPM environment. For intermittent charging, the life of Yuasa A037761 batteries can be extended to over 3 years. The battery life can be shorter in very hot weather conditions or longer in cool weather conditions.

Lower OPM power use

Power use by loads that have resistance decrease when the OPM load bus voltage lowers. Subscriber loops is an example of a load that has resistance.

Advanced battery testing capabilities

Intermittent charging allows battery open circuit, discharge and post boost charge tests to occur. These tests determine the state of the battery strings.

The battery rotation and testing audit is a feature of the system software that controls OPM battery charging and testing. The battery rotation and testing audit has the following five modes of operation:

1. normal battery rotation mode
2. rotation disabled mode
3. ac failure mode
4. post-ac failure mode, short
5. post-ac failure mode, extended

Normal battery rotation mode

During normal battery rotation mode, battery string pairs rotate from the load bus to the charge bus. The rotation lasts for a predetermined time each week and battery testing occurs each Sunday. Office parameters in table OFCSTD control battery rotation and testing.

The following table lists and describes the office parameters of table OFCSTD that contain entries for battery rotation and testing. For additional information about office parameters, refer to *Office Parameters Reference Manual.*

Table 6 Battery rotation and testing parameters entered in table OFCSTD

Parameter	Range	Default value	Description
OPM_CHARGE_ START_TIME	0 through 23	23	Indicates this parameter controls the time-of-day (TOD) when a battery string pair moves from the load bus to the charge bus. The default value is 23 and corresponds to 11:00 P.M.
OPM_CHARGE_ DURATION	0 through 20	7	Indicates this parameter controls the amount of time a battery string remains on the charge bus
OPM_ DISCHARGE_ TIME	0 through 4	-4	Indicates this parameter controls the amount of time a battery string connects to the discharge bus. The battery string is connected to the discharge bus during the weekly discharge test. The default value is 4 and corresponds to one hour.
OPM_MIN_CHG_ VOLT	-400 through -500	-420	Indicates this parameter controls the minimum voltage a battery string must be at to rotate to the charge bus. The default value is -420 and corresponds to -42.0 V.
OPM_VOLT_TST _OCC	0 through -600	-504	Indicates this parameter is the comparison value for the voltage of the battery string during the open circuit test. The default for Yuasa NP24-12 and Eagle-Picher A0386201 batteries is -504 and corresponds to -50.4V. If this parameter is set to zero, the open circuit test does not occur.
OPM_VOLT_TST _DIS	0 through -600	-495	Indicates this parameter is the comparison value for the voltage of the battery string during the discharge test. The default value for Yuasa A037761 and Eagle-Picher A0386201 batteries is -495 and corresponds to -49.5V. If this parameter is set to zero, the discharge test does not occur.

Table 6 Battery rotation and testing parameters entered in table OFCSTD

Parameter	Range	Default value	Description
OPM_VOLT_TST _CHG	0 through -600	-509	Indicates this parameter is the comparison value for the voltage of the battery string during the post-charge test. The default value for Yuasa NP24-12 and Eagle-Picher A0386201 batteries is -509 and corresponds to -50.9V. If this parameter is set to zero, the post charge test is not performed.
OPM_VOLT_TST _LTU_ ADJUSTMENT	0 through 50	10	Indicates that the comparison voltages for the open circuit, discharge and post-charge tests are specified for the MTU. The MTU has 0.5% accuracy and 0.1V resolution. This parameter adjusts the comarison values when an LTU is used to test batteries instead of an MTU. The LTU has 2% accuracy and 1V resolution.

Table OPMINV

The user can set field ENABATST in table OPMINV to Y(yes) or N (no) for each OPM. When set to Y, the system performs weekly battery testing. When set to N, the system bypasses weekly battery testing.

> ***Note:*** Battery strings 3 and 7 contain datafill with an N when the system equips Eagle-Picher A0386201 batteries. The system equips a maximum of six battery strings for each OPM with the Eagle-Picher batteries.

Battery rotation and test cycle

The complete battery rotation and test cycle last 4 weeks and repeats. The following table shows the rotation and test cycle. The present audit week appears under the header `Week at the PES MAP level. The legend for the following table is:`

- O/C open circuit
- DISCHG discharge through NT8X02 card
- CHG charge bus

- STn battery string pair
- MEAS measure voltage

Table 7 OPM battery rotation and test cycle

Wk	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1		MEAS ST0					
	MEAS ALL	DISCHG	LOADBUS	LOADBUS	LOADBUS	LOADBUS	LOADBUS
		ST0	ST0	ST1	ST2	ST3	ST0
	O/C ST0						
	for 24 hr	MEAS ST0	MEAS ST1	MEAS ST2	MEAS ST3	MEAS ST0	
		CHG ST0	CHG ST1	CHG ST2	CHG ST3	CHG ST0	
		O/C ST0	O/C ST1	O/C ST2	O/C ST3	O/C ST0	
		MEAS ST0					
2		MEAS ST1					
	MEAS ALL	DISCHG	LOADBUS	LOADBUS	LOADBUS	LOADBUS	LOADBUS
		ST1	ST1	ST2	ST3	ST0	ST1
	O/C ST1						
	for 24 hr	MEAS ST1	MEAS ST2	MEAS ST3	MEAS ST0	MEAS ST1	
		CHG ST1	CHG ST2	CHG ST3	CHG ST0	CHG ST1	
		O/C ST1	O/C ST2	O/C ST3	O/C ST0	O/C ST1	
		MEAS ST1					
3	MEAS ALL	DISCHG	LOADBUS	LOADBUS	LOADBUS	LOADBUS	LOADBUS

Table 7 OPM battery rotation and test cycle

Wk	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		ST2	ST2	ST3	ST0	ST1	ST2
	O/C ST2						
	for 24 hr	MEAS ST2	MEAS ST3	MEAS ST0	MEAS ST1	MEAS ST2	
		CHG ST2	CHG ST3	CHG ST0	CHG ST1	CHG ST2	
		O/C ST2	O/C ST3	O/C ST0	O/C ST1	O/C ST2	
		MEAS ST2					
4		MEAS ST3					
	MEAS ALL	DISCHG	LOADBUS	LOADBUS	LOADBUS	LOADBUS	LOADBUS
		ST3	ST3	ST0	ST2	ST2	ST3
	O/C ST3						
	for 24 hr	MEAS ST3	MEAS ST0	MEAS ST1	MEAS ST2	MEAS ST3	
		CHG ST3	CHG ST0	CHG ST1	CHG ST2	CHG ST3	
		O/C ST3	O/C ST0	O/C ST1	O/C ST2	O/C ST3	
		MEAS ST3					

For each battery string pair, the rotation cycle provides a charge cycle one time in a one-week interval. A test-and-charge cycle occurs one time in a four-week interval. This cycle occurs for a different battery string pair each week. This action occurs to test all pairs one time in a four-week interval. Less than four battery strings can contain datafill for an OPM. If this condition occurs, battery rotation activity does not occur during periods that are reserved. These periods are reserved for the strings not datafilled.

Test-and-charge cycle description

The test-and-charge cycle detects battery strings that fail to hold enough charge and require replacement.

The test-and-charge cycle starts on a Sunday. The following steps summarize the procedure for all strings in the previous table:

1. Office parameter OPM_CHARGE_START_TIME presets the Sunday start time. The system measures voltages of the load bus, the two BCCs and all open-circuited battery strings that contain entries. The system sends the results to a PES116 log.
2. The string to test is open-circuited for 24 hours.
3. The system measures the voltage of the string pair and tests the string pair against the OPM_VOLT_TST_OCC value. If the pair fails this test and failed the previous test-and-charge cycle, the system marks the string as failed.
4. If the system does not mark the string as failed, the system discharges the string for OPM_DISCHARGE_TIME if OPM_DISCHARGE_TIME > 0 and OPM_VOLT_TST_DIS > 0.
5. The system measures the voltages of the battery strings again, while the strings remain connected to the test load resistor. The system compares the strings to the OPM_VOLT_TST_DIS value. If the pair fails this test and failed the previous test-and-charge cycle, the system marks the string as failed.
6. If the system does not mark the string pair as failed, the string pair is open-circuited. If a discharge did not occur, the system measures the open circuit voltage. The system tests the discharge or open-circuit measured voltage against the OPM_MIN_CHG_VOLT value. This action occurs before the battery string connects to the charge bus. If this action fails, the system does not generate an alarm and aborts the test-and-charge cycle. The system moves the battery to the load bus and a PES115 log reports the bypass of the charge cycle. If the action is successful, the system moves the pair to the charge bus for OPM_CHARGE_DURATION.
7. When the charge period is complete, the pair is open-circuited.
8. At OPM_CHARGE_START_TIME on Tuesday, the system measures and tests against the voltage OPM_VOLT_TST_CHG. If the test fails, the

system marks the string as failed. The system returns the pair to the load bus and the charge cycle for the next string starts.

Note 1: When a system software marks a battery string pair as failed, follow the test procedures listed under "Manual test procedures for system-failed battery strings".

Note 2: The battery string pair can return to service when either of the following conditions occurs:

- the system replaces a battery string pair that failed system testing
- the user manually tests a battery string pair that passed system testing

To RTS the battery string pair, use the BSY and RTS commands to manual busy and return to service the PES.

The rotation cycle for week 2 that uses the default start time of 11 P.M. and the default discharge time of 60 min appears in the following table. The legend for the following table is as follows:

- O/C open circuit
- STn battery string pair
- CHG charge bus
- DISCHG discharge through NT8X02 BCC card
- MEAS measure voltage
- LDB load bus
- TST test.

Table 8 Cycle rotation for week

Wk	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			6:00	6:00	6:00	6:00	6:00
			O/C ST1	O/C ST2	O/C ST3	O/C ST0	O/C ST1
	22:00	22:00					
	MEAS ALL	TST OCC 1					
2	O/C ST1	DCHG ST1					
		23:00	23:00	23:00	23:00	23:00	23:00

Table 8 Cycle rotation for week

Wk	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		TST DIS 1	TST CHG 1				
		CHG ST1	LDB ST1	LDB ST2	LDB ST3	LDB ST0	LDB ST1
			O/C ST2	O/C ST3	O/C ST0	O/C ST1	
			TST MIN 2	TST MIN 3	TST MIN 0	TST MIN1	
			CHG ST2	CHG ST3	CHG ST0	CHG ST1	

Charge cycle

A string must not be put on the charge bus unless the voltage meets the minimum requirements of the bus. The charge cycle begins with a measurement of the voltages of the battery strings. The charge cycle consists of the following steps:

1. At OPM_CHARGE_START_TIME, the battery pair that requires charging is open-circuited and the system measures and tests the voltages against the OPM_MIN_CHG_VOLT value. If either of the voltages does not meet the minimum voltage required, the pair remains on the load bus. The system bypasses the charge cycle for that day and generates a PES115 log.
2. If the pair passed the minimum voltage test, the pair moves to the charge bus for OPM_CHARGE_DURATION.
3. When the charge period is complete, the pair is open-circuited.
4. At OPM_CHARGE_START_TIME on the next day, the pair moves to the load bus and the charge cycle for the next battery string pair starts.

Rotation disabled mode

Use the AUDIT DISABLE command to disable the OPM battery rotation and testing software from the PES MAP level. This command halts all battery rotation, charging and testing activities. This command does *not* halt the hardware audit that runs each hour. When you perform manual maintenance on the batteries, disable the battery rotation and testing software. Disable the battery rotation and testing audit. Now the system allows manual control of the battery strings from the PES MAP level. When you complete manual battery maintenance, use the AUDIT ENABLE command to enable the battery rotation and testing audit.

ac failure mode

If both rectifiers fail and cause an FL0 and FL1 alarm, the OPM enters ac failure mode. During ac failure mode, all battery strings are placed on the load bus and no manual battery activities are allowed. The hardware audit frequency now runs 15 min intervals instead of hour intervals. When the hardware audit runs, the PESALRM card, BCCDRVR card and load bus voltage are checked.

Post-ac failure mode (short)

An outage can cause negative results during the next test-and-charge cycle. To prevent these negative results, the duration of the outage must not exceed 15 min. The action to take depends if power is restored in time to prevent these results.

The system does not resume testing if

- power is restored within 12 h before the start of the test-and-charge cycle
- power is restored during the scheduled test-and-charge cycle

All strings are left on the load bus until the next charge cycle. The next charge cycle can be the charge part of the test-and-charge cycle. If this cycle is part of the test-and-charge cycle, charging is done, but testing does not occur.

If power is restored at another time the scheduled charging activity resumes after a 15 min delay. If a string was on the charge bus or open-circuited, the string is returned to that state. The next charge cycle events occur at the scheduled times. While the occurrence of charge cycle events can result in a short charge period, battery life will not be affected. When the OPM is in post-ac failure mode short, `P/S` appears under `Week` at the PES MAP display.

Post-ac failure mode (extended)

If an ac outage exceeds the short ac failure interval, consider the outage an extended ac outage. The following steps are taken:

1. All strings remain on the load bus for 24 h.
2. In sequence that starts with battery pair 0, each nonfailed equipped battery string pair is charged for 5 h, open-circuited for 1 h and moved to the load bus. If an unequipped or failed pair is present or if a pair fails the minimum charge voltage test, the pair is skipped. Charging of the next equipped, nonfailed pair starts immediately. A skipped, equipped battery pair remains on the load bus.
3. Battery pair 3 is moved to the load bus or skipped. All strings are left on the load bus for 24 h.
4. Audit activity resumes with the next charge period or at the beginning of the next test-and-charge cycle. The activity resumes according to the

normal rotation schedule that appears in the table Cycle Rotation for Week.

When the OPM is in post-ac failure mode extended, `P/E` appears under `Week` at the PES MAP display.

If the RMM at the OPM is out-of-service (OOS), alarms cannot be reported and battery rotation or testing cannot be performed. Alarm reporting, battery rotation and battery testing resumes when the RMM is RTS.

Increase to manual maintenance

The DMS-100 Family of PMs is reliable but automatic maintenance can fail to correct a fault in the DMS network. The system can require operating company personnel to troubleshoot or clear a fault condition.

The following sections describe:

- manual commands operating company personnel can perform at the MAP level
- diagnostic maintenance operating company personnel can perform at the OPM site

Manual testing OPM systems

The PES test (TST) command allows a manual test of the following:

- PESALRM NT0X10AA card
- BCCDRVR NT3X09AA card
- Chargebus NT8X02AA/AB.

If the technician enters the TST command without parameters, the system tests all three items. If the technician enters parameter PESALRM, BCCDRVR, or CHARGEBUS, the system tests only that item.

Put the PESALRM and the BCCDRVR card in the ManB state before you perform a manual test on the cards.

The user cannot perform the TST command for the CHARGEBUS while the OPM is in ac failure mode.

If one or more of the three tests fail, the following events occur:

- The system generates a log.
- The system reports a minor alarm in the PM top level of the MAP display.
- If the OPM state is green, the OPM state changes to amber.

If the test passes, but an alarm is present from a previous test, the following events occur:

- The alarm condition clears.
- The system generates a log.
- If no other OPM alarms are present, the OPM state changes from amber to green.

Manual battery actions and system voltage measurements

The technician can perform the following operations on the OPM batteries from the PES MAP level:

- open-circuit battery string pair
- place battery string pair on the charge bus
- place battery string pair on the load bus.

The technician can measure the following voltages from the PES MAP level:

- all battery string voltages
- system load bus voltage rectifier voltage
- BCC 0 and BCC 1 charge bus voltages.

Before you perform these operations, use the AUDIT DISABLE command to disable the OPM battery rotation and testing audit. When you disable the audit, the OPM state changes from green to amber. The system generates a PES113 log with the message `Battery Audit Dis from Ok`.

OPENCKT_ (0-3)

Use the OPENCKT command to move a battery string pair from the load bus or charge bus to the open circuit state.

The open circuit command operates on the battery string pairs as follows:

- OPENCKT 0 — moves battery strings 0 and 4 to an open circuit state
- OPENCKT 1 — moves battery strings 1 and 5 to an open circuit state
- OPENCKT 2 — moves battery strings 2 and 6 to an open circuit state
- OPENCKT 3 — moves battery strings 3 and 7 to an open circuit state

> ***Note:*** Battery strings 3 and 7 are not equipped when Eagle-Picher A0386201 batteries are used.

CHARGE_ (0-3)

Use the CHARGE command to move a battery string pair from the open circuit state to the charge bus. The CHARGE command operates on battery string pairs with the same method as the OPENCKT command.

Note 1: A battery string pair cannot be moved directly from the load bus to the charge bus. Use the OPENCKT command to open-circuit the battery string pair. Use the CHARGE command to move the string pair to the charge bus.

Note 2: One battery string pair can be placed on the charge bus at a time.

LOADB_ (0-3)

Use the LOADB command to move a battery string pair from the open circuit state to the load bus. The LOADB command operates on battery string pairs with the same method as the OPENCKT command.

Note 1: A battery string pair cannot be moved directly from the charge bus to the load bus. Use the OPENCKT command to open-circuit the battery string pair. Use the LOADB command to move the string pair to the load bus.

Note 2: During an ac failure, all battery strings are moved to the load bus. System software does not allow battery strings to be removed from the load bus until the ac failure clears.

MEASURE

The MEASURE command measures the following:

- voltage of a battery string pair
- the charge buses BCC 0 and BCC 1
- the load bus with the LTU or MTU in slots 3 and 4 or the OPM RMM.

The following measured voltages appear on the PES MAP screen:

- MEASURE LOADB measures load bus voltage
- MEASURE BCC measures the charge bus voltages or BCC 0 and BCC 1
- MEASURE PAIR measures the voltages of battery strings as follows:
  - 0 measures the voltages of strings 0 and 4
  - 1 measures the voltages of strings 1 and 5
  - 2 measures the voltages of strings 2 and 6
  - 3 measures the voltages of strings 3 and 7
- MEASURE ALL measures the voltages of the load bus, BCC 0, BCC 1 and all battery string pairs.

Querying PES alarms

To query the PES alarms, use the QUERYPES command at the PES MAP level. To display the state of all OPM alarm systems, enter the QUERYPES command without parameters. To display OPM alarm systems generating alarms, enter the QUERYPES command followed by the FLT parameter QUERYPES FLT.

A QUERYPES display with no faults in the PES and battery string pair 3 on the charge bus follows:

Example of a MAP response:

```
QueryPES
PES 0 ,  CONDITION GREEN,  KOPM 0 0 ,  RMM  3 ,
BCCDVR CCTNO: 6 ,  PESALRM CCTNO: 10  ON RMM  3 ,
EHT .,ELT .,BCCF0 .,BCCF1 .,FL0 .,FL1 .,HBT .,FRNT O,SIDE .,
BCC0: .    .    .  CHG , FSP ., AC ., CL0 ., CL1 .,
BCC1: .    .    .  CHG , BCCDVR ., PESALRM ., ECU .
AUDIT DIS  AUDIT WEEK:  4
```

The following QUERYPES display appears with the rectifier 1 alarm and the ECU alarm set:

Example of a MAP response:

```
QueryPES
PES 0 ,  CONDITION RED    ,  KOPM 0 0 ,  RMM  3 ,
BCCDVR CCTNO: 6 ,  PESALRM CCTNO: 10  ON RMM  3 ,
EHT .,ELT .,BCCF0 .,BCCF1 .,FL0 .,FL1 F,HBT .,FRNT .,SIDE .,
BCC0: .    .    .    .  , FSP ., AC ., CL0 ., CL1 .,
BCC1: .    .    .    .  , BCCDVR ., PESALRM ., ECU F
AUDIT  .   AUDIT WEEK:  2
```

The following QUERYPES FLT display appears with the ECU alarm set, the audit disabled and battery string pair 1 failed:

Example of a MAP response:

```
QueryPES flt
ECU F,
BCC0: .   F    .    .  ,
BCC1: .   F    .    .  ,
AUDIT DIS
```

In the QUERYPES display, there are no faults, but extended post-ac processing is in progress:

Example of a MAP response:

```
QueryPES
PES 0 ,  CONDITION GREEN ,  KOPM 0 0 ,  RMM  3 ,
BCCDVR CCTNO: 6 ,  PESALRM CCTNO: 10  ON RMM  3 ,
EHT .,ELT .,BCCF0 .,BCCF1 .,FL0 .,FL1 .,HBT .,FRNT .,SIDE .,
BCC0: .  CHG  .   .  , FSP ., AC ., CL0 ., CL1 .,
BCC1: .  CHG  .   .  , BCCDVR ., PESALRM ., ECU .
AUDIT .    AUDIT WEEK:  P/E
```

In the QUERYPES FLT display, there are no faults, but extended post-ac processing is in progress:

```
QueryPES  flt
NO FAULTS--BUT IN POST AC FAILURE MODE. CHECK LOGS
```

The following figures give more information on the display of:

- Posted PES 2 with OPM in GREEN State
- AC Failure Occurrence for PES 2

Figure 12 Posted PES 2 with OPM in GREEN state

```
 CM    MS     IOD      NET     PM     CCS     LNS     Trks    Ext     Appl
  .     .      .        .     1PES     .       .       .       .       .

PES                   SysB   ManB    OffL    CBSY    ISTB    InSV
 0 Quit      PM          0      3       4       0       4      30
 2 Post_
 3                     RED      AMBER     GREEN     OFFL
 4           PES        0         0         4         1
 5
 6 Tst_      PES       2 Cond:  GREEN  REM1     01   0   RMM   3
 7 Bsy_                                          Audit  Week  HBT
 8 Rts_       Common     Rectifiers                 .      2    .
 9 OffL_       AC      FL0 FL1 CL0 CL1    BCCDVR  PESALRM  ECU FSP
10              .       .   .   .   .   .   .        .        .   .
11 Disp_      BCC    0     1     2     3    Temp      Door     BCCFUSES
12 Next      0= W    .     .     .     -   EHT ELT  FRNT SIDE    0   1
13           1= W    .     .     .     -    .   .    .    .      .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18.MEASure_
```

Figure 13 ac failure occurrence for PES 2

```
 CM    MS     IOD      NET    PM     CCS    LNS     Trks   Ext   Appl
  .     .      .        .    1PES     .      .        .      .     .

PES                   SysB   ManB    OffL    CBSY    ISTB    InSV
 0 Quit      PM         0      3       4       0      4       30
 2 Post_
 3                      RED      AMBER     GREEN     OFFL
 4           PES         1         1         2         1
 5
 6 Tst_      PES       2 Cond:  RED    REM1     01   0   RMM   3
 7 Bsy_                                             Audit  Week  HBT
 8 Rts_       Common     Rectifiers                    .     2    .
 9 OffL_       AC     FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
10              F        F   F  .   .       .        .       .  .
11 Disp_      BCC    0     1     2     3    Temp      Door    BCCFUSES
12 Next      0= .    .     .     .     -  EHT ELT  FRNT SIDE    0   1
13           1= .    .     .     .     .   .   .     .   .      .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 MEASure_  >
```

During the ac-failure period, the OPM audit runs the load bus low voltage test in 15 min intervals. If the test fails, the system triggers the major audible alarm. The operating company personnel can use the QUERYPES command to obtain a description of the trouble. Refer to the following figure.

The system response to a QUERYPES is as follows:

Example of a MAP response:

```
PES 2, CONDITION RED, REM1 01 0, RMM 3,
BCCDVR CKTNO 6, PESALRM CKTNO 10   ON RMM 3,
EHT ., ELT ., BCCF0 ., BCCF1 ., FL0 F, FL1 F, FRNT .,      SIDE .,
BCC0: . . . ., FSP ., AC F, CL0 ., CL1 .,
BCC1: . . . ., BCCDVR ., PESALRM ., ECU .
LOAD BUS low voltage alarm
```

Figure 14 Trouble explanation

```
 CM    MS     IOD    NET    PM    CCS    LNS    Trks   Ext   Appl
  .     .      .      .    1PES    .      .       .     .      .

PES                   SysB   ManB    OffL    CBSY    ISTB    InSV
 0 Quit      PM         0      3       4      0        4      30
 2 Post_
 3                      RED      AMBER     GREEN     OFFL
 4           PES         1         1         2        1
 5
 6 Tst_      PES       2 Cond:  RED    REM1     01   0   RMM   3
 7 Bsy_                                                Audit  Week  HBT
 8 Rts_       Common     Rectifiers                      .     2    .
 9 OffL_       AC      FL0  FL1  CL0  CL1   BCCDVR  PESALRM  ECU  FSP
10              F       F    F    .    .       .        .      .  .
11 Disp_      BCC    0    1    2    3    Temp     Door    BCCFUSES
12 Next      0= .    .    .    .    -   EHT ELT  FRNT SIDE    0   1
13           1= .    .    .    .    .    .  .      .   .      .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 MEASure_  >querypes
```

On-site outside maintenance

Use a tent or cover to perform maintenance work during bad weather. Nortel recommends a Pelsue Model 6508B ground tent or equivalent, 2.44 m by 2.44 m by 1.83 m high (8 ft by 8 ft by 6 ft), with a internal ventilator/heater port.

If operating company personnel must perform work with bay zero or bay one opened, heat the tent to an ambient temperature between +5°C to 0°C (41°F to 32°F). Operating company personnel can do work that requires the front doors be open for no longer than 5 or 10 min. The outside ambient temperature of the cabinet can be as low as -15°C (+5°F), but the work must not exceed a time limit of 5 to 10 min. Operating company personnel can open the end-access compartment door for a maximum period of 10 to 20 min at a low minimum ambient temperature of -15°C (+5°F). If the work requires the doors be open for longer periods, erect a tent over the OPM cabinet. Heat the OPM cabinet to an ambient temperature between +5°C to 0°C (41°F to 32°F).

Battery inspection

Inspect the batteries in six month intervals. Inspect battery pack terminals, connectors and shelves for indications of moisture or corrosion.

If signs of moisture or corrosion are present, perform the following actions:

1. Remove all battery packs from the affected shelf.
2. Clean the affected areas with a combination of baking soda and water. Continue until the cleaning liquid no longer foams when you apply the liquid.
3. Dry all cleaned areas and replace the battery packs on their shelves.

Battery electrical inspection

Central control (CC) software loads of BCS31 and higher contain the revised OPM battery-charging and maintenance routines. The type of measurement device on the site determines the battery tests. This device can be a LTU or MTU measurement device.

MTU sites

The MTU contains an internal voltage standard and performs voltage measurements with ± 0.5% accuracy and 0.1V resolution. System software performs all required battery capacity tests monthly. If the system marks a battery string as failed, follow the procedures listed in “Manual test procedures for system-failed battery strings". Use these procedures to confirm the test failure and replace the batteries.

At each three month interval, test the rectifier voltage to make sure that the voltage is set correctly. From the OPM MAP level, use the MEASURE LOADB command to measure the rectifier output voltage. If the voltage does not equal -52.0V dc ± 0.3V, adjust the rectifier voltage at the OPM site. Refer to the procedure “Rectifier voltage adjustments LTU check" in this document for specific instructions.

LTU sites

The LTU does not contain an internal voltage standard. The LTU performs measurements with 2% accuracy and 1V resolution. This percentage is not adequate for system software to accurately measure and diagnose battery strings that lose capacity. A battery cannot swell and crack until its capacity drops below 20% to 30% (47-48V for each string). The 2.0% accuracy and 1V resolution is enough to detect a string before the batteries start to crack. Because the LTU does not have an internal voltage standard, check the LTU periodically to make sure that the LTU is accurate.

Rectifier voltage adjustments LTU check

Perform the rectifier voltage procedure in three month intervals. Refer to the following procedure for instructions on the rectifier voltage adjustment and LTU check.

Adjusting rectifier voltage LTU check

At the OPM site

1. Use a voltmeter with a maximum of 2% error to measure each rectifier output voltage.
2. Adjust the rectifier voltage screws until the voltage is within specification and the current from each rectifier is balanced.

   If the rectifier voltage is low, wait 24 h before you proceed with the battery capacity testing.
3. From the OPM MAP level, perform the MEASURE LOADB command. Make sure that the voltage measurement is -51 or -52V. Repeat this step two more times to maintain accuracy.

If the voltage	do
is out of range	step 4 or 5
is within range	step 6

4. Replace the LTU. Go to step 1.
5. Perform battery capacity tests in three month intervals.
6. Perform battery capacity tests in six month intervals.

Battery capacity tests

If the LTU measurements are within specifications, perform these tests in six month intervals. If the LTU measurements are not within specifications, perform these tests in three month intervals. To prevent conflicts with the automatic battery testing, do not perform this procedure on Monday or Tuesday. Refer to the following procedure for instructions on battery capacity tests.

Testing battery capacity

At the OPM MAP display

1. Make sure that extended power failures did not occur at the OPM site in the last 72 h. Make sure the OPM is not in a post-ac failure recovery mode.
2. From the OPM MAP level, enter the AUDIT DISABLE command to disable the automatic battery rotation and testing.
3. From the OPM MAP level, open circuit strings 0, 1 and 4, 5.
4. Wait 6 h.
5. Proceed to the OPM site.

6. Use a voltmeter with a maximum of 2% error to measure the voltage of battery strings 0, 4, 1 and 5.

   Note: Measure the voltage at the battery terminals, not at the faceplate of the NT8X02 BCC.

7. If the voltage of a string is less than 50.4V (80% capacity) replace the string within one month. If the voltage of a string is less than 49.0V (50% capacity) immediately disconnect that string from the system. This action prevents the risk of batteries cracking before you can order and install new ones.
8. From the OPM MAP level, place battery string pairs 0, 4 and 1, 5 back on the load bus.
9. Repeat steps 3 through 8 on strings 2, 6 and 3, 7 instead of strings 0, 4 and 1, 5.
10. From the OPM MAP level, enter the AUDIT ENABLE command to enable the battery rotation and testing routines again.

    Note: If an ac failure greater than 5 min occurs during this procedure, start over from step 1.

If the system marks a battery string as failed, refer to “Manual test procedures for system-failed battery strings" in this document. Use these procedures to confirm the test failure and replace the batteries.

Manual test procedures for system-failed battery strings

The PES117 log records the voltages of the strings and the test that failed. This log records these measurements when a battery string pair has been marked as failed. The office parameters set the values for testing. The value in office parameter OPM_VOLT_TST_LTU_ADJUSTMENT adjusts the values used for measurements by the LTU.

The voltage identifiers in the PES117 log correspond to the office parameters as follows:

- OPEN-CIRCUIT indicates the value failed the test against OPM_VOLT_TST_OCC, -504 or -50.4V dc for Yuasa and Eagle-Picher batteries
- DISCHARGE TEST indicates the value failed the test against OPM_VOLT_TST_DIS, -495 or -49.5V dc for Yuasa and Eagle-Picher batteries
- POST CHARGE indicates the value failed the test against OPM_VOLT_TST_CHG, -509 or -50.9V dc for Yuasa and Eagle-Picher batteries

The manual test procedures that determine if the user must replace the batteries depend on the test that failed. These procedures consist of activities the user performs at the MAP terminal and at the OPM site.

The following procedures contain instructions on the actions to take for test failures.

Procedure that follows failure of open-circuit test at MAP terminal

At the OPM MAP display:

1. Disable the AUDIT from the PES MAP level.
2. To determine which voltage of the battery strings tested below OPM_VOLT_TST_OCC, use the PES117 log. If strings 1 and 5 were marked failed, determine if string 1, 5, or both caused the alarm.

   For OPMs with an MTU, the default for OPM_VOLT_TST_OCC is -504 or -50.4V dc for Yuasa and Eagle-Picher batteries. For OPMs with an LTU, the default for OPM_VOL_TST_CHG is offset by OPM_VOLT_TST_LTU_ ADJUSTMENT (default=10) and truncated (-504+10) = -494 Trunc (-494) = -490 or -49V dc for Yuasa and Eagle-Picher batteries.
3. Place the failed battery string pair on the charge bus for 6 h.
4. Open circuit the failed battery string pair for a minimum of 6 h.
5. Use the PES MAP level MEASURE command to measure the voltage of the failed battery string pair.

If the voltage	do
is less negative than OPM_VOLT_TST_CHG	leave the battery string pair on open-circuit and proceed with step 8
is equal to or more negative than OPM_VOLT_TST_CHG	the string can still accept a charge. BSY and RTS the BCCDVR to return the battery string pair to service. If the same string is marked failed by the open-circuit test within the next two months, proceed directly to step 8.

Note 1: For OPMs with an MTU, the default for OPM_VOLT_TST_CHG = -509 or -50.9 Vdc for Yuasa and Eagle-Picher batteries.

Note 2: For OPMs with an LTU, the default for OPM_VOL_TST_CHG is offset by OPM_VOLT_TST_LTU_ ADJUSTMENT (default=10) and truncated (-509 + 10 = -499 Trunc-499=(-490) or -49V dc for Yuasa and Eagle-Picher batteries.

6. Disable the AUDIT from the PES MAP level.
7. To determine which voltage of the battery string tested below OPM_VOLT_TST_DIS, use the PES117 log. If strings 1 and 5 were

marked failed, determine if string 1, 5, or both caused the alarm. For OPMs with an MTU, the default for OPM_VOLT_TST_DIS = -495 or -49.5V dc for Yuasa and Eagle-Picher batteries. For OPMs with an LTU, the default for OPM_VOL_TST_CHG is offset by OPM_VOLT_TST_LTU ADJUSTMENT (default=10) and truncated (-495+10 = -485 Trunc(-485) = -480 or -48V dc for Yuasa and Eagle-Picher batteries.

8. Open circuit the failed battery string pair. Go to step Item 9, "Disable the AUDIT from the PES MAP level." on page 1-59.
9. Disable the AUDIT from the PES MAP level.
10. To determine which voltage of the battery string tested below OPM_VOLT_TST_CHG, use the PES117 log. If strings 1 and 5 were marked failed, determine if string 1, 5, or both caused the alarm.

    For OPMs with an MTU, the default for OPM_VOLT_TST_CHG = -509 or -50.9V dc for Yuasa and Eagle-Picher batteries. For OPMs with an LTU, the default for OPM_VOL_TST_CHG is offset by OPM_VOLT_TST_LTU_ ADJUSTMENT (default=10) and truncated (-509+10=-499 Trunc(-499)=-490 or -49V dc for Yuasa and Eagle-Picher batteries.
11. From the PES MAP level place the failed battery string pair on the charge bus for 6 h.
12. Open circuit the failed battery string pair for a minimum of 6 h.
13. Use the PES MAP level MEASURE command to measure the voltage of the failed battery string pair.
14. If the voltage is less negative than OPM_VOLT_TST_CHG, leave the battery string pair open circuit and proceed with OPM site tests.
15. If the voltage is equal to or more negative than OPM_VOLT_TST_CHG, the string can continue to accept a charge. Apply the BSY and RTS commands to the BCCDVR to return the battery string pair to service. The same string can be failed by the post-charge test within the next two months. If this failure occurs, proceed directly to OPM site tests.

OPM site tests

Proceed as follows to perform OPM site tests:

1. Disable the AUDIT. Open-circuit the failed battery string pair from the PES MAP level.
2. Proceed to the OPM site to perform the following steps.
3. Use a voltmeter with a maximum of 0.2% error to measure the voltage of both rectifiers. Connect the voltmeter to the test jacks on the rear of the rectifiers.

4. For OPMs equipped with Yuasa and Eagle-Picher batteries, the voltage must be 52.0V dc , ± 0.3V. Low rectifier voltage can cause a battery string to fail the other tests.

   If rectifier voltage is within specification, measure the voltage of each battery in the failed battery string. Replace the string if the voltage of a battery is more than 1V less than the voltage of the other batteries.

   If the rectifier voltage is not within specification, adjust the rectifier voltage screws. Continue until the voltage is within specification and the current from each rectifier is balanced.

5. Measure the voltage of the complete battery string. The open-circuit or post-charge test can fail. If these failures occur. replace the complete string. Replace the string if the battery string voltage is less than OPM_VOLT_TST_OCC, -50.4V dc for Yuasa and Eagle-Picher batteries.

   The discharge test can fail. If this failure occurs, replace the complete string if the battery string voltage is less than OPM_VOLT_TST_DIS, -49.5V dc for Yuasa and Eagle-Picher batteries.

6. If a string continues to fail the audit test while other strings pass, the string is weak. Replace the complete string.

   If all strings appear operational, return the battery strings to service. Enter the BSY BCCDVR and RTS BCCDVR commands from the PES level of the MAP display.

2 Functional overview

The Outside Plant Module (OPM) is a remote peripheral that provides extended geographic coverage for the Digital Multiplex System-100 (DMS-100) switch. The configuration of the OPM allows the OPM to function at a maximum distance of 160.9 km (100 mi) from the host office.

The OPM contains hardware and software maintenance components that perform routine audits and identify failures in the following:

- OPM
- DS-1 links that connect the OPM to the host controller
- subscriber lines

Functional description

The OPM provides an interface for two to six DS-1 links from the following:

- a line group controller (LGC)
- a line trunk controller (LTC)
- a remote cluster controller (RCC)
- a remote cluster controller2 (RCC2)

The OPM provides a maximum of 640 subscriber lines with a local connection.

> ***Note:*** Software package NTX381AA is required to interface an RCC or RCC2 in the remote-off-configuration.

This chapter contains both a hardware and software description of the OPM configuration.

Hardware description

This section explains to operating company personnel how the different hardware components of the OPM interact for maintenance troubleshooting. The following paragraphs describe the hardware necessary for the Remote Line Concentrating Module, NTX146AA, feature package.

General configuration

A single-bay equipment frame for a standard DMS-100 switch contains the OPM. The OPM frame contains the following main components:

- standard dual-shelf line concentrating module (LCM)
- single-shelf remote maintenance module (RMM)
- host interface equipment (HIE) shelf
- frame supervisory panel (FSP)

The lower part of the frame contains two environmental control units (ECU) that maintain the temperature of the cabinet interior. An LCM consists of two line concentrating arrays (LCA) that have cooling baffles and fuse panels. The upper part of the OPM frame contains the HIE shelf, the RMM shelf and the FSP. The FSP provides power control and alarm circuits for the LCM, HIE and RMM shelves. The FSP provides power control and alarm circuits for the ringing generators (RG) in the HIE shelf. Refer to the OPM frame, shelf and panel arrangement figure for the layout of the OPM equipment frame.

LCM

The LCM occupies shelf positions 04 and 21 of the OPM frame. The dual unit LCM contains two LCA shelves. The LCA-0 is always the bottom array or shelf. The LCA-1 is the top array of the LCM.

Baffle and fuse panels above each LCA permit air circulation for convectional cooling. Baffle and fuse panels above each LCA carry sets of five +5 V, +15 and -48 V fuses for the line drawers. Baffle and fuse panels above each LCA carry a pair of fuses for the ringing voltage outputs (RA, RB). Each LCA shelf is equipped with the following:

- processor
- digroup controller
- power converter
- five line drawers

Each line drawer connects a maximum of 64 line cards, one line card for each analog subscriber line that the OPM services. The 64 line cards are divided into two groups of 32. Each group of 32 line cards is a line subgroup (LSG).

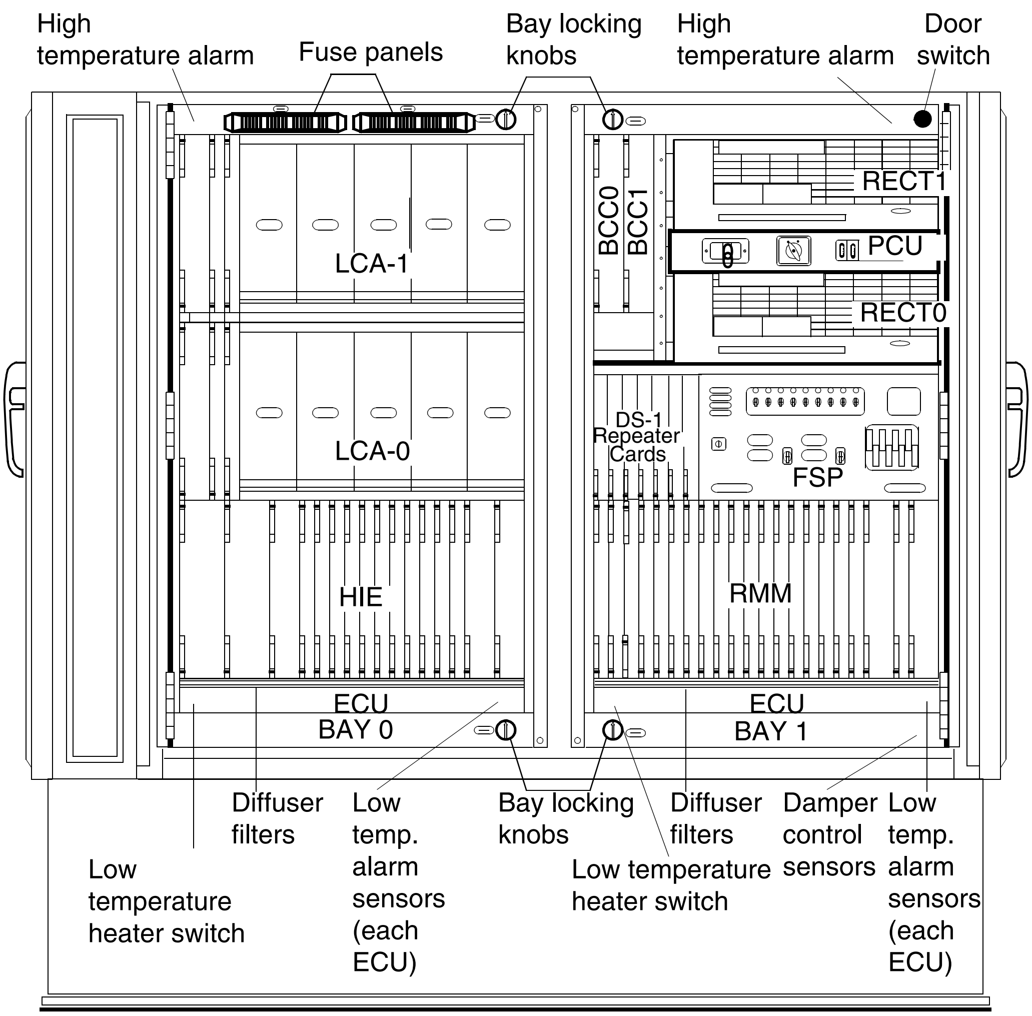
The figure “Bay frame equipment location, OPM-640, (NT8X01AA, AB)" identifies 10 line drawers and the 20 LSGs in the 2 LCA shelves.

The maximum number of lines that can connect to an OPM is 640. This figure results from the number of line drawers (10) times the number of line cards per drawer (64).

In the OPM, the LCM connects two to six DS-1 C-side links to the 640 subscriber lines. This interface contains the following parts:

- 2 power converters
- 2 control complexes (LCM processor and digroup control card)
- 20 LSGs

Figure 1 Bay frame equipment location, OPM-640, (NT8X01AA, AB)



The OPM has a minimum of two DS-1 links because each primary link carries one message channel to the LGC or LTC. Each DS-1 link carries 24 speech channels making available a possible 48 to 144 channels. Two of the available channels are always nailed up to the host controller. A maximum of six ports can be accommodated. The number of ports depend on traffic capacity and the concentration ratio required.

LCA shelf configuration

The layout of the LCA shelves and line drawers of the OPM appears in the “LCA shelf layout figure".

An LCA shelf contains the following parts:

- one power converter
- one control complex
- five line drawers

The power converter card is at the far left of the LCA shelf (slots 01-03). The control complex cards are next to the LCA shelf (slots 04-05). The five line drawers fill the remainder of the shelf.

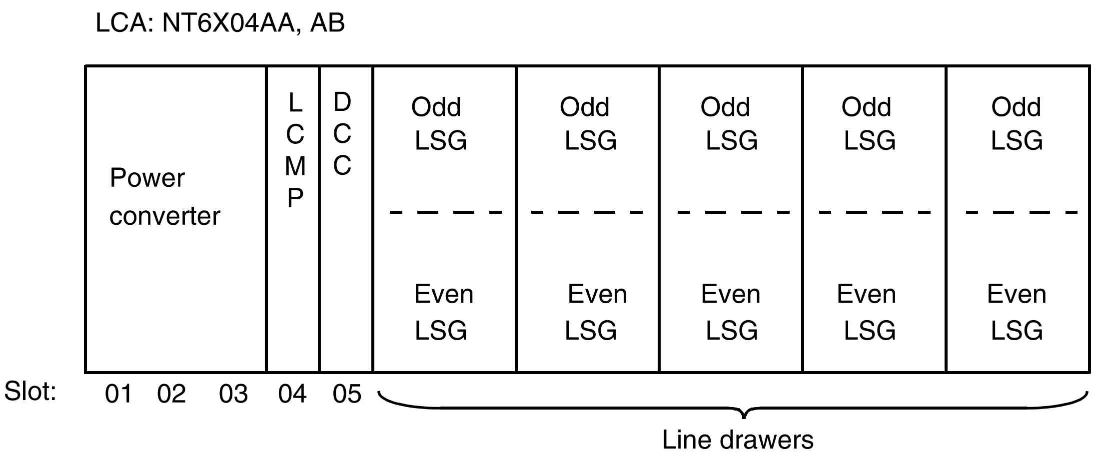
Power converter card

The power converter card (NT6X53), in slots 01-03 of the LCA contains circuits for converting a -48 V office battery to regulated +5 V and +15 V outputs for the shelf circuitry. The power converter contains relay circuits. The relay circuits control the application of the following actions between the ringing generator and the LCM line circuits:

- ringing
- automatic number identification (ANI)
- coin voltages

When the mate converter fails, the arrangement of power connections to the two shelves of an LCM are important. One converter can supply power to both shelves.

Figure 2 LCA shelf layout



Slot	Abbr	NT PEC	Remarks
01–03		6X53AA	Power converter. Also contains ringing and ANI voltage switching circuits.
04	LCMP	6X51AA, AB, AC	LCM processor card (see note)
05	DCC	6X52AA	Digroup control card
–	–	6X05AA	Line drawer
–	LSG	–	Line subgroup

Note: The NT6X04AA contains the NT6X51AA 64 kB processor card that requires the LCM software load. The NT6X04AB contains the NT6X51AB/AC 256 kB processor cards that requires the XLCM software load.

LCM control complex cards

The LCM processor (LCMP) card and digroup control card (DCC) are referred to as common cards in the LCA. In each LCA, the common cards function in the same way. The common cards are always provided. The functions of these cards follow.

XLCM processor card

Slot 04 of each LCA shelf (NT6X04AB) contains the extended-memory line concentrating module (XLCM) processor card (NT6X51AB/AC). The XLCM processor card connects with the digroup control card (DCC) to form the control complex for the LCA. The control complex for the LCA checks sanity and monitors activity. The XLCM processor monitors the power and ringing generator functions of the OPM.

The XLCM contains 256 kB of RAM storage. The XLCM collects dial pulse digits from subscriber lines. The XLCM handles messages to and from the host LTC or LGC to a maximum of 640 lines. The NT6X51AB/AC requires XLCM software loads.

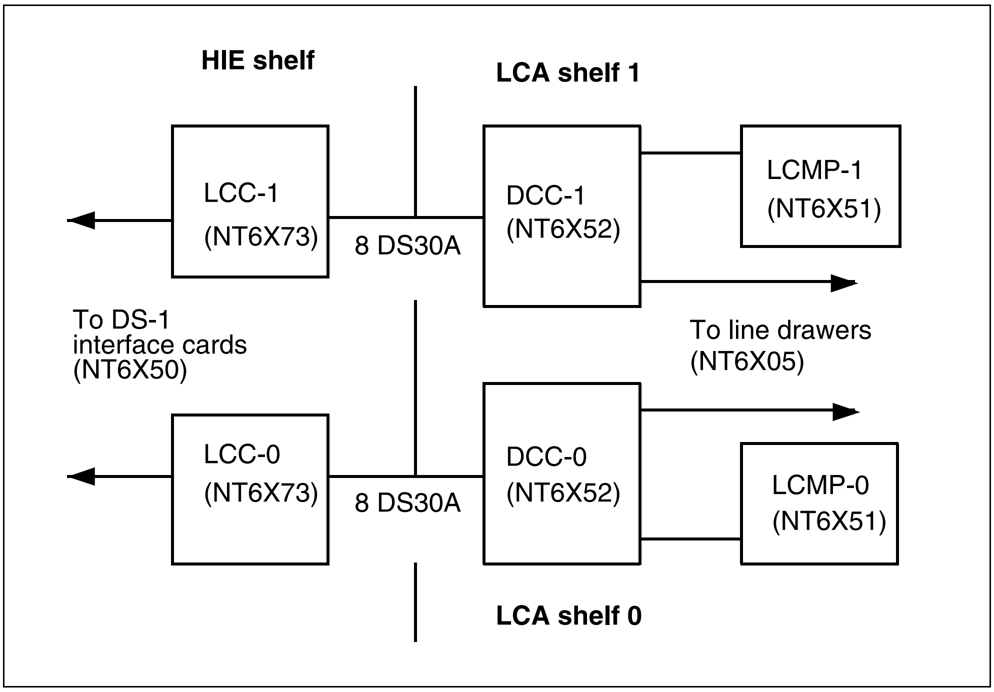
Before the release of BCS28, LCMs were equipped with the NT6X51AA LCM processor card with 64 kB of RAM storage capacity. The NT6X51AA requires LCM software loads. The LCA shelf with these cards is NT6X04AA.

Digroup control card (DCC)

Slot 05 of the LCA shelf contains the DCC (NT6X52). The DCC allows the LCA and HIE shelves to communicate. The DCC provides an interface between the corresponding LCM processor in the LCA and one link control card (LCC) in the HIE. The DCC provides this interface through eight DS30A links. This interface appears in the figure below.

The DCC provides time switching that associates a line card to a given channel on a DS30A link. The DCC provides digital loop-around paths for fault isolation.

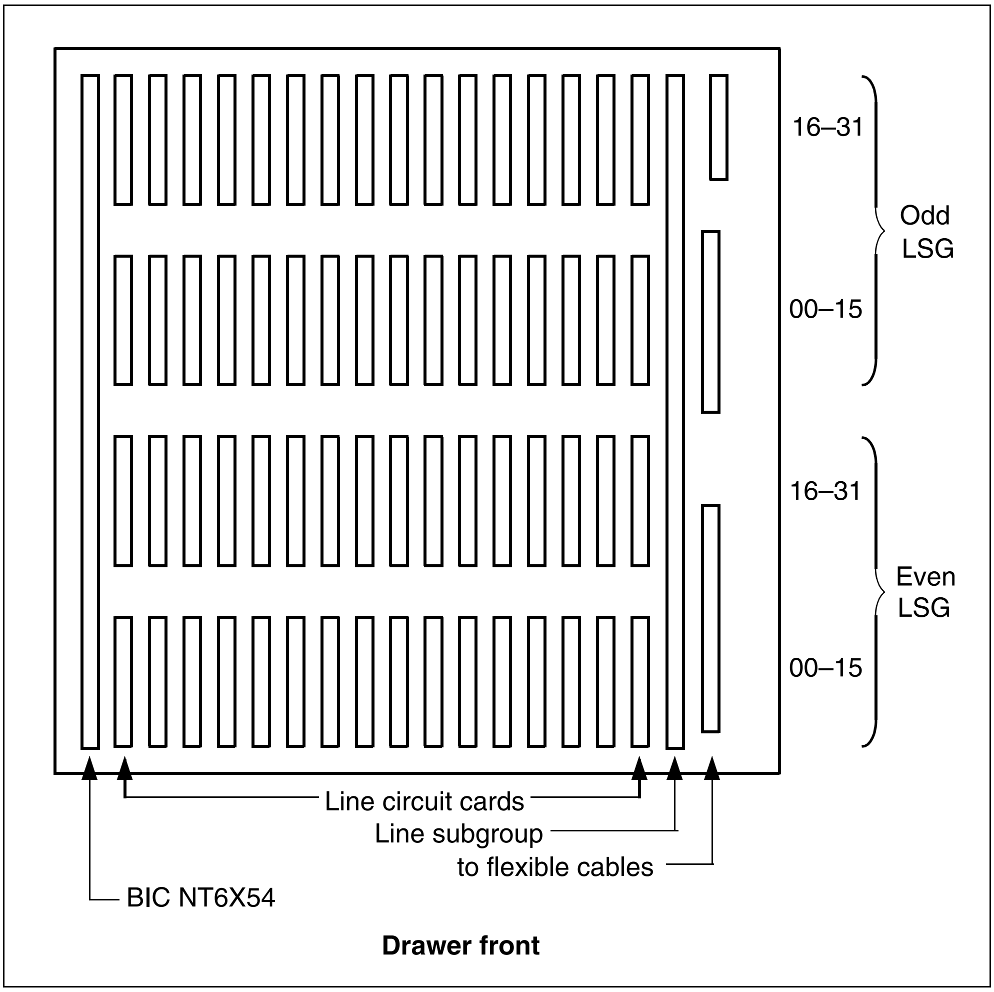
Figure 3 OPM DS30A to DS-1 interface



Line drawers

Each line drawer (NT6X05) in the LCA shelf has one bus interface card (BIC). Each line drawer has a maximum of 64 line cards of different types. The side view of a normal LCA line drawer appears in the figure below. Operating company personnel can remove the line drawer from the frame to access line circuit cards. The line drawer continues to operate because flexible cables connect to the back receptacles.

Figure 4 LCA line drawer NT6X05AA, circuit card location



Drawer state display

A list of the codes that display line drawer states at the MAP terminal appear in table “LCM drawer states". This text uses standard abbreviations instead of code to describe line drawer states.

At the LCM level of the MAP display, the state of the drawers appears below the state of the LCM units. The drawers are numbered from 0 through 19. The numbers are grouped in pairs to show that the numbers share the same bus interface card (BIC). The drawer state numbers normally interface a different processor, odd or even. An example of drawer state appears in the following display:

Example of a MAP response:

```
                                 11 11  11  11  11
 DRWR:  01  23  45  67  89  01  23  45  67  89
        ..  S.  ..  MM  .M  OO  ..  --  SS  I.
```

When the state of a drawer changes, the system updates the state display. The system or the user can change the drawer state.

Table 1 LCM drawer states

Code	Definition (abbreviation)
• (dot)	In service (InSv)
I	In-service trouble (ISTb)
M	Manual busy (ManB)
O	Offline (OffL)
S	System busy (SysB)
-	Unequipped

Bus interface card (BIC)

The BIC (NT6X54) is at the front of the line drawer behind the front faceplate. The BIC connects to the two 32-channel LSGs (64 line cards) in the drawer where the BIC is installed. The BIC connects the two 32-channel LSGs to both LCAs. The BIC performs the following functions:

- Scans line circuits for a hook switch change or a message that describes dialed digits
- Sends signals through a ringing multiplexer to control the relays in the power converter to select ringing and ANI/coin voltages
- Monitors line drawer activity for maintenance
- Performs digital looparound on command from the maintenance system

Communication between LCA-0 and LCA-1, or between two LSGs, occurs through the single BIC in each drawer.

Line cards

The line cards are behind the BIC in 4 rows of a maximum of 16 line cards. The top two rows of line cards form the odd-numbered LSG. The bottom two rows form the even-numbered LSG. Normally, the LCA-1 control complex controls the odd LSG of both arrays. Normally, the LCA-0 control complex controls the even LSGs of both arrays. The LCA-0 and the LCA-1 use the ten

32-channel P-side ports to control the LSGs. The ten 32-channel P-side ports are on the DCC of each array.

Both the LSGs and the separate line cards in the LSGs are numbered. The LSG numbers are in an OPM range from LSG-00 through LSG-19. Line card numbers range from 00 through 31. The line equipment numbers (LEN) identify and arrange the line cards in the DMS switch central control (CC). An example of this event appears in the following table.

Table 2 Parts of LEN for OPM

Part	Description
Site	Four-character alphanumeric name that identifies the remote site of the OPM. The LEN for a line configured in the host office has a site name of HOST.
Frame	Number (00-99) that identifies the OPM frame that contains the line card.
LCM	Number (0) that identifies the LCM in the frame that contains the line card. (The OPM contains only one LCM identified as LCM-0).
LSG	Number (00-19) that identifies the line subgroup of the LCM that contains the line card.
Circuit	Number (00-31) that identifies the position of the line card in the LSG. The example below shows how line cards are numbered for identification in any LSG.

A description of a complete LEN for an OPM line card that consists of five units of information appears in the following table. The example shows LENs for line cards in a normal office. The first two LEN are for OPM-supported lines.

Table 3 Example LENs for line cards

Site	Frame	LCM	LSG	LC
HOST	01	0	14	6
REM1	00	0	07	30
REM2	00	0	18	26

Line cards are available in several types so that the OPM can support different types of analog or digital telephone equipment. The OPM supports the following line cards:

- Standard line card type A (NT6X17AA, AB, AC, AD) or plain old telephone service (POTS) card. The type A card supports single-party, two-party, and PBX analog telephone sets (type 500 or 2500). The type A card supports loop start, superimposed ringing, and frequency selective ringing with bridged ringers. The type A card supports the cutover control circuit. Refer to “Line card type B, coin".

The position for LSG 0, LC-00 is assigned to a type A line circuit and used for analog ringing tests. Circuit LSG 0, LC-00 is not available for assignment to a subscriber line.

- Line card type B, coin, (NT6X18AA, AB, BA). The type B line card provides all features of type A, plus multiparty lines. Line card type B supports the following:
  - coded ringing
  - private branch exchange (PBX)
  - ground start
  - hotel/motel
  - analog pay telephone sets that require coin control

When the suffix of the NT6X18 card is -AA or -AB and the line is identified as ground start (GND=Y in table LNINV), run the diagnostics again if the initial diagnostics fail. This action is possible with the addition of the Service order (Servord) option NPGD, Negate Partial Ground Start Diagnostics. This option allows you to test the line against a smaller subset of ground start diagnostics. Because of this event, loop detector, reversal relay and ground start relay tests are skipped when option NPGD is set in table LENLINES.

- Message-waiting line circuit card (NT6X19AA). This card provides all the features of the type A line circuit, plus a message-waiting lamp driver circuit. When activated, this circuit causes the message waiting lamp on the associated telephone set to flash at 1 Hz. The flash informs the subscriber that the system holds a message.
- Message-waiting converter card (NT6X20AA). This card provides a -150V synchronized pulse for the message-waiting lamp circuit. Synchronized from the 2.56-MHz clock pulse in the OPM. You must install this card in slot positions 0 and 16 of the odd LSG for NT6X20AA to function correctly.
- Line card type C Meridian Digital Centrex (MDC) (NT6X21AA, AB, AC, and AD). Line card type C supports MDC-related electronic multiline telephone sets and operator consoles.

The NT6X21AD line card provides a voice and signaling interface. This interface is between a 2-wire analog subscriber line and one channel of the 4-wire 32-channel 2.56 Mb/s bit stream. This channel is part of the DMS-100 Family of DMS. The card occupies one slot in the line drawer of the LCM for use with a P-phone telephone set. The P-phone telephone set connects to the line card by an ordinary non-loaded (NL) pair of metallic conductors. Simultaneous voice and extended signaling services are provided on the same loop.

The transmission bandwidth on the loop is divided into two frequency bands:

1. Voice channel, 300-3400Hz
2. Signaling channel, 6-10kHz. Normal high-voltage signaling (ringing), is substituted with low level signals.

The NT6X21AD is a single line circuit line card that is hardware backward compatible with the NT6X21AC line card. The NT6X21AD is hardware backward compatible with correct dual in-line package (DIP) switch settings. The NT6X21AD provides the following enhanced features:

- reduced messaging noise
- DIP switch selectable balance impedance
- UDLC (universal digital loop carrier) optimized operation
- DIP switch selectable (0 or -3.5dB) gain in the D/A (digital to analog) direction
- DIP switch selectable short-loop/long-loop (slp/llp), signaling levels

Feature AE1516 allows the entries to the NT6X21AD cardcode. Feature AE1516 is necessary for the following actions:

- maintenance and diagnostics on the new, selectable signaling level
- voice receive D/A level
- balance impedance

A list of the recommended DIP switch settings appears in the following table.

Table 4 Recommended NT6X21AD S1 DIP switch settings

	D/A voice S1		Balance S2		Signaling level S3 and S4			
	Switch position ON	OFF	Switch position ON	OFF	Both ON	Only S4 ON	Only S3 ON	Both OFF
Recommended application	**0dB**	**-3.5dB**	**NL**	**9+2**	**1.3Vpp**	**0.8Vpp**	**0.6Vpp**	**0.14 Vpp**
P-phone sets long loop: 19-24dB EML	X		X		X			
P-phone sets medium loop: 4-17dB EML		X		X			X	
P-phone sets short loops: 0-4dB EML		X		X				X
Northern Telecom UDLCs		X	X					X
Other vendors UDLCs	X			X			X	
6X21AC equivalent mode		X	X		X			

Note: dB=decibel
NL = non-loaded
9+2=loaded (900 ohm + 2.16 micro-farads) network
Vpp=voltage peak to peak
EML= estimated measured loss, as defined in NTP 297-2011-180 BCS35 version 01.02

A list of two acceptable limits for transhybrid loss (THL) appear in the following tables. The limits depend on the D/A level selected. The NT6X21AD line card uses the same diagnostics as the NT6X21AC line card. Because of this event, the THL limits are modified for diagnostics purposes.

The NT6X21AC line card appears in the first table. The NT6X21AD line card appears in the second table.

Table 5 NT6X21AC THL Limits

Frequency	304	704	1505	3204
Minimum	-6.2	-6.2	-6.2	-7.2
Maximum	+1.3	+0.8	+0.8	+0.7

Table 6 NT6X21AD THL Limits

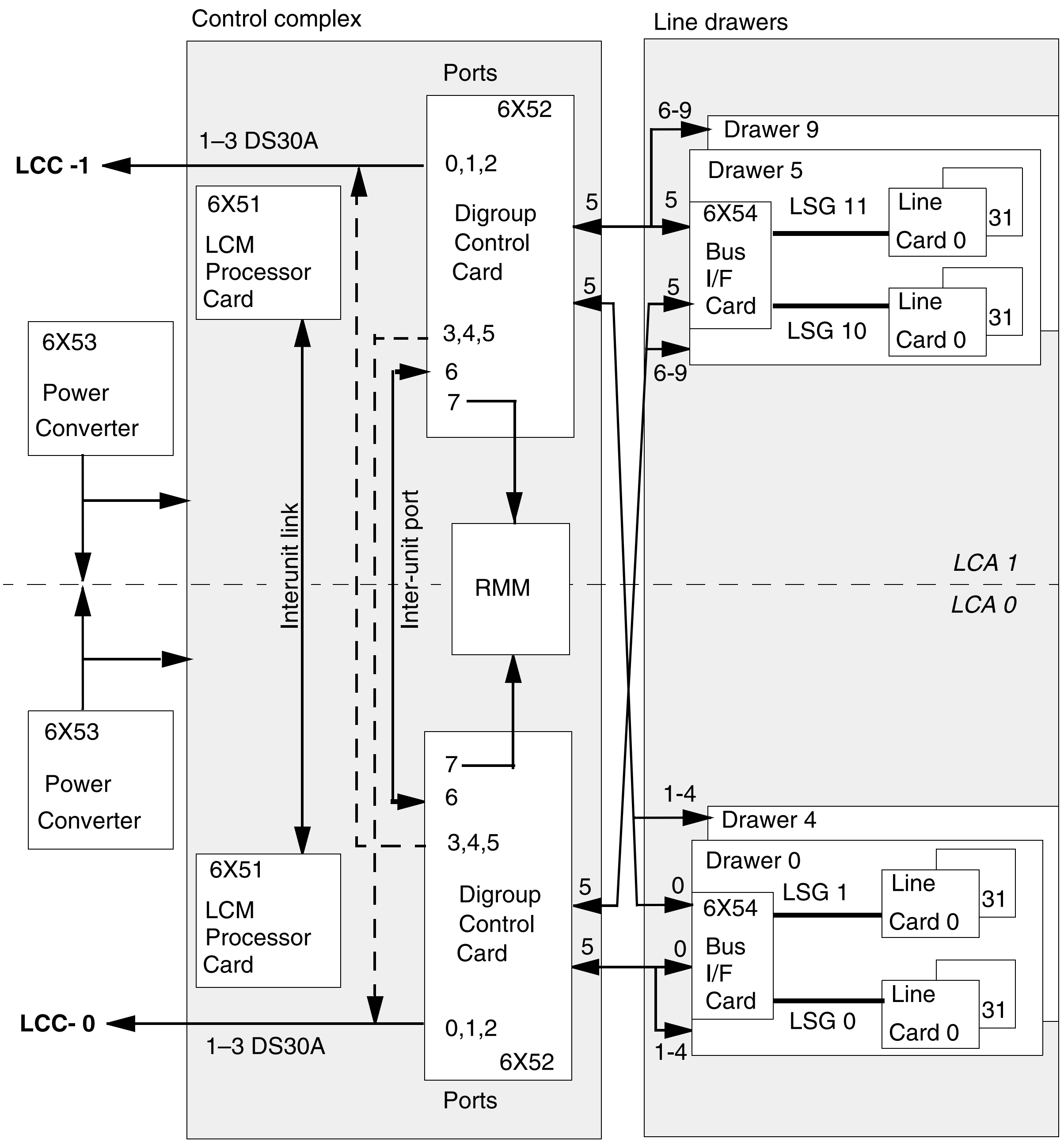
Frequency	**304**	**704**	**1505**	**3204**
Minimum	-2.7	-2.7	-2.7	-3.7
Maximum	+4.8	+4.3	+4.3	+4.2

Both limits are required so that the system software can determine what digital to analog (D/A) gain is selected on the line card. The system compares THL test results against the two possible limits.

- Data line card (DLC) (NT6X71AA, AB, AC). The data line card provides data transmission interfaces for operation with computer terminals.
- Integrated bit error rate test (IBERT) line card (NT6X99AA). The IBERT line card provides bit error rate performance (BERP), through tests of transmission paths. These tests assess bit error performance of OPM hardware components.

Refer to the following figure for a functional block diagram of the OPM LCA shelves. This chapter contains descriptions of all the parts in this figure.

Figure 5 LCA block diagram



Note: Image ports 3, 4, and 5, are normally inactive. The image ports are made active through the backplane wiring in the takeover mode only.

HIE description

The HIE occupies a single shelf at position 05, of bay 0 row A, of the OPM cabinet. The HIE allows the LCA shelves of the OPM to connect to the RMM and to the host office. The HIE shelf contains the following parts:

- two ringing generators
- two LCCs
- two to three DS-1 interface cards
- two power converters
- one emergency stand-alone (ESA) control complex

The following sections describe these parts.

HIE shelf configuration

The two ringing generators occupy slots 01-08 in the HIE. Each generator is four slots wide. The ESA control complex, when provisioned, occupies slots 14-16. The shelf configuration appears in figure “HIE shelf layout."

The LCCs occupy slots 17 and 18 of the HIE shelf.

Two power converters occupy the far right of the HIE shelf in slots 22 and 25, in the order given. Slot 25 is the slot on the shelf furthest to the right.

Ringing generators

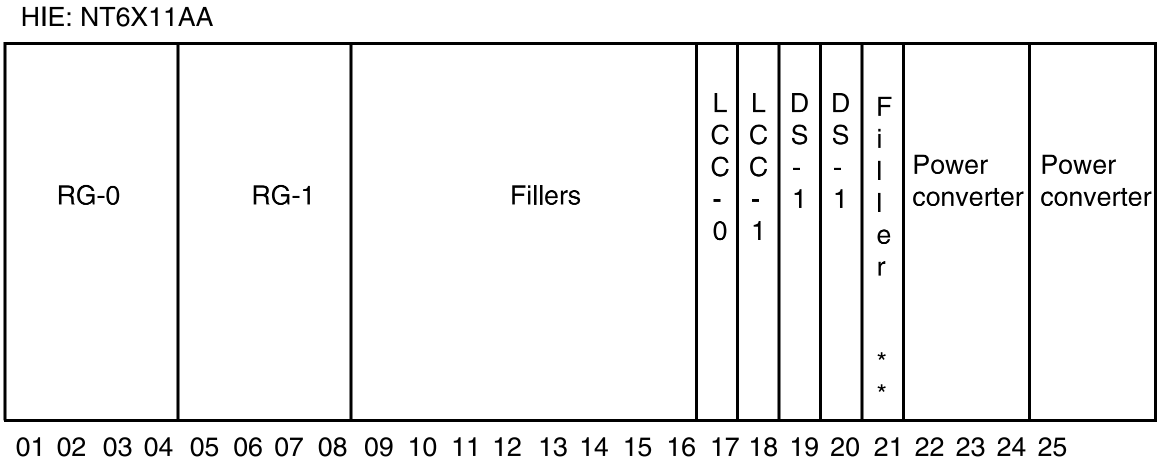
The ringing generators (NT6X60) contain the frequency circuits that generate ringing signals to subscriber line cards on the LCA shelves. Ringing patterns meet requirements set by Bell Canada and Telcordia Technologies. The following types of ringing are supported:

- Coded
- superimposed
- frequency selective ringing

The ringing generators contain ANI and coin generator circuits. The ANI circuits check for two- or four-party ANI. The coin generator circuits check for coin presence in prepay coin telephones.

The ringing generators produce voltages required for ANI and coin control (48 Vdc and 130 Vdc). The ringing generators monitor ANI and coin voltages and ring bus outputs for failure.

Figure 6 The HIE shelf layout



Slot	**Abbr**	**NT PEC**	**Remarks**
01–04	RG-0	6X60AA	Ringing generator (RG)
05–08	RG-1	6X60AA	Ringing generator (RG)
09–13	–	0X50AG	Filler panel
14–16	ESA	(Note)	ESA control complex (Note)
17, 18	LCC	6X73AA	Link control card (LCC-0, LCC-1)
19, 20	DS-1	6X50AA	DS-1 interface (2 DS-1 links per card)
21	–		Filler panel If additional DS-1 links are required (for a total of six DS-1 links), filler panel is replaced by NT6X50AA.
22–24	–	2X70AA	Power converter
25	–	2X70AA	Power converter

Note: When the user does not select the ESA option, these slots have filler panels (NT0X50AA). When the user selects the ESA option, two configurations are possible. Refer to section “ESA control complex” and chapter “ESA maintenance overview” in this document.

Link control cards

The two LCCs (NT6X73) fill slots 17 and 18 of the HIE. Each LCC provides an interface between eight DS30A ports from an OPM LCA shelf and the DS-1 links to the host office. The LCCs also provide an interface between the ESA processor, when provided, and the LCM. The termination of DS-1 links on the LCC and in the LCA appear in the following figure.

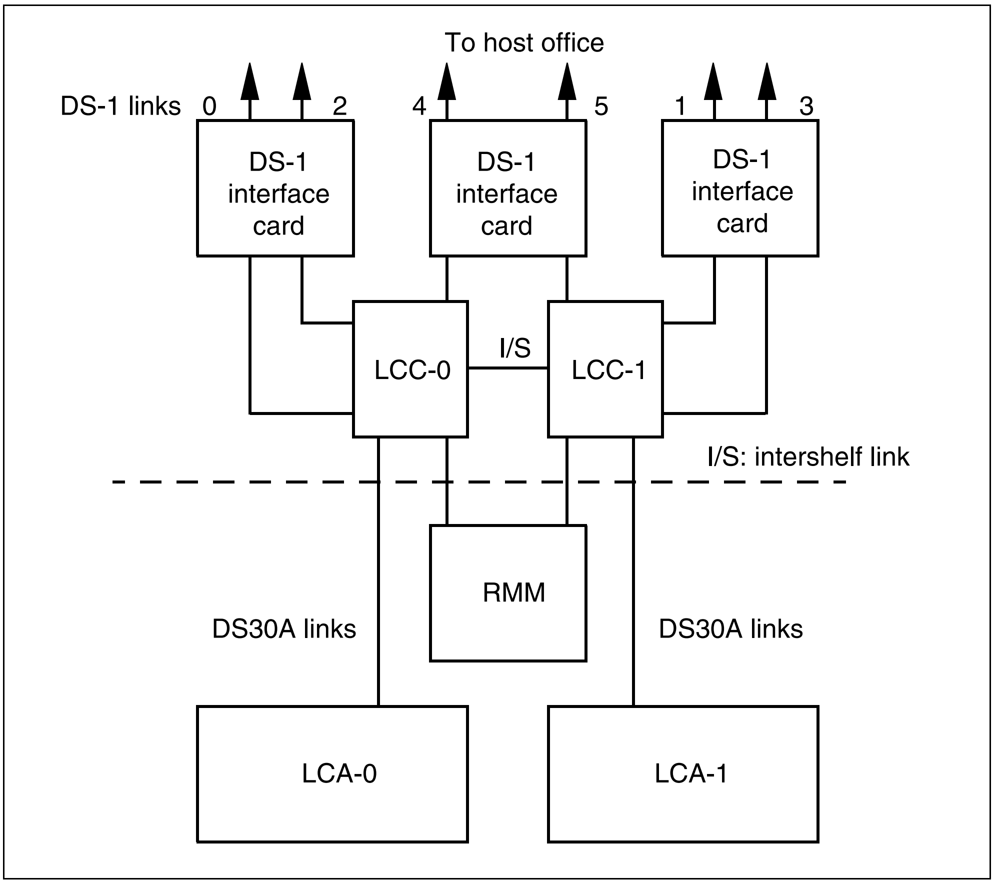
Under normal conditions, when the LCC and the LCA are active, LCC-0 connects LCA-0 and LCC-1 connects LCA-1. LCC-0 serves even numbered DS-1 links from the DS-1 interface cards. LCC-1 serves odd numbered DS-1 links. The even numbered links are 0, 2 and 4. The odd numbered links are 1, 3 and 5. The configuration of LCCs in the OPM appears in the following figure.

One-to-one mapping of LCA primary ports with DS-1 links can occur. This event means that all 24 channels of a DS-1 link exit from one 32-channel DS30A port. Additional channels are for control and signaling, from the host, and for intraspeech and interspeech channels.

The LCC accepts eight DS30A links from the LCA. This event appears in figure “OPM link port and channel structure". Through the LCC, these links provide the following:

- message and speech paths to the host
- connection to the RMM
- link-sharing resources for each LCA

Figure 7 LCC interface to DS-1 interface cards



The LCC provides system clocks for the DCC, RMM and LCM. When both units of the LCM are active, LCC-0 is frequency-locked to the primary DS-1 link of the LCC-O. The LCC-1 clock is locked to LCC-0. The two LCC clocks derive timing from the host LTC.

The DS30A ports in the LCA are numbered 0-7. A list of the port functions appears in the following table.

Table 7 LCA port assignments and use

Number	Port type	Functions
0,1, 2	Primary	Carries three message channels for the LCA shelf. Message channels are mapped on to channels 1, 2 and 3 of each of the two primary DS-1 links. These links are to the host office. Other channels that carry speech are mapped on to channels 4 through 24 of the primary DS-1 links.
3, 4, 5	Image	Normally not active, these ports become active when the mate LCA and LCC are not active and takeover occurs. Port 3 takes over mate port 0. Port 4 takes over mate port 1. Port 5 takes over mate port 2 of the mate LCA. The mapping of all channels on to the DS-1 links continues, and the active LCC takes control of all DS-1 links.
6	Interlink	Provides a DS30A link for connections between shelves. During call processing, the channels on this port can allow the following condition. A subscriber line on one LCA can connect to a subscriber line in the mate LCA. This connection leaves DS-1 channels to the host office free.
7	Maintenance	Provides the LCA access to the RMM through the LCCs. Through the RMM ports, separate line circuits can be selected. Through the RMM ports, metallic test access (MTA) connections can be made to the tip and ring leads for testing.

DS-1 interface cards

Slots 19 and 20 of the HIE shelf contain the DS-1 interface cards (NT6X50). An additional card can be provisioned in slot 21 in place of the filler panel. Each DS-1 interface card accepts two DS-1 links from the host office LGC/LTC. The DS-1 interface card connects a maximum of six links to the LCC.

Two DS-1 cards are required. This requirement makes sure that the two primary message channels from the LCM are carried on different cards for reliability. Add a third DS-1 card when you require six DS-1 links to the host. This event occurs to handle the traffic load of the OPM.

DS-1 ports are not duplicated, but each processor in the LCA shelves of the OPM can control all six DS-1 ports.

Primary ports that map one to one with DS-1 links are equipped ports. The number of equipped ports in an LCA depends on the number of DS-1 interface cards provisioned in the HIE. When three DS-1 cards are provisioned, all three primary ports (0, 1, 2) for each LCA are equipped. When a port is not equipped, the ports are in use or not in use. The ports can operate for features contained in additional OPM feature packages, when provisioned.

> ***Note:*** Links 0 and 1 are message-supporting links that have special maintenance protection applied to them. On each DS-1 message-supporting link, the following looparound occurs. A channel 12 looparound connects the outgoing side of channel 12 to the incoming side of channel 12. The name of the looparound is extended DS-1 maintenance. The looparound prevents the manually busying the link to which the looparound is applied. This event occurs when the unit that the link supports remains in service. When operating company personnel set the unit this link supports to ManB, the looparound is disabled. At this time, the link can be busied and the looparound is enabled as NT6X50 card diagnostics for maintenance of the DS1 link.

Power converter card

The two HIE power converters supply the necessary shelf voltages (5 V, 12 V) for the HIE shelf. Slots 22 and 25 contain the HIE power converters.

ESA control complex

If the user selects the ESA feature package, two configurations are possible.

The NT6X45AF based ESA package consists of three pieces of equipment:

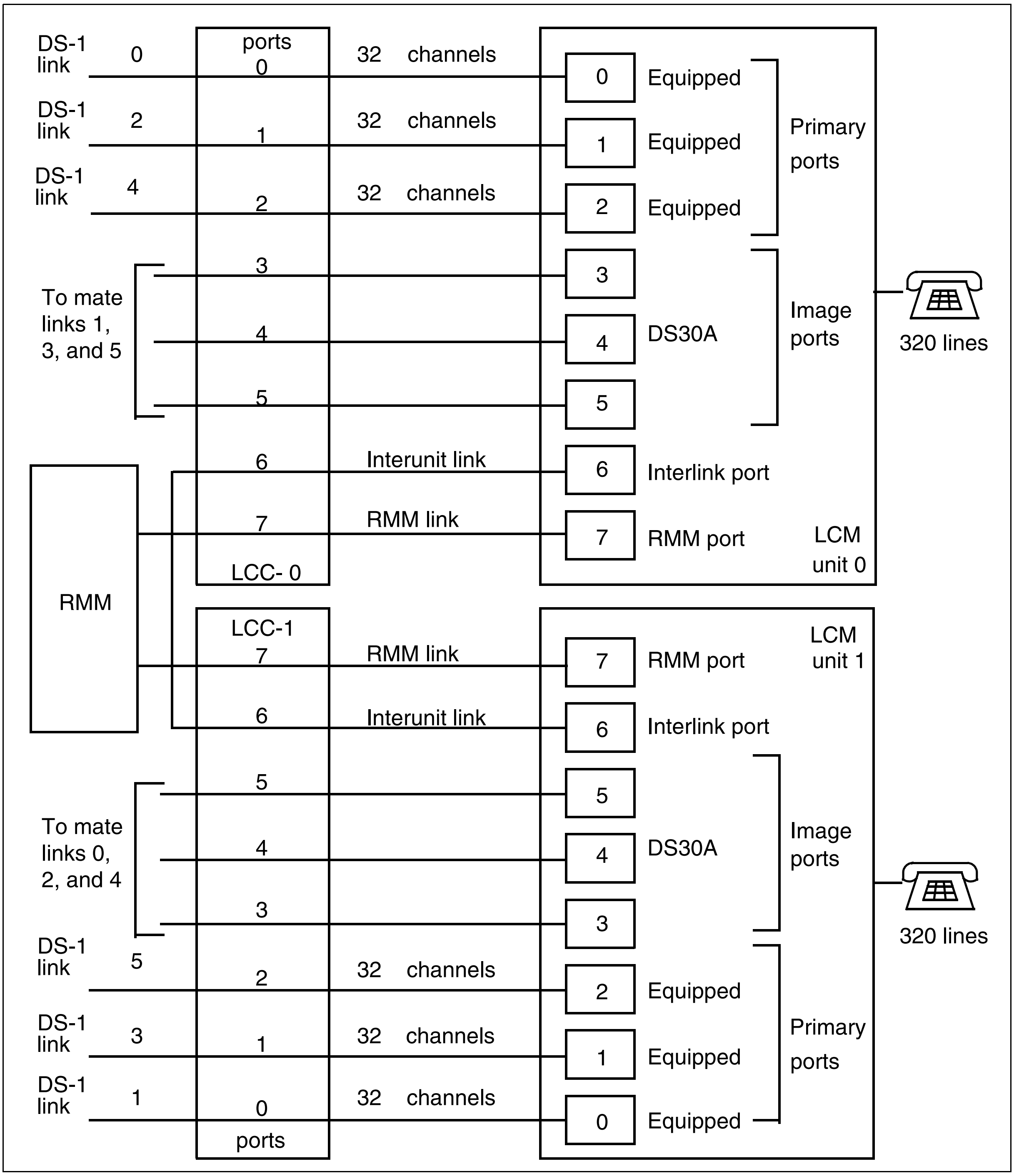
- one ESA memory card (NT6X47AC), slot 14
- one ESA processor card (NT6X45AF), slot 15
- one ESA clock and tone card (NT6X75AA), slot 16

The NTMX45AA based ESA package consists of two pieces of equipment. This package includes an ESA processor that enables duplicate Nxx in ESA mode and provides firmware downloads. This card has 8 Mbytes of on-card memory. With this package, the ESA memory card is not needed and slot 14 has a filler plate.

- one ESA processor card (NTMX45AA), slot 15
- one ESA clock and tone card (NT6X75AA), slot 16

The “OPM link, port and channel structure" appear in the following figure.

Figure 8 OPM link, port and channel structure



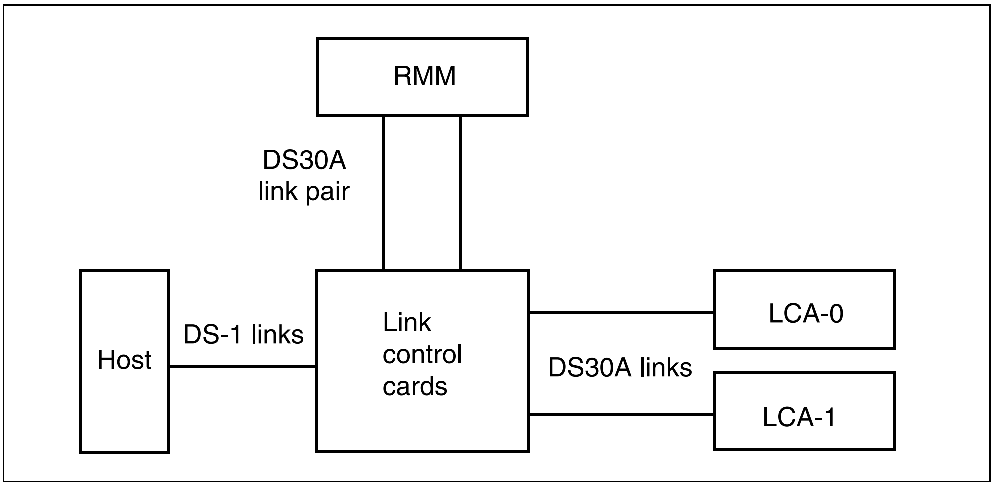
RMM

RMM description

The RMM occupies shelf position 05, bay 1 row B, of the OPM cabinet. The RMM is a modified, cost-reduced form of the maintenance trunk module (MTM). The RMM contains a processor that performs a scan of the service circuits and digit collection during ESA.

The RMM C-side interface uses a pair of DS30A links, one to each LCC in the HIE shelf. The DS30A links make sure the RMM can operate, even though the LCC is active. The LCC passes maintenance requests from the host to the RMM. The LCC provides a link between the RMM and line circuits in the LCA. At the host office, use of the MAP terminal can direct OPM maintenance to the RMM. How the RMM communicates with the host and the LCA through the LCC appears in the following figure.

Figure 9 RMM connection with host and LCA through LCC



With the use of the LCC interface to the DS-1 links, the RMM uses DMS-X protocol to communicate with the host in a reliable way.

The RMM can accommodate a maximum of 14 maintenance and service circuit cards. These cards are different in type and must meet provisioning requirements.

RMM shelf configuration

The RMM shelf has 20 slots. The HIE has 25 slots. The two slots farthest to the left of the RMM (01, 02) are assigned to the DS30 interface and control cards. Slots 17-18 and 20 on the far right of the shelf contain two types of power converters that the RMM requires. The remainder of the shelf (slots 3-16) is assigned to service circuit cards provisioned to meet office engineering requirements. An example of card selections for a standard RMM appear in the “RMM shelf layout" diagram.

RMM control card

The RMM requires the RMM control card (NT6X74AB), located in slot 02. The RMM control card acts as an interface. This interfrace occurs between the line concentrating array shelves and the test trunks, service circuits and alarm circuits of the RMM. The RMM control card processes DMS-X messages, trunk messages and pulse code modulation (PCM) data.

Power converters

The two types of power converters required in the RMM shelf follow:

- multi-output power converter (NT2X09)
- 5-V/40-A power converter (NT2X06)

The multi-output power converter occupies slots 17 and 18 of the RMM. This power converter provides a regulated, common-ground dc power supply. The power supply has five different outputs: +24 V, +12 V, +5 V, -15 V, and -5 V. The other power converter, in slot 20 to the farthest right slot of the RMM, provides a regulated 5-V/40-A power supply to the RMM shelf.

The RMM requires the group codec card (NT2X59AA), which is at the far left of the RMM shelf in slot 01. The codec card codes analog samples from the RMM trunk circuits into PCM code words. When this event occurs, the codec card decodes the PCM words from the host or OPM lines into analog samples.

Provisionable maintenance and service cards

Slots 03-16 of the RMM can be provisioned with various maintenance, test and service circuits. The number and types of these cards depend on engineering needs. In the OPM some slots of the RMM are hard wired for use by specific cards. These provisionable cards follow:

- Remote metallic test access, (remote MTA) card (NT3X09AA). The remote MTA consists of a two-wire metallic matrix with eight horizontal buses and four vertical buses. In the OPM the NT3X09AA is used as the BCCDVR card. This card relays battery control commands from system software to the NT8X02 BCC card to move the battery strings. The BCCDVR moves the battery strings between the open circuit state, load bus, charge bus and discharge bus. The BCCDVR card must go in slot 6.
- Metallic test access (MTA) card (NT3X09BA). The MTA card provides the LTU or MTU, which are connected to one horizontal bus, with metallic access to the LCM line circuits and to each battery string and the charge buses. The MTA card consists of a two-wire metallic matrix with eight horizontal buses and eight vertical buses. The MTA card must go in slot 5.

- Scan detector (SC) card (NT0X10). The SC card provides an interface. The interface allows the DMS-100 Switch Alarm System software to monitor the state of the OPM hardware. The system software detects alarm conditions or manually controlled operations. The SC card is divided into two circuits. Each circuit is called an SC group. Each SC group contains seven SC points. Each SC point connects one circuit to monitor for a change in state. One NT0X10 card is used in slot 8.
- Signal distribution (SD) card (NT2X57). The SD card provides an interface between DMS-100 Switch Alarm System software and relay-controlled equipment. The interface allows the activation of visual and audible alarms. The SC card serves as a monitor, and the SD card serves as an alarm driver. The SD card is divided into two circuits. Each circuit is called an SD group. Each SD group consists of seven SD points. Each SD point connects one visual or audible alarm.
- Digitone (DTR) receiver card (NT2X48AB). The DTR contains four Digitone receivers to collect digits during OPM ESA.
- Line test unit (LTU) card (NT2X10AA, AB, AC, NT2X11AA, AB, AC, AD). The LTU is a testing facility that can connect to a selected line circuit through the remote MTA. The LTU contains an analog test and measurement card (NT2X10), and a control card (NT2X11). The two cards must remain next to each other. The NT2X10AB must be in slot 3 and the NT2X11AA must be in slot 4. The LTU analog test card performs tests and measurements on a subscriber loop or line card circuit. The NT2X11 control card serves as an interface between the LTU analog card and the RMM. The LTU contains one internal test unit.
- Multiline test unit (MTU) card (NT2X10BA, NT2X11BA). The MTU is an improved LTU that can replace the current LTU. The MTU contains an analog test and measurement card (NT2X10BA), and a control card (NT2X11BA). The two cards must remain next to each other, and the NT2X10BA must be in slot 3. The MTU performs all the functions of the LTU with greater speed and accuracy. The MTU can test Meridian Business Set lines and OPM battery maintenance. The NT2X11BA control card serves as an interface between the MTU analog card and the RMM. The MTU contains two internal test units but only one is used in this application.
- Incoming/outgoing test trunk card (NT2X90). The test trunk card provides an interface between external test equipment, like the number 14 line test desk, and the RMM. The test trunk card monitors and provides speech circuits to subscriber lines and allows operator verification calls through a VER90 trunk. One NT2X90 is used in slot 09 and one in slot 10.

Table 8 RMM: 6X13AA or 8X0415

GC	RMMC	MTUA	MTUB	MTA	BCCDVR	SC	Filler	TT	TT	Filler	Filler	Filler	Filler	Filler	Filler	Power	Converter	Filler	Power Convertr
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

SLOT	ABBR	NT PEC	Remark
01	GC	2X59AA	Group codec and tone card
02	RMMC	6X74AB	RMM control card
03	MTUA	2X10BA	Metallic test unit, analog
04	MTUB	2X11BA	Metallic test unit, digital
05	MTA	3X09BA	Remote metallic test access (8X8)
06	BCCDVR	3X09AA	Battery charger controller driver
07		0X50AC	Filler panel
08	SC	0X10AA	Scan detector card (PESALRM)
09	TT	2X09AD	Test trunk circuit
10	TT	2X09AD	Test trunk circuit
11		0X50AC	Filler panel
12		0X50AC	Filler panel
13		0X50AC	Filler panel
14		0X50AC	Filler panel
15		0X50AC	Filler panel
16		0X50AC	Filler panel
17-18		2X09AA	Power converter
19		0X50AC	Filler panel
20		2X06BA	Power converter

Frame supervisory panel (FSP)

The FSP (NT6X25) occupies shelf position 19, bay 1 row A, of the OPM cabinet. The FSP provides talk jacks, fuse alarm features and power control for the OPM. The FSP contains 48-V distribution breakers to the ring generators (RG-0, RG-1) in the HIE. The FSP contains three circuit packs that control the alarm facilities and power converters in the OPM cabinet. These circuit packs and associated functions follow:

- NT6X36AA Alarm card

  This card monitors the power converters in the OPM cabinet. This card generates an alarm when an undervoltage condition occurs in any of the power converters.

- NT0X91AA Alarm and Converter Drive

  This circuit pack controls the alarms and power for the NT6X53AA power converter for unit 1 of the LCM and the NT2X70AA. The NT2X70AA is in slot position 22 of the HIE.

- NT0X91AE Converter Drive and Protection Circuit

This circuit pack controls the alarms and power for the following:

- the NT6X53AA power converter for unit 0 of the LCM
- the NT2X70AA in slot position 25 of the HIE
- the NT2X09AA/NT2X06BA, in the correct slot positions of 17 and 20 of the RMM

The FSP also contains additional circuit breakers (CB) for distribution of -48-V power to the different shelves in the OPM cabinet. Refer to the table FSP circuit breaker assignments for the following information:

- CB power distribution
- assignments
- shelf type
- slot position
- product engineering code (PEC) code
- equipment supported

Table 9 FSP circuit breaker assignments

CB	Shelf type	Shelf pos.	Slot pos.	PEC code	Equipment
CB1	HIE	38	25	NT2X70	LCA 0
CB2	HIE	38	01	NT6X60	RG 0
CB3	HIE	38	05	NT6X60	RG 1
CB4	HIE	38	22	NT2X70	LCA 1
CB5	RMM	56	17	NT2X09/NT2X06	RMM

Table 9 FSP circuit breaker assignments

CB	Shelf type	Shelf pos.	Slot pos.	PEC code	Equipment
CB6	LCA	04	05	NT6X53	LCM unit 0
CB7	LCA	21	05	NT6X53	LCM unit 1
CB8	FSP	72	1-4	T-1 repeaters	T-1 repeaters
CB9	FSP	72	5-7	T-1 repeaters	T-1 repeaters

Software description

The following sections describe the software operation of the NTX146AA feature package.

Interface to DS-1 links

The OPM provides an interface between the host controller and a maximum of 640 subscriber lines through the DS-1 links. The LCCs reassign data carried over the 32 channels of a DS30A link to the 24 channels of an equivalent DS-1 link. The six additional channels are for intraswitching and signaling use.

LCC control data

Before a unit of the OPM changes to InSv, the LCM sends control data to LCC for that unit. The control data indicates the number of DS-1 cards equipped and the clock source the OPM must use. The LCM receives this data from the host LTC/LGC. The host sends messages to the LCM unit during return to service (RTS). The host also sends messages to the LCM unit. This event occurs when the CC attempts to switch the LCM clock source from LCC to LCC.

The OPM software controls the LCC clock source, which is frequency-locked to the primary DS-1 links. The OPM software does not control the LCC clock source when the two units of the LCM are not active. When both units are not active, LCM hardware forces each LCM unit to take a clock source from the LCC. This clock source belongs to the LCM unit.

Other host office functions

The software resident in the host DMS-100 Family office controls the following functions:

- class-of-service
- code interpretation
- screening
- routing
- billing

Signaling and supervision

Signaling allows the DMS-100 switch to communicate with DMS-100 switch stations or other switching offices. The OPM uses DMS-X protocol to communicate over the DS-1 links with the host office. The DMS-X is a half-duplex, byte-oriented protocol like the DS30. The DMS-X is responsible for the transmission and reception of message data over full-duplex media like the DS-1 links. The DMS-X is a state-driven code. The DMS-X requires handshake-messaging between the OPM and host at each stage of data transfer.

The byte transfer rate over DS-1 channels is 125 bytes per microsecond.

Subscriber tones

The host LTC/LGC provides correctly cadenced tones that the OPM applies as needed to subscriber lines. The tones that the host LTC/LGC supports and the OPM applies follow:

- dial tone
- audible ringing
- warble (MDC Meridian business set ringing)
- busy tone
- reorder tone
- receiver off-hook (ROH) tone

The OPM depends on the DMS-100 switch CC and is not involved in any signaling between the host office and other systems.

Intraswitching capability

Feature package NTX156AA provides intraswitching capability to the OPM. The intraswitching feature distributes the traffic load in the OPM again. This event occurs so that the DS-1 links to the host are available to handle external calls. The intraswitching feature allows calls between subscribers served by the same LCM unit of the OPM to be connected. The name of this condition is *intra*switching. When calls between subscribers on different LCM units of the OPM must connect, the name of the condition is *inter*switching. The LCCs in the HIE shelf are responsible for intraswitched and interswitched calls. The LCCs in the HIE shelf connect serially to the DS30A ports of the LCM.

For more information on intraswitching, refer to the data schema section of the *Extended Peripheral Module Translations Reference Manual*.

Functional limits

For feature package NTX146AA to work correctly, certain conditions must be observed. These limits can be hardware-dependent or software-dependent, as follows.

Hardware limits

The following hardware limits apply to the NTX146AA:

- One OPM can serve a maximum of 640 lines.
- The OPM has a maximum traffic-carrying capacity of eight CCS/line, or a maximum of 1.5 calls/second.
- A minimum of two and a maximum of six DS-1 (T-span) links connect the OPM with the host office.
- All DS-1 links to the OPM must terminate on the same host LGC or LTC. These DS-1 links must terminate on different DS-1 interface cards.
- The maximum power input to the OPM bay is 35 A at -48 V.

Software limits

Feature package NTX146AA requires the following software packages to operate:

- NTX000AA: Bilge
- NTX001AA: Common Basic
- NTX270AA: New Peripheral Maintenance Package
- NTX901AA: Local Features I

  The OPM requires feature package NTX156AA, OPM Intracalling for intraswitching capability. The OPM requires feature package NTX154AA, Emergency Stand-Alone Operation to have ESA capability.

Fault conditions

Several types of faults can occur in the parts of the OPM. In the host office, the C-side links from the OPM to the host LTC/LGC can lose activity. When these network links are defective, messaging from the CC can be lost, and subscriber service can be lost.

A circuit card in the OPM, or the power converter card, can be defective. This condition can affect subscriber service in a negative way. OPM equipment, other than circuit cards, can become defective.

The OPM P-side links toward the subscriber carry messages important to the maintenance of subscriber service. A defective peripheral side link can impact subscriber service.

The following sections describe the exact fault conditions that occur in OPM parts and the interfaces between OPM components.

LCA shelf failure

When a fault condition causes one of the LCA units in the LCM to lose service, the following occurs. The InSv unit assumes control of the mate unit lines, in addition to the lines of the in-service unit. This function, called takeover, is an automatic maintenance feature of the LCM configuration. For more infomation, refer to Takeover capability. When one of the following fails, the LCA shelf goes into takeover:

- the mate processor
- the digroup control card in the mate unit
- the power converter in the mate unit
- the ANI and coin voltages in the mate ringing generator
- the mate LCC in the HIE shelf

Line drawer faults

A BIC or line card with a fault causes a fault condition in a line drawer. This fault is not serious enough to cause a takeover.

Link failure

Link failures include the following:

DS-1 link fault

Link failures are normally associated with the DS-1 interface cards in the host controller, DS-1 link or DS-1 interface cards in the OPM. Monitoring is performed through operational measurements (OM) that indicate when counts exceed maintenance or out-of-service thresholds.

The host controller performs the following actions when faults occur on these lines:

- maintains and tests the DS-1 links
- generates alarms for link defects
- reassigns channels

The host controller assigns channels again when faults occur on these links. Operating company personnel can obtain the bipolar violation (BpV) count at the OPM with the following methods:

- Post the host XPM with the REMOTE parameter at the carrier level of the MAP display.
- Post the host XPM and issue the DETAIL command with the REMOTE parameter.

The BpVs are not severe enough to raise an alarm. BpVs can signal failure of a DS1 link.

The host controller or the OPM can detect faults, like BpVs, because the signals on a DS-1 link travel in two directions. The OPM notifies the host controller when the BpV count exceeds the threshold of 1 BpV per 10^3 bits. The OPM also monitors the loss of frame indicator for the DS-1 links. The OPM activates an outgoing alarm for any frame loss more than 2.5 s. The OPM deactivates the outgoing alarm when the frame is restored to 10 s frame loss.

The OPM can detect framing pattern loss for 2.5 s or more, or the host XPM can detect framing pattern loss for 220 ms. When these conditions occur, frame loss at the out-of-service limit occurs. A local carrier group alarm (LCGA) occurs at the carrier level of the MAP display. An LCGA occurs when the host XPM detects loss of frame. A remote carrier group alarm (RCGA) occurs when the OPM detects the loss of frame. For information on standard troubleshooting procedures to clear these faults, refer to the chapter *Troubleshooting chart*.

DS30A links

DS30A links on the P-side of the OPM can fail. These links connect to an RMM or ESA module. Faults on these links can affect the associated modules.

Load file mismatch

A load file mismatch fault condition occurs when a load in the LCM does not match the load specified in table LCMINV.

Automatic maintenance

The DMS-100 Family switch of peripheral modules (PM) is reliable under different fault conditions. Peripheral modules contain several hardware redundancies as backup operations for module, card and link failures. Fault conditions that do not require any manual action can occur because the peripheral modules contain hardware redundancies.

The DMS and the OPM initiate audits or other system actions when fault conditions occur. The DMS and the OPM perform this procedure to attempt to find the fault and to correct the fault.

The following types of automatic maintenance appear in the sections that follow:

- OPM audits
- checksums
- LCM LTC speech path diagnostics
- overload resources
- takeover capability
- ESA capability
- RMM maintenance

- drawer testing
- BIC relay testing (BRT)
- subscriber line automatic maintenance
- LCM routine exercise (REX) tests

OPM audits

Audits are scheduled to run in the OPM every 5 s to refresh the control data for DS-1 and LCC circuits. Audits monitor the LCC for faults on a schedule. A second audit monitors the DS-1 interface cards for faults in 500 ms intervals. The following paragraphs describe the functions of these system audits and how the system audits affect LCC and DS-1 circuits.

LCC maintenance

The OPM monitors the state of the OPM LCC to make sure the system transmits control data correctly to the LCC. The OPM monitors the inactive LCC clock for faults. Control data are rewritten to the LCC periodically.

DS-1 interface card maintenance

The OPM automatically monitors the BpV counter for each of the DS-1 interface cards. The OPM notifies the CC when the count exceeds the threshold of 1 BpV per 10^3 bits (10 kb). The OPM monitors the loss-of-frame indicator for the DS-1 links. The OPM activates an outgoing alarm for any frame loss of more than 2.5 s. The OPM deactivates the outgoing alarm when frame is restored for 10 s.

When the OPM detects DS-1 slips, the OPM increases a slip counter and provides a message-driven interface. The OPM performs this procedure to allow the counter to be queried from the carrier MAP display level of the host office. Control data are rewritten periodically to the DS-1 cards.

LCM drawer maintenance

A system audit runs every 10 min for each LCM. The system audit attempts to RTS any drawers in the SysB state. When the system detects any faults, the system tests and handles drawers that are in the ISTb state.

The LCM unit states and the corresponding tests appear in the following table.

Table 10 Full in-service tests

State	In-service tests	Busy
InSv	In-service tests	Out-of-service tests

Table 10 Full in-service tests

State	In-service tests	Busy
Bsy, sane	In-service tests	Full (all) tests
Bsy, insane	Stand-alone in-service tests	Stand-alone out-of-service tests

Checksums

The DMS-100 Family of peripheral modules uses a number to calculate the checksum (CHKSUM) for each software load. After the PM is loaded and tested, the checksum total is compared with the expected checksum total. When the totals match, the load is correct. When the totals do not match, the load must be loaded again with the LOADPM command. Each PM type has a different checksum value for each load. The QUERYPM command displays a checksum value for the load of the PM.

LCM LTC speech path diagnostics enhancements

The LTC diagnostic tests consist of the following two parts:

- Speech path diagnostic (SPCHDIAG). SPCHDIAG tests all internal components of the LTC (or LGC) speech path for data integrity. These tests include C-side and P-side loop-arounds and speech bus time slots.
- P-side link diagnostic (PLNKDIAG). PLNKDIAG tests links between the LTC and any auxiliary peripherals, like the OPM. The system performs the tests on all links or selected links.

Speech path diagnostic for the LTC

The speech path diagnostic consists of four separate tests:

- hardware presence test
- P-side interface presence test
- P-side loop test
- internal loop test

Each test runs when all the previous tests pass. The following paragraphs describe the four tests.

Hardware presence test This test makes sure the LTC contains the formatter (6X41), message (6X69) and time switch (6X44) cards. This hardware is necessary for the remainder of the tests. When any one of these cards is not present, the diagnostic returns a `No Resources` error message. The diagnostic produces a PM181 log report.

P-side interface presence test . This test makes sure that DS-1 interface (6X50) cards entered for the LGC/LTC are present. The P-side interface test arranges the following P-side loop test. The P-side interface test terminates when a failed 6X50 card is detected or removed. The diagnostic returns a `No Resources` error and produces a PM181 log report.

P-side loop test . The P-side loop test checks for the correct operation of 6X50 cards and other dedicated P-side loop-around circuits for the LTC. The P-side interface test checks for the presence of all 6X50 cards. A description of P-side interface cards supported in the LTC P-side loop test follows.

When the LTC is in inactive mode, the P-side loop test checks only 6X48 P-side loops. Inactive mode occurs when one unit is inactive and the other unit is ManB, SysB or InSv. When the LTC is in active mode, 6X48 and 6X50 P-side loops are tested. Active mode occurs when one unit is active and the other unit is SysB, ManB or InSv. The P-side interface test also checks the LTC multiplexer.

Internal loop test This test checks the integrity of LTC speech channels. When the LTC is out-of-service (OOS), a full test on every channel is run. When the LTC is InSv, the test checks two speech channels selected at random. The internal loop test checks the operation of LTC PCM enable/disable gates.

LTC P-side link diagnostic

The P-side link diagnostic consists of three separate tests:

- hardware presence test
- P-side interface presence test (DS30A and DS-1 link interfaces)
- full peripheral test

Hardware presence test This test checks for the message (6X69) and time switch (6X44) cards in the LTC or LGC. These cards are necessary for the other P-side link diagnostic tests to run. When any of these cards are not present, the diagnostic returns a `No Resources` error message. When this event occurs, the diagnostics produces a PM181 log report.

P-side interface presence test This test is the same as that in the speech path diagnostic. This test makes sure that all LTC P-side links to test are present. This test flags missing or failed 6X48 or 6X50 cards in the LTC.

Full peripheral test After the first two tests in the P-side link diagnostic, this test makes sure necessary hardware is present. The full peripheral test checks one speech channel on each specified LTC P-side link to the OPM. This test is run when the LTC is in active mode.

OPM facility maintenance

The OPM invokes the no-LTU diagnostic for the following reason. The line diagnostics are invoked for OPM-supported lines and the OPM does not have a serving LTU or MTU. This software establishes a connection to a transmission test unit (TTU) in the host office. The TTU uses this circuit for limited line testing in place of the LTU or MTU.

Overload resources

When the traffic load or the amount of call processing on the OPM is greater than the LCM processor cards can handle, the following event occurs. The OPM accepts calls at a slower rate until the overload clears. Normally, when the OPM processes calls, the OPM queues the call requests and assigns the calls priorities in the OPM data store. As the data store fills close to capacity, the OPM overload controls slow the rate of load acceptance. The OPM overload control also halts the call process until store is available.

Overload control in the OPM occurs for the following activities:

- C-side communication
- line scanning

When the LCM processor cards slow or stop the C-side communication, the following event occurs. The LCM processor cards decrease the rate that the LCM processor cards scan for messages on the C-side. The demand for data store decreases when the LCM processor decreases the incoming workload. The MAP display queries of the OPM status slow and C-side responses to OPM-supported terminals become slow.

During overload, the LCM processor cards do not scan the BIC until a specified amount of data store is available. When the LCM processor cards do not scan the BIC, incoming work from the P-side is prevented. The queue of the incoming work in the output buffers of the BIC prevents incoming work from the P-side. When the buffers are full, the LCM processor card does not accept work. The results are partial dials or ignored keys on business sets.

Display of overload state

When the OPM overloads, the LCM status display changes to ISTb while the two units show InSv. When you enter the QUERYPM FLT command at the LCM level, the phrase `LCM Overloaded` appears in the response.

Log reports PM128 and PM181 indicate the overload condition in the OPM. When call processing resumes, the system generates PM128 log with the phrase `LCM out of Overload`.

Current extended memory LCM (XLCM) overload controls

The XLCM has 256 kbytes of memory. The XLCM has a specified number of small, medium and large memory blocks, all of a fixed size. Domestic LCMs and XLCMs use small and large memory blocks to receive external messages and to send messages. Small memory blocks (SMB) are for utility purpose uses like timer control blocks. Medium memory blocks (MMB) are for call data blocks (CDB) use, which hold data associated with active lines.

In the current XLCM installation, overload is reported when the XLCM cannot receive an external message, DMSX or Inter-Unit Communication (IUC). This event occurs because the number of small or large memory blocks is not enough. Some service degradation can appear before the OPM enters overload.

The XLCM has four levels of throttling to prevent overload. Three levels work according to the number of available SMBs, and conserve SMBs. The SMBs are weighted to give terminating calls priority over originations.

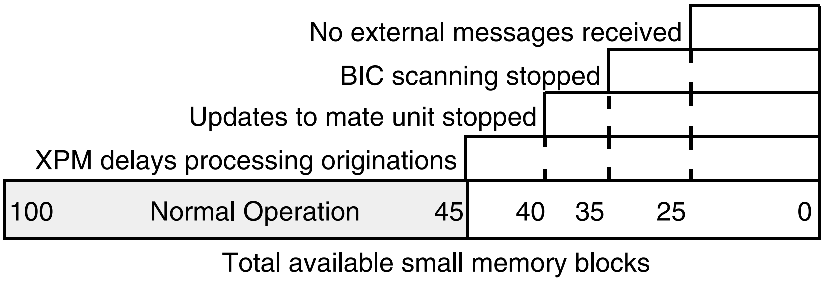
The following describes four levels of throttling:

1. The XPM throttles messages to the XLCM a maximum of two in 50 ms periods. This procedure helps control small peaks of very heavy traffic. Sustained messaging at this rate can drive the XLCM into severe overload.
2. The XLCM appends the number of SMBs available for external messages. The XLCM appends these messages to each POTS origination message and all messages that originate from P-phones. This number equals the number of SMB in reserve subtracted from the total available SMBs. When this number is less than 20, the XPM delays processing the origination. This delay continues until this number returns to a minimum of 20.
3. The total number of SMBs available for external messages can be less than 15. When this event occurs, the XLCM stops sending call processing updates to the XLCM mate. This number equals the total available SMBs minus the number of SMB reserve less than 15.
4. The total number of SMBs available for external messages can be less than 10. When this event occurs, the XLCM stops the scan of the BIC for line scan changes. This number equals the total available SMBs minus the number of SMB reserve less than 10.

For overload protection, the XLCM holds a reserve of small memory blocks. These small memory blocks do not receive external messages. This limit appears in the figure XLCM Overload Protection System. This condition makes sure that internal processes have enough small memory blocks to finish the current tasks. External messages that require SMBs are rejected when the XLCM enters extremely heavy overload. The messages are rejected when the total number of SMBs available is less than or equal to the size of the SMB reserve. The exception is maintenance or monitor messages. At this point, the XLCM sends an overload report to the computing module (CM).

The current overload protection system is static because the throttle levels are constant and non-reactive. The overload protection system can be described as distributed. This description occurs because a single place in which overload is monitored or protective measures are initiated and controlled is not present.

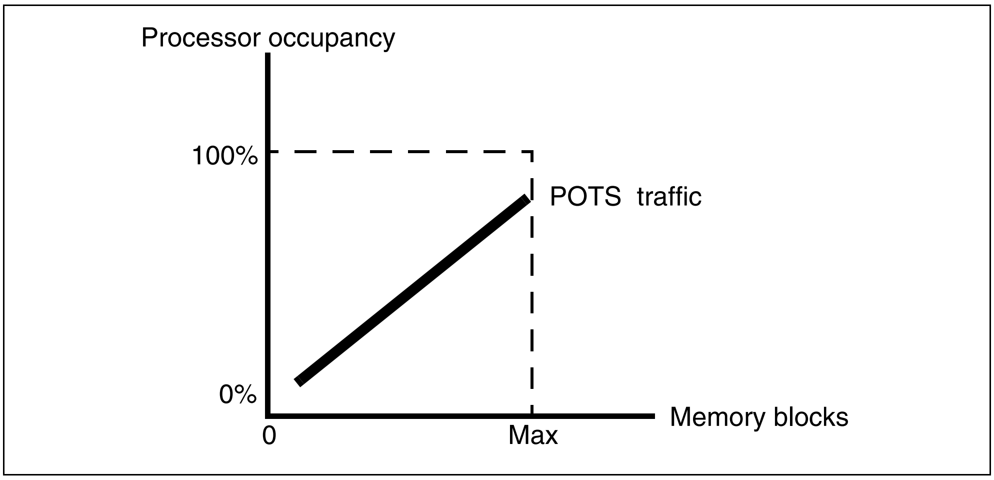
Figure 10 XLCM Overload Protection Systemxxx



Early POTS models of the small memory LCM (64k) can be memory block limited. In the past, the LCM used all the small memory blocks before real-time usage. The design of the LCM depends on this characteristic. Memory block limited is an LCM characteristic transferred to the XLCMs for use.

The XLCM overload system works with POTS traffic. The current selection for the number of SMBs (100) and the size of the SMB reserve (25) allows the following condition. The processor is memory block limited with POTS traffic. The processor runs out of SMBs before real-time use. A rough graph of processor occupancy can demonstrate this condition. Real-time use compared to memory block use demonstrates this condition as follows.

Figure 11 Processor occupancy (real-time use) compared to memory blocks



XLCMs have more memory blocks than small-memory LCMs. There are extra messaging requirements to accommodate P-phones. The P-phones are richly provisioned with features like displays and MADN. The result is that the XLCM can run out of real-time before memory blocks. The following represents this real-time overload condition.

Figure 12 Processor occupancy—real-time overload

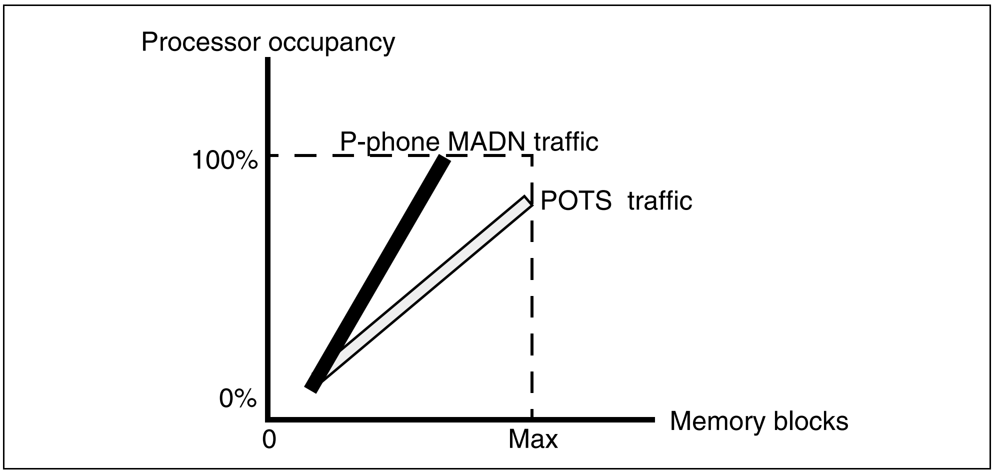
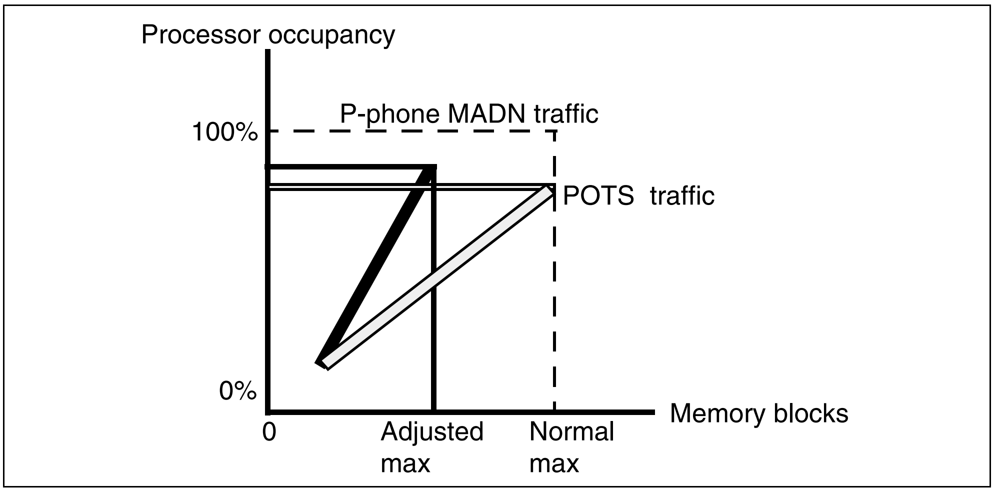


Figure 13 Processor occupancy—memory block reduction after real-time overload detection



The XLCM is memory block limited. The XLCM cannot handle real-time overload. This condition can result in outages because of the following reasons:

- An overload report was not sent. The XLCMs cannot detect real-time overload. As a result, the CM does not suspend functions that require a response from the XLCM. The CM suspends functions when overload is reported. When the XLCM does not respond in time, the CM system busies the XLCM.
- The XLCM cannot handle lack of memory when lower priority tasks do not run. This condition can lead to traps or severe software errors that cause the CM to SysB the XLCM.

Improvements to the overload protection system

The improved XLCM overload protection system performs the following:

- detects when the XLCM is in real-time overload
- reports overload to the CM
- takes protective measures to assure XLCM sanity

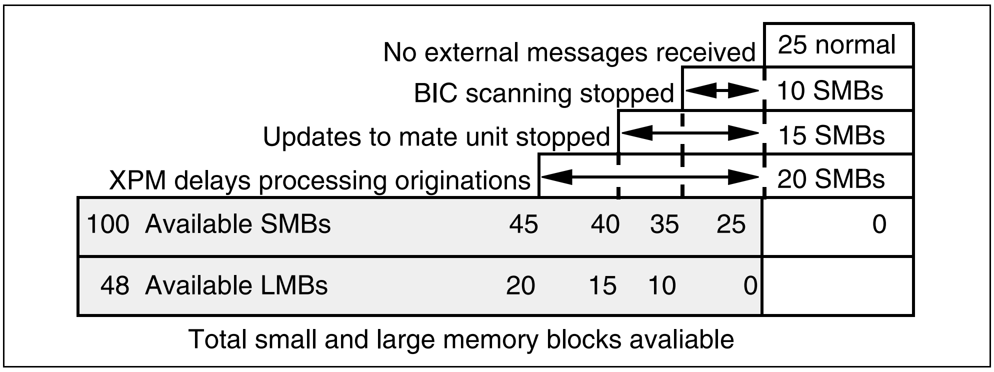
The XLCM overload protection system performs the above functions in addition to current functions. These protective measures are active for the smallest amount of time to retain the XLCM call processing capacity.

This improvement adds three new components to the Overload Protection System. The three improvements follow.

- The processor occupancy data collection component. This component is distributed over key areas of the XLCM code. This component collects raw data that can detect real-time overload. The component leaves the raw data in a depository for the data analysis component. The priority of this component matches the priority of the segment of the system in which the component resides.

- The real-time data analysis component. This component analyzes the data in the depository. The real-time data analysis component produces an easy-to-read processor occupancy state. This state is not a percentage. This state is a distress rating. This component does not use percentages because percentages are too difficult to work on when real-time is scarce. Percentages do not supply all of the information the control component needs. The control component uses the distress rating. The distress rating is reported to the CM when the XLCM reports overload. In addition, the data analysis component provides indication of activity and the running of the the data analysis component. This component runs at a high priority.
- The real-time overload control component. This component monitors the distress rating that the data analysis component outputs. When the output indicates real-time overload, the control component adjusts parameters in the Overload Protection System. The control component recovers some real-time. The control component keeps the memory block limits ahead of the real-time limits of the XLCM. These limits appear in the figure below. When the data does not indicate trouble, the control component begins to restore the Overload Protection System parameters. The Overload Protection System parameters allow maximum call processing. This component runs at a very high priority.

Figure 14 Overload protection system variable thresholds



Changes to the real-time subsystem

The real-time subsystem changes memory block system parameters. The subsystem changes these parameters to keep the memory block limits ahead of the real-time limits.

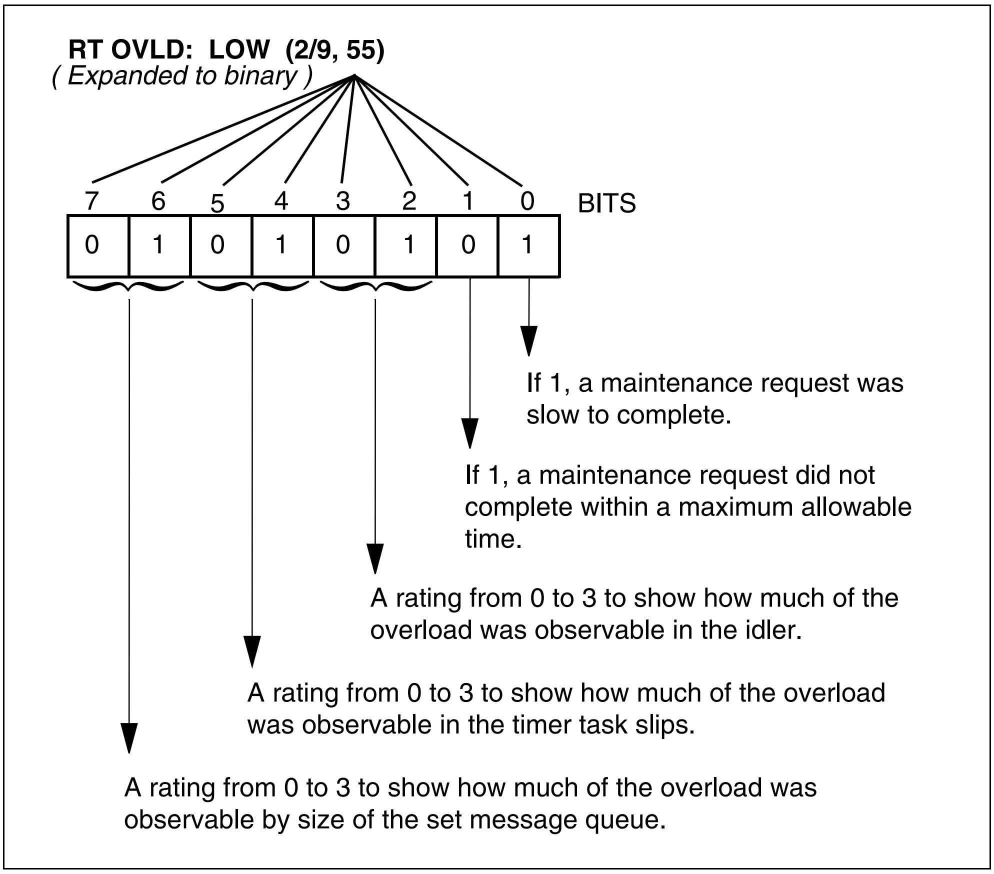
Enhancements to the real-time subsystem include the following functions:

- To preserve real-time and accomplish reduction of memory blocks. This function periodically reduces the number of memory blocks available for external messages. This function reduces associated throttles until the recovery of some real-time use is complete.
- To define real-time overload as a processor occupancy rate of 75% or higher for a minimum amount of time. To calculate percentages in the XLCM is real-time intensive. This is not a flexible method. This method can result in premature reaction when the XLCM is not in severe real-time trouble.
- To monitor the amount of time to process certain key maintenance requests at high levels. These levels must not exceed 100% occupancy. This threshold makes sure the XLCM responds to these requests before the CM times out or enters overload. The real-time subsystem benchmarks the average time to process these key requests. When the time is longer than this benchmarked average, the subsystem assumes real-time overload.
- To monitor idle task activity and to enter real-time overload. The subsystem performs this procedure when an idle task does not run for a specified period of time.
- To characterize the timer task slip counter at a high occupancy rate that does reach 100%. When the timer task slips at more than the normal high occupancy rate, the subsystem enters real-time overload.
- To monitor the size of the set message queue. The XLCM is close to real-time overload when the size reaches 40 or above.
- To include large memory blocks (LMB) in the reduction of memory blocks component. This function makes sure the recovery of real-time is completely effective.

XLCM log report appendages

The XLCM appends a new field to the overload messages sent to the CM. This procedure reflects how extensive the real-time overload is. The CM can be at CCM04 or later. When this event occurs, this new information appears in the modified PM180 LCM Enters Overload log and modified PM180 LCM Overloaded log. The new field contains the following ratio. The ratio of the maximum real-time distress reached before the overload report must be generated (values 0-9). This event must occur to the maximum possible level of real-time distress (values 5-9). A real-time overload indications summary byte in hexadecimal output is provided as described below.

Figure 15 Summary of real-time overload symptoms



The XLCM maintains data about overload that allows the XLCM to provide a summary about the overload period. The figure above describes this summary. This summary appends to the overload exit message of the CM. When the CM is at CCM04 or later, this information appears in a modified PM180 LCM out of Overload log.

This feature is active in XLCMs, and in International XLCMs with extended memory and XPM04 or later loads. The new logs apply when CCM04 is installed in the CM.

This feature detects real-time overload. The overload status can be reported to the CM. When the CM receives the overload state report, real-time can be preserved. The preservation of real-time allows the XLCM to function according to the operating model, memory block limited.

The real-time Overload Detection and Protection subsystem is integrated into the current Memory Block Overload System. When the system detects real-time trouble, the system begins memory block reduction. The system reduces memory blocks with a change of system parameters of memory block overload. This procedure reduces the amount of memory blocks available for new work. This design aspect makes the new overload system dynamic. The system adjusts to allow very high processor occupancy under any traffic configuration.

Takeover capability

Power connections are present between the two shelves of the LCM. The LCM can operate in a load-sharing mode. When one power converter loses service, the mate converter supplies power to both shelves. This condition is a takeover state. In the takeover state, the in-service unit assumes control of the lines associated with the OOS mate unit. In addition, the in-service unit controls the InSv mate unit lines. The InSv unit has access to the DS30A C-side ports used by the OOS mate. The DCC of the InSv unit accesses all 20 line subgroups.

The mate converter distributes ringing, ANI and coin control voltages to all 20 LSGs of the two LCAs. One of the two ringing generators in the HIE supplies the ringing and ANI and coin control voltages.

Takeover occurs when one LCA control complex, like the LCM processor and digroup card fails. When this condition occurs, the control complex that remains can support all DS-1 links and the LSGs of both LCAs.

Calls in process at the time of takeover terminate and require redial. Calls already connected and in progress are maintained.

LCC takeover

The LCC provides an interface between the LCA and the DS-1 interface cards in the HIE shelf. Each LCA associates with an LCC in the HIE shelf. When an LCA shelf fails, the LCA shelf is considered inactive and takes down the associated LCC.

When an LCC fails, an LCC takes down the associated LCA shelf. When an LCC or an LCA shelf fails, the active LCC and LCA perform a takeover. The LCC and LCA support the DS-1 links of the inactive LCC and LCA. Takeover is possible because duplicated paths are present between the LCA shelves. A takeback occurs when the inactive LCC and LCA become active again.

Takeback

When the failed unit is RTS, the subscriber lines in takeover state are distributed back to the normal processor. A loss of calls in the talking or ringing state does not occur during the RTS.

LCM talk battery audit

In the past, the report of a loss of talk battery to an LCM shelf did not occur unless the talk battery fuse was blown. The report of the loss of talk battery does not always occur. When this event occurs, operating company personnel cannot know that LCM subscriber lines cannot draw dial tones.

The Talk Battery Alarm feature addresses this problem with the addition of new CM and LCM maintenance software. This software periodically audits each LCM shelf for the presence of talk battery. When the audit fails to detect talk battery, the critical alarm log report (PM179) alerts the operating company personnel.

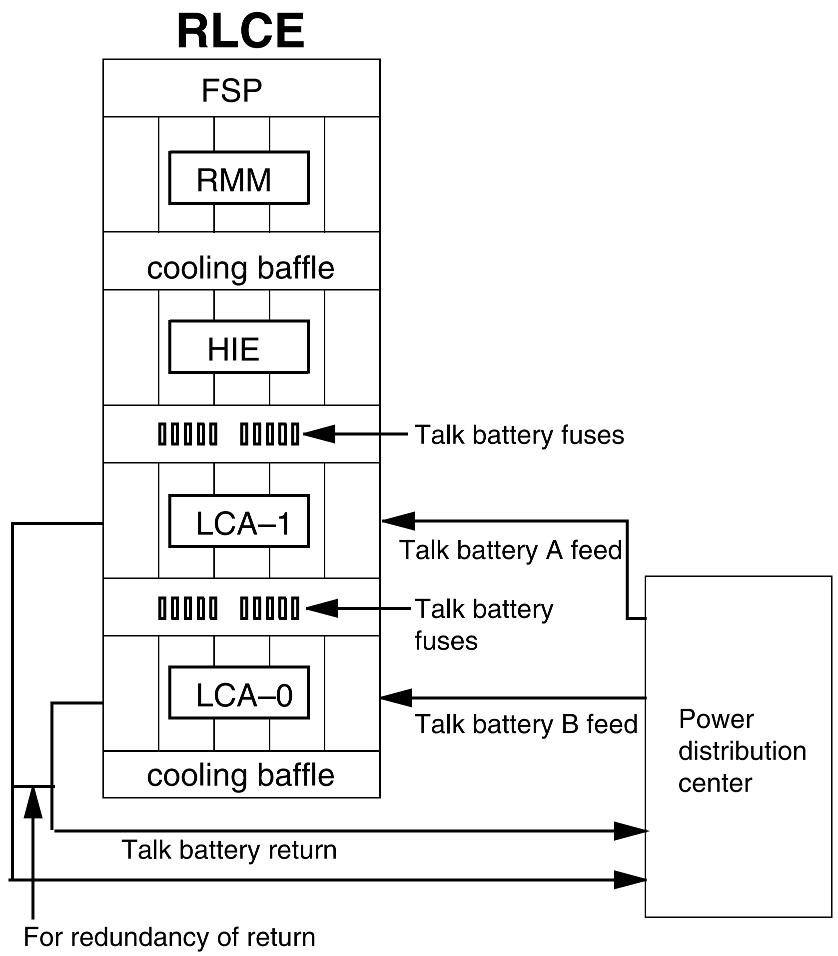
Each LCM shelf must have a minimum of one world line card (WLC) to support this feature. The WLC is normally for the talk battery audit use. The subscriber can also use the WLC for call processing. The system can generate a minor alarm log report (PM179). This event occurs when WLCs are not available to perform the audit when the feature is ON.

> ***Note:*** This feature supports all WLC types. Limits are not present when the WLC is in the LCM shelf.

Loss of talk battery

The following figure shows the distribution of talk battery in a remote line concentrating equipment (RLCE) frame with LCA shelves. The distribution of talk battery is the same for the OPM as for the RLCM. The distribution is A feed to LCA-0 and B feed to LCA-1.

Figure 16 Talk battery distribution on RLCE frame



The A feed provides talk battery for LCA-1 and the B feed provides talk battery for LCA-0. The feeds are not redundant, which can affect up to 320 subscriber lines. Some redundancy with the talk battery returns to avoid an outage by a single fault.

In the past, operating company personnel did not receive an indication of a problem before a loss of talk battery unless the talk battery fuse had blown. The LCM indicates `InSv` (in service) on the MAP display to indicate a blown fuse. The LCM performs a line card audit. This audit cannot check for loss of talk battery. The loss of talk battery affects one or two LCM shelves. The location of the fault determines the affected LCM shelf.

Without talk battery, the LCM line cards cannot signal an off-hook condition. The LCM recognizes any off-hook line as on-hook. Any LCM calls are forced to the on-hook state during the loss of talk battery feed. The LCM lines cannot originate and terminate calls while talk battery is absent.

Feature activation

The change of the value of office parameter TALK_BATTERY_ALARM in table OFCENG, controls activation of the Talk Battery Alarm feature. Default disables the Talk Battery Alarm feature. A WLC must be provisioned in each LCM shelf in the office before this feature is enabled. In any other condition, a minor alarm occurs for each LCM shelf that does not contain a WLC.

After the Talk Battery Alarm feature is enabled, talk battery tests are performed through diagnostics and background audits.

When the Talk Battery Alarm feature is disabled, any talk battery alarms and ISTb reasons that this feature introduces are cleared.

Background audit

Each LCM can audit shelves for loss of talk battery. The Talk Battery Alarm feature can be disabled. When this event occurs, audits do not run to check for the loss of talk battery on any of the LCMs in the office.

When the Talk Battery Alarm feature is enabled, a search is performed to find an available WLC on each LCM shelf. A WLC must be in one of the following states to be available:

- hardware assigned, software unassigned (HASU)
- InSv and assigned to a subscriber

When an available WLC is not found, the system generates a minor alarm log report (PM179). This log report indicates that talk battery cannot be tested. The LCM becomes ISTb. When an available WLC is found, a special audit runs a minimum of one time every minute. This audit checks for loss of talk battery feed. All LCM shelves are tested at the same time. The tests make sure LCM shelf is checked a minimum of one time each minute. Audits do not run talk battery tests on an OOS LCM.

When the available WLC in use for audit testing becomes not available, the audit searches to find another available WLC. When the audit finds another available WLC, audit tests continue with the new WLC. When the audit does not find an available WLC, the system generates a minor alarm log report (PM179). This log report indicates the system cannot test the talk battery. The LCM shelf is set to ISTb.

The WLC must verify the presence of talk battery feed to the WLC to test for loss of talk battery feed. The test passes when talk battery feed is present. The test fails when the talk battery feed is not present.

When off-hook, call processing busy (CPB), or both, occupy an InSv WLC, the audit does not perform the talk battery test. The audit assumes the talk battery test passes. Examples of occupied states are talking, ringing and maintenance lockout. In the ringing state, the WLC is on-hook and in a CPB state.

When the audit finds a failure of the talk battery test, the system generates a critical alarm log report (PM179). The LCM shelf is placed in an ISTb state. The audit does not report the failure again until diagnostics clear the alarm and the ISTb state.

Diagnostics

The talk battery test part of into the InSv and OOS diagnostics for an LCM unit. The diagnostics affected include the following commands:

- Tst Unit unit_no
- Tst PM
- Tst REX NOW
- Rts Unit unit_no
- Rts PM

Diagnostics reports all talk battery failures. This report occurs even when the audit tests the same LCM repeatedly. When the talk battery test passes, the diagnostics clear the alarm and the ISTb reason. Both the manual and automatic versions of these commands are impacted. The diagnostics run talk battery tests while the talk battery alarm feature is enabled.

Each LCM shelf must be provisioned with a WLC to support the talk battery alarm feature. Special provisioning rules do not affect where the WLC resides in the shelf. The maintenance line card in LSG 0 Card 0 for the LCM shelf can be assigned as a WLC. When this event occurs, the feature can or cannot use this card. This line card tests the ringing generators and determines if the feature can use the card.

The MAP commands that can Bsy the last available WLC on an LCM shelf are modified. The commands are modified to issue a warning message when this condition occurs. Three commands can cause this condition.

- the Bsy command at the LTP MAP level when a WLC is posted
- the Diag command at the LTP MAP level when a WLC is posted. Diag is temporarily ManB the WLC
- the Bsy Drwr command at the PM MAP level when an LCM is posted

The issue of one of these commands can cause the Bys of the last available WLC on the LCM shelf. When this event occurs, a warning message appears at the MAP terminal. An example of this message follows:

Example of a MAP response:

```
Busying the last available WLC on LCM shelf.  This prevents
testing for talk battery failure on the LCM shelf.  Minor alarm
will be raised within one minute unless WLC becomes available.
```

The QUERYPM FLT command is modified to display the new ISTb reasons by shelf and LEN for the two alarm conditions. An example of this display follows:

Example of a MAP response:

```
Node inservice trouble exist:

One or both units Inservice Trouble:

LCM UNIT 0 Inservice Trouble Exist:

Talk Battery failure detected on shelf <shelf #> by <LEN>

LCM UNIT 1 No Faults Exist
```

or

```
Node inservice trouble exist:

One or both units Inservice Trouble:

LCM UNIT 0 Inservice Trouble Exist:

LCM UNIT 1 No Faults Exist
```

The MAP commands that can RTS the first available WLC on an LCM shelf are modified to issue the following notification messages. This notification message informs the operating company personnel that the minor alarm and ISTb reason for the LCM shelf is cleared. This condition occurs because a WLC is made available to test for talk battery failures. Two commands can cause this condition. The first command is the RTS command at the LTP MAP level when a WLC is posted and RTSed. An example of a response to the RTS command appears below:

Example of a MAP response:

```
RTSing the first available WLC on the LCM shelf.  Loss of talk
battery can now be detected on LCM shelf.  The minor alarm and
ISTb reason will be cleared for the LCM shelf within ten minutes
(unless the last WLC becomes unavailable again).
```

The second command is the RTS Drwr command at the PM level when an LCM is posted. The entry of the RTS Drwr command causes the following MAP response to appear:

Example of a MAP response:

```
RTSing DRWR of the first available WLC on the LCM shelf.  Loss
of talk battery can now be detected on LCM shelf.  The minor
alarm and ISTb reason will be cleared for the LCM shelf within
ten minutes (unless the last WLC becomes unavailable again).
```

The ESA operation is not impacted on RCC (in remote-off-remote configuration) or OPM. Talk battery alarm conditions are ignored during ESA operation. On exit of ESA mode, the CM diagnoses the LCM to determine when talk battery failures are present.

Limits

The following limits apply to the Talk Battery Alarm feature:

- The following LCM types support the Talk Battery Alarm feature:
  - extended LCM (XLCM) (256-Kbyte capacity)
  - enhanced LCM with ISDN (LCME)
  - cabinetized XLCM (ELCM) (or Meridian cabinetized LCM)
  - remote line concentrating module (RLCM)
  - OPM
  - outside plant access cabinet (OPAC)
- The same WLC for talk battery testing can also operate as a subscriber line. The talk battery test can be in progress on a WLC. The WLC can go on-hook to request a call origination while the subscriber goes off-hook. When this condition occurs, an additional delay of a maximum of 90 ms can occur before the subscriber receives dial tone. The talk battery test can be in progress on a WLC when the WLC receives a call termination request. The request is to ring the line. When this condition occurs, an additional delay of up to 90 ms can occur before ringing begins. For

originations and terminations, this negligible delay is the only impact on call processing.

- The Talk Battery Alarm feature can detect the loss of talk battery *feed* to an LCM shelf. Detection of the loss of talk battery *return* cannot occur because of WLC limits. This limit is not important because talk battery returns are duplicated and the occurrence of return failures is not common. Refer to the previous figure “Talk battery distribution on RLCE frame".
- The CM does not test talk batteries while the LCM, or one of the CM C-side nodes, is in the overload condition.
- The Talk Battery Alarm feature isolates shelf-level failures of talk battery feed. The talk battery feed failures that this feature always reports are failures that affect talk battery for lines on the LCM shelf. This feature does not always detect drawer-level failures. The drawer where the WLC resides and the drawer in which the failure occurs determines if this feature detects Drawer-level failures.
- Particular faults local to the WLC or the WLC drawer can prevent the correct detection of talk battery failures. These faults include faults that cause the WLC to fail line card diagnostics. When these faults occur, the WLC can report talk battery failure incorrectly. This event causes the critical alarm when talk battery can occur for other lines on the shelf. These occurrences are not common. The critical alarm log report PM179 gives the location of the WLC to help troubleshoot these conditions.
- The Talk Battery Alarm feature does not affect ESA operation on RCC, OPM. Talk battery alarm conditions or reports are ignored during ESA operation. The system does not report talk battery failures when an LCM is in ESA mode. On exit of ESA mode, the CM diagnoses the LCM to determine if talk battery failures are present.
- The Talk Battery Alarm feature activates for an office. Ten min can pass before every LCM in the office begins talk battery failure audits. The time the LCM audit requires to cycle through every LCM in the office determines this delay time. An office with heavy traffic and a large number of LCMs can require longer than 10 min.
- The SERVORD OUT command deletes the directory number (DN) assigned to the last WLC on an LCM shelf. When this event occurs, a minor `Cannot test Talk Battery` alarm occurs. The alarm message indicates the WLC for which the last assigned DN is deleted. When this condition occurs, the WLC is HASU. The WLC is not in a normal maintenance state. This state does not allow the LCM to use the

WLC to detect talk battery failures. There are three methods to avoid this condition:

— BSY/RTS the LCM. This action is not recommended because of the service outage. The WLC is in the proper HASU maintenance state and the LCM can use the WLC to perform talk battery tests.

— Assign a DN to the WLC that can now use the WLC to perform talk battery tests.

— Assign a second WLC on the same LCM shelf. This WLC can remain as HASU without a DN assigned.

The second option provides the simplest procedure. The third option requires an additional WLC for extra hardware, and provides redundancy for the Talk Battery Alarm feature.

ESA capability

Loss of communication with the host can occur because of a link or DS-1 card failure. When this event occurs, an OPM with feature package NTX154AA operates independently. The OPM automatically enters the ESA mode. The ESA operation continues until restoration of communications occurs over a minimum of one of the DS-1 links. During entry and exit from ESA, the system drops all calls.

Refer to the chapter “ESA maintenance overview" for a description of ESA operation for the OPM.

RMM maintenance

The RMM performs the following maintenance functions:

- bootstrap-level (direct monitor) functions
- RMM table control and MAP workstation maintenance
- scan monitoring processes
- interface with line test equipment
- RMM testing

Drawer testing

The OPM conducts a BIC looparound test to detect line drawer faults. This action makes sure message and speech data can be sent to and from the BIC. When the BIC test fails, the CC implements a full in-service test on the two BICs. This action makes sure the fault is not transient or from the DCC or processor card.

When any of the BIC or DCC tests fail, the LCM is not forced to takeover mode.

When a drawer state changes to ISTb or SysB, the state of the OPM changes to ISTb or SysB.

Detection of some drawer ISTb conditions can occur only when the drawer or the PM is OOS. These conditions include BIC scan, BIC inhibit, BIC CM and BIC activity. Drawers with these conditions can be returned to service with an ISTb condition. When this event occurs, the ISTb state clears when the InSv unit or drawer tests occur. The sequence of events follow:

- The BIC looparound sets the drawer to the SysB state. This condition does not allow the BIC looparound to send messages to the BIC looparound. All lines to the drawer are made line maintenance busy (LMB) because the call processing is disabled.
- The BIC scan sends a scan message to the BIC. This message makes sure the scan chip can detect supervision changes on all datafilled lines. The path through the DCC is similar to the BIC looparound because this action involves a message.
- The DCC looparound tests a loop in the DCC. The looparound does not test all the DCC hardware for the DCC/BIC communication. When a fault occurs with this hardware, the DCC looparound passes when following BIC looparound tests fail. An accurate drawer fault does not occur.
- The DCC/BIC looparound sets the drawer to the ISTb state. A failure on the speech path hardware to the drawer occurs. When a specific channel fails the test, all channels are not always affected. Call processing is possible at this time. For this reason, the drawer state is updated to ISTb at the MAP display and the drawer can handle call processing. The DCC/BIC looparound sends test patterns to the BIC to test the PCM path. The patterns that the transmit time switch receives are expected to be the same in a timeout period.

The list of full InSv tests follows:

- ACTIVITY_READ
- MSG_LOOPAROUND
- ANI_COIN_FAIL
- PARITY_TRAP_FAIL
- BIC_ACT_TEST
- POWER_CONVERTER_FAIL
- BIC_CM_TEST
- RINGING_FAIL
- BIC_INHIBIT_TEST
- RTM_CM_TEST

- BIC_LA_TEST
- RTTS_CM_TEST
- BIC_LOOPAROUND
- SANITY_TIMEOUT_FAIL
- BIC_SCAN_TEST
- SET_MSG_LOOPAROUND
- DCC_LA_TEST
- SUBCYCLE_LENGTH_FAIL
- DS1_LOOPAROUND
- SUBCYCLE_ORDER_FAIL
- IUC_LA_TEST
- TIMING_TEST
- LC_COM_TEST
- WRITE_PROTECT_FAIL
- LCC_FAIL
- ZERO_CROSSING_INT_FAST_FAIL
- LCC_LOOPAROUND
- ZERO_CROSSING_INT_SLOW_FAIL
- MEMORY_TEST

Faults that occur on a BIC drawer affect call processing. The unit that is in service and controls the drawer does not affect this condition. Because the full in-service tests use the DCC, determine that the fault is not in the DCC. Takeover is justified in the DCC. A reported drawer fault can cause a takeover. When this event occurs, the DCC is at fault event though the LCM fails the BIC test.

In the takeover mode, the inactive unit DCC cannot access any drawers for call processing. The inactive unit DCC can access any drawer for tests. The active LCM unit has access to all drawers through the DCC.

Valid drawer faults do not take an LCM unit out-of-service. The status of the unit continues to be ISTb. The ISTb reason is Self Test or Diag Fail. The test that failed and causes the ISTb condition determines the reason. Additional diagnostic information is available for LCM shelves with the NT6X51AB expanded memory board. After the CC detects an LCM unit is ISTb, the unit can still be made SysB. The reception of many unsolicited messages can cause the LCM to become SysB.

BIC relay test (BRT)

The BRT tests the tip and ring reversal relay on each BIC of a given LCM. The BRT allows for the manual testing of a single drawer of a specified LCM and the scheduled tests of all LCMs in an office. The QUERYPM FLT command is enhanced to indicate the drawers that fail the manual or system BIC relay test. This test generates a PM181 log and a new log, PM132, to indicate test results. Refer to the chapter *OPM related logs* for information on BRT-related logs.

The following paragraphs describe the levels of BRT tests.

Office level

The schedule includes loops over each LCM. A single BRT runs on each drawer of the given LCM. The results of the tests appear in a logutil report. The logutil report combines the results of each drawer test.

LCM level

This test runs from the scheduled BRT. The scheduled test selects an LCM that did not have drawers tested during the BRT window. The office parameters define this BRT window. The system runs a BRT on each drawer of this LCM.

Drawer level

This test runs from the LCM-level scheduled test or manually from the LCM MAP display level. This test is a single LCM drawer test.

The office-level test loops over the LCMs in an office and performs the LCM-level test. The LCM-level test loops over each drawer of a set LCM and performs the drawer-level test. The drawer-level test is a BRT.

Office parameters for user scheduled tests

Scheduling for the BRT uses the information from the new office parameters in table OFCVAR. The new parameters are BICRELAY_XLCM_TEST_SCHEDULE and BICRELAY_NUM_SIMUL_TESTS. These parameters provide user flexibility to schedule the BRT from one to seven days a week. You can define the window size, and define how many tests (LCM-level) run at the same time. These parameters follow:

- BICRELAY_XLCM_TEST_SCHEDULE
  - This parameter defines the start time (BRTST_START_TIME) and stop time (BRTST_STOP_TIME) for the office-level test. These times cannot be the same. The test window must be a minimum of 10 min in length. The last field of this parameter, BRTST_DAYS_OF_TST, specifies the day or days of the week that the office-level test runs. This field can have values MON, TUE, WED, THU, FRI, SAT and SUN.

You can enter up to seven days in any combination. You cannot enter the same day more than one time.

- An error message can appear. This message appears when the start and stop times are the same or when the test window is less than 10 min.
- You can attempt to make a change during the defined test window when the test is in progress. When this event occurs, a message appears that indicates that you can stop the BRT. You can stop the BRT with the BICRELAY OFF command. When the BRT stops, you can make the necessary changes. You can restart the BRT with the BICRELAY ON command.

- BICRELAY_NUM_SIMUL_TESTS
  - This parameter indicates the number of LCM-level tests to run at the same time.
  - The start and stop times of BICRELAY_XLCM_TEST_SCHEDULE and this parameter configure the number of LCMs that the system tests.
  - You can attempt to make a change during the defined test window when the test is in progress. When this event occurs, a message appears that indicates you must wait until the test stops. When the change must occur immediately, you can stop the BRT. Stop the BRT with the BICRELAY OFF command at the command interpreter (CI) level. Make the necessary changes. You can start the BRT with the BICRELAY ON command.

Out of service unit tests

The BIC tests occur during out-of-service LCM unit tests. Drawer tests test drawers in the ISTb or SysB state. Out-of-service unit tests treat previously defective drawers as follows:

- With both units out-of-service, any drawers with the SysB state change to the ISTb state. This event occurs to allow the out-of-service tests to test the drawers. When the defect continues, the system sets the drawer to SysB. When drawers do not have in-service trouble, the state changes to InSv.
- With only one unit out of service, the system tests drawers with the ISTb and the InSv states. This event occurs because the mate unit is InSv and controls all drawers. Drawers with a SysB state do not change or test.

Changes in table LCMINV

The BICTST is a new field in table LCMINV. The BICTST is a boolean value that indicates when a specified LCM is in the test schedule.

Table control for table LCMINV allows you to change the MEMSIZE of a specified tuple. The size changes from 64 kB to 256 kB. The change occurs when the LCM is InSv. This change can occur without a change of load in the

LCM to an XLCM load. When this event occurs, the BRT does not test the LCM. You must busy the LCM, reload the LCM with an XLCM load and RTS the LCM. This action includes LCM in the test schedule.

An office-level test or manual LCM-level test attempt can occur on an LCM with a load that is not changed. When this event occurs, the test does not run. The system outputs a log that indicates the LCM does not contain an XLCM load.

You can change the MEMSIZE field from 256 kB to 64 kB. When you changes this field, the BICTST field must be set to NO. The BICTST field can be set to NO. When this event occurs, a message appears that indicates that the BICTST field is set to YES. The value YES is valid only for XLCMs. The system rejects the change. When you set the MEMSIZE field to 256k, you can set the BICTST field to YES or NO. The system includes any LCM entry in table LCMINV, with the MEMSIZE field set to YES, in the test schedule.

BICRELAY command

The BICRELAY command allows you to enable, disable, reset, allow or disallow the PM181 drawer state to change logs. The drawer state changes logs when a set LCM undergoes the system BRT. Operating company personnel can perform the following actions:

- query the ON or OFF state of the BRT
- determine when the system allows or suppresses the PM181 drawer-state change logs
- query the number of BRTs in progress
- query the next LCM that the system BRT intends to test

Note: The system suppresses the PM181 logs associated with the LCM undergoing the BRT. The system allows any other PM181 log associated with any other LCM or XPM.

The following paragraphs describe the BICRELAY command parameters.

ON

The ON parameter allows the test to begin at the scheduled window. A message appears that indicates the test is turned ON. When the current data and time occurs in the scheduled window, the office-level test starts. When tests are in progress when you issue this command, a message appears. This message indicates you must wait until all tests are complete before you start the BRT. This option does not affect the operation of the manual TST command at the LCM MAP display level.

OFF

The OFF parameter does not allow the resumption of the office-level test. A message appears to indicate the test is OFF. Any system BRTs in progress can complete. OFF is the default.

When the test is disabled, the test does not begin until enabled with the ON option. When the ON option allows the test, the office-level test resumes at the point where the test was turned OFF. This option does not affect the operation of the manual TST command at the LCM MAP display level.

SUPPRESS

When an LCM undergoes a system-initiated BRT, the system busies, tests and RTSs each drawer. When these state changes occur, the system generates a PM181 log that indicates the change. This parameter allows the user to suppress PM181 logs for any LCM that undergoes a system BRT. The system does not suppress the PM181 logs for an LCM that does not in a current system BRT. The SUPPRESS command does not affect a manual BRT run on a single drawer. The parameter can be issued at any time. A message appears that indicates the system suppresses the logs.

ALLOW

The ALLOW parameter allows the PM181 drawer to change logs. The system BRT causes these logs.

RESET

The RESET parameter allows the user to restart an office-level test as if the LCMs had not been tested before. The user must turn the test OFF before use of this parameter occurs. When the user attempts to reset the BRT when the BRT is ON, a message appears. This message indicates the BRT must be OFF before RESET can occur. All current tests must be complete before RESET can occur. Use this option at any time. This option does not affect the operation of a manual TST command at the LCM MAP display level.

QUERY

The QUERY parameter displays the following:

- the current ON/OFF status of the office-level test
- the number of LCM-level tests in progress
- the next LCM to test in the scheduled BRT in the format of HOST 00 0 0
- the status of the SUPPRESS/ALLOW commands

Test operation

The system performs BRT for each LCM. When a manual BRT occurs, the BRT occur for each drawer. For tests that run on each LCM, the BRT occurs on all drawers of the LCM automatically. Use the TST DRWR *drwr_no*

RELAY command at the LCM MAP display level to start the single drawer test.

Office-level test

The system test performs the following steps:

- loops over each LCM the test schedule includes
- loops over each drawer for each LCM
- runs one tip and ring reversal relay test for each drawer
- generates one logutil report with the results of all 20 drawers
- sets the drawer and node ISTb status according to the logutil report

LCM-level test

The system runs an office-level (automated) test when you enter the scheduling in the office parameter. When the system tests an LCM, the system does not reset the LCM until each LCM in the office tests correctly. When all LCMs that the schedule includes test in the window, the BRT stops. Tests resume when the next window arrives. When the system does not test an LCM, the system skips the LCM in the current window. The system generates a PM181 information log that indicates the reason the system does not perform the test. When an LCM test runs when the stop time arrives, the current LCM-level test can complete.

The BRT stores the first LCM tested in the specified window. The system compares each following LCM to test to the first LCM. When the LCMs are the same and the current date and time are in the window, the BRT stops. When the system does not test all LCMs in the window, the BRT begins. The BRT begins at the point where the BRT ends during the last scheduled window.

The user can schedule the BRT to run at the same time with the automatic line test (ALT) or the LCM REX test. The BRT and the ALT *cannot* run at the same time for the following reasons:

- The necessary test equipment these tests use reduces the number of LCMs the system can test in the window.
- The completion of the ALT slows.

None of these tests run at the same time on the same LCM. The user must define a window that occurs at the same time as the scheduled ALT or REX test.

The LCM audit, the manual REX and the system REX cannot run on the same LCM that runs the system BRT. The LCM PM/UNIT cannot become ManB during the system BRT.

Tests at the same time (for each LCM)

The LCM tests run at the same time when test equipment is available to the maximum number the BICRELAY_NUM_SIMUL_TESTS parameter described indicates earlier. LTUs or MTUs must be provisioned to allow the number of tests that occur at the same time (LCM-level) to run. Because of real-time considerations, the BICRELAY_NUM_SIMUL_TEST parameter has a range of one through three. A higher number in this field allows tests for more LCMs in a given window.

Drawer-level test

The BRT drawer-level test requires the metallic test equipment and a single NT6X17 line card. The test equiptment and card must be present in each drawer to test. The system uses the line card to test the BIC relay. The line card must function correctly. The card must not indicate a diagnostics failure at the MAP terminal. The system cannot indicate the card as missing (M).

The system places each drawer in a ManB state before the drawer-level test. Each drawer is out of service for 10 s. During this time, the system suspends call processing. When the tip and ring reversal relay test on all drawers completes, the results appear in a single new logutil report PM132. The PM132 report includes the results of each drawer test of a specified LCM. When a drawer is out of service or call processing is in progress, the system skips the drawer. The system tests the drawer on later passes of the BRT.

Single-drawer test

The single-drawer test is for retest purposes when a failure occurs during the system test. This test is run from the LCM MAP display level. This test is part of the TST DRWR command. The RELAY option allows the BRT to run without the main DRWR test. The BRT only runs when the use specifies the RELAY option. You must set the drawer to ManB before this test runs. The system prompts the user when the drawer is InSv, ISTb or SysB. The manual BRT cannot run on a drawer where the LCM node is ManB, SysB, C-side busy (CBsy) or offline (OffL). A message appears that indicates the request is not valid. The message gives the current state of the node.

The single-drawer test displays a PM181 log and the results of the test. A response and a card list that indicates failed drawers appears at the MAP terminal. When a single-drawer test cannot run, the drawer is not set ISTb. The drawer can be RTSed to the previous state.

Office-level test

The system BRT uses a new logutil information report, PM132, to display the results of each LCM-level test.

The PM132 displays a combined report of each drawer-level test in a set LCM. The PM132 indicate the following:

- test passes
- reversal test fails
- test does not run because line card is not available
- test does not run because of problems encountered with the MTE
- test does not run because test aborted
- test does not run because drawer was previously out-of-service
- test does not run because of call processing is in progress
- test does not run because of bad hardware
- test does not run because of message link problems
- test does not run because resources are not available
- test does not run because of an invalid load in the LCM
- test does not run because of an error condition the system did not expect
- test runs but drawer failed to RTS after test
- test does not run because of conflicts in maintenance software

Refer to the chapter *OPM/OPM related logs* for the syntax of test result reasons.

Equipment that is not available does not allow the LCM-level test to run before each drawer tests. When this event occurs, the system does not test the LCM. The system generates a PM181 log and the LCM node state does not change.

When a drawer test fails to run, the drawer remains in the current state. The system tests the drawer again in a later window.

QUERYPM FLT command

Additional information to the QUERYPM FLT command is present at the MAP display level of the LCM. This information lists all drawers that fail the BRT and are set ISTb. The node ISTb reason is reset to DRAWER FAULT.

Restarts
The following information applies to manual and system-level restarts:

- warm or cold
  - — the system aborts all drawer-level tests.
  - — the system saves ISTb reasons.
  - — All LCM-level tests stop and are system level when the tests are in the window. The test resumes after the restart. The system does not retest the LCMs.
- reload
  - — The system resets BRT as if the RESET option of the BICRELAY command is issued.
  - — The system retains the ON/OFF settings of the BICRELAY command.
  - — The system retains the state of the SUPPRESS/ALLOW commands.
  - — The system clears the ISTb reasons.

Interactions
This feature uses the test access bus, the MTE and a single NT6X17 card in each drawer to complete tests. The ALT and the BRT cannot run at the same time. This action delays both tests because both tests use the same test equipment.

When REX runs on a set LCM, BRT does not run on that LCM. The LCM remains in the current state. The system outputs a PM181 that indicates the BRT does not run because of the REX in progress.

Limits
The following limits apply to this feature:

- The system test manually busies the logical drawer before the system runs the RELAY test. When lines are in a call processing busy state, the system skips this drawer for this test cycle.
- The drawer must be ManB before a manual BRT runs on a single drawer.
- The user must enter all NT6X17 line in each logical drawer. When this requirement does not occur, the system does not test the drawer.
- When the line card selected for tests is removed during the test, the drawer fails.
- When a drawer fails to RTS when the system BRT is complete, the system places the drawer SysB. The system audit can attempt to return the drawer to service.

- This test is not run on an LCM at the same time as an LCM audit and a REX test.
- The user must not enter BRTST_START_TIME and BRTST_STOP_TIME fields of the BICRELAY_XLCM_TEST_SCHEDULE office parameter with the same value. A minimum of 10 min must separate these fields.

Subscriber lines automatic maintenance

Automatic subscriber line tests occur on line circuits and loops. These tests normally occur on a schedule. These tests occur without switch operator involvement other than for initial scheduling. In a DMS-100 switch office, these tests occur under the Lines Maintenance Subsystem (LNS).

LCM REXTEST

The LCM REXTEST consists of two funtions. This test runs out-of-service diagnostics for each LCM unit and in-service diagnostics for each unit in normal and takeover modes. The NODEREXCONTROL office parameter in table OFCVAR controls this test.

The REX occurs during the specified interval for one LCM at a time. The tests occur in the order the user enters the LCMs in the inventory table. The system cannot always test each LCM in the office during the REX interval. When this condition occurs, REX starts where REX stopped during the previous interval when the next interval starts. The system takes a maximum of 15 min to perform a REX test on an LCM.

LCMREX test flow

A REX test for an LCM includes the following procedure:

1. When both units of the LCM are in service, unit 0 is made SysB. The system generates a PM128 state change log with the reason `REX in progress`. The LCM node status is made ISTb. The system generates a minor alarm.
2. In-service diagnostics are run on unit 1. Unit 1 is in takeover. When diagnostics fail, the system places the unit ISTb and generates a PM181 log.
3. Unit 0 is RTS. The system runs OOS and in-service diagnostics. When out-of-service diagnostics fail, the system leaves the unit SysB. The system raises a major alarm and generates PM106. When the unit is RTS correctly and the in-service diagnostic fails, the system places the unit ISTb. The system generates a PM181 log.
4. When unit 0 is RTS correctly, the system repeats this procedure for unit 1.

When a REX test fails, the system generates a PM600 log. The PM600 log initiates a major alarm for the XPM that fails the REX test. The major alarm appears at the MAP terminal under the PM banner at the top of the display. The system generates a PM181 log after a complete REX test.

When an InSv or OOS diagnostic test fails, the REX test failure reason includes the mnemonic. The mnemonic is an-easy to remember abbreviation of the the failed diagnostic and the failed unit (0 or 1).

The PM600 log contains the start time of each step the REX test that follows. The PM600 log also contains the unit the REX test step affects and the failure reason. The REX test steps that the log includes after the failed step are recovery actions. The REX test initiates these recovery actions because of the failure. The log includes the unit number when the REX test action is unit-specific (BSY unit, RTS unit, TST unit, sync). The REX test acion must not affect the node (SWACT, BSY both units). The additional data of the log consists of a card list and a mnemonic of the failed diagnostic.

The QUERYPM, QUERYPM FLT, TST REX QUERY and *TST REXCOV QUERY* commands contain information on the last REX test. Manually and system-initiated REX tests store and display a new date, time and status. The status is passed or failed. The tests store this information in the REX test maintenance record. The status *Passed* means the REX test completed without errors. The status *Failed* means the REX test did not complete because of an error. This information is available through the QUERY PM and TST REX QUERY commands. When the REX test fails, the user performs a manual RTS, a manual REX test or an automated REX test. The user performs these actions to return the XPM to service from ISTb.

The system stores a REX test maintenance record for each XPM. The record contains the following information:

- the REX test scheduler, when the XPM is in the system
- date, time and result (passed or failed) of the last REX test
- failure reason, diagnostics failures and a list of defective cards, if the last REX test failed
- date and time of earlier failed REX test
- date and time of first passed REX test after earlier failure

The following limits apply to REX tests:

- The system REX test controller runs a REX test on one XPM at a time when the office uses the NT-40 processor. The SuperNode supports REX tests at the same time for a maximum of ten XPMs. The XPMs must have the same REX test class.

- A maximum of four LCM_REX_TESTs can run at the same time. This action can occur when the system does not REX test the HOST XPM the tests are associated with.
- The LCM_REXCOV test for converter and ringing voltages in LCM must run separately. The SREX scheduler make sures this condition occurs.
- For a REX test to run, the node must be InSv or ISTb because of a REX test failure.
- When a restart occurs when a REX test is in progress, the system does not generate a PM600 log. This event does not occur because the restart deallocates the temporary data store that builds the PM600 log.

System REX controller: XPM maintenance

Feature AF3771, System REX Controller: XPM Maintenance, provides the SuperNode switch with an S/DMS system REX test (SREX) controller. The controller coordinates all system REX tests under a common REX test scheduler. This feature allows LCM REX tests to run when other REX tests are in progress. The SREX test controller allows performance of a REX test on the whole switch in less time. Tests run on all peripherals, like the OPM. The system performs REX tests to provide early indication of defects that can impact service. The REX tests allow operating company personnel to take corrective measures.

Feature AF3771 allows REX test failures to be found and resolved in a minimum amount of time. This feature reduces outages in the field. The SREX test controller allows operating company personnel to perform the following:

- change the order in which the system tests peripherals
- coordinate between manual- and system-initiated REX tests
- receive alarms for the OPM not REX tested in a time limit set with table REXSCHED

The SREX test scheduler allows the user to enter the CI level REXTEST command and the following parameters:

- The SUSPEND parameter suspends REX tests for one maintenance window. A maintenance window is the time period between the REXSTART and REXSTOP time in table OFCVAR under the NODEREXCONTROL parameter.
- The RESUME parameter resumes REX tests after suspension of REX tests.

- The QUERY parameter returns the status of the REX test. The status is active or suspended.
- The HELP parameter returns a description of the REX test.

The REX test order for feature AF3771 follows:

- critical nodes, like the communications module (CM) and message switch (MS)
- the number of days from the last system or manual REX test
- the order of internal PM number

You must enter table REXSCHED to establish the REX test schedule for the OPM/OPM. This table contains the information the REX test coordinator requires to schedule the tests. Operating company specifications determine the requirement for test shedules. The user can enter table REXSCHED to disable the test. For more information on table REXSCHED, refer to the data schema section of the *Extended Peripheral Module Translations Reference Manual*.

The system generates IOAU112 log report for LCMs when the following events occur:

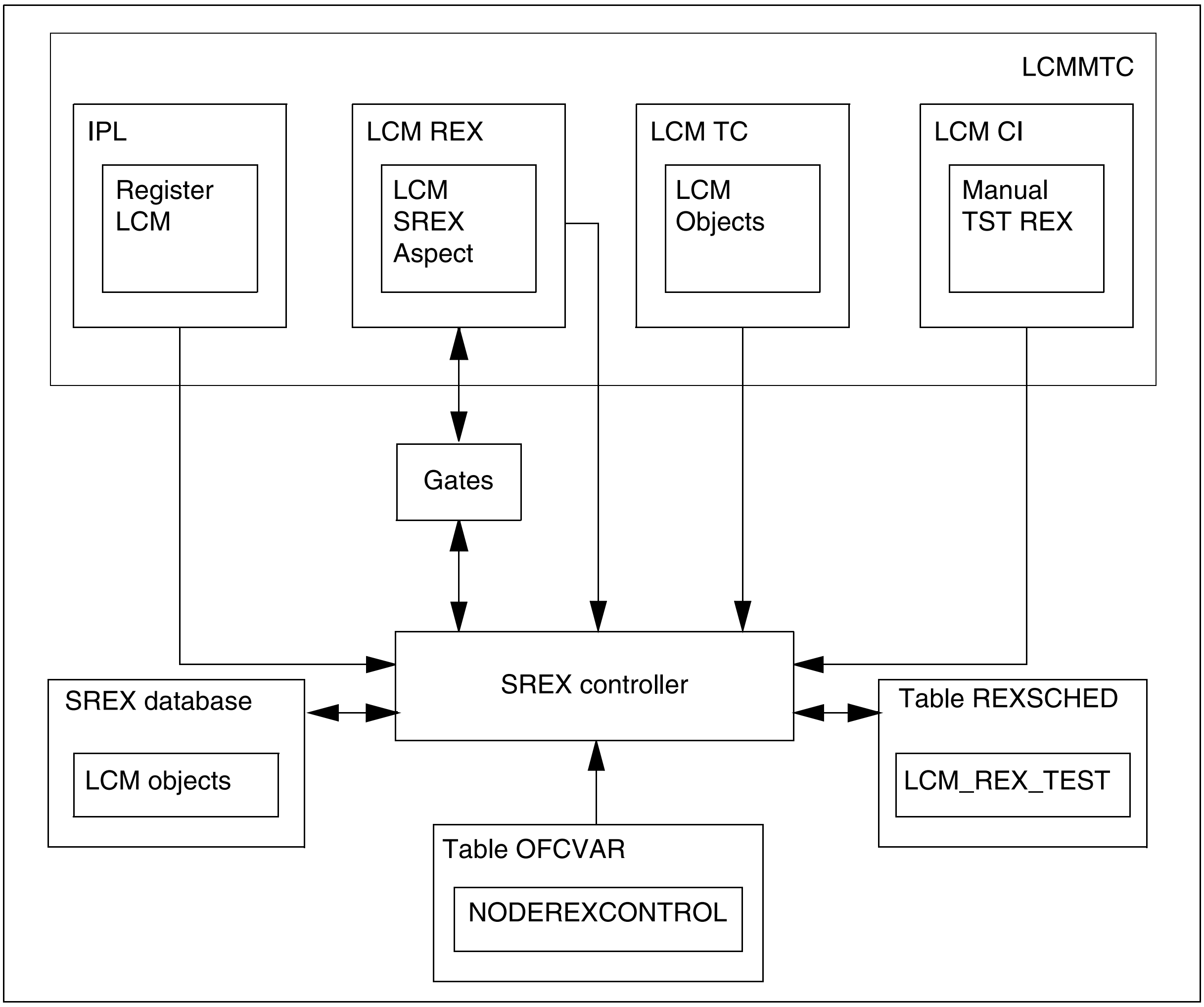
- the LCM does not undergo a REX test in the last seven days
- the REX test takes longer than specified
- the system cannot start REX test after a defined number of attempts

ELCM REX test results

Table REXSCHED controls schedules of system REX (SREX) tests. The LCM_REX_TEST task SREX can run at the same time in multiples of four. This task can run at the same time as REX tests of XPMs. This ability appears in figure “SREX scheduling". The LGC, LTC and the RCC XPMs can be hosts to LCMs. Problems occur when an XPM scheduled for REX tests is the host of an LCM scheduled for REX tests.

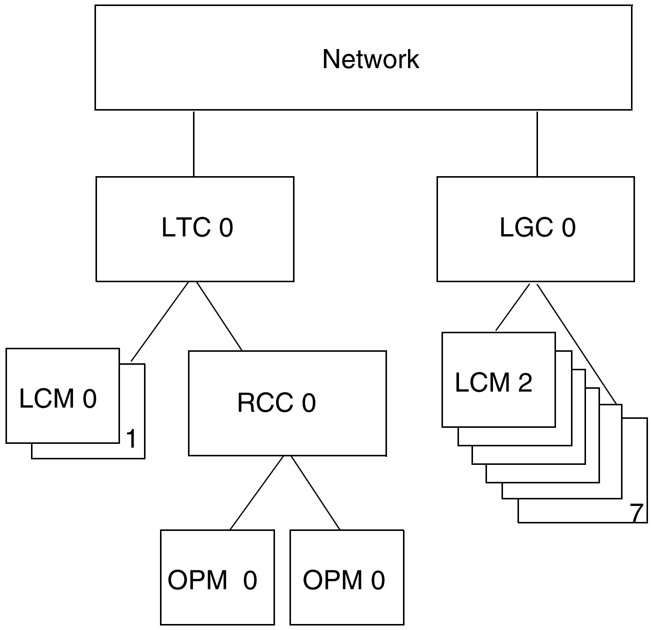
The SREX controller schedules all REX tests of XPMs and LCMs that occur at the same time to avoid problems. This condition appears in the following figure “SREX system dependencies". The LCM SREX subsystem registers the LCM_REX_TEST class and identifies dependencies with other REX_TEST types during initial program load (IPL). The controller makes entries with defaults in table REXSCHED as LCM nodes add to the SREX database.

Figure 17 SREX system dependencies



The converter voltage and ring test sections of LCM_REX_TEST require wait states and unique test resources. These limits cause delays in SREX main task execution that are not acceptable. The LCMCOV_REX_TEST implements these tests separately from the LCM_REX_TEST. The LCMCOV_REX_TEST runs at a lower priority. The LCMCOV_REX_TEST requires logical test unit (LTU) connections in the maintenance line card. An LCM unit can only access the single LTU when the other unit is out of service. This resource limit does not allow LCMCOV_REX_TEST to execute at the same time. The entry of the PARALLEL execution field for LCMCOV_REX_TEST allows a maximum of one LCMCOV_REX_TEST execution. Enter the PARALLEL field in table REXSCHED.

Figure 18 SREX scheduling



Note 1: The REX tests can run on LCM 0 and LCM 1 at the same time as REX tests that run on RCC 0 and LGC 0.

Note 2: The REX tests cannot be run on LCM 2 through LCM 7 if a REX test runs on LGC 0.

Separate the LCM_REX_TEST and the LCMCOV_REX_TEST. This action allows faster completion of site REX_TEST coverage. The LCM_REX_TESTs works without constraints of the converter voltage and ring tests. The LCM_REX_TESTs can run at the same time and scheduled separately for optimum execution periods.

> ***Note:*** Perform LCMCOV_REX_TEST on LCMs, XLCMs and OPMs.

Feature AF3234 provides the following REX test improvements for LCM peripherals and the variants, like LCME:

- ESA REX test
- LCM and ESA-independent REX test
- MAP command for manual REX test
- fault indicators

- REX test maintenance record
- MAP commands to access REX test failures

Emergency stand-alone REX test

The ESA REX tests the ability of OPM units to enter and exit ESA. The ESA REX tests the ability of OPM units to message the ESA processor when in ESA. The ESA REX test begins after the LCM REX test completes.

MAP commands for manual REX tests

The XLCM diagnostics provide the capability to implement a manual LCM REX test. Add a REX or REXCOV parameter to the TST command at the PM level of the MAP display. This action allows you to perform a manual REX test. Examples of this command follow:

>MAPCI;MTC;PM;POST LCM <site><frame><unit>

Note: Post the LCM

>QUERYPM

Note: Displays LCM node information. Feature AF5898 adds information on the LCMCOV REX test.

When the LCM is posted, to set manual control of scheduled LCM or LCMCOV REX tests, type

>TST REX [ON] [OFF]

and press the Enter key

Note: The REX test of the posted LCM is enabled or disabled.

or

>TST COVREX [ON] [OFF]

Note: The COVREX test of the posted LCM is enabled or disabled.

To set LCM REX tests for immediate execution, type

>TST REX NOW

and press the Enter key

Note: Performs LCM_REX_TEST on the posted LCM.

or

>TST COVREX NOW

Note: Performs LCMCOV_REX_TEST on the posted LCM.

The following message appears when you enter the TST COVREX NOW command.

Example of a MAP response:

```
LCM REM1 00 0 will be put into takeover mode during the
COV REX
Do you want to continue with the COV REX test
Please confirm (“YES”, “Y”, “NO”, or “N”)
```

LCM and ESA-independent REX test

The scheduler initiates REX tests on an LCM. The ESA REX test starts when the REX tests complete. A manually started LCM REX test does not start an ESA REX test. A REX test that is not complete sets the LCM to ISTb. This event occurs when InSv diagnostics fail or SysB when OOS diagnostics fail.

Fault indicators

A REX test that does not complete sets the LCM unit ISTb or SysB with a reason of REX failed. The system performs audits on LCMs every 10 min and runs InSv tests. The ISTb flag remains with a REX failed reason. When the audit is not complete and the system detects additional failure conditions, the audit adds to the ISTb list. When the LCM is SysB and the system performs a correct system RTS, the unit returns to ISTb. The unit returns with the REX failed reason. The unit does not return to InSv. To remove the ISTb state, the LCM must complete a manual RTS or a manual or scheduled REX test.

The system generates a node assessment graph (NAG) log report (NAG400) each hour. The system also generates a NAG report in response to the NAG command. The NAG report lists all nodes that are not in-service (InSv). The REX_INFO field of log NAG400 displays the results of the latest REX test. For LCMs, the LCM_REX_TEST result appears first. A colon separates the LCM_REX_TEST result from the LCMCOV_REX_TEST result. For more information on NAG400 logs, refer to the *OPM Related Logs* section of this document.

The CI level NAG command allows operating company personnel to display all out-of-service nodes. The MAP response to the NAG command is like the response that applies to the NAG400 log report. The command and log report are part of the NAG feature. The NAG feature provides a snapshot of nodes in the system that are out-of-service or have a REX issue. Operating company personnel can include the offline nodes in the output. To include offline nodes, enter the command string NAG ALL. The log report function runs each hour. Enter the command string NAG ON or NAG OFF to turn the log report function on or off.

The system can include a node in the output or log report. This event requires that the node must be in SysB, CBsy, ISTb or ManB state. The system can also include a node when the node fails, aborts or does not complete the last REX test. When a node does not have a REX problem, the string ATP appears in the REX column. The string ATP indicates that all tests pass.

The following output describes an abbreviated report in response to the NAG command.

```
Front End Load: FSL37AO
Level   Node        Status  REX INFO    UNTI 0  UNIT 1
   CPU     1          ACT
CM                  NORMAL
MS                  NORMAL
MS                  NORMAL
IOD                 NORMAL
NET                 NORMAL
PM RCC     0         SYSB   ATP         SYSB    SYSB
   LCM  KOPM 12 0    SYSB   PASS:   PASS    SYSB    SYSB
   RMM     1         SYSB   ----          --      --
   ESA     4         SYSB   ----          --      --
    :      :          :       :           :       :
    :      :          :       :           :       :
   SMSR    5         SYSB   ATP         SYSB    SYSB
   LTC     0         ISTB   ATP         ISTB    ISTB
   LTC     1         ISTB   ATP         ISTB    ISTB
   SMA     1         ISTB   ATP         ISTB    ISTB
   IDT     37        ISTB   ---           --      --
   IDT     38        ISTB   ---           --      --
   SMA2    0         ISTB   ATP         ISTB      .
   RCC2    1         ISTB   ATP         ISTB    ISTB
    :      :          :       :           :       :
    :      :          :       :           :       :
   LCM KRCM 03  0     .     PASS:   ----      .       .
Offline Node count:  3
```

REX maintenance records

The system generates a maintenance record from a REX test. This report indicates results of recent REX tests for each LCM entered. This information is available at the PM level of the MAP display for a posted LCM.

> ***Note:*** After a reload restart, the system erases the maintenance record for each LCM.

Escalation to manual maintenance

When automatic maintenance fails to correct a fault in the DMS switch, the DMS switch provides problem indicators. These indicators reveal that a fault condition is present. Alarms are examples of trouble indicators. Some OMs and logs indicate a fault condition and a failure of automatic maintenance. Manual action is necessary as maintenance personnel attempt to clear the fault at the MAP terminal. Refer to the chapter *Troubleshooting chart* for a procedure on how to clear alarms. Refer to the chapter *OPM related logs* for log information. Refer to the chapter *OPM related operational measurements* for operational measurements information.

Alarm conditions

The maintenance system status header on the MAP display screen indicates alarm conditions for the DMS-100 switch subsystems. The alarm conditions and the meanings appear in the following table.

Table 11 Alarm description

Alarm	MAP display	Description
Minor	(blank)	Normally does not affect service
Major	(M)	Normally indicates a condition that threatens to degrade service
Critical	(*C*)	Normally indicates a service outage or potential service outage

The type of alarm present and the alarm severity appear under the header. When several alarms are present, the most severe alarm appears. When this alarm is cleared, the next most severe alarm appears. When an alarm condition is not present, a dot (.) appears under the header PM. The PM system is completely in service when an alarm condition is not present.

The alarms that relate to the OPM appear in the following table. These alarms appear under the PM subsystem header of the MAP display.

> ***Note:*** When nn is greater than 99, two asterisks (**) appear instead of numbers.

Table 12 Alarm class codes, displays, and conditions

PM header display	Condition
`PM` ``	All PMs are in service. Alarm conditions are not in effect.

`PM`
`nnSysB`
`*C*`
	More than 10% of the PMs are SysB-critical alarm.

`PM`
`nnLCM`
`*C*`
	Both units of one or more LCMs are not in-service critical alarm.

`PM`
`LCMRG`
`M`
	Both RGs of an OPM have ISTb and a critical or major alarm is not present.

`PM`
`nnSysB`
`M`
	10% or fewer of the PMs are SysB major alarm.

`PM`
`LCMRG`
`(blank)`
	One RG of an OPM has ISTb, and a critical or major alarm is not present.

`PM`
`nnISTb`
`(blank)`
	The indicated number of PMs are ISTb.

`PM`
`nnCBsy`
`(blank)`
	The indicated number of PMs are CBsy.

`PM`
`nn ManB`
`(blank)`
	The indicated number of PMs are ManB minor alarm.

In addition to the above alarm conditions, ESA module defects can generate alarms at the MAP display PM level. These alarms are the same as the alarms the present peripheral modules raise. The system can generate the following alarms:

- MINOR PM alarm. An ESA module in a ManB state generates this alarm.
- MINOR PM alarm. An ESA module in a CBsy state generates this alarm.
- MINOR PM alarm. An ESA module in an ISTb state generates this alarm.
- MAJOR PM alarm. An ESA module in a SysB state generates this alarm.
- CRITICAL PM alarm. The system generates this alarm when a maximum of 10% of the peripheral modules are in a SysB state

Subscriber lines manual maintenance

The switch operator identifies subscriber lines that fail to meet quality standards. The switch operator posts the failures at the line test position (LTP) or by output reports the ALT log subsystem generates. Refer to the *Input/Output System Reference Manual*, NTP 297-1001-129. The automatic maintenance failures this manual identifies are manually tested and corrected.

Drawer maintenance

You can monitor and change drawer states from the LCM level of the MAP display. You can manually test a unit at the MAP display to run a drawer test.

When the system detects a defective card, you can remove the drawer of the card. Removal of this card does not affect other call proccessing or LCM maintenance. Test and replace this card after removal.

3 PRLCM overview

The PCM30 remote line concentrating module (PRLCM) is a remote peripheral module that provides extended geographic coverage for the DMS-100 switch. The PRLCM is configured to operate at a distance of up to 160.9 km (100 mi) from the host office.

The PRLCM contains hardware and software maintenance components that perform routine audits and identify malfunctions in the following:

- PRLCMs
- PCM30 links that connect the PRLCM to the host controller
- subscriber lines

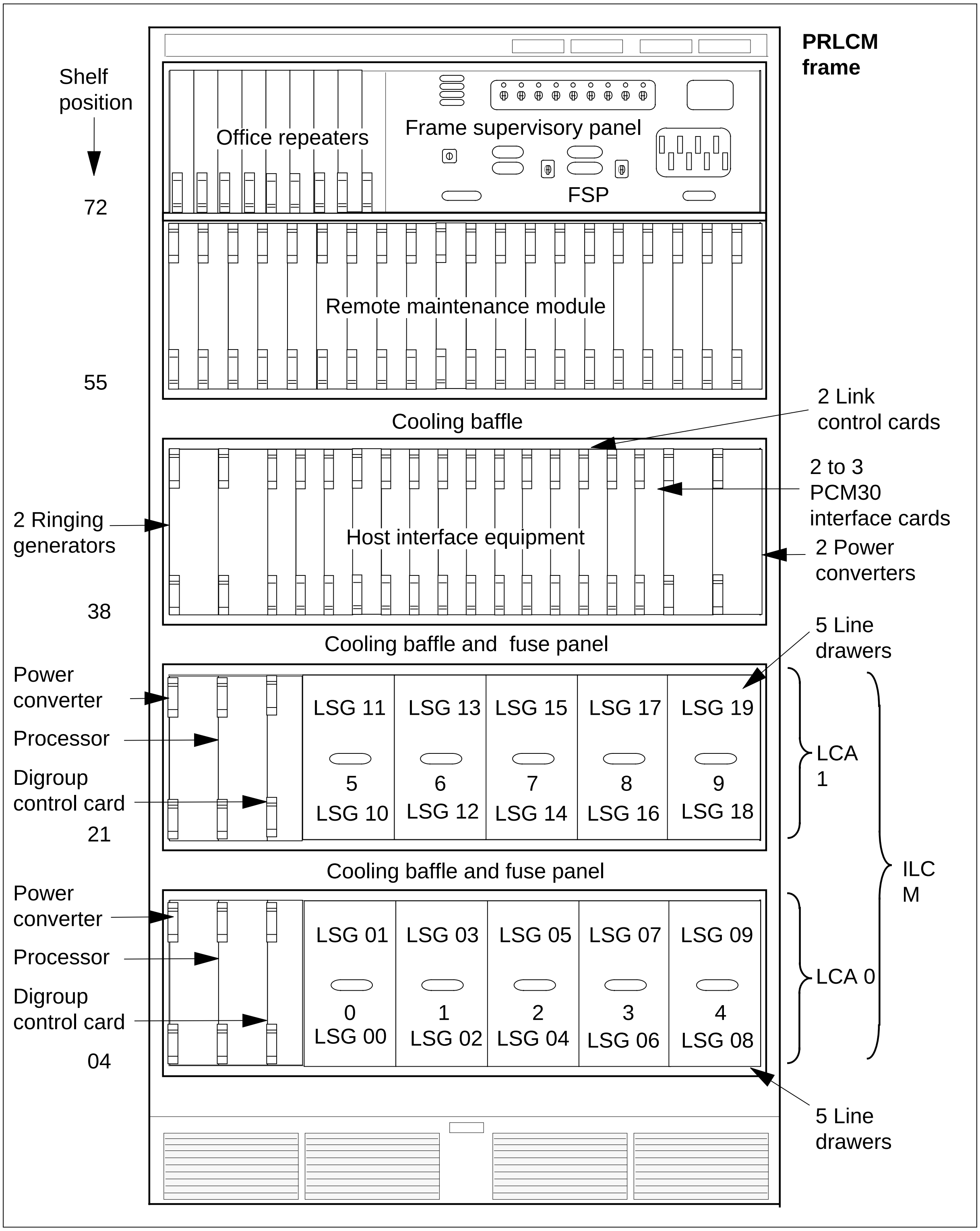
PRLCM configuration

The PRLCM is housed in a standard DMS-100 switch single-bay equipment frame. The PRLCM frame contains the following components:

- standard dual-shelf international line concentrating module (ILCM)
- host interface equipment (HIE) shelf
- single-shelf remote maintenance module (RMM)
- frame supervisory panel (FSP)

The lower part of the frame contains the ILCM, consisting of two line concentrating arrays (LCA). The LCAs are accompanied by cooling baffles and fuse panels. The upper part of the PRLCM frame contains the HIE shelf, the RMM shelf, and the FSP. The FSP provides power control and alarm circuits for the LCM, HIE, and RMM shelves and for the ringing generators (RG) in the HIE shelf. See the following figure for the layout of the PRLCM equipment frame.

Figure 3-1 PRLCM frame, shelf, and panel arrangement



International line concentrating module

The LCM occupies shelf positions 04 and 21 of the PRLCM frame. The dual unit LCM contains two LCA shelves. LCA-0 is always the bottom array or shelf and LCA-1 is the top array of the LCM.

Baffle and fuse panels above each LCA permit air circulation for convectional cooling and carry sets of five +5V, +15V and -48V fuses for the line drawers, as well as a pair of fuses for the ringing voltage outputs (RA and RB). Each LCA shelf is equipped with a processor, digroup controller, power converter, and five line drawers.

Each line drawer connects up to 64 line cards, one for each analog subscriber line serviced by the PRLCM. The 64 line cards are divided into two groups of 32. Each group of 32 line cards is called a line subgroup (LSG).

The 10 line drawers and the 20 LSGs in the 2 LCA shelves are identified in the previous figure.

The maximum number of lines (640) that may be connected to an PRLCM is derived from the number of line drawers (10) times the number of line cards in a drawer (64).

Host interface equipment shelf

The HIE occupies a single shelf at position 38 in the PRLCM frame. The HIE allows the LCA shelves of the PRLCM to connect both to the RMM and to the host office. The HIE shelf contains the following components:

- two ringing generators
- two line control cards (LCC)
- two to three PCM30 interface cards
- two power converters
- one emergency stand-alone (ESA) control complex

Ringing generators

The two ringing generators occupy slots 01 to 08 in the HIE. Each generator is four slots wide.

The ringing generators contain the frequency circuits that generate ringing signals to subscriber line cards on the LCA shelves.

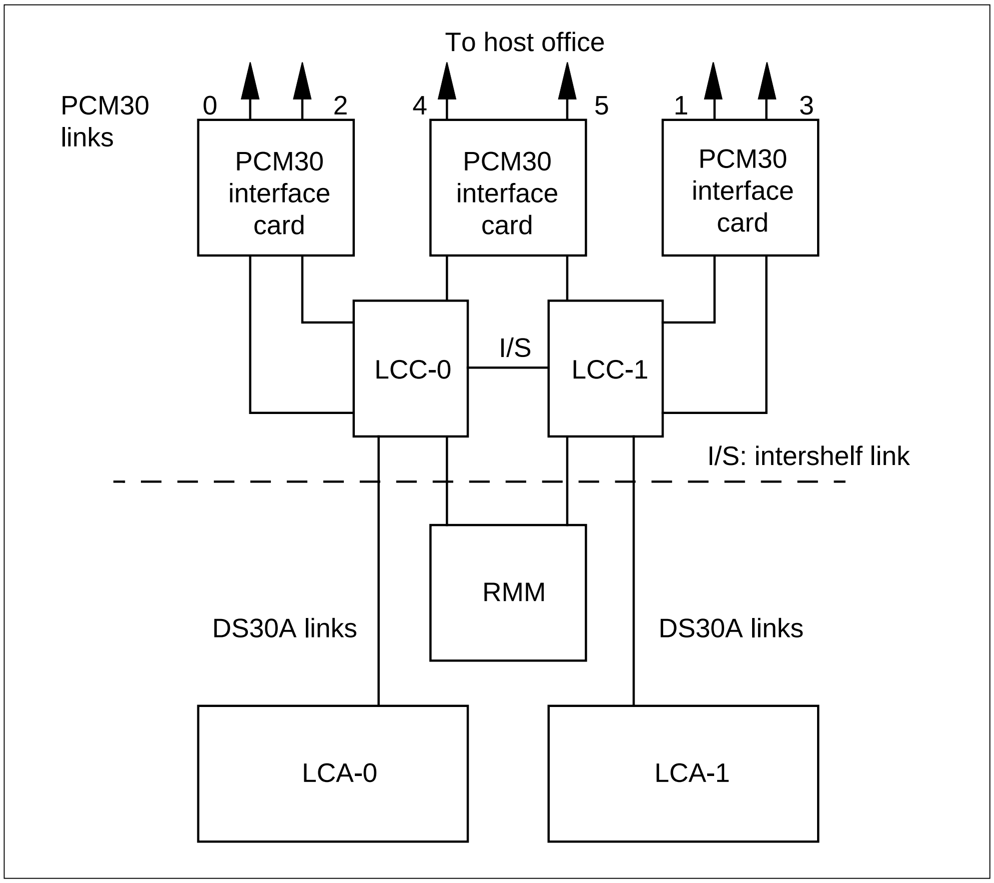
The ringing generators also contain automatic number identification (ANI) and coin generator circuits that check for two- or four-party ANI, and for coin presence in prepay coin telephones.

The ringing generators also produce voltages required for ANI and coin control (48 V dc and 130 V dc). They monitor ANI and coin voltages and ring bus outputs for failure.

Link control cards

The two LCCs fill slots 17 and 18 of the HIE. Each LCC provides an interface between eight DS30A ports from an PRLCM LCA shelf and the PCM30 links to the host office. The LCCs also provide an interface between the ESA processor, if provisioned, and the ILCM. The following figure shows how the PCM30 links are terminated on the LCC and in the LCA.

Figure 3-2 LCC interface to PCM30 interface cards



Under normal conditions, when both are active, LCC-0 connects LCA-0, and LCC-1 connects LCA-1. LCC-0 serves even numbered PCM30 links (0, 2, and 4) from the PCM30 interface cards, and LCC-1 serves odd numbered PCM30 links (1, 3, and 5). The following figure shows how the LCCs are configured in the PRLCM.

One-to-one mapping of LCA primary ports with PCM30 links means that all 24 channels of a PCM30 link come out of one 32-channel DS30A port. Extra channels are used for control and signaling, from the host, and for intra- and interspeech channels.

The LCC accepts eight DS30A links from its LCA. Through the LCC, these links provide the following:

- message and speech paths to the host
- connection to the RMM
- link-sharing resources for each LCA

The LCC also provides system clocks for the digroup controller card (DCC), RMM, and LCM. When both units of the LCM are active, LCC-0 is frequency-locked to its primary PCM30 link, and the LCC-1 clock is locked to LCC-0. Thus, both LCC clocks derive their timing from the same source, which is the host line trunk controller (LTC).

The DS30A ports in the LCA are numbered 0 to 7. Their functions are listed in the following table.

Table 3-1 LCA port assignments and use (Sheet 1 of 2)

Number	Port type	Functions
0,1, 2	Primary	Carries three message channels for the LCA shelf. Message channels are mapped onto channels 1, 2, and 3 of each of the two primary PCM30 links to the host office. Other channels, carrying speech, are mapped onto channels 4 through 24 of the primary PCM30 links.
3, 4, 5	Image	Normally inactive, these ports become active if the mate LCA and LCC are inactive and takeover occurs. Port 3 takes over mate port 0, port 4 takes over mate port 1, and port 5 takes over mate port 2 of the mate LCA. The mapping of all channels onto the PCM30 links is maintained, and the active LCC takes control of all PCM30 links.

Table 3-1 LCA port assignments and use (Sheet 2 of 2)

Number	Port type	Functions
6	Interlink	Provides a DS30A link for intershelf connections. During call processing, the channels on this port allow a subscriber line on one LCA to be connected to a subscriber line in the mate LCA, leaving PCM30 channels to the host office free.
7	Maintenance	Provides the LCA access to the RMM through the LCCs. Through the RMM ports, individual line circuits can be selected and metallic test access (MTA) connections can be made to the tip and ring leads for testing.

PCM30 interface cards

The PCM30 interface cards (NT6X50) are located in slots 19 and 20 of the HIE shelf, and an additional card may be provisioned in slot 21 in place of the filler panel. Each PCM30 interface card accepts two PCM30 links from the host office LGC/LTC and connects them on up to six links to the LCC.

A minimum of two PCM30 cards are required so the two primary message channels from the LCM are carried on different cards for reliability. A third PCM30 card is added only if six PCM30 links to the host are needed to handle the traffic load of the PRLCM.

PCM30 ports are not duplicated, but each processor in the LCA shelves of the PRLCM can control all six PCM30 ports.

Primary ports that map one to one with PCM30 links are known as equipped ports. The number of equipped ports in an LCA depends on the number of PCM30 interface cards provisioned in the HIE. If three PCM30 cards are provisioned, all three primary ports (0, 1, 2) for each LCA are equipped. If a port is unequipped, its ports are either not used or are used for features contained in additional PRLCM feature packages, if provisioned.

> ***Note:*** Links 0 and 1 are message-supporting links that have special maintenance protection applied to them. On each PCM30 message-supporting link, a channel 12 looparound connects the outgoing side of channel 12 to the incoming side of channel 12. This looparound is called extended PCM30 maintenance. The looparound prevents manually busying the link where the looparound is applied when the unit it supports is still in service. When the unit this link supports is manually busied, the looparound (extended PCM30 maintenance) is disabled. At this time, the link can be busied and the looparound is reenabled as NT6X50 card diagnostics for maintenance of the PCM30 link.

Power converter card

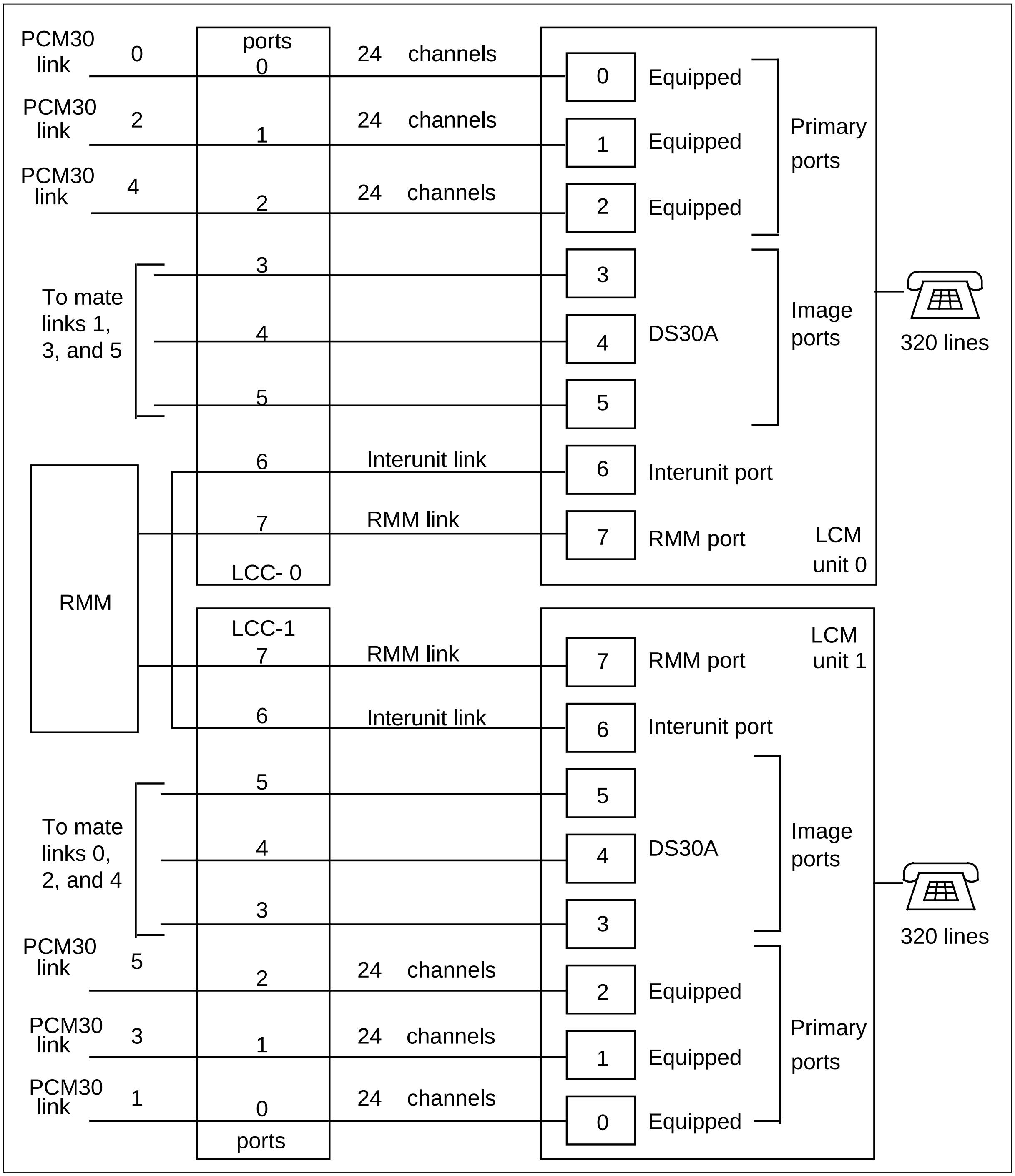
Two power converters occupy the far right of the HIE shelf in slots 22 to 24 and 25, respectively. Slot 25 is the rightmost slot on the shelf.

ESA control complex

If the ESA feature package is provisioned, the HIE shelf contains three additional circuit cards, which are located in slots 14, 15, and 16. These cards are the ESA processor card, the ESA memory card, and the ESA clock and tone card. The ESA configuration and operation is discussed in detail in the chapter “ESA maintenance overview."

The following figure shows the PRLCM link, port, and channel structure.

Figure 3-3 PRLCM link, port and channel structure



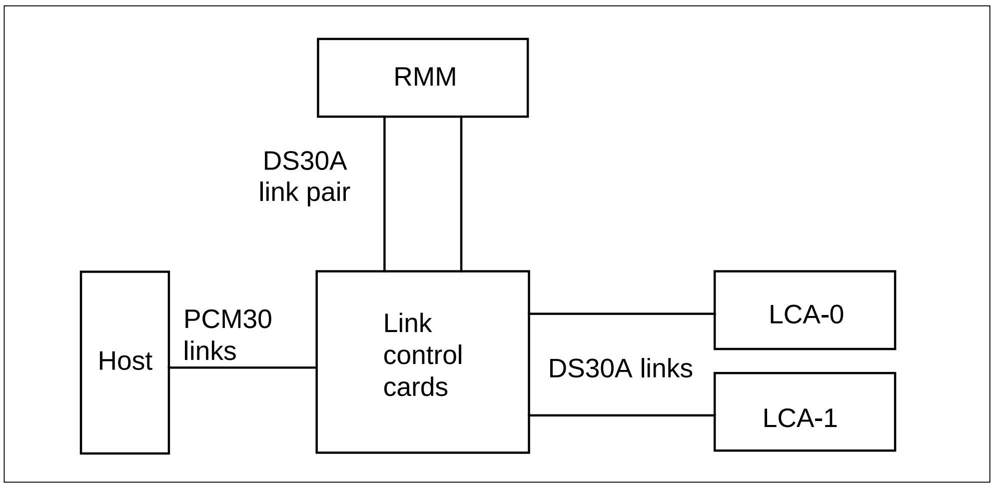
Remote maintenance module

The RMM, which occupies shelf position 56 in the PRLCM frame, is a modified, cost-reduced form of the maintenance trunk module (MTM). The

RMM contains its own processor, which performs scanning of the service circuits and digit collection during ESA.

The RMM C-side interface uses a pair of DS30A links, one to each LCC in the HIE shelf. The DS30A links ensure the RMM is operable, regardless of which LCC is active. The LCC passes maintenance requests from the host to the RMM and provides a link between the RMM and line circuits in the LCA. At the host office, PRLCM maintenance is directed to the RMM using the MAP terminal. The following figure shows how the RMM communicates with both the host and the LCA through the LCC.

Figure 3-4 RMM connection with host and LCA through LCC



Frame supervisory panel

The FSP occupies shelf position 60 of the RLCC cabinet. The FSP provides talk jacks, fuse alarm features, and power control for the RLCM. The FSP contains 48-V distribution breakers to the four cards that control the alarm facilities and power converters in the RLCC cabinet. These cards and their functions are as follows:

- NT6X36AA Alarm card

  This card is used to monitor the power converters in the RLCC cabinet, and generate an alarm when an undervoltage condition occurs in any of the power converters.

- NT6X36AC Fan Alarm card

  This card is used to monitor the power in the RLCC cabinet related to the fan cooling units located below shelf 05 which provides cooling for the RLCM-EDC cabinet, and generates an alarm when an undervoltage or fan failure condition occurs in the cabinet.

- NT0X91AA Alarm and Converter Drive

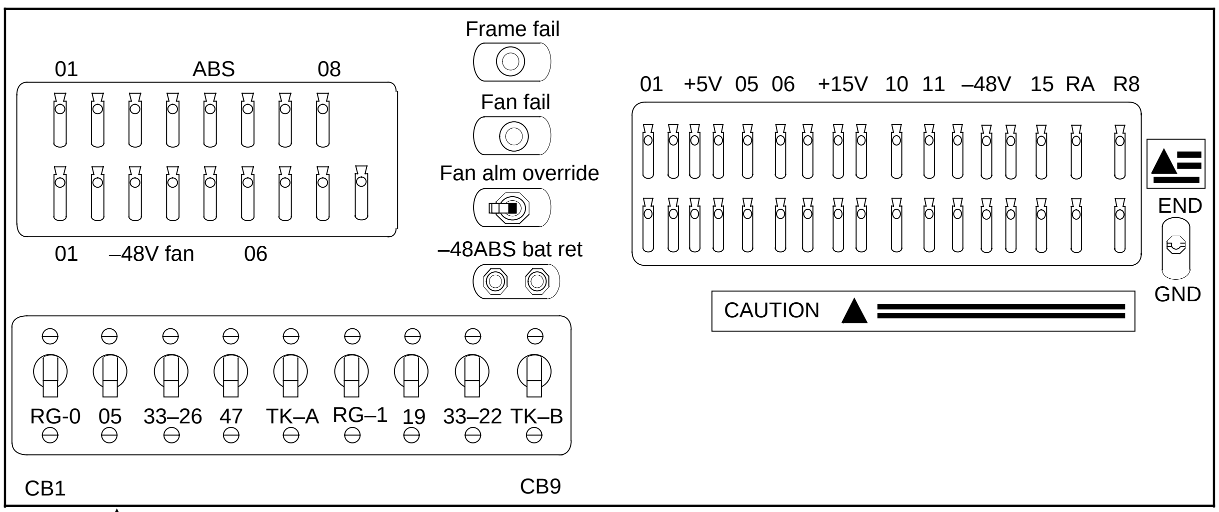
This card controls the alarms and power for the NT6X53AA power converter for unit 1 of the LCM and the NT2X70AA in slot position 22 of the HIE.

- NT0X91AE Converter Drive and Protection Circuit

  This card controls the alarms and power for the NT6X53AA power converter for unit 0 of the LCM, the NT2X70AA in slot position 25 of the HIE, and the NT2X09AA/NT2X06BA in slot positions 17 and 20, respectively, of the RMM.

The FSP has circuit breakers (CB) to distribute -48V power to shelves in the RLCC cabinet. Refer to the following figure, “FSP shelf layout," and table “FSP circuit breaker assignments," for CB power distribution, assignments, shelf type and slot position, product engineering code (PEC) and equipment supported.

Figure 3-5 FSP shelf layout



Not to scale

Emergency stand alone description

The PRLCM with the ESA is a different configuration than the standard PRLCM. Special hardware components are required in addition to the ESA software. Therefore, the ESA configuration is treated separately in this chapter.

Because the PRLCM is a remote configuration, there is always the chance that the communication links between the PRLCM and the host site may be damaged or severed and service interrupted. Therefore, the ESA feature package has been designed for the PRLCM to provide stand-alone call-processing ability in case communication with the host is lost. With the

ESA feature package, the PRLCM emulates the call processing functions of the LTC and the central control (CC).

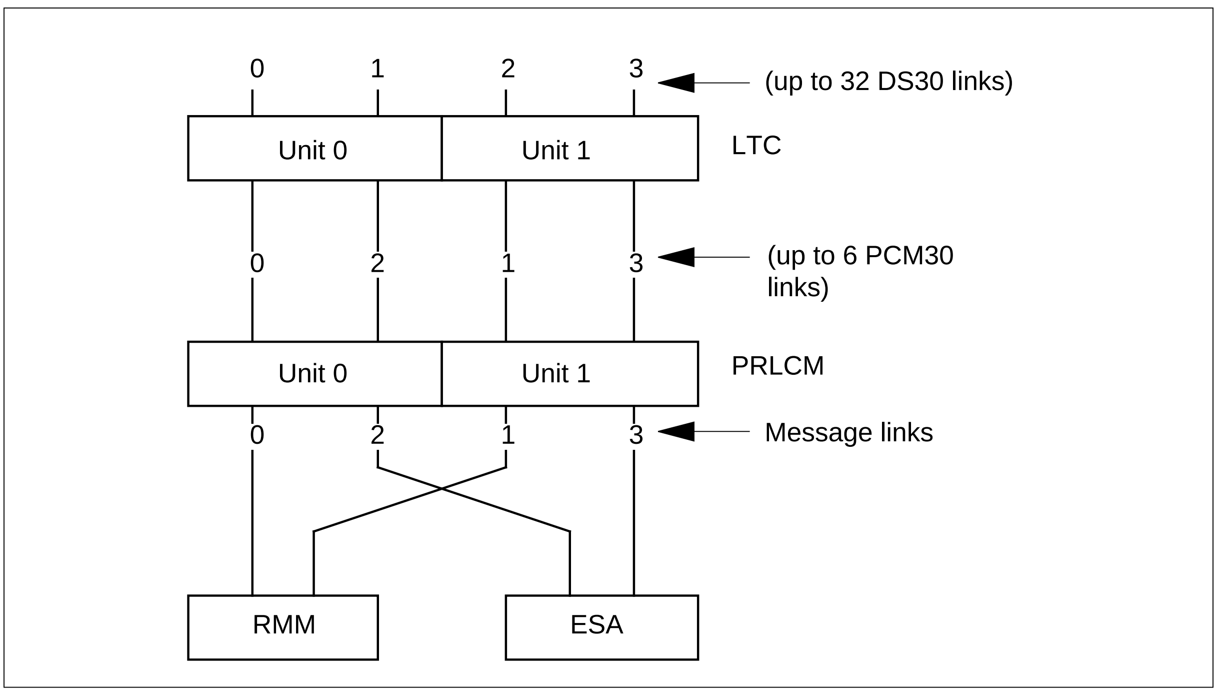
ESA hardware representation

An illustration of the ESA hardware configuration, from the viewpoint of the MAP terminal, is shown in the following figure. This illustration shows the PRLCM as a C-side node to both the ESA processor and the remote maintenance module (RMM). In this case, the PRLCM is not in the ESA mode.

When the PRLCM goes into ESA mode, the illustration in the figure below is no longer accurate. In ESA mode, the ESA processor functionally takes the role of the host peripheral module (PM), in this case, the LTC. This hardware configuration is not seen from the viewpoint of the MAP terminal because the PRLCM is functioning independently of the host.

In the following figure, links 0 and 1 to the RMM are DS30A links supporting 30 channels each. Links 2 and 3 to the ESA processor are single-channel message links.

Figure 3-6 PRLCM ESA hardware representation



ESA operation

The PRLCM enters ESA mode when the PRLCM determines that it can no longer communicate with the host site. The two situations that cause entry into ESA mode at the PRLCM are as follows:

- unusable communication links
- looparound message audit failure

When the PRLCM enters ESA mode, all active calls are taken down. This is called a cold enter.

The ILCM detects the loss of communication with the host. When the ILCM determines the ESA mode is required, the ILCM switches the C-side links from the host to the ESA processor. The ESA processor detects the switching of links through the clock and tone card.

When the ESA processor detects the switching of links, ESA-enter is initiated. The time between loss of communication and ESA mode depends on the type of failure situation.

The ESA processor has a nailed-up (direct) communication link with the DMS CC at all times. The ESA processor is the only processor at the PRLCM that can communicate with the DMS CC during ESA exit. The DMS CC must instruct the ESA processor to exit ESA.

During ESA mode, call processing is done through the ESA processor. The ESA processor contains a module of software, called the ESA CC, that emulates the DMS CC and handles line-to-line call processing. The ESA CC contains a subset of the translation data found in the DMS CC.

This subset is a snapshot of the DMS CC data needed for ESA call processing. The translation data in the snapshot data are known as static data. PRLCM ESA mode is not entered until the ESA processor is loaded with static data.

The download of the static data to the ESA CC from the DMS CC truncates some translation data; thus static data are not true subsets of the DMS CC and only basic calls are supported. During PRLCM ESA mode, plain old telephone service (POTS) and Meridian Digital Centrex (MDC) subscriber lines are supported.

ESA hardware

The additional hardware for the PRLCM equipment frame consists of the following circuit cards:

- one ESA processor card, NT6X45AF
- one 2-Mbyte memory card, NT6X47AB, or one 4-Mbyte memory card, NT6X47AC
- one ESA clock and tone card, NT6X75AA

For a block diagram of an PRLCM with the ESA hardware see the figure PRLCM with ESA Hardware Block Diagram.

NT6X45AF - ESA processor card

This is the same processor card that is used in the LTC. The LTC processor card, when used in the PRLCM equipment frame, is called the ESA processor.

NT6X47AB - 2-Mbyte memory card

This is the same memory card that is used in the LTC. This card provides the memory required by the ESA processor and is used for call processing when the PRLCM enters ESA mode.

NT6X47AC - 4-Mbyte memory card

This is the same memory card that is used in the LTC. This card contains 4 Mbyte of memory, of which 3 Mbyte may be used for call processing when the PRLCM enters ESA. The NT6X47AC is required for ESA loads for BCS33 and up.

NT6X75AA - ESA clock and tone card

This card provides the following:

- a frame pulse for clock generation during ESA mode to replace the lost PCM30 frame pulse from the host
- tones to an LCM during ESA
- an interface so the ESA processor can send and receive messages to and from the host during normal operations. During ESA mode, this card communicates with both units of the LCM and the RMM.

The ESA memory card, processor, and clock and tone card occupy slots 14, 15, and 16, respectively, on the HIE shelf.

NT2X48AB - Digitone receiver card

The Digitone receiver (DTR) card is required in the RMM for ESA operation. The ESA processor brings the DTRs into service when in ESA and turns them off when coming out of ESA. A single card four-channel DTR, NT2X48BB, is also used in the RMM for ESA Digitone calls. In addition to Digitone reception, the RMM provides diagnostics for the ESA processor.

Additional LTC hardware

The additional hardware in feature package NTX154AA for the host LTC is the messaging card, NT6X69. This card allows communications with the ESA processor.

Intracalling during ESA mode

Intracalling provides the capability of switching calls at the remote location during ESA mode.

The number of intra- and interswitched calls supported during ESA is determined by the number of designated intracalling channels on the PRLCM. The number of channels depends on the number of equipped PCM30 ports available and the number of PCM30 links used for host communication.

During ESA mode, all the intracalling is handled through the ESA processor. The ESA processor contains a subset of the translation data found in the DMS CC.

ESA call processing

When the PRLCM is in ESA mode, the ESA CC handles line-to-line call processing. See the figure ESA CC Basic Call Processing Structure.

The ESA CC has only one queue; therefore, all messages from the server are sent to this first-in first-out queue for call processing. Before call processing begins, terminal data are needed. Terminal data are gathered from the static data downloaded from the DMS CC and the dynamic data stored in the terminal status table (TST).

Channel configuration

On ESA entry, the C-side channel map of the PRLCM is reconfigured to provide more interswitch channels for ESA call processing.

Inter- and intraswitch channels make call connections through the PRLCM without involving a host connection. The inter- and intraswitch capability allows call processing to continue in ESA operation.

On PRLCM ESA entry, the PRLCM channels are configured as if all PCM30 ports are unequipped except for primary ports 0 and 1. Ports 0 and 1 must be equipped in PRLCM ESA.

By reconfiguring the C-side channels on ESA entry, more interswitch channels are available for unit-to-unit calls. Refer to the following table for a list of the channel breakdown in PRLCM ESA.

Table 3-2 Channel availability after ESA entry

Port number	Number of intra channels	Intra channels	Number of inter channels	Inter channels
0	6	2, 7, 12, 18, 23, 28	0	none
1	6	2, 7, 12, 18, 23, 28	0	none
2	18	2, 3, 5, 7, 8, 10, 12, 13, 15, 18, 19, 21, 23, 24, 26, 28, 29, 31	12	1, 4, 6, 9, 11, 14, 17, 20, 22, 25, 27, 30
3	18	2, 3, 5, 7, 8, 10, 12, 13, 15, 18, 19, 21, 23, 24, 26, 28, 29, 31	12	1, 4, 6, 9, 11, 14, 17, 20, 22, 25, 27, 30
4	18	2, 3, 5, 7, 8, 10, 12, 13, 15, 18, 19, 21, 23, 24, 26, 28, 29, 31	12	1, 4, 6, 9, 11, 14, 17, 20, 22, 25, 27, 30
5	18	2, 3, 5, 7, 8, 10, 12, 13, 15, 18, 19, 21, 23, 24, 26, 28, 29, 31	12	1, 4, 6, 9, 11, 14, 17, 20, 22, 25, 27, 30

By reconfiguring the C-side channels on PRLCM ESA entry, the PRLCM does not gain channels overall. However, the PRLCM does gain in the number of interswitch channels offset by a decrease in the number of intraswitch channels.

Exiting PRLCM ESA mode

After communications are restored, the DMS CC recovers the PRLCM from the ESA mode. When the PRLCM exits ESA mode, all active calls are taken down. This is called a cold exit.

When C-side communications are restored between the PRLCM and the DMS CC, the DMS CC initiates the ESA exit sequence. Before the ESA exit sequence begins, the DMS CC communicates with the ESA processor over the nailed-up connection. This communication determines if the PRLCM is in ESA mode and if the PRLCM can be recovered immediately. The two possibilities for recovering the PRLCM are a system exit or a manual exit.

ESA system exit

A system exit is an automatic exit from ESA mode started by the DMS CC without operator interference. A system exit is started if the following situations are present:

- At least one LCM unit of the PRLCM is SysB or C-side busy (CBsy).
- The PRLCM_XPMESAEXIT office parameter time-out value is not zero.

The following is the system exit sequence:

1. The C-side communications are restored between the DMS CC and the PRLCM.
2. The DMS CC discovers the PRLCM is in ESA mode.
3. The DMS CC enters ESA time-out mode.
4. When the DMS CC times out, the DMS CC sends an ESA-exit request to the ESA processor.
5. The PRLCM and the ESA processor perform exit operations.
6. The ESA processor tells the LCM to return the LCC to normal operations.
7. The ESA processor sends operational measurements, peg counts, and the reason for entering ESA mode back to the DMS CC; this information is displayed in the PM171 log. The PM181 log is generated if the ESA exit has problems.
8. The DMS CC returns the PRLCM to service.
9. Return to service the ESA processor and RMM nodes.

ESA manual exit

A manual exit is an exit from ESA mode started by operating company personnel at the LCM MAP level using the RTS command. A manual exit is required if any of the following situations are present:

- Both LCM units of the PRLCM are in a ManB state.
- The PRLCM_XPMESAEXIT office parameter time-out value is zero.

Manually overriding a time-out value other than zero by manually busying the LCM units of the PRLCM at the LCM MAP level starts a manual exit. The FORCE option should also be used with the BSY command.

The following steps describe the manual exit sequence:

1. The C-side communications between the DMS CC and the PRLCM are restored.
2. The DMS CC discovers that the PRLCM is in ESA mode.
3. The DMS CC queries the PRLCM for the number of active calls.
4. The DMS CC displays the number of active calls on the MAP display and queries the operating company personnel if ESA-exit is desired.
5. If operating company personnel confirms to the DMS CC that ESA-exit is desired, the DMS CC sends the ESA-exit request to the ESA processor.
6. If operating company personnel does not want to continue with the ESA-exit, the PRLCM is left ManB. The PRLCM stays in ESA mode.
7. The PRLCM and the ESA processor perform exit operations.
8. The ESA processor tells the LCM to return the LCC card to normal operations.
9. The ESA processor sends operational measurements, peg counts, and the reason that the PRLCM dropped into ESA mode to the DMS CC. This information is displayed in the PM171 and PM181 logs.
10. The DMS CC returns the PRLCM to service.
11. Return the ESA processor and RMM nodes to service.
12. Receiver off-hook

4 ESA maintenance overview

Functional description

The Outside Plant Module (OPM) with the Emergency Stand-Alone (ESA) feature package NTX154AA is a different configuration than the standard OPM. Special hardware components are required in addition to the ESA software. This chapter treats the ESA configuration separately.

When the OPM is a remote configuration, defective or severed communication links between the OPM and the host site can interrupt service. The ESA feature package allows the OPM to provide stand-alone call-processing ability if the OPM loses communication with the host. With the ESA feature package, the OPM imitates the call processing functions of the Line Trunk Controller (LTC) and the central control (CC).

ESA hardware representation

Figure “ESA hardware configuration" illustrates the ESA hardware configuration from the point of the MAP terminal. In the figure, the OPM is a C-side node for the ESA processor and the Remote Maintenance Module (RMM). In this occurrence, the OPM is not in the ESA mode.

In the following figures, links 0 and 1 to the RMM are DS30A links, a link can support 30 channels. Links 2 and 3 to the ESA processor are single-channel message links.

Figure 1 ESA hardware representation

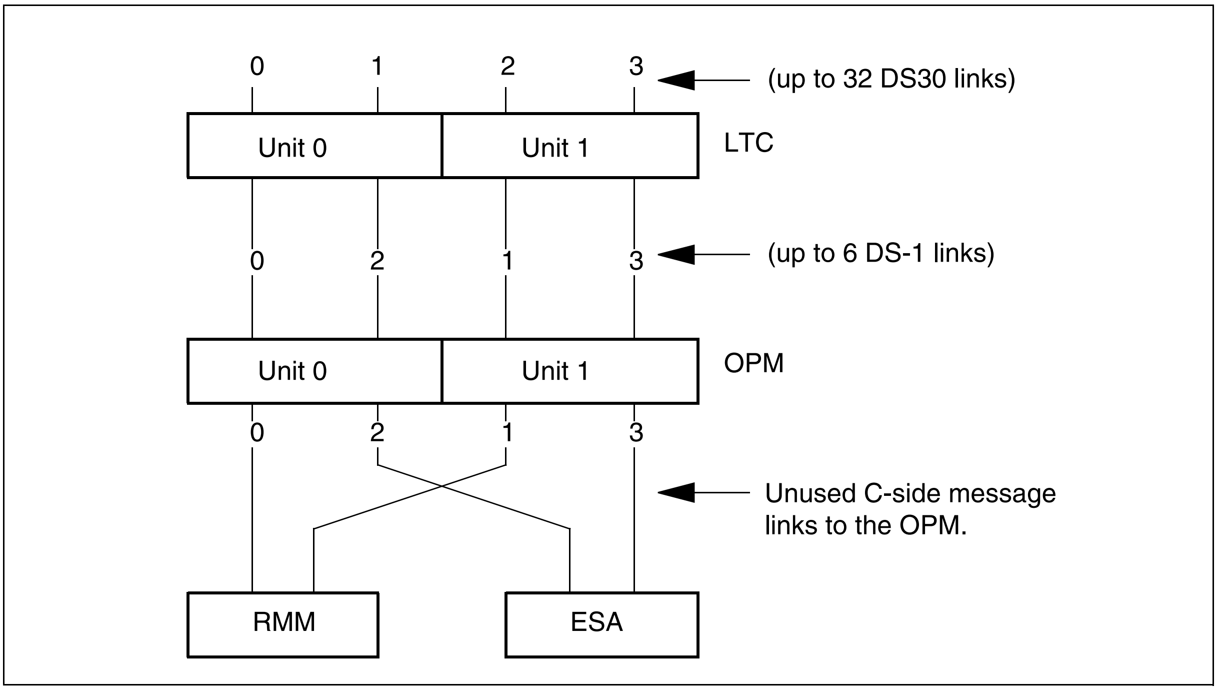
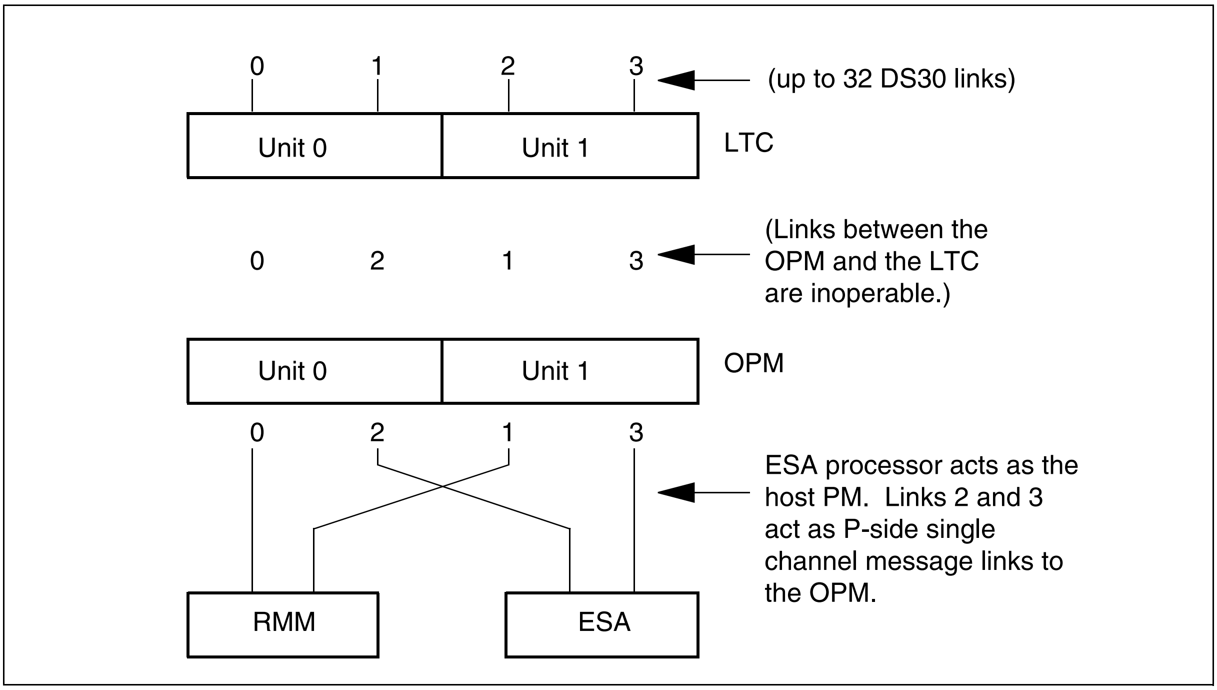


Figure “ESA hardware representation in ESA mode" represents the OPM in ESA mode. In ESA mode, the ESA processor becomes the host LTC. This hardware configuration does not appear from the point of the MAP terminal because the OPM cannot communicate with the host.

Figure 2 ESA hardware representation in ESA mode



ESA operation

The OPM enters ESA mode when the OPM determines that the OPM cannot communicate with the host site. The two conditions that cause entry into ESA mode at the OPM are as follows:

- unusable communication links
- looparound message audit failure

When the OPM enters ESA mode a cold enter occurs. The system takes all active calls down.

The line concentrating module (LCM) detects the loss of communication with the host. The LCM determines when to use the ESA mode. To use the ESA mode the LCM switches the C-side link from the host to the ESA processor. The ESA processor detects the switching of links through the clock and tone card.

When the ESA processor detects the switch of links, the system initiates ESA-enter. The time span between loss of communication and the ESA mode, depends on the type of failure.

The ESA processor has a nailed-up (direct) communication link with the DMS CC at all times. The ESA processor is the only processor at the OPM that can communicate with the DMS CC during ESA exit. The DMS CC must instruct the ESA processor to exit ESA.

During ESA mode, the system processes calls through the ESA processor. The ESA processor contains the ESA CC, a software module that imitates the DMS CC and handles line-to-line call processing. The ESA CC contains a subset of the translation data found in the DMS CC.

This subset is a snapshot of the DMS CC data needed for ESA call processing. The translation data in the snapshot data are static data. The system does not enter OPM ESA mode until the ESA processor is loaded with static data.

The ESA processor has a nailed-up direct communication link with the DMS CC when the OPM is not in ESA operation. The link is not available during ESA operation. The ESA processor establishes the nailed-up connection with the DMS CC after the links are restored. The DMS CC must instruct the ESA processor to exit ESA. The ESA processor is the only processor at the OPM that can communicate with the DMS CC during ESA exit.

Download of the static data to the ESA CC from the DMS CC truncates some translation data. Static data are not true subsets of the DMS CC and the system only supports basic calls. During OPM ESA mode, the system supports plain old telephone service (POTS) and Meridian Digital Centrex (MDC) subscriber lines.

ESA hardware

Feature package NTX154AA for the RLCM equipment frame has two possible configurations.

1. The NT6X45AF based ESA package consists of three pieces of equipment:

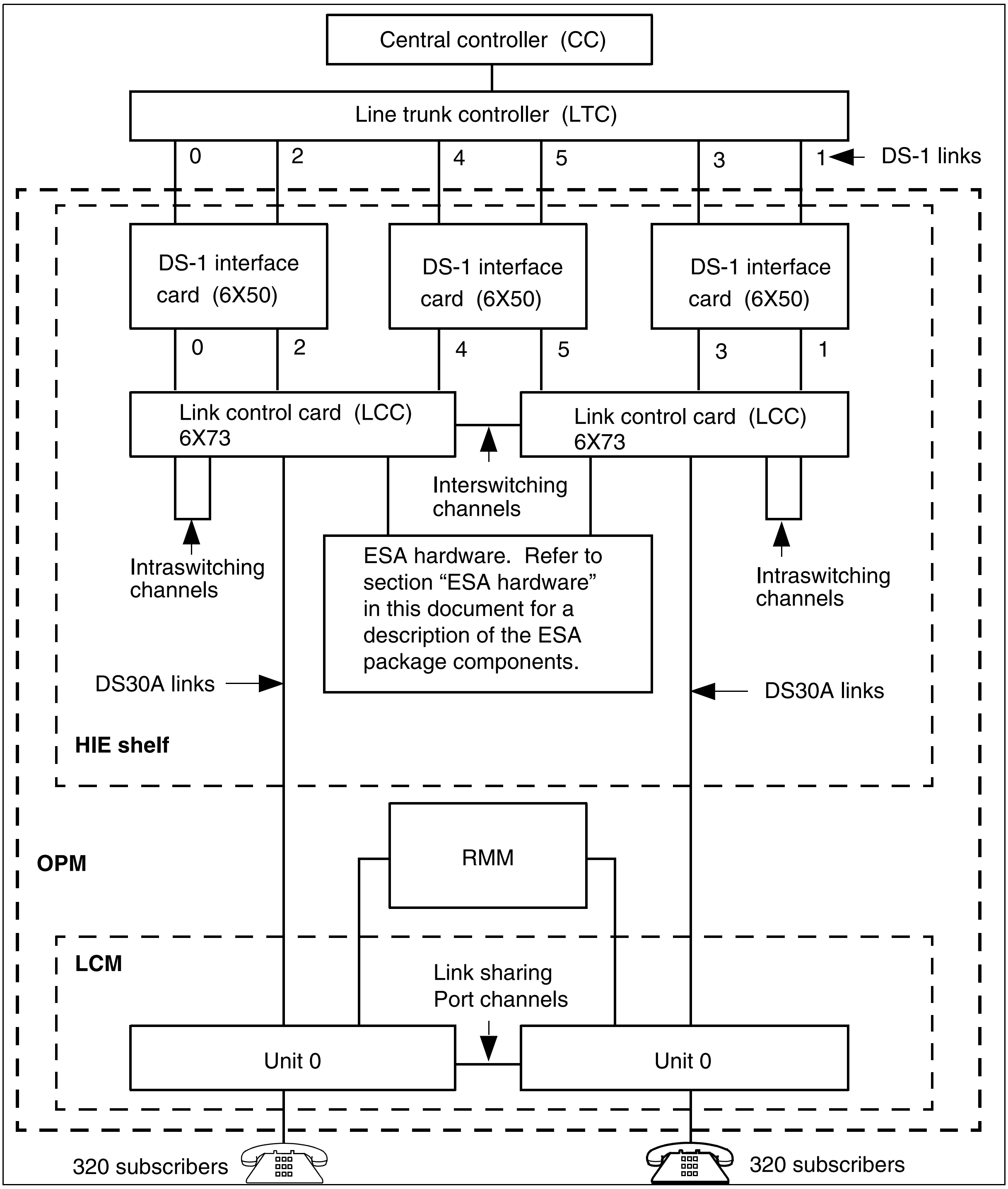
- one ESA memory card (NT6X47AC), slot 14
- one ESA processor card (NT6X45AF), slot 15
- one ESA clock and tone card (NT6X75AA), slot 16

2. The NTMX45AA based ESA package consists of two pieces of equipment. This package includes an ESA processor that enables duplicate Nxx in ESA mode and provides firmware downloads. This card has 8 Mbyte of on-card memory. With this package, the ESA memory card is not needed and slot 14 has a filler plate.

- one ESA processor card (NTMX45AA), slot 15
- one ESA clock and tone card (NT6X75AA), slot 16

Refer to the figure below for a block diagram of an OPM with the ESA hardware.

Figure 3 OPM with ESA hardware block diagram



NT6X45AF - ESA processor card

This card is the same processor card used in the LTC. The LTC processor card, when used in the RLCM equipment frame, is called the ESA processor.

NT6X47AC - 4 Mbyte memory card

This card is the same memory card used in the LTC. This card contains 4 Mbyte of memory. The system uses 3 Mbyte of memory for call processing when the RLCM enters ESA. The 6X47AC is required for ESA loads for BCS33 and higher.

NT6X75AA - ESA clock and tone card

This card provides the following:

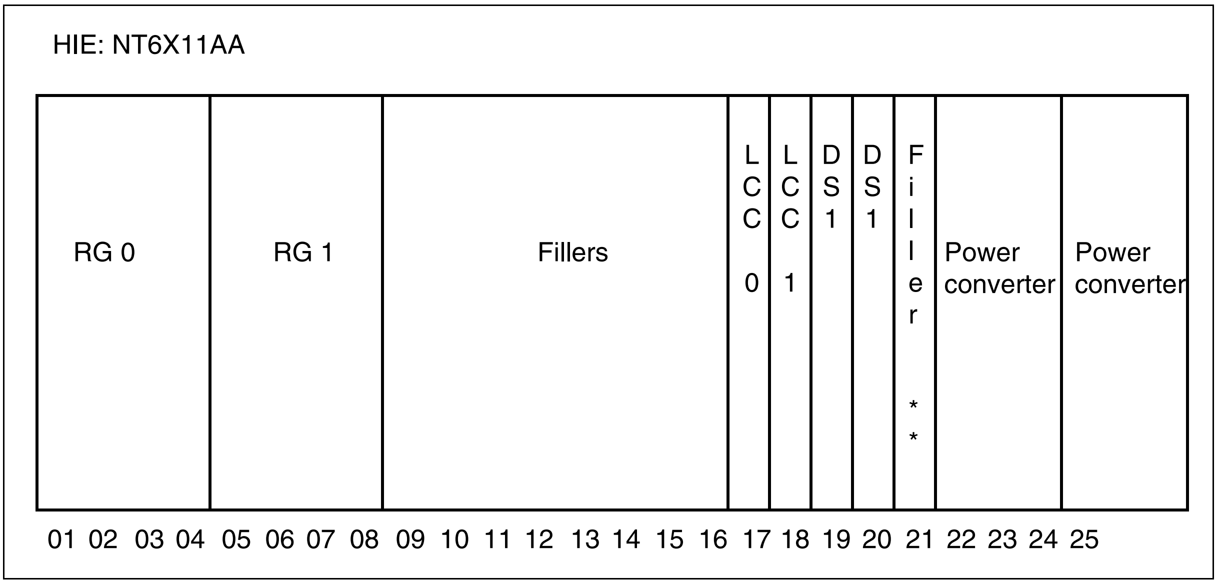
- A frame pulse for clock generation during ESA mode to replace the lost DS-1 frame pulse from the host.
- Tones to an LCM during ESA.
- An interface for the ESA processor. The ESA processor can send and receive messages to and from the host during normal operations. During ESA mode this card communicates with the LCM units and the RMM units.

NTMX45AA - ESA processor card

This card is an improvement over the NT6X45AF ESA processor. Eight megabytes of on-card memory enable duplicate Nxx numbers in ESA mode. This card also supports in-service firmware downloads. With this ESA processor, the NT6X47AC ESA memory card is not needed and slot 14 of the HIE shelf has a filler plate.

The components appear in figure “Host interface equipment shelf."

Figure 4 Host interface equipment shelf



The following table describes the cards in the host interface equipment shelf.

Table 1 Host interface equipment cards

Slot	ABBR	NT PEC	Remarks
01-04	RG 0	NT6X60AA	OPM ringing generator
05-08	RG 1	NT6X60AA	OPM ringing generator
09-13		NT0X50AG	Filler panel
14-16	ESA	(Note 1)	ESA control complex (Note 1)
17,18	LCC	NT6X73AA	Link control card (LCC-0, LCC-1)
19,20	DS-1	NT6X50AA	DS-1 interface (2 DS-1 links per card)
21		NT0X50AA	Filler panel. (Note 2)
22-24		NT2X70AA	Power converter
25		NT2X70AA	Power converter

Note 1: When ESA is not provisioned, these card slots have filler panels (NT0X50AA). When selected, the ESA package has two possible configurations. Refer to sections “ESA hardware" and “ESA control complex" in this document.

Note 2: For a total of six DS-1 links, slot 21 contains a DS-1 interface card.

The figure below illustrates a normal setup of RMM test and service circuit cards. For more information about provisioning, refer to the *DMS-100 Provisioning Manual* and *Extended Peripheral Modules Operational Measurements Reference Manual*, 297-8321-815.

Table 2 RMM: 6X13AA

GC	RMMC	MTUA	MTUB	MTA	BCCDVR	SC	Filler	TT	TT	Filler	Filler	Filler	Filler	Filler	Filler	Power	Converter	Filler	Power Convertr
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

SLOT		ABBR		NT PEC		Remark
01		GC		2X59AA		Group codec and tone card
02		RMMC		6X74AB		RMM control card

Table 2 RMM: 6X13AA

03		MTUA		2X10BA		Metallic test unit, analog
04		MTUB		2X11BA		Metallic test unit, digital
05		MTA		3X09BA		Remote metallic test access (8X8)
06		BCCDVR		3X09AA		Battery charger controller driver
07				0X50AC		Filler panel
08		SC		0X10AA		Scan detector card (PESALRM)
09		TT		2X09AD		Test trunk circuit
10		TT		2X09AD		Test trunk circuit
11				0X50AC		Filler panel
12				0X50AC		Filler panel
13				0X50AC		Filler panel
14				0X50AC		Filler panel
15				0X50AC		Filler panel
16				0X50AC		Filler panel
17-18				2X09AA		Power converter
19				0X50AC		Filler panel
20				2X06BA		Power converter

In-service firmware downloading

In-service firmware downloading permits ESA processor firmware loading in an XPM unit while the unit is in service (InSv). This feature reduces the amount of time one unit of the XPM is out-of-service (OOS). In-service firmware downloading supports the NTMX45AA ESA processor.

> ***Note:*** In-service firmware downloading refers to the loading of the firmware while the unit is InSv. The upgrade of the firmware occurs with the XPM unit out of service (OOS).

LOADFW command syntax determines the firmware load application from the firmware upgrade application. The command syntax for the LOADFW command is:

```
LOADFW: Load Firmware onto ESA.
        ALL parameter will execute LOADFW on
        all ESAs in the post set.
        LOADFW UPGRADE must be used to activate
        the new firmware.
Parms:  [<FILE> STRING]
        [UPGRADE {UPGRADE}]
        [NOWAIT {NOWAIT}]
        [ALL {ALL}]
```

To download firmware to the ESA, execute one of the following commands. The following are examples of the LOADFW command.

>LOADFW

or

>LOADFW <file_name>

> ***Note 1:*** If the firmware file name is not specified with the LOADFW command, the command applies the firmware file name provisioned in table XESAINV, field E2LOAD.
>
> ***Note 2:*** By using the LOADFW command without the UPGRADE option, the firmware downloads to the ESA.

Loadfile verification

The system performs integrity checks on the firmware for loadfile accuracy. A loadfile record length check makes sure the file is a firmware file before the XPM uses the file. If the record length is not 54, a message is output to the user and the LOADFW command fails.

Another accuracy check is a 32-bit cyclic redundancy check (CRC) with a 16-bit checksum. The CM sends a validation message to the XPM to check the accuracy of the firmware load. The XPM extracts the CRC and checksum that is in the firmware load. The XPM calculates the CRC value and the checksum. The XPM compares the computed and extracted values to see if the values are the same. The XPM sends the result of the comparison to the CM.

To verify the firmware load enter the following command at the MAP display terminal:

>QUERYPM CNTRS

Firmware upgrade

After loadfile verification, the XPM is ready for the firmware upgrade. To upgrade the firmware use one of the following command string sets:

```
>LOADFW UPGRADE
```

> ***Note:*** By using the LOADFW command with the UPGRADE option, the firmware is upgraded to the new firmware load.

The next table lists parameters used with the LOADFW command.

Table 3 LOADFW parameters

Parameter	Value	Definition
filename	n/a	Name of firmware file. If the firmware file is not specified, the firmware load found in table XESAINV, field E2LOAD is used.
UPGRADE	n/a	Upgrades the PM to the new firmware load. UPGRADE is an optional parameter.
ALL	n/a	Permits the use of the LOADFW command on a posted set of PMs. ALL is an optional parameter.
NOWAIT	n/a	Returns the prompt before the command is finished, on-screen status is not visible. NOWAIT is an optional parameter.
Note: In this table N/A is an abbreviation for not applicable.		

Software operation

The *Extended Peripheral Modules Translations Reference Manual*, 297-8321-815 contains an summary of the software operation of the ESA feature package. This manual also includes a complete list of specified features.

Intracalling during ESA mode

The ESA mode uses the intracalling feature, which also functions in non-ESA mode. Intracalling can switch calls at a remote location without transmission back to the host.

The number of designated intracalling channels on the OPM determines the number of calls that the system supports. The system supports intraswitched and interswitched calls during ESA. The number of channels depends on the equipped DS-1 ports available and the DS-1 links used for host communication.

During ESA mode, the system handles all intracalls through the ESA processor. The ESA processor contains a subset of the translations data found in the DMS CC.

ESA call processing

When the OPM is in ESA mode, the ESA CC processes line-to-line calls. The following figure shows the basic call processing structure of the ESA CC.

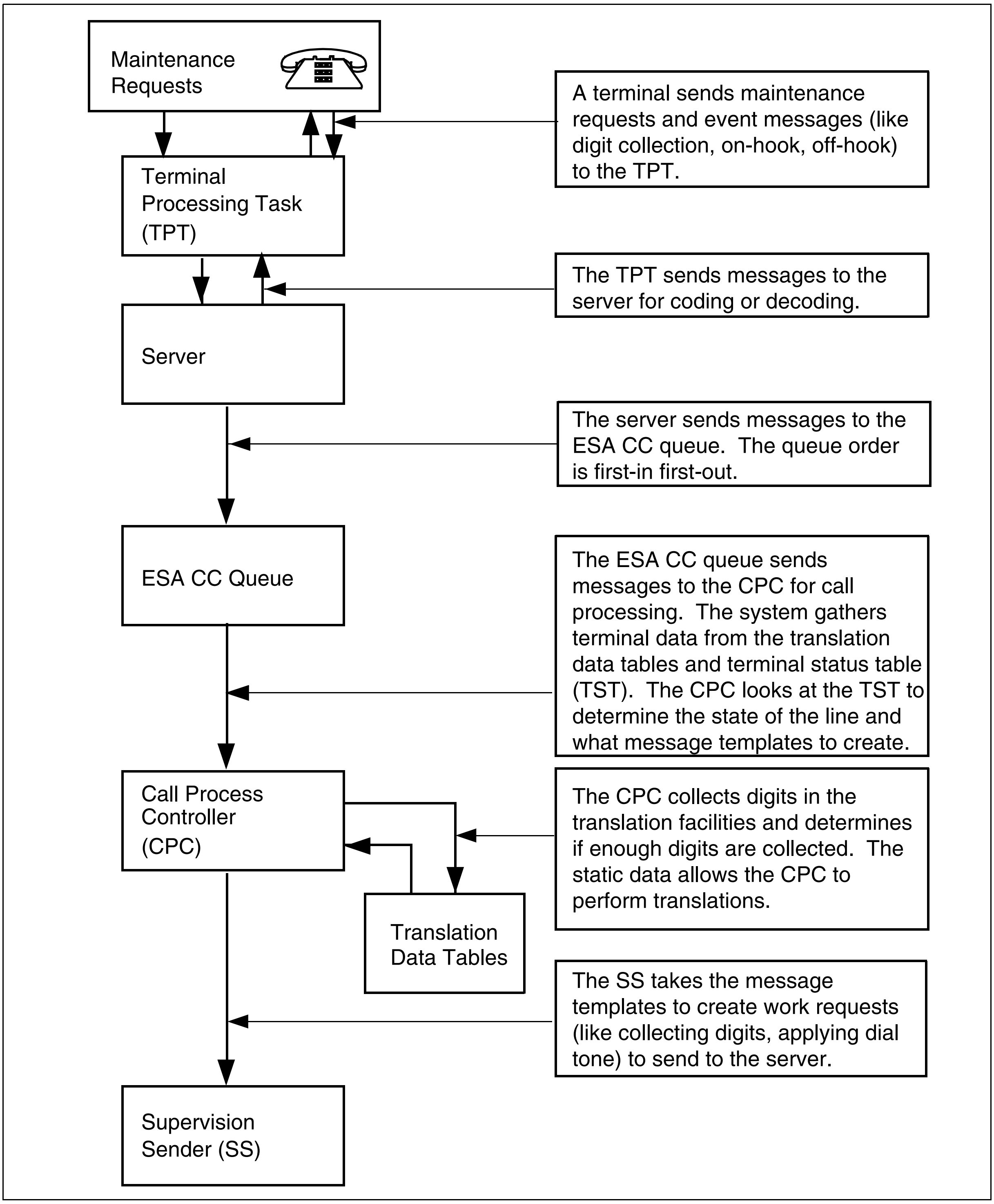
The ESA CC has one queue. The system sends all messages from the server to this first-in, first-out queue for call processing. Before call processing begins, the system needs terminal data. The system gathers terminal data from the static data downloaded from the DMS CC and the data stored in the terminal status table (TST).

Terminal status table

The TST has an entry for each line appearance that the ESA processor can handle. Each entry has two bytes and each byte contains a data structure. The two data structures are the following:

- Unprotected line data (ULD): The ULD helps the ESA CC decide what action to take when an event message arrives from a terminal. An event message establishes or changes a line state. The ULD also keeps track of errors that a line generates during call processing.
- ESA call process block (CPB): The ESA CPB stores the number of origination attempts for a line. After successful completion of an origination, the TST stores the index of the call in a CPB.

Figure 5 ESA CC basic call processing structure



Each line can have more than one call processing line state. The call processing line states determine what the system does with a specified message. The ESA CC initially screens the line states of all messages. The CPC handles all lines in the idle, originate, abandon or lockout states. The CPC also handles all lines in the state of call processing busy. The CPB of a line contains the state of the call process. The system processes these lines based on the call processing state. The CPC ignores all lines in the state of system busy (SysB) or manual busy (ManB).

Refer to the following figure for an example of the TST.

Figure 6 Terminal status table

Line	Byte 1								Byte 0							
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0	Error count/cause				Line state				CPB index/origination count							
⋮	⋮				⋮				⋮							
640	Error count/cause				Line state				CPB index/origination count							

The first byte in the TST contains line data that is not protected. The system divides first byte in the TST as follows:

- Error count/cause: The first four bits contain the count of the errors that the software of a line detects. Each error increases the count. If the error counts reach a preset threshold, the system takes the line out of service. The system records the last cause of the error in place of the error count.
- Line state: The last four bits contain the current state of the line. The line states are as follows:
  - — ManB: The line is ManB. The system suspends service to the line. The system ignores messages from the line. Calls cannot terminate to this line.
  - — Idle: The line is equipped. The line is call processing idle and looks for an off-hook condition. The system treats origination messages from the line as a call origination, and calls can terminate to this line.
  - — Originated: The line originates a call, but resources are not available to service the line. If still off-hook, the line originates the call again after a 1 s delay. If the system receives an on-hook message before the timer expires, the system places the line in the abandon state. The line can originate three times before the system places the line into the lockout state. Calls cannot terminate to this line.
  - — Abandon: The line waits for another origination attempt. With any off-hook or on-hook message, the system places the line into the idle

state. When in the idle state, the system starts the idle scan for an off-hook condition. Calls cannot terminate to this line.

- — Call processing busy: The line is in a call-processing-busy state. In this state, a CPB associates with the line. The associated CPB index is in the second byte of the TST. The system directs messages that this line generates to the associated CPB index. Calls cannot terminate to this line.
- — Lockout: The line is not involved with an active call. A CPB is not associated with the line, but the system monitors the line for an on-hook condition. An on-hook message causes the line to return to an idle state. When in the idle state, the idle scan for an off-hook condition starts. Calls cannot terminate to this line.
- — SysB: The system detects too many errors on the line. The system places the line out of service. The system stores the last cause of the error in the error count/cause byte of the TST. The system ignores all messages from the line.

The ESA line-audit process returns the line to service.

The second byte in the TST contains the CPB index/origination count. A CPB is the data base that associates with the active call process. There are only enough CPBs to handle the maximum number of intraswitched and interswitched calls. The number of ESA calls that the system can support is less than the number of lines supported. As a result, there are not enough CPBs for the available channels. The signaling states and call processing data that form the CPB are as follows:

- CPB states
  - — Call processing idle (CP_Idle): The start-up state before call processing. The system requests line resources (DTR and connection) at this time.
  - — Dialing: The SERVER receives the digits. The system performs digit translation when the system receives a digit report.
  - — Routing: A transitional state from Dialing or CP_Idle to another state.
  - — Revertive wait for on-hook: A revertive call, the system waits for the call originator to go on-hook before the system applies ringing.
  - — Ringing: The system applies ringing to the call terminator. The system applies audible ringing to the call originator. If the call is revertive and

the office has coded ringing, the system applies a ring splash to the opposite side of the terminator.

— Talking: A voice connection between the call originator and terminator. The system restores tip and ring reversal relay for semi-post-paid coin line.

— Originator disconnect: The originator goes on-hook first. The system idles the originating line. Supervision continues on the terminating line.

— Terminator disconnect: The terminator goes on-hook first. The system idles the terminating line. Supervision continues on the originating line. Lines with cutoff on disconnect feature have the system operate cutoff relay.

— Release originator: A transitional state when the system releases the originator from call processing.

— Busy: The system applies a busy tone to the originating line. The system performs supervision and timing on the terminal.

— Reorder: The system applies a reorder tone to the terminal. The system performs supervision and timing on the terminal.

— Coin disconnect supervise: The originating coin line goes on-hook first. The system implements the coin release function. Call processing waits for the result of the coin function. Supervision continues on the terminating line.

- — Coin disconnect: The terminating coin line goes on-hook first. The system implements the coin release function. Call processing waits for the result of the coin function.

- call-processing data:
  - — Digit count/digit registers: The system stores collected digits in the registers. Digit count indicates the number of digits collected.
  - — Routing information: This byte contains the results of digit translation. The results include the following types of termination:
    - – regular
    - – automatic line
    - – revertive
    - – hunt group
    - – reorder termination
    - – busy
  - — Terminator line character: The byte results from digit translation.
  - — Terminator ring character: The byte contains the ringing characteristics, the result of digit translation.
  - — Originator revertive ring character: The byte contains the ringing characteristics of digit translation.
  - — Originator, terminator, DTR: The channel numbers of the three types of terminals that use channels in an active call.
  - — Translation and audit-specific data: Translations use this data as flags for audits on a CPB during the digit collection phase.

Call channel management

All calls at an OPM in ESA mode are intraswitched or interswitched. The systems needs an intraswitched or interswitched channel to complete a call. If an intraswitched or interswitched channel is not available, the TPT sends a channel-blocking message to the ESA CC. The originator of the call receives a reorder tone.

Digitone receiver management

The ESA processor needs the location of the DTRs are located in the RMM. The system downloads DTR data with the static data. Because digitone receivers are allocated in a circular fashion, all receivers receive equal distribution. The following steps explain how the system uses a receiver.

1. When a line goes off-hook and originates a call, the system requests a receiver.
2. If the system finds an available receiver, the system marks the available receiver, not free, and assigns this receiver to the call.

   If all receivers are assigned, the system waits 3 s to locate a free receiver. If the system does not find a free receiver after 3 s, the system places the line in the abandon state.
3. When dialing finishes, the system marks the receiver, free. The receiver is available for another call to use.

The system also frees a receiver when the system receives a dial pulse (DP) digit. The system receives a DP digit when a user uses a DP phone on a line entered as Digitone. When the system frees the receiver, the system maximizes DTR use.

ESA CC supervision sender

The ESA CC uses a streamlined set of execs to handle call processing. The system loads the definition of execs in the ESA exec lineup at the exec download time of the RTS sequence. The supervision sender uses the execs to create work requests for the server.

ESA translation data

When the OPM is in ESA mode, the ESA CC uses a subset of translation data from the DMS CC to perform translations. The DMS CC downloads this subset of the DMS CC data, needed for ESA call processing, to the ESA CC. This type of translation data is static data. The system generates ESA logs when the downloaded data exceeds the OPM ESA maximum. Refer to *Extended Peripheral Modules Translations Reference Manual* for more information about ESA translations.

The ESA CC requires two types of static data:

- general XPM-type
- ESA translations

The general static data are manually downloaded when the ESA CC is ManB. The system loads general static data when the ESA CC returns to service. The system loads ESA static translations data when the ESA CC is in service (InSv).

Downloading the ESA processor

The system downloads translation data to the ESA processor as follows:

- manually: The LOADPM command downloads data manually to the ESA processor.
- during return to service (RTS): The RTS command downloads data automatically to the ESA processor if the ESA processor cannot perform call processing with current data.
- automatically: The system loads data during daily updates of the ESA processor as the RLCM_ESADUPD_HOUR office parameter specifies.

Supported subscriber line types

During OPM ESA mode, the supported subscriber line types are POTS and MDC. The line types are listed below.

POTS line types

The supported POTS line types are as follows:

- 1FR - single party flat rate
- 1MR - individual message rate. The system treats the lines the same as single party flat rate lines.
- 2FR - two-parties flat rate
- 4FR - four-parties flat rate fully selected without ANI
- 8FR - eight-parties flat rate semi-selective without ANI
- 10FR - multi-party flat rate without ANI
- CCF - coin coin first service. The system returns the coin.
- CDF - coin dial tone first service. The system returns the coin. The CDF phones cannot make *911* or *0* calls without the initial coin deposit while in ESA mode.
- CSP - coin semi-postpay service. The system does not return the coin and coins are not required to enable a speech path.
- PBX lines - PBX message rate lines are treated as PBX flat rate lines.

MDC lines

The supported MDC line types are as follows:

- loop and ground start lines
- 500 and 2500 set
- Meridian business set (MBS). The system handles the MBS as a 2500 set. The system supports primary directory number (PDN), HOLD and RELEASE keys.

- digital data unit (DDU). The system supports PDN, HOLD and RELEASE keys. There is no modem pooling.
- lines with cutoff on disconnect option. The cutoff relay is operated for 300 ms.

Supported subscriber services

During OPM ESA mode, the supported subscriber services are POTS and MDC.

POTS subscriber services

The POTS services provided include the following:

- one home numbering plan area (HNPA) code for each OPM
- services for single party, multi-party, coin and PBX lines
- three to seven digits local dialing plan
- up to 16 prefix or special numbers per OPM with a maximum of 15 digits each for special termination. For example, 0-, 0+, 411 and 911.
- invalid or vacant terminations that the system routes to reorder or announcement termination

MDC customer group services

The MDC services provided include the following:

- maximum 640 members in a customer group
- maximum 32 customer groups per OPM
- up to eight prefix or special numbers per OPM with a maximum of 15 digits each for each customer group (for example, 0+, 411, 9+ with or without second dial tone, prefix fence and ambiguous numbers)
- station-to-station dialing for one-digit through six-digit extension numbers
- denied incoming call for a station
- direct outward dialing with or without second dial tone for termination to another customer group or POTS lines within the same OPM
- inter-customer group calling by the same dialing plan (except lines with the denied incoming option)
- treatment of primary numbers of the multiple appearance directory number (MADN) groups as normal MDC lines
- multiple centrex customer dialing plans

Channel configuration

On ESA entry, the system arranges the C-side channel map of the OPM to provide more interswitch channels for ESA call processing.

Interswitch and intraswitch channels make call connections through the OPM and do not involve a host connection. The interswitch and intraswitch abilities allow call processing to continue in ESA operation.

On OPM ESA entry, the system configures OPM channels. The channels of all DS-1 ports are not equipped except for primary ports 0 and 1. Ports 0 and 1 must be equipped in OPM ESA.

More interswitch channels are available for unit-to-unit calls when the system arranges C-side channels on ESA entry. Refer to the following table for a list of the channel breakdown in OPM ESA.

Table 4 Channel availability after ESA entry

Port number	Number of intra channels	Intra channels	Number of inter channels	Inter channels
0	6	2, 7, 12, 18, 23, 28	0	none
1	6	2, 7, 12, 18, 23, 28	0	none
2	18	2, 3, 5, 7, 8, 10, 12, 13, 15, 18, 19, 21, 23, 24, 26, 28, 29, 31	12	1, 4, 6, 9, 11, 14, 17, 20, 22, 25, 27, 30
3	18	2, 3, 5, 7, 8, 10, 12, 13, 15, 18, 19, 21, 23, 24, 26, 28, 29, 31	12	1, 4, 6, 9, 11, 14, 17, 20, 22, 25, 27, 30
4	18	2, 3, 5, 7, 8, 10, 12, 13, 15, 18, 19, 21, 23, 24, 26, 28, 29, 31	12	1, 4, 6, 9, 11, 14, 17, 20, 22, 25, 27, 30
5	18	2, 3, 5, 7, 8, 10, 12, 13, 15, 18, 19, 21, 23, 24, 26, 28, 29, 31	12	1, 4, 6, 9, 11, 14, 17, 20, 22, 25, 27, 30

The OPM does not gain channels when the system arranges the C-side channels on OPM ESA entry. The OPM gains interswitch channels when there is a decrease of intraswitch channels.

Exiting the OPM ESA mode

After communications restore, the DMS CC recovers the OPM from the ESA mode. When the OPM exits ESA mode, the system performs a cold exit. The system takes all active calls down.

When the system restores C-side communications between the OPM and the DMS CC, the DMS CC initiates the ESA exit sequence. Before the ESA exit sequence begins, the DMS CC communicates with the ESA processor over the direct connection. This communication determines if the OPM is in ESA mode and if the system can recover the OPM immediately. The two possibilities to recover the OPM are a system exit or a manual exit.

ESA system exit

A system exit is an automatic exit from ESA mode that the DMS CC start without operator interference. The system starts a system exit if any of the following conditions exist:

- At least one LCM unit of the OPM is SysB or C-side busy (CBsy).
- The RLCM_XPMESAEXIT office parameter time-out value is not zero.

The following is the system exit sequence.

1. The system restores C-side communications between the DMS CC and the OPM.
2. The DMS CC discovers the OPM is in ESA mode.
3. The DMS CC enters ESA time-out mode.
4. When the DMS CC times out, the DMS CC sends an ESA-exit request to the ESA processor.
5. The OPM and the ESA processor perform exit operations.
6. The ESA processor tells the LCM to return the LCC to normal operations.
7. The ESA processor sends operational measurements, peg counts, and the reason the system entered ESA mode to the DMS CC. The system displays this information in the PM171 log. The system generates the PM181 log if the ESA exit has problems.
8. The DMS CC RTS the OPM.
9. Return to service the ESA processor and RMM nodes.

ESA manual exit

A manual exit is an exit from ESA mode that the operating company personnel start at the LCM MAP level with the RTS command. The system requires a manual exit when any of the following conditions exist:

- Both LCM units of the OPM are in a ManB state.
- The RLCMM_XPMESAEXIT office parameter time-out value is zero.

Manually-busy the LCM units to manually override a time-out value (other than zero). Manually-override the LCM units of the OPM at the LCM MAP level to start a manual exit. With the use of the Force option, use the BSY command.

The following steps describe the manual exit sequence:

1. The system restores the C-side communications between the DMS CC and the OPM.
2. The DMS CC discovers that the OPM is in ESA mode.
3. The DMS CC queries the OPM for the number of active calls.
4. The DMS CC displays the number of active calls on the MAP display. The DMS CC also queries if operating company personnel want ESA-exit.
5. If operating company personnel confirm the DMS CC ESA-exit, the DMS CC sends the ESA-exit request to the ESA processor.
6. If operating company personnel do not want to continue with the ESA-exit, the OPM stays ManB. The OPM stays in ESA mode.
7. The OPM and the ESA processor performs exit operations.
8. The ESA processor tells the LCM to return the LCC card to normal operations.
9. The ESA processor sends operational measurements, counts, and the reason that the OPM dropped into ESA mode to the DMS CC. The system displays this information in the PM171 and PM181 logs.
10. The DMS CC RTS the OPM.
11. RTS the ESA processor and RMM nodes.

Tones during ESA mode

The ESA clock and tone card (NT6X75AA) provides five continuous tones when an OPM is in ESA mode. The LCM interrupts these tones to gives system specified types of tones. The tones appear on channel 16 on the incoming C-side ports of the OPM. The following table shows the OPM ESA tones, their channel appearance, and cadence.

Table 5 OPM ESA tones

Tone type	Tone ID	Channel appearance		Cadence (in seconds)	
	(HEX)	Port	Channel	On	Off
Busy	81	1	16	0.5	0.5
Reorder	82	1	16	0.25	0.25
ROH*	83	2	16	0.1	0.1
Audible	80	4	16	2.0	4.0
Warble	8D	5	16	2.0	4.0
Dial	06	7	16	N/A	N/A

Note: Idle tone uses a start-cadence message, but the OPM connects the receive path to a port that provides idle tone.

Providing tones

The following steps are required to provide tone to a subscriber:

1. The ESA processor sends a start-cadence message to the ESA clock and tone card. This message specifies the tone required, the terminal identification, and the cadence times.
2. When the system receives the start cadence message, the ESA clock and tone card perform the following actions:
   a. If necessary, breaks the current receive path of the terminal connection.
   b. Connects the receive path of the terminal to the appropriate port.
   c. Sets the specified cadence for that tone.

The following steps are required to clear the tone:

1. The ESA processor sends a stop-cadence message to the ESA clock and tone card. This message specifies the terminal identification.
2. When the system receives the stop cadence message, the ESA clock and tone card sends stop-cadence messages to the LCM. This action disconnects the terminals connection to the correct port and channel 16.

Ringing during ESA mode

The OPM needs duplicated ringing generators. The ringing types supported during OPM ESA mode are as follows:

- coded ringing
- frequency ringing
- superimposed ringing
- immediate ringing

Treatments during ESA mode

The treatments supported during OPM ESA mode are as follows:

- busy tone
- reorder tone
- receiver off-hook, (ROH), tone

ESA limits

The limits applied to the OPM in ESA mode are as follows:

Limits during the ESA mode

Limits during the ESA mode for POTS lines and features are as follows:

- The system supports only the three to seven digit POTS dialing plan.
- The system supports one home number plan area (HNPA) code for each OPM.

Limits during the ESA mode for MDC lines and features are as follows:

- The system supports only the MDCXLA translation selector (number of digits in the extension number) for station-to-station calling. If the selector is not entered, the system uses POTS translation.
- The system does not support network class of service (NCOS) for MDC lines. Customer groups or lines are restricted to a dialing plan common to all customer groups.
- To be supported during the ESA mode, the primary number of a multiple appearance directory number (MADN) group must be one of the following:
  - — an MDC business set PDN key
  - — a 500/2500 Set directory number

  Note: The system does not support all MDC and POTS features or lines.

Restrictions during ESA mode

Global restrictions during ESA mode are as follows:

- The system does not support line diagnostics while the OPM is in ESA mode.
- The system does not provide ESA mode for an OPM that changes.
- The system does not support MADN group operation.
- The system does not support recorded announcements.

Restrictions during ESA mode for POTS lines and features are as follows:

- The system does not support local call detail recording (LCDR).
- The system does not support local automatic message accounting (LAMA).
- The system does not support centralized automatic message accounting (CAMA).
- The system does not support remote register signal distributor point lines.
- The system does not support dial tone speed operational measurements (OM).
- The system does not support teletypewriter exchange service (TWX).
- The system does not support foreign exchange calls.
- The system does not support equal access features.

Restrictions during ESA mode for MDC lines and features are as follows:

- The system does not support station message detail recording (SMDR).
- The system does not support attendant consoles.
- The system does not support custom calling features. These features are as follows:
  - flashing
  - conference calls
  - digital data unit (DDU) feature keys. No action occurs when the caller presses feature keys.
- The system does not support remote meter pulsing lines.
- The system does not support MDC electronic business set feature keys. No action occurs when the caller presses feature keys.
- The system does not support party line circle digits.
- The system does not support automatic number identification (ANI).

Fault conditions

The fault condition of unusable communication links triggers the ESA mode of operation. The possible reasons for this fault condition are described below.

Unusable communication links

Communication links from the OPM to the DMS CC cannot be used when the following conditions exist:

- The links are severed between the OPM and the host.
- The peripheral side (P-side) message link (DS-1 cards) of the LTC are pulled out.
- The C-side message link (DS-1 cards) of the OPM are pulled out.

The RLCM_ESAENTRY_BADLINK office parameter determines the desired delay time between failure of the C-side message link and the entering of ESA mode.

Looparound message audit failure

The OPM enters ESA mode when the looparound message audit detects the failure of messaging between the OPM and the DMS CC. The looparound message audit detects this failure because of the following conditions:

- A loss of communication with the DMS CC, longer than the time-out period specified in the RLCM_ESAENTRY_BADCSIDE office parameter.
- Both LTC units (C-side peripherals) are ManB.
- Network planes of the LTC or LGC are ManB.

The RLCM_ESAENTRY_BADCSIDE office parameter determines the desired delay time between the following two events:

- the failure of OPM communication with the C-side peripheral
- the entrance of the OPM into ESA mode

The delay time prevents the OPM from entering the ESA mode during a restart. A restart causes the looparound message to fail. The OPM enters ESA mode if all looparound messages in the time-out period fail.

Fault conditions that can occur during ESA operation are as follows:

- line errors
  - too many originations
  - confusion message received
  - line translation error
  - dial pulse error (bad digits)
  - Digitone error (bad digits)
  - ringing error
  - coin error
- defective Digitone receivers
- static data failure

Audits correct the fault conditions. The following section on automatic maintenance describes these audits.

Automatic ESA maintenance

When fault conditions occur, the host switch and the OPM initiate audits and other system processes to clear the fault. For ESA maintenance, these automatic features are

- line audits
- DTR audits
- downloading static data
- routine exercise (REX) tests
  - read only memory (ROM) diagnostics
  - read access memory (RAM) diagnostics

ESA line audits

The ESA line audit process returns SysB lines to service after a specified period of time. In ESA mode, the system declares a line SysB when there are too many errors.

Each time an error occurs on a line, the error count associated with that line increases. If the error count reaches a preset threshold, the system makes the line SysB. The system stores the last cause of error in the TST.

A line in a SysB state cannot originate or terminate a call. The system does not tie up ESA resources. At intervals, the line audit process returns the SysB lines to service. The process makes sure that the system does not deny service to a line with a transient fault.

Digitone receiver audit

The DTR audit monitors the status of the Digitone receivers. If a call process possesses a DTR for more than two audits, the audit terminates the process. The audit starts the clean-up process for the CPB. The audit also marks the DTR as available. This action makes the DTR ready for use.

Error tracking detects receivers that are defective. Before the system changes the assignment of a receiver, the system makes an error count check. When a preset error threshold is reached, the system takes the receiver out of service. An audit automatically returns to service the receiver and sets the error count to zero.

Automatic static data downloading and system maintenance

The system automatically loads the ESA CC with static translations data. The system can download this data after ESA RTS. Operating company personnel can download this data manually, when the ESA CC is InSv.

At a time that office parameter RLCM_ESADUPD_HOUR determines, the system updates the static translations data in the ESA CC. The system performs the equivalent to the LoadPM CC ESADATA command in sequence on each OPM with the ESA option. This ESA option is set in table LCMINV.

> ***Note:*** The OPM must not be on the same static update hour as a host Remote Switching Center (RSC). This action corrupts static data.

If the OPM runs another maintenance function at the automatic update time, the automatic update process waits 30 s for the current function to finish. If the current function continues to runs after 30 s, the system marks the OPM with the in-service trouble (ISTb) status. The reason associated with the ISTb is ESA STATIC DATA.

If the automatic update process fails during the loading of the static data, the system marks the OPM with the SysB status. If the system fails to download a table, the system generates an ESA log (ESA101 through ESA107). Each log identifies and describes the table that failed to download. The remainder of the tables are not downloaded. The system marks the OPM with the SysB status and a reason of ESA DATA.

> ***Note 1:*** The OPM cannot enter ESA while the static data loads.
>
> ***Note 2:*** If the OPM is out of service during the daily update, the system updates the data as part of the normal RTS sequence.

Routine exercise test

The system performs routine exercise (REX) tests on the ESA hardware. The REX tests test ESA hardware that is not in use while the ESA processor provides normal service. Perform these tests regularly. To perform this test, use the test (TST) command with the REX option. These tests require that both LCM units of the OPM, RMM and ESA processor are InSv.

The REX test tests the ability of the LCM units to enter and exit ESA mode. The REX also tests the ability of the LCM units to send messages to the ESA processor while in ESA mode. The system tests one LCM unit at a time. If the system tests both units at the same time, a loss of service results. The loss of services affects calls connected at the time of the test. While the system tests one unit, the other unit continues call processing in the takeover mode.

The system prevents accidental attempts to perform maintenance on an LCM unit that is in ESA mode. The system runs a lockout task on the tested LCM unit. The lockout task is the same task that the system uses during an ESA exit. Lockout does not perform any maintenance.

Takeover and take back on an LCM unit affects calls that the system connected. This condition does not affect calls that the system already connected. The system returns the LCM to service before the system tests the other unit.

The following actions occur during a REX test:

1. The system tests the messaging ability of the peripherals, ESA module, LCM units, and RMM. If any of these preliminary tests fail, the system does not run REX tests.
2. If the preliminary tests pass, the system places one LCM unit in the ESA mode and the other unit in the takeover mode. This action switches the messaging links of the unit in the ESA mode from the host to the ESA module.
3. The ESA processor tests the ability of the LCM units to message to the ESA module under ESA conditions.
4. The system performs other diagnostics on the ESA module. These diagnostics are the tones test and a comparison of LCC control and 6X75 status bytes.
5. After the tests are complete, the system takes the unit from the ESA mode and returns the unit to service.
6. If the REX tests pass, the system tests the ESA module with the other LCM unit.

ESA ROM diagnostics

The ESA processor has a ROM diagnostic test. Operating company personnel can implement this test with the LOADPM command.

This test consists of the standard XPM ROM tests. These tests test the processor and memory complex, and also basic messaging functions. The messaging functions are the DMS CC to ESA processor messaging capabilities.

ESA RAM diagnostics

The ESA processor has a RAM diagnostic test. Operating company personnel can implement this test with the TST command. The system can implement this test during a RTS. The ESA RAM diagnostic test consists of the following tests:

- a message test
- a 6X75 card test that tests the following functions:
  - 6X75 status to ESA processor
  - ESA processor to 6X75 control
  - A-bus interface to ESA processor and memory
  - frame interrupt generator
  - clock synchronization hardware
  - tone generator
  - ESA messaging hardware
- the 6X75 card test includes the following:
  - status and control test
  - RAM test
  - frame pulse interrupt test
  - VCXO clock test

Escalation to manual maintenance

Some testing conditions require manual maintenance. The instructions for manual maintenance are as follows:

Loading ESA static translations data

This section describes how to load the ESA processor manually with static translations data. Static translations data are the subset of DMS CC translation data that are downloaded into the ESA processor.

The steps to download static data manually, are as follows:

1. Display the ESA MAP level for the desired OPM.
2. Make sure that the ESA processor is InSv or ISTb.
3. Type: **>LOADPM CC ESADATA**
4. Press: ENTER

If the process fails, the system makes the ESA processor SysB.

ESA manual exit

Operating company personnel can use the RTS command to perform a manual exit from the ESA mode at the LCM MAP level. Perform a manual exit when any of the following conditions exist:

- Both LCM units of the OPM are in a ManB state.
- The time-out value for the RLCM_XPMESAEXIT office parameter is set to zero.

> ***Note:*** To override a time-out value other than zero, manual-busy the LCM units of the OPM at the LCM MAP level. This action starts a manual exit. Use the FORCE option with the BSY command.

The manual exit sequence instructions are located in the ESA manual exit, in this document.

LTC maintenance to prevent ESA mode

When both of the LTC (C-side peripheral) units are ManB, the system interrupts communication between the OPM and DMS CC. When the system interrupts communication between the OPM and the DMS CC, the OPM enters ESA mode. The OPM enters ESA mode after the time-out period in the RLCM_ESAENTRY_BADCSIDE office parameter expires. The following warning message when you attempt to manually busy an LTC: `This action will take this PM and its subtending nodes out of service.`

Busy the OPM or ESA CC before you place the LTC in a ManB state. This action makes sure that you do not place the OPM into the ESA mode.

5 OPM hardware

This chapter describes the Outside Plant Module (OPM) hardware components that give subscribers the full resources of the digital switching system. The following sections describe the hardware components and additional components that OPM contains.

OPM hardware components

A standard DMS frame houses the OPM. The DMS frame has four shelves and contains the following components:

- line concentrating module (LCM)
- host interface equipment (HIE)
- frame supervisory panel (FSP)
- remote maintenance module (RMM)

Hardware configuration

The layout of the OPM equipment, in a single DMS-100 equipment bay appears in the figure OPM frame, shelf and panel arrangement. The approximate external dimensions of the bay are 2208 mm by 685 mm by 457 mm (87 inches by 27 inches by 18 inches).

Line concentrating module

The LCM is the basic design building block of the remote peripheral group. The control side (C-side) of an LCM interfaces with the host network over DS30A links. The OPM connects to the host network over two to six DS-1 links through a connection controller peripheral. Possible connection controller peripheral includes a line group controller (LGC), a line trunk controller (LTC) or a remote cluster controller (RCC).

The LCM can function as an OPM when the LCM is connected to DS-1 links. The DS30A ports of the LCM are mapped to DS-1 interface cards which connect to the host office. This condition is the basic operating specification behind the OPM. The DS30A ports are on the digroup control cards (DCC) of the LCM.

The LCM contains two shelves called line concentrating arrays (LCA). Each LCA contains five line drawers. A fully equipped LCM contains ten line drawers. An LCM supports 640 subscriber lines when the LCM is fully equipped. Each LCA has a control complex, processor and digroup control and power converter. The control units operate in a load sharing mode. If one of the processors fails, the mate processor takes over complete control of the LCM. If one power converter fails, the power converter that remains can supply power to all line cards of the LCM.

The OPM contains a dual-unit LCM (NT6X04AA or NT6X04AB), mounted in an LCM shelf assembly (NT6X0401). The NT6X04AA contains NT6X51AA processor cards with 64 kbyte of memory and requires the LCM software load. The NT6X04AB contains NT6X51AB processor cards with 256 kbyte of memory that requires the extended memory LCM (XLCM) software load. The circuits contained in the LCM are as follows:

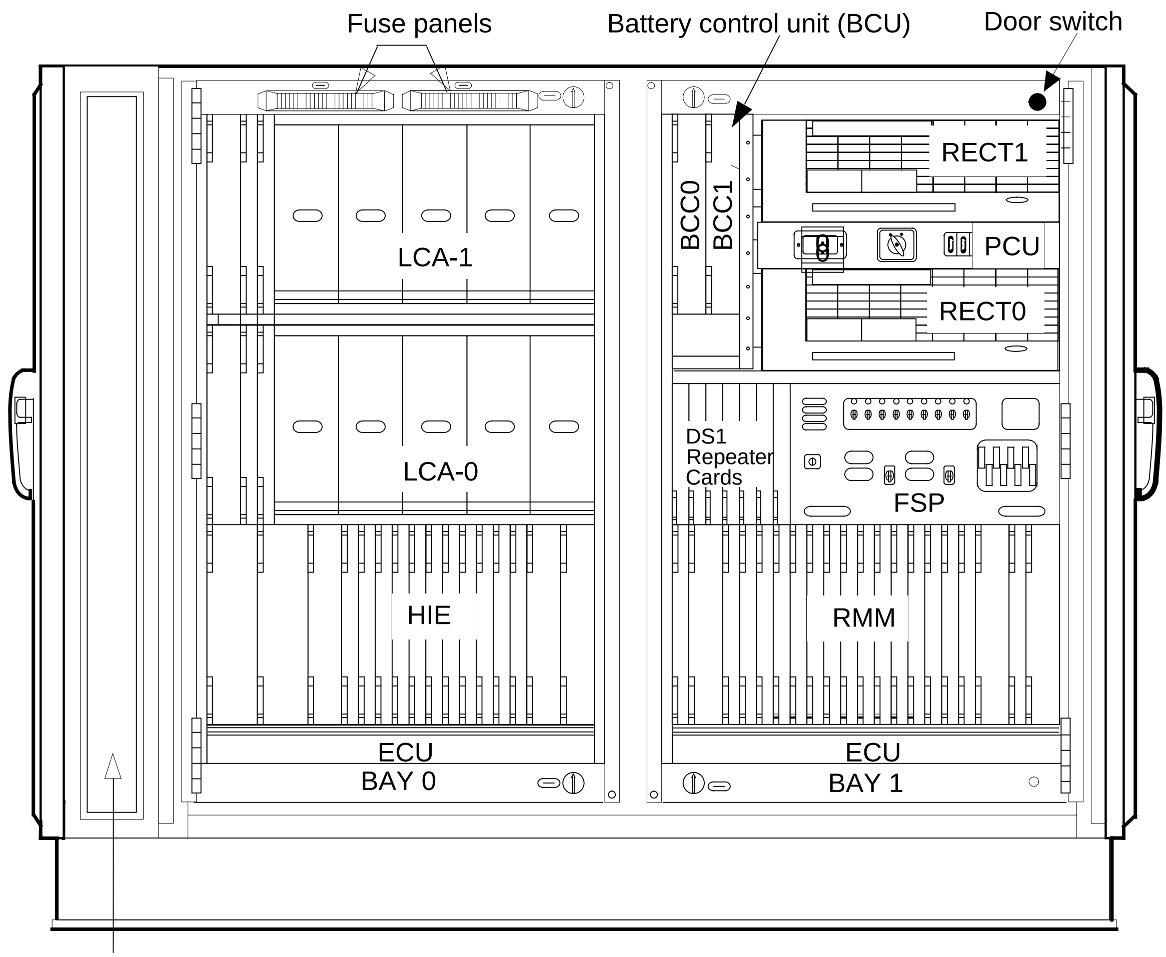
- NT6X53AA—Power converter 5V/15V
- NT6X51AA, AB—LCM processor and extended LCM processor
- NT6X52AA—Digroup controller
- NT6X54AA—Bus interface card (BIC) (up to ten)
- A maximum of 640 line cards

Line cards

Each of the ten line drawers of the LCM contains a pair of line subgroups (LSG) and a single bus interface card (BIC). Each LSG contains 32 line cards that support a maximum of 640 subscriber lines. The subscriber line card types the OPM supports are as follows:

- NT6X17AA, AB, AC—Standard line card type A or NT6X17BA—World line card
- NT6X18AA, AB—Line card type B with and without +48 V (coin, PBX, and ground-start)
- NT6X19AA—Message waiting line card
- NT6X20AA—Message waiting power converter
- NT6X21AA, AB, AC—Standard line card type C and Meridian business set line card
- NT6X71AA, AB, AC—Data line card (DLC) DMS-100/SC-100
- NT6X99AA Integrated bit error rate test (IBERT) line card

Figure 5-1 Frame, shelf, and panel arrangement, OPM-640 (NT8X01AA, AB)



Host interface equipment

The host interface equipment (HIE) shelf (NT6X1101) contains the DS-1 interface cards (NTX650AA) to connect the DS-1 links to the host controller. The HIE shelf also contains the following common circuit cards:

- NT6X60AA—OPM ringing generator (two)
- NT6X73AA—Link control card (two)
- NT2X70AE—Power converter, 5 V, 12 V (two)

Link control cards

The link control cards (LCC) in the HIE shelf converts data between DS-1 format and the DS30 format. The data in the DS-1 format travels to and from the host office. The data in the DS30 format travels to and from the LCM. The

DS30A ports of the LCM are mapped to the DS-1 interface cards in the HIE. Data travels through the DS-1 links to the host.

One LCC is present in the HIE for each LCM unit (LCA shelf). In normal operation, the two LCCs connect alternately to even and odd LCAs. If an LCC fails in the HIE, the mate LCA can handle all the DS-1 links.

Each LCC locks the frequency of the LCC to the primary DS-1 link. This action allows each LCC to function as a clock. The host LTC/LGC drives both LCC clocks. One of the LCCs becomes the primary LCC the host LTC/LGC directs. The primary LCC frequency locks to the C-side primary link to synchronize to the timing downloaded by the host peripheral of the primary LCC. The other LCC frequency locks to the primary LCC to derive the timing of the other LCC. The LCC clock functions serve both the DCCs and if the RMM is provisioned the Remote Maintenance Module (RMM).

Frame supervisory panel

The OPM is provisioned with a frame supervisory panel (FSP) (NT6X25AA) or a remote FSP (NT6X25BA). The FSP provides interface between the power distribution center in the FSP and the power converters in the LCM. The FSP also contains alarm circuits to monitor under-voltage conditions from the power converters.

Additional OPM components

HIE components

In order for the OPM to function with emergency stand-alone (ESA) capability, the HIE shelf must contain the following additional cards:

- NT6X45AF—XPM processor card
- NT6X47AC—4Mb master processor memory plus card
- NT6X75AA—ESA clock and tone card

Remote maintenance module

An optional component of the OPM is the RMM (NT6X13AB). The RMM shelf assembly (NT6X1301) contains the RMM. The RMM is a single-shelf module based on the maintenance trunk module (MTM). The RMM provides maintenance and service capabilities for the OPM. The RMM consists of two power converters, an RMM control card, a codec and tone card. The RMM contains space for a maximum of 14 provisionable service cards.

The RMM contains one set of common cards (NT6X13AB). The common cards in the RMM are as follows:

- NT2X59AA—Group codec
- NT6X74AB—RMM control

- NT2X06AB—Power converter common feature
- NT2X09AA—Multi-output power cards

Cards that can appear in the RMM are as follows:

- NT2X90AD—Incoming/outgoing test trunk
- NT2X10AC—Line test unit analog
- NT2X11AD—Line test unit digital
- NT2X10BA—Multi-line test unit analog
- NT2X11BA—Multi-line test unit digital
- NT3X09AA, BA—Remote metallic test access
- NT0X10AA—Scan card
- NT2X57AA—Signal distribution

If the OPM has ESA, the RMM shelf must contain the ESA Digitone receivers (NT2X48).

OPM configuration

The OPM is a freestanding configuration of the OPM housed in a special cabinet. This special cabinet provides mechanical protection and a controlled environment for the OPM electronic equipment. The OPM is available in two configurations. These configurations are the OPM-640 and the OPM-256. The OPM-640 has the capacity for 640 subscriber lines. The OPM-256 has the capacity for 256 subscriber lines and can expand to 576 lines. The following sections provide a general description of the OPM components. Any components that are different to configuration and optional components are discussed separately. The OPM bay configuration appears in the figure OPM bay frame and equipment arrangement OPM-640 (NT8X01AA, AB).

OPM cabinet

The OPM cabinet is 1676 mm wide, 1676 mm high, and 660 mm deep (66 inches by 66 inches by 26 inches). An empty cabinet weighs approximately 400 kg (880 lb). A fully equipped cabinet with electronics and batteries, weighs approximately 1000 kg (2200 lb). The housing consists of 13-gauge cold-rolled steel, except for bay frames and bases, which use heavier materials. The base is galvanized to provide additional corrosion resistance. The cabinet consists of a main compartment and an end-access compartment, which this section describes.

Main compartment

The main compartment houses the repackaged OPM, ac breakers, rectifiers, batteries, environmental control system, and the optional calibration device.

The access to the main compartment of the OPM is from the front of the cabinet by a pair of swinging doors. Concave lock pins hinge each cabinet door. Each cabinet door can be padlocked. Each door opens approximately 120 degrees. Each door locks in the open position by a door check. An alarm activates when the door opens.

The OPM equipment frame contains a pair of double-latched, hinged equipment bays. Each hinged equipment bay contains three shelves of equipment for a total of six shelves. The OPM equipment uses four shelves. The hinged bays allow access to the rear of the shelves. The hinged bays allow access to additional equipment against the back wall of the cabinet.

The two LCAs of the OPM-640 LCM use two shelves. The combined LCM (LCM-C) for the OPM-256 is a one-shelf module. The LCM-C contains two LCAs and four line drawers. One shelf is empty.

The section OPM-256 optional equipment shelf describes the optional equipment for the additional shelf. The RMM and HIE occupy two shelves. The other two shelves contain an FSP that includes office repeaters, a power control unit (PCU) for ac power, and a rectifier system. The rectifier system consists of a pair of switch mode rectifiers and a battery control unit (BCU). An environmental control unit (ECU) occupies the bottom of each bay.

End-access compartment

The end-access compartment is at the left end of the cabinet. The access to the end-access compartment is a single swinging door. The compartment contains equipment required for voice frequency (VF), special service and DS-1 pair termination, protection, and rearrangement. Subscriber VF cables and industry ac power enter the OPM through sealed cable entrance ports at the base of the cabinet. Also, the cables that carry host DS-1 and special service pairs enter the OPM the same way.

OPM hardware components

The OPM contains the same basic components as described for the OPM. The OPM also contains the following additional components:

- battery control unit (BCU)
- environmental control unit (ECU)
- rectifier system
- cable-connecting compartment (end-access compartment)

Battery control unit

The BCU is in the top left hand corner of row A, bay 1. The BCU consists of two battery charge controllers (BCC0 and BCC1). Each BCC controls four battery strings. The BCU is optional if batteries are not used.

The OPM batteries have a maximum of eight strings of Yuasa batteries or six strings of Eagle Picher batteries. Each battery string consists of 24 cells. The battery strings connect to the OPM load or the charge bus through the two BCCs and the BCU.

> ***Note:*** For major retrofits of Yuasa batteries, Northern Telecom recommends you convert to Eagle-Picher batteries because of the extended life expectancy of these batteries.

The batteries are against the back wall of the cabinet. The location of the battery strings and other back wall components appears in the figure “OPM bay frame and equipment arrangement OPM-640 (NT8X01AA,AB)".

Environmental control unit

An ECU is at the bottom of each bay. An ECU consists of four circulation fans, an air damper, an air heater and an air filter. These components interact to maintain temperature and relative humidity of the OPM cabinet in acceptable limits for the electronic equipment of the OPM. The OPM has temperature sensors to detect extremely high or low temperatures.

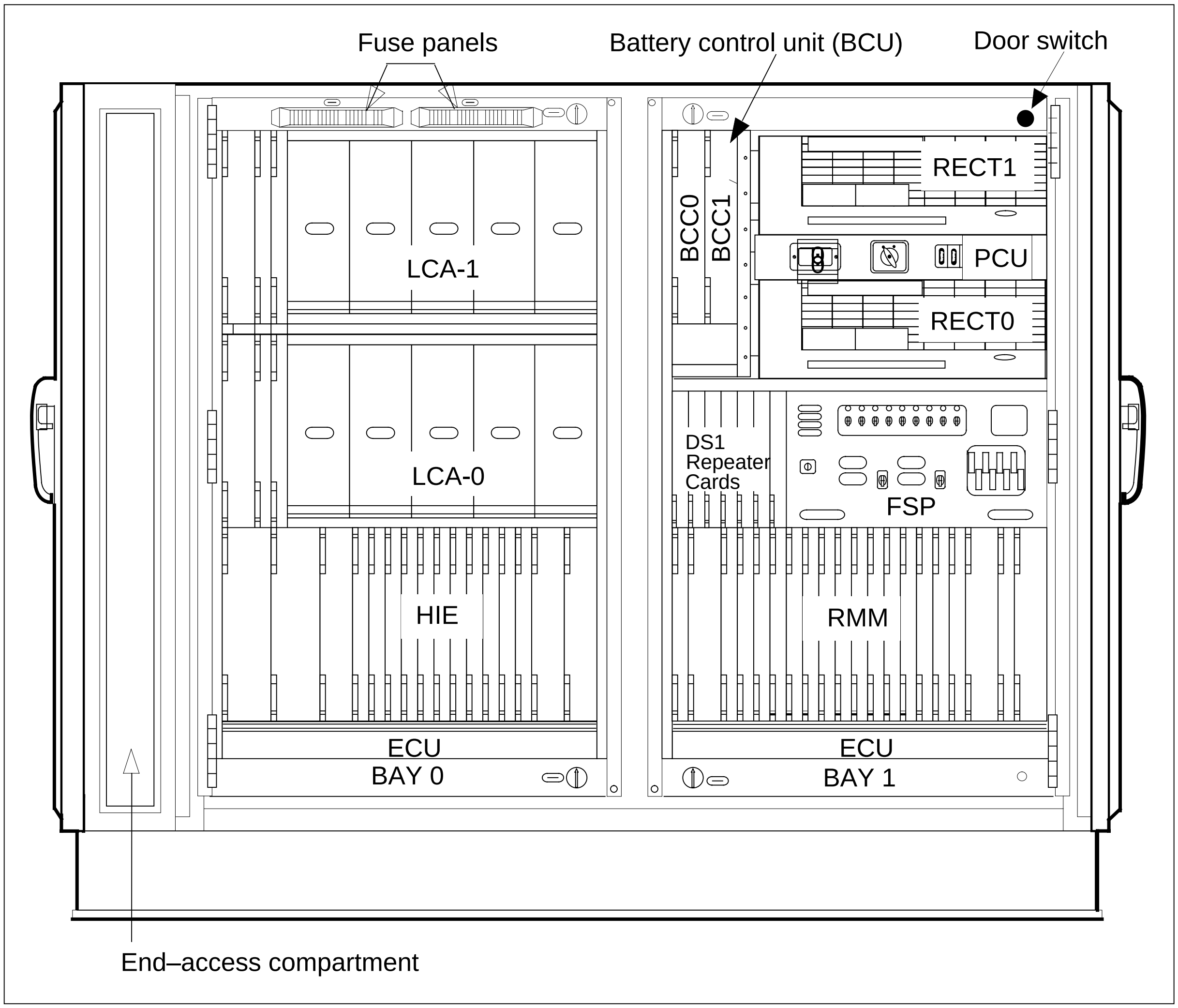
Rectifier system

The rectifiers convert the commercial ac power supply to dc power to operate the OPM equipment and fans. The dc power charges the batteries. The rectifiers are on both sides of the power control unit. The power control unit consists of an ac service receptacle with surge protection, circuit breakers, and a switch for manual control of the power source.

Cable-connecting compartment

The cable-connecting compartment is in the end-access compartment. The cable-connecting compartment provides outside plant cable protection, terminals, and cross-connections for incoming lines and cables. Refer to “End-access compartment" in this document.

Figure 5-2 Bay frame and equipment arrangement, OPM-640 (NT8X01AA, AB)



Additional OPM components

The following sections describe optional components that are available for both the OPM-640 and the OPM-256.

Calibration device

The OPM-640 and the OPM-256 can support the installation of a calibration device. This device tests for calibration of the Digital Remote Test Unit (DRTU) testing equipment. A small case, approximately 76 mm by 114 mm by 36 mm (3 in by 4.5 in by 1.4 in), contains the calibration device. The small case is mounted above the utility power breaker. Refer to the figure “OPM bay frame and equipment arrangement OPM-640 (NT8X01AA, AB)".

Digital Remote Test Unit

The DRTU (NT0J42AA) model 3704 allows a full set of accurate and cost-effective line tests over standard DS-1 or fiber-optic facilities. The fiber-optic facilities are at an OPM remote location. The DRTU is mounted on the back wall of an OPM-640 or OPM-256. For more information about the DRTU, refer to the *Model 3704 Digital Remote Test Unit (DRTU) Description and Installation Guide*, 662-5021-233. You also can refer to the *Model 3704 Digital Remote Test Unit (DRTU)/Outside Plant Module (OPM) Installation Instructions*, 662-5021-235. Refer to figure “Battery arrangement and back wall components in the OPM cabinet".

Fiber Multiplex Terminal-6

The Fiber Multiplex Terminal-6 (FMT-6), is a compact stand-alone multiplexer and 6-Mbps light-wave transmission system. The FMT-6 transports a maximum of four DS-1 electrical signals by single mode or multimode fiber-optic cable. The FMT-6 can be mounted on the back wall of an OPM-640 or OPM-256. For FMT-6 ordering, installation, and operation information, refer to the *FMT-6 User Guide*, 321-3231-290.

Additional OPM-256 components

The following sections describe optional components available for the OPM-256. Also, refer to the figure “Bay frame equipment location for OPM-256 (NT8X01BC)".

OPM-256 optional equipment shelf

The OPM-256 is a one-shelf module that contains two LCAs with only four line drawers. One shelf is empty for optional equipment. The flexibility of the OPM configuration allows provisioning of advanced digital services to remote subscribers. The optional equipment available for this shelf includes:

- line size upgrade equipment
- DE-4E enhanced PCM channel bank
- FMT-150B fiber terminal

The section describes the optional equipment available for OPM-256.

Line size upgrade equipment

A 320-line upgrade kit (NT8X09AB, AC, AD) increases the total line size of the OPM-256 to 576 lines. This option can be installed as a field upgrade without loss in service. This condition provides a lower cost result for small community growth needs. Additional line cards and the requirement for an additional scan card (NT0X10), in the RMM in slot 7 causes the change in OPM function.

Channel bank option

The installation of a user-selected channel bank provides special services. The special services include foreign exchange, non-switched digital data, and off-premises extensions. The channel bank does not share any operational functionality with the OPM, except alarms. Alarms require the addition of a scan card (NT0X10) in the RMM slot 7. The only restrictions on the channel bank used are the internal environmental and operational restrictions of the OPM.

DE-4E Smart channel bank

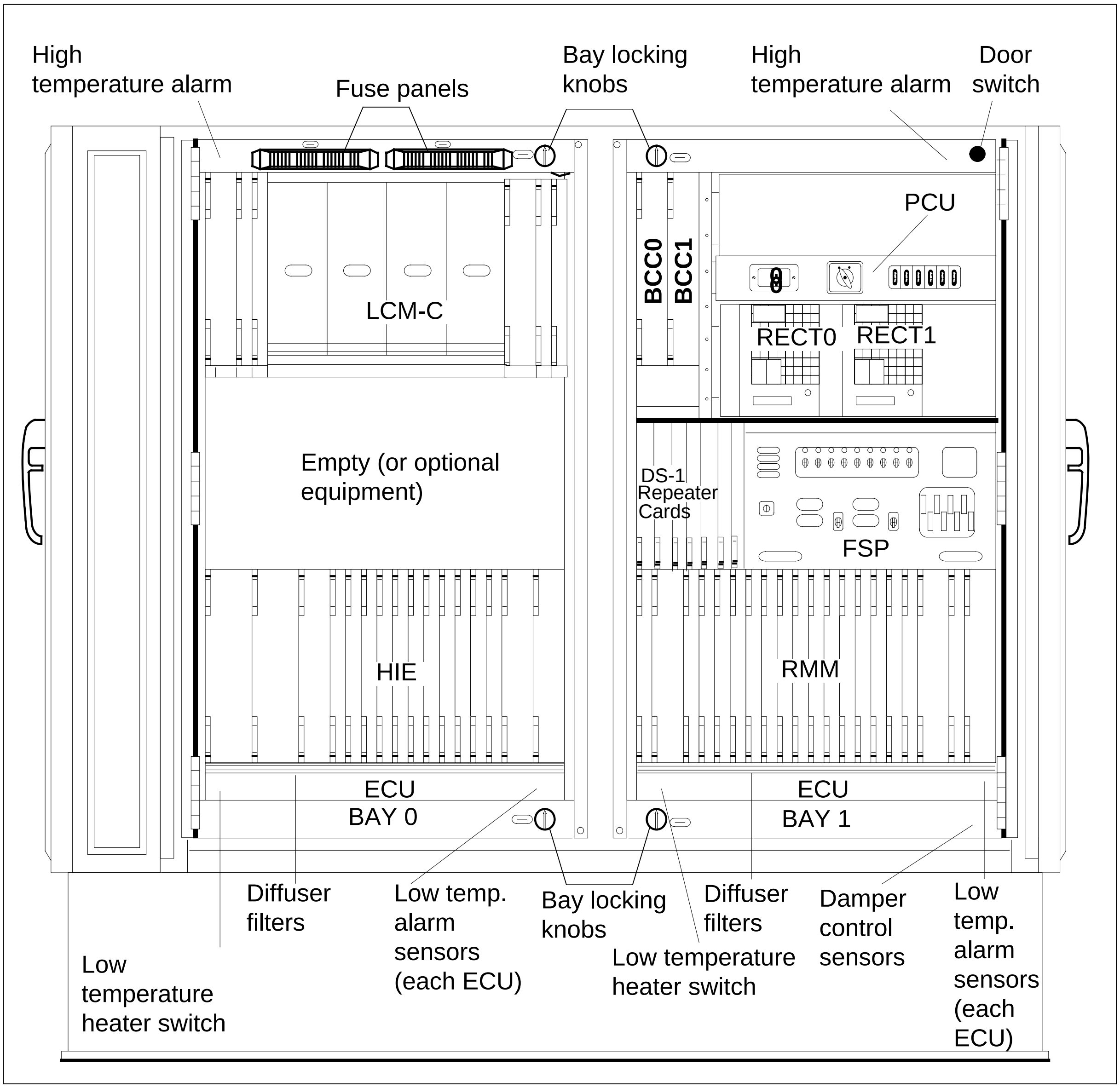
The DE-4E smart channel bank (NT4S42CA) is available from Northern Telecom. The DE-4E Smart is a 24-channel digital carrier terminal for two-way transmission of voice and data signals. The signals travel over T1, T1C, or T2 compatible carrier systems. All classes of switched telephone trunks and special service voice frequency applications can use the DE-4E. For more information, refer to the *DE-4E Smart Index to Applicable Publications*, 368-5161-001. You also can refer to the *DE-4 Enhanced PCM Channel Bank Description*, 368-5151-110.

The DE-4E can only be mounted in the optional equipment shelf of the OPM-256. Mounting kits required for the DE-4E Smart channel bank are:

- NT0X1980—Used with OPM-256 equipped with 4-pin protector blocks
- NT0X1981—Used with OPM-256 equipped with 5-pin protector block (without 50ft. cable stub).
- NT0X1982—Used with OPM-256 equipped with 5-pin protector block (with 50ft. cable stub).

The OPMs NT6X60 ringing generators can be used as the DE-4Es ringing source for single coded 20 hertz application only. Refer to the figure “Bay frame equipment location for OPM-256 (NT8X01BC)" for a diagram of the OPM-256 cabinet layout.

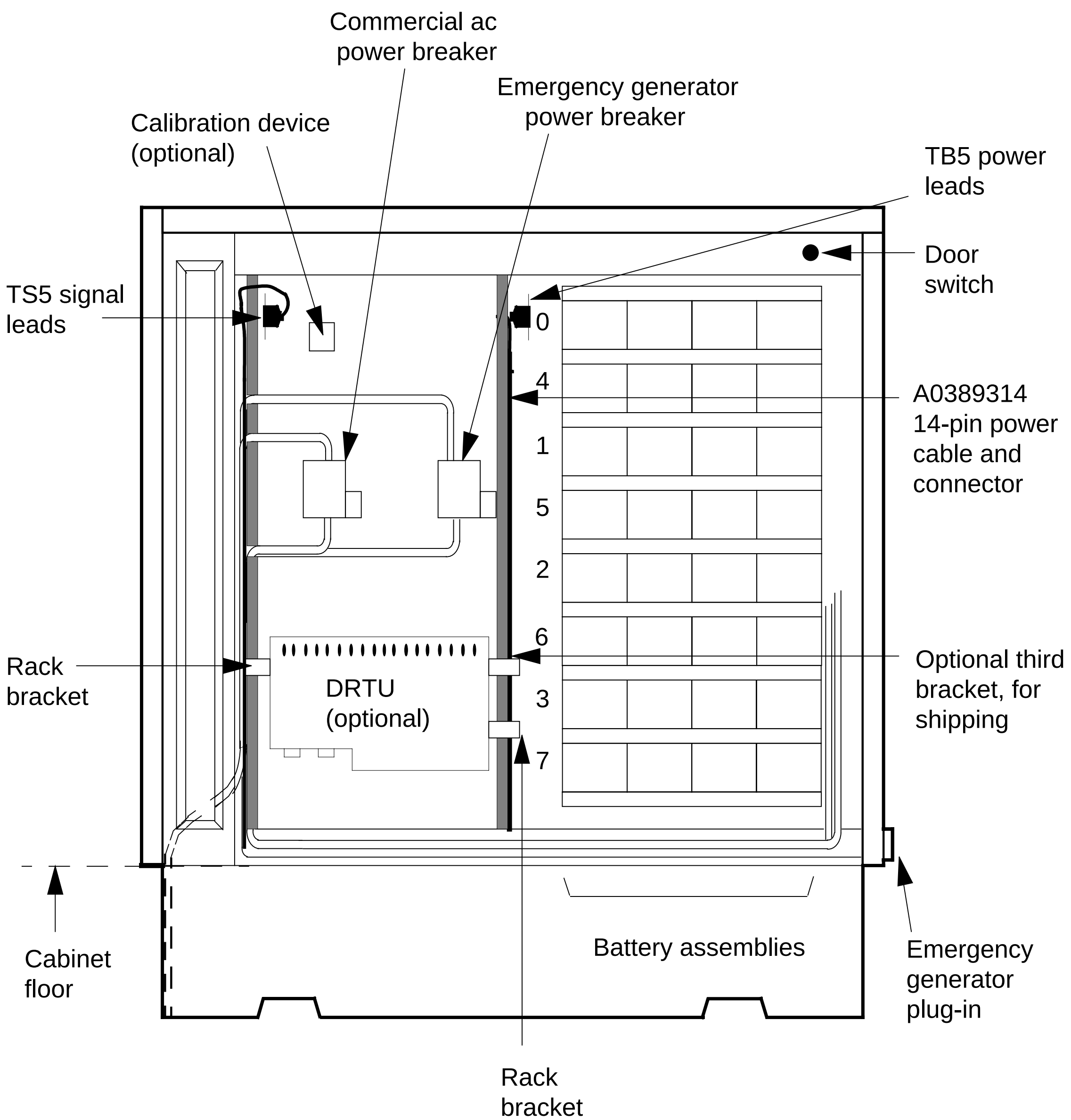
Figure 5-3 Bay frame equipment location for OPM-256 (NT8X01BC)



Fiber interface option

Fiber optic connectivity significantly enhances transmission quality and reduces the need for repeaters. The FMT-150B is a fiber multiplex terminal that can be mounted on the OPM optional equipment shelf. Refer to the *FMT-150 Optical Fiber Digital Transmission System User Guide,* 321-3211-001, for additional information on the FMT-150 system.

Figure 5-4 Battery arrangement and back wall components in the OPM cabinet



Note 1: Batteries are at the back of the cabinet.

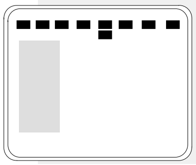
Note 2: Battery strings 3 and 7 are not provisioned for OPM-256.

6 The OPM recovery procedures

This chapter contains a recovery procedure that recovers an Outside Plant Module (OPM) to service from a completely out-of-service condition. Maintenance personnel can use this procedure in a DMS-100/200 office.

OPM

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nLCM**	.	.	.	.	.
				C					

Application

Use this procedure to recover service in an outside plant module (OPM) when the following two conditions occur:

- the ac power is interrupted
- battery (dc) power is discharged below the low voltage limit

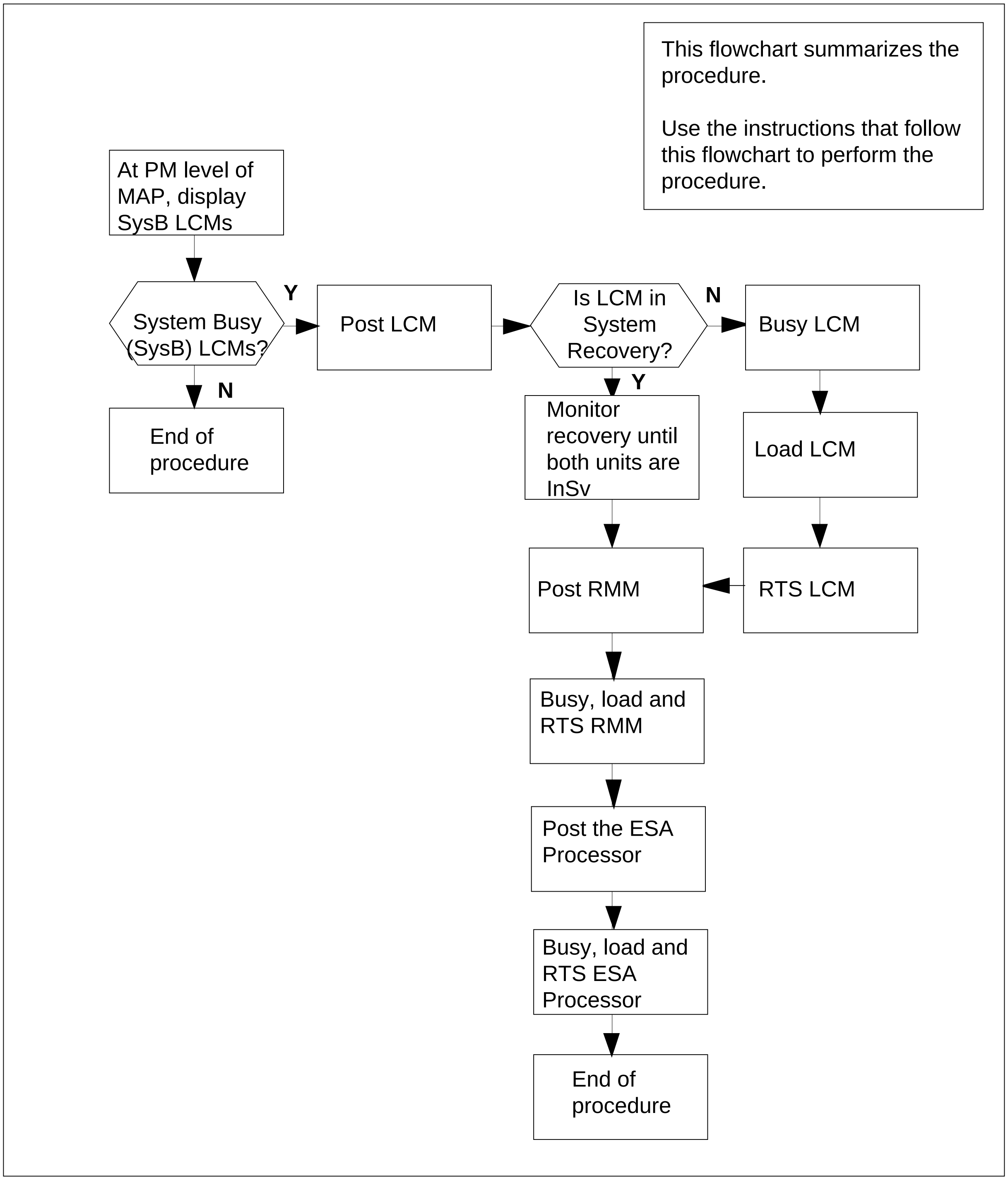
The OPM does not have ac or dc power.

Action

This procedure contains a procedure and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

OPM (continued)

Summary of OPM recovery procedure



OPM (continued)

OPM recovery procedure

At the OPM site

1 Open the front doors and both bays of row A. Open Bay 1 first.

2 Verify that ac and dc power are present.

If OPM	Do
is NT8X01AA,AB, BA or BB	step 3
is NT8X01AC or BC	step 4

3 To verify that ac and dc power are present, perform the following:

- **a** Make sure ac ON lamps on the J2427B rectifiers are ON.
- **b** Make sure dc ammeters indicate the DC load of the J2427B rectifiers.
- **c** Go to step 5.

4 To verify that ac and dc power are present, make sure the digital display LEDs indicate the dc load of the 5C6CA rectifier.

5 Close and lock the two bays of row A. Close Bay 0 first.

On the RMM shelf

6 Restore power to the RMM shelf as follows:

- **a** Make sure the POWER switch is ON for the two power converters (NT2X09 and NT2X06).
- **b** Press and hold the RESET button on the NT2X09 power converter. Reset CB5 on the FSP.

On the HIE shelf

7 Restore power to the HIE shelf as follows:

- **a** Make sure the POWER switch is ON for the two NT2X70 power converters.
- **b** Press and hold the RESET button of the NT2X70 in slot position 22. Reset CB4.
- **c** Press and hold the RESET button of the NT2X70 in slot position 25. Reset CB1.

At the MAP terminal

8 To access the peripheral module (PM) level of the MAP display, type

>MAPCI;MTC;PM

and press the Enter key.

9 To post the OPM with the power failure, type

>post lcm **site frame lcm**

and press the Enter key.

where

site
is the site name of the OPM (alphanumeric)

frame
is the frame number of the OPM cabinet

lcm
is the number of the LCM

Note: The display on the right of the MTCE flag of the two units reads SYSTEM RECOVERY. Monitor the recovery until the two units are in-service.

If system recovery	Do
passes	step 13
fails	step 10

10 To busy the LCM , type

>BSY PM

and press the Enter key.

11 To load the LCM, type

>LOADPM PM CC

and press the Enter key.

If the load	Do
passes	step 12
fails	step 22

12 To return the LCM to service, type

>RTS PM

and press the Enter key.

If the LCM	Do
returns to service	step 13
fails to return to service	step 22

13 To display the peripheral-side (P-side) peripherals, type

>TRNSL P

and press the Enter key.

14 To post the remote maintenance module (RMM) on the P-side of the LCM, type

>POST RMM rmm_no

OPM (continued)

and press the Enter key.

where

rmm_no
is the number of the RMM to post in step 13

15 To busy the RMM, type

>BSY

and press the Enter key.

16 To load the RMM, type

>LOADPM

and press the Enter key.

If loadpm	Do
passes	step 17
fails	step 22

17 To return the RMM to service, type

>RTS

and press the Enter key.

If the rmm	Do
returns to service	step 18
fails to return to service	step 22

18 To post the emergency stand-alone (ESA) processor on the P-side of the LCM, type

>POST ESA esa_no

and press the Enter key.

where

esa_no
is the number of the ESA processor to post in step 13

19 To busy the ESA processor, type

>BSY

and press the Enter key.

20 To load the ESA processor, type

>LOADPM

and press the Enter key.

If loadpm	Do
passes	step 21

OPM (end)

If loadpm	Do
fails	step 22

21 To return the ESA processor to service, type

>RTS

and press the Enter key.

If the ESA processor	Do
returns to service	step 23
fails to return to service	step 22

22 For additional help, contact the next level of support.

23 The procedure is complete. If additional alarms appear, proceed to the appropriate *Alarm Clearing Procedures*.

7 OPM alarm clearing procedures

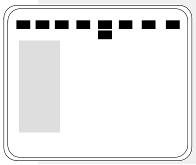
This chapter contains the alarm clearing procedures for the Outside Plant Module (OPM). The alarm indicates the procedure required to clear the trouble.

Maintenance personnel use these procedures to clear alarms as the alarms appear at the MAP display.

Procedures in this section correspond with the alarms. The system names the alarms as the alarms appear at the MAP display. These procedures appear in alphabetical order.

LCM critical

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nLCM**	.	.	.	.	.
				C					

Indication

Use this procedure to restore service in an outside plant module (OPM) when both units of the line concentrating module (LCM) are out of service (OOS). This condition always produces a central-side busy (CBsy) alarm.

The LCM alarm appears under the peripheral module (PM) header in the MAP subsystem display. This alarm indicates an alarm condition in the OPM. The *n* indicates the number of LCMs with alarms. The **C** that appears under the alarm indicates a critical alarm.

Meaning

Both units of the LCM are CBsy.

Result

Call processing ceases with critical alarm indication.

Common procedures

There are no common procedures.

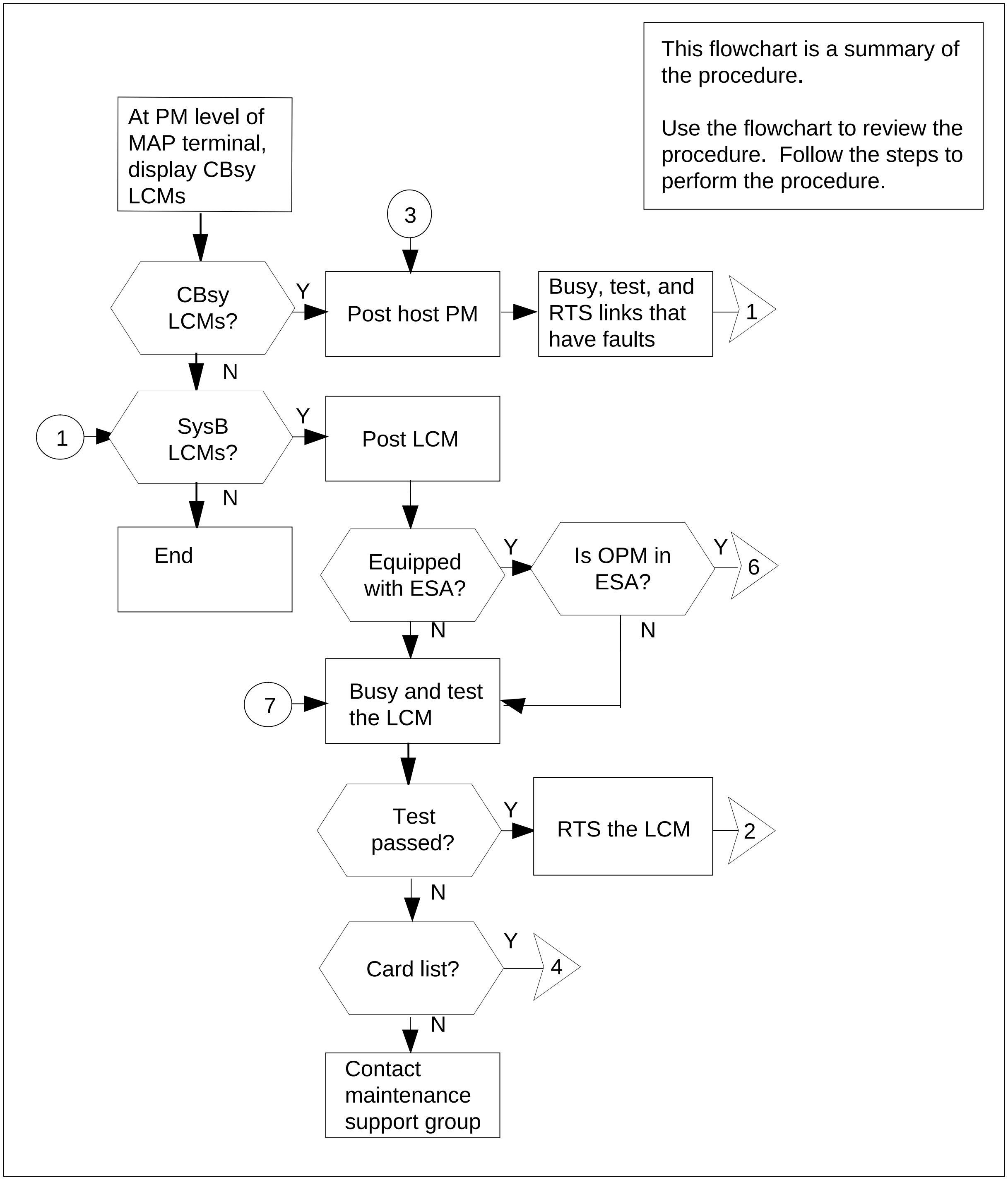
Action

The following flowchart provides a summary of the procedure. Use the flowchart to review the step-action procedure. Follow the steps to perform the procedure.

> ***Note:*** The numbers represented in the flowchart do not coincide with the step-action numbers. The numbers indicate movement within the flowchart.

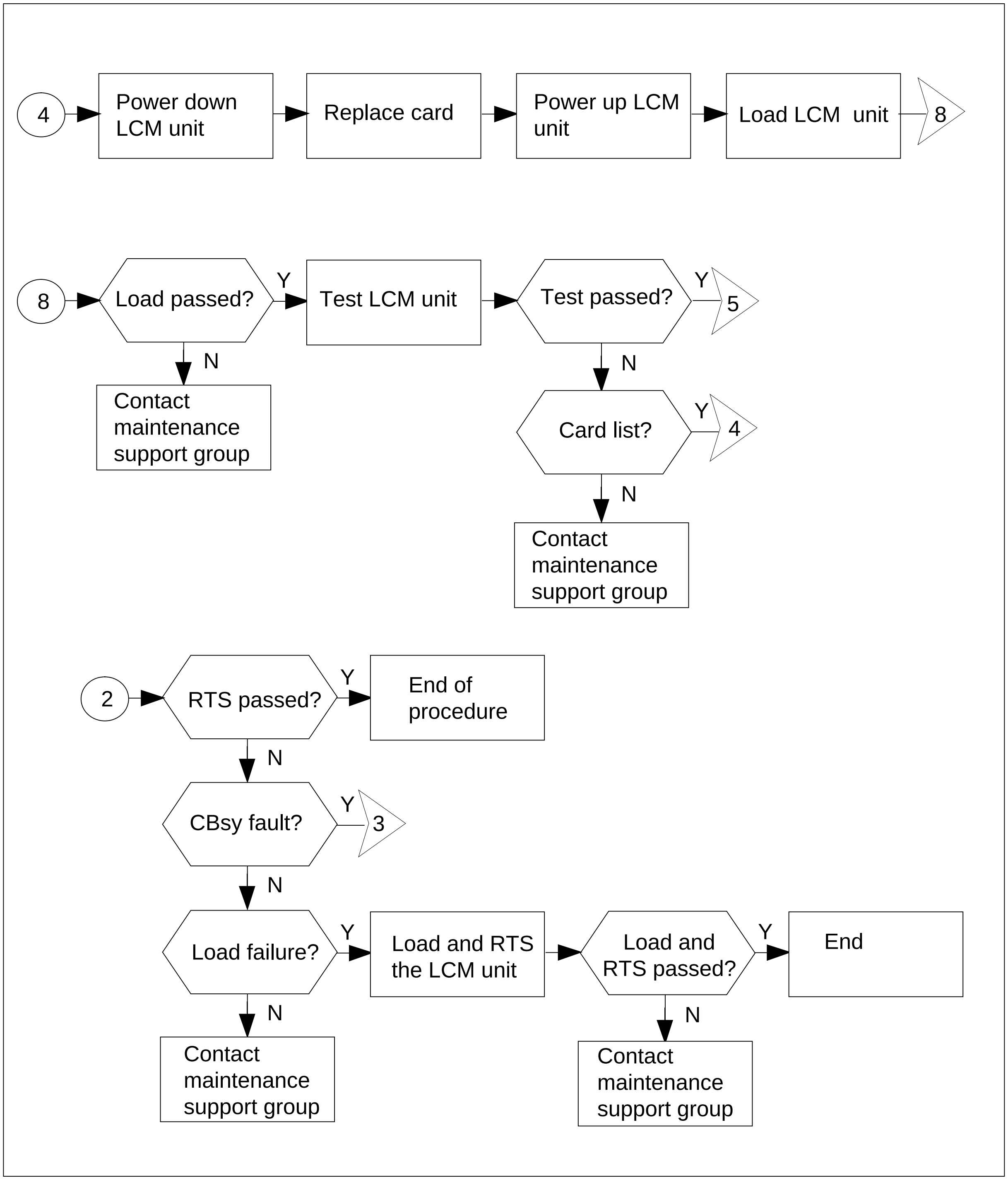
LCM
critical (continued)

Summary of clearing an LCM critical alarm



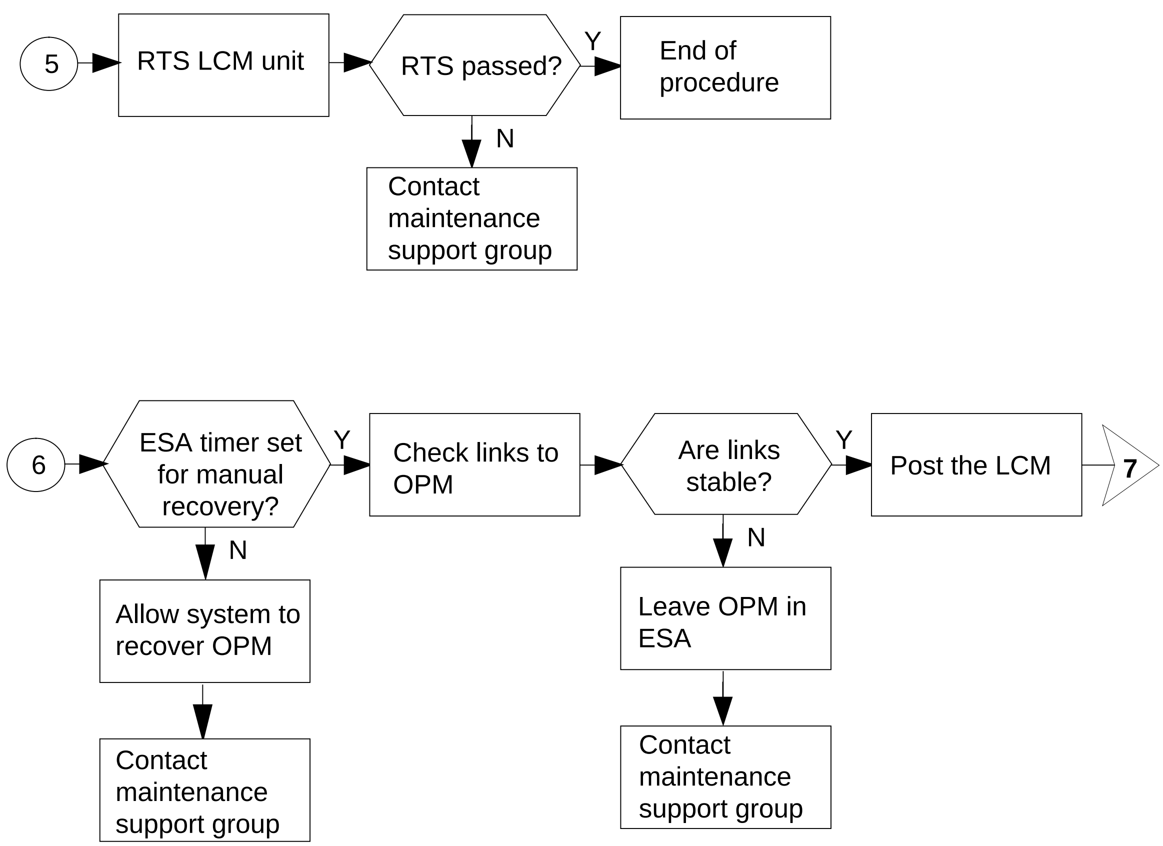
LCM critical (continued)

Summary of clearing an LCM critical alarm (continued)



LCM critical (continued)

Summary of clearing an LCM critical alarm (continued)



LCM
critical (continued)

Clearing an LCM critical alarm

At the MAP terminal

1 Enter this procedure from a PM system level alarm clearing procedure step that idenifies a PM alarm associated with an OPM fault.

2 To make sure that the OPM is receiving power, check light-emitting diodes (LEDs) on power converters in the host interface equipment (HIE), remote maintenance module (RMM), battery charge controller (BCC) and LCM shelves.

If LEDs are	Do
lit	step 3
not lit	step 4

3 To power up the OPM, move the power switch on the power converters to the ON position. Move the associated circuit breaker in the frame supervisory panel (FSP) to the ON position. Hold the FSP in the ON position while you press the reset switch on the faceplate of the power converter. Release both switches when power restores. Refer to the following table:

Shelf number and location	CB
NT2X70 in row A bay 0, shelf 05 slot 25	CB1
NT2X70 in row A bay , shelf 05 slot 22	CB4
NT2X09 in row A bay 1 , shelf 05 slots 17 and 20	CB5
NT6X53 in row A bay 0 , shelf19/33 slot 1	CB6/CB7
NT6X60 in row A bay 0 , shelf 05 slots 1 and 5	CB2/CB3
NT8X02 in row A bay 1 , shelf 32 slots 2 and 4	ON/OFF switch on faceplate

4 To silence an audible alarm, type:

>MAPCI;MTC;SIL

and press the Enter key.

5 To access the PM level of the MAP display, type:

>PM

and press the Enter key.

LCM
critical (continued)

6 To identify the OPM that has faults, type:

>DISP STATE CBSY LCM

and press the Enter key.

If response	Do
indicates no CBsy LCMs	step 17
indicates CBsy LCMs	step 7

7 To post the OPM with the alarm condition, type:

>POST LCM CBsy

and press the Enter key.

Note the name and number of this OPM.

8 To identify central side (C-side) links to the host PM, type:

>TRNSL C

and press the Enter key.

Example of a MAP response:

```
Link 0: LTC 0   2; Cap MS; Status: SysB  ;MsgCond: CLS
Link 1: LTC 0   6; Cap MS; Status: SysB  ;MsgCond: CLS
```

9 To post the host PM, type:

>POST pm pm_no

and press the Enter key.

where

pm
is a line group controller (LGC), line trunk controller (LTC), or remote cluster controller (RCC)

pm_no
is the number of the PM

10 To display the peripheral-side (P-side) links, type:

>TRNSL P

and press the Enter key.

Example of a MAP response:

```
Link 2: LCM REM1 00 0    2; Cap MS; Status: SysB ;MsgCond: CLS
Link 6: LCM REM1 00 0    1; Cap MS; Status: SysB ;MsgCond: CLS
```

Record information for the links that have a status other than OK.

11 To busy the link that has faults, type:

>BSY LINK link_no

and press the Enter key.

LCM
critical (continued)

where

link_no
is the number of a P-side link identified in step 10

12 To test the busied link, type:

>TST LINK link_no

and press the Enter key.

where

link_no
is the number of a P-side link busied in step 11

If test	Do
passed	step 13
failed	step 33

13 To return to service (RTS) the busied link, type:

>RTS LINK link_no

and press the Enter key.

where

link_no
is the number of a P-side link tested in step 12

If RTS	Do
passed and no other links are system busy (SysB)	step 14
passed but other links are SysB	step 11
failed	step 33

14 To post the OPM noted in step 7 with the alarm condition, type:

>POST LCM site frame lcm

and press the Enter key.

where

site
is the site name of the OPM (alphanumeric)

frame
is the frame number of the OPM (0 to 511)

lcm
is the number of the LCM unit of the OPM

15 To busy both LCM units of the OPM, type:

>BSY PM

and press the Enter key.

16 To RTS the PM, type:

>RTS PM

and press the Enter key.

If RTS	Do
passed	step 40
failed	step 33

17 To identify the OPM that has faults and display the LCM by site, type:

>DISP STATE SYSB LCM

and press the Enter key.

If response	Do
indicates no SysB LCMs	step 40
indicates SysB LCMs	step 18

18 To post the OPM with the alarm condition, type:

>POST LCM SYSB

and press the Enter key.

19

CAUTION
If you do not allow the time required for the system to clear the alarm, a false alarm indication occurs.
Allow 3 to 5 m for the system to clear the alarm before you proceed to the next step.

To determine if the OPM is equipped with emergency stand-alone (ESA), type:

>QUERYPM

and press the Enter key.

Example of a MAP response:

LCM
critical (continued)

```
PM Type: LCM  Int. No.: 20  Status index: 9  Node_No: 165
Memory Size: 256K
ESA equipped: Yes, Intraswitching is On
Loadnames:LCMINV –XLCM06AW,Unit0:XLCM06AW, Unit1:XLCM06AW
Node Status: (OK, FALSE)
Unit 0 Status: (OK, FALSE)
Unit 1 Status: (OK, FALSE)
 Site Flr RPos Bay_id  Shf  Description   Slot   EqPEC
 REM1  01 D04  LCM 40  04  LCM  40       0:0    6X04AA
```

If OPM	Do
is equipped with ESA	step 20
is not equipped with ESA	step 27

20 To determine if the OPM is in ESA, perform a manual check for a dial tone at the remote. A PM alarm appears on the MAP screen that indicates the OPM is in ESA.

If the OPM	Do
has dial tone	step 21
does not have dial tone	step 27

21 Determine if the OPM has the ESA timer set for manual recovery from ESA. To access table OFCENG, type:

>TABLE OFCENG

and press the Enter key.

22 To check the OPM time of exit, type:

>POS RLCM_XPMESAEXIT

and press the Enter key.

Example of a MAP response:

```
        PARMNAME            PARMVAL
---------------
RLCM_XPMESAEXIT               3
```

If PARMVAL	Do
is set to zero	step 23
is greater than zero	Allow the system to recover the OPM. Go to step 33.

LCM
critical (continued)

23 Before you perform a manual restore on the OPM from ESA, check if the links to the OPM are stable To find the link numbers for this OPM, type:

>TRNSL C

and press the Enter key.

Example of a MAP response:

```
Link  0:    LTC 1       0;Cap MS;Status:OK     ;MsgCon:OPN
Link  1:    LTC 1       2;Cap MS;Status:OK     ;MsgCon:OPN
Link  2:    LTC 1       3;Cap  S;Status:OK
Link  3:    LTC 1       4;Cap  S;Status:OK
```

24 To access the CARRIER level of the MAP terminal, type:

>TRKS;CARRIER

and press the Enter key.

25 To post the host XMS-based peripheral module (XPM) links and check link conditions for slips and framing errors, type:

>POST pm_type pm_no link_no

and press the Enter key.

where

pm_type
is an LGC, LTC, or RCC

pm_no
is the number of the PM zero to 127

link_no
is the number of the link associated with the host XPM. Refer to step 23 display.

Repeat the POST command for each link.

Example MAP response:

```
N CLASS  SITE LTC CK D ALRM SLIP FRME   BER    ES SES STATE
0 REMOTE HOST   1  0 C        0    0      1      0  0  INSV
```

where

The number that appears under the CK (circuit) header is the host XPM link number.

Note: This display shows carrier facilities from the host XPM to the OPM. Use the Detail REM option to check the carrier facilities from the remote site back to the host XPM.

If link conditions	Do
display a high number of SLIP and FRME	Leave the OPM in ESA. Go to step 32.

LCM
critical (continued)

If link conditions	Do
display a very low number of SLIP and FRME	step 26

26 To post the OPM with the alarm condition, type:

>PM; POST LCM site frame lcm

and press the Enter key.

where

site
is the site name of the OPM (alphanumeric)

frame
is the frame number of the OPM (0 to 511)

lcm
is the number of the LCM unit of the OPM

27 To busy both LCM units of the OPM, type:

>BSY PM

and press the Enter key.

Go to step 30.

28 To test both LCM units of the OPM, type:

>TST PM

and press the Enter key.

If test	Do
passed	step 30
failed, and the system generated a card list	step 29
failed, and the system did not generate a card list	step 33

29 The card list identifies the cards at risk for faults. Replace the cards one at a time in the order listed.

If you	Do
did not replace the last card on the list	step 34
did replace the last card on the list	step 33

LCM
critical (continued)

30 To attempt to return the OPM to service, type:

>RTS PM

and press the Enter key.

If MAP prompt	Do
indicates RTS is successful	step 40
indicates CBsy	step 8
indicates load failure	step 31
indicates all other results	step 33

31 To attempt to reload the OPM, type:

>LOADPM PM CC

and press the Enter key.

If load	Do
is successful	step 30
is not successful	step 33

32 Contact the carrier maintenance support group for maintenance on the open links or unstable links. When carriers are restored, go to step 25.

33 Contact your maintenance support group for additional instructions to clear this fault.

34 Move the circuit breaker switch to the OFF position to power down the converter in the LCM unit of the OPM.

Use the following table to determine which FSP circuit breaker serves the unit:

IfCircuit breaker	DoUnit
CB06	LCA 0
CB07	LCA 1

35 Go to the *Card Replacement Procedures.* Replace the first or next card on the card list. Notify outside plant personnel that you are changing the card. Go to step 36 after you replace the card

36 Power up the converter in the LCM unit of the OPM you are working on. Switch ON the circuit breaker that was turned OFF in step 34.

37 To attempt to load the LCM unit, type:

>LOADPM UNIT lcm_unit

and press the Enter key.

LCM
critical (end)

where

lcm_unit
is the LCM unit of the OPM to be loaded (0 or 1)

If load	Do
is successful	step 38
is not successful	step 33

38 To test the LCM unit, type:

>TST UNIT lcm_unit

and press the Enter key.

where

lcm_unit
is the LCM unit of the OPM to be tested (0 or 1)

If test	Do
passed	step 39
failed, and the system generated a card list	step 29
failed, but the system did not generate a card list	step 33

39 To attempt to return the LCM unit to service, type:

>RTS UNIT lcm_unit

and press the Enter key.

where

lcm_unit
is the LCM unit of the OPM to return to service (0 or 1)

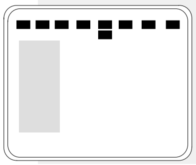
If RTS	Do
passed	step 40
failed	step 33

40 The procedure is complete.

Proceed to the correct procedure to clear an alarm if additional alarms appear.

LCM (RG) critical

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nLCM**	.	.	.	.	.
				C					

Indication

At the MTC level of the display, *n*LCM appears under the PM subsystem header. A *C* under the *n*LCM indicates a critical alarm involving an LCM. The *n* indicates the number of LCMs with this alarm.

Meaning

The ringing generator units are in the in-service trouble (ISTb) state.

Result

If both ringing generator units fail, the system cannot automatically switch to an active ringing generator (SwRG). The system cannot generate ringing. This condition affects subscriber service.

Common procedures

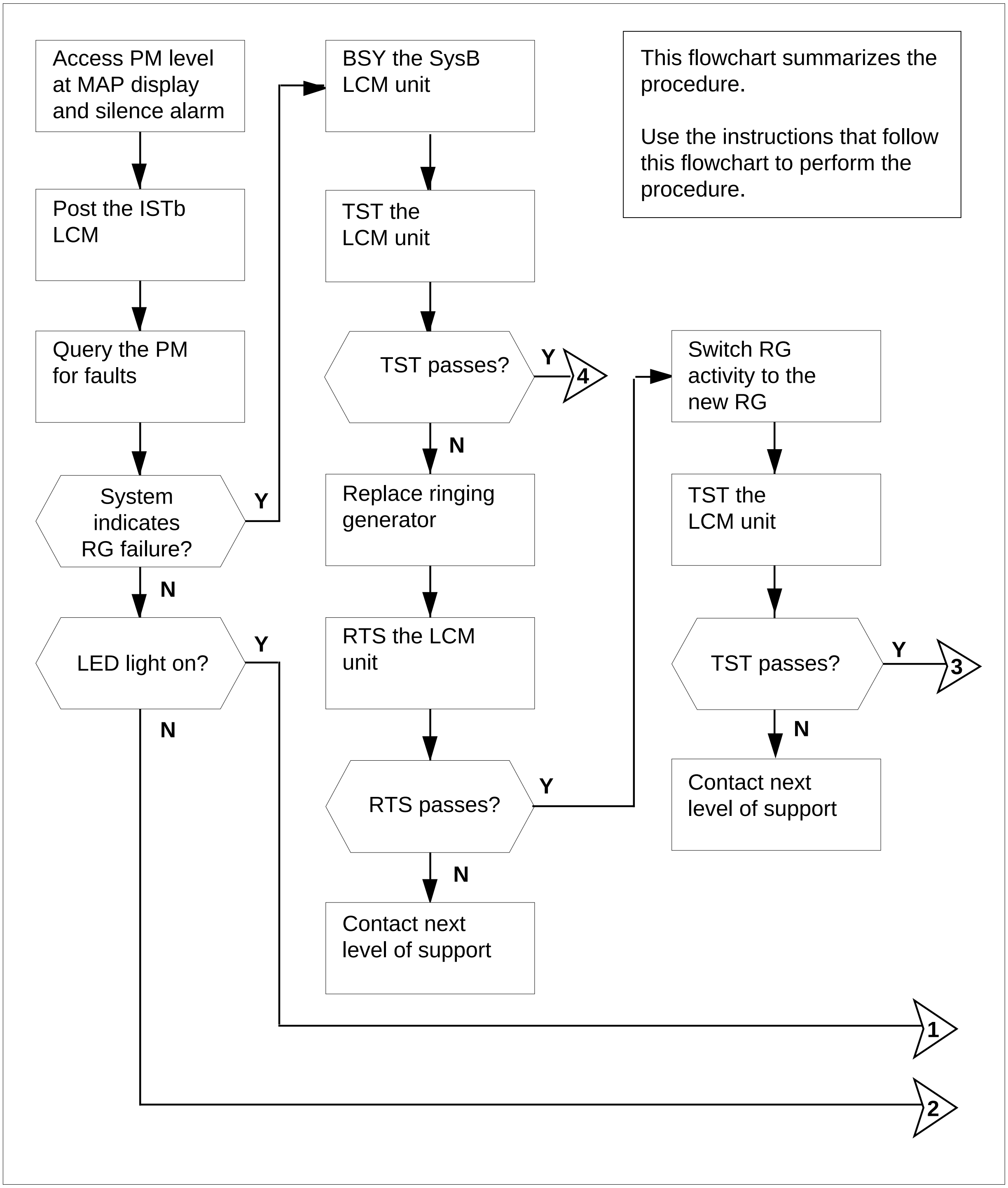
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

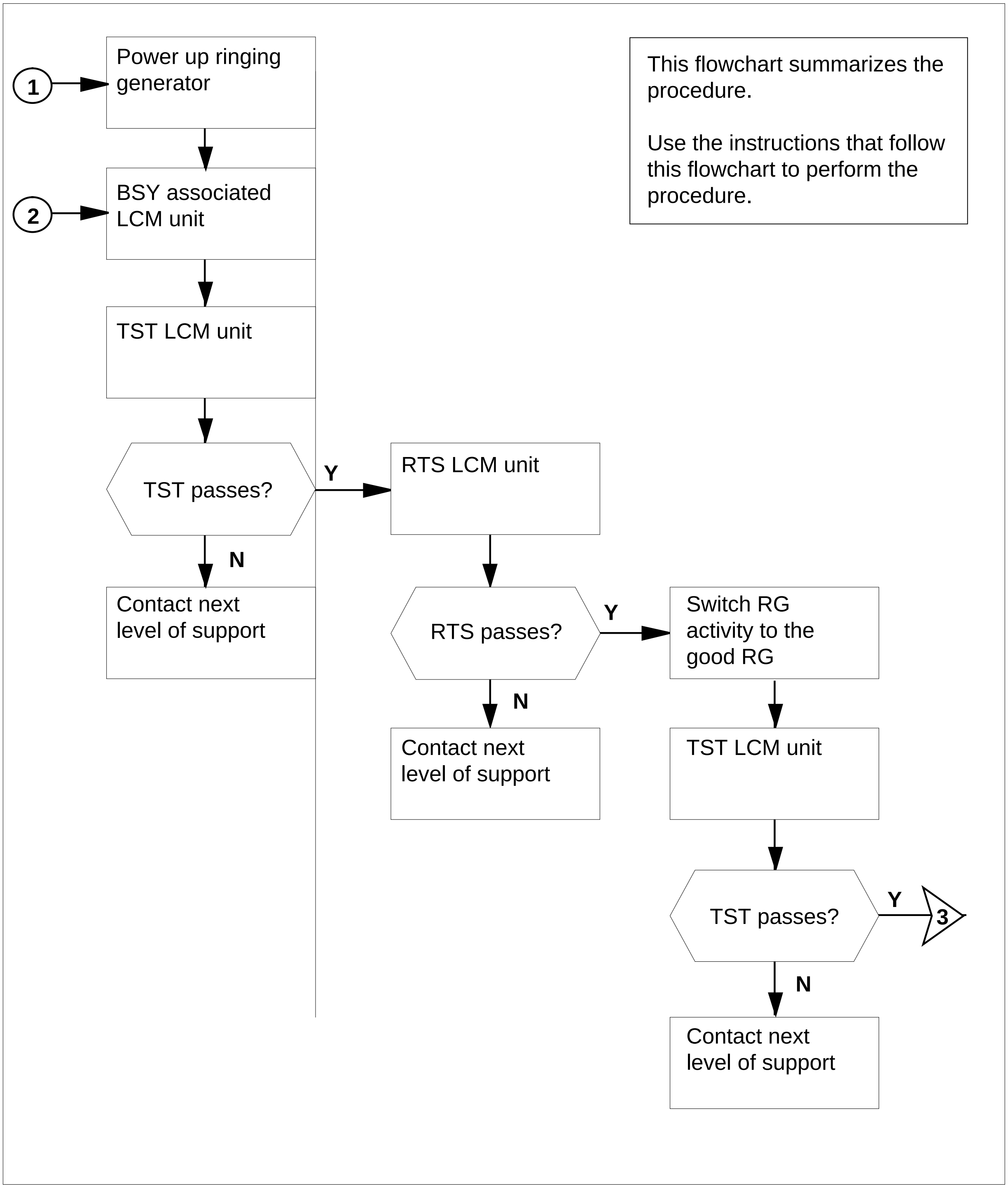
LCM (RG) critical (continued)

Summary of clearing an LCM (RG) critical alarm



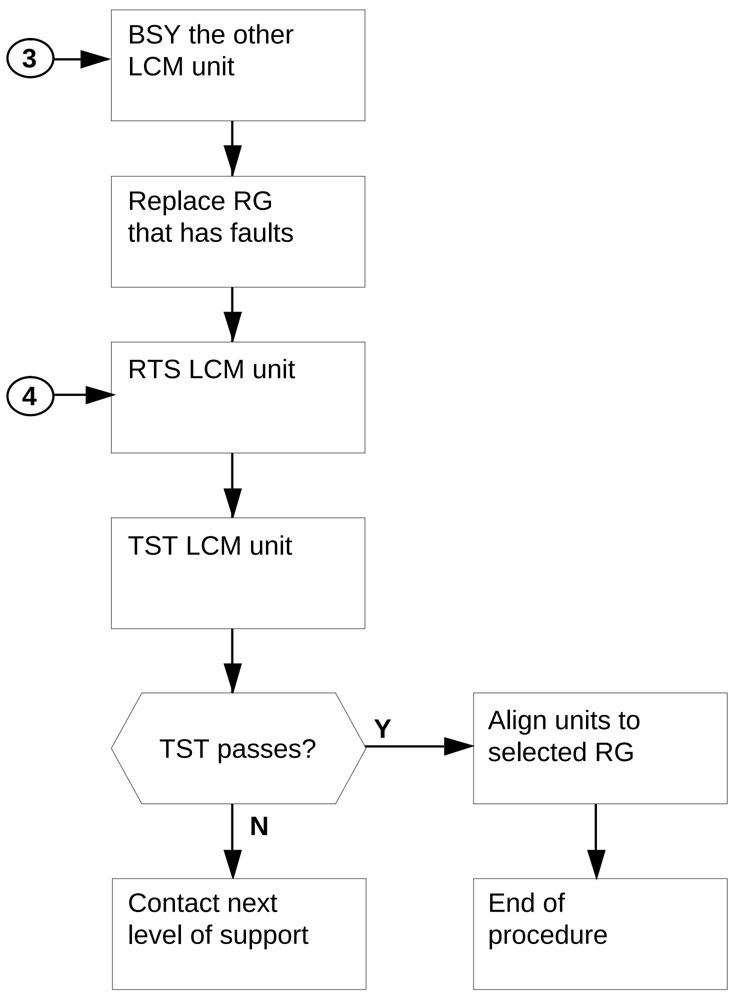
LCM (RG) critical (continued)

Summary of clearing an LCM (RG) critical alarm (continued)



LCM (RG)
critical (continued)

Summary of clearing an LCM (RG) critical alarm (continued)



LCM (RG)
critical (continued)

Clearing an LCM (RG) critical alarm associated with a ringing generator

> **ATTENTION**
> Enter this procedure from the PM system level alarm clearing procedure step. This step must identify a PM alarm associated with an OPM ringing generator fault.

At the MAP terminal

1 To silence the alarm, type

>MAPCI;MTC;PM;SIL

and press the Enter key.

2 To identify the PM that has faults, type

>DISP STATE ISTB LCM

and press the Enter key.

3 To post the ISTb PM identified in step 2, type

>POST LCM site frame_no lcm_no

and press the Enter key.

where

site
is the name of the site where the PM is located

frame_no
is the number of the PM frame (00 to 99)

lcm_no
is the number of the LCM (0 or 1) in the frame

Example of a MAP display:

```
       SysB     ManB     OffL     CBsy     ISTb      InSv
PM      1        0        2        0        0          12
LCM     1        0        2        0        0           9

LCM   REM1  14 1 ISTb  Links_OOS:  CSide  0   PSide   0
Unit0:   SysB                /RG: 0
Unit1:   ISTb                /RG: 0
                           11  11  11  11  11  RG:Pref 0 ISTb
 Drwr:  01  23  45  67  89  01  23  45  67  89     Stby 1 ISTb
        ..  ..  ..  ..  ..  ..  ..  ..  ..  ..
```

4 To check for fault indicators, type

>QUERYPM FLT

and press the Enter key.

LCM (RG)
critical (continued)

Example of a MAP display:

```
 LCM   UNIT 0  Inservice troubles Exist:
Ringing Generator Failure:Ring Generator ANI/COIN Fault
 LCM   UNIT 1  Inservice Troubles Exist:
Ringing Generator Failure:Ring Generator in Excess load
```

If the system	Do
indicates RG failure	step 6
does not indicate RG failure	step 5

At the OPM site

5 Perform a visual inspection of the ringing generator. Check if the LED light is on.

If the LED	Do
is on	step 6
is off	step 7

6 To power up the ringing generator, move the circuit breakers to the ON position. The LED goes off. These switches are as follows:

- RG 0 circuit breaker CB2
- RG 1 circuit breaker CB3

At the MAP terminal

7 To manually busy the SysB LCM unit identified in step 3, type

>BSY UNIT unit_no

and press the Enter key.

where

unit_no
is the number of the SysB LCM unit (0 or 1)

8 To test the ManB LCM unit, type

>TST UNIT unit_no

and press the Enter key.

where

unit_no
is the number of the ManB LCM unit (0 or 1)

If the system	Do
generates a card list	step 9

LCM (RG)
critical (continued)

If the system	Do
does not generate a card list	step 18

9 Check the card list that appears at the MAP display.

Example of a MAP response:

```
SITE FLR RPOS BAY_ID   SHF DESCRIPTION SLOT EQPEC
REM1 01  A00  OPE 00   05   LCM:14 1   :01  6X60
REM1 01  A00  OPE 00   19   LCM:14 1   :04  6X51
REM1 01  A00  OPE 00   05   LCM:14 1   :05  6X60
REM1 01  A00  OPE 00   33   LCM:14 1   :04  6X51
```

10 Determine if you replaced the NT6X60 card.

If you	Do
replaced the NT6X60 card	step 18
did not replace the NT6X60 card	step 17

11 To return the LCM unit to service, type

>RTS UNIT unit_no

and press the Enter key.

where

unit_no
is the number of the ManB LCM unit (0 or 1)

If RTS	Do
passes	step 12
fails	step 18

12 To align RG activity to the new RG, type

>SWRG UNIT unit_no

and press the Enter key.

where

unit_no
is the LCM unit (0 or 1) associated with the new RG

LCM (RG) critical (continued)

Example of a MAP display:
LCM REM1 14 1 Unit 1 SWRG Passed

If the SWRG command	Do
passes, and you must switch RG activity for the other unit	step 13
passes, and RG activity is correct for both units	step 13
fails	step 18

13 Repeat step 12 for the other LCM unit.

14 To test the new RG, type

>TST UNIT unit_no

and press the Enter key.

where

unit_no
is the number of the LCM unit (0 or 1) associated with the new RG.

Example of a MAP response:
LCM REM1 00 0 Unit 1 InSvce Tests Initiated
LCM REM1 00 0 Unit 1 Tst Passed

If TST	Do
passes	step 15
fails	step 18

15 Repeat steps 7 to 14 for the other LCM unit.

16 To align RG activity to the selected RG, type

>SWRG UNIT unit_no

and press the Enter key.

where

unit_no
is the LCM unit (0 or 1) associated with the new RG

Example of a MAP display:
```
LCM REM1 00 0 InSv Links  OOS: Cside 0 Pside 0
Unit 0: InSv      /RG:0
Unit 1: InSv      /RG:0
                  11 11  11 11  11  RG: Pref 0 InSv
Drwr:  01  23  45  67  89  01  23  45  67  89     Stby 1 InSv         .. .. .. ..
.. .. .. .. .. ..
```

LCM (RG) critical (end)

Note: Repeat this step until both units of the LCM are on the selected RG.

If the SWRG command	Do
passes	step 19
fails	step 18

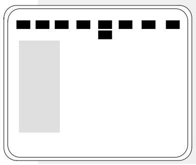
17 Go to *Card Replacement Procedures*. Complete the card replacement procedure. Go to step 11 of this procedure.

18 For additional help, contact the next level of support.

19 The procedure is complete. If the system displays other alarms, refer to the appropriate alarm clearing procedures for the indicated alarms.

LCM talk battery alarm critical

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nLCM**	.	.	.	.	.
				C					

Indication

The following text beneath the PM header at the MTC level of the MAP display indicates an alarm in an outside plant module (OPM):

- an *n* next to the LCM indicates the number of LCM modules affected
- a *C* indicates that the alarm class is critical

Meaning

One or both units of the OPM do not have a talk battery.

Result

If circuit breaker CB8 is affected, call processing ceases. There is no alarm.

If circuit breaker CB9 is affected, call processing ceases. An alarm sounds to indicate this condition.

Common Procedures

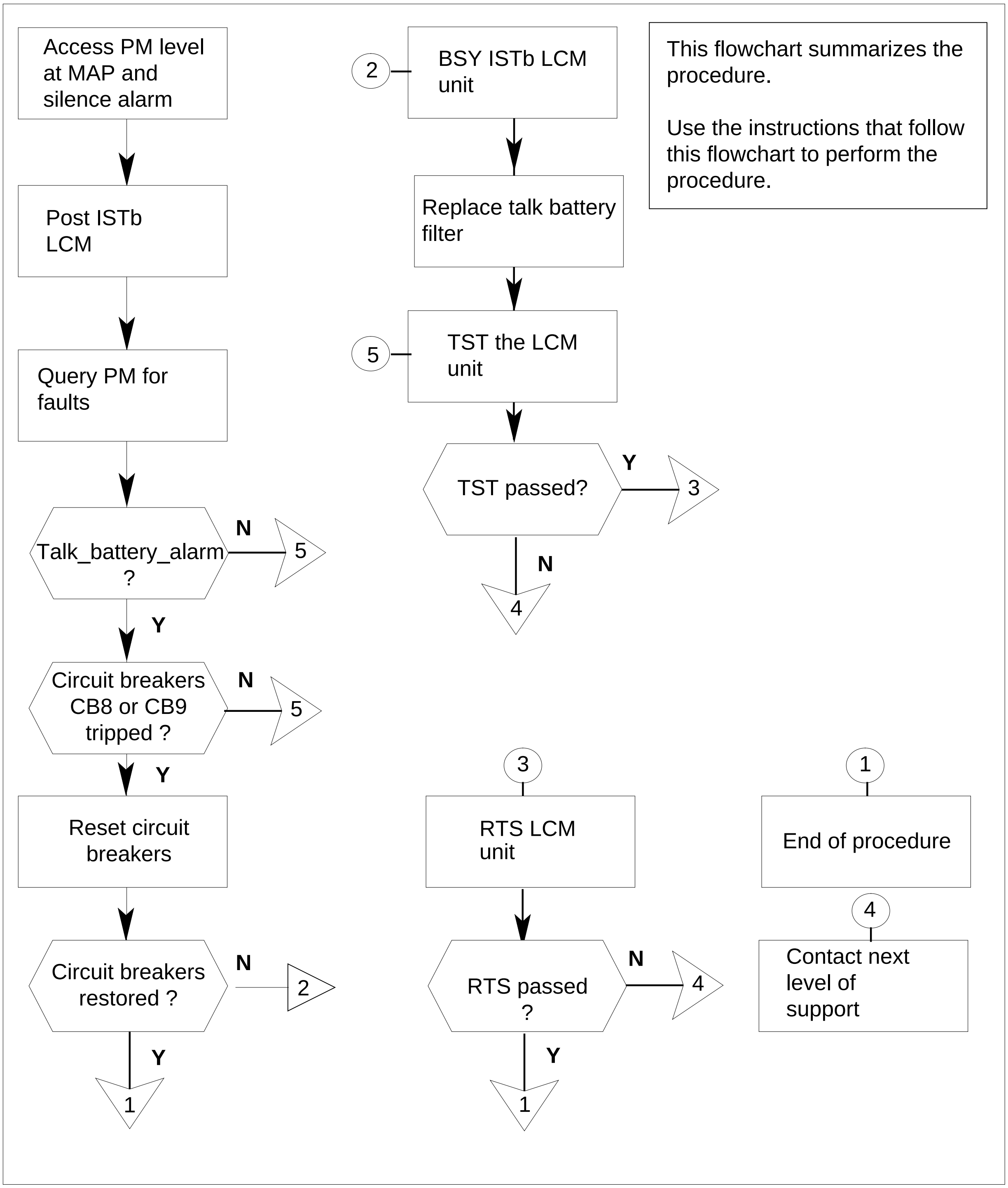
There are no common procedures.

Action

This section provides a summary flowchart of the procedure and a list of steps to clear an alarm. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

LCM talk battery alarm critical (continued)

Summary of clearing an LCM talk battery alarm critical alarm



LCM talk battery alarm critical (continued)

Clearing an LCM talk battery alarm critical alarm

At the MAP terminal

1

> **ATTENTION**
> Enter this procedure from a PM system level alarm clearing procedure step that identified a PM alarm associated with an OPM fault.

To silence an audible alarm, type

>MAPCI;MTC;SIL

and press the Enter key.

2 To access the PM level of the MAP display, type

>PM

and press the Enter key.

3 To identify the OPM that has faults, type

>DISP STATE ISTB LCM

and press the Enter key.

4 To post the OPM that lost talk battery, type

>POST LCM site frame lcm

and press the Enter key.

site
is the site name of the OPM (alphanumeric)

frame
is the frame number of the OPM (0 to 511)

lcm
is the number of the LCM (0-1)

Example of a MAP display:

```
 CM    MS     IOD     Net     PM     CCS     Lns     Trks     Ext  APPL
  .     .      .       .     1LCM     .       .       .        .     .
                              *C*

LCM              SysB     ManB     OffL     CBsy     ISTb      InSv
 0 Quit     PM    0         0        2        0        2         42
 2 Post_    LCM   0         0        0        0        2          9
 3 ListSet
 4 SwRG     LCM   REM04     ISTB     Links_OOS:  CSide  0   PSide   0
 5 Trnsl_   Unit0:   InsV                 /RG: 1
 6 Tst_     Unit1:   InsV                 /RG: 1
 7 Bsy_                                11  11  11  11  11  RG:Pref 1 InsV
 8 RTS_     Drwr:  01  23  45  67  89  01  23  45  67  89     Stby 0 Insv
 9 OffL            ..  ..  ..  ..  ..  ..  ..  ..  ..  ..
10 LoadPM_
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

At the OPM site

5 Check the fuses in each LCA baffle.

If the fuses	Do
are blown (the indicator protrudes)	step 6
are not blown	step 11

6 Determine which fuse is blown.

Note: Fuses 01-05 each supply +5 V. Fuses 06-10 each supply +15 V. Fuses 11 to 15 each supply -48 V.

If the blown fuse	Do
is one of 01 to 05	step 9
is one of 06 to 15	step 7

LCM talk battery alarm critical (continued)

7 Use the following table to determine the +15V fuse (06-10) associated with a -48V fuse (11 to15).

If-48V fuse number	Do +15V fuse number
11	06
12	07
13	08
14	09
15	10

8 Remove the blown fuse and the associated fuse. For example, if the blown fuse is fuse 11, remove fuse 06.

9 Obtain a replacement fuse with the same voltage and amperage as the blown fuse.

10

DANGER
Risk of fire
For continued protection against risk of fire, replace the blown fuse with a fuse of the same type, rating (color code), and manufacturer.

Insert the +15V fuse, and the -48V fuse.

If the fuse	Do
blows again	step 56
does not blow	step 11

11 Make a visual inspection of the frame supervisory panel (FSP). Check circuit breakers CB8 and CB9.

If circuit breakers	Do
tripped	step 21
did not trip	step 12

At the PDC frame

12 Locate the fuses that power the OPM talk battery circuits.

LCM talk battery alarm critical (continued)

13 Determine if the fuse is blown.

If the fuse	Do
is blown	step 14
is not blown	step 57

14 Remove the fuse holder that contains the blown fuse.

At the OPM site

15 Trip the circuit breaker CB8 or CB9 to remove the talk battery filter from the circuit to prevent a blown cartridge fuse.

If affected unit	Do Trip circuit breaker
is Unit 0	CB8
is Unit 1	CB9

At the PDC frame

16 Replace the cartridge fuse in the fuse holder.

17

DANGER
Risk of fire
For continued protection against risk of fire, replace the blown fuse with a fuse of the same type, rating (color code), and manufacturer.

Replace the blown fuse.

18 Install the fuse holder on the PDC frame again.

At the OPM site

19 Move the switch to the ON/OFF position and back to the ON position in quick sequence. This action resets circuit breaker CB8 or CB9 and causes the LED device to go off.

If circuit breaker	Do
trips again	step 20
remains at the ON position and the LED goes off	step 57

LCM talk battery alarm critical (continued)

20 Determine if the fuse did blow again.

If the fuse	Do
did blow again	step 56
did not blow again	step 57

21 Determine if the FSP uses network termination 1 (NT1) repeaters.

If NT1 repeaters	Do
are used	step 22
are not used	step 32

22 Move the switch to the ON/OFF position and back to the ON position in quick sequence. This action resets circuit breaker CB8 or CB9 and causes the LED device to go off.

If the circuit breaker	Do
trips again	step 23
remains at the ON position and the LED goes off	step 57

At the MAP terminal

23 To busy the LCM unit, type

>BSY UNIT lcm_unit

and press the Enter key.

where

lcm_unit
is the LCM unit you must busy

If the tripped circuit breaker	Do Busy
is CB8	unit 0
is CB9	unit 1

24 To identify the C-side peripheral, type

>trnsl c

and press the Enter key.

Example of a MAP response:

LCM talk battery alarm critical (continued)

```
                 ┌─ Host XPM type and number
                 ▼
 Link  0: LTC 0    0;Cap  MS;Status:OK   ;MsgCon:CLS
 Link  1: LTC 0    1;Cap  MS;Status:OK   ;MsgCon:CLS
 Link  2: LTC 0    3;Cap   s;Status:OK
 Link  3: LTC 0    4;Cap   S;Status:OK
```

25 To post the host peripheral, type

>POST pm_type pm_no

and press the Enter key.

where

pm_type
is the name of the host XPM (LGC, LTC, or RCC)

pm_no
is the number of the host XPM

26 To display the P-side links, type

>TRNSL P

and press the Enter key.

Example of a MAP response:

```
Link 0: LCM REM1 00 0  2;Cap MS;Status:OK;  MsgCond: CLS
Link 1: LCM REM1 00 0  1;Cap MS;Status:OK;  MsgCond: CLS
```

Record information for the links that you must busy.

27 To busy the links, type

>BSY LINK link_no

and press the Enter key.

where

link_no
is the number of a P-side link that interfaces the OPM

Note: Perform this step for each link that interfaces the OPM unit busied in step 23.

28 To access the CARRIER level of the MAP display, type

>trks;carrier

and press the Enter key.

29 To post the P-side links of the host XMS-based peripheral module (XPM), type

>POST pm_type pm_no link_no

and press the Enter key.

where

LCM talk battery alarm critical (continued)

pm_type
is the host peripheral (LGC, LTC, RCC, or RCC2)

pm_no
is the number of the peripheral (0 or 256)

link_no
is the number of the link associated with the host XPM. See step 24 display.

When the `MORE ...` prompt appears, use the NEXT command to view additional links.

Example of a MAP response:

```
N CLASS SITE LTC CK D ALRM SLIP FRME BER   ES SES STATE
0 REMOTE HOST 0   0 C       0    0    1     0  0   ManB
                  ▲
                  └─Host XPM P-side link number
```

30 Offline the links to prevent alarms and to reset the counters after the restoration of the links occurs. To offline the links, type

`>OFFL item_no`

and press the Enter key.

where

item_no
is the item number under the *n* (0-4) column

Note: Perform this step for each link busied in step 27.

At the OPM site

31 Remove the fuses and unseat the repeaters for the affected LCM unit.

If affected LCM unit	Do
is unit 0	step 32
is unit 1	step 33

32 Remove the fuses and repeaters associated with CB8 and LCA 0 in the following order:

- **a** remove -48V line drawer fuses 11 to 15
- **b** remove fuse F01 of the FSP, associated with CB8 only
- **c** unseat NT repeater cards 1 to 4.
- **d** Go to step 34.

33 Remove the fuses and repeaters associated with CB8 and LCA 0 in the following order:

- **a** remove -48V line drawer fuses, 11 through 15
- **b** unseat NT repeater cards, 5 through 7.

LCM talk battery alarm critical (continued)

34 Obtain a capacitor forming tool.

Note: A capacitor forming tool consists of a 100 watt 120V light bulb tightened into a socket with pigtail leads.

35 Loosen the slotted nut on the front of the FSP.

36

> **DANGER**
> **Risk of electrocution**
> Some terminals in the FSP have an electrical potential of -48V dc to -60V dc. Do not touch any terminals in the FSP.

Open the FSP panel.

37

> **DANGER**
> **Risk of electrocution**
> Some terminals in the FSP have an electrical potential. Remove all jewelry before you perform this step.

Connect the leads of the capacitor forming tool across the terminals that connect to wires. The terminals are in the tripped circuit breaker. The terminals that connect to wires are the top and the second from the bottom terminals.

If, after one minute, the lamp	Do
is lit and you did not replace the capacitor	step 38
is lit and you replaced the capacitor	step 56
is not lit	step 45

38 Locate the talk battery filter capacitor in the FSP.

If the circuit breaker	Do The capacitor to replace
is CB8	C1
is CB9	C2

LCM talk battery alarm critical (continued)

39 Obtain a replacement capacitor.

40 Label the leads that connect to the positive terminal of the capacitor as (+). Label the leads that connect to the negative terminal as (-). The labels prevent a reversal of the leads.

41 Disconnect the leads from the short-circuited capacitor.

42 Remove the capacitor.

43 Install a replacement capacitor.

44 Connect the leads labeled (+) to the positive terminal of the capacitor. Connect the leads labeled (-) to the negative terminal of the capacitor. Go to step 37.

45 Set the circuit breaker to the ON position.

If the circuit breaker	Do
remains at the ON position	step 46
trips again	step 56

46 Insert the five -48V line drawer fuses removed in step 32. Pause for 15 s between the insertion of each fuse.

47 Reseat the NT1 repeaters unseated in step 32.

At the MAP terminal

48 To access the CARRIER level of the MAP display, type

>trks;carrier

and press the Enter key.

49 To post the host XPM P-side links, type

>POST pm_type pm_no link_no

and press the Enter key.

where

pm_type
is the host peripheral (LGC, LTC, RCC, or RCC2)

pm_no
is the number of the peripheral (0 or 256)

link_no
is the number of the link associated with the host XPM. See step 24 display.

Note: When the `MORE ...` prompt appears, use the NEXT command to view additional links.

Example of a MAP response:

LCM talk battery alarm critical (continued)

```
N CLASS SITE LTC CK D ALARM SLIP FRAME  BER   ES SES STATE
0 REMOTE HOST 0   0 C        0     0     1     0  0  OFFL
                  └─Host XPM P-side link number
```

50 To busy the links offlined in step 30, type

>BSY item_no

and press the Enter key.

where

item_no
is the item number under the *n* (0 to 4) column

Note: Perform this step for each link offlined before.

51 To access the PM level of the MAP display and post the host peripheral, type

>PM;POST pm_type pm_no

and press the Enter key.

where

pm_type
is the name of the host XPM (LGC, LTC, or RCC)

pm_no
is the number of the host XPM

52 To return to service the links busied in step 27, type

>RTS LINK link_no

and press the Enter key.

where

link_no
is the number of a P-side link that interfaces to the OPM

Note: Perform this step for each manually busied link.

53 To post the OPM, type

>POST LCM site frame lcm

and press the Enter key.

site
is the site name of the OPM (alphanumeric)

frame
is the frame number of the OPM (0 to 511)

lcm
is the number of the LCM

54 To test the LCM unit, type

>TST UNIT lcm_unit

and press the ENTER key.

LCM talk battery alarm critical (end)

where

lcm_unit
is the LCM unit busied in step 23

If the test	Do
passed	step 55
failed	step 56

55 To return to service (RTS) the LCM unit, type

>RTS UNIT lcm_unit

and press the ENTER key.

where

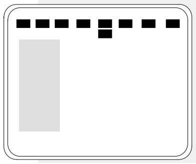
lcm_unit
is the LCM unit tested in step 54

56 For additional help, contact the next level of support.

57 The procedure is complete. If other alarms appear, refer to the correct alarm clearing procedures for the indicated alarms.

LCM
major

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nLCM** **M**	.	.	.	.	.

Indication

The alarm code LCM (line concentrating module) appearing under the peripheral module (PM) subsystem header indicates an LCM alarm. The `M` under the LCM indicates the alarm class is major . The number *n* before LCM indicates the number of OPMs affected by the alarm.

Meaning

The *n* in front of LCM indicates the number of LCMs in the manual busy (ManB), system busy (SysB), or C-side busy (CBsy) state.

Result

The ManB and SysB LCMs do not directly affect service because one unit of the LCM continues to provide service. There is no local backup. If the other unit of the LCM fails, service will be interrupted.

A CBsy condition can interrupt communication between the OPM and the host. A CBsy condition reduces the service that the OPM provides to the local area only.

Common procedures

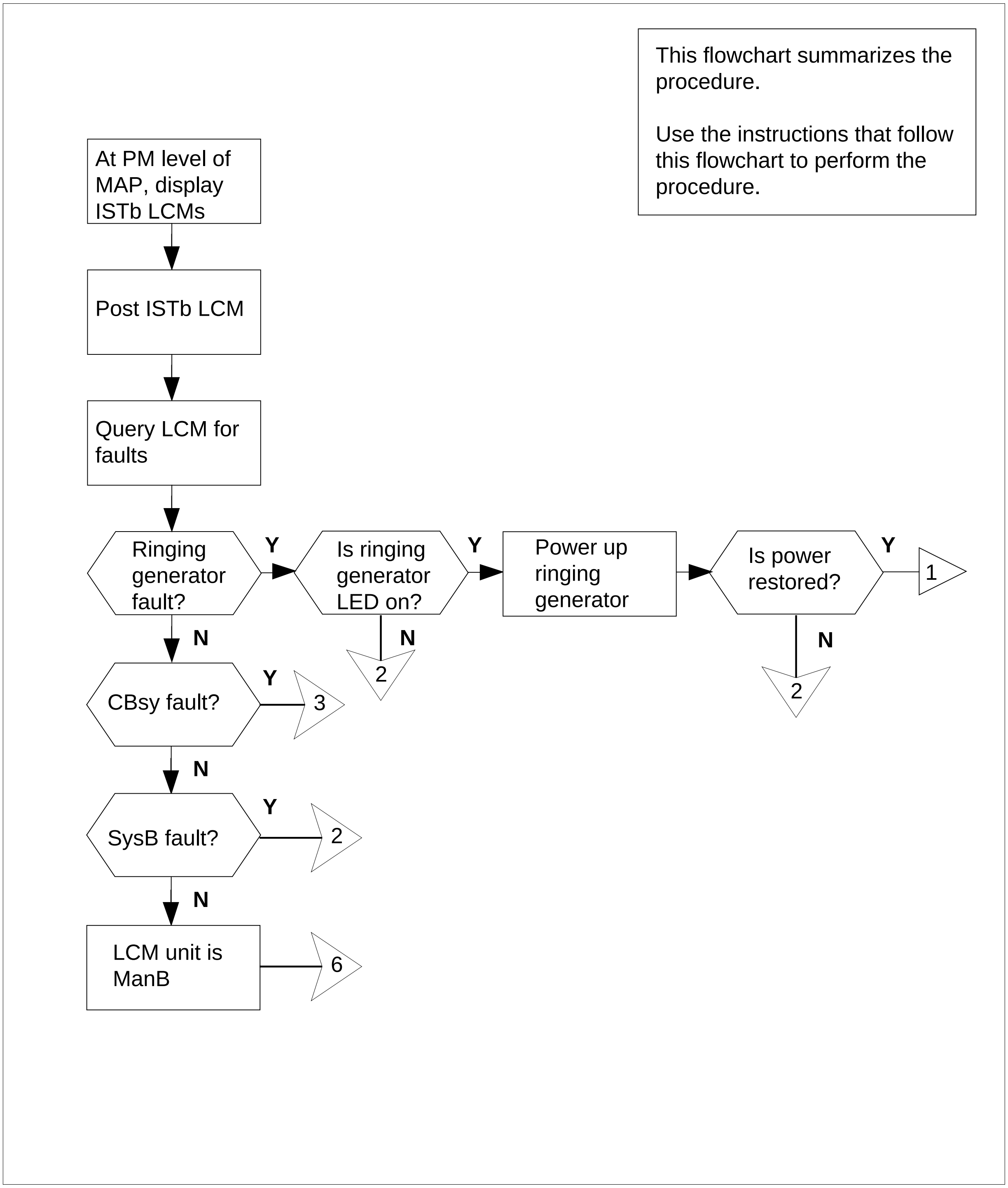
There are no common procedures.

Action

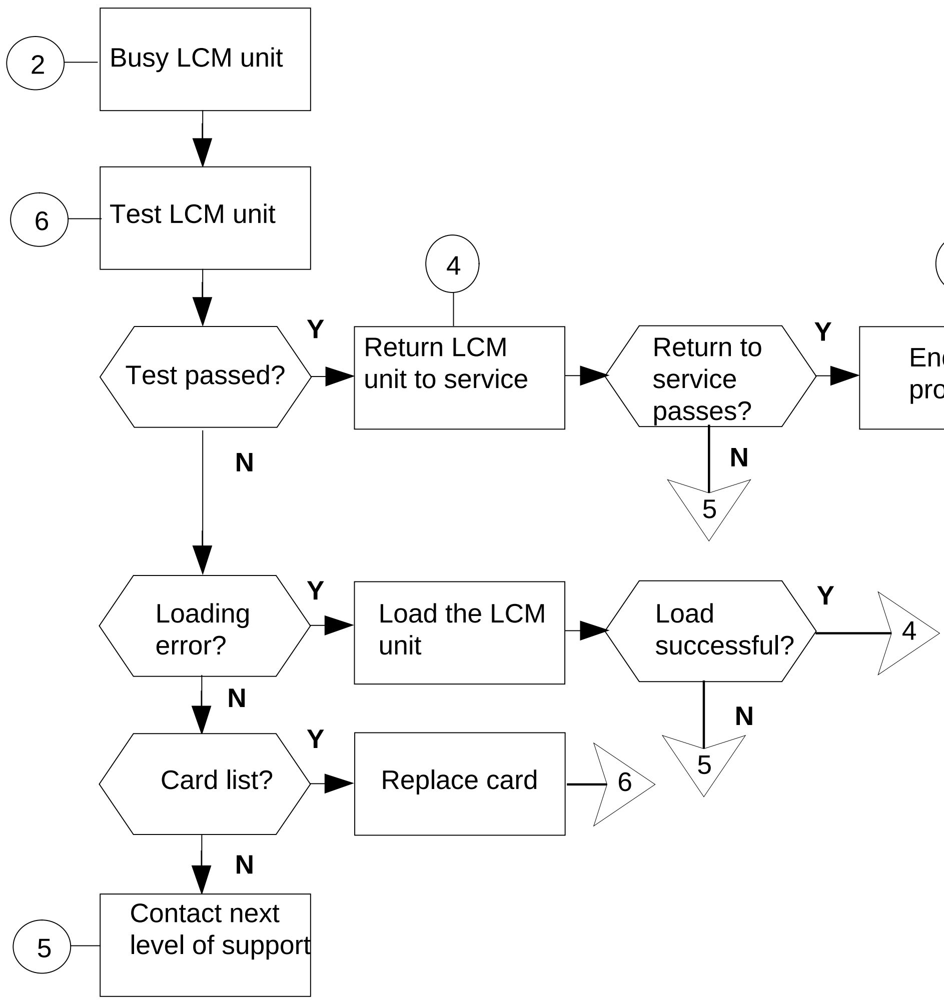
This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

LCM
major (continued)

Summary of clearing an LCM major alarm

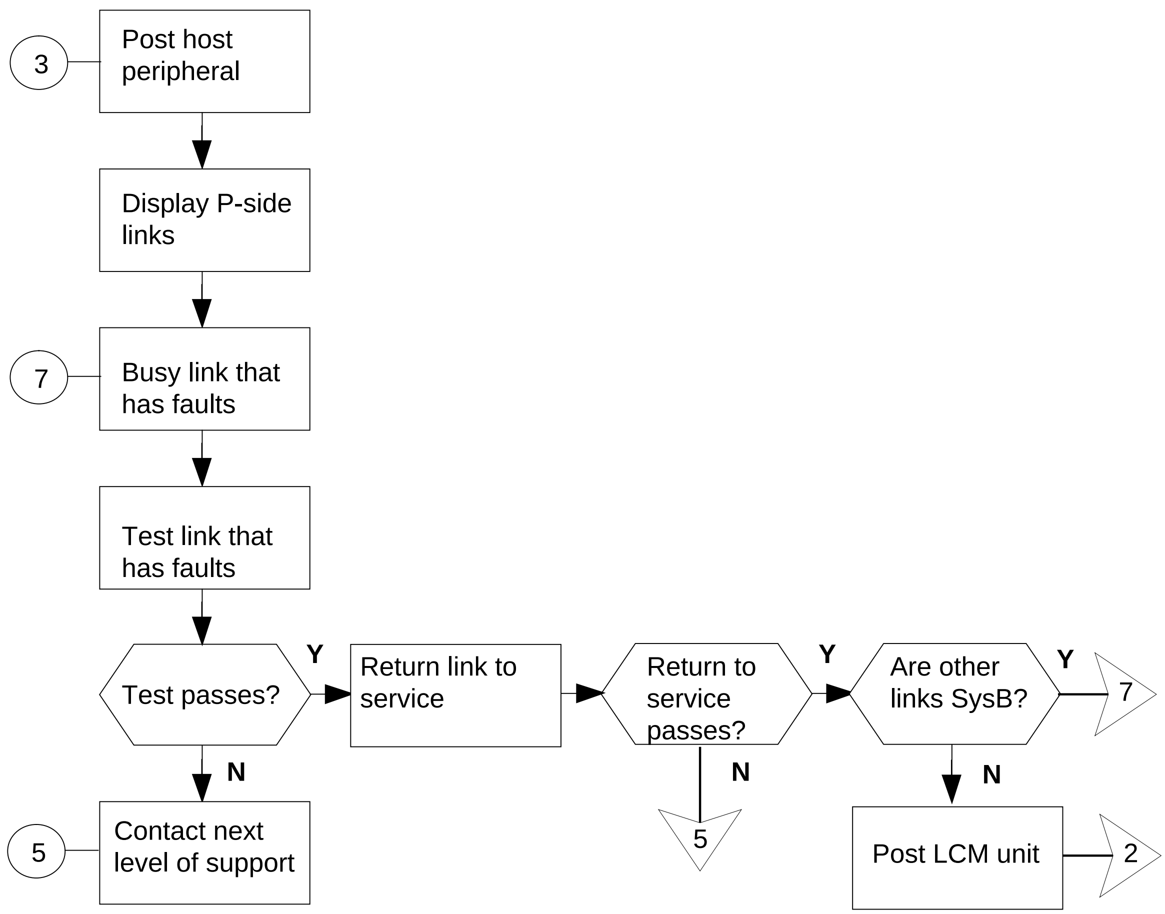


Summary of clearing an LCM major alarm (continued)



LCM
major (continued)

Summary of clearing an LCM major alarm (continued)



Clearing an LCM major alarm

At the MAP terminal

1

> **ATTENTION**
> Enter this procedure from a PM system level alarm clearing procedure step that identified a PM alarm with an OPM fault.

To silence an audible alarm, type

`>MAPCI;MTC;SIL`

and press the Enter key.

2 To access the PM level of the MAP display, type

`>PM`

and press the Enter key.

3 To identify the OPM that has faults, type

`>DISP STATE ISTB LCM`

and press the Enter key.

4 To post the OPM with the alarm condition, type

`>POST LCM  site frame lcm`

and press the Enter key.

where

site
is the site name of the OPM (alphanumeric)

frame
is the frame number of the OPM (0 to 511)

lcm
is the number of the OPM

5 To determine the fault indicators, type

`>QUERYPM FLT`

and press the Enter key.

If fault indicated	Do
is ringing generator	step 6
is CBsy (C-side busy)	step 9
is SysB	step 16

LCM major (continued)

If fault indicated	Do
is ManB	step 17

At the OPM site

6 Inspect the ringing generator to see if the LED is lit.

If the LED	Do
is lit	step 7
is not lit	step 16

7 To power up the ringing generator move the circuit breaker to the ON position. (The LED goes OFF.) These switches are:

- RG 0 corresponds to LCM unit 0 CB2
- RG 1 corresponds to LCM unit 1 CB3

8 Determine if power restores to the ringing generator.

If power	Do
restores	step 23
does not restore	step 16

At the MAP terminal

9 To identify C-side links to the host PM, type

>TRNSL C

and press the Enter key.

Example of a MAP response:

```
Link 0: LTC 0       2; Cap MS; Status: OK    ;MsgCond: OPN
Link 1: LTC 0       6; Cap MS; Status: SysB  ;MsgCond: CLS
```

10 To post the host peripheral (LGC, LTC, or RCC), type

>POST pm_type pm_no

and press the Enter key.

where

pm_type
is LGC, LTC, or RCC

pm_no
is the number of the host peripheral

11 To identify the P-side links that have faults, type

>TRNSL P

and press the Enter key.

Example of a MAP response:

```
Link 2:LCM REM1 00 0  0;Cap MS;Status:OK   ;MsgCond: OPN
Link 6:LCM REM1 00 0  1;Cap MS;Status:SysB ;MsgCond: CLS
```

Record information for the links that have a status other than OK.

12 To busy the link that has faults, type

>BSY LINK link_no

and press the Enter key.

where

link_no
is the number of a P-side link identified in step 11

13 To test the busied link, type

>TST LINK link_no

and press the Enter key.

where

link_no
is the number of a P-side link busied in step 12

If test	Do
passes	step 14
fails	step 21

14 To return the busied link to service, type

>RTS LINK link_no

and press the Enter key.

where

link_no
is the number of a P-side link busied in step 12

If RTS	Do
passes and other links are not SysB	step 15
passes but other links are SysB	step 12
fails	step 21

15 To post the OPM with the alarm condition, type

>POST LCM site frame lcm

LCM
major (continued)

and press the Enter key.

where

site
is the site name of the OPM (alphanumeric)

frame
is the frame number of the OPM (0 to 511)

lcm
is the number of the OPM

16

> **WARNING**
> **If you do not allow the time required for the system to clear the alarm, a false alarm indication can occur.**
> Allow 3 to 5 minutes for the system to clear the alarm before you proceed to the next step.

To busy the OPM unit associated with the alarm, type

>BSY UNIT lcm_unit

and press the Enter key.

where

lcm_unit
is the LCM unit to be busied (0 or 1)

17 To test the busied unit, type

>TST UNIT lcm_unit

and press the Enter key.

where

lcm_unit
is the LCM unit to test (0 or 1)

If test	Do
fails because of a load error	step 18
passes	step 19
fails, and the system produces a card list	step 20
fails, and the system did not produce a card list	step 21

LCM
major (end)

18 To attempt to load the OPM unit, type

>LOADPM UNIT lcm_unit CC

and press the Enter key.

where

lcm_unit
is the LCM unit to be loaded (0 or 1)

If load	Do
is successful	step 19
is not successful	step 21

19 To attempt to return the OPM unit to service, type

>RTS UNIT lcm_unit

and press the Enter key.

where

lcm_unit
is the LCM unit to return to service (0 or 1)

If RTS	Do
passes	step 23
fails	step 21

20 The card list identifies the cards with possible faults. Replace the cards one at a time in the order listed:

If you	Do
did not replace all the cards on the list	step 22
replaced all the cards on the list	step 21

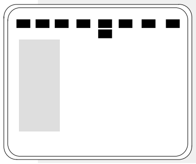
21 For additional help to clear this fault, contact the next level of support.

22 To replace the first (or next) card on the card list go to the *Card Replacement Procedures* . For an OPM, notify outside operating company personnel that you are changing the card. Go to step 17 when you replace the card.

23 The procedure is complete. If additional alarms display, refer to the appropriate how to clear an alarm procedure.

OPM (RG) major

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nLCM**	.	.	.	.	.
				M					

Indication

An *n*LCM under the PM subsystem header indicates an alarm that involves an OPM ringing generator. The number *n* indicates the number of units affected by the alarm. The letter `M` below the *n*LCM indicates that the alarm classs is major. This alarm code appears at the MTC level of the MAP display.

Meaning

One of the ringing generator units is in the in-service trouble (ISTb) state.

Result

This alarm does not affect subscriber service. The system automatically switches support to a backup ringing generator (SwRG). If the backup ringing generator fails, ringing does not occur.

Common procedures

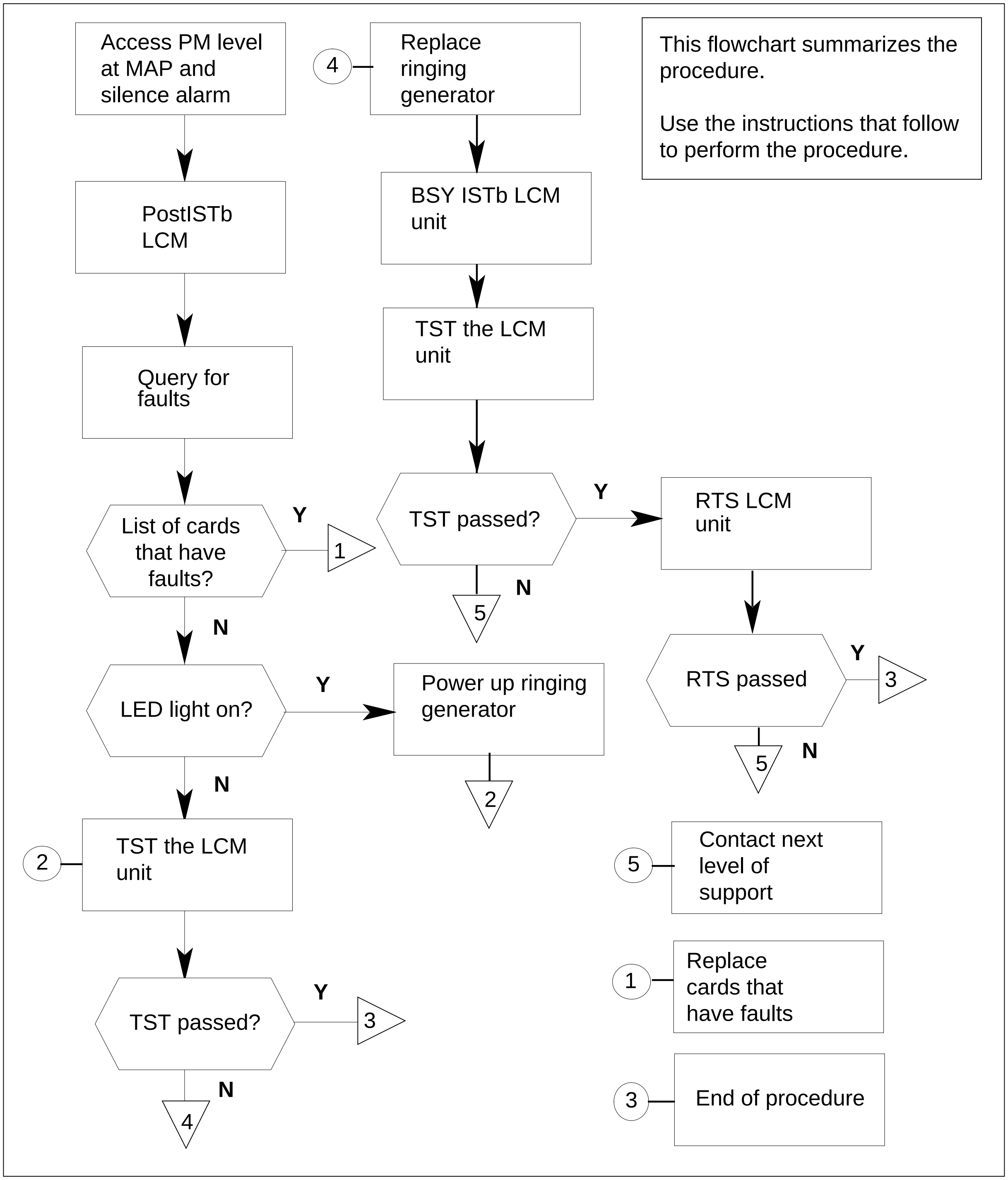
There are no common procedures.

Action

This procedure contains a flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

OPM (RG)
major (continued)

Summary of clearing an OPM (RG) major alarm



OPM (RG)
major (continued)

Clearing an OPM (RG) major alarm

At your current location

1 Enter this procedure from a PM system-level alarm clearing procedure step. This step must identify a PM alarm associated with an OPM ringing generator fault.

At the MAP terminal

2 To silence the alarm, type

>MAPCI;MTC;PM;SIL

and press the Enter key.

3 To identify the OPM that has faults, type

>DISP STATE ISTB LCM

and press the Enter key.

4 To post the ISTb LCM identified in step 3, type

>POST LCM ISTB

and press the Enter key.

Example of a MAP display:

```
 CM    MS      IOD      Net      PM     CCS     Lns     Trks     Ext     Appl
  .     .       .        .      1LCM     .       .        .       .        .
                                 M

LCM              SysB      ManB      OffL      CBsy      ISTb       InSv
 0 Quit     PM     1         0         2         0         2          12
 2 Post_    LCM    0         0         2         0         2           9
 3 ListSet
 4 SwRG     LCM   REM1  14 1 ISTb  Links_OOS:  CSide  0   PSide   0
 5 Trnsl_   Unit0:   InsV                 /RG: 1
 6 Tst_     Unit1:   ISTb                 /RG: 1
 7 Bsy_                                11  11  11  11  11 RG:Pref 1 ISTb
 8 RTS_     Drwr:  01  23  45  67  89  01  23  45  67  89    Stby 0 Insv
 9 OffL            ..  ..  ..  ..  ..  ..  ..  ..  ..  ..
10 LoadPM_
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

OPM (RG) major (continued)

5 To check for fault indicators, type

>QUERYPM FLT

and press the Enter key.

Example of a MAP display:

```
 CM     MS     IOD     Net     PM      CCS     Lns    Trks    Ext   Appl
  .     .       .       .     1LCM      .       .      .       .     .
                                M

LCM                  SysB     ManB     OffL     CBsy     ISTb      InSv
 0 Quit      PM        1        0        2        0        2         12
 2 Post_     LCM       0        0        2        0        2          9
 3 ListSet
 4 SwRG      LCM    REM1  14 1 ISTb  Links_OOS:  CSide  0   PSide   0
 5 Trnsl_    Unit0:   InsV                 /RG: 1
 6 Tst_      Unit1:   ISTb                 /RG: 1
 7 Bsy_                                11  11  11  11  11  RG:Pref 1 ISTb
 8 RTS_      Drwr:  01  23  45  67  89  01  23  45  67  89    Stby 0 InsV
 9 OffL             ..  ..  ..  ..  ..  ..  ..  ..  ..  ..
10 LoadPM_   QUERYPM FLT
11 Disp_      Node inservice troubles exist:
12 Next         One or both Units inservice trouble
13            LCM   UNIT 0  No faults exist
14 QueryPM
15            LCM   UNIT 1  Inservice Troubles Exist:
16                 Ring Generator in Excess load
17
18
```

If the system	Do
indicates a card that has faults	step 14
does not indicate a card that has faults	step 6

At the OPM site

6 Make a visual inspection of the ringing generator. Check to see if the LED is lit.

If the LED	Do
is lit	step 7
is not lit	step 8

OPM (RG)
major (continued)

7 To power up the ringing generator, move the circuit breaker to the ON position The LED goes out. These switches are identified here as:

- RG 0 corresponds to LCM unit 0 CB2
- RG 1 corresponds to LCM unit 1 CB3

At the MAP terminal

8 To manually busy the ISTb LCM unit identified in step 3, type

>BSY UNIT unit_no

and press the Enter key.

where

unit_no
is the number of the ISTb LCM unit.

9 To test the ManB LCM, type

>TST UNIT unit_no

and press the Enter key.

where

unit_no
is the number of the ManB LCM unit.

Example of a MAP response:

```
LCM Rem1 14 1 Unit 1 InSvce Test Initiated
LCM Rem1 14 1 Unit 1 Tst Failed:(Reason for failure)
```

or:

```
LCM Rem1 14 1 Unit 1 InSvce Test Initiated
LCM Rem1 14 1 Unit 1 Tst passed
```

10 Determine the result of the test performed in step 9.

If	Do
TST PASSED	step 12
TST FAILED	Replace the ringing generator and go to step 11.

11 After replacing the ringing generator (NT6X60), test the LCM unit again. Type

>TST UNIT unit_no

and press the Enter key.

If	Do
TST PASSED	step12

OPM (RG) major (end)

If	Do
TST FAILED	step 17

12 To return the LCM to service, type

>RTS UNIT unit_no

and press the Enter key.

where

unit_no
is the number of the ManB OPM.

13 Determine if RTS is successful.

If	Do
RTS PASSED	step 18
RTS FAILED	step 14

14 Check the card listing that appears in the following MAP display. The listing results from step 9.

Example of a MAP response:

```
SITE FLR RPOS BAY_ID   SHF DESCRIPTION SLOT EQPEC
REM1 01  A00  OPE 00   05  LCM:14 1    :01  6X60
REM1 01  A00  OPE 00   19  LCM:14 1    :04  6X51
```

15 Determine if the user replaced all cards on the list.

If you	Do
replaced all the cards on the list	step 17
did not replace all the cards on the list	step 16

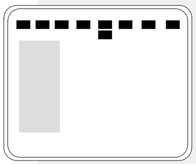
16 Go to *Card Replacement Procedures*. When you complete the card replacement procedures, go to step 11 of this procedure.

17 For additional help, contact the next level of support.

18 The procedure is complete. If other alarms appear, refer to the correct alarm clearing procedures for the indicated alarms.

Ext FSP
OPM cabinet major

Alarm display



CM	MS	IOD	Net	PM	CCS	Lns	Trks	**Ext**	Appl
.	.	.	.	.	.	.	.	**1FSP**	.
								M	

Indication

The alarm code FSP appears under the EXT header of the alarm banner, at the MTC level of the MAP display. The alarm code indicates an external frame supervisory panel (FSP) major alarm. The number preceding the alarm code indicates the number of frames or cabinets affected by the alarm. The letter M below the alarm code indicates that the alarm class is major.

Meaning

This alarm means that one or more frames or cabinets in the office has a power defect or a cooling unit defect.

Result

The impact on subscriber service depends on two conditions:

- the characteristics of the fault
- the type of frame or cabinet that has the fault

Common procedures

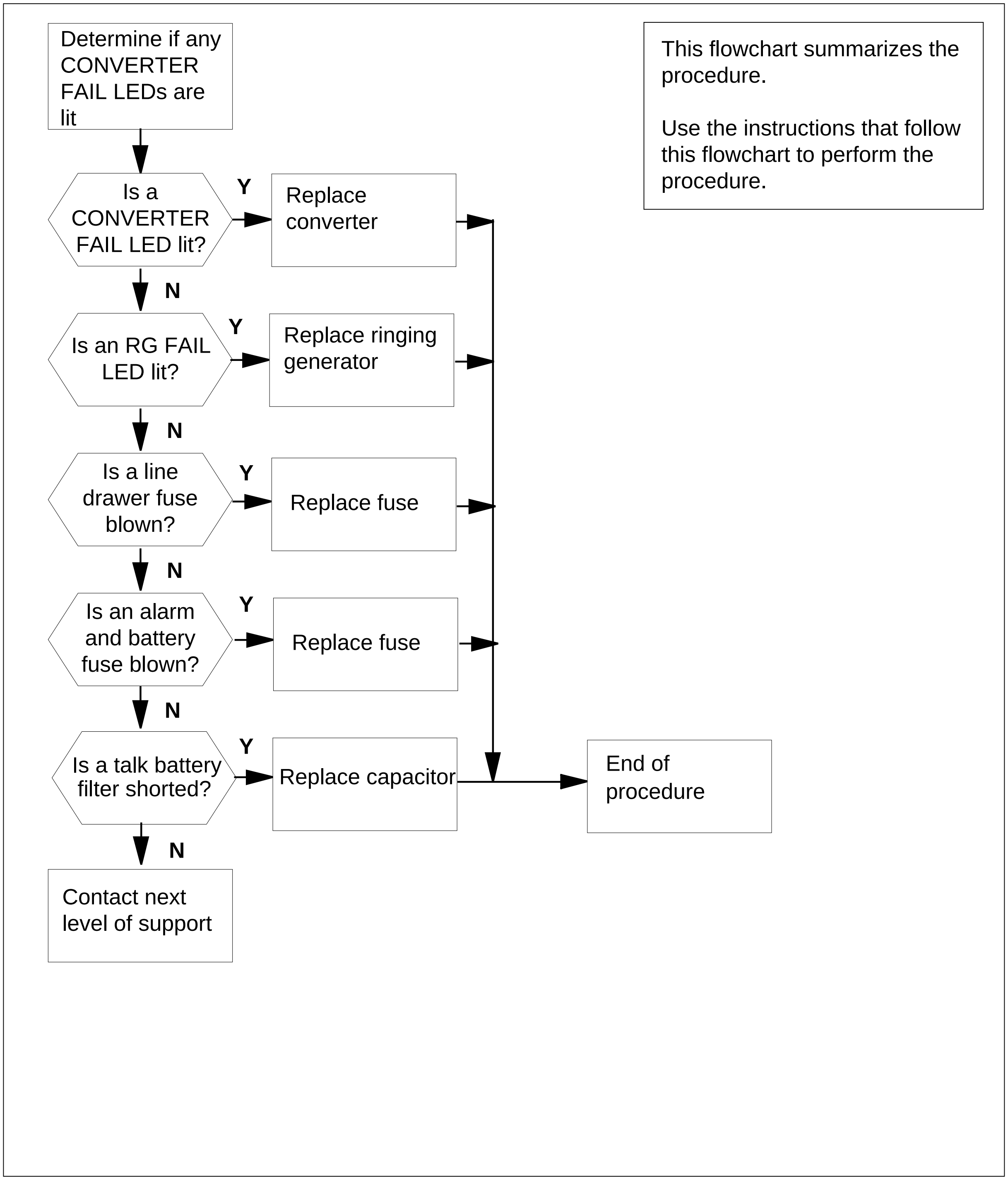
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Ext FSP
OPM cabinet major (continued)

Summary of clearing an Ext FSP OPM cabinet major alarm



Ext FSP
OPM cabinet major (continued)

Clearing an Ext FSP OPM cabinet major alarm

At the OPM cabinet

1

> **ATTENTION**
> Enter this procedure from a peripheral module (PM) system level alarm clearing procedure step that identified a PM alarm associated with an OPM cabinet fault.

Determine if any of the power converter fail LEDs on each converter in the cabinet are lit.

If	Do
a converter fail LED is lit	step 55
the converter fail LEDs are not lit	step 2

2 Determine if one or both of the ringing generator (RG) FAIL LEDs on the two RGs are lit. The RG FAIL LEDs are located at the top of the frame.

Note: The FAIL LED is behind the front panel of the RG.

If FAIL LEDs	Do
are lit	step 41
are not lit	step 3

3 Determine if any line drawer fuses (01 to 15, and RA and RB) are blown. The fuses are located on the fuse panel above each unit in the frame.

If a fuse	Do
is blown	step 9
is not blown	step 4

4 Determine if any alarm battery supply (ABS) fuses (01 to 08), located on the FSP, are blown (protruding fuse indicator).

If a fuse	Do
is blown	step 5

Ext FSP
OPM cabinet major (continued)

If a fuse	**Do**
is not blown	step 109

5 Determine if the ABS wiring inside the FSP is short-circuited. Contact the next level of support.

6 Obtain a replacement fuse with the same voltage and amperage as the blown fuse.

7 Remove the blown fuse.

8

> **DANGER**
> **Risk of fire**
> For continued protection against risk of fire, make sure to replace the blown fuse with a fuse of the same type, rating (color code), and vendor.

Insert the replacement fuse.

If the fuse	**Do**
blows again	step 112
does not blow	step 105

9 Determine which fuse is blown.

Note: Fuses 01 to 05 each supply +5 V, fuses 06 to 10 each supply +15 V, and fuses 11 to 15 each supply -48 V.

If the blown fuse	**Do**
is any one of 01 to 05	step 14
is any one of RA or RB	step 14
is any one of 06 to 15	step 10

10 Use the following table to determine the +15V fuse (06 through 10) associated with the -48V fuse (11 through 15).

If -48V fuse number is	**Do associate +15V fuse number**
11	06
12	07
13	08

Ext FSP
OPM cabinet major (continued)

If -48V fuse number is	Do associate +15V fuse number
14	09
15	10

11 Remove the blown fuse and the associated fuse. For example, if the blown fuse is fuse number 06, remove fuse number 11.

12 Obtain a replacement fuse with the same voltage and amperage as the blown fuse.

13

DANGER
Risk of fire
For continued protection against risk of fire, make sure to replace the blown fuse with a fuse of the same type, rating (color code), and vendor.

Insert the +15V fuse first. Insert the -48V fuse second.

If the fuse	Do
blows again	step 17
does not blow	step 105

14 Obtain a replacement fuse with the same voltage and amperage as the blown fuse.

15 Remove the blown fuse.

16

DANGER
Risk of fire
For continued protection against risk of fire, make sure to replace the blown fuse with a fuse of the same type, rating (color code), and vendor.

Insert the replacement fuse.

If the fuse	Do
blows again	step 19
does not blow	step 105

Ext FSP
OPM cabinet major (continued)

17 Remove the blown fuse and the associated fuse. For example, if the blown fuse is fuse number 06, remove fuse number 11.

18 Obtain a replacement fuse with the same voltage and amperage as the blown fuse.

19 Use the following table to determine which drawer in the shelf below the fuse panel is associated with the blown fuse.

Fuse number	**Drawer number Array 0**	**Drawer number Array 1**
01, 06, 11	0 (far left)	5 (far left)
02, 07, 12	1	6
03, 08, 13	2	7
04, 09, 14	3	8
05, 10, 15	4	9

Note: The RA and RB fuses supply ringing voltage to all five drawers in the shelf. Array 0 houses drawers 0-4 and array 1 houses drawers 5-9.

20

CAUTION
Loss of service
Make sure to perform this procedure during periods of low traffic.

Pull out the line drawer you identified in step 19.

Note: When you replace a blown RA or RB fuse, begin with the drawer to the far left.

21

DANGER
Personal injury
Use caution when you handle the line card. The line feed resistor can be hot.

Ext FSP
OPM cabinet major (continued)

Unseat all the line cards in the drawer.

Note: Do not remove the line cards from the drawer.

If you	Do
handle any one of fuses 01 to 05	step 23
handle an RA or RB fuse	step 23
handle any one of fuses 06 to 15	step 22

22

> **DANGER**
> **Risk of fire**
> For continued protection against risk of fire, make sure to replace the blown fuse with a fuse of the same type, rating (color code), and vendor.

Insert the +15V fuse first. Insert the -48V fuse second.

If the fuse	Do
blows again	step 26
does not blow	step 28

23 Obtain a replacement fuse with the same voltage and amperage as the blown fuse.

24 Remove the blown fuse.

25

> **DANGER**
> **Risk of fire**
> For continued protection against risk of fire, make sure to replace the blown fuse with a fuse of the same type, rating (color code), and vendor.

Insert the replacement fuse.

If the fuse	Do
blows again	step 26
does not blow	step 28

Ext FSP
OPM cabinet major (continued)

26 Determine if the drawer has any loose or short-circuited wires.

If the wires	Do
are loose or short-circuited	step 112
are not loose or short-circuited, the fuse is a ringing voltage fuse (RA or RB) and all five drawers in the shelf are not complete	step 27
are not loose or short-circuited, the fuse is a ringing voltage fuse (RA or RB) and all five drawers in the shelf are complete	step 112
are not loose or short-circuited, the fuse is one of the line drawer fuses (01 to 15)	step 112

27 Reseat all the line cards in the drawer and repeat steps 20 and 21 for the next drawer.

28 Reseat the line cards one at a time.

29 Determine if the fuse is blown after you reseat each card.

If after you	Do
reseat any line card, the fuse blows again	step 30
reseat all of the line cards, the fuse does not blow	step 105

30

> **DANGER**
> **Personal injury**
> Use caution when you handle the line card. The line feed resistor can be hot.

Remove the line card from the drawer.

31 Obtain a replacement line card. Make sure the replacement card has the same product engineering code (PEC), including the suffix, as the card removed.

32 Insert the replacement line card into the drawer.

If you	Do
handle any one of fuses 01 to 05	step 36

Ext FSP
OPM cabinet major (continued)

If you	Do
handle an RA or RB fuse	step 36
handle any one of fuses 06 to 15	step 33

33 Obtain a replacement fuse with the same voltage and amperage as the blown fuse.

34 Remove the blown fuse and the associated fuse. For example, if the blown fuse is fuse number 06, remove fuse number 11.

35

> **DANGER**
> **Risk of fire**
> For continued protection against risk of fire, make sure to replace the blown fuse with a fuse of the same type, rating (color code), and vendor.

Insert the +15V fuse first. Insert the -48V fuse second.

If the fuse	Do
blows again	step 112
does not blow	step 39

36 Obtain a replacement fuse with the same voltage and amperage as the blown fuse.

37 Remove the blown fuse.

38

> **DANGER**
> **Risk of fire**
> For continued protection against risk of fire, make sure to replace the blown fuse with a fuse of the same type, rating (color code), and vendor.

Insert the replacement fuse.

If the fuse	Do
blows again	step 112
does not blow	step 39

Ext FSP
OPM cabinet major (continued)

39 Reseat all the other line cards in the drawer.

40 Push the drawer back in. Go to step 105.

41 Use the following table to identify the circuit breaker associated with the RG that is lit FAIL LED. The CB is located at on the FSP.

If RG number is	Do use circuit breaker number
RG0 (far left)	CB2
RG1	CB3

42 Determine if the associated circuit breaker is ON or OFF.

If the circuit breaker	Do
is ON	step 52
is OFF	step 43

43 Set the circuit breaker to ON.

If the circuit breaker	Do
turns OFF, and the FAIL LED on the RG is lit	step 44
remains ON, and the FAIL LED on the RG is not lit	step 105
remains ON, and the FAIL LED on the RG is lit	step 52

At the PDC frame

44 Locate the fuse that powers the RG in the OPM frame.

45 Determine if the fuse is blown.

If the fuse	Do
is blown	step 46
is not blown	step 113

46 Remove the fuse holder that contains the blown fuse.

47 Replace the cartridge fuse inside the fuse holder.

Ext FSP
OPM cabinet major (continued)

48

> **DANGER**
> **Risk of fire**
> For continued protection against risk of fire, make sure to replace the blown fuse with a fuse of the same type, rating (color code), and vendor.

Replace the blown fuse.

49 Install the fuse holder back on the PDC frame.

50 Determine if the fuse blows again.

If the fuse	Do
blows again	step 112
does not blow again	step 51

At the OPE frame

51 Set the circuit breaker to ON.

If the circuit breaker	Do
turns OFF, and the RG FAIL LED is lit.	step 53
remains ON, and the RG FAIL LED is not lit	step 105
remains ON, and the RG FAIL LED is lit	step 52

52 Set the circuit breaker to OFF.

53 Refer to the correct procedure in *Card Replacement Procedures* to replace the RG. When you complete this procedure, return to this point.

54 Determine if the RG FAIL LED for the RG you replaced is lit.

If the RG FAIL LED	Do
is lit	step 112
is not lit	step 105

Ext FSP
OPM cabinet major (continued)

55 Determine which power converter has a lit CONVERTER FAIL LED.

If the converter	Do
is an NT6X53	step 56
is not an NT6X53	step 59

56 Use the following table to identify the circuit breaker associated with the shelf with a lit CONVERTER FAIL LED. The circuit breaker is on the FSP.

If Shelf number is	Do use circuit breaker number
Row A bay 0 shelf 19 slot 01	CB6
Row A bay 0 shelf 33 slot 01	CB7

57 Determine if the associated circuit breaker is ON or OFF.

If the circuit breaker	Do
is ON	step 77
is OFF	step 58

58 Set the circuit breaker you identified in step 56 to ON.

If the circuit breaker	Do
turns OFF, and the RG FAIL LED is lit	step 66
remains ON, and the CONVERTER FAIL LED is lit	step 77
remains ON, and the CONVERTER FAIL LED is not lit	step 105

59 Determine if the POWER switch on the converter is ON or OFF.

If the POWER switch	Do
is ON	step 61
is OFF	step 60

60 Set the POWER switch on the converter to ON.

If the CONVERTER FAIL LED	Do
is lit	step 61
is not lit	step 105

Ext FSP
OPM cabinet major (continued)

61 Use the following table to identify the circuit breaker associated with the shelf with the lit CONVERTER FAIL LED. The circuit breaker is on the FSP.

If shelf number is	Do use circuit breaker number
NT2X70 in slot 22 (row A bay 0 shelf 05 slot 22)	CB4
NT2X70 in slot 25 (row A bay 0 shelf 05 slot 25)	CB1
NT2X09 in slot 17 (row A bay 1 shelf 05 slot 17)	CB5

62 Determine if the associated circuit breaker is ON or OFF.

If the circuit breaker	Do
is ON	step 63
is OFF	step 64

63 Set the circuit breaker you identified in step 61 to OFF.

64 Press and hold the RESET button on the converter while you set the circuit breaker to ON.

65 Release the RESET button.

If the circuit breaker	Do
turns OFF, and the CONVERTER FAIL LED is lit	step 66
remains ON, and the CONVERTER FAIL LED is not lit	step 105
remains ON, and the CONVERTER FAIL LED is lit	step 77

66 Record the numbers of the frame and shelf with the lit CONVERTER FAIL LED.

At the PDC frame

67 Locate the fuse that powers the shelf in the OPM cabinet.

68 Determine if the fuse is blown.

If the fuse	Do
is blown	step 69
is not blown	step 78

Ext FSP
OPM cabinet major (continued)

69 Remove the fuse holder that contains the blown fuse.

70 Replace the cartridge fuse inside the fuse holder.

71

> **DANGER**
> **Risk of fire**
> For continued protection against risk of fire, make sure to replace the blown fuse with a fuse of the same type, rating (color code), and vendor.

Replace the blown fuse.

72 Install the fuse holder back on the PDC frame.

At the OPM cabinet

73 Determine which type of converter had a lit CONVERTER FAIL LED.

If the converter	Do
is an NT6X53	step 76
is not an NT6X53	step 74

74 Press and hold the RESET button on the converter while you set the circuit breaker to ON.

75 Release the RESET button.

If the circuit breaker	Do
turns OFF, and the CONVERTER FAIL LED is lit	step 78
remains ON, and the CONVERTER FAIL LED is not lit	step 105
remains ON, and the CONVERTER FAIL LED is lit	step 77

76 Set the circuit breaker to ON.

If the circuit breaker	Do
turns OFF, and the CONVERTER FAIL LED is lit	step 78
remains ON, and the CONVERTER FAIL LED is not lit	step 105
remains ON, and the CONVERTER FAIL LED is lit	step 77

Ext FSP
OPM cabinet major (continued)

77 Set the circuit breaker to OFF.

78 Refer to the correct procedure in *Card Replacement Procedures* to replace the converter. When you complete the procedure, return to this point.

79 Determine which type of converter you replaced.

If the converter you replaced	Do
is an NT6X53	step 81
is not an NT6X53	step 80

80 Determine if the CONVERTER FAIL LED for the converter you replaced is lit.

If the CONVERTER FAIL LED	Do
is lit	step 97
is not lit	step 105

81 Determine the state of the converter you replaced, and the associated circuit breaker.

If the circuit breaker	Do
turns OFF, and the CONVERTER FAIL LED is lit	step 83
remains ON, and the CONVERTER FAIL LED is not lit	step 105
remains ON, and the CONVERTER FAIL LED is lit	step 82

82 Set the circuit breaker to OFF.

83 Remove the NT6X51 and NT6X52 cards from the shelf with the lit CONVERTER FAIL LED.

84 Set the circuit breaker to ON.

If the CONVERTER FAIL LED	Do
is lit	step 97
is not lit	step 85

85 Set the circuit breaker to OFF.

86 Insert the NT6X51 card back into the shelf.

87 Set the circuit breaker to ON.

If the circuit breaker	Do
turns OFF, and the CONVERTER FAIL LED is lit	step 89

Ext FSP
OPM cabinet major (continued)

If the circuit breaker	Do
remains ON, and the CONVERTER FAIL LED is not lit	step 91
remains ON, and the CONVERTER FAIL LED is lit	step 88

88 Set the circuit breaker to OFF.

89 Replace the NT6X51 card. Refer to the correct procedure in *Card Replacement Procedures.* When you complete the procedure, return to this point.

90 Set the circuit breaker to ON.

If the circuit breaker	Do
turns OFF, and the CONVERTER FAIL LED is lit	step 95
remains ON, and the CONVERTER FAIL LED is not lit	step 91
remains ON, and the CONVERTER FAIL LED is lit	step 94

91 Set the circuit breaker to OFF.

92 Insert the NT6X52 card back in the shelf.

93 Set the circuit breaker to ON.

If the circuit breaker	Do
turns OFF, and the CONVERTER FAIL LED is lit	step 95
remains ON, and the CONVERTER FAIL LED is not lit	step 105
remains ON, and the CONVERTER FAIL LED is lit	step 94

94 Set the circuit breaker to OFF.

95 Replace the NT6X52 card. Refer to the correct procedure in *Card Replacement Procedures.* When you complete the procedure, return to this step.

96 Set the circuit breaker to ON.

If the CONVERTER FAIL LED	Do
is lit	step 102
is not lit	step 105

Ext FSP
OPM cabinet major (continued)

97 Determine if the pins on the backplane of the shelf are bent or short-circuited.

If the pins	Do
are bent or short-circuited	step 98
are not bent or short-circuited, and the converter is an NT6X53	step 100
are not bent or short-circuited, and the converter is not an NT6X53	step 102

98 Set the circuit breaker to OFF.

99 Straighten or replace bent or short-circuited pins. Go to step 96.

100 Insert the NT6X51 and the NT6X52cards on the shelf.

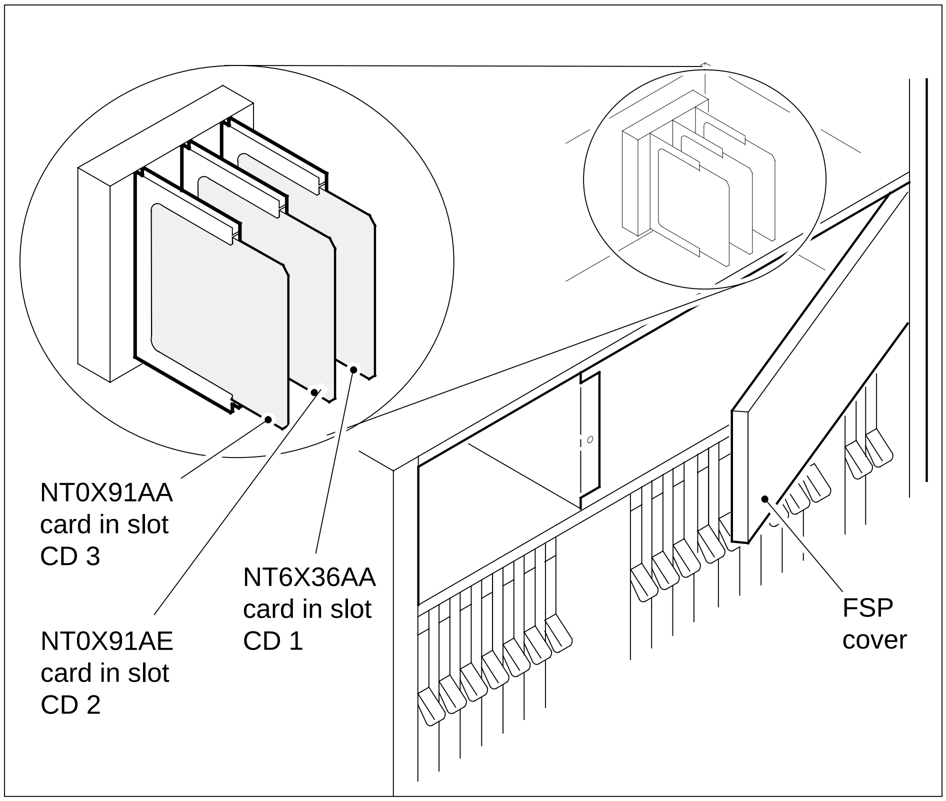
101 Set the circuit breaker to ON.

If the CONVERTER FAIL LED	Do
is lit	step 102
is not lit	step 105

102 Use the following table and diagram to identify the alarm and control card associated with the shelf with the lit CONVERTER FAIL LED.

Shelf number	Alarm and control card	Card position
NT2X70 in slot 25 row A bay 0 shelf 05	slot CD2 NT0X91AE	center
NT2X70 in slot 22 row A bay 0 shelf 05	slot CD3 NT0X91AA	left
NT2X09 in slot 17 and 20 row A bay 1 shelf 05	slot CD2 NT0X91AE	center
NT6X53 in slot 1 row A bay 0 shelf 19 and 33	slot CD1 NT6X36	right
NT6X60 in slots 1 and 5 row A bay 0 shelf 05	slot CD1 NT6X36	right

Ext FSP
OPM cabinet major (continued)



103 Record the numbers of the line concentrating module (LCM) and remote maintenance module (RMM) in the OPM cabinet.

104 Replace the alarm and control card. Refer to the correct procedure in *Card Replacement Procedures.* When you complete the procedure, return to this step.

At the OPM cabinet

105 Determine if the FRAME FAIL lamp on the FSP is lit.

If the FRAME FAIL lamp	Do
is lit, and there are more lit FAIL LEDs or blown fuses	step 2
is lit, and there are no more lit FAIL LEDs or blown fuses	step 112
is not lit	step 106

Ext FSP
OPM cabinet major (end)

At the MAP terminal

106 To access the EXT level of the MAP display, type

`>MAPCI;MTC;EXT`

and press the Enter key.

107 Determine if an FSP alarm is present.

If an FSP alarm	Do
is present, and you did not access all the frames with an FSP alarm	step 108
is present, and you did access all the frames with an FSP alarm	step 112
is not present	step 113

108 Perform the correct procedure for the type of frame that has the FSP alarm. When you complete the procedure, return to this step.

At the OPE frame

109 Make a visual inspection of the FSP. Check circuit breakers CB8 and CB9.

If circuit breakers	Do
are tripped	step 110
are not tripped	step 113

110 Reset the circuit breaker (CB8 or CB9). Move the switch to the ON/OFF position, and immediately back to the ON position. (The LED light goes OFF).

If circuit breaker	Do
trips again	step 111
remains ON (LED goes off)	step 113

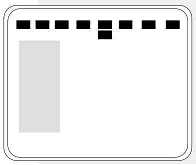
111 Check the table of contents for the *LCM talk battery alarm* procedure. Perform the procedure. When you complete the procedure, return to this step.

112 For additional help, contact the next level of support.

113 The procedure is complete.

RMM
major

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nSysB**	.	.	.	.	.
				M					

Indication

The alarm code *n*SysB under the peripheral module (PM) subsystem header indicates an alarm that involves an RMM. The letter *M* below the alarm code indicates that the alarm class is major. The header is at the MTC level of the MAP display.

Meaning

The *n* in front of the system-busy (SysB) alarm indicates the number of RMMs in the SysB state.

Result

If the RMM unit fails, the system stops maintenance and line testing. This alarm does not affect subscriber service.

Common procedures

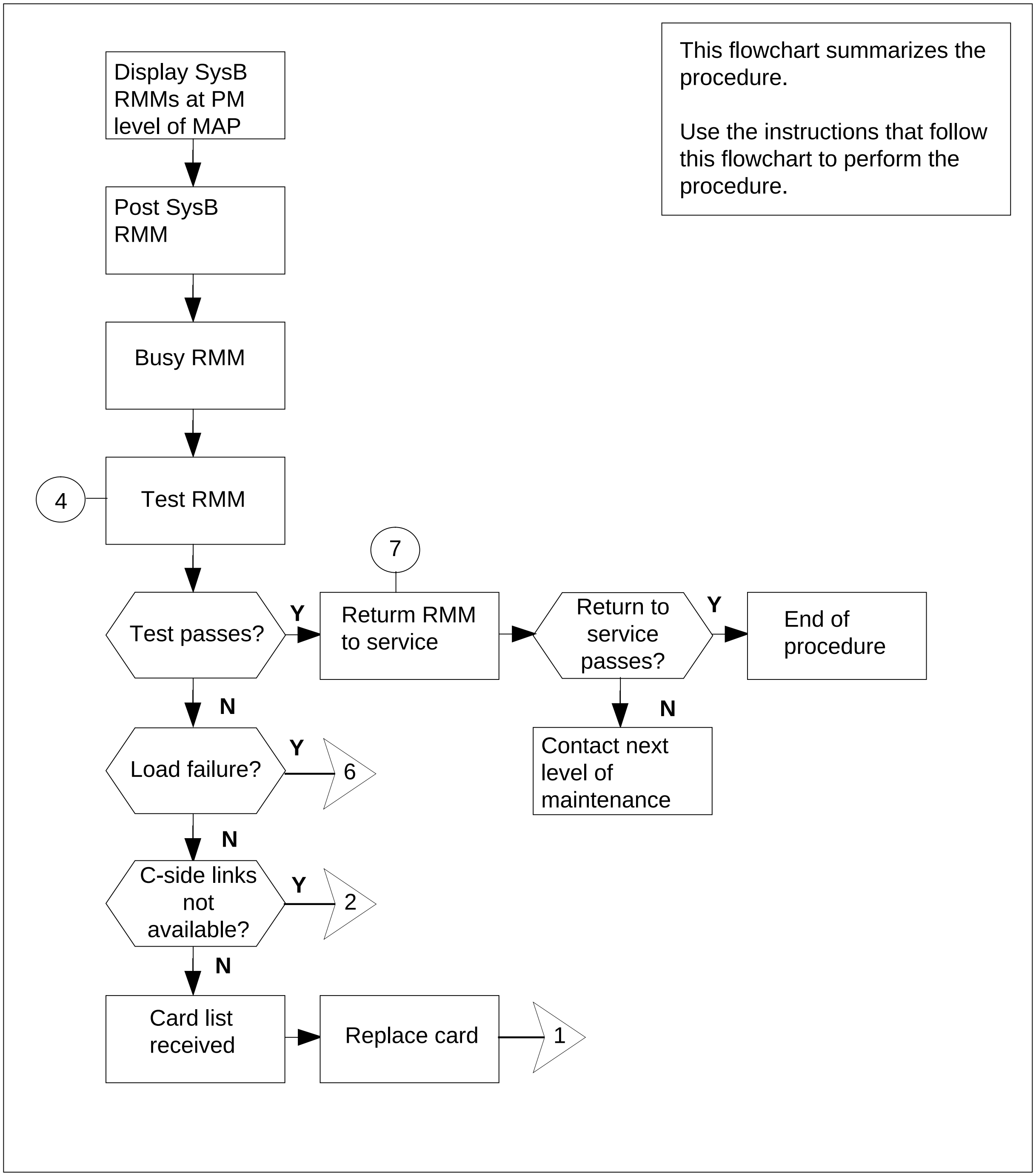
There are no common procedures.

Action

This procedure contains a summary procedure and a list of steps. Follow the flowchart to review the procedure. Use the steps to perform the procedure.

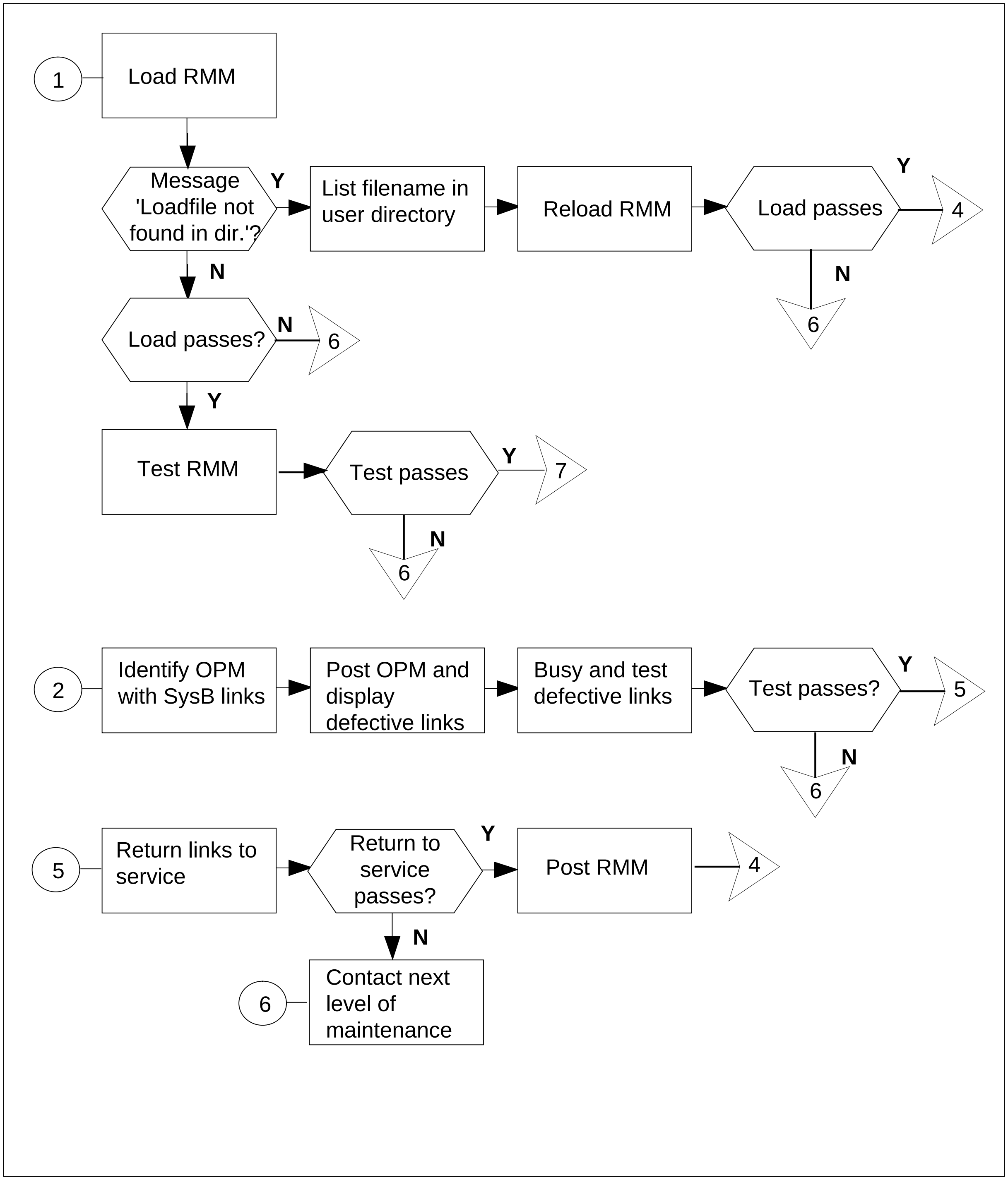
RMM
major (continued)

Summary of clearing an RMM major alarm



RMM
major (continued)

Summary of clearing an RMM major alarm (continued)



RMM
major (continued)

Clearing an RMM major alarm

At the MAP terminal

1 Enter this procedure from a PM system level alarm clearing procedure step. This step must identify a PM alarm associated with an RMM fault.

2 To silence the alarm, type:

>MAPCI;MTC;PM;SIL

and press the Enter key.

3 To identify the RMM that has faults, type:

>DISP STATE SYSB RMM

and press the Enter key.

Example of a MAP response:

```
SysB  RMM: 2
```

4 To post the SysB RMM from step 3, type:

>POST RMM rmm_no

and press the Enter key.

where

rmm_no
is the number of the RMM that has faults

5 To manually busy the RMM that appears in step 4, type:

>BSY

and press the Enter key.

6 To perform a test on the RMM that has faults, type:

>TST

and press the Enter key.

If test	Do
passes	step 33
fails because of load failure	step 7
fails because C-side links not available	step 25
fails and the system generates a card list	step 34

RMM
major (continued)

7 To load the RMM, type:

>LOADPM

and press the Enter key.

If	Do
the system displays the message `load file not found in directory`	step 8
load passes	step 32
load fails	step 36

8 Determine the type of device where the PM load files are located.

If load files	Do
are on a tape	step 9
are on an IOC disk	step 15
are on an SLM disk	step 20

9 Locate the tape containing the PM load files.

At the IOE frame

10 Mount the tape on a magnetic tape drive.

At the MAP terminal

11 To download the tape, type:

>MOUNT tape_no

and press the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

12 To list the contents of the tape in your user directory, type:

>LIST T tape_no

and press the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

13 To demount the tape drive, type:

>DEMOUNT T tape_no

RMM
major (continued)

and press the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

14 Go to step 24.

15 From office records, determine and note the number of the input/output controller (IOC) disk. Note the name of the volume containing the PM load files.

16 To access the disk utility level of the MAP type:

>DSKUT

and press the Enter key.

17 To list the IOC file names in your user directory, type:

>LISTVOL volume_name ALL

and press the Enter key.

where

volume_name
is the name of the volume containing the PM load files obtained in step 15

18 To leave the disk utility, type:

>QUIT

and press the Enter key.

19 Go to step 24.

20 From office records, determine and note the number of the system load module (SLM) disk. Note the name of the volume containing the PM load files.

21 To access the disk utility level of the MAP, type:

>DISKUT

and press the Enter key.

22 To list the SLM file names in your user directory, type:

>LF volume_name

and press the Enter key.

where

volume_name
is the name of the volume containing the PM load files obtained in step 20

23 To leave the disk utility, type:

>QUIT

and press the Enter key.

RMM
major (continued)

24 To reload the RMM, type

>LOADPM

and press the Enter key.

If load	Do
fails	step 36
passes	step 32

25 To identify the OPM with links in a SysB condition, type:

>TRNSL C

and press the Enter key.

Example of a MAP response:

```
LINK 0: LCM REM1 14 1  0;CAP MS;STATUS:SysB,;MSGCOND:CLS
LINK 1: LCM REM1 14 1  1;CAP MS;STATUS:SysB,;MSGCOND:CLS
```

26 To post the OPM from step 24, type:

>POST LCM site frame lcm

and press the Enter key.

where

site
is the site name of the OPM (alphanumeric)

frame
is the frame number of the OPM (0 to 511)

lcm
is the number of the LCM

27

WARNING
If you do not allow the time required for the system to clear the alarm, a false alarm indication can occur.
Make sure to allow 3 to 5 min for the system to clear the alarm before you proceed to the next step.

To identify the P-side links that have faults, type:

>TRNSL P

and press the Enter key.

Example of a MAP response:

RMM
major (continued)

```
LINK  0: RMM 0 0;CAP MS;STATUS:SysB,;MSGCOND: CLS
LINK  1: RMM 0 1;CAP MS;STATUS:SysB,;MSGCOND: CLS
LINK  2: ESA 0 0;CAP  S;STATUS:  OK,;MSGCOND: OPN
LINK  4: ESA 0 1;CAP  S;STATUS:  OK,;MSGCOND: OPN
```

28 To busy the link that has faults, type:

>BSY LINK link_no

and press the Enter key.

where

link_no
is the number of a P-side link from step 27

29 To test the ManB link, type:

>TST LINK link_no

and press the Enter key.

where

link_no
is the number of the link (0 or 1) manually busied in step 28

If test	Do
passes	step 30
fails	step 36

30 To return the link to service, type:

>RTS LINK link_no

and press the Enter key.

where

link_no
is the number of the link (0 or 1) tested in step 29

If RTS	Do
passes	step 31
fails	step 36

31 To post the ManB RMM, type:

>POST RMM rmm_no

and press the Enter key.

where

rmm_no
is the number of the RMM manually busied in step 5

RMM
major (end)

32 To test the RMM, type:

>TST

and press the Enter key.

If test	Do
passes	step 33
fails, and the system produces a cardlist	step 35
fails, and the system does not produce a cardlist	step 36

33 To return the ManB RMM to service, type:

>RTS

and press the Enter key.

If RTS	Do
passes	step 37
fails	step 36

34 The card list identifies the cards with possible faults. Replace the cards one at a time according to this procedure.

If you	Do
replaced all the cards on the list	step 36
did not replace all the cards on the list	step 35

35 Go to the card replacement procedure in the *Card Replacement Procedures* for the next card on the card list. When you finish with the card replacement procedures, go to step 7.

36 For additional help, contact the next level of maintenance.

37 The procedure is complete. If other alarms appear at the MAP display, refer to the appropriate alarm clearing procedures.

LCM minor

Alarm display

CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	Appl
.	.	.	.	***n*LCM**	.	.	.	.	.

Indication

The alarm code LCM under the PM subsystem header indicates an LCM alarm. The absence of *C* or M under the LCM indicates a minor alarm. The number *n* before LCM indicates the number of LCMs with a minor alarm.

Meaning

The number *n* of LCMs are in the in-service trouble (ISTb) state.

Result

The in-service trouble condition does not directly affect service. One unit of the LCM continues to provide service. There is no local backup. Failure of the other LCM unit interrupts service.

Common procedures

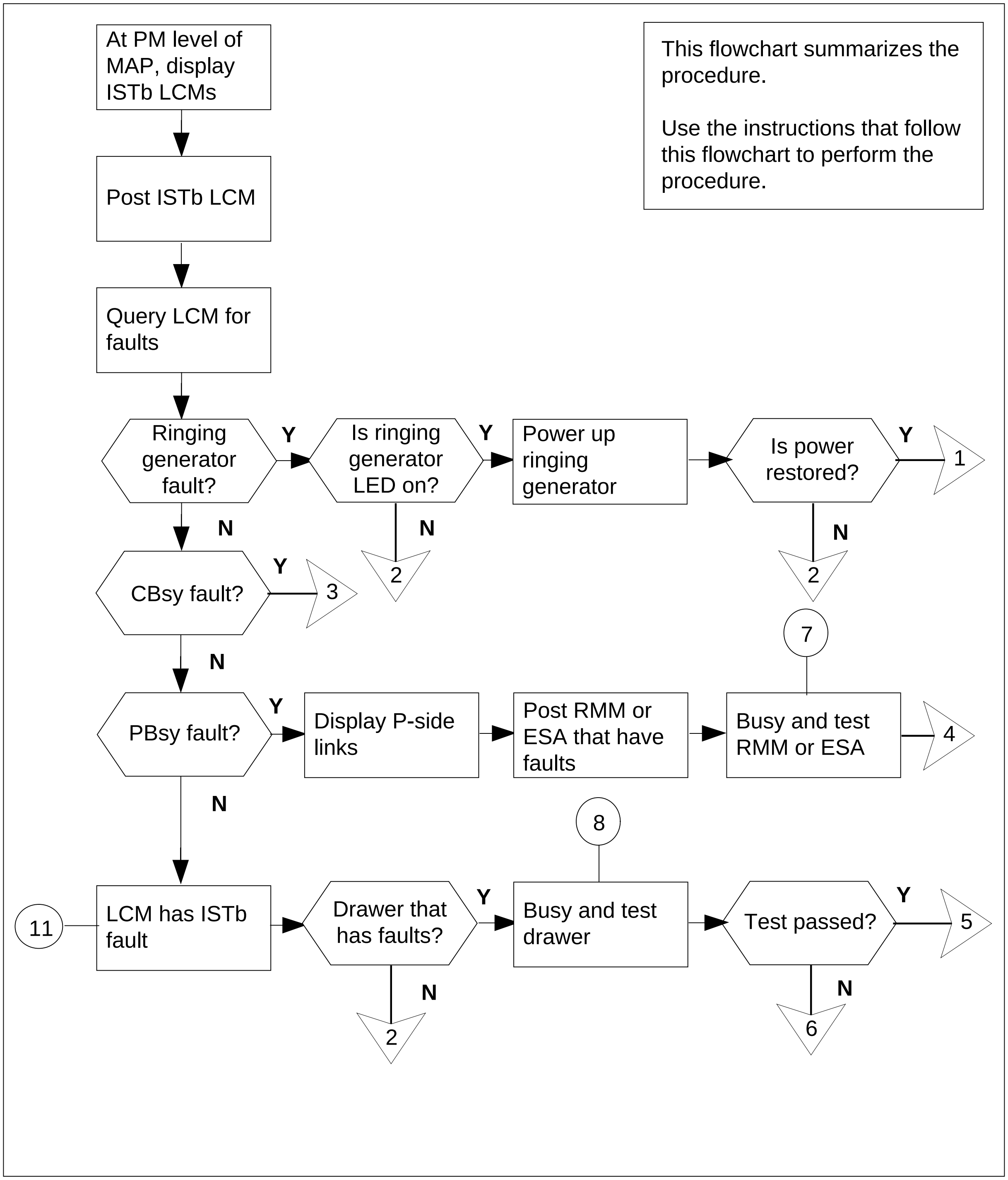
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

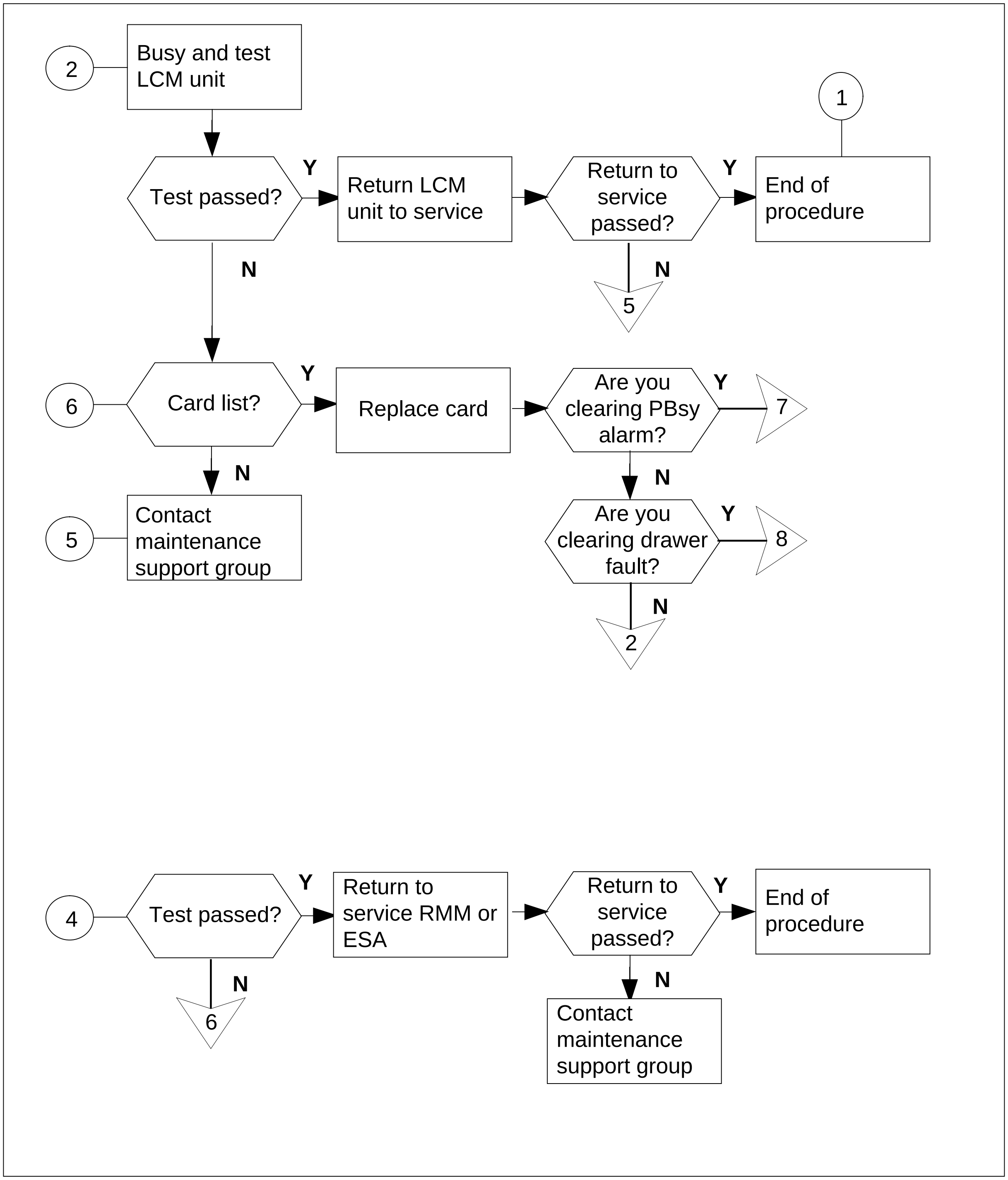
LCM
minor (continued)

Summary of clearing an LCM minor alarm



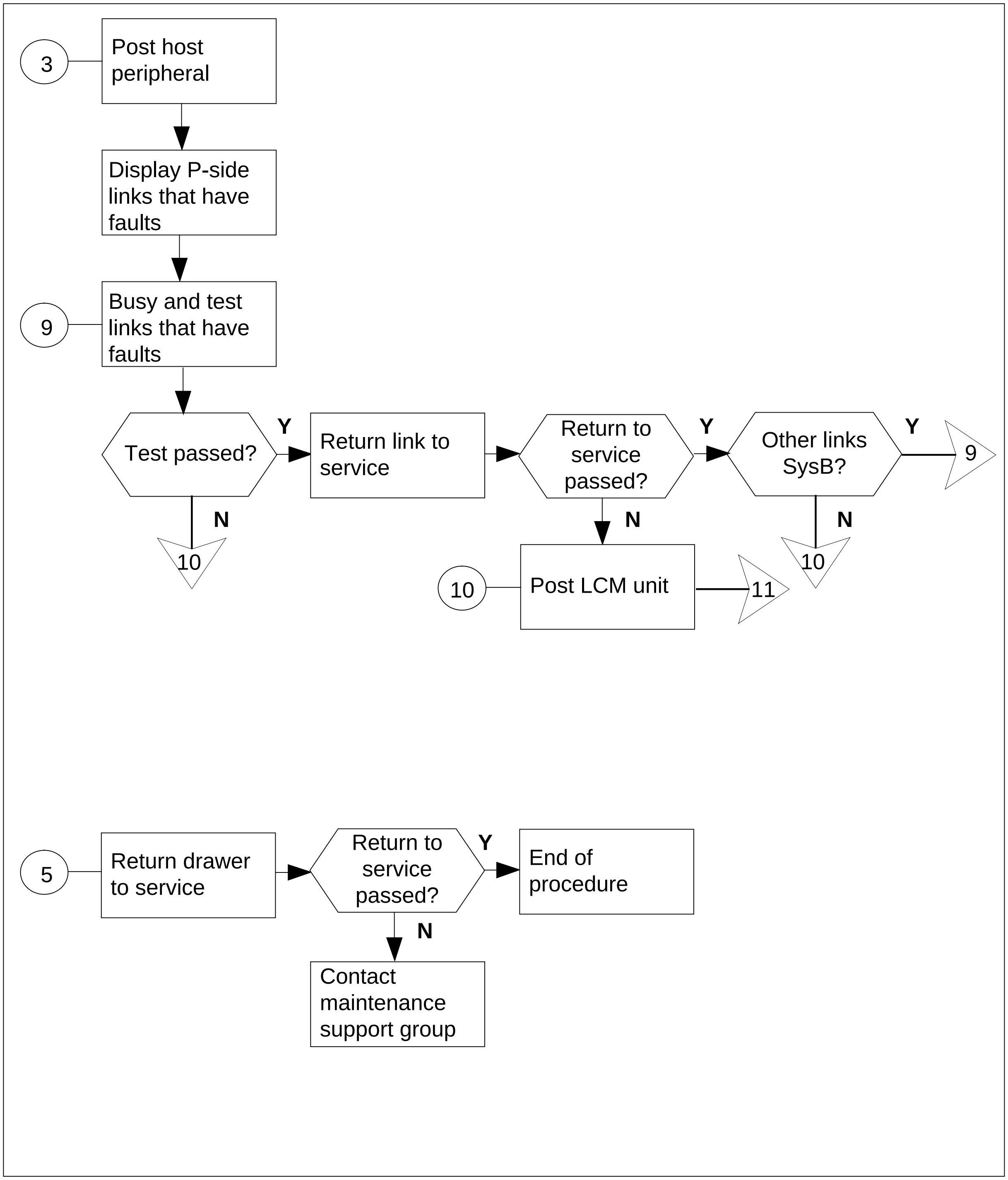
LCM
minor (continued)

Summary of clearing an LCM minor alarm (continued)



LCM minor (continued)

Summary of clearing an LCM minor alarm (continued)



LCM
minor (continued)

Clearing an LCM minor alarm

At the MAP terminal

1

> **ATTENTION**
> Enter this procedure from a PM system level alarm clearing procedure step that identified a PM alarm associated with an OPM fault.

To silence an audible alarm, type

>MAPCI;MTC;SIL

and press the Enter key.

2 To access the PM level of the MAP display, type

>PM

and press the Enter key.

3 To identify the OPM that has faults, type

>DISP STATE ISTB LCM

and press the Enter key.

4 To post the LCM with the alarm condition, type

>POST LCM site frame lcm

and press the Enter key.

where

site
is the site name of the OPM (alphanumeric)

frame
is the frame number of the OPM (0 to 511)

lcm
is the number of the LCM

Example of a MAP response:

```
LCM  REM1 00 0   ISTb   Links OOS: Cside  0 Pside  0
Unit0: InSv                      /RG: 0
Unit1: SysB                      /RG: 0
                      11 11 11 11 11 RG: Pref 0 InSv
Drwr:  01 23 45 67 89 01 23 45 67 89     Stby 1 InSv
       .. .. .. .. .. .. .. .. .. ..
```

LCM
minor (continued)

5 To determine the fault indicators, type

>QUERYPM FLT

and press the Enter key.

If the system	Do
indicates a ringing generator fault	step 6
indicates a CBsy (C-side busy) fault	step 9
indicates a PBsy (P-side busy) fault	step 16
indicates a DRWR FLT (drawer fault)	step 22
indicates a ISTb (In-service trouble) fault	step 26

At the OPM site

6 Inspect the ringing generator to see if the LED is lit.

If the LED	Do
is lit	step 7
is not lit	step 26

7 To power up the ringing generator, move the circuit breaker to the ON position. (The LED goes off.) These switches are identified as follows:

- RG 0 corresponds to LCM unit 0 CB2
- RG 1 corresponds to LCM unit 1 CB4

8 Determine if the system restores power to the ringing generator.

If the system	Do
restores power	step 32
does not restore power	step 26

At the MAP terminal

9 To identify C-side links to the host PM, type

>TRNSL C

and press the Enter key.

Example of a MAP response:

```
Link 0: LTC 0      2; Cap MS; Status: OK    ;MsgCond: OPN
Link 1: LTC 0      6; Cap MS; Status: SysB  ;MsgCond: CLS
```

LCM
minor (continued)

10 To busy the SysB unit, type

>BSY UNIT unit_no

and press the Enter key.

where

unit_no
is the number of the SysB unit

Example of a MAP response:

```
LCM  REM1 00 0   ISTb   Links OOS: Cside  0 Pside  0
Unit0: InSv                     /RG: 0
Unit1: ManB                     /RG: 0
                      11 11 11 11 11 RG: Pref 0 InSv
Drwr:  01 23 45 67 89 01 23 45 67 89     Stby 1 InSv
       .. .. .. .. .. .. .. .. .. ..
```

11 To post the host peripheral (LGC, LTC, or RCC), type

>POST pm_type pm_no

and press the Enter key.

where

pm_type
is LGC, LTC, or RCC

pm_no
is the number of the host peripheral

12 To identify the P-side links that have faults, type

>TRNSL P

and press the Enter key.

Example of a MAP response:

```
Link 2: LCM REM1 00 0  2;Cap MS;Status: OK  ;MsgCond: OPN
Link 6: LCM REM1 00 0  1;Cap MS;Status: SysB,;MsgCond: CLS
```

Record information for the links that have a status other than OK.

13 To choose and busy the link that has faults, type

>BSY LINK link_no

and press the Enter key.

where

link_no
is the number of a P-side link identified in step 12

14 To test the busied link, type

>TST LINK link_no

and press the Enter key.

where

link_no
is the number of a P-side link busied in step 13

If test	Do
passed	step 15
failed	step 22

15 To return the busied link to service, type

>RTS LINK link_no

and press the Enter key.

where

link_no
is the number of a P-side link busied in step 12

If RTS	Do
passed and no other links are SysB	step 27
passed but other links are SysB	step 13
failed	step 30

16 To display P-side links, type

>TRNSL P

and press the Enter key.

Example of a MAP response:

```
Link  0: RMM 0      0;Cap MS;Status:PBsy ,P;MsgCond:CLS
Link  1: RMM 0      1;Cap MS;Status:PBsy ,P;MsgCond:CLS
Link  2: ESA 0      0;Cap M ;Status:OK   ,P;MsgCond:OPN
Link  3: ESA 0      1;Cap M ;Status:OK   ,P;MsgCond:OPN
```

17 To post the RMM or ESA processor that has faults (if equipped), type

>POST module module_no

and press the Enter key.

where

module
is the name of the P-side module (RMM or ESA)

module_no
is the number of the RMM or ESA processor

LCM
minor (continued)

18 To busy the RMM or ESA processor, type

>BSY

and press the Enter key.

19 To test the RMM or ESA processor, type

>TST

and press the Enter key.

If test	Do
passed	step 20
failed, and the system produces a card list	step 29
failed, but the system does not produce a card list	step 30

20 To return to service the RMM or ESA processor, type

>RTS

and press the Enter key.

If RTS	Do
passed	step 32
failed	step 30

21 To post the OPM with the alarm condition, type

>POST LCM site frame lcm

and press the Enter key.

where

site
is the site name of the OPM (alphanumeric)

frame
is the frame number of the OPM (0 to 511)

lcm
is the number of the LCM

22

CAUTION
If you do not allow the time required for the system to clear the alarm, a false alarm indication can occur.
Allow 3 to 5 min for the system to clear the alarm before you proceed to the next step.

Determine if the problem is a drawer that has faults. Letters under the line subgroup numbers, associated with a physical drawer, indicate a drawer that has faults.

Example of a MAP response:

```
LCM  REM1 00 0   ISTb   Links OOS: Cside  0 Pside  0
Unit0: InSv                    /RG: 0
Unit1: InSv                    /RG: 0
                      11 11 11 11 11 RG: Pref 0 InSv
Drwr:  01 23 45 67 89 01 23 45 67 89     Stby 1 InSv
       .. SS .. .. .. .. .. .. .. ..
```

If the system	Do
indicates a drawer that has faults	step 23
does not indicate a drawer that has faults	step 26

23 To busy both line subgroups associated with the drawer that has faults, type

>BSY DRWR lsg

and press the Enter key

where

lsg
is the number of the line subgroups associated with the defective drawer

Example of a MAP response:

```
LCM  REM1 00 0   Drwr 2 will be taken out of service
Please confirm (“YES” or “NO”):
```

>YES

and press the Enter key

Repeat this step for the other line subgroup associated with the drawer that has faults.

LCM
minor (continued)

24 To test both line subgroups associated with the drawer that has faults, type

>TST DRWR lsg

and press the Enter key.

where

lsg
is the number of one of the line subgroups associated with the drawer that has faults.

Note: Repeat this step for the other line subgroup associated with the drawer that has faults.

If test	Do
passed	step 25
failed, and the system produces a card list	step 29
failed, but the system does not produce a card list	step 30

25 To return to service both line subgroups, type

>RTS DRWR lsg

and press the Enter key.

where

lsg
is the number of one of the line subgroups associated with the drawer that has faults

Example of a MAP response:

```
OSvce Tests Initiated
LCM  REM1 00 0   Drwr 2 Tst Passed
LCM  REM1 00 0   Drwr 2 Rts Passed
```

Repeat this step for the other line subgroup associated with the drawer that has faults.

If return to service	Do
passed	step 32
failed	step 30

26 To busy the LCM unit associated with the alarm, type

>BSY UNIT Icm_unit

and press the Enter key.

where

lcm_unit
is the LCM unit to be busied (0 or 1)

27 To test the busied unit, type

>TST UNIT lcm_unit

and press the Enter key.

where

lcm_unit
is the LCM unit to test (0 or 1)

If test	Do
passed	step 28
failed, and the system produces a card list	step 29
failed, but the system does not produce a card list	step 30

28 To attempt to return the LCM to service, type

>RTS UNIT lcm_unit

and press the Enter key.

where

lcm_unit
is the LCM unit to return to service (0 or 1)

If RTS	Do
passed	step 32
failed	step 30

29 The card list identifies the cards with possible faults. Replace the cards one at a time in the order listed.

If you	Do
replaced the last card	step 31
did not replace the last card	step 30

30 For additional help, contact the next level of support.

31 Go to the *Card Replacement Procedures* to replace the first (or next) card on the card list. For an OPM, notify outside operating company personnel that

LCM
minor (end)

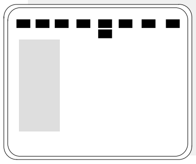
you are changing the card. After you replace the card, return to the step in this procedure as indicated below.

If you	Do
are clearing a PBsy alarm	step 19
are clearing drawer faults	step 24
are clearing all other alarms	step 27

32 The procedure is complete. If the system displays additional alarms, proceed to the correct alarm clearing procedure.

RMM
minor

Alarm display



CM	MS	IOD	Net	**PM**	Lns	Trks	Ext	Appl
.	.	.	.	**nCBsy**	.	.	.	.

Indication

An *n*CBsy under the peripheral module (PM) subsystem header indicates a minor alarm that involves an remote maintenance module (RMM). This header appears at the maintenance (MTC) level of the MAP display.

Meaning

The *n* indicates the number of RMMs in the central-side (C-side) busy (CBsy) state.

Impact

Subscriber service is not affected. Local RMM backup is not available when the unit fails.

Common procedures

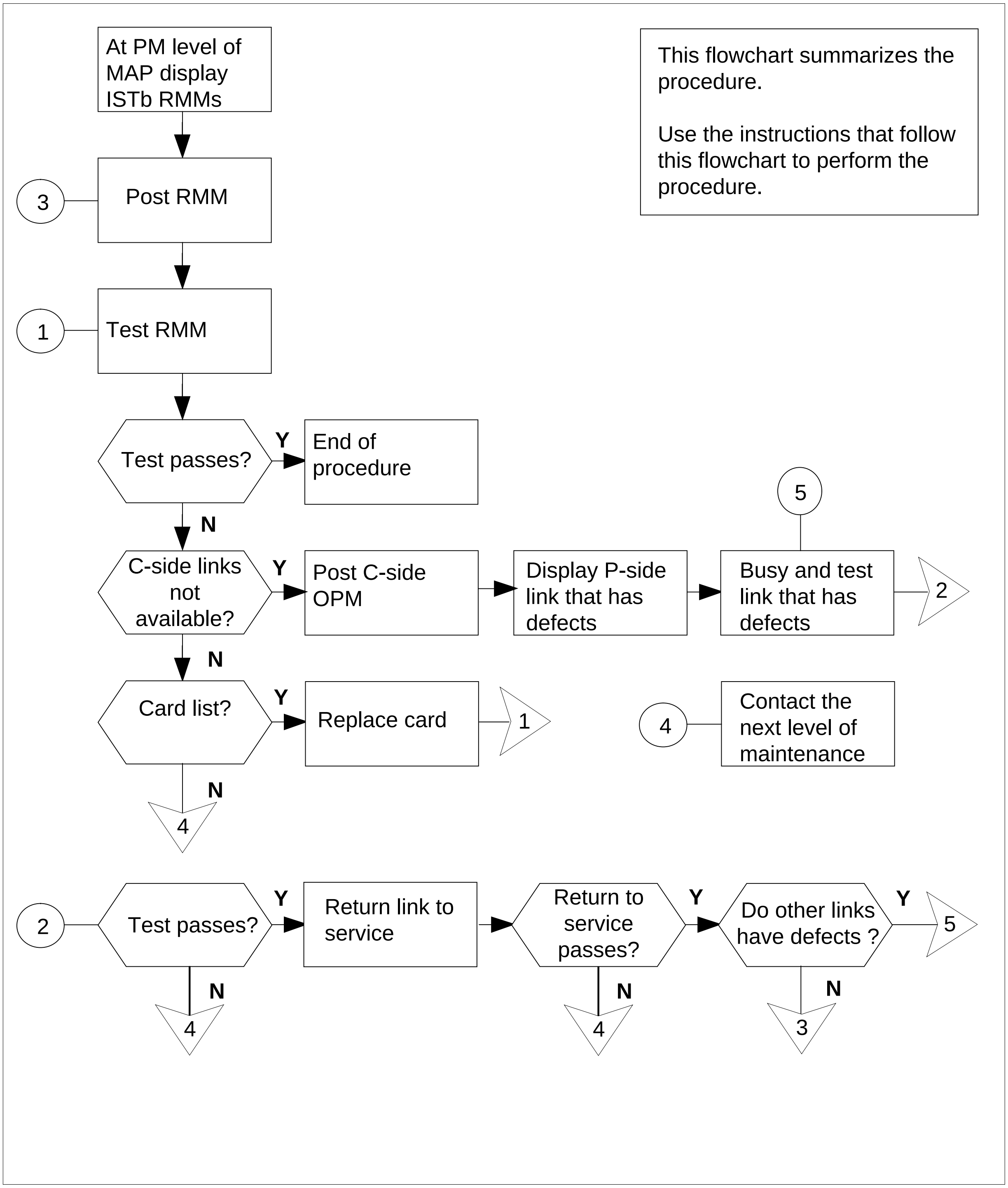
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Use the steps to perform the procedure.

RMM
minor (continued)

Summary of clearing an RMM minor alarm



Clearing an RMM minor alarm

At the MAP terminal

1

> **ATTENTION**
> Enter this procedure from a step in the PM system level alarm clearing procedure. This step identifies a PM alarm associated with an OPM fault.

To silence the alarm, type:

>MAPCI;MTC;PM;SIL

and press the Enter key.

2 To identify the RMM that has defects, type:

>DISP STATE ISTB RMM

and press the Enter key.

Example of a MAP response

```
ISTb  RMM: 2
```

3 To post the ISTb RMM from step 2, type:

>POST RMM rmm_no

and press the Enter key.

where

rmm_no
is the number of the RMM that has defects

4 To perform an in-service test on the RMM that has defects type:

>TST

and press the Enter key.

If test	Do
passes	step 17
fails because of C-side links not available	step 5
fails and the system produces a card list	step 14
fails and the system does not produce a card list	step 16

RMM
minor (continued)

5 To identify the OPM with links that are busied by the system (SysB), type:

>TRNSL C

and press the Enter key.

Example of a MAP response

```
LINK  0:  LCM OPM 00 0  0;CAP MS;STATUS:SysB,;MSGCOND:CLS
LINK  1:  LCM OPM 00 0  1;CAP MS;STATUS:  OK,;MSGCOND:OPN
```

6 To post the OPM identified in step 5, type:

>POST LCM site frame lcm

and press the Enter key.

where

site
is the site name of the OPM (alphanumeric)

frame
is the frame number of the OPM (0-511)

lcm
is the number of the LCM

7

WARNING
If you do not allow the time required for the system to clear the alarm, a false alarm indication occurs.
Allow 3 to 5 min for the system to clear the alarm then proceed to the next step.

To identify the peripheral-side (P-side) links that have defects, type:

>TRNSL P

and press the Enter key.

Example of a MAP response:

```
LINK 0: RMM 0 0;CAP MS;STATUS:SysB,;MSGCOND: CLS
LINK 1: RMM 0 1;CAP MS;STATUS:  OK,;MSGCOND: OPN
LINK 2: ESA 0 0;CAP  S;STATUS:  OK,;MSGCOND: OPN
LINK 4: ESA 0 1;CAP  S;STATUS:  OK,;MSGCOND: OPN
```

8 To busy the link that has defects, type:

>BSY LINK link_no

and press the Enter key.

where

link_no
is the number of the the P-side link that has defects from step 7

9 To test the manually busied (ManB) link, type:

>TST LINK link_no

and press the Enter key.

where

link_no
is the number of the manually busy link (0 or 1) from step 8

If	Do
TST PASSED	step 10
TST FAILED	step 16

10 To return the link to service, type:

>RTS LINK link_no

and press the Enter key.

where

link_no
is the number of the link (0 or 1) tested in step 9

If	Do
RTS PASSED	step 11
RTS FAILED	step 16

11 Determine if you have to clear additional links.

If the links that have defects	Do
have cleared	step 12
have not cleared	step 7

12 To post the RMM, type:

>POST RMM rmm_no

and press the Enter key.

where

rmm_no
is the number of the posted RMMs

13 To test the RMM, type:

>TST

RMM
minor (end)

and press the Enter key.

If test	Do
`TST PASSED`	step 17
`TST FAILED`, and the system produces a cardlist	step 14
`TST FAILED`, and the system does not produce a cardlist	step 16

14 The card list identifies the cards that can have defects. Replace one card at a time according to the procedure.

If the cards on the list	Do
are replaced	step 16
are not replaced	step 15

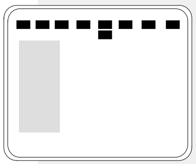
15 Go to the *Card Replacement Procedures* for the next card on the card list. When you finish with the card replacement procedures, go to step 13.

16 For additional help, contact the next level of maintenance.

17 The procedure is complete. If other alarms appear at the MAP display, refer to the appropriate alarm clearing procedure.

ESA
critical, minor

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nESA**	.	.	.	.	.
				C					

Indication

The alarm code ESA under the PM subsystem header indicates an ESA alarm. The *C* indicates a critical ESA alarm. The absence of *C* under the ESA indicates a minor ESA alarm. The number *(n)* before ESA indicates the number of ESA processors with the alarm condition.

Meaning

The *n* is the number of ESAs in the system busy (SysB) or in-service trouble (ISTb) state.

Impact

The SysB condition does not directly affect service. Local backup is not available. An interruption of service can occur if the OPM cannot contact the host office and the ESA processor is SysB.

The ISTb condition does not directly affect service. Operating company personnel must investigate the trouble condition to avoid the possibility of service interruption if the ESA condition deteriorates.

Common procedures

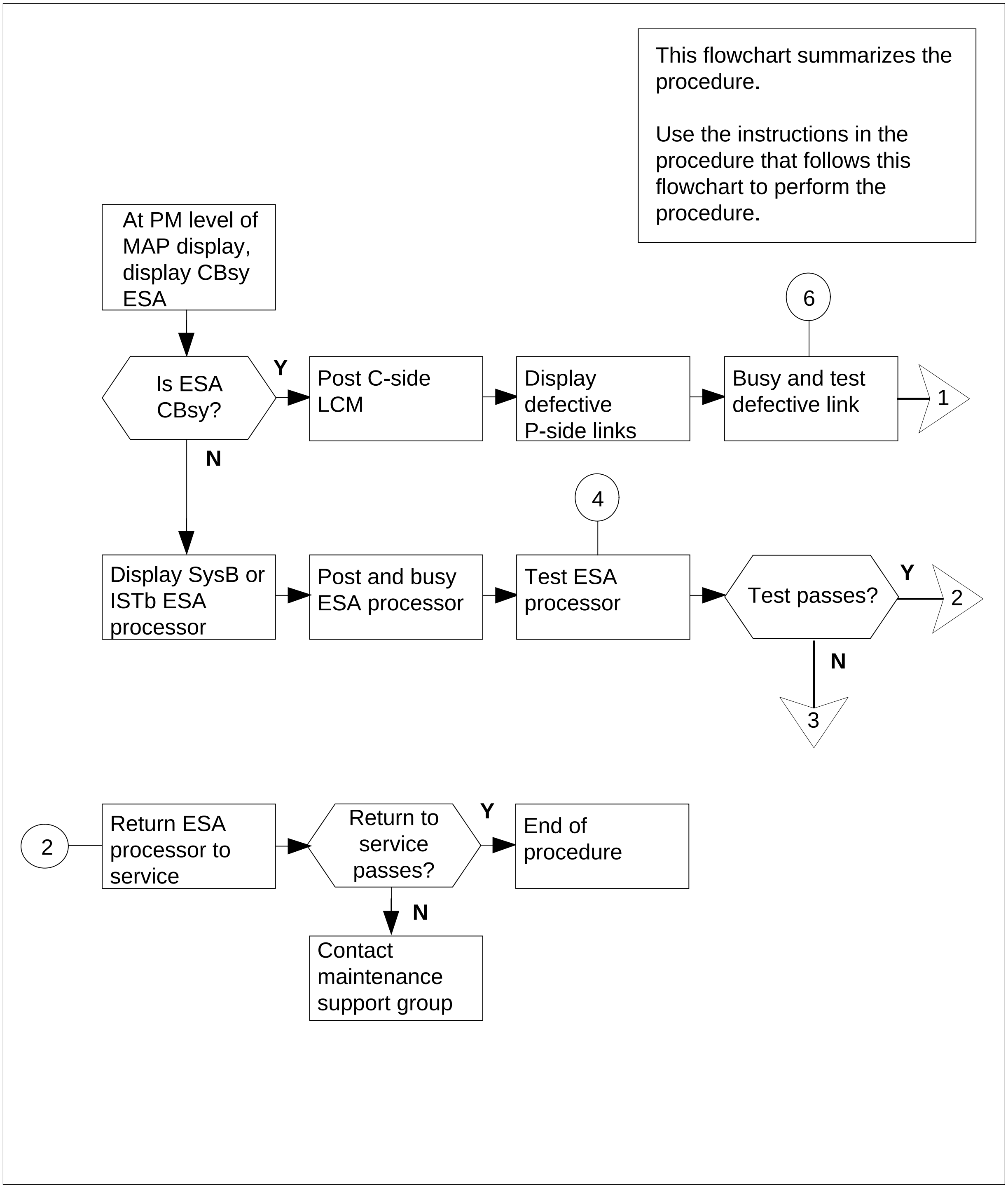
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Use the steps to perform the procedure.

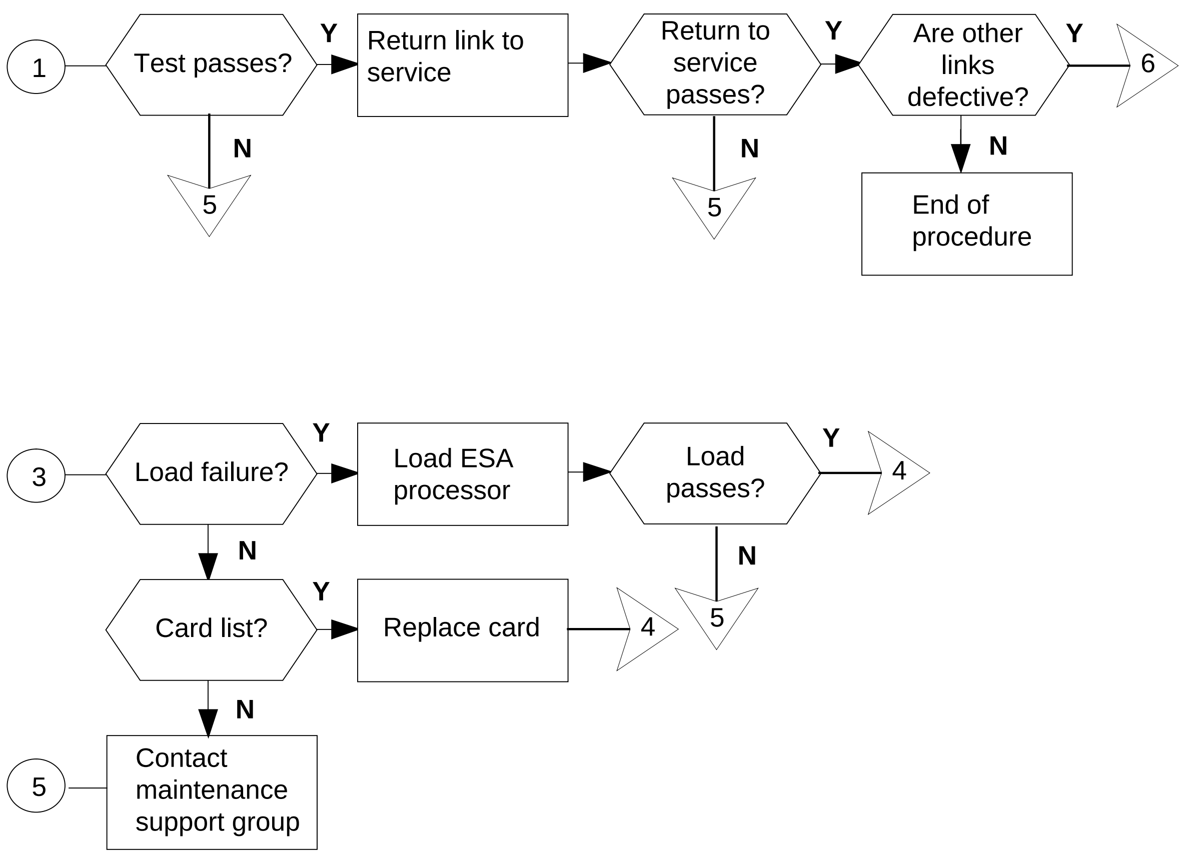
ESA
critical, minor (continued)

Summary of clearing ESA critical, minor alarms



ESA
critical, minor (continued)

Summary of clearing ESA critical, minor alarms (continued)



ESA
critical, minor (continued)

Clearing ESA critical, minor alarms

At the MAP terminal

1

> **ATTENTION**
> Enter this procedure from a PM system level alarm clearing procedure step. This step identifies a PM alarm that associates with an OPM fault.

To silence an audible alarm, type:

>MAPCI;MTC;SIL

and press the Enter key.

2 To access the PM level of the MAP display, type:

>PM

and press the Enter key.

3 To identify the central-side busy (CBsy) ESA processor, type:

>DISP STATE CBSY ESA

and press the Enter key.

If ESA	Do
is CBsy	step 4
is not CBsy	step 11

4 To post the ESA processor, type:

>POST ESA esa_no

and press the Enter key.

where

esa_no
is the number of the ESA processor (0 to 255)

Example of a MAP response:

```
REM1  ESA    0 CBsy
```

5 To display the C-side links and identify the associated OPMs, type:

>TRNSL

and press the Enter key.

Example of a MAP response:

```
Link 0: LCM 0        0;Cap M ;Status:SysB  ;MsgCond:CLS
Link 1: LCM 0        1;Cap M ;Status:SysB  ;MsgCond:CLS
```

Record information for the ESA links that have a status other than OK.

6 To post the OPM associated with the link that has faults, type:

>POST LCM site frame lcm

and press the Enter key.

where

site
is the site name of the OPM (alphanumeric)

frame
is the frame number of the OPM (0 to 511)

lcm
is the number of the LCM (0 to 1)

7 To identify the peripheral-side (P-side) links that have faults and associate with ESA, type:

>TRNSL P

and press the Enter key.

Example of a MAP response:

```
Link 0: RMM 0        0;Cap MS;Status:OK    ;MsgCond:OPN
Link 1: RMM 0        1;Cap MS;Status:OK    ;MsgCond:OPN
Link 2: ESA 0        0;Cap M ;Status:SysB  ;MsgCond:CLS
Link 3: ESA 0        1;Cap M ;Status:SysB  ;MsgCond:CLS
```

Record information for the ESA links that have a status other than OK.

8 To busy the link that has defects, type:

>BSY LINK link_no

and press the Enter key.

where

link_no
is the number of a P-side link identified in step 7

9 To test the busied link, type:

>TST LINK link_no

and press the Enter key.

where

ESA
critical, minor (continued)

link_no
is the number of a P-side link that has defects

If test	Do
passes	step 10
fails	step 20

10 To return to service the busied link, type:

>RTS LINK link_no

and press the Enter key.

where

link_no
is the number of a P-side link that has defects

If return to service	Do
passes and other links are not SysB	step 21
passes and other links are SysB	step 8
fails	step 20

11 To identify the SysB ESA processor, type:

>DISP STATE SYSB ESA

and press the Enter key.

If ESA	Do
is SysB	step 13
is not SysB	step 12

12 To identify the ISTb ESA processor, type:

>DISP STATE ISTB ESA

and press the Enter key.

13 To post the ESA processor with the alarm condition, type:

>POST ESA esa_no

and press the Enter key.

where

esa_no
is the number of the ESA processor (0 to 255)

ESA
critical, minor (continued)

Example of a MAP display:

```
REM1  ESA    0 SysB
```

14 To busy the posted ESA processor, type:

>BSY

and press the Enter key.

MAP response:

```
This action will take this PM out of service
Please confirm (“Yes” or “No”)
```

To confirm busy, type:

>YES

and press the Enter key.

15 To test the ESA processor, type:

>TST

and press the Enter key.

If test	Do
passes	step 18
fails because of loading error	step 16
fails and the system produces a cardlist	step 17
fails but the system does not produce a cardlist	step 20

16 To attempt to reload the ESA processor, type:

>LOADPM

and press the Enter key.

If load	Do
passes	step 15
fails	step 20

17 The card list identifies the cards that can have faults. Replace the cards one at a time in the order listed.

If all cards on the list	Do
are replaced	step 20
are not replaced	step 19

ESA
critical, minor (end)

18 To return to service the ESA processor, type:

>RTS

and press the Enter key.

If return to service	Do
is successful	step 21
fails because of loading error	step 16
fails because of CBsy condition	step 4
other	step 20

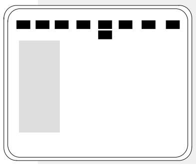
19 Go to the card replacement procedure *Card Replacement Procedures* for the next card on the card list. When you finish with the card replacement procedure, go to step 15.

20 For additional help, contact the next level of maintenance.

21 The procedure is complete. If additional alarms appear at the MAP display, proceed to the appropriate alarm clearing procedure.

PM PES
critical, major, minor

Alarm display



CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	Appl
.	.	.	.	**nPES**	.	.	.	.	.
				M					

Indication

The alarm code PES, under the peripheral module (PM) header, indicates a power and environment system (PES) alarm in an Outside Plant Module (OPM). The MAP terminal displays the following information under the PES alarm according to how important the alarm is:

Alarm	Information displayed under PES
critical	`*C*`
major	`M`
minor	a blank space

At the PES level of the MAP terminal, software displays the number of OPMs in different maintenance states. The states are red, amber, green, and offline (OFFL). The following example of a display at the PES level of the MAP displays the following information. One OPM is in the RED state. Two OPMs are in the AMBER state. Three OPMs are in the GREEN state. One OPM is in the OFFL state.

Example of a MAP response:

```
          RED   AMBER  GREEN  OFFL
    PES     1      2      3     1
```

For more detailed information about an OPM that has a PES alarm, enter the POST command. Enter this command with a correct parameter (for example, POST GREEN) at the PES level of the MAP display. When you enter the POST command, a display like the following one appears on the MAP display:

PM PES
critical, major, minor (continued)

Example of a MAP response:

```
OPMPES    2 Cond:  GREEN  REM2     2   1   RMM   2
                                       Audit  Week  HBT
    Common     Rectifiers                    .     2    .
     AC     FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
      .        .   .   .   .      .       .      .   .
    BCC    0    1    2    3    Temp     Door    BCCFUSES
   0= .    .    .    .    .  EHT ELT  FRNT SIDE    0   1
   1= .     .    .    .    .   .   .    .    .     .   .
```

Meaning

At the MTC level of the MAP display, the number that precedes the PES alarm indicates the number of OPMs that have a PES alarm. The alarm can be critical, major, or minor.

- critical alarm

  More than 10 percent of all OPMs in the office have a maintenance state of RED.

- major alarm

  Ten percent or fewer of all OPMs in the office have a maintenance state of RED.

- minor alarm

  One or more OPMs have a maintenance state of AMBER, and no OPM has a maintenance state of RED.

At the OPMPES level of the MAP display, the numbers under RED, AMBER, GREEN, or OFFL indicate the number of OPMs that are in the indicated state. The meaning of each of these maintenance states follows:

- RED

The system detects one or more of the following faults in the OPM:

- ac power failure
- rectifier failure
- too much current draw
- door open
- temperature inside OPM too high or low
- frame supervisory panel (FSP) failure

PM PES
critical, major, minor (continued)

- high battery temperature alarm set
- battery rotation audit disabled
- battery string failed system testing
- AMBER

The system detects one or more of the following faults in the OPM:

- fuse blown on charger 0 or charger 1
- environmental control unit (ECU) failure
- the battery charger controller driver (BCCDVR) card or the PES alarm detector (PESALRM) card is peripheral busy (P), system busy (S), or manual busy (M).
  - — high battery temperature alarm set
  - — battery rotation audit disabled
  - — battery string failed system testing
- GREEN

  There are no faults in any OPM.
- OFFL

  Both the BCCDVR and PESALRM cards are offline.

The information that appears under each of the headers in this display indicates conditions. This information indicates the conditions of different items in the OPM that you posted. This information helps to determine the cause of the PES alarm. The following list describes the information that the system can display:

- common AC

```
condition of the ac power supply
   .    ac power present
   F    ac power absent (failed)
```

- rectifiers

PM PES
critical, major, minor (continued)

```
condition of rectifiers
FL0   condition of rectifier 0
   .    no rectifier fault detected
   F   rectifier failed to detect its output
FL1 condition of rectifier 1
   .    no rectifier fault detected
   F    rectifier failed to detect its output
CL0 current limiting condition of rectifier 0
   .    current limiting circuitry not active
   F    current limiting circuitry active
CL1 current limiting condition of rectifier 1
   .    current limiting circuitry not active
   F    current limiting circuitry active
```

- temp

```
internal temperature of the OPM
EHT   extremely high temp. in OPM
   .   extremely high temp. not detected
   F   extremely high temp. detected
ELT   extremely low temp. in OPM
   .   extremely low temp. not detected
   F   extremely low temp. detected
HBT   Extremely high battery temp. in OPM
   .        Extremely high battery temp.
not detected
   F   Extremely high battery temp.
detected
```

- door

```
position of doors on the OPM
FRNT    position of the front door
   .    door closed
   o    door open
SIDE    position of the side door
   .    door closed
   o    door open
```

- ECU

```
condition of environmental control unit (ECU)
     .  ECU not faulty
     F  ECU faulty
```

PM PES
critical, major, minor (continued)

- FSP

```
condition of the frame supervisory
panel
   .    FSP not faulty
   F    FSP fault detected
```

- BCC

```
condition of the battery charger controller
   .  normal load bus configuration in use
   W  one or more battery strings not
      connected to the load bus
```

- 0123

```
states of the battery string pairs
   .    string connected to load bus
   CHG  string connected to charge bus
   BSY  driver card manual busy or offline
   O/C  string open-circuit
   DIS  string connected to discharge test bus
   F    string failed system testing
   —    string not equipped
```

- BCCFUSES

```
state of the battery charger controller fuses
   .    fuses not faulty
   F    faulty fuse
```

- BCCDVR

```
state of the battery charger controller driver card
   .    in service, no fault detected
   M    manually busy
   S    system busy
   P    peripheral busy
```

- PESALRM

```
state of the power and environmental system alarm scan card
   .    in service, no fault detected
   M    manually busy
   S    system busy
   P    peripheral busy
```

PM PES
critical, major, minor (continued)

- AUDIT

```
state of the battery rotation and testing audit
   .    audit enabled
  DIS   audit disabled
```

- WEEK

```
mode of battery rotation and testing audit
   n    battery strings 1–4, audit enabled for normal
   rotation and testing
   .    audit enabled, ac or rectifier failure
   P/S  post ac failure recovery mode (short outage)
   P/E  post ac failure recovery mode (extended outage)
```

Impact

A PES alarm does not affect subscriber service directly.

Common procedures

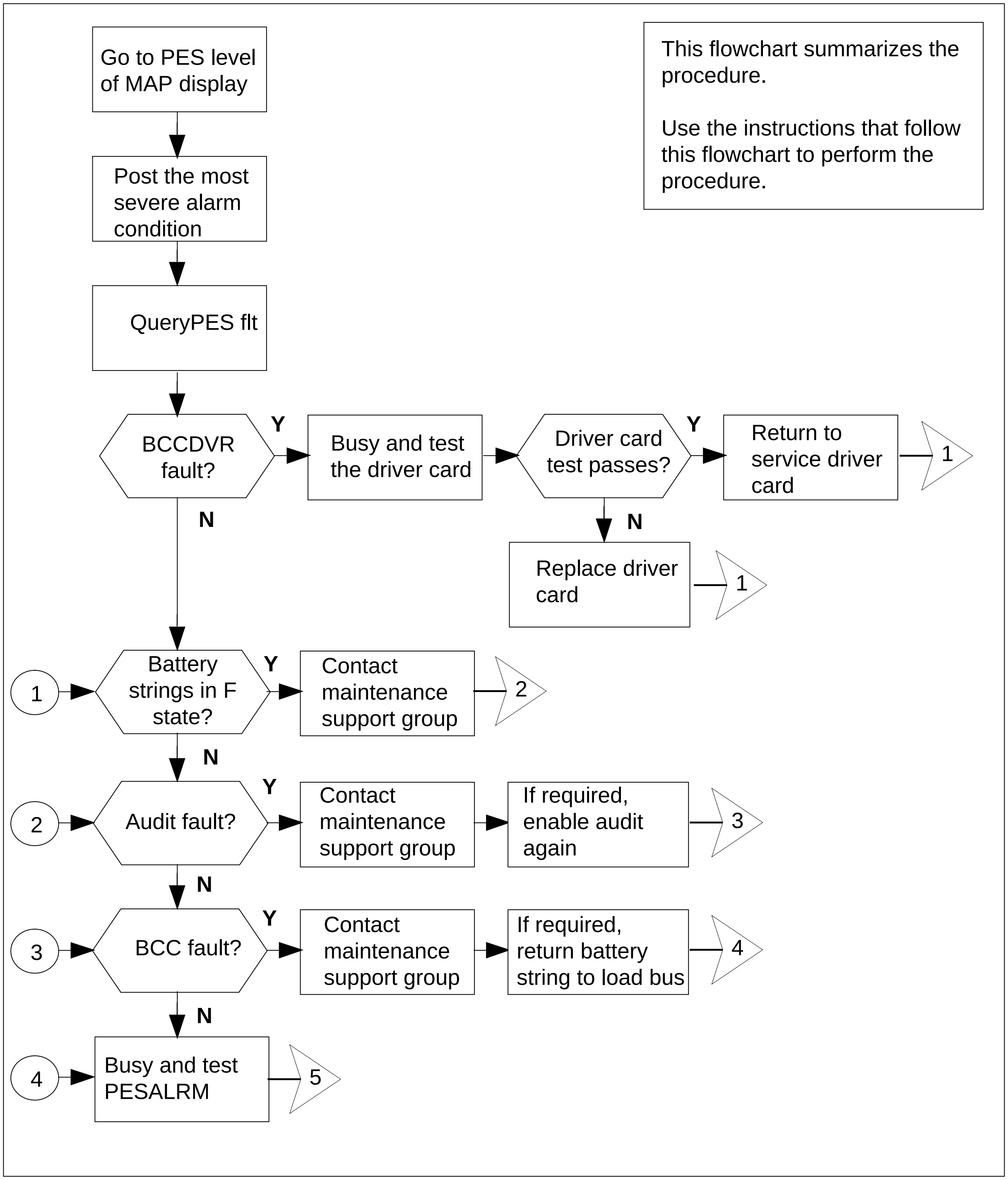
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

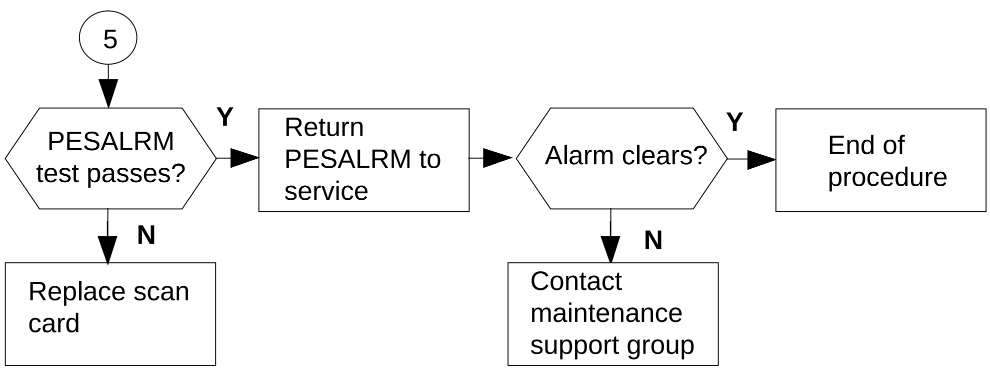
PM PES
critical, major, minor (continued)

Summary of clearing PM PES critical, major, minor alarms



PM PES
critical, major, minor (continued)

Summary of clearing PM PES critical, major, minor alarms (continued)



PM PES
critical, major, minor (continued)

Clearing PM PES critical, major, minor alarms

At the MAP terminal

1

> **ATTENTION**
> Enter this procedure from a PM system level alarm clearing procedure step. This step must identify a PM alarm associated with an OPM fault.

If an alarm continues to be audible, silence the alarm. To silence the alarm, type

>MAPCI;MTC;sSIL

and press the Enter key.

2 To enter the PES MAP level, type

>PM;PES

and press the Enter key.

3 Examine the display to determine the most important alarm condition. Refer to the alarm condition description at step 6.

4 To post the most important alarm condition, type

>POST condition

and press the Enter key.

where

condition
is the condition (red or amber)

A display like the following one appears on the MAP display.

PM PES
critical, major, minor (continued)

Example of a MAP display:

```
 CM     MS     IOD    NET    PM     CCS    LNS    Trks   Ext   Appl
 .      .      .      .     1PES    .      .      .      .      .

 OPMPES                 SysB   ManB   OffL   CBSY   ISTB   InSV
 0 Quit      PM           0      3      4      0      4     30
 2 Post_
 3                       RED      AMBER     GREEN     OFFL
 4           OPMPES      0          1          3        1
 5
 6 Tst_      OPMPES    2 Cond:  AMBER    REM2     2   1   RMM   2
 7 Bsy_                                         Audit  Week  HBT
 8 Rts_       Common     Rectifiers               .      2    .
 9 OffL_       AC     FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
10              .      .   .   .   .   .   .       .      .   .
11 Disp_      BCC    0    1    2    3    Temp     Door    BCCFUSES
12 Next      0= w    .    .    .    -  EHT ELT  FRNT SIDE    0   1
13 Audit_    1= w    .    .    .    -   .   .    .    .      .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 Measure_
```

5 To query the PES fault to determine the problem, type

>QUERYPES FLT

and press the Enter key.

6 Select one of the alarm condition from the MAP command at the following step:.

If the selection	Do
is AC (common)	step 8
is FL0/FL1	step 8
is EHT/ELT	step 8
is HBT	step 8
is FRNT/SIDE	step 8
is ECU	step 8
is FSP	step 8
is BCCFUSES	step 8
is PESALRM	step 8

PM PES
critical, major, minor (continued)

If the selection	Do
is CL0/CL1	step 8
is BCCDVR	step 13
is BCC (0/1)	step 18
is Audit	step 7
is 0/1/2/3 (battery string pairs) in an F (fail) state	step 22

7 To disable the audit, type

>AUDIT DISABLE

and press the Enter key.

8 To busy the scan card, type

>BSY PESALRM

and press the Enter key.

The letter M appears under PESALRM on the MAP display.

Example of a MAP display:

```
 CM      MS      IOD     NET     PM     CCS     LNS     Trks    Ext    Appl
 .       .        .       .     1PES     .       .       .       .       .

 PES                     SysB    ManB    OffL    CBSY    ISTB    InSV
 0 Quit      PM            0       3       4       0       4      30
 2 Post_
 3                        RED      AMBER     GREEN     OFFL
 4           PES           1          2         3        1
 5
 6 Tst_      PES         2 Cond:  AMBER    REM2      2   1   RMM   2
 7 Bsy_                                              Audit  Week  HBT
 8 Rts_       Common      Rectifiers                   DIS    -     .
 9 OffL_       AC       FL0 FL1 CL0 CL1   BCCDVR   PESALRM   ECU FSP
10              .        .   .   .   .    .   .       M         .   .
11 Disp_       BCC    0     1     2     3    Temp      Door     BCCFUSES
12 Next       0= w    .     .     .     -   EHT ELT  FRNT SIDE    0   1
13 Audit_     1= w    .     .     .     -    .   .     .    .     .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 Measure_
```

9 To test the scan card, type

>TST PESALRM

PM PES
critical, major, minor (continued)

and press the Enter key.

If test	Do
fails	step 10
passes	step 12

10 You must replace the scan card. Use the *Card Replacement Procedures* to replace the card. Notify outside operating company personnel. Go to step 11.

11 To test the new scan card, type

>TST PESALRM

and press the Enter key.

If test	Do
fails	step 22
passes	step 12

12 To return the scan card to service, type

>RTS PESALRM

and press the Enter key.

If alarm condition	Do
continues to exist	step 22
does not continue to exist	step 23

13 To busy the driver card, type

>BSY BCCDVR

and press the Enter key.

The letter M appears under BCCDVR on the MAP display.

PM PES
critical, major, minor (continued)

Example of a MAP display:

```
CM     MS     IOD    NET    PM    CCS    LNS    Trks   Ext   Appl
 .      .      .      .    1PES    .      .      .      .     .

 PES                   SysB   ManB    OffL    CBSY    ISTB    InSV
 0 Quit      PM          0      3       4       0       4      30
 2 Post_
 3                      RED       AMBER      GREEN      OFFL
 4           PES         1           2          3         1
 5
 6 Tst_      PES       2 Cond:  AMBER    REM2      2   1   RMM   2
 7 Bsy_                                           Audit  Week  HBT
 8 Rts_       Common     Rectifiers                 DIS    -    .
 9 OffL_       AC      FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
10              .       .   .   .   .   .  M        .        .   .
11 Disp_      BCC    0    1    2    3    Temp      Door    BCCFUSES
12 Next      0= w    .    .    .    -  EHT ELT  FRNT SIDE    0   1
13 Audit_    1= w    .    .    .    -   .   .    .    .      .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 Measure_
```

14 To test the BCCDVR card, type

>TST BCCDVR

and press the Enter key.

If test	Do
fails	step 15
passes	step 17

15 You must replace the BCCDVR card. Use the *Card Replacement Procedures* to replace the card. Notify outside operating company personnel. Go to step 16 after the card replacement is complete.

16 To test the new BCCDVR card, type

>TST BCCDVR

and press the Enter key.

If test	Do
fails	step 22
passes	step 17

17 To return the BCCDVR card to service, type

>RTS BCCDVR

PM PES
critical, major, minor (end)

and press the Enter key.

If the system	Do
does not display W under BCC	step20
displays W under BCC	step 18

18 This system generates the alarm if only one or more equipped battery string pair is on the load bus. Consult office records or operating company personnel to determine why more than one battery string pair does not connect to the load bus.

If battery return to load bus	Do
is installed	step 19
is not installed	step 23

19 To place the battery on the load bus, type

>LOADB n

and press the Enter key.

where

n
is the battery string pair number 0, 1, 2, or 3

If the system response	Do
is not OK	step 22
is OK	step 20

20 To enable the audit, type

>AUDIT ENABLE

and press the Enter key.

21 Go to step 23.

22 You cannot clear the condition from the office. Advise outside personnel and contact your maintenance support group.

23 The procedure is complete. If the system displays additional alarms, proceed to the correct alarm clearing procedure.

8 OPM card replacement procedures

This chapter contains the card replacement procedures for the Outside Plant Module (OPM). These procedures are used by maintenance personnel to remove and replace hardware modules.

Except when used as part of verification or acceptance procedures, these procedures are used only when referred to by another maintenance procedure, such as the *Alarm Clearing Procedures*.

Procedures in the manual are named to correspond with the Northern Telecom (NT) product equipment code (PEC) and the shelf where the card is to be replaced. These procedures are arranged in alphabetical order for easy location.

NT0X10
in an OPM RMM

Application

Use this procedure to replace the following card in an RMM.

PEC	Suffixes	Name
NT0X10	AA	Miscellaneous Scan Card (SC)

Common procedures

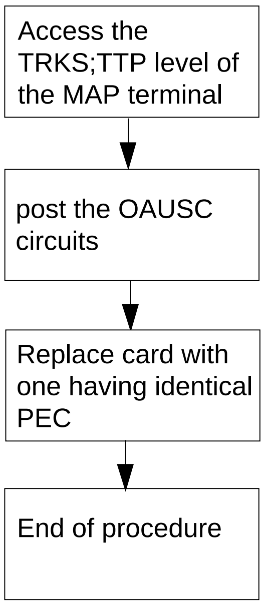
The replacing a card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT0X10
in an OPM RMM (continued)

Summary of card replacement procedure for an NT0X10 card in an RMM



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

NT0X10
in an OPM RMM (continued)

Replacing an NT0X10 card in an RMM

At your current location

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

At the MAP display

2 Access the TTP level of the MAP and post the scan points on the card to be replaced by tying

>MAPCI;MTC;TRKS;TTP;POST P RMM rmm_no ckt_no

and pressing the Enter key.

rmm_no
is the number of the RMM with the faulty NT0X10 card.

ckt_no
is the number of the first scan point (SC) of the seven SC points on this card.

Example of a MAP display response:

```
LAST CIRCUIT = 14
POST CKT IDLED
SHORT CLLI IS:  1146
OK, CLLI POSTED

POST  13   DELQ       BUSY Q         DIG
TTP 6–006
CKT TYPE   PM NO.     COM LANG       STA S R DOT TE R
OG TESTEQ  RMM 0 0     OAUSC    0     IDL
```

At the RMM shelf

3

DANGER
Static electricity damage
Wear a wrist strap connected to the wrist strap grounding point of a frame supervisory panel (FSP) while handling circuit cards. This protects the cards against damage caused by static electricity.

Replace the NT0X10 card using the common replacing a card procedure in this document. When you have completed the procedure, return to this point, otherwise go to step 6.

4 Send any faulty cards for repair according to local procedure.

NT0X10
in an OPM RMM (end)

5 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 7.

6 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

7 You have completed this procedure.

NT0X91AA in an OPM

Application

Use this procedure to replace the following card in an FSP.

PEC	Suffixes	Name
NT0X91	AA	FSP drive and alarm circuit pack

Common procedures

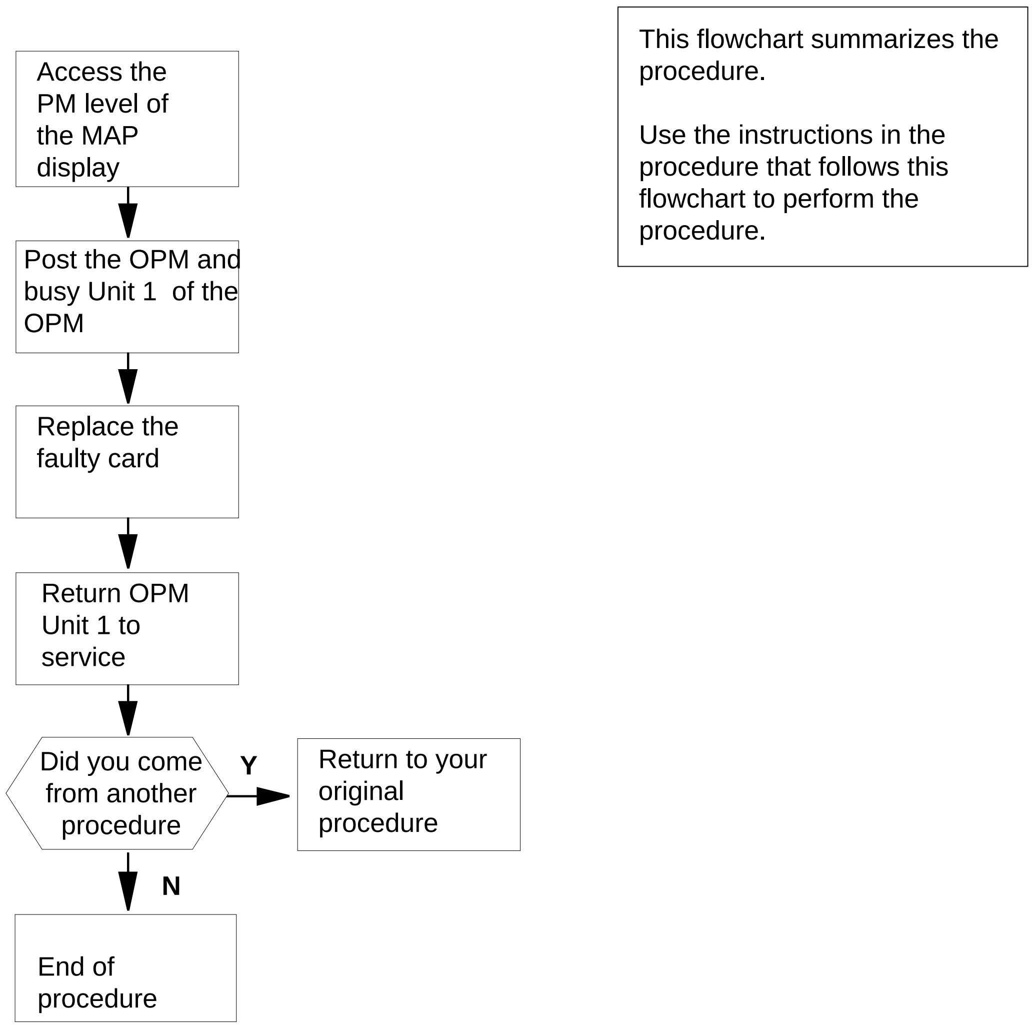
None

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT0X91AA in an OPM (continued)

Summary of card replacement procedure for an NT0X91AA card in an OPM



NT0X91AA
in an OPM (continued)

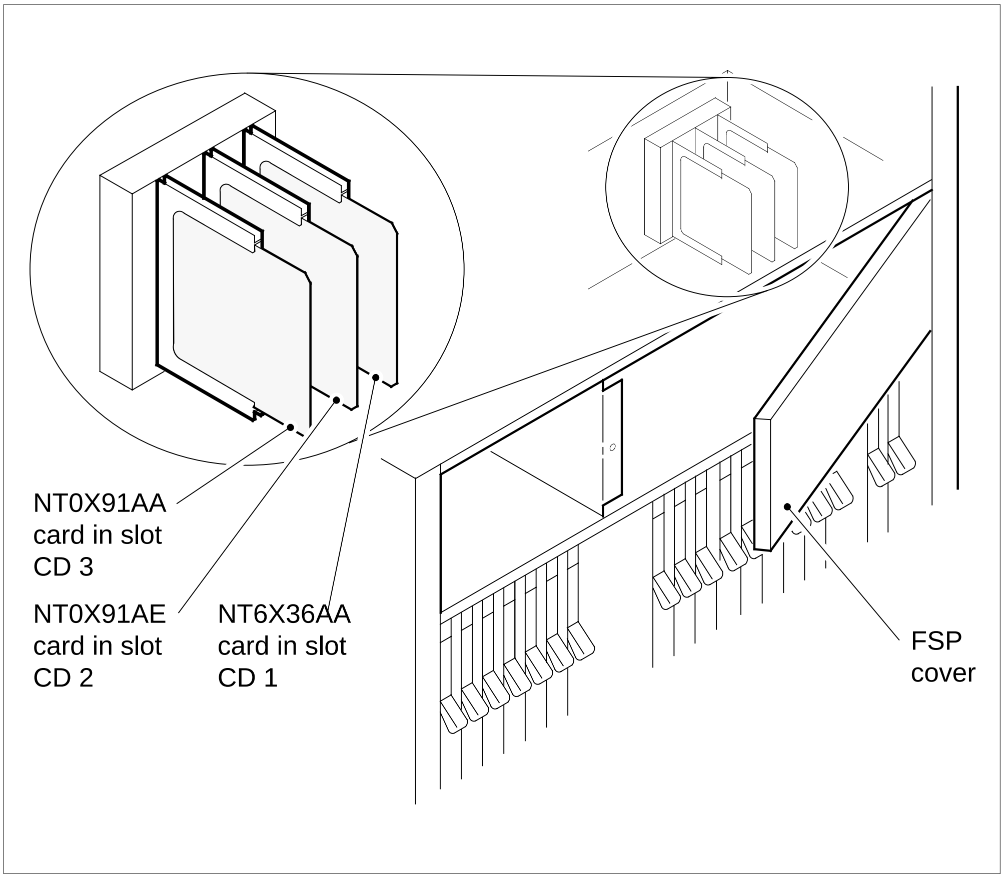
Replacing an NT0X91AA card in an OPM

At your current location

1 Obtain a replacement card. Ensure that the replacement card has the same product engineering code (PEC), including suffix, as the card being removed.

2

FSP Alarm and control cards



Use the following table to identify the slot containing the alarm and control card to be replaced.

If Alarm and control card	Do slot
NT0X91AA	slot CD3
NT0X91AE	slot CD2
NT6X36AA	slot CD1

Note: Refer to the following (above) diagram for FSP card slot locations.

NT0X91AA
in an OPM (continued)

3 Use the following table to identify which shelves, converters, and circuit breakers (CB) are associated with the alarm and control card you want to replace.

Alarm and Shelf control card	power Converter	shelf number	circuit breaker
NT0X91AA	NT2X70 in slot 22	05	CB4
NT0X91AE	NT2X70 in slot 25	05	CB1
NT0X91AE	NT2X09 and NT2X06	05	CB5

Note: The CBs are located on the FSP, shelf position 19.

4 Record the numbers of the shelves and CBs associated with the alarm and control card.

5 Record the outside plant module (OPM) shelf associated with the alarm and control card.

At the MAP display

6 Access the PM level of the MAP display by typing

`>MAPCI;MTC;PM`

and pressing the Enter key.

7 Post the OPM that is controlled by the alarm and control card as recorded in step 5 by typing

`>POST LCM  site_name frame_no lcm_no`

and pressing the Enter key.

where

site_name
is the name of the site where the LCM is located

frame_no
is the number of the frame where the LCM is located

lcm_no
is the number of the LCM associated with the faulty card

NT0X91AA in an OPM (continued)

8

> **CAUTION**
> **Loss of service**
> This procedure contains directions to busy one unit of a peripheral module (PM) in a frame. Since busying a unit of a PM affects redundancy, replace alarm and control cards only during periods of low traffic.

Busy LCM unit 1 by typing

`>BSY  UNIT 1`

and pressing the Enter key.

At the OPM cabinet

9 Put on a wrist strap.

10 Set CB4 as recorded in step 4 to the OFF position.

11 Unscrew the slotted nut located on the left-hand side of the FSP.

12

> **DANGER**
> **Risk of electrocution**
> Some of the terminals inside the frame supervisory panel (FSP) have an electrical potential of -48 V dc. Remove all jewelry before replacing a card in the FSP. Do not touch any terminals in the FSP.

Open the FSP panel.

13 Remove the NT0X91AA card from the slot identified in step 2.

14 Insert the replacement card.

15 Close the FSP panel.

16 Tighten the slotted nut on the FSP.

17 Set CB4 as recorded in step 4 to the ON position.

18 Proceed as follows to reset the converters in the host interface equipment shelf (HIE).

19 Press and hold the RESET button on the converter while setting the associated CB, identified in step 3, to the ON position.

20 Release the RESET button.

21 Remove the wrist strap.

NT0X91AA in an OPM (end)

22 Determine if a Converter Fail LED is lit.

If Converter Fail LED is	Do
lit	step 28
not lit	step 23

At the MAP display

23 Access the PM level of the MAP display by typing

>MAPCI;MTC;PM

and pressing the Enter key.

24 Post the OPM that is controlled by the alarm and control card as recorded in step 5 by typing

>POST LCM site_name frame_no lcm_no

and pressing the Enter key.

where

site_name
is the name of the site where the LCM is located

frame_no
is the number of the frame where the LCM is located

lcm_no
is the number of the LCM unit associated with the faulty card

25 Return to service LCM unit 1 by typing

>RTS UNIT 1

and pressing the Enter key.

26 The next action depends on your reason for performing this procedure

If you were	Do
directed to this procedure from a maintenance procedure	step 27
not directed to this procedure from a maintenance procedure	step 29

27 Return to the maintenance procedure that sent you to this procedure and continue as directed.

28 For further assistance, contact the personnel responsible for the next level of support.

29 You have completed this procedure.

NT0X91AE in an OPM

Application

Use this procedure to replace the following card in an FSP.

PEC	Suffixes	Name
NT0X91	AE	FSP drive and alarm circuit pack

Common procedures

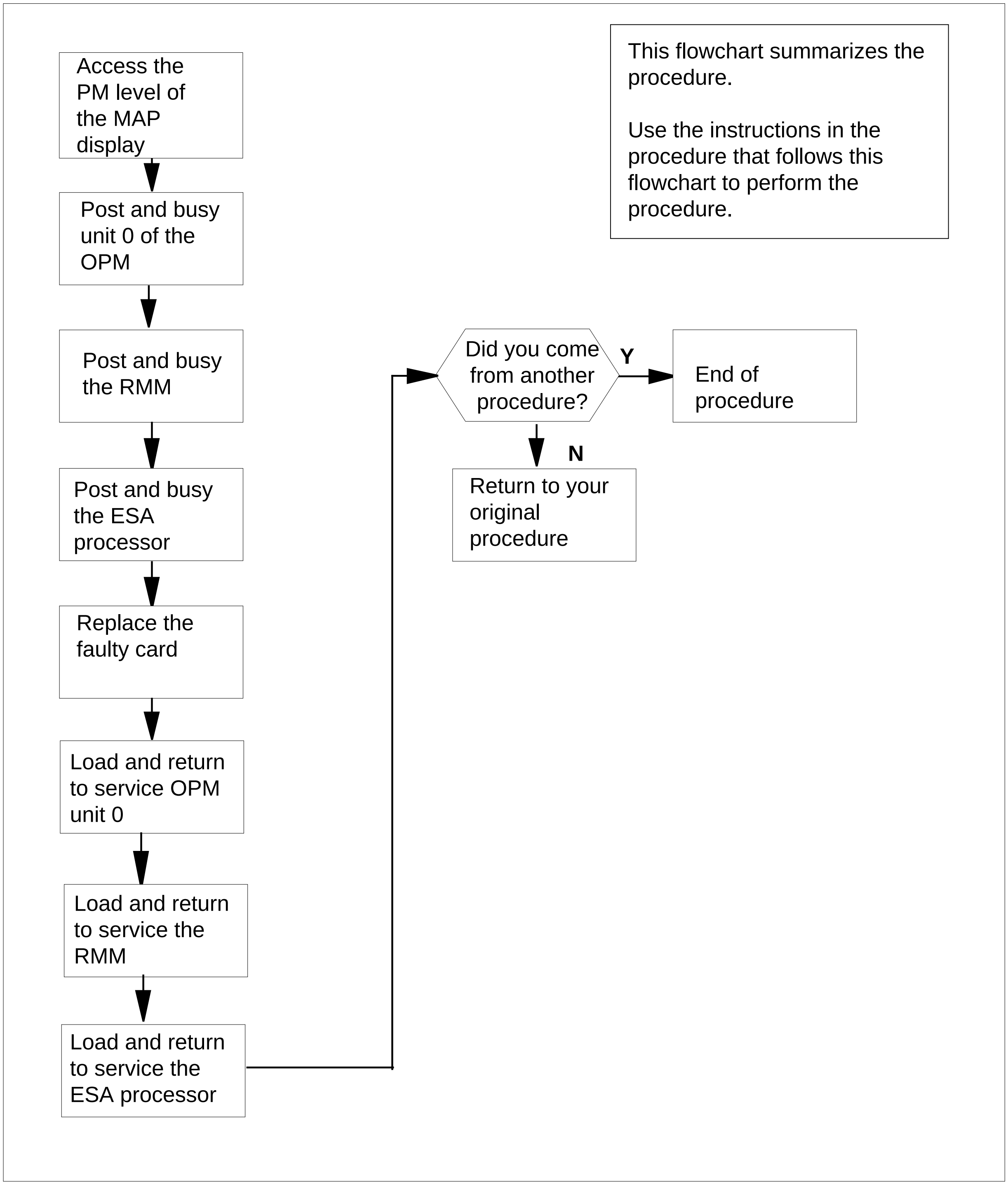
None.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT0X91AE
in an OPM (continued)

Summary of card replacement procedure for an NT0X91AE card in an OPM



NT0X91AE
in an OPM (continued)

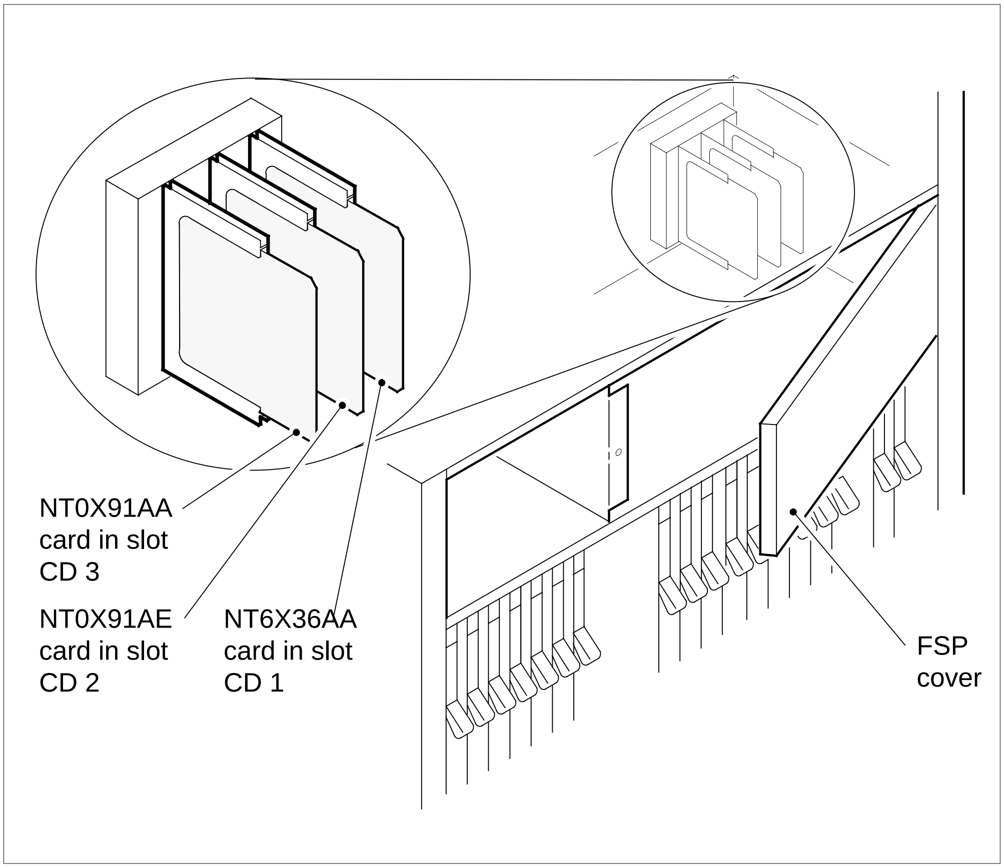
Replacing an NT0X91AE card in an OPM

At your current location

1 Obtain a replacement card. Ensure that the replacement card has the same product engineering code (PEC), including suffix, as the card being removed.

2

FSP Alarm and Control cards



Use the following table to identify the slot containing the alarm and control card to be replaced.

If Alarm and control card	Do slot
NT0X91AA	slot CD3
NT0X91AE	slot CD2
NT6X36AA	slot CD1

Note: Refer to the following (figure above) for FSP card slot locations.

NT0X91AE
in an OPM (continued)

3 Use the following table to identify which shelves, converters, and circuit breakers (CB) are associated with the alarm and control card you want to replace.

Alarm and Shelf control card	power Converter	shelf number	circuit breaker
NT0X91AA	NT2X70 in slot 22	05	CB4
NT0X91AE	NT2X70 in slot 25	05	CB1
NT0X91AE	NT2X09 and NT2X06	05	CB5

Note: The CBs are located on the FSP, shelf position 19.

4 Record the numbers of the shelves and CBs associated with the alarm and control card.

5 Record the numbers of each outside plant module (OPM), remote maintenance module (RMM) and emergency stand alone (ESA) module associated with the alarm and control card to be replaced.

At the MAP display

6 Access the PM level of the MAP display by typing

>MAPCI;MTC;PM

and pressing the Enter key.

7

CAUTION
Loss of service
This procedure contains directions to busy one or more peripheral modules (PM) in a frame. Since busying a PM affects subscriber service, replace alarm and control cards only during periods of low traffic.

Post the OPM that is controlled by the alarm and control card as recorded in step 5 by typing

>POST LCM site_name frame_no lcm_no

and pressing the Enter key.

where

site_name
is the name of the site where the LCM is located

NT0X91AE
in an OPM (continued)

rame_no
is the number of the frame where the LCM is located

lcm_no
is the number of the LCM unit associated with the faulty card

8 Busy LCM unit 0 by typing

>BSY UNIT 0

and pressing the Enter key.

9 Post the RMM that is controlled by the alarm and control card as recorded in step 5 by typing

>POST RMM rmm_no

and pressing the Enter key.

where

rmm_no
is the number of the RMM to be posted, as recorded in step 5

10 Busy the RMM by typing

>BSY

and pressing the Enter key.

11 Post the ESA processor that is controlled by the alarm and control card as recorded in step 5 by typing

>POST ESA esa_no

and pressing the Enter key.

where

esa_no
is the number of the ESA processor to be posted, as recorded in step 5

12 Busy the ESA processor by typing

>BSY

and pressing the Enter key.

13 Set CB1 as recorded in step 4 to ON.

At the OPM cabinet

14 Put on a wrist strap.

15 Set CB1 as recorded in step 4 to OFF.

16 Set CB5 as recorded in step 4 to OFF.

17 Unscrew the slotted nut located on the left-hand side of the FSP.

NT0X91AE
in an OPM (continued)

18

> **DANGER**
> **Risk of electrocution**
> Some of the terminals inside the frame supervisory panel (FSP) have an electrical potential of -48 V dc. Remove all jewelry before replacing a card in the FSP. Do not touch any terminals in the FSP.

Open the FSP panel.

19 Remove the NT0X91AE card from the slot identified in step 2.

20 Insert the replacement card.

21 Close the FSP panel.

22 Tighten the slotted nut on the FSP.

23 Proceed as follows to reset the converters in the host interface equipment shelf (HIE), and the RMM.

24 Power up the NT2X70 in slot 25 as follows:

If NT2X70 suffix is	Do
AE	step 25
AA, AB, AC, or AD	step 26

25 Toggle the ON/OFF/RESET switch on the power converter faceplate, identified in step 3, to the RESET position and hold while setting CB1, on the FSP, to the ON position. Both the converter FAIL LED and FRAME FAIL lamp on the FSP will go OFF, release the ON/OFF/RESET switch.

26 Press the RESET button on the power converter faceplate while setting CB1, identified in step 3, on the FSP to the ON position. The converter FAIL LED will go OFF, release the RESET button.

27 Set the power switch on the NT2X09 and NT2X06 power converters on the RMM shelf to the ON position.

28 Press the RESET button on the NT2X09 power converter while setting CB5, on the FSP to the ON position. Both the converter FAIL LED and FRAME FAIL lamp on the FSP will go off.

29 Remove the wrist strap.

30 Determine if a Converter Fail LED is lit.

If Converter Fail LED is	Do
lit	step 47
not lit	step 31

NT0X91AE
in an OPM (continued)

At the MAP display

31 Access the PM level of the MAP display by typing

>MAPCI;MTC;PM

and pressing the Enter key.

32 Post the LCM that is controlled by the alarm and control card you have just replaced by typing

>POST LCM site_name frame_no lcm_no

and pressing the Enter key.

where

site_name
is the name of the site where the LCM is locatedf

rame_no
is the number of the frame where the LCM is located

lcm_no
is the number of the LCM unit with the faulty card

33 Query the LCM for the name of the current PM load by typing

>QUERYPM

and pressing the Enter key.

34 Access the disk volume which contains the PM loads by typing

>DISKUT

and pressing the Enter key.

35 List the disk volume which contains the PM load files by typing

>LF volume_name ALL

and pressing the Enter key.

where

volume_name
is the name of the SLM disk volume containing the PM load files.

36 Quit the diskut environment by typing

>QUIT

and pressing the Enter key.

37 Load LCM unit 0 by typing

>LOADPM UNIT 0 CC

and pressing the Enter key.

38 Return LCM unit 0 to service by typing

>RTS UNIT 0

NT0X91AE
in an OPM (continued)

and pressing the Enter key.

If unit 0	Do
RTS passed	step 39
RTS failed	step 47

39 Post the RMM that is controlled by the alarm and control card you have just replaced by typing

>POST RMM rmm_no

and pressing the Enter key.

where

rmm_no
is the number of the RMM to be posted, as recorded in step 5

40 Load the RMM by typing

>LOADPM

and pressing the Enter key.

41 Return the RMM to service by typing

>RTS

and pressing the Enter key.

If the rmm	Do
RTS passed	step 42
RTS failed	step 47

42 Post the ESA processor that is controlled by the alarm and control card you have just replaced by typing

>POST ESA esa_no

and pressing the Enter key.

where

esa_no
is the number of the ESA processor to be posted, as recorded in step 5

43 Load the ESA processor by typing

>LOADPM

and pressing the Enter key.

44 Return the ESA to service by typing

>RTS

NT0X91AE in an OPM (end)

and pressing the Enter key.

If ESA processor	Do
RTS passed	step 45
RTS failed	step 47

45 The next action depends on your reason for performing this procedure

If you were	Do
directed to this procedure from a maintenance procedure	step 46
not directed to this procedure from a maintenance procedure	step 48

46 Return to the maintenance procedure that sent you to this procedure and continue as directed.

47 For further assistance, contact the personnel responsible for the next level of support.

48 You have completed this procedure.

NT2X06
in an OPM RMM

Application

Use this procedure to replace the following card in an RMM.

PEC	Suffixes	Name
NT2X06	AA, AB	Power Converter (5V/40A)

Common procedures

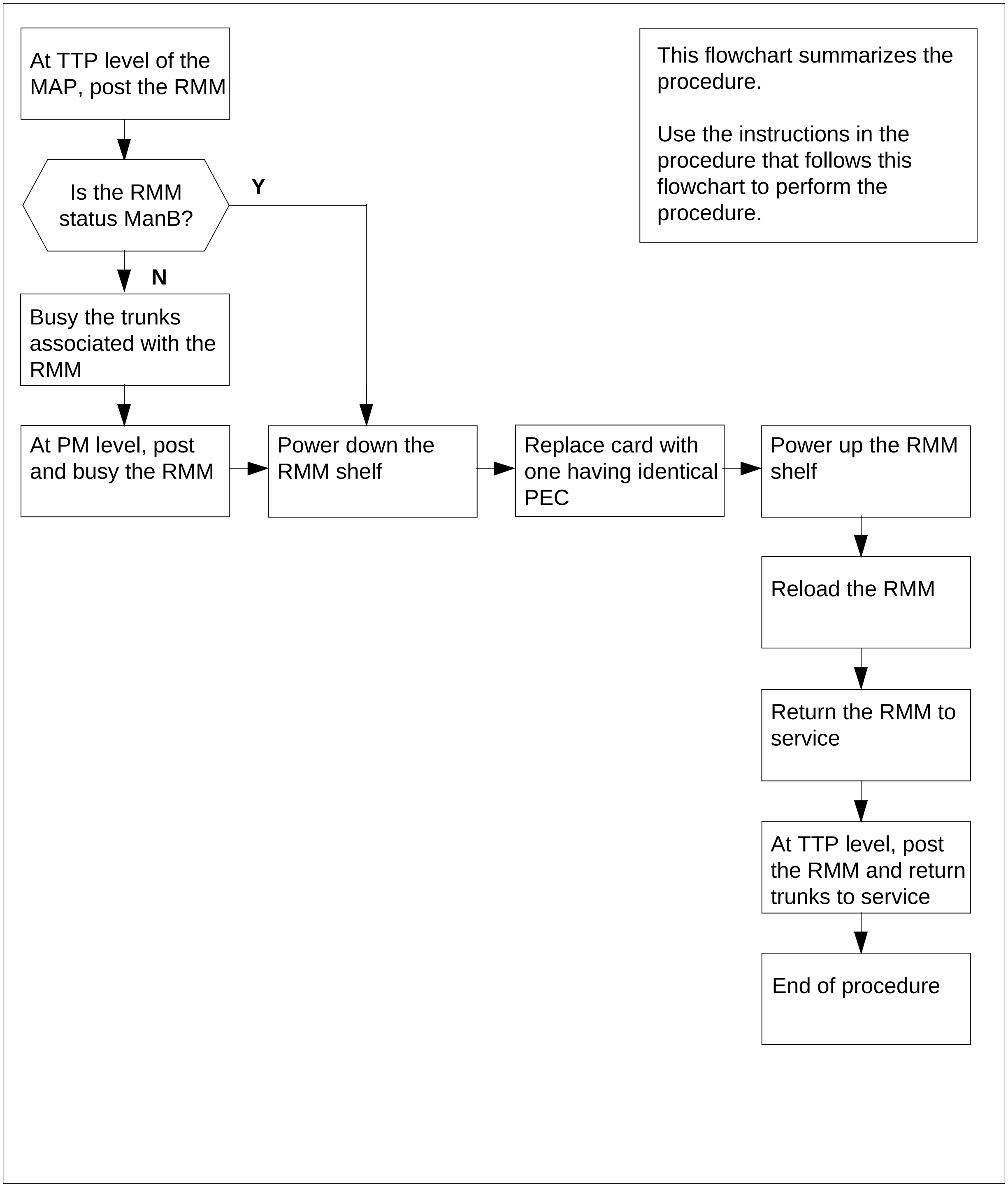
The replacing a card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT2X06
in an OPM RMM (continued)

Summary of card replacement procedure for an NT2X06 card in an RMM



NT2X06
in an OPM RMM (continued)

Replacing an NT2X06 card in an RMM

At your current location

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

2 If you were directed to this procedure from another maintenance procedure, go to step 8; otherwise, continue with step 3.

At the MAP display

3 Access the TTP level of the MAP and post the RMM that contains the card to be replaced by typing

>MAPCI;MTC;TRKS;TTP;POST P RMM rmm_no

and pressing the Enter key.

where

rmm_no
is the number of the RMM shelf in which the card is to be replaced

Example of a MAP response:

```
LAST CIRCUIT = 27
POST CKT IDLED
SHORT CLLI IS:  OTDA00
OK, CLLI POSTED

POST   20   DELQ       BUSY Q          DIG
TTP 6-006
CKT TYPE   PM NO.     COM LANG         STA S R DOT TE R
OG    MF RMM 0 0  OTWAON23DA00 2001   LO
                                      P_IDL
```

4 Check the status of the RMM.

If	Do
MB, PMB, RMB	step 8
other	step 5

5 Busy the trunks that are associated with the RMM to be busied by typing

>BSY ALL

and pressing the Enter key.

6 At the PM level of the MAP display, post the RMM by typing

>PM;POST RMM rmm_no

and pressing the Enter key.

where

NT2X06
in an OPM RMM (continued)

rmm_no
is the number of the RMM shelf in which the card is to be replaced

Example of a MAP display:

```
        SysB     ManB     Offl     CBsy     ISTb     InSv
PM         0        2        2        0        7       21
RMM        0        0        1        0        0        6

RMM     0    InSv
```

7 Busy the RMM by typing

>BSY

and pressing the Enter key.

At the RMM shelf

8

DANGER
Static electricity damage
Wear a wrist strap connected to the wrist strap grounding point of a frame supervisory panel (FSP) while handling circuit cards. This protects the cards against damage caused by static electricity.

Power down the unit by setting the ON/OFF switch on the power converter faceplate to the OFF position. Both the converter FAIL LED and FRAME FAIL lamp on the frame supervisory panel (FSP) will be ON. An audible alarm may sound. If an alarm does sound, silence it by typing

>sil

and pressing the Enter key.

9 Replace the NT2X06 card using the common replacing a card procedure in this document. When you have completed the procedure, return to this point.

10 Power up the RMM unit as follows:

a Ensure that the converter (NT2X06) is inserted. A major audible alarm may sound. This alarm is silenced when power is restored to the converter.

b Set the POWER switch to the ON position.

11 Press the RESET button on the power converter while setting the circuit breaker on the frame supervisory panel (FSP) to the ON position. Both the converter FAIL LED and FRAME FAIL lamp on the FSP will be ON.

12 If you were directed to this procedure from another maintenance procedure, return now to the procedure that directed you here and continue as directed; otherwise, continue with step 13.

NT2X06
in an OPM RMM (continued)

At the MAP display

13 Go to the PM level and post the RMM, if not already posted, and load the RMM by typing

>PM;POST RMM rmm_no;LOADPM

and pressing the Enter key.

where

rmm_no
is the number of the RMM shelf in which the card is to be replaced

If	Do
message `loadfile not found in directory` is received	step 14
load passes	step 31
load fails	step 36

14 Determine the type of device on which the PM load files are located.

If load files are located on	Do
tape	step 15
IOC disk	step 21
SLM disk	step 26

15 Locate the tape that contains the PM load files.

At the IOE frame

16 Mount the tape on a magnetic tape drive.

At the MAP display

17 Download the tape by typing

>MOUNT tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

18 List the contents of the tape in your user directory by typing

>LIST T tape_no

and pressing the Enter key.

wherewhere

NT2X06
in an OPM RMM (continued)

tape_no
is the number of the tape drive containing the PM load files

19 Demount the tape drive by typing

>DEMOUNT T tape_no

and pressing the Enter key.

wherewhere

tape_no
is the number of the tape drive containing the PM load files

20 Go to step 30.

21 From office records, determine and note the number of the input/output controller (IOC) disk and the name of the volume that contains the PM load files.

22 Access the disk utility level of the MAP by typing

>DSKUT

and pressing the Enter key.

23 List the IOC file names into your user directory by typing

>LISTVOL volume_name ALL

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files obtained in step 21.

24 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

25 Go to step 30.

26 From office records, determine and note the number of the system load module (SLM) disk and the name of the volume that contains the PM load files.

27 Access the disk utility level of the MAP by typing

>DISKUT

and pressing the Enter key.

28 List the SLM file names into your user directory by typing

>LV CM;LF Volume_name

and pressing the Enter key.

where

Volume_name
is the name of the volume containing the PM load files, obtained in step 26.

NT2X06
in an OPM RMM (continued)

29 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

30 Reload the RMM by typing

>LOADPM

and pressing the Enter key.

If	Do
load failed	step 36
load passed	step 31

31 Return the RMM to service by typing

>RTS

and pressing the Enter key.

If RTS	Do
passed	step 32
failed	step 36

32 Go to the TTP level of the MAP and post the RMM by typing

>TRKS;TTP;POST P RMM rmm_no

and pressing the Enter key.

where

rmm_no
is the number of the RMM shelf in which the card is to be replaced

33 Return to service the circuits busied in step 7 by typing

>RTS ALL

and pressing the Enter key.

If	Do
passed	step 34
failed	step 36

34 Send any faulty cards for repair according to local procedure.

35 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

NT2X06
in an OPM RMM (end)

Go to step 37.

36 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

37 You have completed this procedure.

NT2X09
in an OPM RMM

Application

Use this procedure to replace the following card in an RMM.

PEC	Suffixes	Name
NT2X09	AA, AB	Multioutput Power Converter (5V/40A)

Common procedures

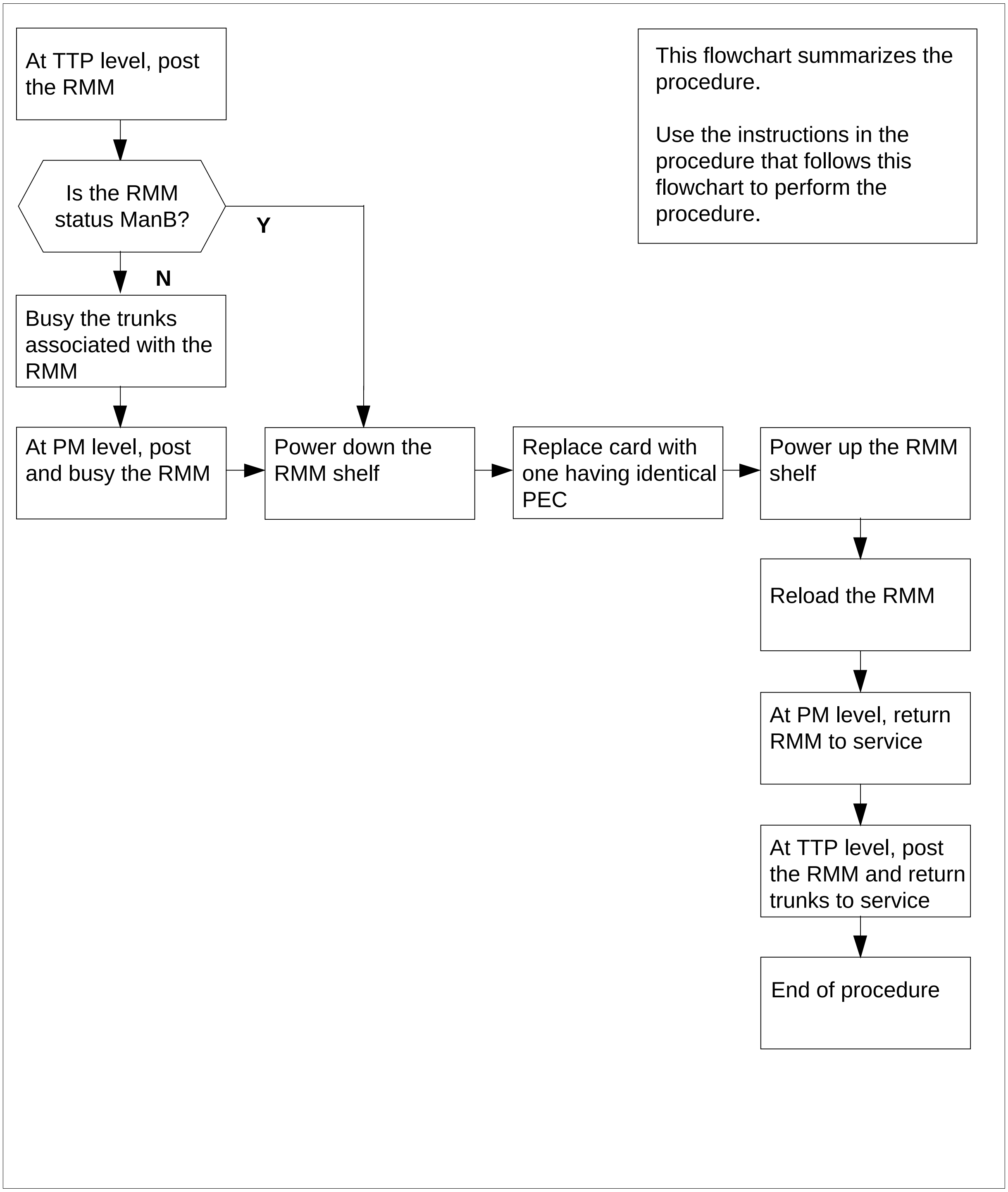
The replacing a card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT2X09
in an OPM RMM (continued)

Summary of card replacement procedure for an NT2X09 card in an RMM



NT2X09
in an OPM RMM (continued)

Replacing an NT2X09 card in an RMM

At your current location

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

2 If you were directed to this procedure from another maintenance procedure, go to step 8; otherwise, continue with step 3.

At the MAP display

3 Access the TTP level of the MAP and post the RMM that contains the card to be replaced by typing

>MAPCI;MTC;TRKS;TTP;POST P RMM rmm_no

and pressing the Enter key.

where

rmm_no
is the number of the RMM shelf in which the card is to be replaced

Example of a MAP response:

```
LAST CIRCUIT = 27
POST CKT IDLED
SHORT CLLI IS:  OTDA00
OK, CLLI POSTED

POST   20   DELQ       BUSY Q          DIG
TTP 6-006
CKT TYPE   PM NO.     COM LANG        STA S R DOT TE R
OG    MF RMM 0 0  OTWAON23DA00 2001   LO
                                      P_IDL
```

4 Check the status of the RMM.

If RMM status is	Do
MB, PMB, RMB	step 8
other	step 5

5 Busy the trunks that are associated with the RMM to be busied by typing

>BSY ALL

and pressing the Enter key.

6 Go to the PM level of the MAP and post the RMM by typing

>PM;POST RMM rmm_no

and pressing the Enter key.

where

NT2X09
in an OPM RMM (continued)

rmm_no
is the number of the RMM shelf in which the card is to be replaced

Example of a MAP display:

```
        SysB     ManB     Offl     CBsy     ISTb     InSv
PM         0        2        2        0        7       21
RMM        0        0        1        0        0        6

RMM     0    InSv
```

7 Busy the RMM by typing

>BSY

and pressing the Enter key.

At the RMM shelf

8

> **DANGER**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist strap grounding point of a frame supervisory panel (FSP) while handling circuit cards. This protects the cards against damage caused by static electricity.

Power down the unit by setting the ON/OFF switch on the power converter faceplate to the OFF position. Both the converter FAIL LED and FRAME FAIL lamp on the frame supervisory panel (FSP) will be ON. An audible alarm may sound. If an alarm does sound, silence it at the MAP terminal by typing

>sil

and pressing the Enter key.

9 Replace the NT2X09 card using the common replacing a card procedure in this document. When you have completed the procedure, return to this point.

10 Power up the RMM unit as follows:

a Ensure that the converter (NT2X09) is inserted. A major audible alarm may sound. This alarm is silenced when power is restored to the converter.

b Set the POWER switch to the ON position.

11 Press the RESET button on the power converter while setting the circuit breaker on the frame supervisory panel (FSP) to the ON position. Both the converter FAIL LED and FRAME FAIL lamp on the FSP will be ON.

12 If you were directed to this procedure from another maintenance procedure, return now to the procedure that directed you here and continue as directed; otherwise, continue with step 13.

NT2X09
in an OPM RMM (continued)

At the MAP display

13 Go to the PM level and post the RMM, if not already posted, and load the RMM by typing

>PM;POST RMM rmm_no;LOADPM

and pressing the Enter key.

where

rmm_no
is the number of the RMM associated with the new NT2X09 card

If	Do
message "loadfile not found in directory" is received	step 14
load passes	step 31
load fails	step 36

14 Determine the type of device on which the RMM load files are located.

If	Do
tape	step 15
IOC disk	step 21
SLM disk	step 26

15 Locate the tape that contains the PM load files.

At the IOE frame

16 Mount the tape on a magnetic tape drive.

At the MAP display

17 Download the tape by typing

>MOUNT tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

18 List the contents of the tape in your user directory by typing

>LIST T tape_no

and pressing the Enter key.

where

NT2X09
in an OPM RMM (continued)

tape_no
is the number of the tape drive containing the PM load files

19 Demount the tape drive by typing

>DEMOUNT T tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

20 Go to step 30.

21 From office records, determine and note the number of the input/output controller (IOC) disk and the number of the volume that contains the PM load files.

22 Access the disk utility level of the MAP by typing

>DSKUT

and pressing the Enter key.

23 List the IOC file names into your user directory by typing

>LISTVOL volume_name all

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step 21.

24 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

25 Go to step 30.

26 From office records, determine and note the number of the system load module (SLM) disk and the number of the volume that contains the PM load files.

27 Access the disk utility level of the MAP by typing

>DISKUT

and pressing the Enter key.

28 List the SLM file names into your user directory by typing

>LV CM;LF Volume_name

and pressing the Enter key.

where

Volume_name
is the name of the volume containing the PM load files, obtained in step 26.

NT2X09
in an OPM RMM (continued)

29 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

30 Reload the RMM by typing

>LOADPM

and pressing the Enter key.

If	Do
load failed	step 36
load passed	step 31

31 Return the RMM to service by typing

>RTS

and pressing the Enter key.

If RTS	Do
passed	step 32
failed	step 36

32 Go to the TTP level of the MAP and post the RMM by typing

>TRKS;TTP;POST P RMM rmm_no

and pressing the Enter key.

33 Return to service the circuits by typing

>RTS ALL

and pressing the Enter key.

where

rmm_no
is the number of the RMM shelf in which the card is to be replaced

If RTS	Do
passed	step 34
failed	step 36

34 Send any faulty cards for repair according to local procedure.

35 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

NT2X09
in an OPM RMM (end)

Go to step 37.

36 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

37 You have completed this procedure.

NT2X10
in an OPM RMM

Application

Use this procedure to replace the following card in an RMM.

PEC	Suffixes	Name
NT2X10	AA, AC, BA	Line Test Unit Analog Card (LTUA)

Common procedures

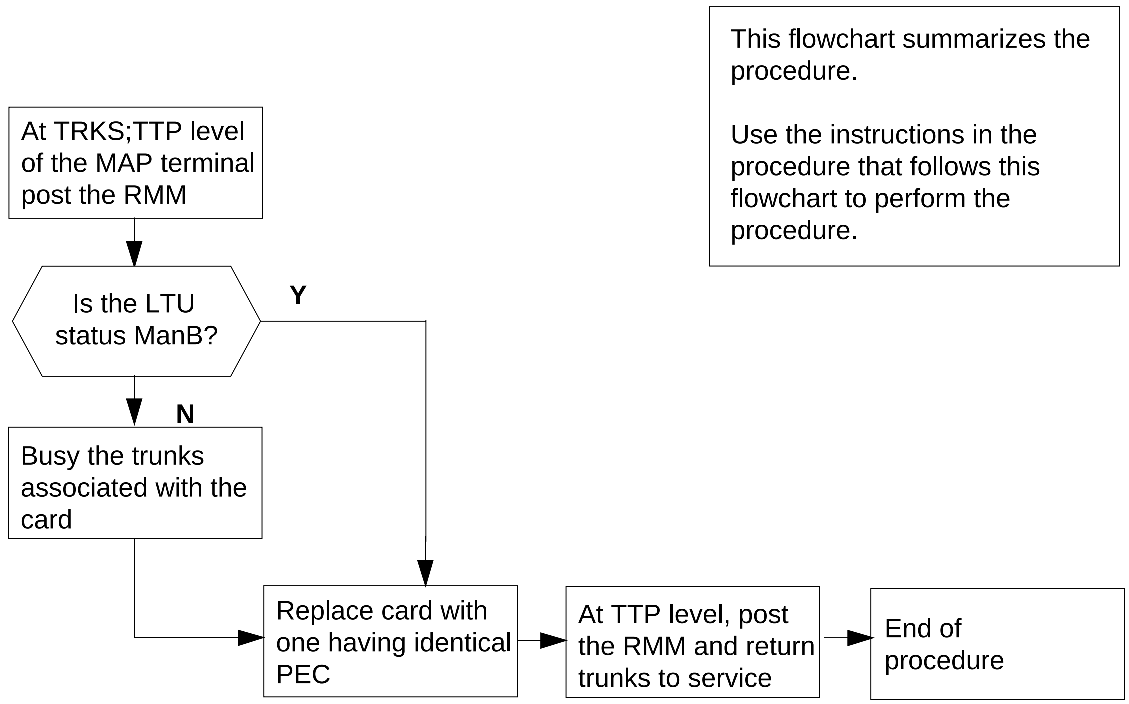
The replacing a card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT2X10
in an OPM RMM (continued)

Summary of card replacement procedure for an NT2X10 card in an RMM



NT2X10
in an OPM RMM (continued)

Replacing an NT2X10 card in an RMM

At your current location

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

At the MAP display

2 Access the TTP level of the MAP and post the Line Test Unit to be replaced by typing

>MAPCI;MTC;TRKS;TTP;POST T LTU ltu_no

and pressing the Enter key.

where

ltu_no
is the number of the faulty LTU

Example of a MAP response:

```
LAST CIRCUIT = 27
POST CKT IDLED
SHORT CLLI IS:  LTU
OK, CLLI POSTED

POST       DELQ       BUSY Q          DIG
TTP 6–006
CKT TYPE   PM NO.     COM LANG        STA S R DOT TE R
OG         RMM 0 0     LTU   21       IDL
```

3 Busy the trunks that are associated with the card to be replaced by typing

>BSY

and pressing the Enter key.

NT2X10
in an OPM RMM (end)

At the RMM shelf

4

> **WARNING**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist strap grounding point of a frame supervisory panel (FSP) while handling circuit cards. This protects the cards against damage caused by static electricity.

Replace the NT2X10 card using the common replacing a card procedure in this document. When you have completed the procedure, return to this point.

At the MAP display

5 Test the new NT2X10 card by typing

>TST

and pressing the Enter key.

If TST	Do
passed	step 6
failed	step 9

6 Return to service the circuits busied in step 3 by typing

>RTS

and pressing the Enter key.

If RTS	Do
passed	step 7
failed	step 9

7 Send any faulty cards for repair according to local procedure.

8 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 10.

9 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

10 You have completed this procedure.

NT2X11
in an OPM RMM

Application

Use this procedure to replace the following card in an RMM.

PEC	Suffixes	Name
NT2X11	AA, AB, AC, AD, BA	Line Test Unit Digital Card (LTUD)

Common procedures

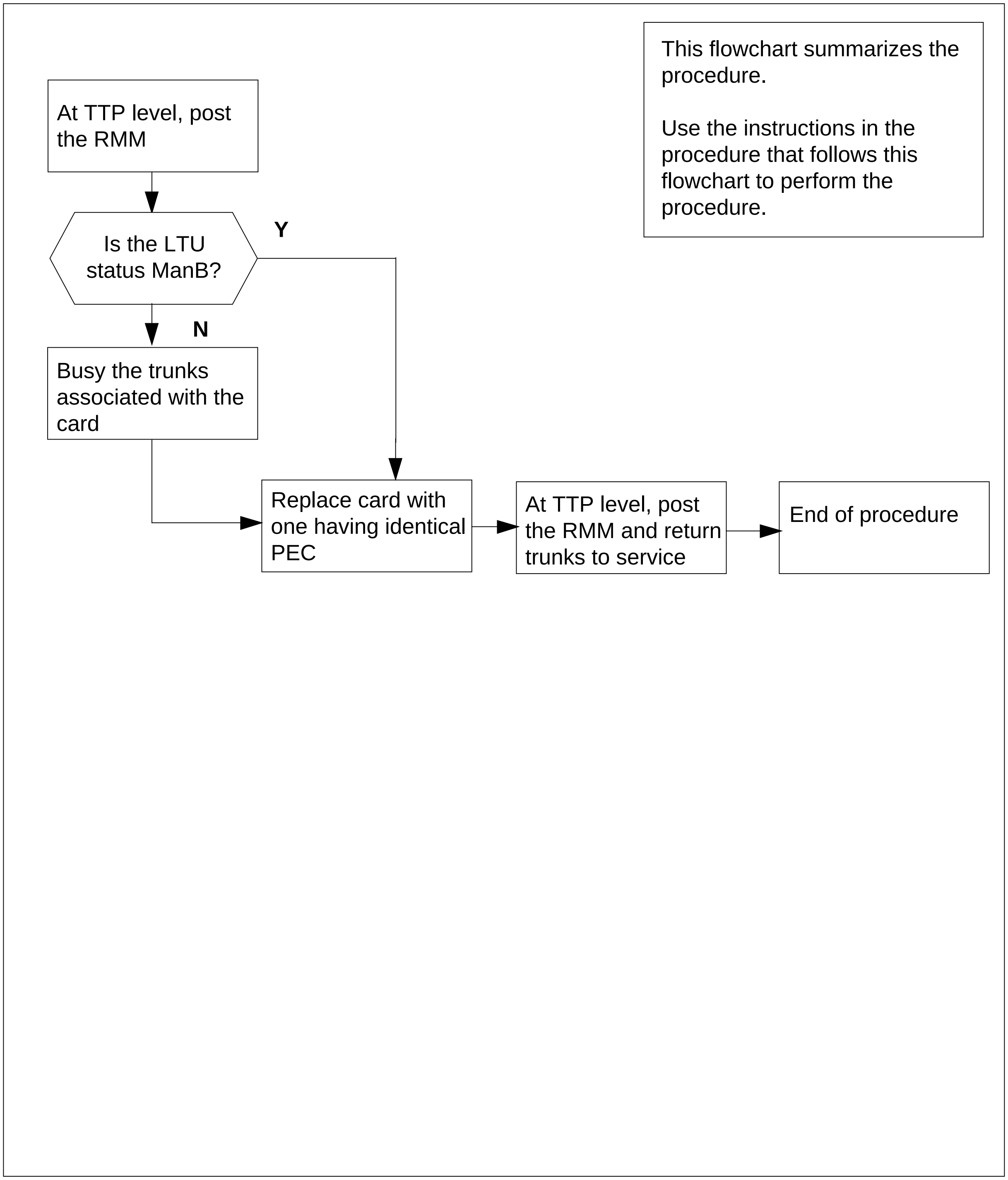
The replacing a card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT2X11
in an OPM RMM (continued)

Summary of card replacement procedure for an NT2X11 card in an RMM



NT2X11
in an OPM RMM (continued)

Replacing an NT2X11 card in an RMM

At your current location

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

At the MAP display

2 Access the TTP level of the MAP and post the line test unit to be replaced by typing

>MAPCI;MTC;TRKS;TTP;POST T LTU ltu_no

and pressing the Enter key.

where

ltu_no
is the number of the line test unit which is to be replaced

Example of a MAP response:

```
LAST CIRCUIT = 27
POST CKT IDLED
SHORT CLLI IS:  LTU
OK, CLLI POSTED

POST       DELQ       BUSY Q         DIG
TTP 6–006
CKT TYPE   PM NO.     COM LANG       STA S R DOT TE R
OG         RMM 0 0     LTU  21       LO
                                     P_IDL
```

3

DANGER
Briefly state reasons for the warning
Enter the reasons for the warning: a warning informs the reader of a risk of service interruption, or damage to equipment, or both.

Busy the trunks that are associated with the card to be replaced by typing

>BSY

and pressing the Enter key.

NT2X11
in an OPM RMM (end)

At the RMM shelf

4 Replace the NT2X11 card using the common replacing a card procedure in this document. When you have completed the procedure, return to this point.

At the MAP display

5 Test the new NT2X11 card by typing

>TST

and pressing the Enter key.

If TST	Do
passed	step 6
failed	step 9

6 Return to service the circuits busied in step 3 by typing

>RTS

and pressing the Enter key.

If RTS	Do
passed	step 7
failed	step 9

7 Send any faulty cards for repair according to local procedure.

8 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to Step 10

9 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

10 You have completed this procedure.

NT2X48
in an OPM RMM

Application

Use this procedure to replace the following card in an RMM.

PEC	Suffixes	Name
NT2X48	AB	Digital 4-channel Digitone Receiver

Common procedures

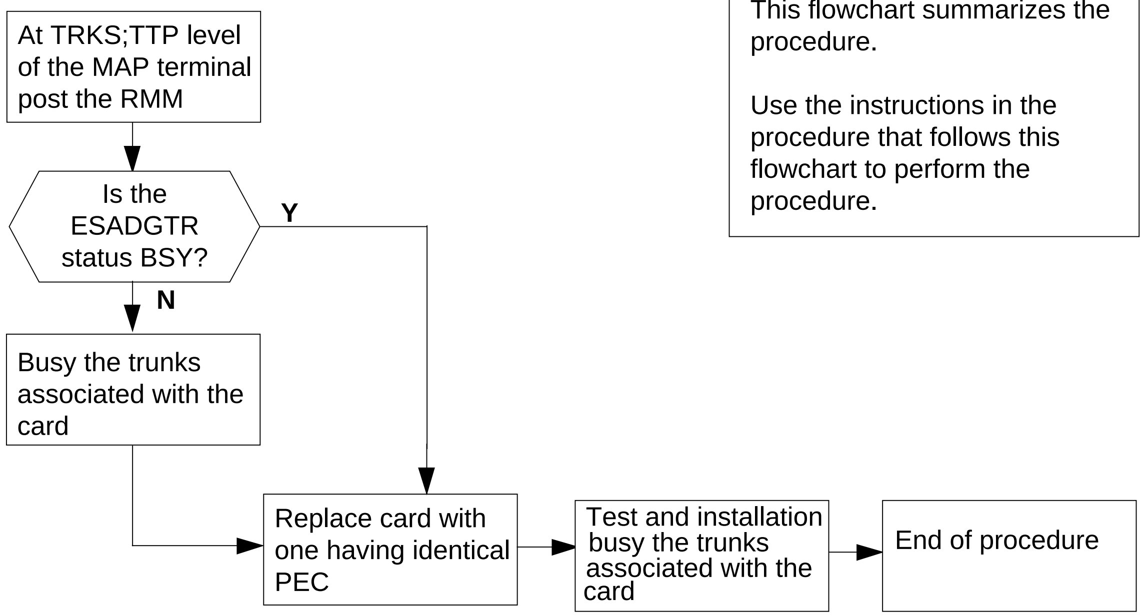
The replacing a card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT2X48
in an OPM RMM (continued)

Summary of card replacement procedure for an NT2X48 card in an RMM



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

NT2X48
in an OPM RMM (continued)

Replacing an NT2X48 card in an RMM

At the MAP display

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

2 Access the TTP level of the MAP and post the ESA digitone receivers associated with the card to be replaced by typing

>MAPCI;MTC;TRKS;TTP;POST P RMM rmm_no ckt_no

and pressing the Enter key.

where

rmm_no
is the number of the RMM shelf in which the card is to be replaced

ckt_no
is the number of the first circuit where the NT2X48 card is physically located.

Example of a MAP response:

```
LAST CIRCUIT = 27
POST CKT IDLED
SHORT CLLI IS:  1125
OK, CLLI POSTED

POST  3   DELQ       BUSY Q          DIG
TTP 6–006
CKT TYPE   PM NO.     COM LANG        STA S R DOT TE R
OG     RMM   0 0      ESAGDTR 11       INB
```

3 Busy the trunks that are associated with the card to be replaced by typing

>BSY;NEXT

and pressing the Enter key.

Note: Repeat this step for each circuit associated with the NT2X48 being replaced.

NT2X48
in an OPM RMM (continued)

At the RMM shelf

4

> **WARNING**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist strap grounding point of a frame supervisory panel (FSP) while handling circuit cards. This protects the cards against damage caused by static electricity.

Replace the NT2X48 card using the common replacing a card procedure in this document. When you have completed the procedure, return to this point.

At the MAP display

5 Test all of the digitone receivers on the new NT2X48 card by typing

>TST

6 Continue testing through all four digitone circuits on the card by typing

>NEXT

If TST	Do
passed	step 8
failed	step 11

7 Repost all four ESADGTR circuits by typing

>POST P RMM rmm_no ckt_no to ckt_no

and pressing the Enter key.

where

ckt_no
is the number of the first and last circuits on the NT2X48 card.

Example of a MAP response:

```
LAST CIRCUIT = 27
POST CKT IDLED
SHORT CLLI IS:  1125
OK, CLLI POSTED

POST  3   DELQ       BUSY Q          DIG
TTP 6-006
CKT TYPE   PM NO.     COM LANG        STA S R DOT TE R
OG     RMM   0 0      ESAGDTR 11       IDL
```

NT2X48
in an OPM RMM (end)

8 Installation busy the trunks that are associated with the new NT2X48 card by typing

>BSY INB ALL

and pressing the Enter key.

> ***Note:*** ESA digitone receivers should always be in an INB state when the RLCM is under CC control, to prevent CC access. The ESA processor will turn the circuits up to an idle state when the RLCM is in the ESA environment.

9 Send any faulty cards for repair according to local procedure.

10 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 12.

11 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

12 You have completed this procedure.

NT2X57 in an OPM RMM

Application

Use this procedure to replace the following card in an RMM.

PEC	Suffixes	Name
NT2X57	AA	Signal Distribution Card (SD)

Common procedures

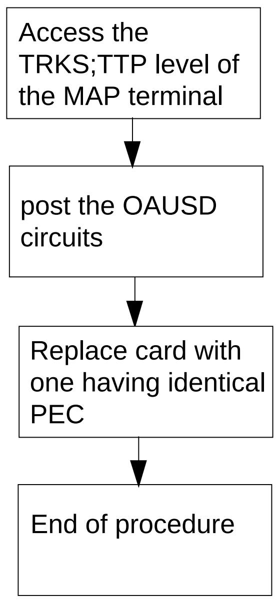
The common replacing a card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT2X57
in an OPM RMM (continued)

Summary of card replacement procedure for an NT2X57 card in an RMM



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

NT2X57
in an OPM RMM (continued)

Replacing an NT2X57 card in an RMM

At the MAP display

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

2 Access the TTP level of the MAP and post the signal distribution circuits on the card to be replaced by typing

>MAPCI;MTC;TRKS;TTP;POST P RMM rmm_no ckt_no

and pressing the Enter key.

where

rmm_no
is the number of the RMM shelf where the card is to be replaced

ckt_no
is the number of the first circuit where the NT2X57 card is physically located.

Example of a MAP response:

```
LAST CIRCUIT = 14
POST CKT IDLED
SHORT CLLI IS:  1147
OK, CLLI POSTED

POST  13   DELQ       BUSY Q          DIG
TTP 6-006
CKT TYPE   PM NO.     COM LANG        STA S R DOT TE R
OG TESTEQ RMM 0 0     OAUSD 0         IDL
```

At the RMM shelf

3

> **WARNING**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist strap grounding point of a frame supervisory panel (FSP) while handling circuit cards. This protects the cards against damage caused by static electricity.

Replace the NT2X57 card using the common replacing a card procedure in this document. When you have completed the procedure, return to this point.

NT2X57
in an OPM RMM (end)

At the MAP display

4 Repost to verify the signal distribution circuits on the card that was replaced by typing

>POST P RMM rmm_no ckt_no

and pressing the Enter key.

where

rmm_no
is the number of the RMM shelf where the card was replaced

ckt_no
is the number of the first circuit where the NT2X57 card is physically located.

Example of a MAP response:

```
LAST CIRCUIT = 14
POST CKT IDLED
SHORT CLLI IS:  1147
OK, CLLI POSTED

POST  13   DELQ       BUSY Q         DIG
TTP 6-006
CKT TYPE   PM NO.     COM LANG       STA S R DOT TE R
OG TESTEQ RMM 0 0     OAUSD 0        IDL
```

5 Send any faulty cards for repair according to local procedure.

6 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 8.

7 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

8 You have completed this procedure.

NT2X59
in an OPM RMM

Application

Use this procedure to replace the following card in an RMM.

PEC	Suffixes	Name
NT2X59	AA	Group CODEC Card

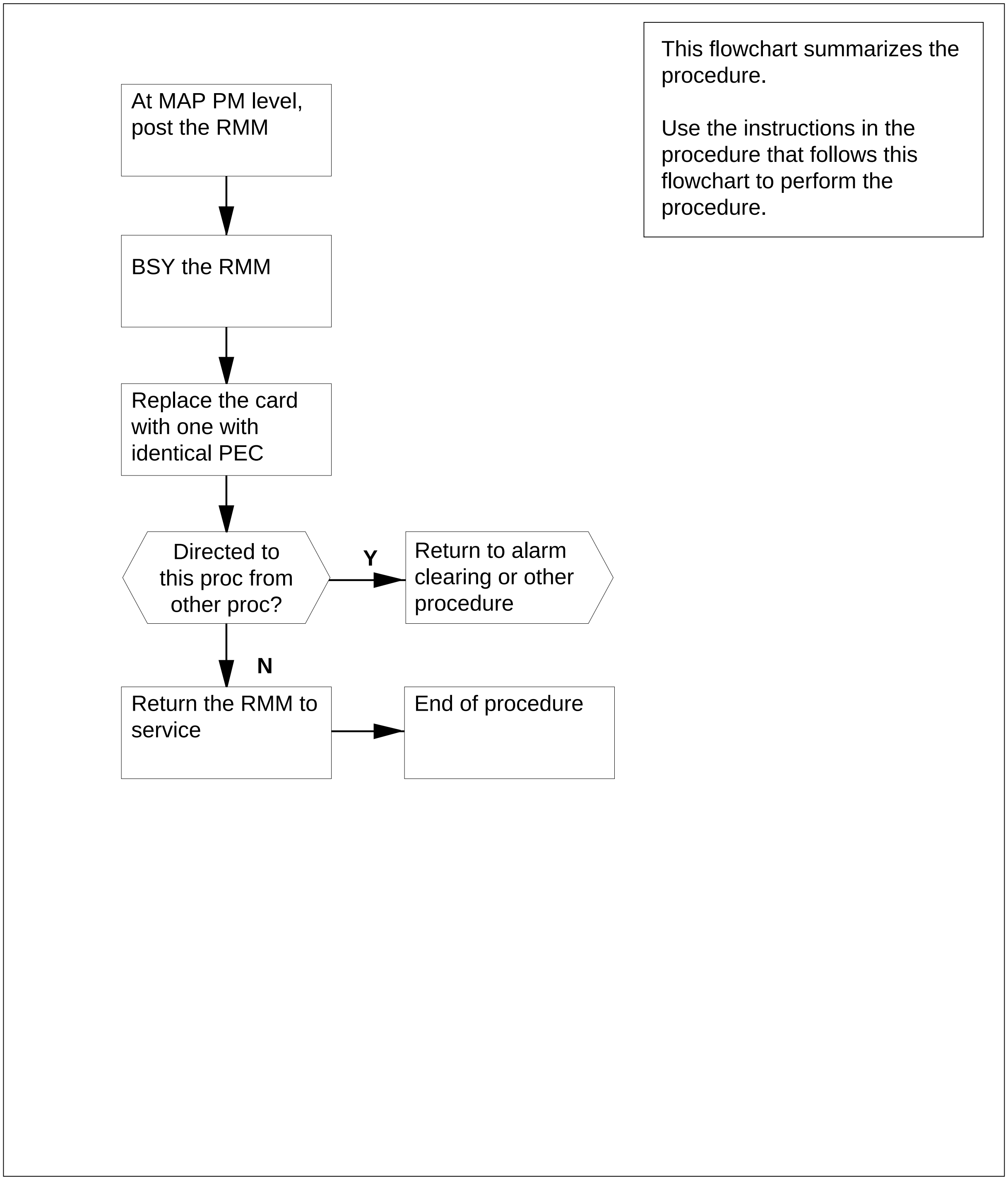
Common procedures

None

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT2X59
in an OPM RMM (continued)



NT2X59
in an OPM RMM (continued)

Replacing an NT2X59 card in an RMM

At your current location

1 Proceed only if you were either directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure to verify or accept cards, or were directed to this procedure by your maintenance support group.

2 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC) including suffix, as the card to be removed.

At the MAP display

3 Access the PM level and post the RMM by typing

>MAPCI;MTC;PM;POST RMM rmm_no

and pressing the Enter key.

where

rmm_no
is the number of the RMM where the card is to be replaced

Example of a MAP display:

```
   CM     MS     IOD     Net     PM     CCS     LNS     Trks     Ext     APPL
   .      .       .       .     4SysB    .       .        .       .       .

RMM                  SysB      ManB      OffL      CBsy      ISTb       InSv
 0 Quit    PM         4         0        10         3         3        130
 2 Post_   RMM        1         0         0         0         0         15
 3
 4         RMM  5  SysB
 5 Trnsl
 6 Tst
 7 Bsy
 8 RTS
 9 OffL
10 LoadPM
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

4 Busy the RMM by typing

>BSY

and pressing the Enter key.

NT2X59
in an OPM RMM (continued)

Example of a MAP display:

```
  CM    MS     IOD     Net     PM     CCS     LNS     Trks     Ext     APPL
  .     .       .       .     3SysB    .       .       .        .       .

RMM                 SysB      ManB      OffL      CBsy      ISTb      InSv
 0 Quit    PM          3         0        10         3         3       130
 2 Post_   RMM         0         1         0         0         0        15
 3
 4         RMM  5  ManB
 5 Trnsl
 6 Tst
 7 Bsy
 8 RTS
 9 OffL
10 LoadPM
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

At the RMM shelf

5

CAUTION
Static discharge may cause damage to circuit packs
Put on a wrist strap and connect it to the frame of the RMM before removing or inserting any cards. This protects the RMM against service degradation caused by static electricity.

Put on a wrist strap.

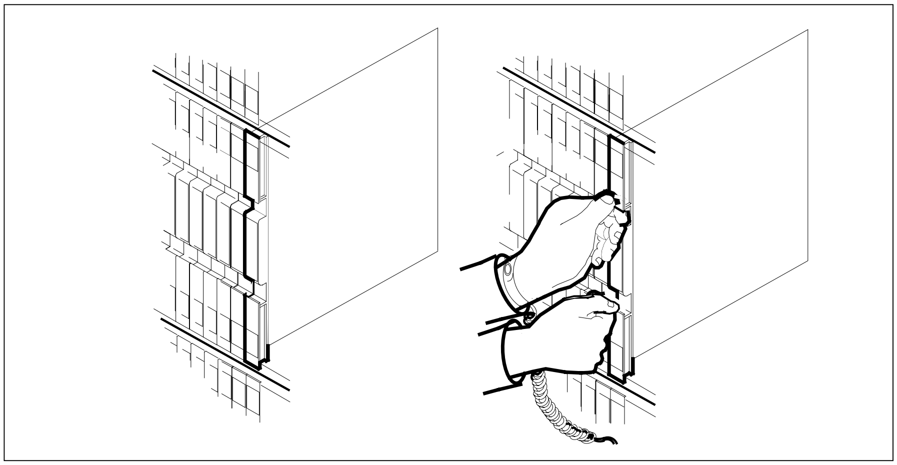
6

DANGER
Equipment damage
Take these precautions when removing or inserting a card
1. Do not apply direct pressure to the components.
2. Do not force the cards into the slots.

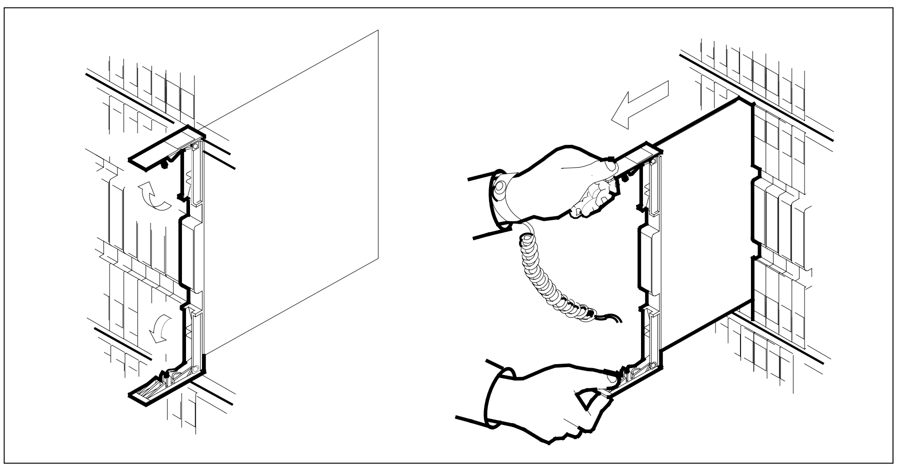
Remove the NT2X59 card as shown in the following figures.

NT2X59 in an OPM RMM (continued)

a Locate the card to be removed on the appropriate shelf.



b Open the locking levers on the card to be replaced and gently pull the card towards you until it clears the shelf.

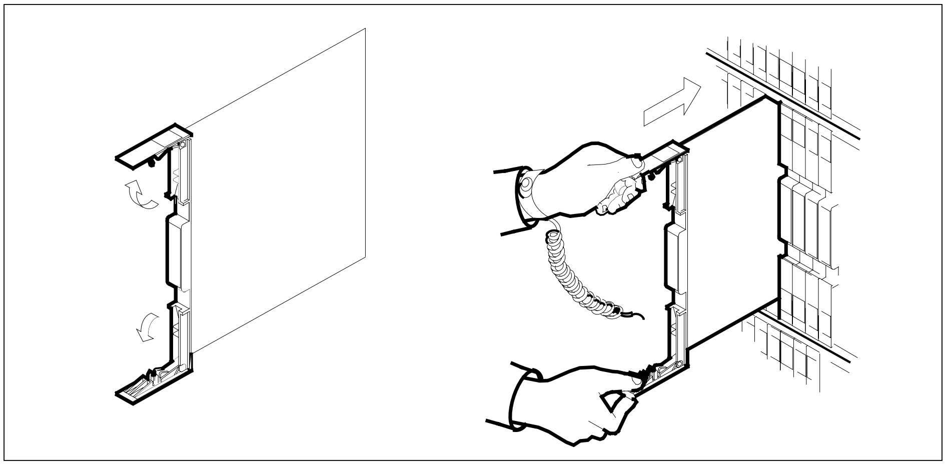


c Ensure that the replacement card has the same PEC including suffix, as the card you just removed.

7 Open the locking levers on the replacement card.

Align the card with the slots in the shelf and gently slide the card into the shelf.

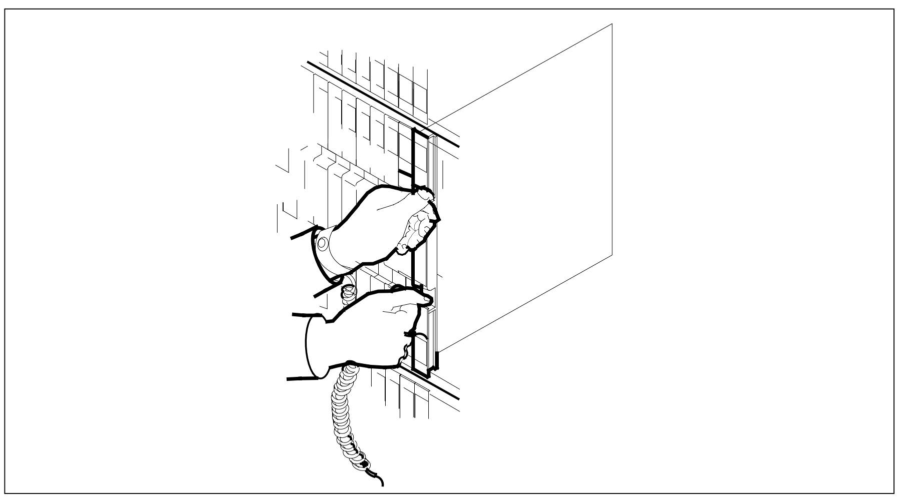
NT2X59
in an OPM RMM (continued)



8 Seat and lock the card.

a Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure that the card is fully seated in the shelf.

b Close the locking levers.



9 Use the following information to determine the next step in this procedure.

If you entered this procedure	Do
from an alarm clearing procedure	step 16
from other	step 10

NT2X59 in an OPM RMM (end)

At the MAP display

10 Load the RMM by typing

>LOADPM

and pressing the Enter key.

11 Test the RMM by typing

>TST

and pressing the Enter key.

Example of a MAP response:

```
Test Passed
    or
Test Failed
```

If TST	Do
passed	step 12
failed	step 16

12 Return the RMM to service by typing

>RTS

and pressing the Enter key.

If RTS	Do
passed	step 13
failed	step 17

13 Send any faulty cards for repair according to local procedure.

14 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

15 Go to step 18.

16 Return to the *Alarm Clearing Procedure* that directed you to this card replacement procedure. If necessary, go to the point where the faulty card list was produced, identify the next faulty card on the list, and go to the appropriate replacement procedure in this manual for that card.

17 Obtain further assistance in replacing this card by contacting personnel responsible for higher level of support.

18 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

NT2X70
in an OPM HIE

Application

Use this procedure to replace the following card in the host interface equipment (HIE) shelf.

PEC	Suffixes	Name
NT2X70	AA, AB, AC, AD, AE, AF	Power Converter (5V/12V)

Common procedures

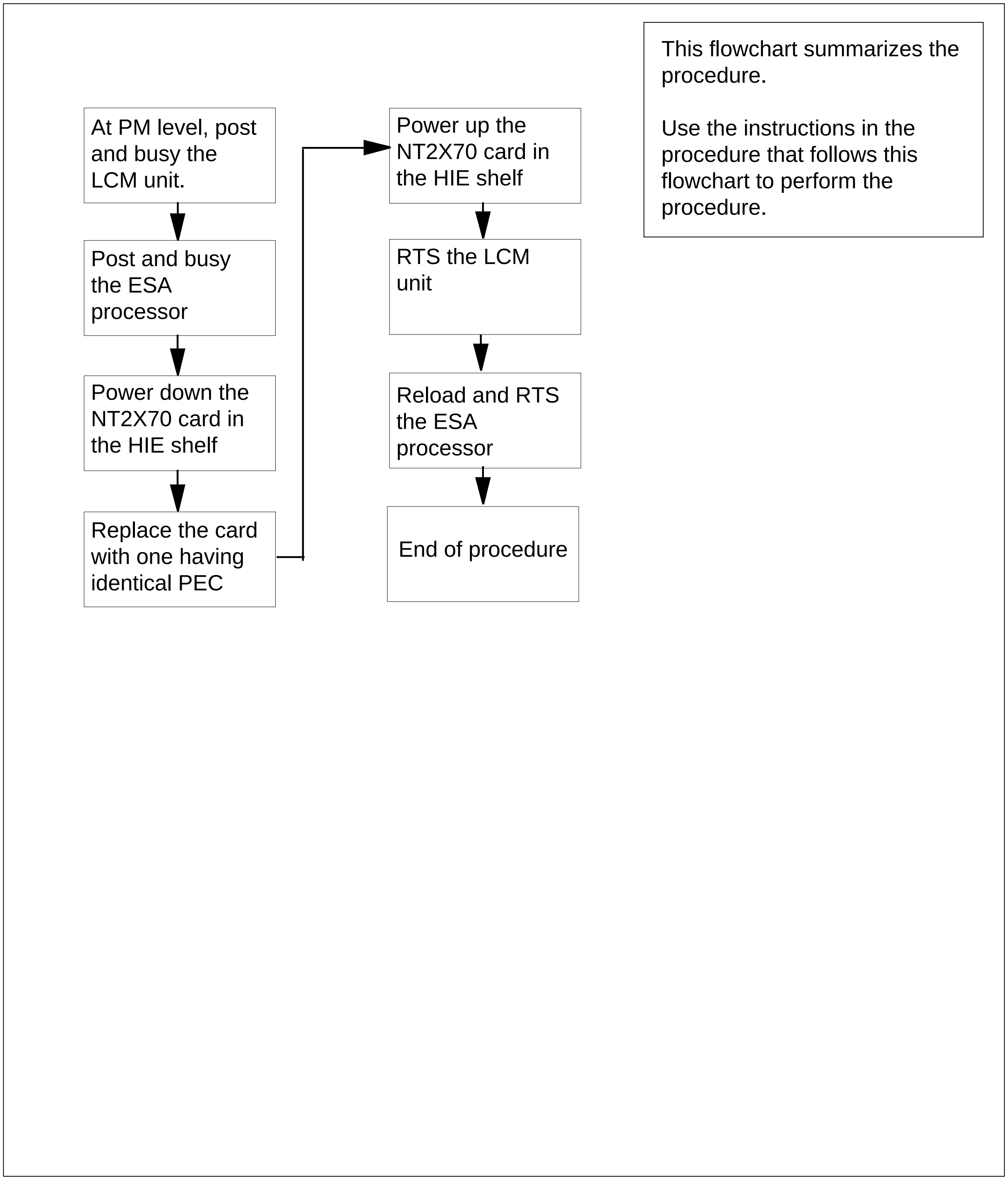
The common replacing a card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT2X70 in an OPM HIE (continued)

Summary of card replacement procedure for an NT2X70 card in an HIE shelf



Replacing an NT2X70 card in an HIE shelf

At your current location

1 Proceed only if you were either directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure to verify or accept cards, or were directed to this procedure by your maintenance support group.

2 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC) including suffix, as the card to be removed.

At the MAP display

3 Access the PM level of the MAP display and post the outside plant module (OPM) associated with the faulty NT2X70 card by typing

>MAPCI;MTC;PM;POST LCM site_name frame_no lcm_no

and pressing the Enter key.

where

site_name
is the name of the site, where the OPM is located

frame_no
is the number of the frame where the LCM is located

lcm_no
is the number of the LCM module in the frame

If the NT2X70 card is in	Do
slot 25	step 4
slot 22	step 36

4 Display the P-side links of the OPM by typing

>TRNSL P

and pressing the Enter key.

Example of a MAP display:

```
Link    0:  RMM 0   0;  Cap MS;Status:    OK;  MsgCond:OPN
Link    1:  RMM 0   1;  Cap MS;Status:    OK;  MsgCond:OPN
Link    2:  ESA 0   0   Cap M ;Status:    OK;  MsgCond:OPN
Link    3   ESA 0   1   Cap M ;Status:    OK;  MsgCond:OPN
```

Note: In this example both the RMM and ESA modules are provisioned. However, should either of these modules not be provisioned in your office, skip the steps relating to that module and continue with the rest of the procedure.

NT2X70
in an OPM HIE (continued)

5

> **CAUTION**
> **Loss of service**
> This procedure contains directions to busy one or more peripheral modules (PM) in a frame. Since busying a PM affects subscriber service, replace power converters only during periods of low traffic.

Busy unit 0 of the OPM by typing

>BSY UNIT 0

and pressing the Enter key.

6 Post the ESA processor identified in step 4 by typing

>POST ESA esa_no

and pressing the Enter key.

where

esa_no
is the number of the ESA processor associated with the faulty NT2X70 card.

Busy the ESA processor by typing

>BSY

and pressing the Enter key.

Example of a MAP response:

```
This action will take this PM out of service
Please confirm (“Yes” or “No”)
```

Respond to the system prompt by typing

>YES

NT2X70
in an OPM HIE (continued)

At the HIE shelf

7

> **WARNING**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist strap grounding point of a frame supervisory panel (FSP) while handling circuit cards. This protects the cards against damage caused by static electricity.

Power down the NT2X70 card in slot 25 of the HIE shelf by setting the ON/OFF switch on the power converter faceplate to the OFF position. Both the converter FAIL LED and FRAME FAIL lamp on the frame supervisory panel (FSP) will be ON. An audible alarm may sound. If an alarm does sound, silence it, at the MAP terminal, by typing

>SIL

and pressing the Enter key.

If NT2X70 is in	Dotrip circuit breaker
shelf 5 slot 25	CB1 on FSP
shelf 5 slot 22	CB4 on FSP

8 Replace the NT2X70 card in slot 25 using the common replacing a card procedure in this document. When you have completed the procedure, return to this point.

9 Power up the NT2X70 card in slot 25 of the HIE shelf as follows:

a Ensure that the converter (NT2X70) is inserted. A major audible alarm may sound. This alarm is silenced when power is restored to the converter.

b Set the POWER switch to the ON position.

If NT2X70 suffix is	Dotrip circuit breaker
AE, or AF	step 10
AA, AB, AC, or AD	step 11

10 Toggle the ON/OFF/RESET switch on the power converter faceplate to the RESET position and hold while setting the circuit breaker on the FSP to the ON position. Both the converter FAIL LED and FRAME FAIL lamp on the FSP will go OFF, release the ON/OFF/RESET switch. Go to step 12.

11 Press the RESET button on the power converter faceplate while setting the circuit breaker on the FSP to the ON position. Both the converter FAIL LED and FRAME FAIL lamp on the FSP will go OFF, release the RESET button.

NT2X70
in an OPM HIE (continued)

12 If you were directed to this procedure from another maintenance procedure, return now to the procedure that directed you here and continue as directed; otherwise, continue with step 13.

At the MAP display

13 Post the OPM associated with the faulty NT2X70 card by typing

>POST LCM site_name frame_no lcm_no

and pressing the Enter key.

where

site_name
is the name of the site where the OPM is located

frame_no
is the number of the frame where the LCM is located

lcm_no
is the number of the LCM module in the frame

14 Return LCM unit 0 to service by typing

>RTS UNIT 0

and pressing the Enter key.

If RTS	Do
passed	step 15
failed	step 73

15 Post the ESA processor associated with the faulty NT2X70 card by typing

>POST ESA esa_no

and pressing the Enter key.

where

esa_no
is the number of the ESA processor identified in step 4.

16 Load the ESA processor by typing

>LOADPM

and pressing the Enter key.

If	Do
message “loadfile not found in directory" is not received	step 17
load passed	step 33
load failed	step 37

NT2X70
in an OPM HIE (continued)

17 Determine the type of device on which the PM load files are located.

If load files are located on	Do
tape	step 18
IOC disk	step 24
SLM disk	step 29

18 Locate the tape that contains the PM load files.

At the IOE frame

19 Mount the tape on a magnetic tape drive.

At the MAP display

20 Download the tape by typing

>MOUNT tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

21 List the contents of the tape in your user directory by typing

>LIST T tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files.

22 Release the tape drive from your user directory by typing

>DEMOUNT T tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive mounted in step 20.

23 Go to step 34.

24 From office records, determine and note the number of the input/output controller (IOC) disk and the name of the volume that contains the PM load files.

25 Access the disk utility level of the MAP by typing

>DSKUT

and pressing the Enter key.

NT2X70
in an OPM HIE (continued)

26 List the IOC file names into your user directory by typing

>LISTVOL volume_name ALL

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step 24.

27 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

28 Go to step 34.

29 From office records, determine and note the number of the system load module (SLM) disk and the name of the volume that contains the PM load files.

30 Access the disk utility level of the MAP by typing

>DISKUT

and pressing the Enter key.

31 List the SLM disk volume names by typing

>LV CM

and pressing the Enter key.

32 List the SLM file names into your user directory by typing

>LF volume_name

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step 29.

33 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

34 Load the LCM unit by typing

>LOADPM

and pressing the Enter key.

If loadpm	Do
passed	step 35
failed	step 73

NT2X70
in an OPM HIE (continued)

35 Return the LCM unit to service by typing

>RTS

and pressing the Enter key.

If RTS	Do
passed	step 69
failed	step 73

At the MAP display

36 Post the OPM associated with the faulty NT2X70 card by typing

>POST LCM site_name frame_no lcm_no

and pressing the Enter key.

where

site_name
is the name of the site where the OPM is located

frame_no
is the number of the frame where the LCM is located

lcm_no
is the number of the LCM module in the frame

37 Busy unit 1 of the OPM by typing

>BSY UNIT 1

and pressing the Enter key.

38 Post the ESA processor identified in step 4 by typing

>POST ESA esa_no

and pressing the Enter key.

where

esa_no
is the number of the ESA processor associated with the faulty NT2X70 card.

39 Busy the ESA processor by typing

>BSY

and pressing the Enter key.

Example of a MAP response:

```
This action will take this PM out of service
Please confirm (“Yes” or “No”)
```

Respond to the system prompt by typing

>YES

NT2X70
in an OPM HIE (continued)

At the HIE shelf

40

> **WARNING**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist strap grounding point of a frame supervisory panel (FSP) while handling circuit cards. This protects the cards against damage caused by static electricity.

Power down the NT2X70 card in slot 22 of the HIE shelf by setting the ON/OFF switch on the power converter faceplate to the OFF position. Both the converter FAIL LED and FRAME FAIL lamp on the frame supervisory panel (FSP) will be ON. An audible alarm may sound. If an alarm does sound, silence it by typing

>SIL

and pressing the Enter key.

If NT2X70 is in	Dotrip circuit breaker
shelf 5 slot 25	CB1 on FSP
shelf 5 slot 22	CB4 on FSP

41 Replace the NT2X70 card in slot 22 using the common replacing a card procedure in this document. When you have completed the procedure, return to this point

42 Power up the NT2X70 card in slot 22 of the HIE shelf as follows:

a Ensure that the NT2X70 card is inserted. A major audible alarm may sound. This alarm is silenced when power is restored to the converter.

b Set the POWER switch to the ON position.

If NT2X70 suffix is	Dotrip circuit breaker
AE, or AF	step 43
AA, AB, AC, or AD	step 44

43 Toggle the ON/OFF/RESET switch on the power converter faceplate to the RESET position and hold while setting the circuit breaker on the FSP to the ON position. Both the converter FAIL LED and FRAME FAIL lamp on the FSP will go OFF, release the ON/OFF/RESET switch. Go to step 45.

44 Press the RESET button on the power converter faceplate while setting the circuit breaker on the FSP to the ON position. Both the converter FAIL LED and FRAME FAIL lamp on the FSP will go OFF, release the RESET button.

NT2X70
in an OPM HIE (continued)

45 If you were directed to this procedure from another maintenance procedure, return now to the procedure that directed you here and continue as directed; otherwise, continue with step 46.

At the MAP display

46 Post the OPM associated with the faulty NT2X70 card by typing

>POST LCM site_name frame_no lcm_no

and pressing the Enter key.

where

site_name
is the name of the site where the OPM is located

frame_no
is the number of the frame where the LCM is located

lcm_no
is the number of the LCM module in the frame

47 Return LCM unit 1 to service by typing

>RTS UNIT 1

and pressing the Enter key.

If RTS	Do
passed	step 48
failed	step 73

48 Post the ESA processor associated with the faulty NT2X70 card by typing

>POST ESA esa_no

and pressing the Enter key.

where

esa_no
is the number of the ESA processor identified in step 4.

49 Load the ESA processor by typing

>LOADPM

and pressing the Enter key.

If	Do
message “loadfile not found in directory" is not received	step 50
load passed	step 68
load failed	step 73

NT2X70
in an OPM HIE (continued)

50 Determine the type of device on which the PM load files are located.

If load files are located on	Do
tape	step 51
IOC disk	step 57
SLM disk	step 62

51 Locate the tape that contains the PM load files.

At the IOE frame

52 Mount the tape on a magnetic tape drive.

At the MAP display

53 Download the tape by typing

>MOUNT tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

54 List the contents of the tape in your user directory by typing

>LIST T tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files.

55 Release the tape drive from your user directory by typing

>DEMOUNT T tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive mounted in step 53.

56 Go to step 67.

57 From office records, determine and note the number of the input/output controller (IOC) disk and the name of the volume that contains the PM load files.

58 Access the disk utility level of the MAP by typing

>DSKUT

and pressing the Enter key.

NT2X70
in an OPM HIE (continued)

59 List the IOC file names into your user directory by typing

>LISTVOL volume_name ALL

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step 57.

60 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

61 Go to step 67.

62 From office records, determine and note the number of the system load module (SLM) disk and the name of the volume that contains the PM load files.

63 Access the disk utility level of the MAP by typing

>DISKUT

and pressing the Enter key.

64 List the SLM disk volume names by typing

>LV CM

and pressing the Enter key.

65 List the SLM file names into your user directory by typing

>LF volume_name

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step 62.

66 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

67 Load the LCM unit by typing

>LOADPM

and pressing the Enter key.

If loadpm	Do
passed	step 68
failed	step 73

NT2X70 in an OPM HIE (end)

68 Return the ESA processor to service by typing

>RTS

and pressing the Enter key.

If RTS	Do
passed	step 69
failed	step 73

69 Send any faulty cards for repair according to local procedure.

70 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card.

71 Go to step 74.

72 Return to the procedure that directed you to this card replacement procedure. If necessary, go to the point where the faulty card list was produced, identify the next faulty card on the list, and go to the appropriate replacement procedure in this manual for that card.

73 Obtain further assistance in replacing this card by contacting personnel responsible for higher level of support.

74 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

NT2X90
in an OPM RMM

Application

Use this procedure to replace the following card in an RMM.

PEC	Suffixes	Name
NT2X90	AB, AC, AD	Incoming/outgoing Transmission Test Trunk Circuit (TTT)

Common procedures

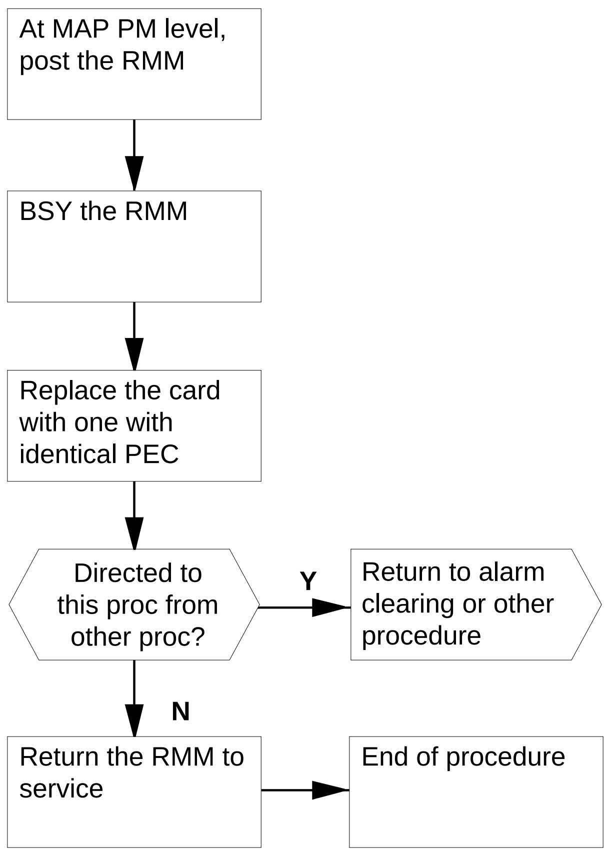
None

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT2X90
in an OPM RMM (continued)

Summary of card replacement procedure for an NT2X90 card in an RMM



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

NT2X90
in an OPM RMM (continued)

Replacing an NT2X90 card in an RMM

At your current location

1 Proceed only if you were either directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure to verify or accept cards, or were directed to this procedure by your maintenance support group.

2 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC) including suffix, as the card to be removed.

At the MAP display

3 Access the PM level and post the RMM by typing

>MAPCI;MTC;PM;POST RMM rmm_no

and pressing the Enter key.

where

rmm_no
is the number of the RMM from which the card is to be removed

Example of a MAP display:

```
   CM    MS    IOD    Net    PM    CCS    LNS    Trks    Ext    APPL
   .     .      .      .   4SysB   .      .       .      .      .

RMM                 SysB     ManB     OffL     CBsy     ISTb     InSv
 0 Quit    PM          4        0       10        3        3      130
 2 Post_   RMM         0        1        1        0        0        2
 3
 4         RMM  5  INSV
 5 Trnsl
 6 Tst
 7 Bsy
 8 RTS
 9 OffL
10 LoadPM
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

4 Busy the RMM by typing

>BSY

and pressing the Enter key.

NT2X90
in an OPM RMM (continued)

Example of a MAP display:

```
   CM     MS     IOD     Net     PM    CCS     LNS     Trks     Ext     APPL
    .      .      .       .     4SysB   .       .       .        .        .

RMM                  SysB      ManB      OffL      CBsy      ISTb       InSv
 0 Quit     PM          4         0        10         3         3        130
 2 Post_    RMM         0         1         1         0         0          2
 3
 4          RMM  5  ManB
 5 Trnsl
 6 Tst
 7 Bsy
 8 RTS
 9 OffL
10 LoadPM
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

At the RMM shelf

5

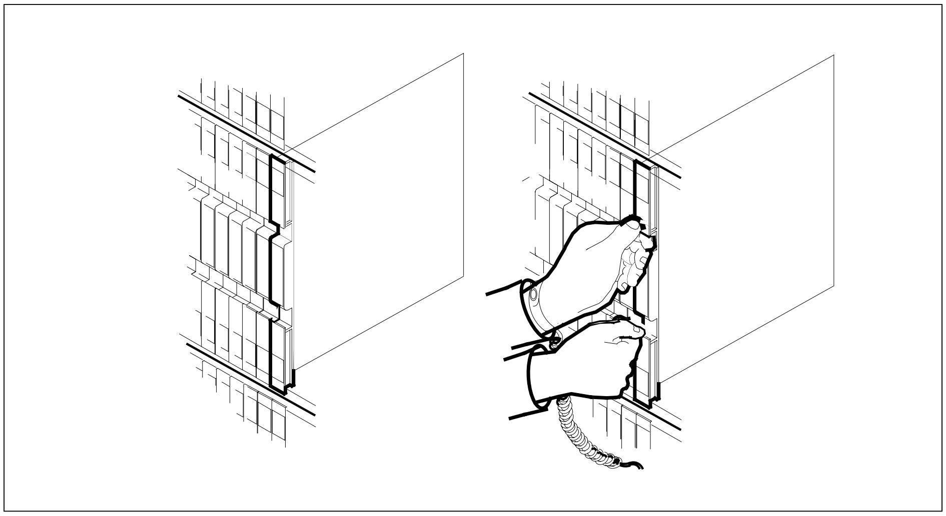
> **CAUTION**
> **Static discharge may cause damage to circuit packs**
> Put on a wrist strap and connect it to the frame of the RMM before removing or inserting any cards. This protects the RMM against service degradation caused by static electricity.

Put on a wrist strap.

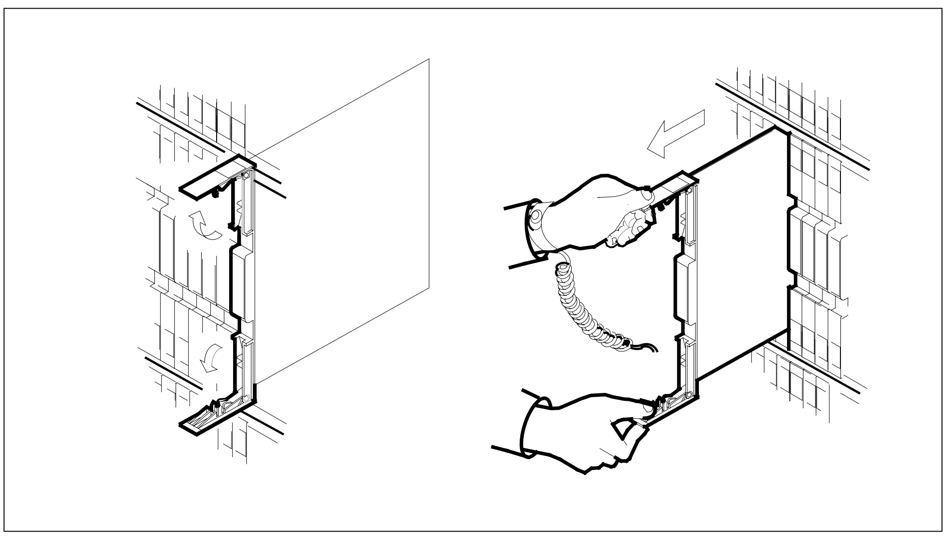
6 Remove the NT2X90 card as shown in the following figures.

a Locate the card to be removed on the appropriate shelf.

NT2X90
in an OPM RMM (continued)



b Open the locking levers on the card to be replaced and gently pull the card towards you until it clears the shelf.



c Ensure that the replacement card has the same PEC including suffix, as the card you just removed.

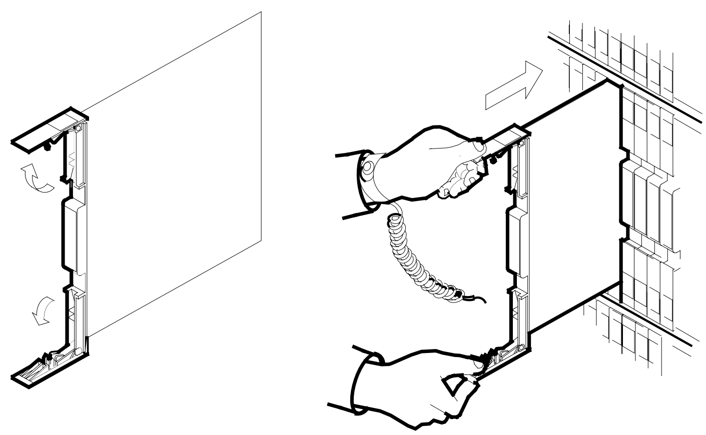
NT2X90
in an OPM RMM (continued)

7

DANGER
Equipment damage
Take these precautions when removing or inserting a card:1. Do not apply direct pressure to the components.2 .Do not force the cards into the slots.

Open the locking levers on the replacement card.

Align the card with the slots in the shelf and gently slide the card into the shelf.

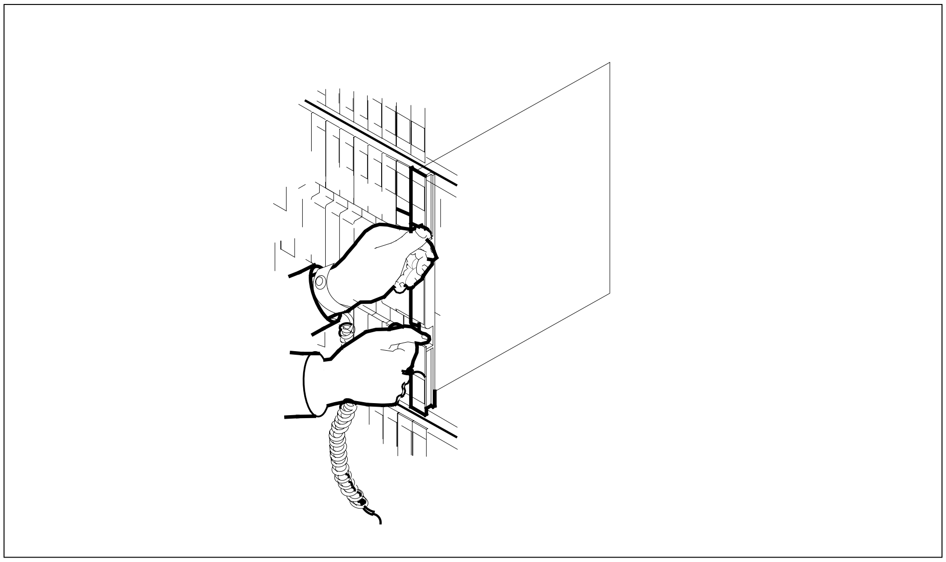


8 Seat and lock the card.

a Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure that the card is fully seated in the shelf.

b Close the locking levers.

NT2X90
in an OPM RMM (continued)



9 Use the following information to determine the next step in this procedure.

If you entered this procedure	Do
from an alarm clearing procedure	step 15
from other	step 10

At the MAP display

10 Test the RMM by typing

>TST

and pressing the Enter key.

Example of a MAP response:

```
Test Passed
    or
Test Failed
```

If the TST	Do
passes	step 11
fails	step 16

11 Return the RMM to service by typing

>RTS

NT2X90 in an OPM RMM (end)

and pressing the Enter key.

If the RTS	Do
passes	step 12
fails	step 16

12 Send any faulty cards for repair according to local procedure.

13 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card.

14 Go to step 17.

15 Return to the *Alarm Clearing Procedures* that directed you to this card replacement procedure. If necessary, go to the point where the faulty card list was produced, identify the next faulty card on the list, and go to the appropriate replacement procedure in this manual for that card.

16 Obtain further assistance in replacing this card by contacting personnel responsible for higher level of support.

17 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

NT3X09
in an OPM RMM

Application

Use this procedure to replace the following card in an RMM.

PEC	Suffixes	Name
NT3X09	AA, BA	Remote Metallic Access (MTA) card

Common procedures

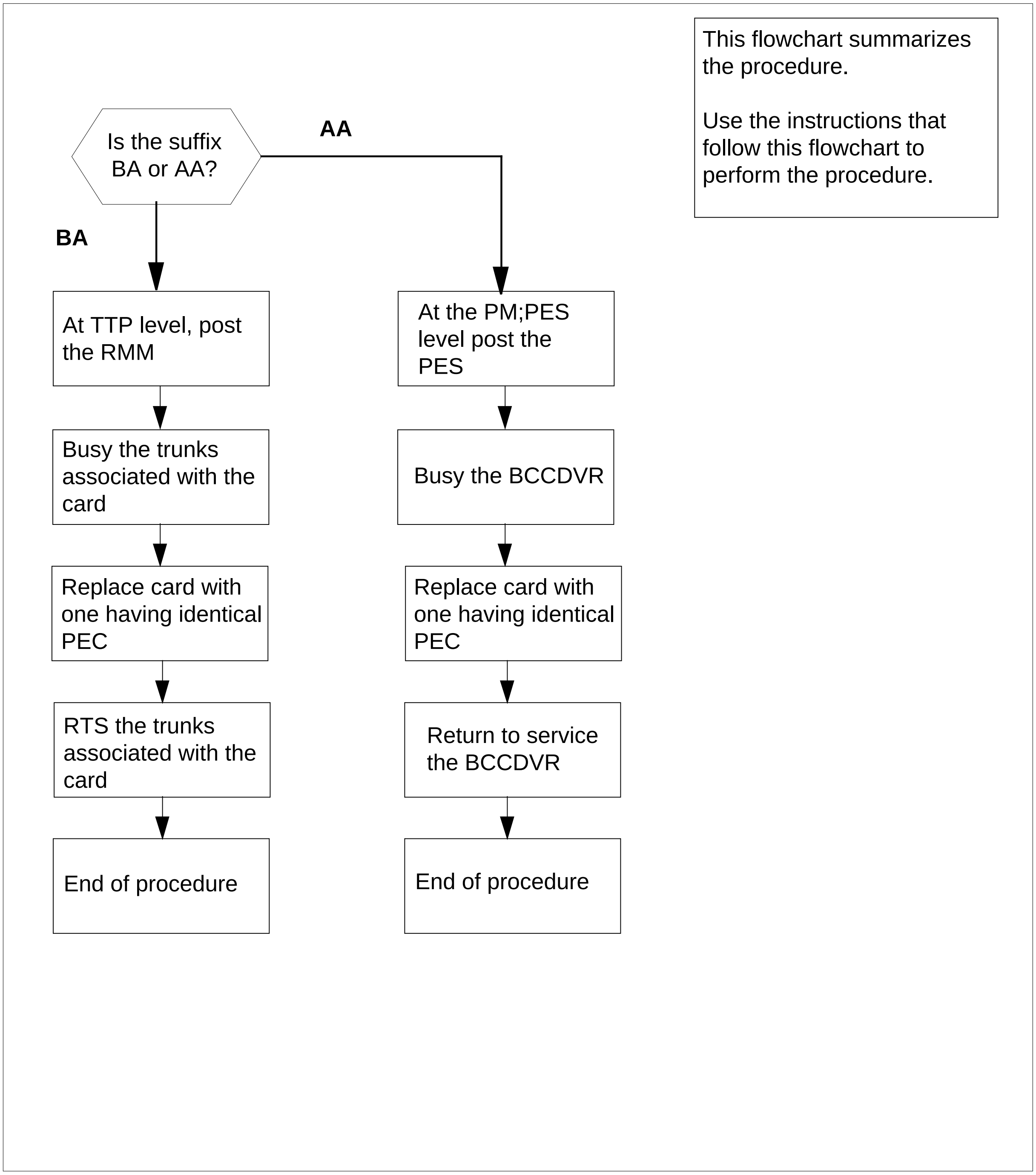
The common replacing a card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT3X09
in an OPM RMM (continued)

Summary of replacing an NT3X09 card in an RMM



NT3X09
in an OPM RMM (continued)

Replacing an NT3X09 card in an RMM

At your current location

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

At the MAP terminal

2 Determine the suffix of the NT3X09 card to be replaced.

If suffix is	Do
BA	step 3
AA	step 9

3 Access the TTP level of the MAP terminal and post the RMM that contains the card to be replaced by typing

>MAPCI;MTC;TRKS;TTP;POST P RMM rmm_no ckt_no

and pressing the Enter key.

where

rmm_no
is the number of the RMM shelf in which the card is to be replaced

ckt_no
is the number of the first circuit where the NT3X09 card is physically located

Example of a MAP response:

```
LAST CIRCUIT = 27
POST CKT IDLED
SHORT CLLI IS:  1118
OK, CLLI POSTED

POST  20   DELQ       BUSY Q          DIG
TTP 6-006
CKT TYPE   PM NO.     COM LANG        STA S R DOT TE R
OG  MISC RMM 0 0    MTADRIVER 20      LO
```

4 Check the status of the RMM.

If RMM status is	Do
MB, PMB, RMB	step 6
other	step 5

NT3X09
in an OPM RMM (continued)

5 Busy the trunks that are associated with the card to be replaced by typing

>BSY ; NEXT

and pressing the Enter key.

> ***Note:*** Repeat this step for all circuits associated with the faulty NT3X09AA/BA card to be replaced.

At the shelf

6

> **WARNING**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist strap grounding point of a frame supervisory panel (FSP) while handling circuit cards. This protects the cards against damage caused by static electricity.

Replace the NT3X09 card using the common replacing a card procedure in this document. When you have completed the procedure, return to this point.

At the MAP terminal

7 Post the new NT3X09 card by typing

>POST P RMM rmm_no ckt_no

and pressing the Enter key.

where

rmm_no
is the number of the RMM shelf in which the card is to be replaced

ckt_no
is the number of the first circuit where the NT3X09 card is physically located

8 Return to service the circuits busied in step 5 by typing

>RTS ;NEXT

and pressing the Enter key.

> ***Note:*** Repeat this step for all circuits associated with the new NT3X09 card.

If RTS	Do
passed	step 15
failed	step 17

NT3X09
in an OPM RMM (continued)

9 Access the PES level of the MAP terminal and post the PES that contains the faulty NT3X09 card to be replaced by typing

>MAPCI;MTC;PM;PES; POST pes_no

and pressing the Enter key.

where

pes_no
is the number of the OPM containing the faulty NT3X09 card

10 Disable the audit by typing

>AUDIT DISABLE

and pressing the Enter key.

11 Busy the battery charge controller (BCCDVR) by typing

>BSY BCCDVR

and pressing the Enter key.

Example of a MAP terminal display:

```
 CM     MS      IOD     NET     PM     CCS     LNS     Trks    Ext
 .      .       .       .      1PES     .       .       .       .
 OPMPES                SysB   ManB    OffL    CBSY    ISTB    InSV
 0 Quit      PM          0      3       4       0       4      30
 2 Post_
 3                      RED      AMBER     GREEN     OFFL
 4           OPMPES      1         0         3         1
 5
 6 Tst_      OPMPES    2 Cond:  RED    REM2     2   1   RMM   2
 7 Bsy_                                             Audit  Week  HBT
 8 Rts_       Common     Rectifiers                  DIS    -     .
 9 OffL_       AC     FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
10             .       .   .   .   .       M        .        .   .
11 Disp_       BCC    0    1    2    3     Temp     Door    BCCFUSES
12 Next          0= W  BSY  BSY  BSY  BSY   EHT ELT  FRNT SIDE    0   1
13               1= W  BSY  BSY  BSY  BSY    .   .    .    .      .   .
14 QueryPES_
15 OpenCkt_
16 Charge_
17 LoadB_
18 MEASure_
```

12 Replace the NT3X09 card using the common replacing a card procedure in this document. When you have completed the procedure, return to this point.

13 Return to service the battery charge controller (BCCDVR) by typing

>RTS BCCDVR

and pressing the Enter key.

Example of a MAP display:

NT3X09
in an OPM RMM (end)

```
 CM      MS       IOD      NET      PM      CCS      LNS      Trks     Ext
 .       .        .        .        .       .        .        .        .
 OPMPES                   SysB    ManB    OffL     CBSY     ISTB     InSV
 0 Quit      PM            0       3        4        0        4       30
 2 Post_
 3                         RED      AMBER      GREEN      OFFL
 4           OPMPES        0          1          3         1
 5
 6 Tst_      OPMPES    2 Cond:  RED    REM2     2   1   RMM   2
 7 Bsy_                                          Audit  Week  HBT
 8 Rts_       Common     Rectifiers               DIS    -     .
 9 OffL_       AC      FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
10              .       .   .   .   .      .        .       .   .
11 Disp_     BCC    0     1    2    3       Temp     Door     BCCFUSES
12 Next     0= W      .    .    .    .  EHT ELT  FRNT SIDE    0   1
13          1= W      .    .    .    .  .    .    .      .    .   .
14 QueryPES_
15 OpenCkt_
16 Charge_
17 LoadB_
18 MEASure_
```

14 Enable the audit by typing

>AUDIT ENABLE

and pressing the Enter key.

15 Send any faulty cards for repair according to local procedure.

16 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 18.

17 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

18 You have completed this procedure.

NT6X17
in an OPM

Application

Use this procedure to replace the following card in an OPM.

PEC	Suffixes	Name
NT6X17	AA, AB, AC	Standard Line Circuit Type A (POTS)

Common procedures

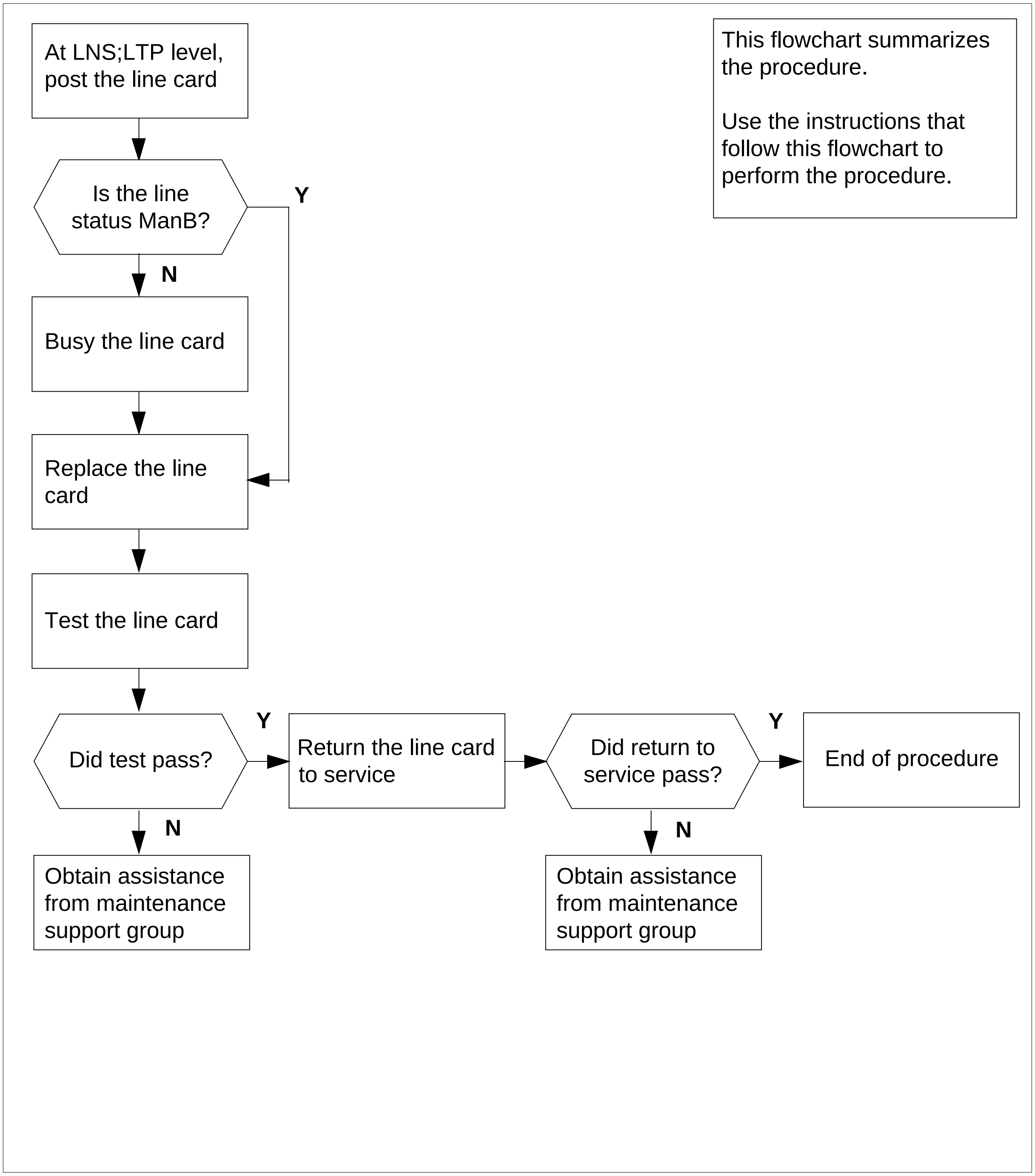
The common replacing a line card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X17
in an OPM (continued)

Summary of replacing an NT6X17 card in an OPM



NT6X17
in an OPM (continued)

Replacing an NT6X17 card in an OPM

At your current location

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

At the MAP terminal

2 Access the LTP level of the MAP terminal and post the line associated with the card to be replaced by typing

>MAPCI;MTC;LNS;LTP;POST L site lcm lsg ckt

and pressing the Enter key.

where

site
is the name of the site where the OPM is located

lcm
is the number of the OPM with the faulty card

lsg
is the number of the line subgroup with the faulty card

ckt
is the number of the circuit associated with the faulty card

Example of a MAP response:

```
LCC PTY RNG .....LEN.........  DN   STA F S LTA TE RESULT
1FR      REM1 00 0 03 03     7213355 MB
```

3 Check the status of the posted line.

If the line status is	Do
manual busy (ManB)	step 5
not ManB	step 4

4 Busy the line by typing

>BSY

and pressing the Enter key.

5 Go to the common replacing a line card procedure in this document. When you have completed the procedure, return to this point.

NT6X17 in an OPM (end)

At the MAP terminal

6 Test the line card just replaced by typing

>DIAG

and pressing the Enter key.

If DIAG	Do
passed	step 7
failed	step 10

7 Return the line card to service by typing

>RTS

and pressing the Enter key.

If RTS	Do
passed	step 8
failed	step 10

8 Send any faulty cards for repair according to local procedure.

9 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 11.

10 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

11 You have successfully completed this procedure.

NT6X18
in an OPM

Application

Use this procedure to replace the following card in an OPM.

PEC	Suffixes	Name
NT6X18	AA, AB	Line Card Type B (Coin/Ground Start)
NT6X18	BA	World Line Card Type B

Common procedures

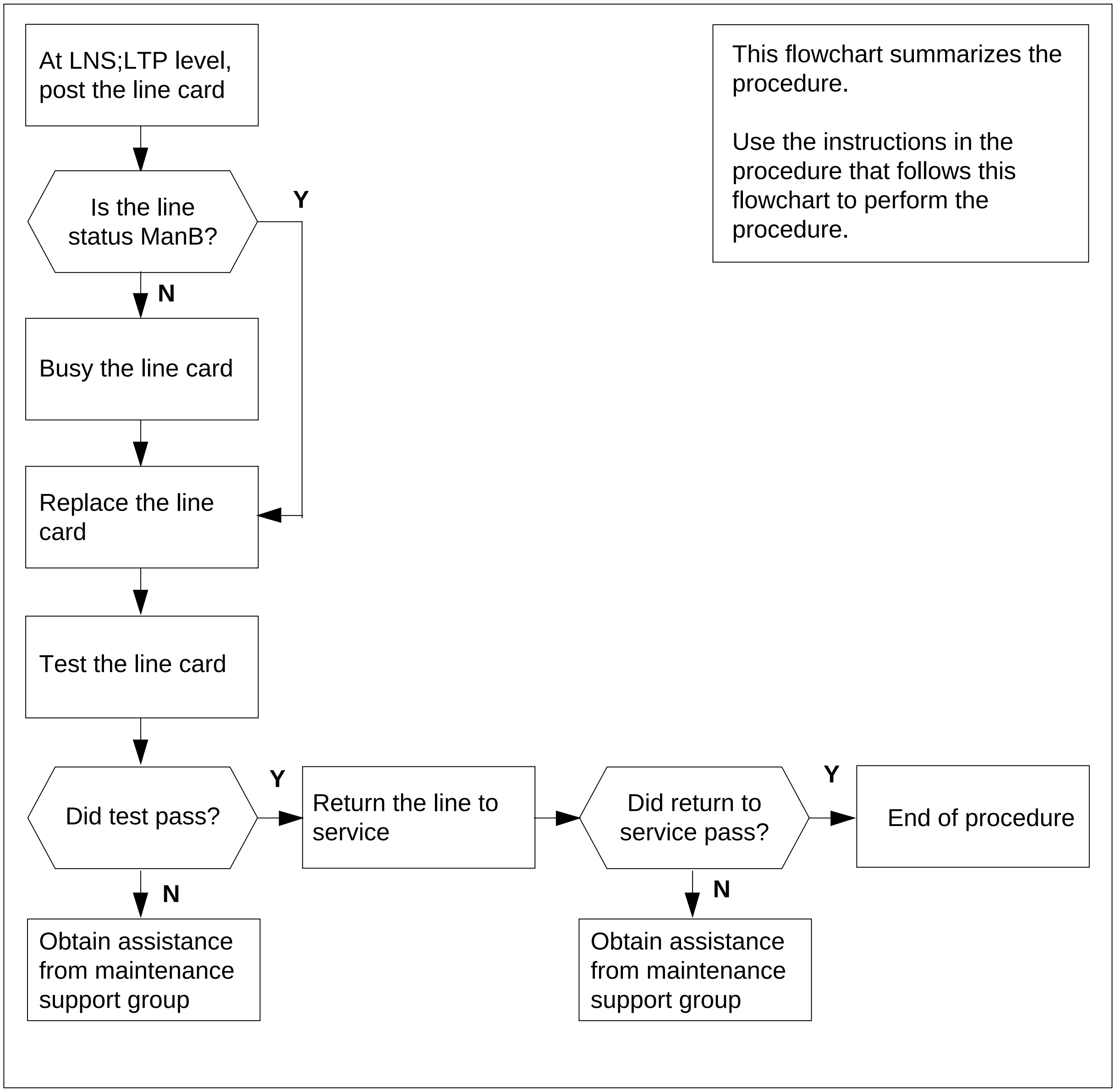
The common replacing a line card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X18
in an OPM (continued)

Summary of replacing an NT6X18 card in an OPM



NT6X18
in an OPM (continued)

Replacing an NT6X18 card in an OPM

At your current location

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

At the MAP terminal

2 Access the LTP level of the MAP and post the line associated with the card to be replaced by typing

>MAPCI;MTC;LNS;LTP;POST L site lcm lsg ckt

and pressing the Enter key.

where

site
is the name of the site where the OPM is located

lcm
is the number of the OPM with the faulty card

lsg
is the number of the line subgroup with the faulty card

ckt
is the number of the circuit associated with the faulty card

Example of a MAP response:

```
LCC PTY RNG .....LEN.........  DN   STA F S LTA TE RESULT
1FR         REM1 00 0 03 03   7213355 MB
```

3 Check the status of the posted line.

If the line status is	Do
manual busy (ManB)	step 5
not ManB	step 4

4 Busy the line by typing

>BSY

and pressing the Enter key.

5 Go to the common replacing a line card procedure in this document. When you have completed the procedure, return to this point.

NT6X18
in an OPM (end)

At the MAP terminal

6

> **ATTENTION**
> There is a new diagnostics test for NT6X18AA/AB cards. This NT6X18 card may be good. See the NT6X18 line card description in the general maintenance section of this book for information on running an enhanced diagnostics.

Test the line card just replaced by typing

>DIAG

and pressing the Enter key.

If DIAG	Do
passed	step 7
failed	step 10

7 Return the line card to service by typing

>RTS

and pressing the Enter key.

If RTS	Do
passed	step 8
failed	step 10

8 Send any faulty cards for repair according to local procedure.

9 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 11.

10 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

11 You have successfully completed this procedure.

NT6X19 in an OPM

Application

Use this procedure to replace the following card in an OPM.

PEC	Suffixes	Name
NT6X19	AA	Message Waiting Line Card

Common procedures

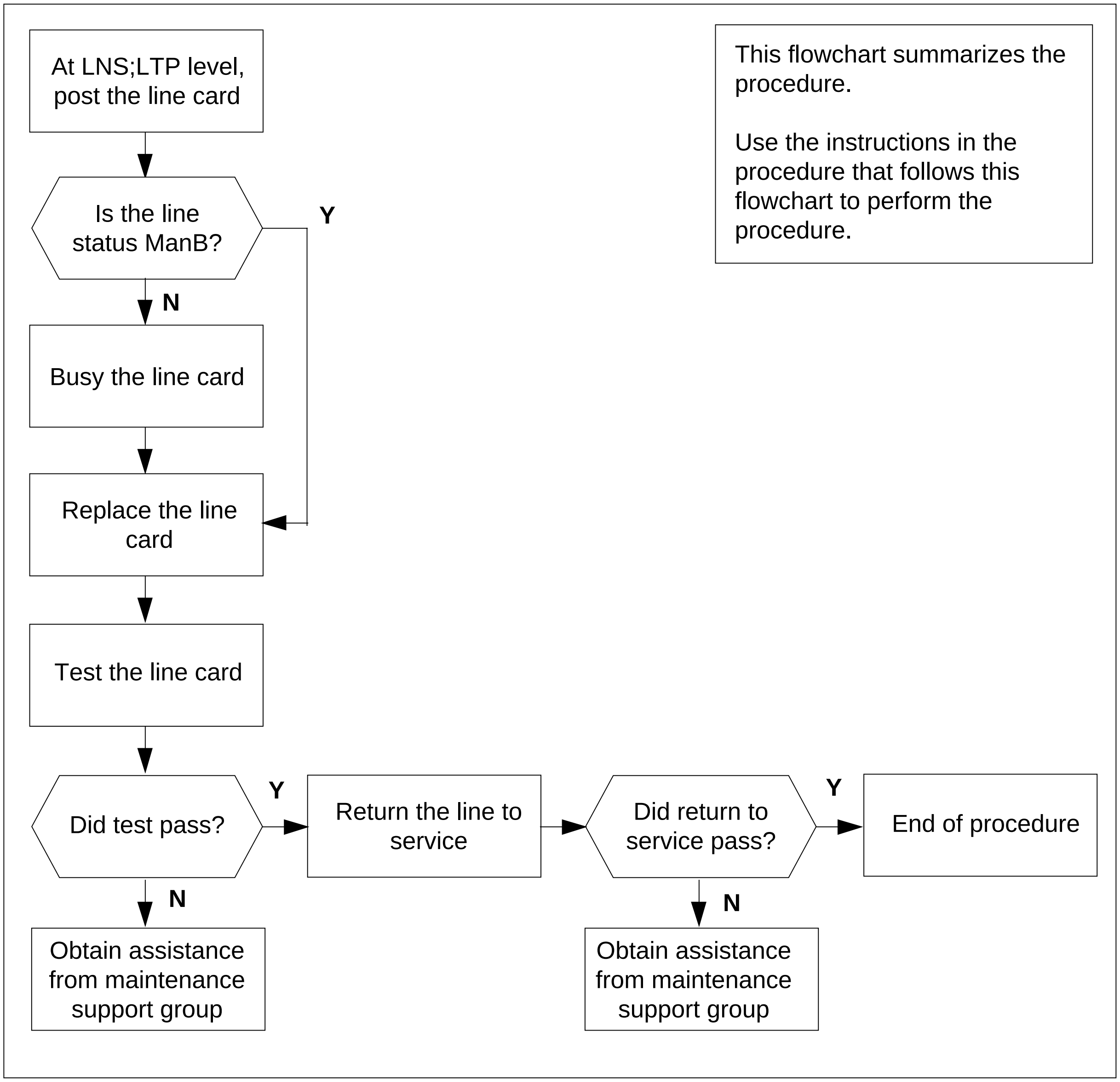
The common replacing a line card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X19
in an OPM (continued)

Summary of replacing an NT6X19 card in an OPM



NT6X19
in an OPM (continued)

Replacing an NT6X19 card in an OPM

At your current location

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

At the MAP terminal

2 Access the LTP level of the MAP and post the line associated with the card to be replaced by typing

>MAPCI;MTC;LNS;LTP;POST L site lcm lsg ckt

and pressing the Enter key.

where

site
is the name of the site where the OPM is located

lcm
is the number of the OPM with the faulty card

lsg
is the number of the line subgroup with the faulty card

ckt
is the number of the circuit associated with the faulty card

Example of a MAP response:

```
LCC PTY RNG .....LEN.......... DN   STA F S LTA TE RESULT
1FR      REM1 00 0 03 03     7213355 MB
```

3 Check the status of the posted line.

If the line status is	Do
manual busy (ManB)	step 5
not ManB	step 4

4 Busy the line by typing

>BSY

and pressing the Enter key.

5 Go to the common replacing a line card procedure in this document. When you have completed the procedure, return to this point.

NT6X19
in an OPM (end)

At the MAP terminal

6 Test the line card just replaced by typing

>DIAG

and pressing the Enter key.

If DIAG	Do
passed	step 7
failed	step 10

7 Return the line card to service by typing

>RTS

and pressing the Enter key.

If RTS	Do
passed	step 8
failed	step 10

8 Send any faulty cards for repair according to local procedure.

9 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 11.

10 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

11 You have successfully completed this procedure.

NT6X20
in an OPM

Application

Use this procedure to replace the following card in an OPM.

PEC	Suffixes	Name
NT6X20	AA	Message Waiting Converter

Common procedures

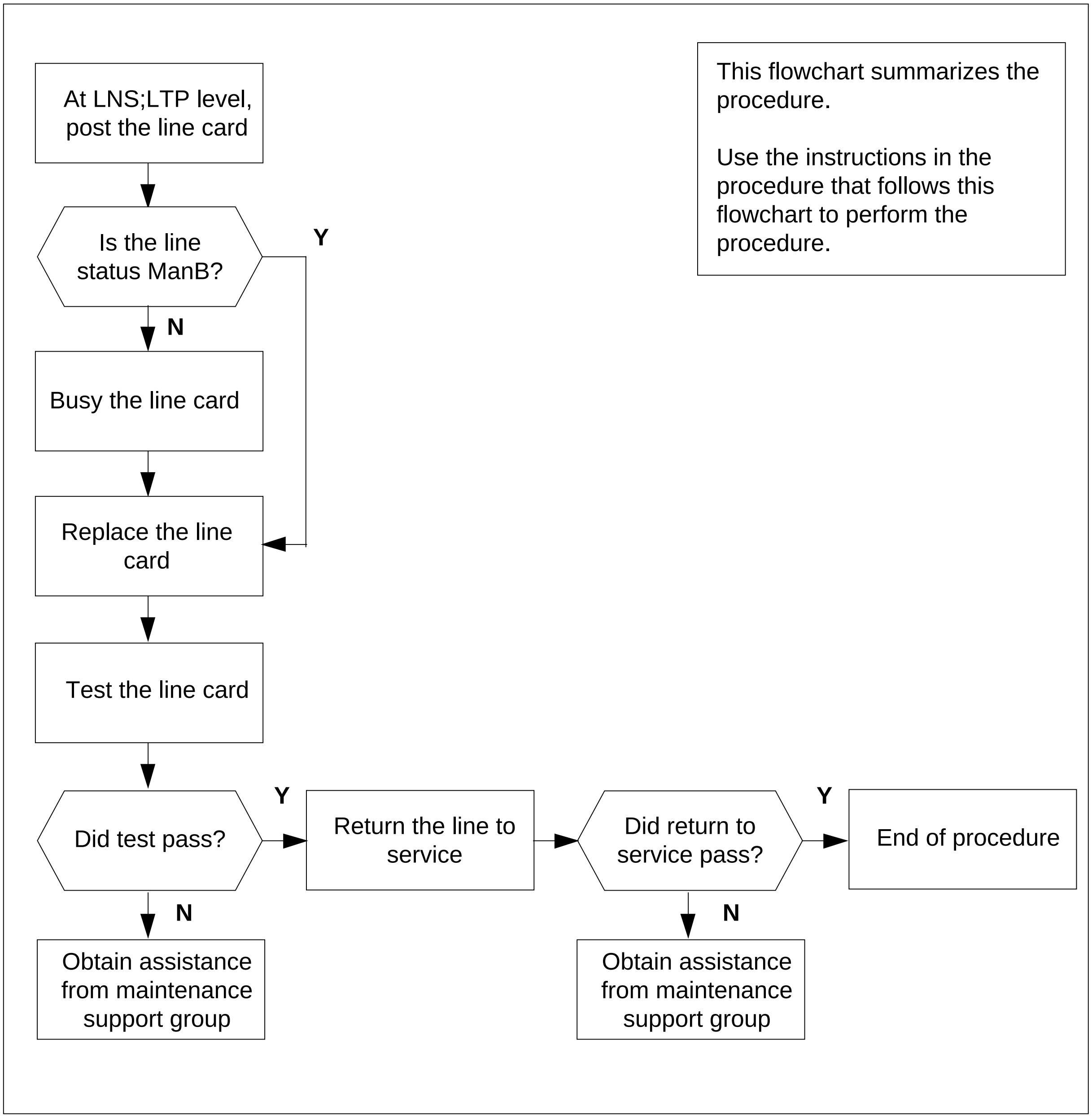
The common replacing a line card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X20 in an OPM (continued)

Summary of card replacement procedure for an NT6X20 card OPM



NT6X20
in an OPM (continued)

Replacing an NT6X20 card in an OPM

At your current location

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

At the MAP terminal

2 Access the LTP level of the MAP terminal and post the line associated with the card to be replaced by typing

>MAPCI;MTC;LNS;LTP;POST L site lcm lsg ckt

and pressing the Enter key.

where

site
is the name of the site where the OPM is located

lcm
is the number of the OPM with the faulty card

lsg
is the number of the line subgroup with the faulty card

ckt
is the number of the circuit associated with the faulty card

Example of a MAP response:

```
LCC PTY RNG .....LEN.......... DN   STA F S LTA TE RESULT
1FR      REM1 00 0 03 03     7213355 MB
```

3 Check the status of the posted line.

If the line status is	Do
manual busy (ManB)	step 5
not ManB	step 4

4 Busy the line by typing

>BSY

and pressing the Enter key.

5 Go to the common replacing a line card procedure.in this document. When you have completed the procedure, return to this point.

NT6X20
in an OPM (end)

At the MAP terminal

6 Test the line card just replaced by typing

>DIAG

and pressing the Enter key.

If DIAG	Do
passed	step 7
failed	step 10

7 Return the line card to service by typing

>RTS

and pressing the Enter key.

If RTS	Do
passed	step 8
failed	step 10

8 Send any faulty cards for repair according to local procedure.

9 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 11.

10 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

11 You have successfully completed this procedure.

NT6X21
in an OPM

Application

Use this procedure to replace the following card in an OPM.

PEC	Suffixes	Name
NT6X21	AA, AB, AC, AD	Line card type C, Meridian Digital Centrex (MDC), electronic business set

Common procedures

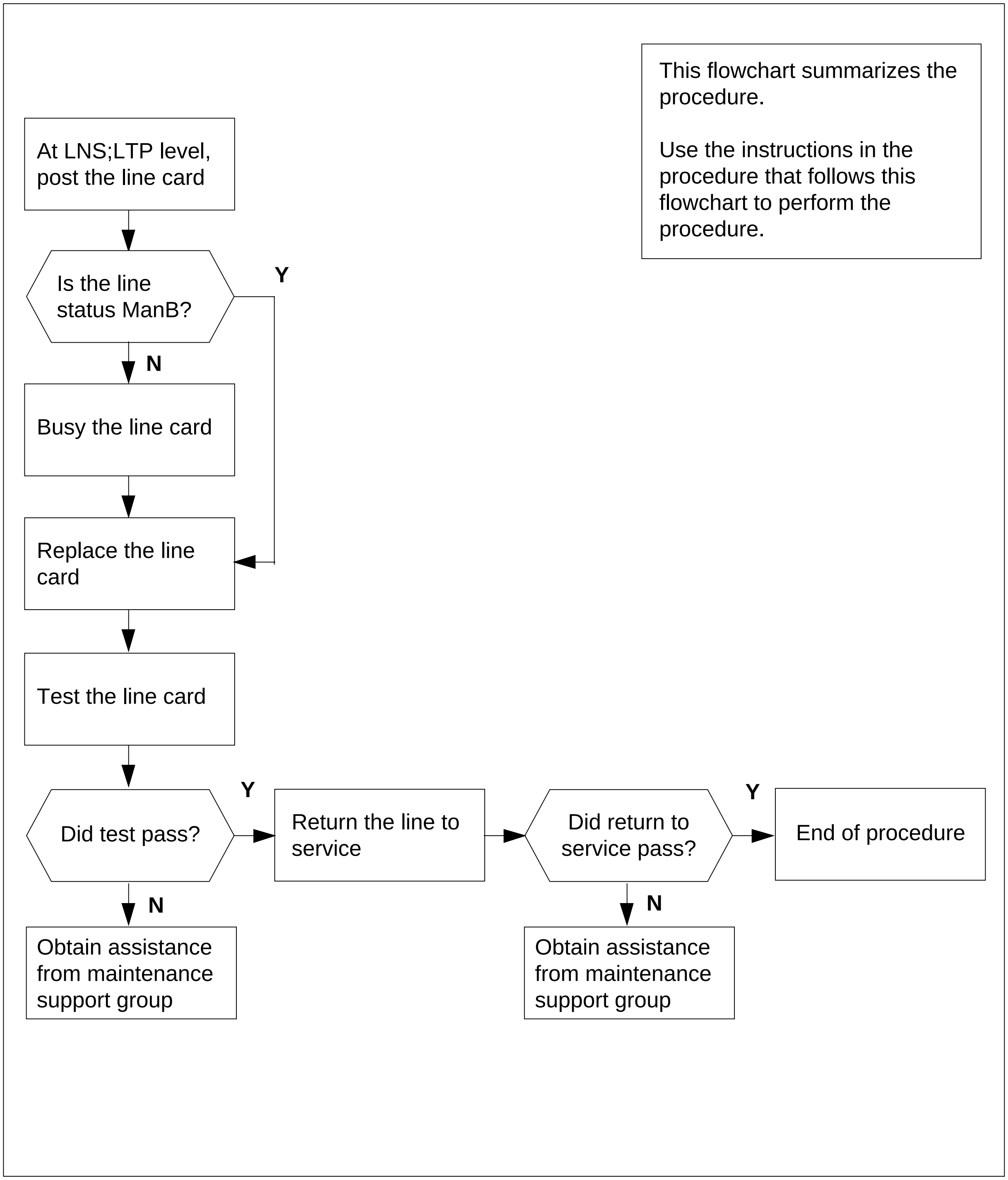
The common replacing a line card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X21
in an OPM (continued)

Summary of replacing an NT6X21 card in an OPM



NT6X21
in an OPM (continued)

Replacing an NT6X21 card in an OPM

At your current location

1 Obtain a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

2 Make DIP switch changes for the line card.

If the line card code is	Do
AA, AB, AC	step 4
AD	step 3

3 Make DIP switch settings as referenced in the *Maintenance* section of this manual.

At the MAP terminal

4 Access the LTP level of the MAP terminal and post the line associated with the card to be replaced by typing

>MAPCI;MTC;LNS;LTP;POST L site lcm lsg ckt

and pressing the Enter key.

where

site
is the name of the site where the OPM is located

lcm
is the number of the OPM with the faulty card

lsg
is the number of the line subgroup with the faulty card

ckt
is the number of the circuit associated with the faulty card

Example of a MAP response:

```
LCC PTY RNG .....LEN.......... DN   STA F S LTA TE RESULT
1FR      REM1 00 0 03 03     7213355 MB
```

5 Check the status of the posted line.

If the line status is	Do
manual busy (ManB)	step 7
not ManB	step 6

NT6X21 in an OPM (end)

6 Busy the line by typing

>BSY

and pressing the Enter key.

At the OPM cabinet

7 Go to the common replacing a line card procedure in this document. When you have completed the procedure, return to this point.

At the MAP terminal

8 Test the line card just replaced by typing

>DIAG

and pressing the Enter key.

If the DIAG	Do
passed	step 9
failed	step 12

9 Return the line card to service by typing

>RTS

and pressing the Enter key.

If RTS	Do
passed	step 10
failed	step 12

10 Send any faulty cards for repair according to local procedure.

11 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 13.

12 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

13 You have successfully completed this procedure.

NT6X27
in an OPM HIE

Application

Use this procedure to replace the following card in an HIE shelf.

PEC	Suffixes	Name
NT6X27	BB	PCM-30 Interface

Common procedures

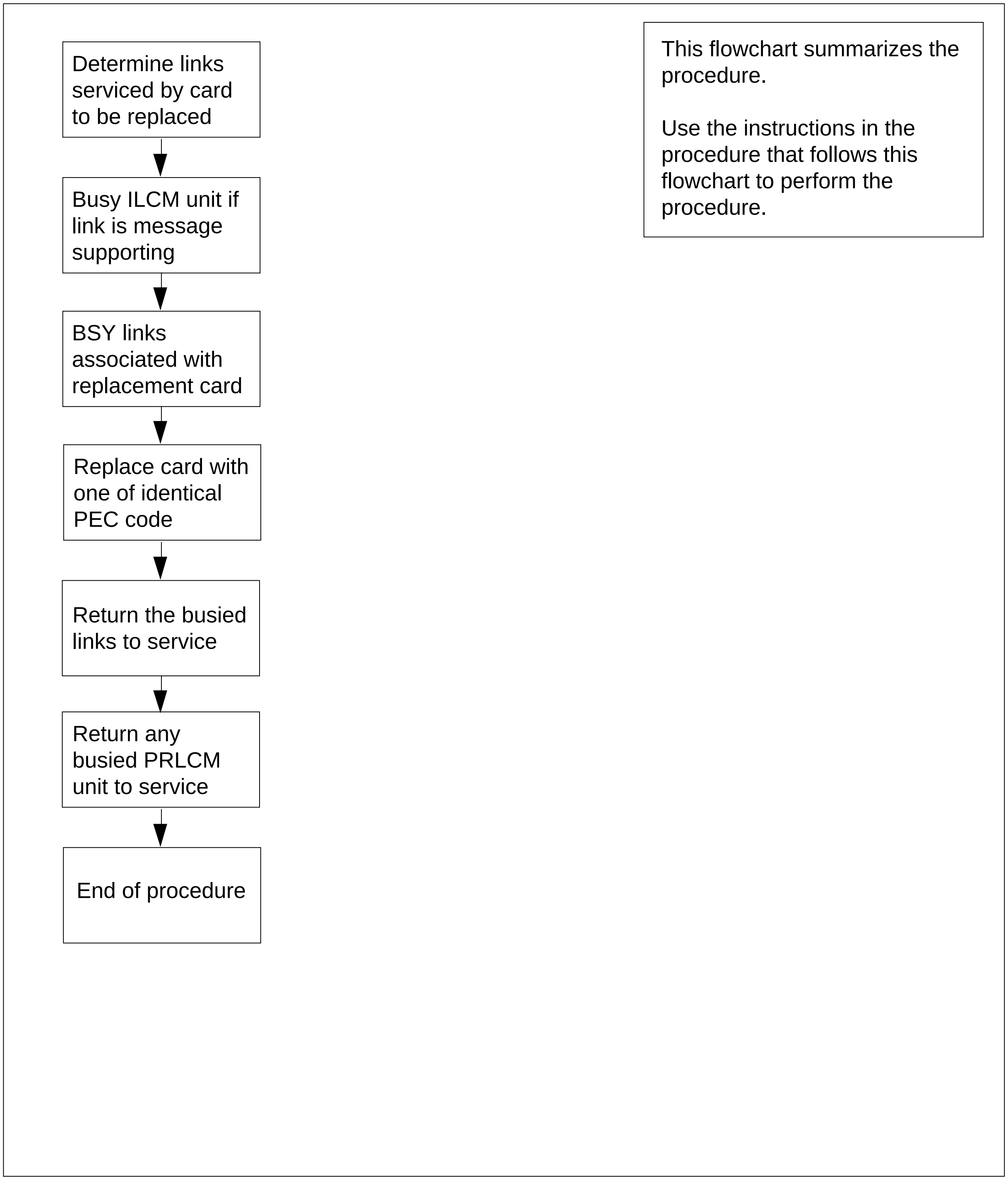
The common replacing a card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X27
in an OPM HIE (continued)

Summary of card replacement procedure for an NT6X27 card in an in HIE



Replacing an NT6X27 card in an HIE

At your current location:

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

2 If you were directed to this procedure from another maintenance procedure, go to step 4; otherwise, continue with step 3.

At the MAP display

3 Access the PM level and post the ILCM by typing

>MAPCI;MTC;PM;POST ILCM site frame lcm_no

and pressing the Enter key.

where

site
is the name of the PRLCM site (alphanumeric)

frame
is the frame number of the PRLCM cabinet

lcm_no
is the number of the PRLCM ILCM

4 Display C-side link information by typing

> TRNSL C

and pressing the Enter key.

Example of a MAP response:

PLGC P-side link numbers

```
Link 0: PLGC 0       2; Cap MS; Status: OK    ;MsgCond: OPN
Link 1: PLGC 0       6; Cap MS; Status: SysB  ;MsgCond: CLS
```

5 From the display in step 4, determine the C-side peripheral module (PLGC, or RCO2) to which the PRLCM is connected and post it by typing

> POST host_pm host_pm_no

and pressing the Enter key.

where

host_pm
is the name of the host PM (PLGC, or RCO2)

host_pm_no
is the number of the host PM

NT6X27 in an OPM HIE (continued)

6 Display P-side link information by typing

> TRNSL P

and pressing the Enter key.

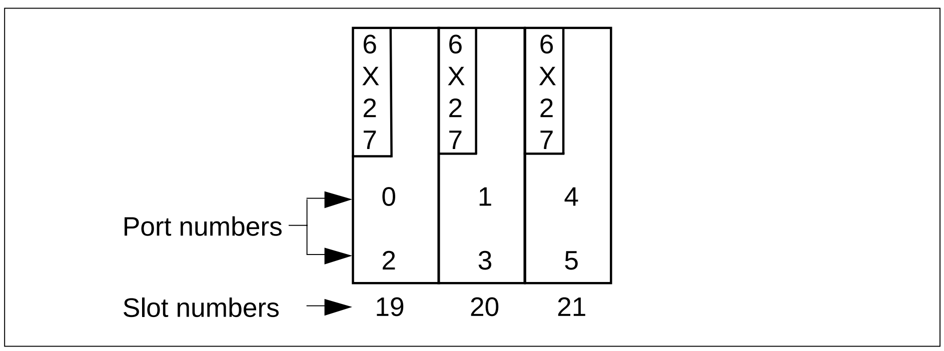
Example of a MAP response:

NT6X27 port numbers

```
Link 2: ILCM REM1 00 0  0;Cap MS;Status:OK   ;MsgCond: OPN
Link 6: ILCM REM1 00 0  1;Cap MS;Status:SysB ;MsgCond: CLS
```

7 Record the numbers of the links with status not OK.

Use the following diagram to determine which PCM-30 interface card or cards corresponds to the links identified as faulty in step 6. Note that each NT6X27 card has 2 ports. For example, the faulty link 6 displayed in step 6 is connected to port 1 as indicated, which corresponds to the NT6X27 in slot 20.



8 Determine the slot location of the faulty card.

If faulty card is in slot	Do
19 or 20 of the HIE	step 9
21 of the HIE	step 12

9 Post the ILCM by typing

>POST ILCM site frame lcm_no

and pressing the Enter key.

where

site
is the name of the PRLCM site (alphanumeric)

frame
is the frame number of the PRLCM cabinet

lcm_no
is the number of the ILCM

NT6X27
in an OPM HIE (continued)

10 Busy ILCM unit by typing

>BSY UNIT lcm_unit

and pressing the Enter key.

where

lcm_unit
is the ILCM unit to be busied (0 or 1)

Note: For ILCM unit 0, card is in slot 19. For ILCM unit 1, card is in slot 20.

11 Post the C-side peripheral module, previously posted in step 5, where the PRLCM is interfaced by typing

>POST host_pm host_pm_no

and pressing the Enter key.

where

host_pm
is the name of the host PM, (PLGC, RCO2)

host_pm_no
is the number of the host PM

12 Using the information collected in step 7, busy both links associated with the faulty card by typing

>BSY LINK link_no

and pressing the Enter key.

where

link_no
is one of two links associated with the faulty card

Note: Repeat this step for the other link associated with the faulty card.

At the PRLCM cabinet

13

DANGER
Calls in progress may be interrupted.
The craftsperson must wait at least 15 minutes to allow calls in progress to be completed before removing the NT6X27 PCM-30 interface card.

Change dip switch settings on the new replacement card to match the faulty card being removed.

14 Replace the NT6X27 card using the common replacing a card procedure in this document. When the card has been replaced, return to this step.

NT6X27
in an OPM HIE (continued)

At the MAP display

15 Test the links busied in step 12 by typing

>TST LINK link_no

and pressing the Enter key.

where

link_no
is one of two links associated with the replacement card

Note: Repeat this step for the other link associated with the replacement card.

If test	Do
failed	step 23
passed	step 16

16 Return to service the links busied in step 12 by typing

>RTS LINK link_no

and pressing the Enter key.

where

link_no
is one of two links associated with the replacement card

Note: Repeat this entry for the other link associated with the replacement card.

If RTS	Do
failed	step 23
passed	step 17

17 Determine if there are remaining links to clear.

If there are	Do
remaining links to clear	step 12
no remaining links to clear	step 18

18 If you were directed to this procedure from another maintenance procedure, return now to the procedure that directed you here and continue as directed.

19 Post the ILCM by typing

>POST ILCM site frame lcm_no

and pressing the Enter key.

where

NT6X27
in an OPM HIE (end)

site
is the site name of the PRLCM (alphanumeric)

frame
is the frame number of the PRLCM cabinet

lcm_no
is the number of the ILCM

20 Return the busied unit to service by typing

>RTS UNIT lcm_unit

and pressing the Enter key.

where

lcm_unit
is the ILCM unit busied in step 10

If RTS	Do
failed	step 23
passed	step 21

21 Send any faulty cards for repair according to local procedure.

22 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Proceed to step 24.

23 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

24 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

NT6X36
in an OPM

Application

Use this procedure to replace the following card in an OPM.

PEC	Suffixes	Name
NT6X36	AA, AB	FSP alarm card
NT6X36	KA	FSP alarm and control card

Common procedures

None

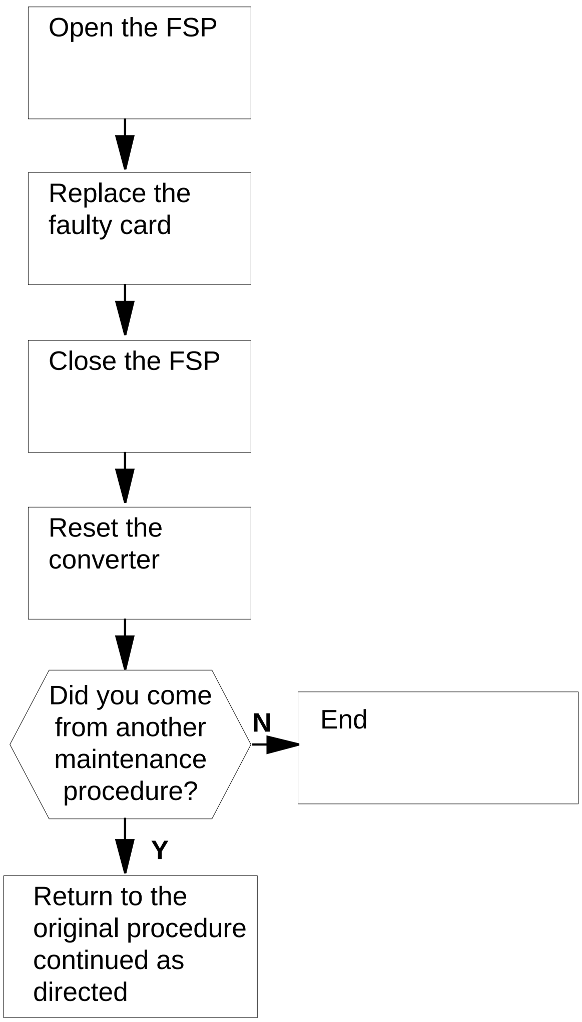
Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X36
in an OPM (continued)

Summary of replacing an NT6X36 card in an OPM

This flowchart summarizes the procedure. Use the instructions that follow to perform the procedure.



NT6X36
in an OPM (continued)

Replacing an NT6X36 card in an OPM

At your Current Location

1

> **WARNING**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist-strap grounding point of a frame supervisory panel (FSP) or a modular supervisory panel (MSP) while handling circuit cards. This protects the cards against damage caused by static electricity.

Obtain a replacement card. Ensure that the replacement card has the same product engineering code (PEC), including suffix, as the card being removed.

At the OPM cabinet

2

> **DANGER**
> **Risk of electrocution**
> Some of the terminals inside the frame supervisory panel (FSP) have an electrical potential of -48V dc. Remove all jewelry before replacing a card in the FSP. Do not touch any terminal in the FSP.

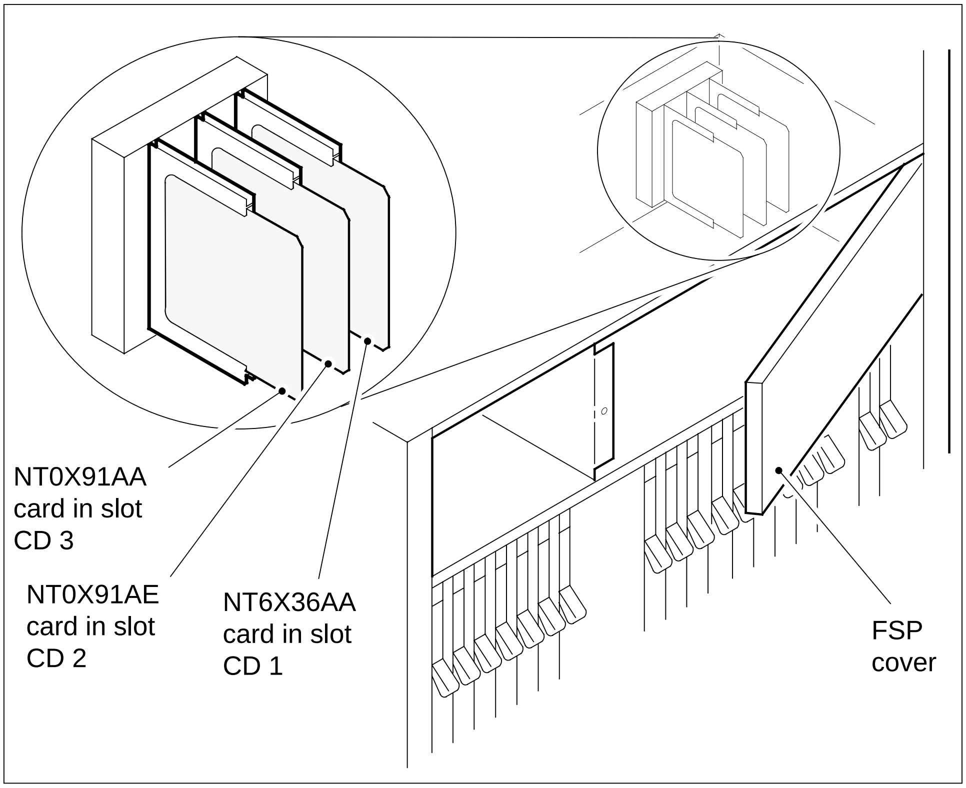
Unscrew the slotted nut on the left-hand side of the FSP.

3 Open the FSP panel.

4 Remove the alarm and control card.

NT6X36
in an OPM (continued)

FSP Alarm and control cards



5 Insert the replacement alarm and control card.

6 Close the FSP panel.

7 Tighten the slotted nut on the FSP.

Proceed as follows to reset the converter in each shelf that is controlled by the alarm and control card you have just replaced.

8 Press the RESET button.

If the CONVERTER FAIL LED is	Do
lit	step 11
not lit	step 9

9 The next action depends on your reason for performing this procedure.

If you were	Do
directed to this procedure from a maintenance procedure	step 10

NT6X36
in an OPM (end)

If you were	Do
not directed to this procedure from a maintenance procedure	step 12

10 Return to the maintenance procedure that sent you to this procedure and continue as directed.

11 For further assistance, contact the personnel responsible for the next level of support.

12 You have completed this procedure.

NT6X45
in an OPM HIE

Application

Use this procedure to replace the following card in an HIE shelf.

PEC	Suffixes	Name
NT6X45	AF	OPM ESA Processor (Master Processor-ESA)

Note: NT6X45 with suffix AF is the ESA processor supported only for OPM ESA.

Common procedures

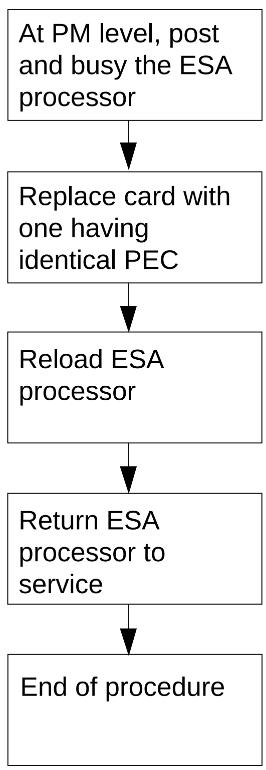
The common replacing a card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X45
in an OPM HIE (continued)

Summary of replacing an NT6X45 card in an HIE



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

NT6X45
in an OPM HIE (continued)

Replacing an NT6X45 card in an HIE

At your Current Location

1 Obtain a replacement card. Verify that the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

2 If you were directed to this procedure from another maintenance procedure, go to step 5; otherwise, continue with step 3.

At the MAP terminal

3 Post the ESA processor by typing

>MAPCI;MTC;PM;POST ESA esa_no

and pressing the Enter key.

where

esa_no
is the number of the ESA processor (0 to 255)

4 Busy the ESA processor by typing

>BSY

and pressing the Enter key.

Example of a MAP response:

```
This action will take this PM out of service
Please confirm (“Yes” or “No”)
```

Respond by typing

>YES

and pressing the Enter key.

At the OPM cabinet

5 Replace the NT6X45 card using the common replacing a card procedure in this document. When you have completed the procedure, return to this point.

6 If you were directed to this procedure from another maintenance procedure, return now to the procedure that directed you here and continue as directed; otherwise, continue with step 7.

7 Load the ESA processor by typing

>LOADPM

and pressing the Enter key.

If	Do
message “loadfile not found in directory" is received	step 8
load passes	step 26

NT6X45 in an OPM HIE (continued)

If	Do
load fails	step 29

8 Determine the type of device on which the PM load files are located.

If load files are located on	Do
tape	step 9
IOC disk	step 15
SLM disk	step 20

9 Locate the tape that contains the PM load files.

10 Mount the tape on a magnetic tape drive.

At the MAP terminal

11 Download the tape by typing

>MOUNT tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

12 List the contents of the tape in your user directory by typing

>LIST T tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

13 Demount the tape by typing

>DEMOUNT T tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

14 Go to step 25.

15 From office records, determine and note the number of the input/output controller (IOC) disk and the name of the volume that contains the PM load files.

16 Access the disk utility level of the MAP display by typing

>DSKUT

NT6X45
in an OPM HIE (continued)

and pressing the Enter key.

17 List the IOC file names into your user directory by typing

`>LISTVOL volume_name ALL`

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step15

18 Leave the disk utility by typing

`>QUIT`

and pressing the Enter key.

19 Go to step 25.

20 From office records, determine and note the number of the system load module (SLM) disk and the name of the volume that contains the PM load files.

21 Access the disk utility level of the MAP display by typing

`>DISKUT`

and pressing the Enter key.

22 List all SLM disk volumes into your user directory by typing

`>LV CM`

and pressing the Enter key.

23 List the SLM file names into your user directory by typing

`>LF volume_name`

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step 20

24 Leave the disk utility by typing

`>QUIT`

and pressing the Enter key.

25 Reload the ESA processor by typing

`>LOADPM`

and pressing the Enter key.

If loadpm	Do
failed	step 29

NT6X45
in an OPM HIE (end)

If loadpm	Do
passed	step 26

26 Return the ESA processor to service by typing

>RTS

and pressing the Enter key.

If RTS	Do
passed	step 27
failed	step 29

27 Send any faulty cards for repair according to local procedure.

28 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 30.

29 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

30 You have completed this procedure.

NT6X47 in an OPM HIE

Application

Use this procedure to replace the following card in an HIE shelf.

PEC	Suffixes	Name
NT6X47	AB, AC	Master Processor Memory (ESA) Plus

Common procedures

The common replacing a card procedure is referenced in this procedure.

Action

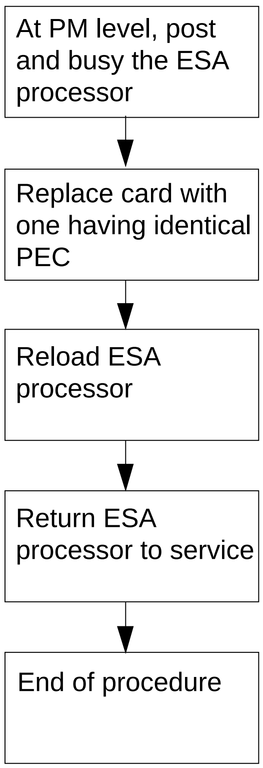
The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X47
in an OPM HIE (continued)

Summary of replacing an NT6X47 card in an HIE

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.



NT6X47
in an OPM HIE (continued)

Replacing an NT6X47 in an HIE

At your Current Location

1 Obtain a replacement card. Verify that the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

2 If you were directed to this procedure from another maintenance procedure, go to step 5; otherwise, continue with step 3.

At the MAP terminal

3 Post the ESA processor by typing

>MAPCI;MTC;PM;POST ESA esa_no

and pressing the Enter key.

where

esa_no
is the number of the ESA processor (0 to 255)

4 Busy the ESA processor by typing

>BSY

and pressing the Enter key.

Example of a MAP response:

```
This action will take this PM out of service
Please confirm (“Yes” or “No”)
```

Respond by typing

>YES

and pressing the Enter key.

At the OPM cabinet

5 Replace the NT6X47 card using the common replacing a card procedure in this document. When you have completed the procedure, return to this point.

6 If you were directed to this procedure from another maintenance procedure, return now to the procedure that directed you here and continue as directed; otherwise, continue with step 7.

NT6X47
in an OPM HIE (continued)

At the MAP terminal

7 Load the ESA processor by typing

>LOADPM

and pressing the Enter key.

If	Do
message “loadfile not found in directory" is received	step 8
load passed	step 26
load failed	step 29

8 Determine the type of device on which the PM load files are located.

If load files are located on	Do
tape	step 9
IOC disk	step 15
SLM disk	step 20

9 Locate the tape that contains the PM load files.

10 Mount the tape on a magnetic tape drive.

At the MAP terminal

11 Download the tape by typing

>MOUNT tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

12 List the contents of the tape in your user directory by typing

>LIST T tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

13 Demount the tape by typing

>DEMOUNT T tape_no

and pressing the Enter key.

NT6X47
in an OPM HIE (continued)

where

tape_no
is the number of the tape drive containing the PM load files

14 Go to step 25.

15 From office records, determine and note the number of the input/output controller (IOC) disk and the name of the volume that contains the PM load files.

16 Access the disk utility level of the MAP display by typing

>DSKUT

and pressing the Enter key.

17 List the IOC disk file names into your user directory by typing

>LISTVOL volume_name ALL

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step 15

18 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

19 Go to step 25.

20 From office records, determine and note the number of the system load module (SLM) disk and the name of the volume that contains the PM load files.

21 Access the disk utility level of the MAP display by typing

>DISKUT

and pressing the Enter key.

22 List the SLM disk volumes into your user directory by typing

>LV CM

and pressing the Enter key.

23 List the SLM file names into your user directory by typing

>LF volume_name

and pressing the Enter key.

where

volume_name
is the name of the volume containing the PM load files, obtained in step 20

24 Leave the disk utility by typing

>QUIT

NT6X47
in an OPM HIE (end)

and pressing the Enter key.

25 Reload the ESA processor by typing

>LOADPM

and pressing the Enter key.

If	Do
load fails	step 29
load passes	step 26

26 Return the ESA processor to service by typing

>RTS

and pressing the Enter key.

If RTS	Do
passed	step 27
failed	step 29

27 Send any faulty cards for repair according to local procedure.

28 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 30.

29 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

30 You have completed this procedure.

NT6X50
in an OPM HIE

Application

Use this procedure to replace the following card in an HIE shelf.

PEC	Suffixes	Name
NT6X50	AA	DS-1 Interface

Common procedures

The common replacing a card procedure is referenced in this procedure.

Action

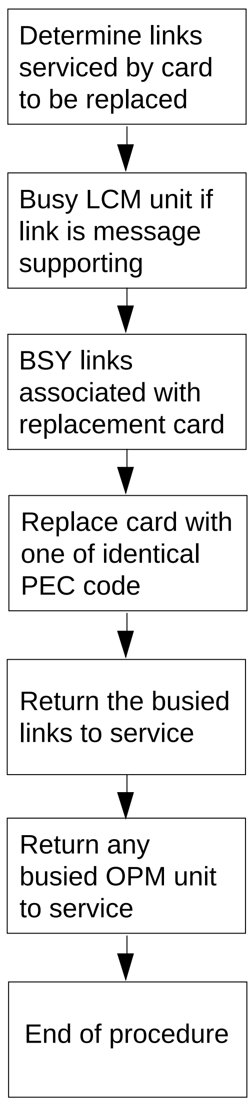
The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X50
in an OPM HIE (continued)

Summary of card replacement procedure for an NT6X50 card in an HIE

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.



NT6X50
in an OPM HIE (continued)

Replacing an NT6X50 card in an HIE

At your Current Location

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

2 If you were directed to this procedure from another maintenance procedure, go to step 4; otherwise, continue with step 3.

At the MAP display

3 Access the PM level and post the LCM by typing

>MAPCI;MTC;PM;POST LCM site frame lcm

and pressing the Enter key.

where

site
is the name of the OPM site (alphanumeric)

frame
is the frame number of the OPM (0 to 511)

lcm
is the number of the LCM

4 Display C-side link information by typing

> TRNSL C

and pressing the Enter key.

Example of a MAP response:

LTC P-side link numbers

```
Link 0: LTC 0       2; Cap MS; Status: OK    ;MsgCond: OPN
Link 1: LTC 0       6; Cap MS; Status: SysB  ;MsgCond: CLS
```

5 From the display in step 4, determine the C-side peripheral module (LTC, LGC, or RCC) to which the OPM is connected and post it by typing

> POST host_pm host_pm_no

and pressing the Enter key.

where

host_pm
is the name of the host PM (LTC, LGC, or RCC)

host_pm_no
is the number of the host PM

NT6X50
in an OPM HIE (continued)

6 Display P-side link information by typing

> TRNSL P

and pressing the Enter key.

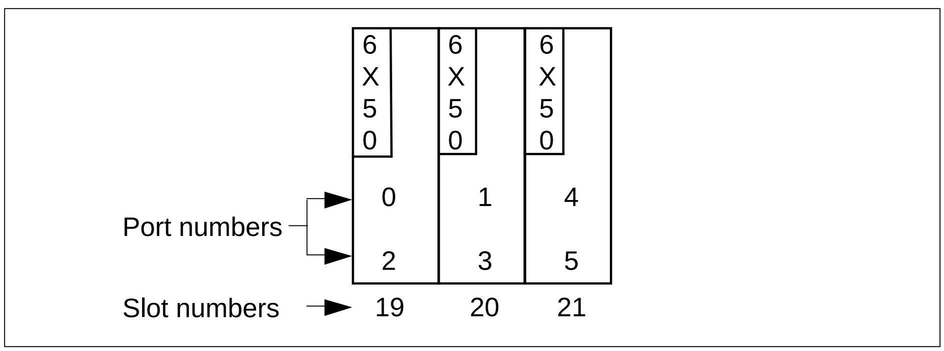
Example of a MAP response:

NT6X50 port numbers

```
Link 2: LCM REM1 00 0  0;Cap MS;Status:OK   ;MsgCond: OPN
Link 6: LCM REM1 00 0  1;Cap MS;Status:SysB ;MsgCond: CLS
```

7 Record the numbers of the links with status not OK.

Use the following diagram to determine which DS-1 interface card or cards corresponds to the links identified as faulty in step 6. Note that each NT6X50 card has 2 ports. For example, the faulty link 6 displayed in step 6 is connected to port 1 as indicated, which corresponds to the NT6X50 in slot 20.



8 Determine the slot location of the faulty card.

If faulty card is in slot	Do
19 or 20 of the HIE	step 9
21 of the HIE	step 12

9 Post the LCM by typing

>POST LCM site frame lcm

and pressing the Enter key.

where

site
is the name of the OPM site (alphanumeric)

frame
is the frame number of the OPM (0-511)

lcm
is the number of the LCM

NT6X50
in an OPM HIE (continued)

10 Busy LCM unit 0 for card in slot 19 or LCM unit 1 for card in slot 20 by typing

>BSY UNIT lcm_unit

and pressing the Enter key.

where

lcm_unit
is the OPM unit to be busied (0 for card in slot 19 or 1 for card in slot 20)

11 Post the C-side peripheral module, previously posted in step 5, where the OPM is interfaced by typing

>POST host_pm host_pm_no

and pressing the Enter key.

where

host_pm
is the name of the host PM, previously posted in step 5

host_pm_no
is the number of the host PM

12 Using the information collected in step 7, busy both links associated with the faulty card by typing

>BSY LINK link_no

and pressing the Enter key.

where

link_no
is one of two links associated with the faulty card

Note: Repeat this step for the other link associated with the faulty card.

At the OPM cabinet

13

DANGER
Calls in progress may be interrupted.
The craftsperson must wait at least 15 minutes to allow calls in progress to be completed before removing the NT6X50 DS-1 interface card.

Change dip switch settings on the new replacement card to match the faulty card being removed.

14 Replace the NT6X50 card using the common replacing a card procedure in this document. When the card has been replaced, return to this point.

NT6X50
in an OPM HIE (continued)

At the MAP display

15 Test the links busied in step 12 by typing

>TST LINK link_no

and pressing the Enter key.

where

link_no
is one of two links associated with the replacement card

Note: Repeat this step for the other link associated with the replacement card.

If test	Do
failed	step 24
passed	step 16

16 Return to service the links busied in step 12 by typing

>RTS LINK link_no

and pressing the Enter key.

where

link_no
is one of two links associated with the replacement card

Note: Repeat this entry for the other link associated with the replacement card.

If RTS	Do
failed	step 24
passed	step 17

17 Determine if there are remaining links to clear.

If there are	Do
remaining links to clear	step 12
no remaining links to clear	step 18

18 If you were directed to this procedure from another maintenance procedure, return now to the procedure that directed you here and continue as directed; otherwise, continue with step 19.

19 Determine if an LCM unit is manual busy.

If LCM unit	Do
is ManB	step 20

NT6X50
in an OPM HIE (end)

If LCM unit	Do
is not ManB	step 22

20 Post the LCM by typing

>POST LCM site frame lcm

and pressing the Enter key.

where

site
is the site name of the OPM (alphanumeric)

frame
is the frame number of the OPM (0 to 511)

lcm
is the number of the LCM

21 Return the busied unit to service by typing

>RTS UNIT lcm_unit

and pressing the Enter key.

where

lcm_unit
is the OPM unit busied in step 10

If RTS	Do
failed	step 24
passed	step 22

22 Send any faulty cards for repair according to local procedure.

23 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Proceed to step 25.

24 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

25 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

NT6X51 in an OPM

Application

Use this procedure to replace the following card in an OPM.

PEC	Suffixes	Name
NT6X51	AA, AB, AC	LCM Processor Card

Common procedures

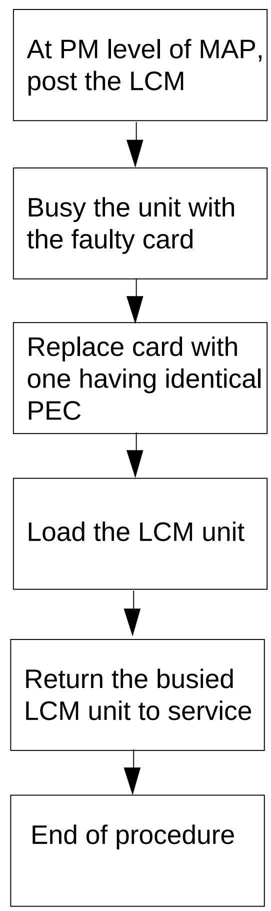
The common replacing a card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X51
in an OPM (continued)

Summary of card replacement procedure for NT6X51 card in an OPM



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

NT6X51
in an OPM (continued)

Replacing an NT6X51 card in an OPM

> **ATTENTION**
> Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure for verifying or accepting cards, or have been directed to this procedure by your maintenance support group.

At your Current Location

1

> **CAUTION**
> **Loss of service**
> This procedure includes directions to manually busy one or more peripheral module (PM) units. Since manually busying a PM unit can cause service degradation, perform this procedure only if necessary to restore out-of-service components. Otherwise, carry out this procedure during periods of low traffic.

Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

2 If you were directed to this procedure from another maintenance procedure, go to step 6; otherwise, continue with step 3.

At the MAP display

3 Access the PM level and post the LCM by typing

`>MAPCI;MTC;PM;POST LCM site frame lcm`

and pressing the Enter key.

where

site
is the site name of the OPM (alphanumeric)

frame
is the frame number of the OPM (0-511)

lcm
is the number of the LCM

NT6X51
in an OPM (continued)

4 Determine the state of the PM unit associated with the card you are replacing.

If the state of the PM unit is	Do
`SysB` , `CBsy`, `ISTb`, `InSv`	step 5
`ManB`	step 6
`Offl`	step 31

5 Busy the LCM unit containing the faulty card by typing

`>BSY UNIT lcm_unit`

and pressing the Enter key.

where

lcm_unit
is the LCM unit to be busied (0 or 1)

6

> **DANGER**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist-strap grounding point of a frame supervisory panel (FSP) or a modular supervisory panel (MSP) while handling circuit cards. This protects the cards against damage caused by static electricity.

Go to the common replacing a card procedure in this document to replace the NT6X51 card. When the card is replaced, return to this step.

7 If you were directed to this procedure from another maintenance procedure, return now to the procedure that directed you here and continue as directed; otherwise, continue with step 8.

At the MAP terminal

8 Load the LCM unit by typing

`>LOADPM UNIT lcm_unit CC`

and pressing the Enter key.

where

lcm_unit
is the LCM unit to be loaded (0 or 1)

If	Do
message “loadfile not found in directory" is received	step 9

NT6X51 in an OPM (continued)

If	Do
load passed	step 27
load failed	step 30

9 Determine the type of device on which the PM load files are located.

If load files are located on	Do
tape	step 10
IOC disk	step 16
SLM disk	step 21

10 Locate the tape that contains the PM load files.

At the OPM frame

11 Mount the tape on a magnetic tape drive.

At the MAP display

12 Download the tape by typing

`>MOUNT tape_no`

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

13 List the contents of the tape in your user directory by typing

`>LIST T tape_no`

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files.

14 Demount the tape drive by typing

`>DEMOUNT T tape_no`

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

15 Go to step 26.

NT6X51
in an OPM (continued)

16 From office records, determine and note the number of the input/output controller (IOC) disk and the name of the volume that contains the PM load files.

17 Access the disk utility level of the MAP by typing

>DSKUT

and pressing the Enter key.

18 List the IOC file names into your user directory by typing

>LISTVOL volume_name ALL

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step 16.

19 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

20 Go to step 26.

21 From office records, determine and note the number of the system load module (SLM) disk and the name of the volume that contains the PM load files.

22 Access the disk utility level of the MAP by typing

>DISKUT

and pressing the Enter key.

23 List the SLM disk volume names by typing

>LV CM

and pressing the Enter key.

24 List the SLM file names into your user directory by typing

>LF volume_name

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step 21.

25 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

26 Load the LCM unit by typing

>LOADPM UNIT lcm_unit CC

NT6X51
in an OPM (end)

and pressing the Enter key.

where

lcm_unit
is the LCM unit to be loaded (0 or 1)

If	Do
load failed	step 30
load passed	step 27

27 Return the LCM unit to service by typing

>RTS UNIT lcm_unit

and pressing the Enter key.

where

lcm_unit
is the LCM busied in step 5 (0 or 1)

If RTS	Do
passed	step 28
failed	step 30

28 Send any faulty cards for repair according to local procedure.

29 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card.

Go to step 32.

30 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

31 Consult office personnel to determine why the component is offline. Continue as directed by office personnel.

32 You have successfully completed this procedure.

NT6X52
in an OPM

Application

Use this procedure to replace the following card in an OPM.

PEC	Suffixes	Name
NT6X52	AA, AB	Digital Control Card (DCC)

Common procedures

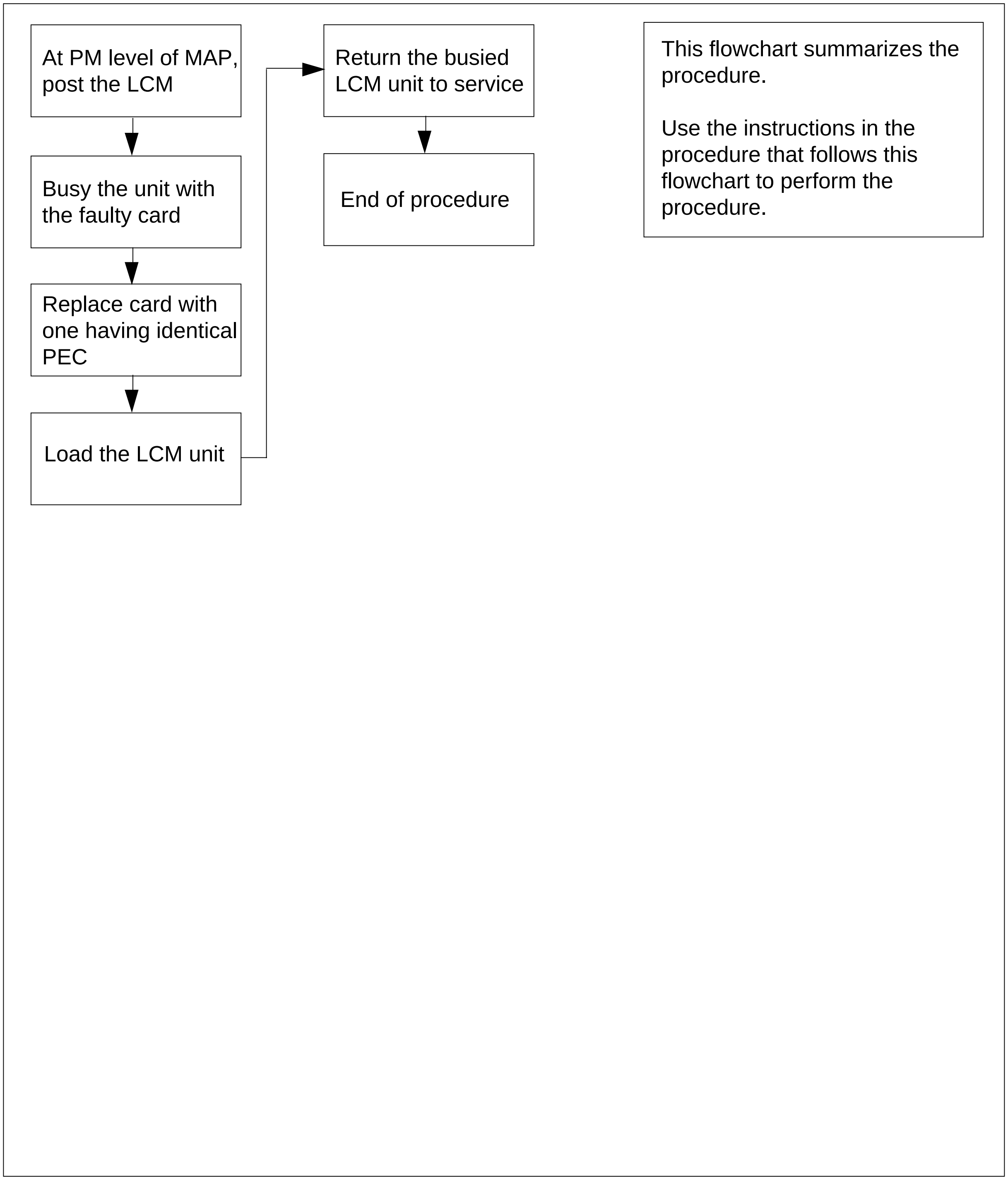
The common replacing a card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X52
in an OPM (continued)

Summary of card replacement procedures for an NT6X52 card in an OPM



NT6X52
in an OPM (continued)

Replacing an NT6X52 card in an OPM

At your Current Location

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

2 If you were directed to this procedure from another maintenance procedure, go to step 5; otherwise, continue with step 3.

At the MAP display

3 Access the PM level and post the LCM by typing

`>MAPCI;MTC;PM;POST LCM site frame lcm`

and pressing the Enter key.

where

site
is the site name of the OPM

frame
is the frame number of the OPM cabinet (0 to 511)

lcm
is the number of the LCM

4 Busy the LCM unit containing the faulty card by typing

`>BSY UNIT lcm_unit`

and pressing the Enter key.

where

lcm_unit
is the LCM unit to be busied (0 or 1)

At the OPM cabinet

5 Replace the NT6X52 card using the common replacing a card procedure in this document.

6 If you were directed to this procedure from another maintenance procedure, return now to the procedure that directed you here and continue as directed; otherwise, continue with step 7.

7 Load the LCM unit by typing

`>LOADPM UNIT lcm_unit CC`

and pressing the Enter key.

where

NT6X52
in an OPM (continued)

lcm_unit
is the LCM unit to be loaded (0 or 1)

If	Do
message “loadfile not found in directory" is received	step 8
load passed	step 26
load failed	step 29

8 Determine the type of device on which the PM load files are located.

If load files are located on	Do
tape	step 9
IOC disk	step 15
SLM disk	step 20

9 Locate the tape that contains the PM load files.

10 Mount the tape on a magnetic tape drive.

At the MAP display

11 Download the tape by typing

>MOUNT tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

12 List the contents of the tape in your user directory by typing

>LIST T tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

13 Demount the tape by typing

>DEMOUNT T tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

NT6X52
in an OPM (continued)

14 Go to step 25.

15 From office records, determine and note the number of the input/output controller (IOC) disk and the name of the volume that contains the PM load files.

16 Access the disk utility level of the MAP by typing

>DSKUT

and pressing the Enter key.

17 List the IOC file names into your user directory by typing

>LISTVOL volume_name ALL

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files obtained in step 15

18 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

19 Go to step 25.

20 From office records, determine and note the number of the system load module (SLM) disk and the name of the volume that contains the PM load files.

21 Access the disk utility level of the MAP by typing

>DISKUT

and pressing the Enter key.

22 List the SLM disk volume names by typing

>LV CM

and pressing the Enter key.

23 List the SLM file names into your user directory by typing

>LF volume_name

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files,obtained in step 20

24 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

NT6X52
in an OPM (end)

25 Reload the LCM unit by typing

>LOADPM UNIT lcm_unit CC

and pressing the Enter key.

where

lcm_unit
is the LCM unit to be loaded (0 or 1)

If	Do
load failed	step 29
load passed	step 26

26 Return the LCM unit to service by typing

>RTS UNIT lcm_unit

and pressing the Enter key.

where

lcm_unit
is the LCM busied in step 4 (0 or 1)

If RTS	Do
passed	step 27
failed	step 29

27 Send any faulty cards for repair according to local procedure.

28 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card.

Go to step 30.

29 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

30 You have successfully completed this procedure.

NT6X53
in an OPM

Application

Use this procedure to replace the following card in an OPM

PEC	Suffixes	Name
NT6X53	AA, BA, CA	Power Converter Card (5V/15V)

Common procedures

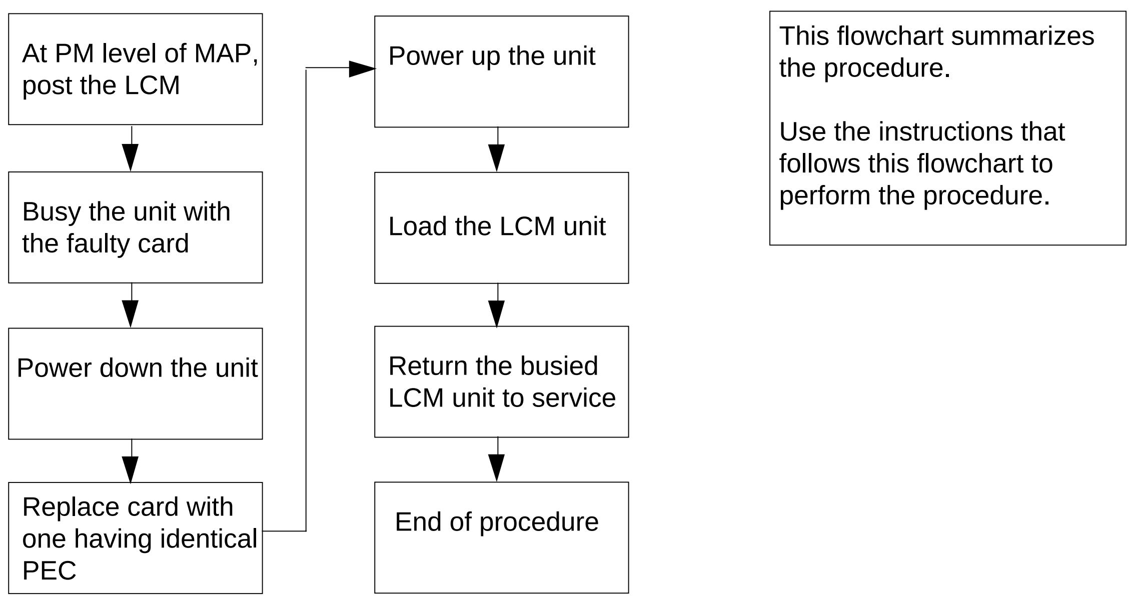
None

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X53
in an OPM (continued)

Summary of card replacement for NT6X53 card in an OPM



NT6X53
in an OPM (continued)

Replacing an NT6X53 card in an OPM

At your Current Location

1 Proceed only if you were either directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure to verify or accept cards, or were directed to this procedure by your maintenance support group.

2 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

At the MAP display

3 Access the PM level of the MAP and post the LCM by typing

>MAPCI;MTC;PM;POST LCM site frame lcm

and pressing the Enter key.

where

site
is the name of the OPM site

frame
is the frame number of the OPM cabinet (0 to 511)

lcm
is the number of the LCM

Example of a MAP display:

```
 CM    MS    IOD    Net    PM   CCS   LNS   Trks    Ext    Appl
  .     .     .      .    1LCM   .      .     .      .      .

LCM            SysB     ManB     OffL     CBsy     ISTb      InSv
 0 Quit    PM    0        1        0        0        0        130
 2 Post_   LCM   0        1        0        0        0          0
 3
 4 SwRg          LCM   Rem1  OO 0 ISTb   Links_OOS: CSide 0 PSide 0
 5 Trnsl         Unit-0:  InSv  Mtce TakeOver    /RG:  0
 6 Tst           Unit-1:  SysB  Mtce             /RG:  0
 7 Bsy                                 11 11 11 11 11 RG:Pref:0 InSv
 8 RTS           Drwr: 01 23 45 67 89 01 23 45 67 89    Stby:1 InSv
 9 OffL                .. .. .. .. .. .. .. .. .. ..
10 LoadPM
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

NT6X53
in an OPM (continued)

4 Busy the LCM unit containing the faulty card by typing

>BSY UNIT lcm_unit

and pressing the Enter key.

where

lcm_unit
is the LCM unit (0 or 1) to be busied

Example of a MAP display:

```
 CM    MS    IOD    Net    PM   CCS   LNS   Trks    Ext    Appl
  .     .     .      .    1LCM   .      .     .      .      .

 LCM           SysB     ManB     OffL     CBsy     ISTb      InSv
 0 Quit    PM    0        1        0        0        0       130
 2 Post_   LCM   0        1        0        0        0         0
 3
 4 SwRg            LCM   Rem1  OO 0 ISTb   Links_OOS: CSide 0 PSide 0
 5 Trnsl           Unit-0:  InSv  Mtce TakeOver    /RG:  0
 6 Tst             Unit-1:  ManB  Mtce             /RG:  0
 7 Bsy                                  11 11 11 11 11 RG:Pref:0 InSv
 8 RTS             Drwr: 01 23 45 67 89 01 23 45 67 89    Stby:1 InSv
 9 OffL                  .. .. .. .. .. .. .. .. .. ..
10 LoadPM
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

NT6X53
in an OPM (continued)

At the OPM cabinet

5 Turn the circuit breaker OFF for the unit in which the power converter is being replaced. Use the table below to determine which FSP circuit breaker serves the unit.

Circuit breaker	Unit FED	Locations
CB6	LCA 0	Shelf 04 slot 01 (OPM)
CB7	LCA 1	Shelf 21 slot 01 (OPM)
CB6	LCA 0	Row A bay 0 slot 01 (OPM-640)
CB6	LCA 0	Row A bay 0 slot 01 (OPM-256)
CB7	LCA 1	Row A bay 0 slot 01 (OPM-640)
CB7	LCA 1	Row A bay 0 slot 23 (OPM-256)

Note: For the NTNX14AA cabinet the circuit breaker assignments are:

Circuit breaker	Unit FED	Locations
CB2	LCA 0	bay 0 slot 01
CB7	LCA 1	bay 0 slot 01

6 Replace the NT6X53 card as shown in the following figures.

NT6X53 in an OPM (continued)

7

DANGER
Card damage—transport
Take these precautions to protect the circuit cards from electrical and mechanical damage during transportation:When handling a circuit card not in an electrostatic discharge (ESD) protective container, stand on a conductive floor mat and wear a wrist strap connected, through a 1-megohm resistor, to a suitably grounded object, such as a metal workbench or a DMS frame (Northern Telecom Corporate Standard 5028).Store and transport circuit cards in an ESD protective container.

DANGER
Static electricity damage
Before removing any cards, put on a wrist strap and connect it to the wrist strap grounding point on the left side of the frame supervisory panel of the LCM. This protects the equipment against damage caused by static electricity.

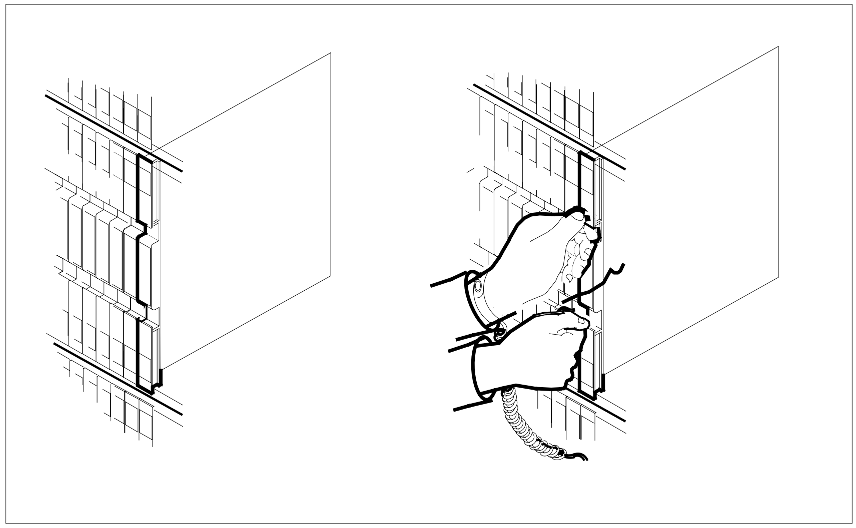
DANGER
Equipment damage
Take these precautions when removing or inserting a card:1. Do not apply direct pressure to the components.
2. Do not force the cards into the slots.

Put on a wrist strap.

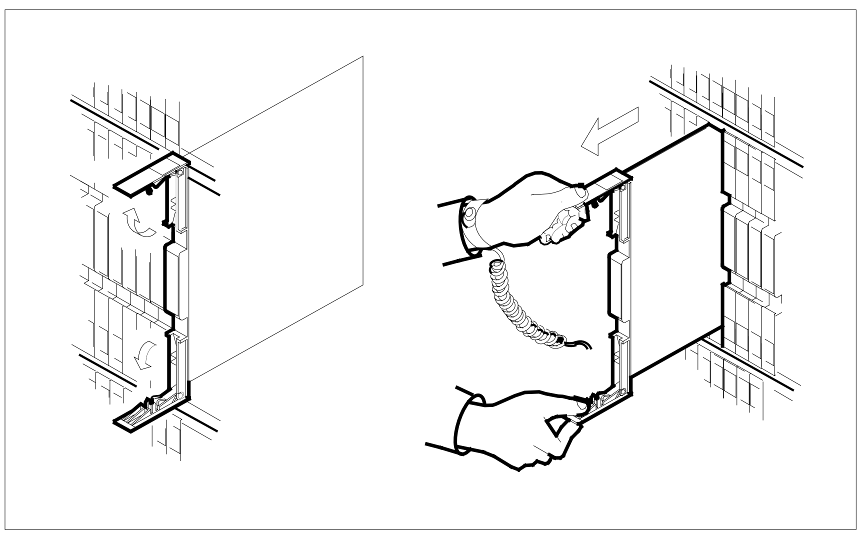
8 Remove the NT6X53 card as shown in the following figures.

a Locate the card to be removed on the appropriate shelf.

NT6X53
in an OPM (continued)



b Open the locking levers on the card to be replaced and gently pull the card towards you until it clears the shelf.

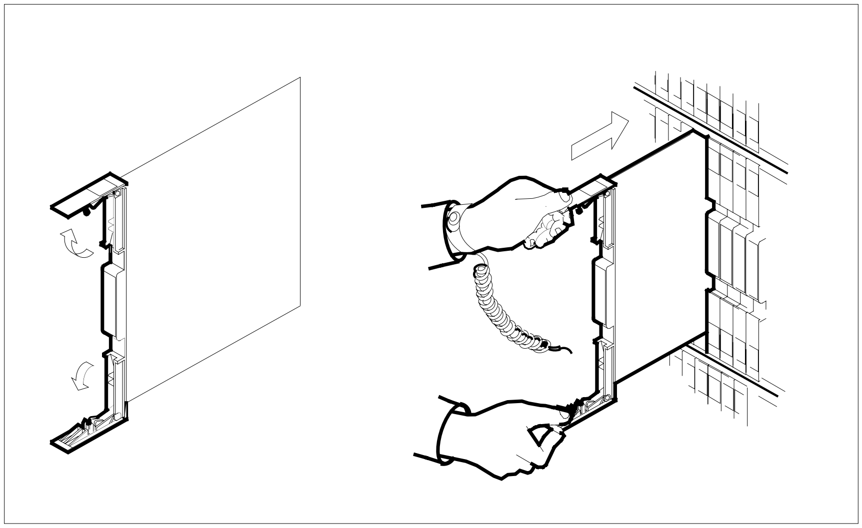


c Ensure that the replacement card has the same PEC including suffix, as the card you just removed.

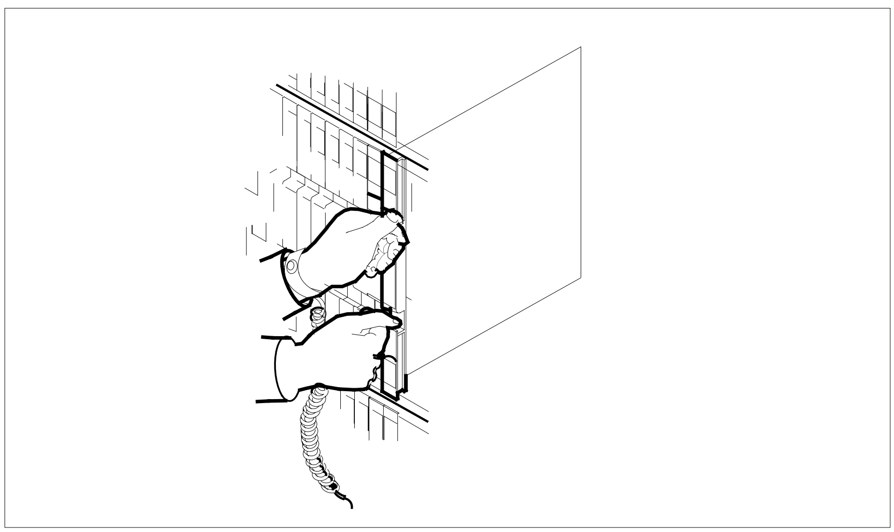
9 Open the locking levers on the replacement card.

a Align the card with the slots in the shelf and gently slide the card into the shelf.

NT6X53 in an OPM (continued)



10 Seat and lock the card.



a Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure that the card is fully seated in the shelf.

b Close the locking levers.

11 Power up the LCM unit as follows:

1. Ensure that the power converter (NT6X53) is inserted. A major audible alarm may sound. This alarm is silenced when power is restored to the converter.

2. Set the circuit breaker to the ON position. The converter fail LED and frame fail lamp on the FSP will be extinguished.

NT6X53
in an OPM (continued)

Determine the correct FSP switch for the shelf in which the power converter was replaced from the diagram below. The switches are numbered corresponding to the shelf position.

Circuit breaker	Unit FED	Locations
CB6	LCA 0	Shelf 04 slot 01 (OPM)
CB7	LCA 1	Shelf 21 slot 01 (OPM)
CB6	LCA 0	Row A bay 0 slot 01 (OPM-640)
CB6	LCA 0	Row A bay 0 slot 01 (OPM-256)
CB7	LCA 1	Row A bay 0 slot 01 (OPM-640)
CB7	LCA 1	Row A bay 0 slot 23 (OPM-256)

3. Turn the circuit breaker on for the unit with the new power converter.
   a. The converter fail LED will be extinguished.
   b. The frame fail lamp on the FSP will be extinguished.

12 If you were directed to this procedure from another maintenance procedure, return now to the procedure that directed you here and continue as directed; otherwise, continue with step 13.

At the MAP display

13 Load the LCM unit by typing

`>LOADPM UNIT lcm_unit CC`

and pressing the Enter key.

where

lcm_unit
is the LCM unit (0 or 1)to be loaded

If	Do
message “loadfile not found in directory" is received	step 14
load pases	step 33

NT6X53
in an OPM (continued)

If	Do
load fails	step 37

14 Determine the type of device on which the PM load files are located.

If load files are located on	Do
tape	step 15
IOC disk	step 21
SLM disk	step 26

15 Locate the tape that contains the PM load files.

At the OPM cabinet

16 Mount the tape on a magnetic tape drive.

At the MAP display

17 Download the tape by typing

>MOUNT tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

18 List the contents of the tape in your user directory by typing

>LIST T tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files.

19 Release the tape drive from your user directory by typing:

>DEMOUNT T tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive mounted in step 17.

20 Go to step 31.

21 From office records, determine and note the number of the input/output controller (IOC) disk and the name of the volume that contains the PM load files.

NT6X53
in an OPM (continued)

22 Access the disk utility level of the MAP by typing

>DSKUT

and pressing the Enter key.

23 List the IOC file names into your user directory by typing

>LISTVOL volume_name ALL

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step 21.

24 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

25 Go to step 31.

26 From office records, determine and note the number of the system load module (SLM) disk and the name of the volume that contains the PM load files.

27 Access the disk utility level of the MAP by typing

>DISKUT

and pressing the Enter key.

28 List the SLM disk volume names by typing

>LV CM

and pressing the Enter key.

29 List the SLM file names into your user directory by typing

>LF volume_name

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step 26.

30 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

31 Load the LCM unit by typing

>LOADPM UNIT lcm_unit CC

and pressing the Enter key.

where

NT6X53 in an OPM (end)

lcm_unit
is the LCM unit (0 or 1)to be loaded

If	Do
load failed	step 37
load passed	step 32

32 Use the following information to determine the next step in this procedure.

If you entered this procedure	Do
an alarm clearing procedure	step 36
other	step 33

33 Return the LCM unit to service by typing

`>RTS UNIT lcm_unit`

and pressing the Enter key.

where

lcm_unit
is the LCM (0 or 1) busied in step 4

If RTS	Do
passed	step 34
failed	step 37

34 Send any faulty cards for repair according to local procedure.

35 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card.

Go to step 38.

36 Return to the *Alarm Clearing Procedure* that directed you to this procedure. If necessary, go to the point where the faulty card list was produced, identify the next faulty card on the list, and go to the appropriate card replacement procedure for that card in this manual.

37 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

38 You have successfully completed this procedure.

NT6X54 in an OPM

Application

Use this procedure to replace the following card in an OPM.

PEC	Suffixes	Name
NT6X54	AA	Bus interface card (BIC)
NT6X54	DA	ISDN drawer controller (IDC) card (BIC) ***Note:*** Peripherals with ISDN line drawer for remotes (ILDR) must use the NT6X54DA card. ILDR is first available for remote switching center-SONET (RSC-S) and remote switching center (RSC) configurations in the NA007/XPM08 timeframe. ILDR is first available for remote line concentrating module (RLCM), outside plant module (OPM), and outside plant access cabinet (OPAC) configurations in the NA008/XPM81 timeframe.

Common procedures

None

Action

The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X54
in an OPM (continued)

Summary of card replacement procedure for an NT6X54 card in an OPM

At PM level, post the LCM

↓

Busy LSGs of drawer containing faulty card

↓

Remove –48, +15, and +5 volt fuses

↓

Replace the faulty card with one of same PEC

↓

Replace +5, +15, and –48 volt fuses

↓

Return the drawer to service

↓

End of procedure

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

NT6X54
in an OPM (continued)

Replacing an NT6X54 in an OPM

At your Current Location

1

> **ATTENTION**
> If you are entering this procedure due to a loss of power in the LCM's controller (LGC/LTC/RCC), check logutil for PM181 log with reason text of: DCC BIC Looparound and go to step 10.

Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure for verifying or accepting cards, or have been directed to this procedure by your maintenance support group.

2 Obtain a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

3 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 10. Otherwise, continue with step 4.

At the MAP terminal

4 Access the peripheral module (PM) level of the MAP (maintenance and administration position) display and post the OPM by typing

`>MAPCI;MTC;PM;POST OPM site frame opm`

and pressing the Enter key.

where

site
is the site name (alphanumeric) of the OPM

frame
is the frame number (0 through 511) of the OPM cabinet

lcm
is the number (0 or 1) of the LCM

Example of a MAP display:

NT6X54
in an OPM (continued)

```
 CM    MS    IOD    Net    PM   CCS   LNS   Trks    Ext    Appl
  .     .     .      .    1LCM   .      .     .      .      .

LCM            SysB     ManB     OffL     CBsy     ISTb      InSv
 0 Quit    PM    0        1        0        0        0       130
 2 Post_   LCM   0        1        0        0        0         0
 3
 4 SwRg         LCM   Rem1  OO 0 ISTb   Links_OOS: CSide 0 PSide 0
 5 Trnsl        Unit-0:  InSv  Mtce       /RG:  0
 6 Tst          Unit-1:  InsV  Mtce       /RG:  0
 7 Bsy                               11 11 11 11 11 RG:Pref:0 InSv
 8 RTS          Drwr: 01 23 45 67 89 01 23 45 67 89    Stby:1 InSv
 9 OffL               .. .. SS .. .. .. .. .. .. ..
10 LoadPM
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

Note: ILDR drawers are identified in reverse video on the MAP display.

5 Determine whether or not you need to access the ILD level on the MAP terminal.

If the card you are replacing is	Do
NT6X54DA	step 6
NT6X54AA	step 9

6 Access the ILD level on the MAP terminal by typing

>ILD

and pressing the Enter key.

7 Post the ILDR drawer in which the card is being replaced by typing

>POST drawer_no

and pressing the Enter key.

where

drawer_no
is the ILD drawer number (0 through 19) in the LCM

8 Busy both line subgroups associated with the LCM drawer in which the card is being replaced by typing

>BSY DRWR

and pressing the Enter key.

NT6X54
in an OPM (continued)

Example of a MAP response;

```
Please confirm (“YES,” “Y,” “NO,” or “N”):
```

Confirm the system prompt by typing

>YES

and pressing the Enter key.

Go to step 10.

9 Busy both line subgroups associated with the OPM drawer in which the card is being replaced by typing

>BSY DRWR lsg

and pressing the Enter key.

where

lsg
is one of two line subgroups (0 through 19) associated with the drawer

Example of a MAP response:

```
LCM REM1 00 0  Drwr 4 will be taken out of service
Please confirm (“YES,” “Y,” “NO,” or “N”):
```

Confirm the system prompt by typing

>YES

and pressing the Enter key.

Note: Repeat this step for the other line subgroup associated with the line drawer.

Example of a MAP display:

NT6X54
in an OPM (continued)

```
 CM     MS     IOD     Net     PM    CCS    LNS    Trks     Ext     Appl
  .      .      .       .     1LCM    .      .      .        .       .

LCM             SysB      ManB      OffL      CBsy      ISTb       InSv
 0 Quit    PM    0         1         0         0         0        130
 2 Post_   LCM   0         1         0         0         0          0
 3
 4 SwRg          LCM   Rem1  OO O ISTb   Links_OOS: CSide 0 PSide 0
 5 Trnsl         Unit-0:  InSv  Mtce       /RG:  0
 6 Tst           Unit-1:  InsV  Mtce       /RG:  0
 7 Bsy                                11 11 11 11 11 RG:Pref:0 InSv
 8 RTS           Drwr: 01 23 45 67 89 01 23 45 67 89    Stby:1 InSv
 9 OffL                .. .. MM .. .. .. .. .. .. ..
10 LoadPM
11 Disp_
12 Next
13
14 QueryPM
15
16
17
18
```

At the OPM cabinet

10 Remove the -48V fuse for the line drawer containing the faulty bus interface card.

11 Remove the +15V fuse for the line drawer containing the faulty bus interface card.

12 Remove the +5V fuse for the line drawer containing the faulty bus interface card.

If entry into this procedure is due to	Do
replacement of BIC	step 13
loss of power in LCM's controller	step 17

NT6X54
in an OPM (continued)

13

DANGER
Static electricity damage
Before removing any cards, put on a wrist strap and connect it to the wrist strap grounding point on the left side of the frame supervisory panel (FSP) of the OPM. This protects the equipment against damage caused by static electricity.

DANGER
Card damage—transport
Take the following precautions to protect circuit cards from electrical and mechanical damage during transport:

When handling a circuit card not in an electrostatic discharge (ESD) protective container, stand on a conductive floor mat. Wear a wrist strap connected, through a 1-megohm resistor, to a suitably grounded object, such as a metal workbench or a DMS switch cabinet (Nortel [Northern Telecom] Corporate Standard 5028). Store and transport circuit cards in an ESD protective container.

DANGER
Equipment damage
Take the following precautions when removing or inserting a card:

1. Do not apply direct pressure to the components.
2. Do not force the cards into the slots.

DANGER
Hot materials
Exercise care when handling the line card. The line feed resistor may be very hot.

Put on a wrist strap.

14 Open the line drawer by following these substeps:

a Face the drawer shelf and grasp the lip at the bottom of the drawer.

NT6X54
in an OPM (continued)

b Push up on the drawer latch with your thumb and pull the drawer out approximately 15.0 cm (about 6.0 in).

15 Remove the BIC to be replaced by following these substeps:

a Open the locking levers on the BIC.

b Grasping the open locking levers, remove the card from the line drawer in one steady motion. The card will unplug from its socket.

Note: Do not use a rocking motion to remove the card.

16 Replace the faulty card by following these substeps:

a Remove the replacement card from the ESD container.

b Open the locking levers on the card.

c Position the card in its backplane socket. In one steady motion, push against the top and bottom of the card with your thumbs until the card plugs fully into the backplane socket, close and lock the locking levers.

Note: Do not use a rocking motion to insert the card.

d Close the line drawer.

17 Replace the +5V fuse for the line drawer containing the faulty bus interface card.

18 Replace the +15V fuse for the line drawer containing the faulty bus interface card.

19 Replace the -48V fuse for the line drawer containing the faulty bus interface card.

20 If you were directed to this procedure from the *Alarm clearing procedure* , return now to the main procedure that directed you here. Otherwise, continue with step 21.

At the MAP terminal

21 Determine which procedure to use to return the line subgroups to service.

If the card you are replacing is	Do
NT6X54AA	step 22
NT6X54DA	step 23

22 Return the line subgroups to service by typing

>RTS DRWR lsg

and pressing the Enter key.

where

lsg
is one of two line subgroups (0 through 19) associated with the drawer

NT6X54
in an OPM (end)

Note: Repeat this step for the other line subgroup associated with the line drawer.

If RTS	Do
passed	step 24
failed	step 26

23 Return the line subgroups to service by typing

>RTS DRWR

and pressing the Enter key.

If RTS	Do
passed	step 24
failed	step 26

24 Send any faulty cards for repair according to local procedure.

25 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 27.

26 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

27 You have successfully completed this procedure.

NT6X60
in an OPM HIE

Application

Use this procedure to replace the following card in a host interface environment (HIE).

PEC	Suffixes	Name
NT6X60	AA, BA, CA , DA	North American ringing Generator (RG)

A summary of the card replacement procedure for the NT6X60 in a HIE is shown below. The procedure used to perform the task follows the flowchart.

Common procedures

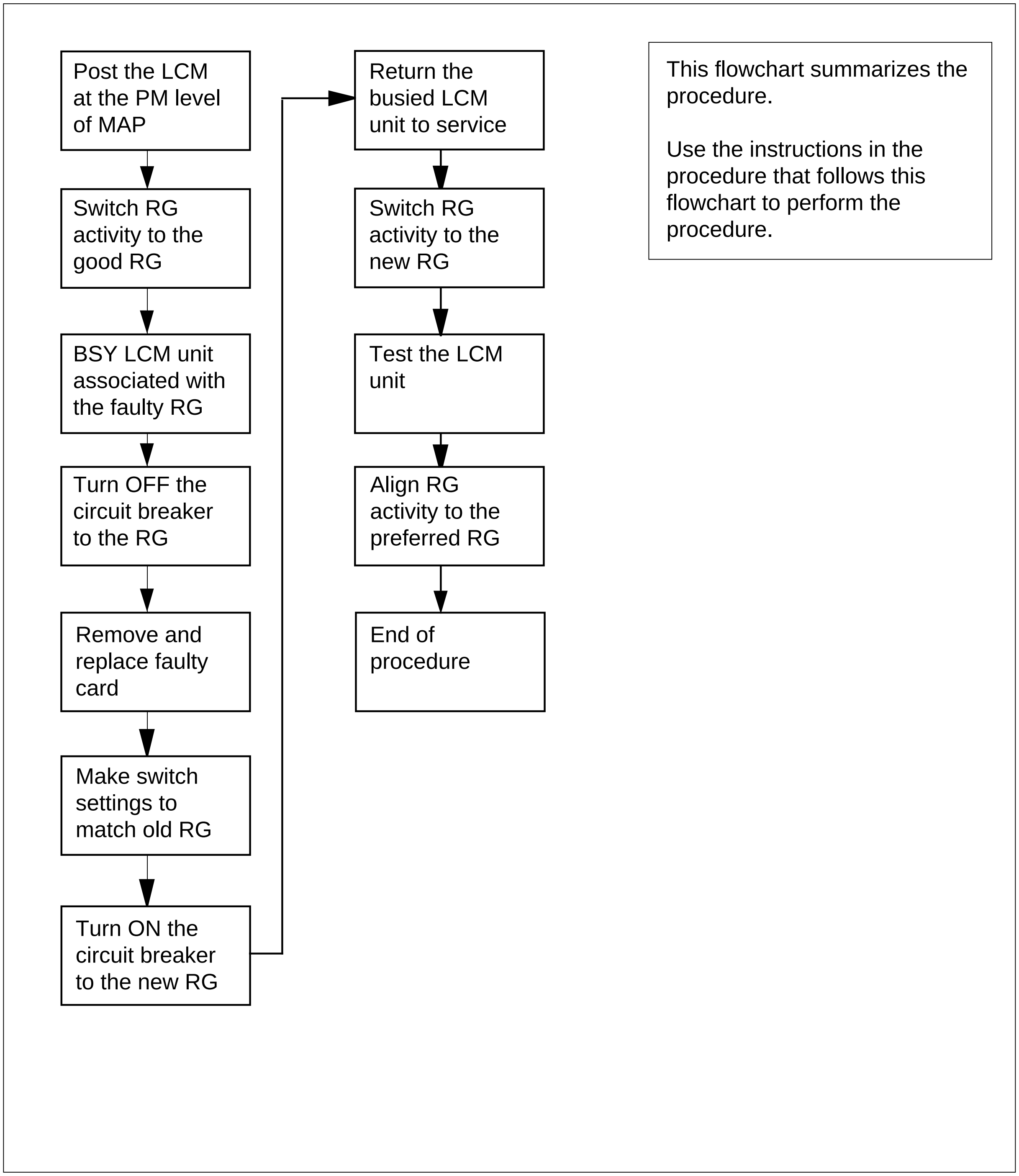
None

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X60
in an OPM HIE (continued)

Summary of card replacement procedures for an NT6X60 card in an HIE



NT6X60 in an OPM HIE (continued)

Replacing an NT6X60 card in an HIE

At your Current Location

1

CAUTION
Loss of service
This procedure includes directions to manually busy one or more peripheral module (PM) units. Since manually busying a PM unit can cause service degradation, perform this procedure only if necessary to restore out-of-service components. Otherwise, carry out this procedure during periods of low traffic.

Proceed only if you were either directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure for verifying or accepting cards, or were directed to this procedure by your maintenance support group.

2 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC) including suffix, as the card that is to be removed.

3 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 9. Otherwise, continue with step 4.

At the MAP

4 Access the PM level and post the LCM by typing

`>MAPCI;MTC;PM;POST LCM site frame lcm`

and pressing the Enter key.

where

site
is the name of the site at which the LCM is located

frame
is the number of the frame (0 to 511)

lcm
is the number of the LCM (0 to 199)

Example of a MAP display:

NT6X60
in an OPM HIE (continued)

```
LCM   REM1    00 0   ISTb    LINKS    OOS:   Cside 0 Pside 0
Unit 0:       ISTb           /RG:1
Unit 1:       InSv           /RG:1

                           11 11 11 11 11RG: Pref 0 ISTb
Drwr: 01 23 45 67 89 01 23 45 67 89         Stby 1 InSv
          .. .. .. .. .. .. .. .. .. ..
```

5 Determine the line concentrating array (LCA) associated with the NT6X60 card to be replaced by using the following table.

LCM unit	RG card	HIE slot
LCA-0	RG-0	1, 2, 3, 4
LCA-1	RG-1	5, 6, 7, 8

6 Check the state of the PM units.

If the PM units are	Do
OFFL or SysB	step 8
One unit is InSv or ISTb the other unit is ISTB or SysB	step 7

7 Switch ringing generator activity to the good NT6X60 card by typing

>SWRG UNIT unit_no

and pressing the Enter key.

where

lcm_unit
is the LCM unit (0 or 1) aligned to the faulty RG

Note: If necessary repeat this step until both units of the LCM are aligned to the good RG.

If the SWRG command	Do
passed	step 8
failed	step23

8 Busy the LCM unit associated with the faulty RG by typing

>BSY UNIT lcm_unit

NT6X60 in an OPM HIE (continued)

and pressing the Enter key.

where

lcm_unit
is the LCM unit (0 or 1) as seen in step 5

At the OPM cabinet

9 Turn OFF the circuit breaker for the ringing generator to be replaced by using the information in the following table:

IfCircuit breaker	DoRinging Generator
CB2	RG-0
CB3	RG-1

10

DANGER
Static electricity damage
Before removing any cards, put on a wrist strap and connect it to the wrist strap grounding point on the left side of the frame supervisory panel of the OPM cabinet. This protects the equipment against damage caused by static electricity.

DANGER
Equipment damage
Take these precautions when removing or inserting a card:1. Do not apply direct pressure to the components.2. Do not force the cards into the slots.

Put on a wrist strap.

NT6X60
in an OPM HIE (continued)

At the HIE

11 Remove the NT6X60 card as follows:

1. Locate the card to be removed on the appropriate shelf.

2. Open the locking levers on the card to be replaced and gently pull the card towards you until it clears the shelf.

3. Place the card you have removed in an electrostatic discharge (ESD) protective container.

4. Examine the switch settings (if any) of the card just removed. Ensure that the switch settings on the replacement card match those of the card being replaced.

5. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card you just removed.

12 Open the locking levers on the replacement card. Align the card with the slots in the shelf and gently slide the card into the shelf.

13 Seat and lock the card.

1. Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure that the card is fully seated in the shelf.

2. Close the locking levers.

At the OPM cabinet

14 Turn ON the circuit breaker turned OFF in step 9.

15 Remove the wrist strap.

16 If you were directed to this procedure from the *Alarm Clearing Procedures*, return now to the alarm clearing procedure that directed you here. Otherwise, continue with step 17.

At the MAP terminal

17 Return the LCM unit to service by typing

`>RTS UNIT lcm_unit`

and pressing the Enter key.

where

lcm_unit
is the number of the LCM unit busied in step 8

If RTS	Do
passed	step 18
fai led	step 23

18 Switch ringing generator activity to the new NT6X60 card by typing

`>SWRG UNIT unit_no`

and pressing the Enter key.

NT6X60
in an OPM HIE (continued)

where

lcm_unit
is the LCM unit (0 or 1)

Note: Repeat this step until both units of the LCM are aligned to the new RG.

If SWRG command	Do
passed	step 19
failed	step 23

19 Test the new RG by typing

>TST UNIT lcm_unit_no

and pressing the Enter key.

where

lcm_unit_no
is the number of the LCM unit posted in step 4

Example of a MAP response:
LCM REM1 14 1 Unit 0 InSvce Tests Initiated LCM REM1 14 1 Unit 0 Tst Passed

If TST	Do
passed	step20
failed	step 23

20 If required align RG activity to the preferred RG by typing

>SWRG UNIT unit_no

and pressing the Enter key.

where

unit_no
is the number of the LCM unit (0 or 1)

Note: Repeat this step until both units of the LCM are aligned to the preferred RG.

If the SWRG command	Do
passed	step 21
failed	step 23

21 Send any faulty cards for repair according to local procedure.

NT6X60
in an OPM HIE (end)

22 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to Step 24

23 Obtain further assistance in replacing this card by contacting personnel responsible for a higher level of support.

24 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

NT6X71
in an OPM

Application

Use this procedure to replace the following card in an OPM.

PEC	Suffixes	Name
NT6X71	AA	Data line card DMS-100/SL-100

Common procedures

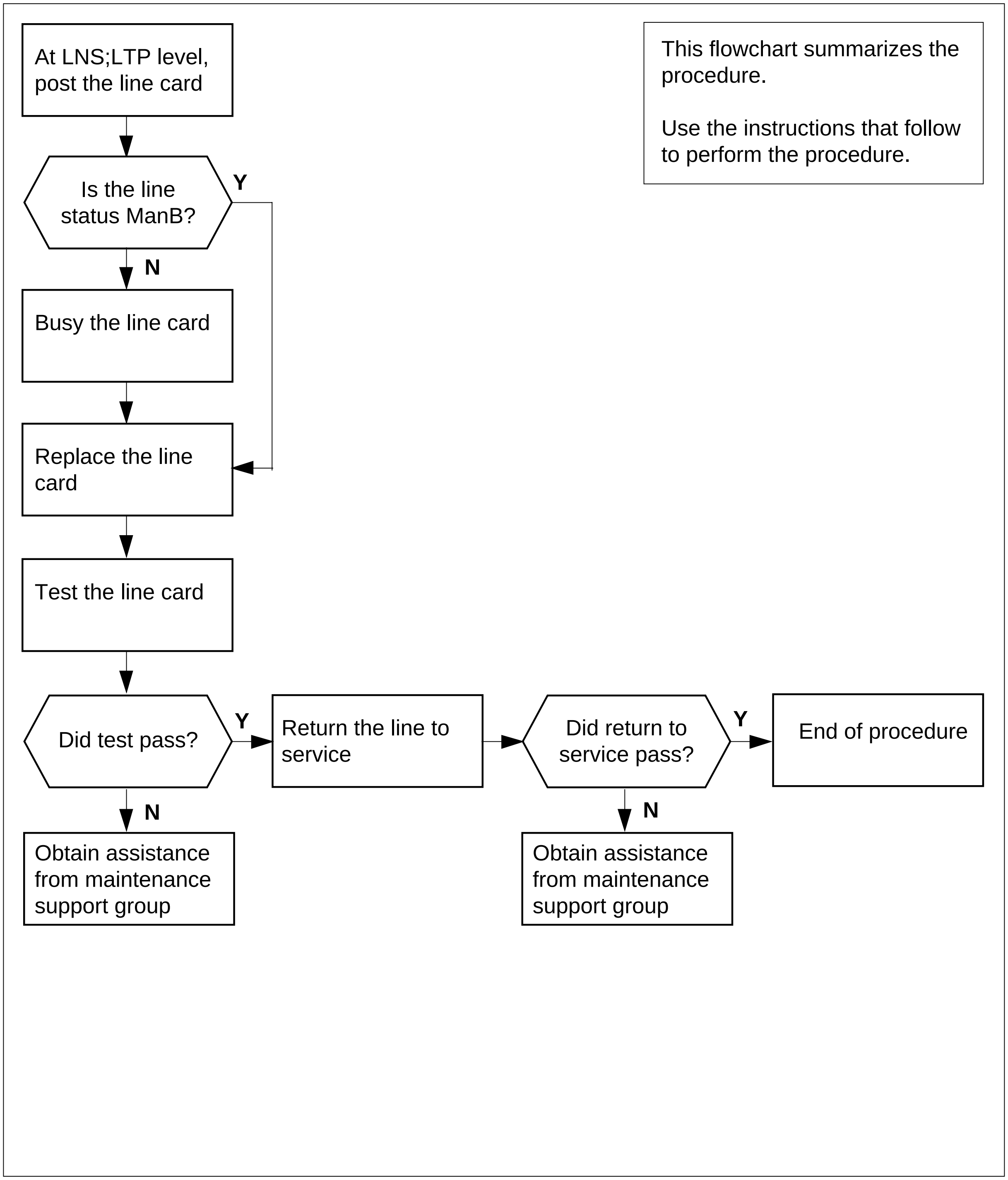
The common replacing a line card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X71
in an OPM (continued)

Summary of card replacement procedures for an NT6X71 card in an OPM



NT6X71
in an OPM (continued)

Replacing an NT6X71 card in an OPM

At your Current Location

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

At the MAP terminal

2 Access the line test position (LTP) level of the MAP display and post the line associated with the card to be replaced by typing

>MAPCI;MTC;LNS;LTP;POST L site lcm lsg ckt

and pressing the Enter key.

where

site
is the name of the site where the OPM is located

lcm
is the number of the OPM with the faulty card

lsg
is the number of the line subgroup with the faulty card

ckt
is the number of the circuit associated with the faulty card

Example of a MAP display:

```
LCC PTY RNG .....LEN..........  DN   STA F S LTA TE RESULT
1FR      REM1 00 0 03 03     7213355 MB
```

3 Check the status of the posted line.

If the line status is	Do
ManB	step 5
not ManB	step 4

4 Busy the line by typing

>BSY

and pressing the Enter key.

5 Go to the common replacing a line card procedure in this document. When you have completed the procedure, return here.

NT6X71
in an OPM (end)

At the MAP

6 Test the line card just replaced by typing

>DIAG

and pressing the Enter key.

If the DIAG	**Do**
passed	step 7
failed	step 10

7 Return the line card to service by typing

>RTS

and pressing the Enter key.

If RTS	**Do**
passed	step 8
failed	step 10

8 Send any faulty cards for repair according to local procedure.

9 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 11.

10 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

11 You have successfully completed this procedure.

NT6X73 in an OPM HIE

Application

Use this procedure to replace the following card in a host interface equipment (HIE) shelf.

PEC	Suffixes	Name
NT6X73	AA	Link Control Card (LCC)

Common procedures

The common replacing a card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X73
in an OPM HIE (continued)

Summary of card replacement procedures for an NT6X73 card in an HIE

At the PM level of the MAP terminal, post the LCM

↓

Busy the LCM unit associated with faulty card

↓

Replace card with one of identical PEC code

↓

Return the LCM unit to service

↓

This procedure is complete

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.

Replacing an NT6X73 card in an HIE

At your Current Location

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure for verifying or accepting cards, or have been directed to this procedure by your maintenance support group.

2 Obtain a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

3 If you were directed to this procedure from another maintenance procedure, go to step 7. Otherwise, continue with step 4.

NT6X73
in an OPM HIE (continued)

At the MAP terminal

4 Access the peripheral module (PM) level and post the line concentrating module (LCM) by typing

>MAPCI;MTC;PM;POST LCM site frame lcm

and pressing the Enter key.

where

site
is the site name of the OPM (alphanumeric)

frame
is the frame number of the OPM cabinet (0 to 511)

lcm
is the number of the LCM

5 Use the following table to determine which LCM unit is associated with the faulty NT6X73.

LCM unit	LCC card	LCC slot
0	LCC0	17
1	LCC1	18

6

CAUTION
Loss of service
This procedure contains directions to busy one or more peripheral modules (PM) in a frame. Since busying a PM affects subscriber service, replace the link control card (LCC) only during periods of low traffic

Busy the LCM unit associated with the faulty NT6X73 by typing

>BSY UNIT lcm_unit

and pressing the Enter key.

where

lcm_unit
is the LCM unit number (0 to 1)

At the HIE shelf

7 Replace the NT6X73 card using the common replacing a card procedure in this document.

NT6X73
in an OPM HIE (end)

8 If you were directed to this procedure from another maintenance procedure, return now to the alarm clearing procedure that directed you here; otherwise, continue with step 9.

At the MAP terminal

9 Return the busied unit to service by typing

>RTS UNIT lcm_unit

and pressing the Enter key.

where

lcm_unit
is the OPM unit busied in step 6

If RTS	Do
failed	step 12
passed	step 10

10 Send any faulty cards for repair according to local procedure.

11 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Proceed to step 13.

12 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

13 You have successfully completed this procedure.

NT6X74 in an OPM RMM

Application

Use this procedure to replace the following card in an RMM.

PEC	Suffixes	Name
NT6X74	AB	RMM Control Card

Common procedures

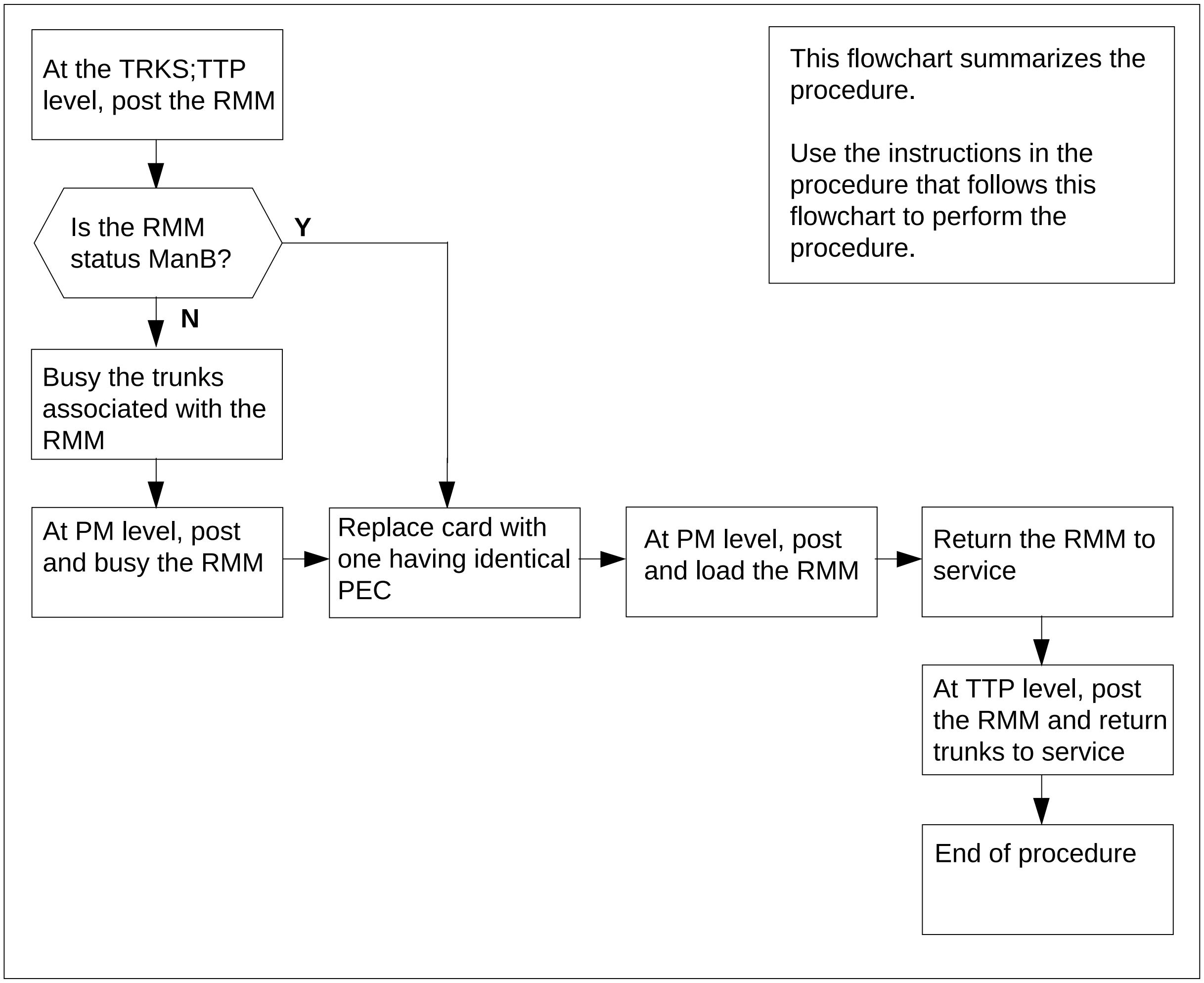
The common replacing a card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X74
in an OPM RMM (continued)

Summary of card replacement procedures for an NT6X74 card in an RMM



Replacing an NT6X74 card in an RMM

At your Current Location

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

2 If you were directed to this procedure from another maintenance procedure, go to step 8; otherwise, continue with step 3.

NT6X74 in an OPM RMM (continued)

At the MAP display

3 Access the TTP level of the MAP and post the RMM that contains the card to be replaced by typing

>MAPCI;MTC;TRKS;TTP;POST P RMM rmm_no

and pressing the Enter key.

where

rmm_no
is the number of the RMM shelf in which the card is to be replaced

Example of a MAP response:

```
LAST CIRCUIT = 27
POST CKT IDLED
SHORT CLLI IS:  OTDA00
OK, CLLI POSTED

POST  20   DELQ       BUSY Q          DIG
TTP 6-006
CKT TYPE   PM NO.     COM LANG        STA S R DOT TE R
OG    MF RMM 0 0  OTWAON23DA00 2001   LO
                                      P_IDL
```

4 Check the status of the RMM.

If RMM status is	Do
MB, PMB, RMB	step 8
other	step 5

5 Busy the trunks that are associated with the card to be replaced by typing

>BSY ALL

and pressing the Enter key.

6 Go to the PM level of the MAP and post the RMM by typing

>PM;POST RMM rmm_no

and pressing the Enter key.

where

rmm_no
is the number of the RMM shelf in which the card is to be replaced

Example of a MAP response:

NT6X74
in an OPM RMM (continued)

```
          SysB     ManB     Offl     CBsy     ISTb     InSv
PM           0        2        2        0        7       21
RMM          0        0        1        0        0        6

RMM      0    InSv
```

7 Busy the RMM by typing

>BSY

and pressing the Enter key.

At the RMM

8 Replace the NT6X74 card using the common replacing a card procedure in this document. When the card has been replaced, return to this point.

9 If you were directed to this procedure from another maintenance procedure, return now to the procedure that directed you here and continue as directed; otherwise, continue with step 10.

At the MAP display

10 Load the RMM by typing

>LOADPM

and pressing the Enter key.

where

rmm_no
is the number of the RMM shelf in which the card is to be replaced

If	Do
message “loadfile not found in directory" is received	step 11
load passed	step 27
load failed	step 32

11 Determine the type of device on which the PM load files are located.

If load files are located on	Do
tape	step 12
IOC disk	step 17
SLM disk	step 22

12 Locate the tape that contains the PM load files.

13 Mount the tape on a magnetic tape drive.

NT6X74
in an OPM RMM (continued)

14 Download the tape by typing

>MOUNT tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

15 List the contents of the tape in your user directory by typing

>LIST T tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files.

16 Demount the tape drive by typing

>DEMOUNT T tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files.

Go to step 27.

17 From office records, determine and note the number of the input/output controller (IOC) disk and the name of the volume that contains the PM load files.

18 Access the disk utility level of the MAP by typing

>DSKUT

and pressing the Enter key.

19 List the IOC file names into your user directory by typing

>LISTVOL volume_name ALL

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step 17.

20 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

21 Go to step 27.

22 From office records, determine and note the number of the system load module (SLM) disk and the name of the volume that contains the PM load files.

NT6X74
in an OPM RMM (continued)

23 Access the disk utility level of the MAP by typing

>DISKUT

and pressing the Enter key.

24 List all disk volumes to user directory by typing

>LV CM

and pressing the enter key.

25 List the SLM file names into your user directory by typing

>LF volume_name

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step 22.

26 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

27 Reload the RMM by typing

>LOADPM

and pressing the Enter key.

If	Do
load failed	step 33
load passed	step 28

28 Return the RMM unit to service by typing

>RTS

and pressing the Enter key.

If RTS	Do
passed	step 29
failed	step 33

29 Go to the TTP level of the MAP and post the RMM by typing

>TRKS;TTP;POST P RMM rmm_no

and pressing the Enter key.

where

rmm_no
is the number of the RMM shelf in which the card is to be replaced

NT6X74 in an OPM RMM (end)

30 Return to service the circuits busied in step 5 by typing

>RTS ALL

and pressing the Enter key.

If RTS	Do
passed	step 31
failed	step 33

31 Send any faulty cards for repair according to local procedure.

32 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 34.

33 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

34 You have successfully completed this procedure.

NT6X75 in an OPM HIE

Application

Use this procedure to replace the following card in an HIE shelf.

PEC	Suffixes	Name
NT6X75	AA	OPM ESA Tone and Clock Card

Common procedures

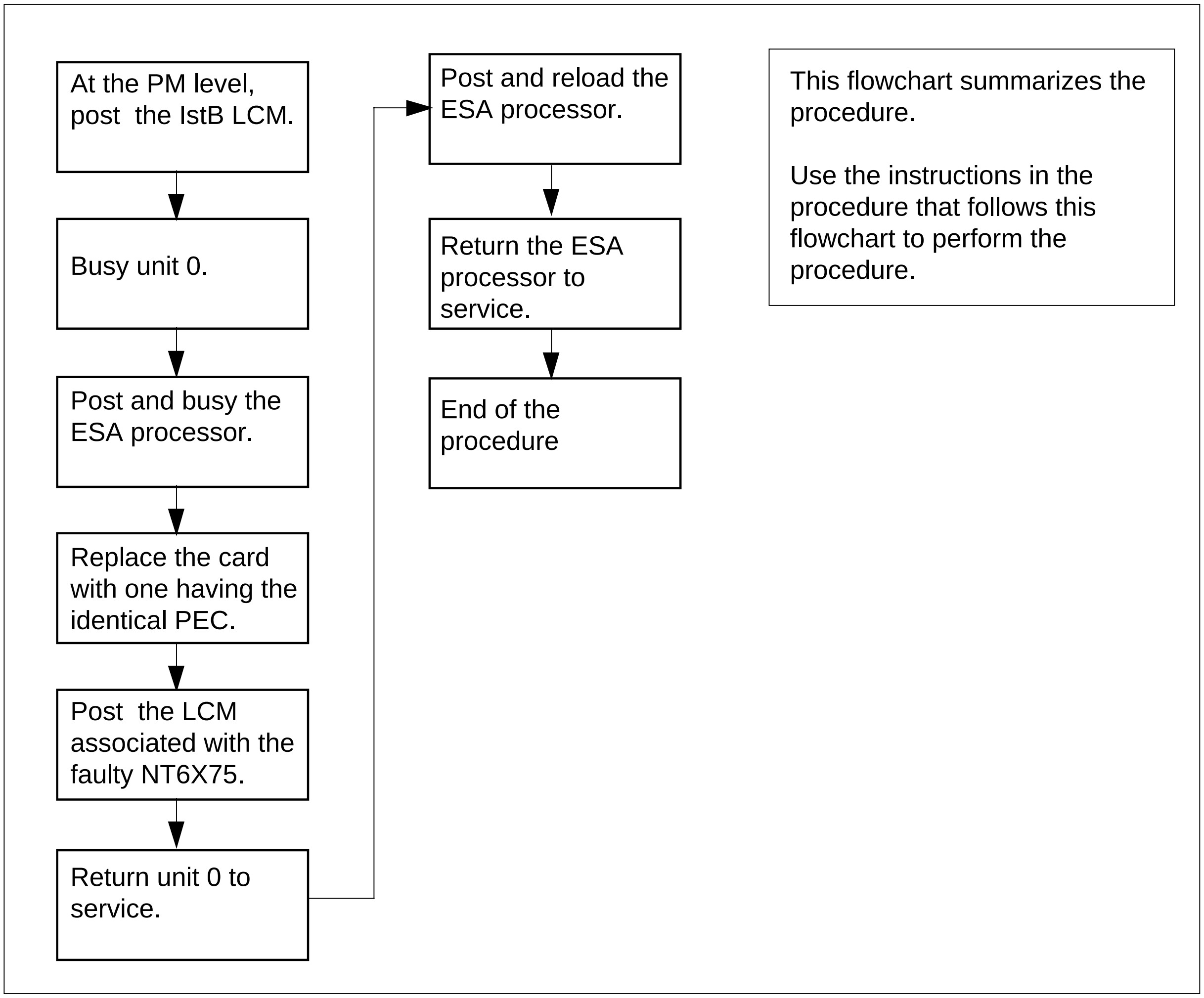
The common replacing a card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X75
in an OPM HIE (continued)

Summary of card replacement procedures for an NT6X75 card in an HIE



Replacing an NT6X75 card in an HIE

At your Current Location

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure for verifying or accepting cards, or have been directed to this procedure by your maintenance support group.

2 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

3 If you were directed to this procedure from another maintenance procedure, go to step 10; otherwise, continue with step 4.

NT6X75
in an OPM HIE (continued)

At the MAP display

4 Post the LCM associated with the faulty NT6X75 card by typing

>MAPCI;MTC;PM;POST LCM site frame lcm

and pressing the Enter key.

where

site
is the name of the location of the OPM

frame
is the number of the OPM cabinet

lcm
is the number of the LCM in the OPM cabinet

5 Translate the links to the P-side peripherals by typing

>TRNSL P

and pressing the Enter key.

6 Post the Emergency Stand-Alone (ESA) processor by typing

>POST ESA esa_no

and pressing the Enter key.

where

esa_no
is the number of the ESA processor identified in step 5.

7 Busy the ESA processor by typing

>BSY

and pressing the Enter key.

Example of a MAP response:

```
This action will take this PM out of service
Please confirm (“Yes” or “No”)
```

Respond by typing

>YES

and pressing the Enter key.

8 Post the LCM associated with the faulty NT6X75 card by typing

>POST LCM site frame lcm

and pressing the Enter key.

where

site
is the name of the location of the OPM

frame
is the number of the OPM cabinet

NT6X75 in an OPM HIE (continued)

lcm
is the number of the LCM in the OPM cabinet

9 Busy unit 0 by typing

>BSY UNIT 0

and pressing the Enter key.

At the OPM cabinet

10 Replace the NT6X75 card using the common replacing a card procedure in this document. When you have completed the procedure, return to step 11 of this procedure.

11 If you were directed to this procedure from the *Alarm Clearing Procedures*, return now to the alarm clearing procedure that directed you here. Otherwise, continue with step 12.

At the MAP terminal

12 Return to service unit 0 by typing

>RTS UNIT 0

and pressing the Enter key.

If RTS	Do
passed	step 13
failed	step 36

13 Post the ESA processor identified in step 5 by typing

>POST ESA esa_no

and pressing the Enter key.

where

esa_no
is the number of the ESA processor

14 Load the ESA processor by typing

>LOADPM

and pressing the Enter key.

If	Do
message “loadfile not found in directory" is received	step 15
load passed	step 33
load failed	step 36

NT6X75
in an OPM HIE (continued)

15 Determine the type of device on which the PM load files are located.

If load files are located on	Do
tape	step 16
IOC disk	step 22
SLM disk	step 27

16 Locate the tape that contains the PM load files.

At the OPM cabinet

17 Mount the tape on a magnetic tape drive.

At the MAP display

18 Download the tape by typing

>MOUNT tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

19 List the contents of the tape in your user directory by typing

>LIST T tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

20 Demount the tape by typing

>DEMOUNT T tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

21 Go to step 32.

22 From office records, determine and note the number of the input/output controller (IOC) disk and the name of the volume that contains the PM load files.

23 Access the disk utility level of the MAP by typing

>DSKUT

and pressing the Enter key.

NT6X75
in an OPM HIE (continued)

24 List the IOC file names into your user directory by typing

>LISTVOL volume_name ALL

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step 22.

25 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

26 Go to step 32.

27 From office records, determine and note the number of the system load module (SLM) disk and the name of the volume that contains the PM load files.

28 Access the disk utility level of the MAP by typing

>DISKUT

and pressing the Enter key.

29 List the disk volume names for both S00D and S01D by typing

>LV CM

and pressing the Enter key.

30 List the SLM file names into your user directory by typing

>LF volume_name

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step 27.

31 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

32 Reload the ESA processor by typing

>LOADPM

and pressing the Enter key.

If	Do
load failed	step 36
load passed	step 33

NT6X75
in an OPM HIE (end)

33 Return the ESA processor to service by typing

>RTS

and pressing the Enter key.

If RTS	Do
passed	step 34
failed	step 36

34 Send any faulty cards for repair according to local procedure.

35 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card.

Go to step 37.

36 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

37 You have successfully completed this procedure.

NT6X99
in an OPM

Application

Use this procedure to replace the following card in an OPM.

PEC	Suffixes	Name
NT6X99	AA	

Common procedures

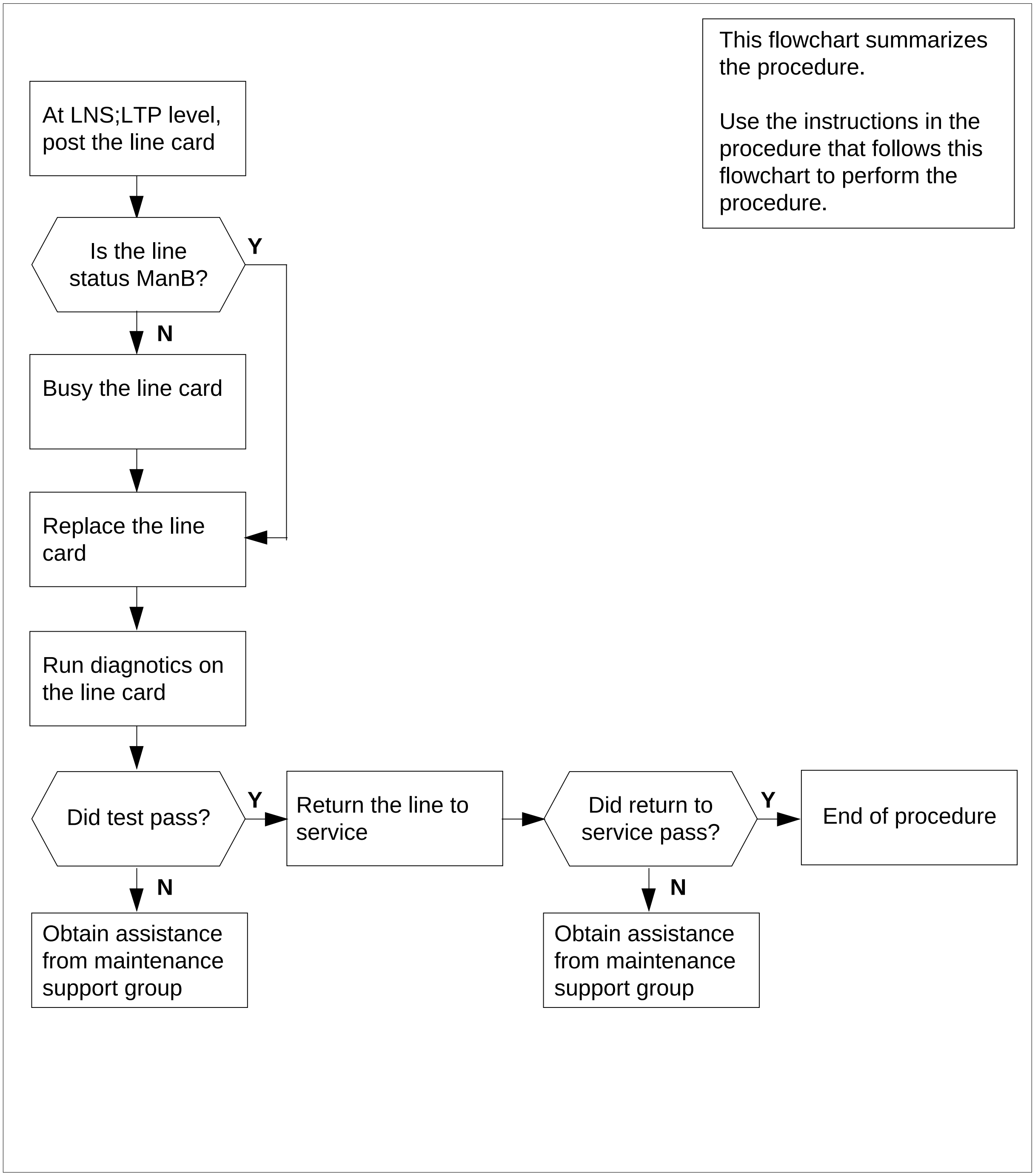
The common replacing a line card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT6X99
in an OPM (continued)

Summary of card replacement procedure for an NT6X99 card in an OPM



NT6X99
in an OPM (continued)

Replacing an NT6X99 card in an OPM

At your Current Location

1 Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

At the MAP display

2 Access the LTP level of the MAP and post the line associated with the card to be replaced by typing

>MAPCI;MTC;LNS;LTP;POST L site lcm lsg ckt

and pressing the Enter key.

where

site
is the name of the site where the OPM is located

lcm
is the number of the OPM with the faulty card

lsg
is the number of the line subgroup with the faulty card

ckt
is the number of the circuit associated with the faulty card

Example of a MAP Response:

```
LCC PTY RNG .....LEN..........DN   STA F S LTA TE RESULT
1FR         REM1 00 0 03 03  IBERT
```

3 Check the status of the posted line.

If the line status is	Do
manual busy (MB)	step 5
not MB	step 4

4 Busy the line by typing

>BSY

and pressing the Enter key.

5 Go to the common replacing a line card procedure in this document. When you have completed the procedure, return to this step.

NT6X99
in an OPM (end)

At the MAP display

6 Test the line card just replaced by typing

>DIAG

and pressing the Enter key.

If the DIAG	**Do**
passed	step 7
failed	step 10

7 Return the line card to service by typing

>RTS

and pressing the Enter key.

If the RTS	**Do**
passed	step 8
failed	step 10

8 Send any faulty cards for repair according to local procedure.

9 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 11.

10 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

11 You have successfully completed this procedure.

NT8X02
in an OPM BCU

Application

Use this procedure to replace the following card in an OPM BCU battery control unit (BCU).

PEC	Suffixes	Name
NT8X02	AA, AB	Battery Charger Controller card (BCC)

Common procedures

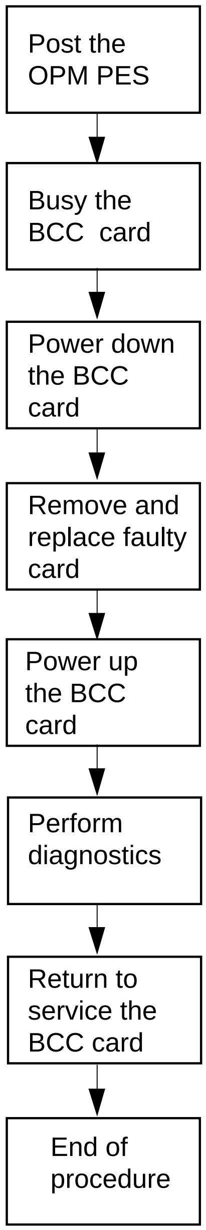
The common replacing a card procedure is referenced in this procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT8X02
in an OPM BCU (continued)

Summary of card replacement procedure for an NT8X02 card in an BCU



This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

NT8X02
in an OPM BCU (continued)

Replacing an NT8X02 card in an BCU

At your Current Location

1 Proceed only if you have been directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure for verifying or accepting cards, or have been directed to this procedure by your maintenance support group.

2 Obtain a replacement card. Ensure the replacement card has the same product equipment code (PEC), including suffix, as the card to be removed.

3 If you were directed to this procedure from the *Alarm Clearing Procedures*, go to step 6. Otherwise, continue with step 4.

At the MAP terminal

4 Post the OPM PES with the BCU containing the battery charger controller (BCC) card to be replaced by typing

>MAPCI;MTC;PM;PES;POST opmpes

and pressing the Enter key.

where

opmpes
is the PES discrimination number (0 to 199)

Example of a MAP response:

```
               RED     AMBER     GREEN     OFFL
      OPMPES     1         2         3        4

      OPMPES  2 Cond: GREEN   REM2    2  1   RMM  2
                                  Audit Week  HBT
   Common    Rectifiers              .    2    .
   AC     FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
    .      .   .   .   .       s      .       .   .
BCC   0   1   2   3   Temp     Door     BCCFUSES
0=W  BSY BSY BSY BSY EHT ELT  FRNT SIDE     0  1
1=W  BSY BSY BSY BSY  .   .     .    .      .  .
```

5 Busy the BCC driver (BCCDVR) card by typing

>BSY BCCDVR

and pressing the Enter key.

NT8X02
in an OPM BCU (continued)

At the OPM cabinet

6

DANGER
Possible loss of service during BCC (NT8X02) replacement
Do not turn off more than one BCC NT8X02 at a time or service is lost if AC power is interrupted. Turn off BCC0 when working on battery strings 0, 1, 2, or 3. Turn off BCC1 when working on battery strings 4, 5, 6, or 7.

Turn switch on front of the BCC (NT8X02) card to the OFF position.

7 Replace the NT8X02 card by using the common replacing a card procedure in this document. When the card is replaced, return to this step.

8 Turn the switch on the BCC (NT8X02) card to the ON position.

9 If you were directed to this procedure from the *Alarm Clearing Procedures*, return now to the alarm clearing procedure that directed you here. Otherwise, continue with step 10.

At the MAP terminal

10 Perform diagnostics by typing

>TST

and pressing the Enter key.

If test	Do
passed	step 11
failed	step 14

11 Return the BCCDVR card to service by typing

>RTS BCCDVR

and pressing the Enter key.

If RTS	Do
passes	step 12
fails	step 14

12 Send any faulty cards for repair according to local procedure.

13 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

NT8X02
in an OPM BCU (end)

Go to step 15.

14 Obtain further assistance in replacing this card by contacting the personnel responsible for higher level of support.

15 You have successfully completed this procedure.

NTMX45
in an OPM HIE

Application

Use this procedure to replace an NTMX45 in host interface equipment (HIE) shelf.

PEC	Suffixes	Name
NTMX45	AA	Emergency Stand-Alone (ESA) processor (EP)

If you cannot identify the PEC, suffix, and shelf or frame for the card you want to replace, refer to the “Index" in this document. The index lists the cards, shelves, and frames in this card replacement NTP.

Common procedures

This procedure does not refer to any common procedures.

Next level of maintenance

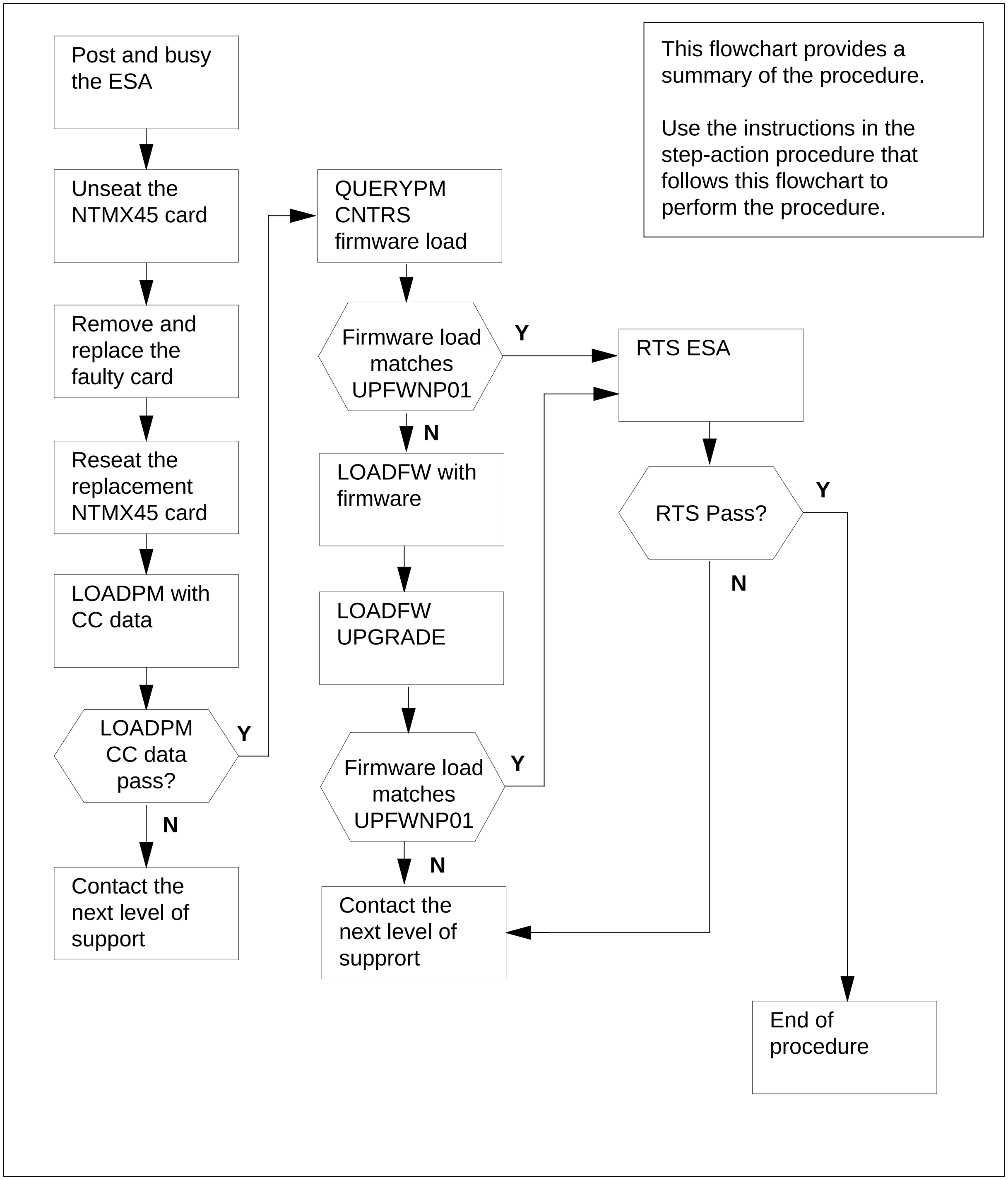
A problem can occur that requires the help of the local maintenance personnel. Gather all important logs, reports, and system information (that is, product type and current software load) for analysis. The related logs, maintenance notes, and system information help make sure that the next level of maintenance and support can find the problem. More detail about logs appears in the *Log Report Reference Manual*.

Action

The flowchart that follows provides a summary of this procedure. Use the instructions in the step-action procedure that follows the flowchart to replace the card.

NTMX45
in an OPM HIE (continued)

Summary of replacing an NTMX45 HIE



Replacing an NTMX45 HIE

At your Current Location

1 Continue if you were referred to this card replacement procedure

- from a step in a maintenance procedure
- to verify or accept cards
- by your maintenance support group

2 Get a replacement card. Make sure the replacement card has the same product equipment code (PEC) including suffix, as the original card.

At the MAP terminal

3 Access the PM level of the MAP and post the ESA by typing

>MAPCI;MTC;PM;POST ESA esa_no

and pressing the Enter key.

where

esa_no
is the number of the ESA unit to be busied (0 to 255)

Example of a MAP display:

```
  CM    MS   IOD   Net    PM    CCS    LNS    Trks    Ext    APPL
   .     .    .     .    1RLCM   .      .      .       .      .

 ESA              SysB     ManB     OffL     CBsy     ISTb      InSv
 0 Quit     PM     0        0        2        0        2         25
 2 Post_    ESA    0        0        0        0        1          1
 3 ListSet
 4                                Links_OOS: CSide  0
 5 Trnsl          RLCM  ESA    4 Sysb
 6 Tst
 7 Bsy_
 8 RTS_
 9 OffL
10 LoadPM
11 Disp_
12 Next_
13
14 QueryPM
15
16
17
18
```

NTMX45
in an OPM HIE (continued)

At the MAP terminal

4 Busy the inactive ESA processor by typing

>BSY

and pressing the Enter key.

Example of a MAP response:

```
ESA 4      This action will take this PM
           out of service
Please confirm (“YES”, “Y”, “NO”, or “N”):
```

Respond by typing

>YES

At the RLCM frame

5

WARNING
Static electricity damage
Before removing any cards, put on a wrist strap and connect it to the wrist strap grounding point on the left side of the frame supervisory panel of the LCM. This protects the equipment against damage caused by static electricity.

DANGER
Equipment damage
Take the following precautions when removing or inserting a card:

1. Do not apply direct pressure to the components.

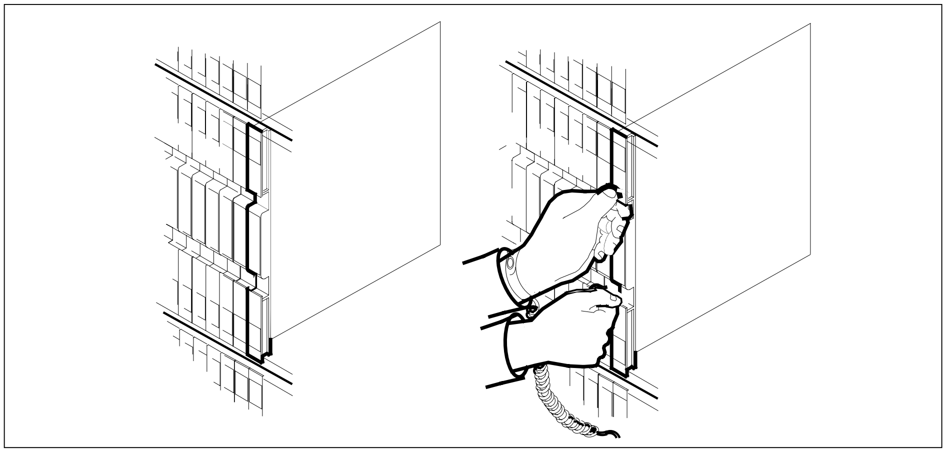
2. Do not force the cards into the slots.

Put on a wrist strap.

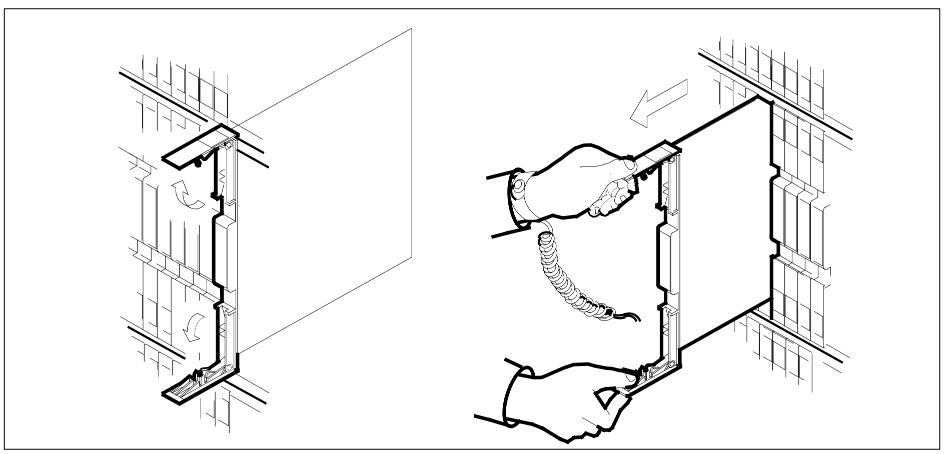
6 Remove the NTMX45 card as shown in the following figures.

a Locate the damaged card on the appropriate shelf.

NTMX45
in an OPM HIE (continued)



b Open the locking levers on the damaged card and carefully pull the card towards you until it clears the shelf.

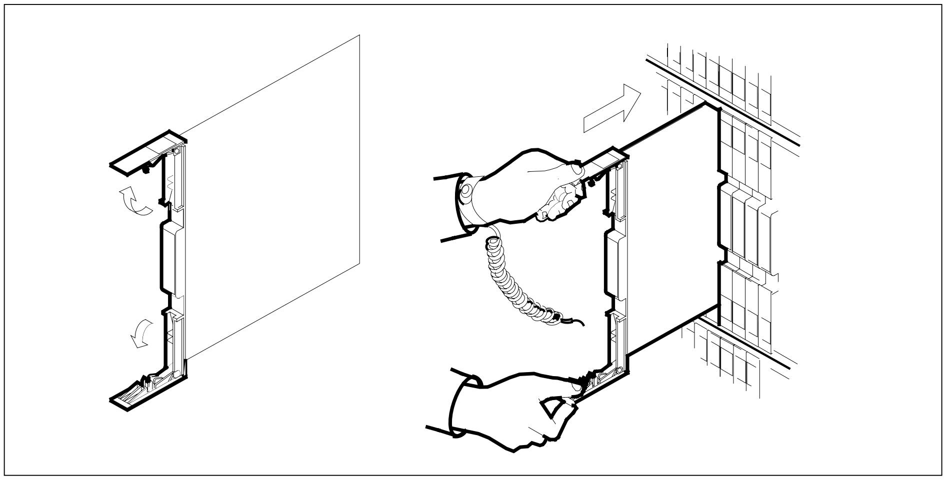


c Make sure that the replacement card has the same PEC and suffix as the card you just removed. Also make sure that all DIP switches on the replacement card match settings of the card just removed.

7 Open the locking levers on the replacement card.

a Align the card with the slots in the shelf and carefully slide the card into the shelf.

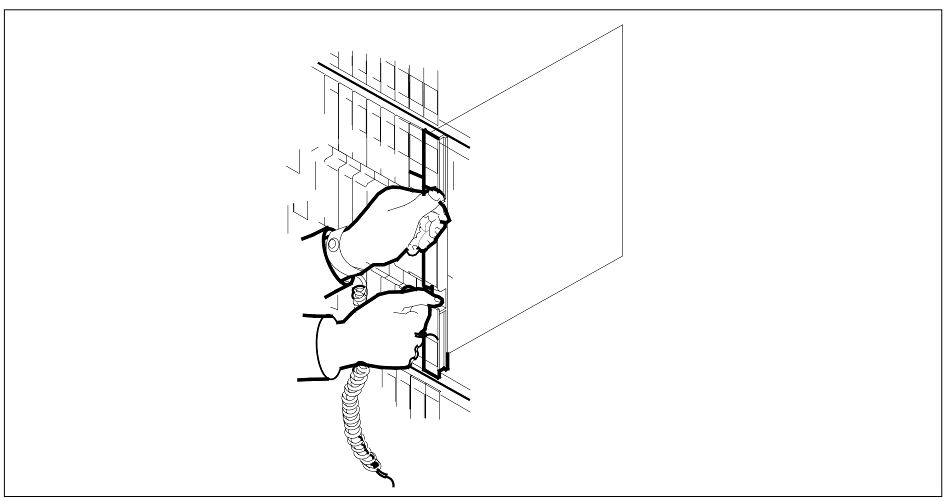
NTMX45
in an OPM HIE (continued)



Seat and lock the card.

b Use your fingers or thumbs to push on the upper and lower edges of the faceplate.

c Close the locking levers.



8 Use the following table to determine the next step in this procedure.

If you entered this procedure from	Do
an alarm clearing procedure	step 34
other	step 9

NTMX45
in an OPM HIE (continued)

9 Load the ESA processor by typing

>LOADPM

and pressing the Enter key.

If the load	Do
message “loadfile not found in directory" is received	step 10
load passes	step 28
load fails	step 35

10 Determine the type of device on which the PM load files are located.

If load files are located on	Do
tape	step 11
IOC disk	step 17
SLM disk	step 22

11 Locate the tape that contains the PM load files.

12 Mount the tape on a magnetic tape drive.

At the MAP terminal

13 Download the tape by typing

>MOUNT tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

14 List the contents of the tape in your user directory by typing

>LIST T tape_no

and pressing the Enter key.

where

tape_no
is the number of the tape drive containing the PM load files

15 Demount the tape by typing

>DEMOUNT T tape_no

and pressing the Enter key.

where

NTMX45
in an OPM HIE (continued)

tape_no
is the number of the tape drive containing the PM load files

16 Go to step 27.

17 From office records, determine and note the number of the input/output controller (IOC) disk and the name of the volume that contains the PM load files.

18 Access the disk utility level of the MAP display by typing

>DSKUT

and pressing the Enter key.

19 List the IOC file names into your user directory by typing

>LISTVOL volume_name ALL

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step 17

20 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

21 Go to step 27.

22 From office records, determine and note the number of the system load module (SLM) disk and the name of the volume that contains the PM load files.

23 Access the disk utility level of the MAP display by typing

>DISKUT

and pressing the Enter key.

24 List all SLM disk volumes into your user directory by typing

>LV CM

and pressing the Enter key.

25 List the SLM file names into your user directory by typing

>LF volume_name

and pressing the Enter key.

where

volume_name
is the name of the volume that contains the PM load files, obtained in step 22

26 Leave the disk utility by typing

>QUIT

and pressing the Enter key.

NTMX45
in an OPM HIE (continued)

27 Reload the ESA processor by typing

>LOADPM

and pressing the Enter key.

If loadpm	Do
passes	step 28
fails	step 35

28 Query the PM counters for the firmware load on the NTMX45 by typing

>QUERYPM CNTRS

and pressing the Enter key.

Example of a MAP display:

```
Unsolicitited MSG limit = 250, count = 0
Ram Load: MSA12AM1
EPRom Version: Ac01
EEPRom Load: Loadable NP02 , Executable: NP02
EP:MX45AA
```

NTMX45 Firmware loadname

If firmware is	Do
valid	step 31
invalid	step 29

29 Load the NTMX45 firmware by typing

>LOADFW

and pressing the Enter key.

> ***Note:*** The command applies the firmware file provisioned in table XESAINV unless the firmware load is indicated with the command.

If load	Do
passes	step 30
fails	step 35

30 Upgrade the firmware in the NTMX45AA by typing

>LOADFW UPGRADE

NTMX45
in an OPM HIE (end)

and pressing the Enter key.

If the LOADFW UPGRADE	Do
passes	step 31
fails	step 35

31 Return the ESA to service by typing

>RTS

and pressing the Enter key.

If the RTS	Do
passes	step 32
fails	step 35

32 Send any damaged cards for repair according to local procedure.

33 Record the following items in office records:

- date the card was replaced
- serial number of the card
- problems that required replacement of the card

Go to step 36.

34 Return to the *Alarm Clearning Procedure* that referred you to this procedure. If necessary, go to the point where the damaged card list was produced, identify the next damaged card on the list, and go to the appropriate procedure for that card in this manual.

35 Contact the next level of support for additional help to replace this card.

36 You have completed this procedure. Return to the maintenance procedure that referred you to this card replacement procedure and continue.

Replacing a card

Application

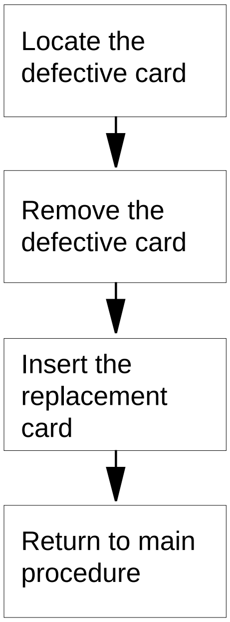
Use this procedure to unseat, remove, and reseat cards.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

Replacing a card (continued)

Summary of common procedures for Replacing a card



This flowchart summarizes the procedure.

Use the instructions that follows this flowchart to perform the procedure.

Replacing a card (continued)

Replacing a card

At the frame supervisory panel:

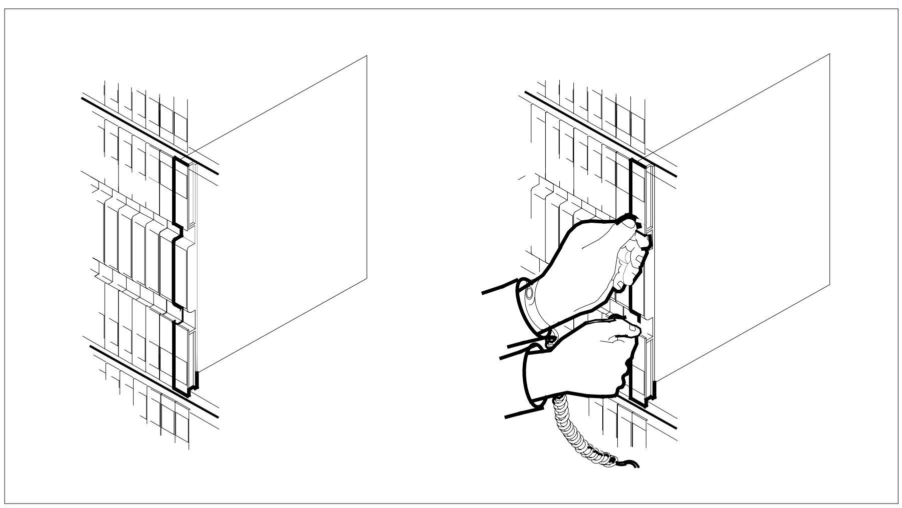
1 Proceed only if you have been directed to this procedure from a step in a maintenance procedure. Using this procedure independently may cause equipment damage or loss of service.

2

> **DANGER**
> **Static electricity damage**
> Wear a wrist strap connected to the wrist strap grounding point on the frame supervisory panel (FSP) while handling cards. This precaution protects the cards against damage caused by static electricity.

Remove any cables from the faceplate of the card to be replaced and note the connector numbers.

3 Locate the card to be removed on the appropriate shelf if you have not already done so.

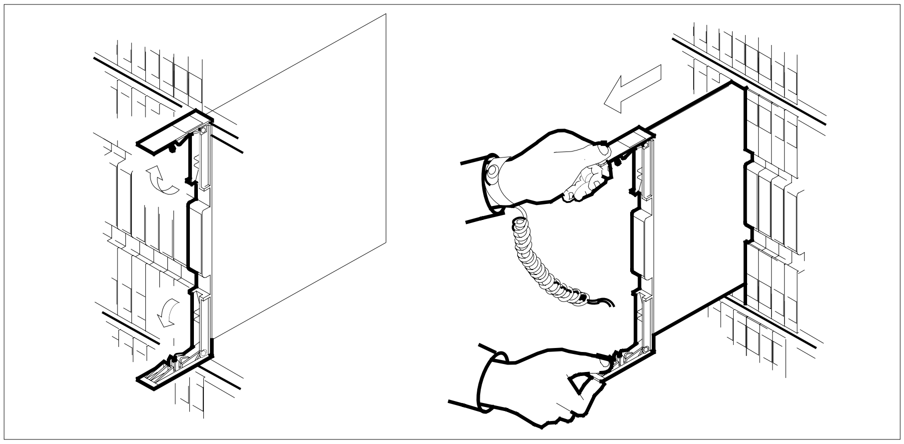


4

> **DANGER**
> **Do not hold card by levers only**
> Holding a card by the levers only may result in lever breakage. Once the card has been pulled half way out of the shelf, carefully grasp the card underneath for more secure support and continue to remove the card from the shelf. Avoid touching any wires or internal parts on the card.

Replacing a card (continued)

Open the locking levers on the card to be replaced and gently pull the card toward you until it clears the shelf.



5 Examine the switch settings (if any) of the card just removed. Ensure that the switch settings on the replacement card match those of the card being replaced.

6 Place the card you have removed in an electrostatic discharge (ESD) protective container.

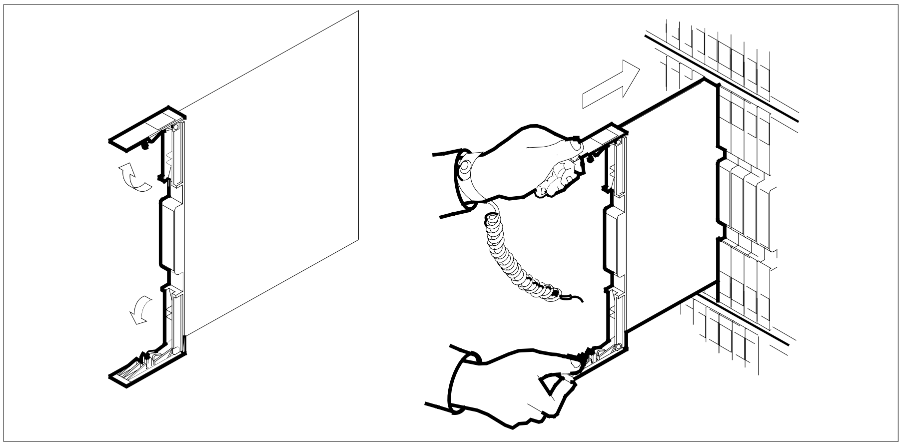
7 Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card you just removed.

8

DANGER
Improper insertion may damage circuit packs
Do not apply direct pressure to the components.Do not force the cards into the slots.

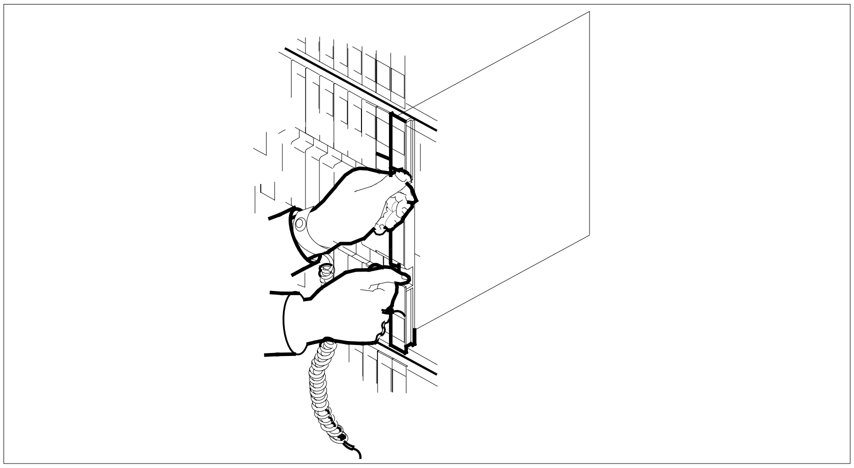
Open the locking levers on the replacement card. Align the card with the slots in the shelf and gently slide the card into the shelf.

Replacing a card (end)



9 Seat and lock the card.

- **a** Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure that the card is fully seated in the shelf.
- **b** Close the locking levers.



10 Reconnect any previously removed cables to the faceplate of the replacement card.

11 You have completed this procedure. Return to the main procedure that sent you to this procedure and continue as directed.

Replacing a line card

Application

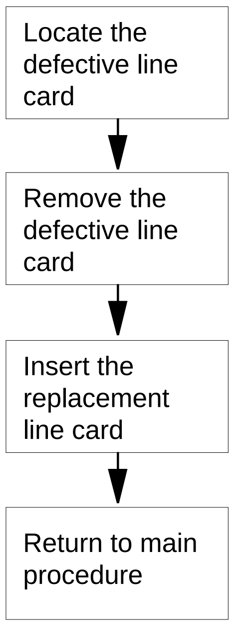
Use this procedure to unseat, remove, and reseat line cards if you have been directed from a maintenance procedure.

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

Replacing a line card (continued)

Summary of procedure for Replacing a line card



This flowchart summarizes the procedure.

Use the instructions in the step-action table that follows this flowchart to perform the procedure.

Replacing a line card (continued)

Replacing a line card

At your current location:

1

> **DANGER**
> **Improper handling could possibly damage cards**
> Store and transport circuit cards in electrostatic discharge (ESD) protective containers to prevent electrical and mechanical damage. When handling circuit cards not in ESD protective containers, stand on a conductive floor mat and wear a wrist strap, connected through a 1-megohm resistor to a suitably grounded object such as a metal workbench or a DMS frame. (Refer to Northern Telecom Corporate Standard 5028.)

> **DANGER**
> **Equipment damage**
> Take these precautions when removing or inserting a card:
> •.Do not apply direct pressure to the components.
> •.Do not force the cards into the slots.

> **DANGER**
> **Hot materials**
> Exercise care when handling the line card. The line feed resistor may be very hot.

> **CAUTION**
> **Special tools required**
> Card shrouds and removal tools are required for removing cards from the line drawers. For descriptions of these tools, refer to the note at the end of this procedure.

Proceed only if you have been directed to this procedure from a step in a maintenance procedure. Using this procedure independently may cause equipment damage or loss of service.

2 Locate the line drawer containing the line card to be removed.

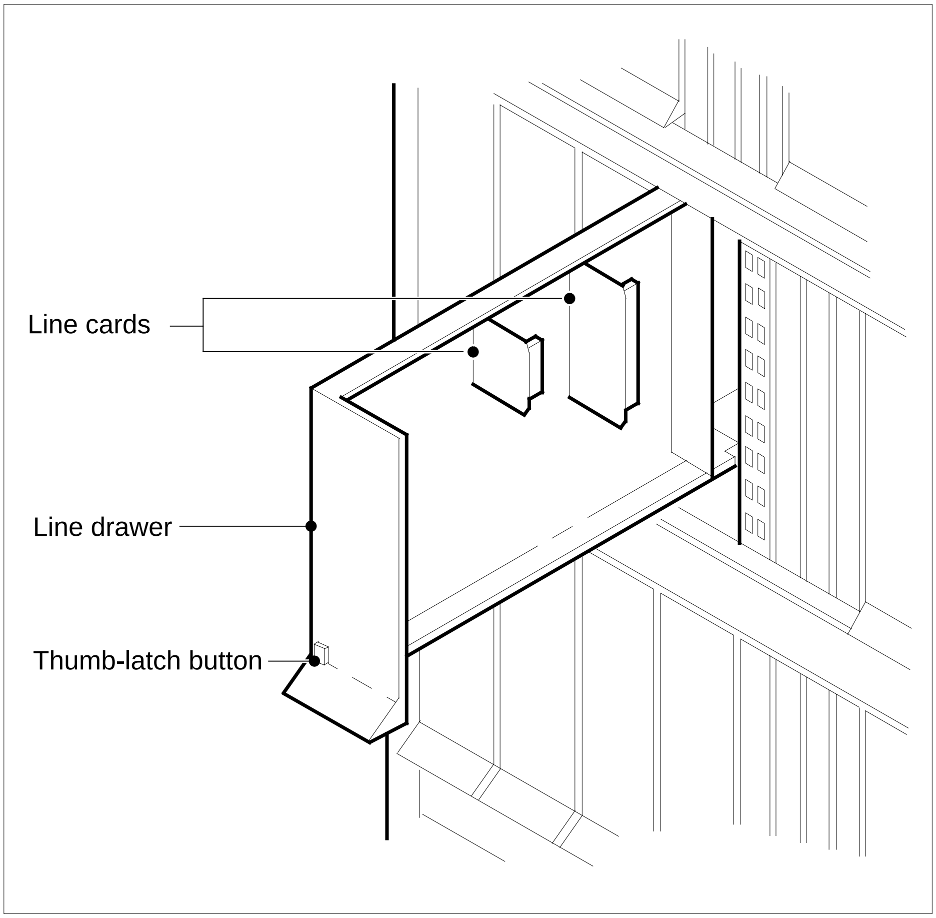
3 Open the line drawer to prepare to remove the faulty card by following the steps below:

Replacing a line card (continued)

a Face the drawer shelf and grasp the handle at the bottom of the drawer with the right hand.

b Push up on the drawer latch with your thumb and pull the drawer out until fully withdrawn. It is fully withdrawn when the drawer stop, at the top, prevents further travel.

c Ensure that a card shroud and line card extractor are available. (See note at end of this procedure.)



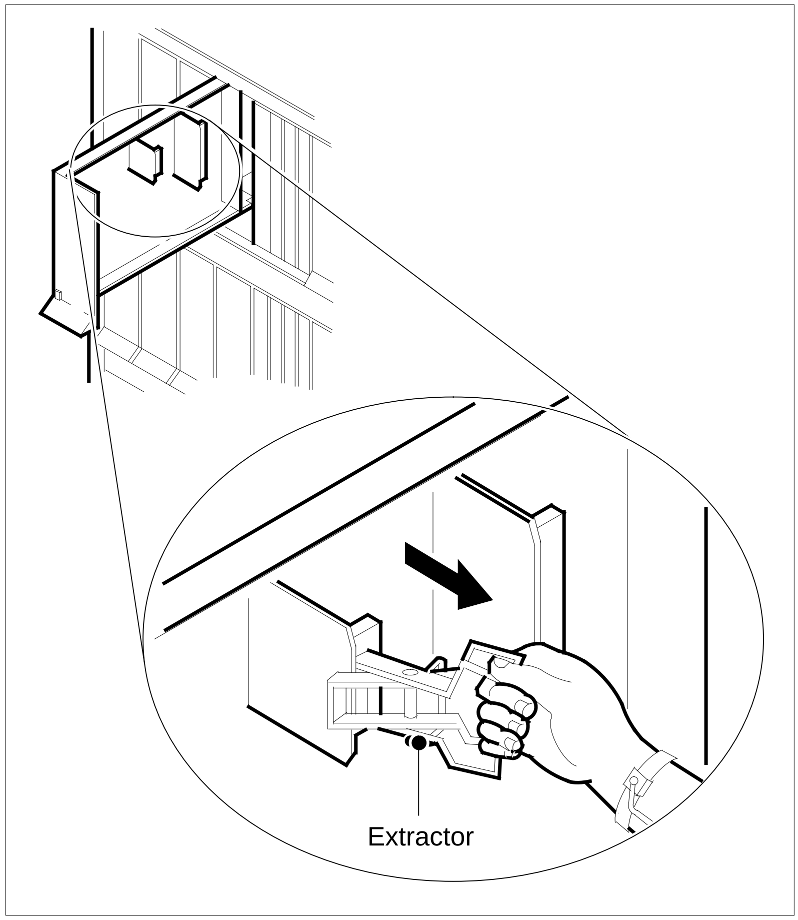
4 Remove the line card to be replaced by using the following steps:

a Slide a card shroud over the card to be removed and an adjacent card. (If there is not an adjacent card on either side, do not use the card shroud.)

b Grasp the edge of the card with a line card extractor at a point midway between the top and bottom edges. Hold the extractor in your right hand.

c Squeeze the handles of the extractor together to grasp the card tightly.

Replacing a line card (continued)



Step 4 continued...

d Hold the front cover of the line drawer to steady it with your left hand.

e Pull the extractor away from the drawer to unplug the card from its socket on the drawer backplane.

f Continue pulling the card with the extractor until the card is clear of the shroud.

g Insert the removed card into an ESD container and store according to local procedures.

5 Verify that the product equipment code (PEC) on the nameplate of the removed card and of the replacement card is the same.

6 Replace the faulty card using the following steps:

a Remove the replacement card from its ESD container.

b Slide the card into the shroud guide slots toward the drawer backplane.

c Hold the front cover of the line drawer with your left hand to steady it.

d Grasp the top and bottom edges of the card with the fingers of your right hand.

Replacing a line card (end)

e Push the card toward the backplane until it plugs fully into the backplane socket.

7 You have completed this procedure. Return to the main procedure that sent you to this procedure and continue as directed.

> ***Note:*** Card shrouds are required for inserting or removing cards in line drawers. Two sizes are available for use with 3-inch and 6-inch cards. Descriptions of these shrouds are as follows:

Line Card Insertion/Withdrawal Tool (3 in.)

QTH56A (Apparatus Code)

A0298291) (Common Product Code)

Line Card Insertion/Withdrawal Tool (6 in.)

QTH58A (Apparatus Code)

A0313317) (Common Product Code)

Card Removal Tool (3 in. or larger)

QTH57A (Apparatus Code)

A0298292 (Common Product Code)

Large grip tool for 4 inch or larger cards is NT tool ITA9953

9 Locating and clearing OPM problems

This problem locate and clear section is for maintenance engineering and field maintenance personnel. Maintenance engineering and field maintenance personnel already have a basic knowledge of the DMS-100 Series of switches and the Outside Plant Module (OPM). This section is not for operating company personnel that require exact procedures to perform maintenance tasks.

10 Trouble isolation and correction

Description of troubleshooting procedures

Basic troubleshooting procedures contain the following:

- how to locate and clear faults
- fault isolation tests
- diagnostic tests
- product-specific test tools

Performance indicators

The first step in how to locate faults is to examine the performance indicators the system generates on a regular basis. Operational measurements (OM), log reports, and alarms indicate if fault conditions are present.

Operational measurements

The OMs are a data collecting system that tracks specified types of events and the frequency these events occur. The OM data givex an indication of performance and use. The OM data can detect actual and potential system troubles. The OM thresholding feature can monitor and report key Outside Plant Module (OPM) activity. The user must use this feature to compose these reports daily or weekly. The user must use these reports as the primary method of trouble detection. Refer to *Operational Measurements Reference Manual* for more information OMs associated with the OPM.

Log reports

Logs, used as an analysis tool, provide detailed information on call errors, diagnostic results, and system state. Logs can indicate trouble conditions when the following conditions are present:

- sudden increase in volume of logs
- message not printed reports
- large number of similar logs

Alarms

Audible and visual alarms require action to correct the problem. Correct performance of routine system maintenance and use of OMs and logs minimizes the occurrence of alarms.

The level of alarm indicates how severe the alarm is and the associated emergency to correct the action. The level of alarm can be minor, major, or critical. The following table describes alarm conditions.

Table 10-1 Alarm description

Alarm	MAP display	Description
Minor	(blank)	Normally does not affect service
Major	(M)	Normally indicates a condition that degrades service
Critical	(*C*)	Normally indicates a service outage or potential service outage

The user must follow the following guidelines when the user responds to alarms:

- When more than one severe alarm appears on the MAP display screen, clear the alarms. Clear the alarms from the left to the right of the screen.
- If a very severe alarm occurs when the user fixes an alarm, respond to the new alarm. Do not continue attempts to clear the less severe alarm.

For alarm clearing procedures, refer to *Alarm Clearing Procedures*.

Locating and clearing faults

The standard troubleshooting steps for how to locate and clear faults appear in the following list:

1 The system causes Silence audible alarms when the system detects alarm conditions.

2 Read status displays and trace fault codes to the menu level needed to clear the fault to isolate the fault.

3 Busy the hardware to remove the system access to the defective component. When you busy the hardware, maintenance activity can occur without system interference.

4 Test the defective component. Identify the card you must replace. Replace the defective card and test the card again.

5 Return the hardware to service.

Fault isolation tests

When the system detects a fault condition in the OPM, maintenance action is required. Fault isolation tests determine which component causes the fault. Fault isolation tests determine if the fault condition requires immediate correction or if the fault condition must be reported to the correct maintenance support organization. The following sections list the procedures involved in how to isolate and correct faults with specified OPM components.

Faulty line drawer

To handle a defective line drawer:

1 Post, busy, test, and RTS the drawer.

2 If a test or RTS fails with a card list, replace the cards with a correct card replacement procedure. Test and RTS the drawer.

3 If a test or RTS fails without a card list, perform the correct tests that the MAP response indicates. RTS the drawer.

Faulty shelf circuit pack

To handle a defective shelf circuit pack:

1 Post the line concentrating module (LCM).

2 Determine if any fault indicators are present.

3 Busy the unit that has the defective card.

4 Perform the correct card replacement procedures.

5 Test and RTS the LCM unit.

Faulty line card

If a single card fails during line card diagnostics, the card causes a whole LCM unit to fail. Location of the single defective card can be difficult. Normally this condition affects only one unit of the LCM. The following two procedures can identify the defective card.

Perform procedure 1 during a maintenance window to avoid any service interruptions. Qualified technicians can perform this procedure during the day if the technicians take correct precautions.

To identify a defective card:

Procedure 10-1

1 Find the vertical connection to the LCM in trouble. Use Table MTAVERT.

2 Use a buttset with caution on the backplane of the MTADRIVER.

Operating company personnel can hear the following sounds:

- dial tone—Operating company personnel received a dial tone from a 6X17 card. Dial the operator and ask the number you are on. This number is your defective line.
- 8khz tone— Identified as data line card 6X71 or 6X76.
- talk battery—If possible, connect to a proprietary telephone. Call the operator to see the directory number (DN) that is in use.

To identify a defective card:

Procedure 10-2

1 Access the line test position (LTP) level of the MAP display. Post any line equipment number (LEN) located on the defective LCM.

2 Put a tone on the posted LEN. Go to the mainframe with the buttset. Listen to all other LENS on the LCM.

Note: Operating company personnel can locate two LENS with tone. One LENS is the original LEN posted at the LTP level. The second LENS is the defective line card.

Faulty DS-1 link

To handle a defective DS-1 link:

1 Post the OPM.

2 Determine if any fault indicators are present.

3 Display the central side (C-side) links.

4 Post the host XMS-based peripheral module (XPM). Determine the peripheral module (PM) state of the host XPM.

5 If the host XPM is in-service (InSv), display peripheral side (P-side) links, busy, test, and RTS the host XPM.

6 If the host XPM is in-service trouble (ISTb), busy and test the host PM. Busy and test the host PM to locate the correct card list.

7 Perform the correct card replacement procedures.

8 RTS the host XPM.

Faulty ringing generator (RG) frequency generator circuit

To handle a defective RG frequency generator circuit:

1 Test the RG.

2 If the test fails, replace the RG.

Load file mismatch

To handle a load file mismatch:

1 Post the OPM.

2 Use the QUERYPM command to display the PM load that resides in the OPM.

3 Determine the correct OPM PM load.

4 Correct Table LCMINV if the table has the wrong PM load for the OPM.

5 If the table has a PM load that is not correct for the OPM, obtain the correct PM load. Load the OPM again.

Diagnostic tests

Bit error rate performance testing

Bit error rate performance (BERP) tests test transmission paths through the network. The BERP test allows the operating company to assess the bit error performance of the Digital Multiplex System-100 (DMS-100) switch and subtending nodes. The BERP are provided with tests with feature package NTX881AB. The BERP requires the NT6X99AA IBERT line card supplied in the LCM of the OPM.

The BERP tests consist of many separate bit error rate tests (BERT). To perform a BERT test, operating company personnel must transmit a known bit pattern and connect an integrated bit error rate tester (IBERT) to one of the following:

- the IBERT
- a specified endpoint, like data line card (DLC)

The system reflects this bit pattern back to the IBERT and compares the IBERT to the item that was sent. The system records any errors in the returned bit stream. The results of these separate BERTs comprise the result of the BERP test.

The user can access the BERP test from the maintenance (MTC) level of the MAP terminal. Commands at the BERP level set up tests all the time or for a fixed duration.

Link tests

The BERP tests can perform on the DS-1 links that connect the host controller to the OPM. To perform the BERP test on a DS-1 link, a loopback must be present at some point on the transmission path. The DS-1 loopback is at the P-side of the host XPM. The system loops back all 24 channels on the DS-link. When use of a DS-1 loopback occurs, the removal of the DS-1 link undergoes necessary tests from service.

XPM bit error ratio test

The host XPM performs the XPM bit error ratio test (XBERT) for the OPM subsystem. The XBERT is a diagnostic test that does the following:

- detects and measures pulse code modulation (PCM) bit errors that occur in XPM and OPM cards
- commissions DS-1 and PCM-30 links and trunks which are looped back DS-1 and PCM-30 without the use of a remote node

The XBERT detects bit errors in the transmission of high-speed data in the cards of the host XPM. These cards can be a line group controller (LGC), line trunk controller (LTC), or remote cluster controller (RCC), and cards in the OPM. The XBERT tests are provided with feature package NTX885AA. These tests also require the NT6X99AA IBERT line card supplied in the LCM of the OPM.

> ***Note:*** To use XBERT, the XPM must have an NT6X69AB message protocol card or an NT6X69AA message protocol card. The XPM must have an NT6X69AB message protocol card or an NT6X69AA message protocol card with an NT6X79 tone card.

Test conditions

For accurate fault detection, XBERT tests run on an active in-service XPM unit. The XBERT tests also can run on an out-of-service unit. A minimum of one unit of the OPM must be in-service.

> ***Note:*** The user must not use the XBERT as a tool that provides accurate bit error ratio evaluation. The XBERT test procedure does not use the CCITT standard test patterns. The XBERT uses XPM tone PCM to provide the 64-kbps test bit stream.

Test types

The XBERT runs two tests, with the use of the Initiate (I) command. The tests involve the OPM. The test names and the associated cards of the test names appear in the following table.

Table 10-2 XBERT tests

Test name	Related cards
XBERTDCC	NT6X44, NT6X50, NT6X69, NT6X52, NT6X73
XBERTBIC	NT6X44, NT6X50, NT6X69, NT6X52, NT6X54, NT6X73

The isolate command automatically runs tests to isolate a fault to a specified set of cards. The number of cards in the card list of the cards varies from one to three. The separate test results determine the number of cards in the list.

One manual request can test the P-side ports of the XPM or the OPM bus interface cards (BIC) in order.

Test XBERTDCC (digroup control cards)

To test the digroup control cards (DCC), the XPMDCC test path travels through the following cards:

- Message card (NT6X69)
- Timeswitch card (NT6X44)
- DS-1 interface card (NT6X50)
- DCC (NT6X52)
- Link control card (LCC) (NT6X73)

The XBERTDCC attempts to establish a looparound of a manually specified P-side port at the OPM DCC to set up a test path. If the attempt is not successful, a response appears. The system aborts the test. If the whole OPM looparound is allocated, the system runs the test.

Test XBERTBIC (bus interface cards)

To test BICs, the XBERTBIC test path travels through the following cards:

- Message card (NT6X69)
- Timeswitch card (NT6X44)
- DS-1 interface card (NT6X50)
- LCC (NT6X73)
- DCC (NT6X52)
- BIC (NT6X54)

The XBERTBIC attempts to establish a looparound of the manually specified P-side port at an OPM BIC to set up the test path. With BIC, the user must manually specify the test loop to terminate. If the attempt is not successful, a response appears. The system aborts the test. If the whole NT6X54 looparound is allocated, the system runs the test.

Entering XBERT

The user can enter the XBERT level at any level of the MAP terminal. The user enters one of the following commands:

- XBERT <<PM>> <<PM#>>
- XBERT N <<node#>>

When the user enters the command XBERT N <<node#>>, the user enters XBERT through the PMs node-assignment number. Table NNASST contains node-assignment numbers. The user can locate node-assignment numbers with the QUERYPM command to post the PM. Test at the PM MAP display level.

Lines maintenance

Tests occur under the the lines maintenance (LNS) subsystem for line circuits, subscriber loops, and stations. Tests occur on line circuits and subscriber loops manually and automatically in this subsystem.

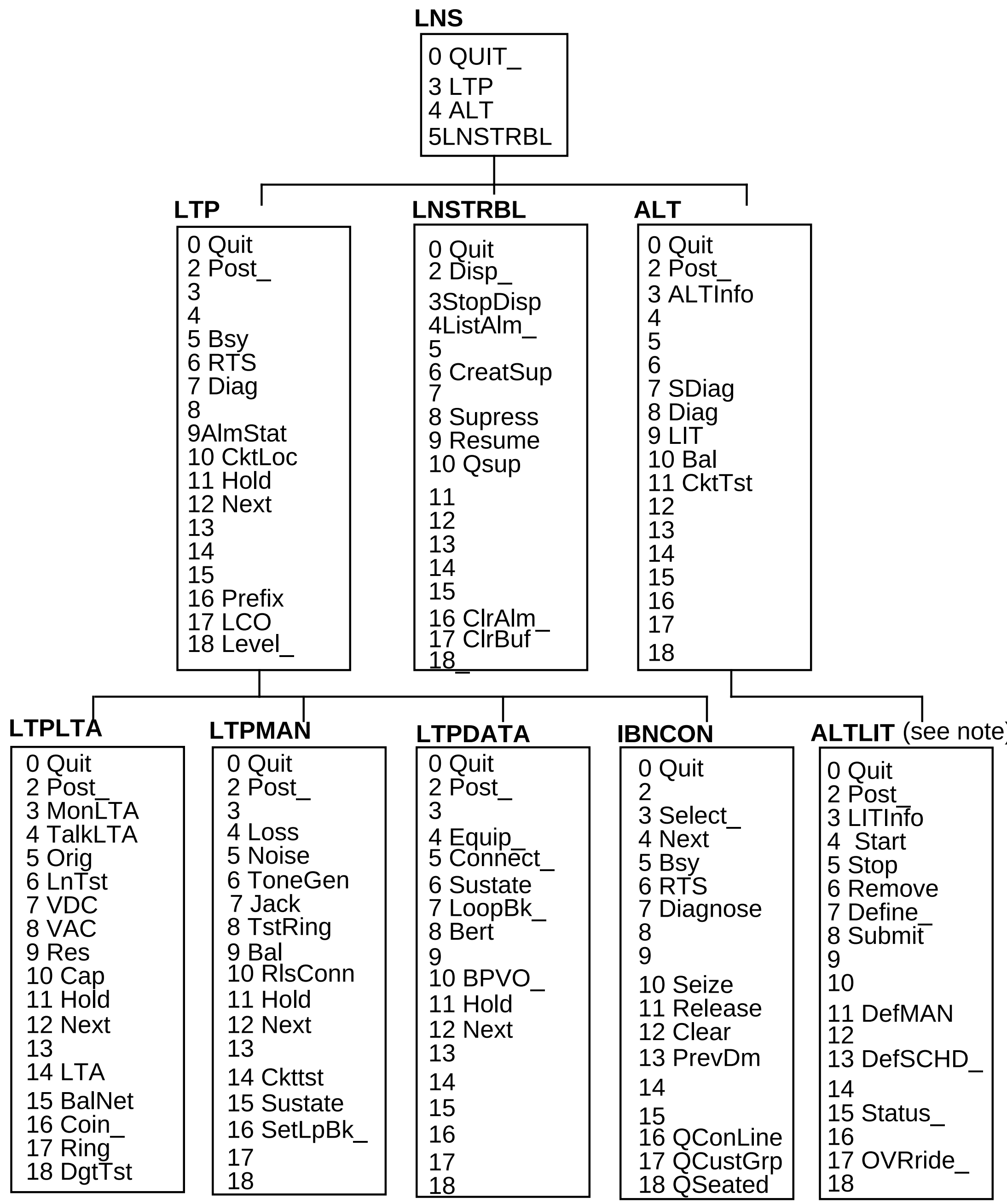
Line tests help determine if a line circuit, loop, or line circuit and loop group operate correctly. If the line is defective, line tests determine if the fault occurs in the line circuit or the attached loop. When a fault is in the loop, another department, like plant maintenance, handles this fault. When the fault is in the line circuit, the system replaces the line card. Tests for the line occur again to check that the fault cleared.

Automatic line testing

Automatic line tests (ALT) occur on line circuits and loops on a scheduled basis. The ALT occur without switch operator involvement other than for the first scheduling. The ALT must occur when a line indicates a fault.

The following figure shows the commands available at the sublevels of the LNS subsystem.

Figure 10-1 Line maintenance commands



Note: The menu of commands for the ALTLIT level is the same as for the other ALT sublevels. The command LITINFO in the ALTLIT level does not appear at any other ALT sublevel.

The ALT in a DMS-100 switch office occurs under the LNS subsystem. The previous figure shows the commands available at the ALT level of the LNS level, which define the ALT. A description of these commands follows:

- The DIAGN command executes a full diagnostic test on the line card circuits. The DIAGN command identifies defective line cards before the defective line cards generate customer reports. The DIAGN command uses the line test unit (LTU) of the OPM RMM to start tests. If the LTU is not present, this command starts the no-LTU diagnostic.
- The SDIAG command is a subset of the DIAG test. The SDIAG command makes sure that most of the line card circuitry operates correctly.
- The BAL command automatically sets the balance network in the line card to provide transmission balance. The transmission balance occurs between the four-wire side of the switch and the two-wire loop. The condition minimized subscriber reports of noise, echo, and garbled speech.
- The LIT command starts an automatic test that detects cable pair faults. These faults must be cleared before the faults affect service and subscribers report problems like hum, noise, grounds, or false ring trip.

The CKTTST uses the following to apply to loops:

- Meridian business sets (MBS)
- data units (DU) that associate with Datapath
- asynchronous interface modules (AIM)
- IBERT line cards

The CKTTST performs circuit tests to confirm the ability of the set or line card to transmit and receive messages correctly. The CKTTST performs circuit tests to confirm the ability of the set or line card to adhere to message protocol.

When the user posts the failures at the LTP, the switch operator receives the lines that fail to meet standards of quality. Lines are also identified by output reports the ALT log subsystem generates. The user manually tests and corrects the identified failures.

Station tests

Station tests occur under the LNS subsystem at a MAP terminal. For Silent Switchman (SSMAN) and Station Ringer (SR) tests, station tests occur from a station. Tests for stations are manual tests.

Station test results appear at the visual display unit (VDU), except for the Station Ringer and Silent Switchman tests. The station receives the results of these tests.

Station tests help determine if a station operates correctly when connected to a loop and line circuit group.

Manual line testing

The switch operator performs manual line tests on line circuits, loops, and stations. The switch operator tests line circuits and loops on a separate basis. The results of the test appear at a VDU to the switch operator immediately after the test.

Manual line tests occur as part of routine maintenance when the system generates a customer report or an ALT failure occurs. Manual line tests occur at the LTP level with any of the four levels of the LNS subsystem. The four levels of the LNS subsystem are ALT, LTP, LTP manual (LTPMAN), and LTP line test access (LTPLTA).

Manual line tests at the ALT level defines one line on which tests occur immediately. At the other three levels, manual tests occur when the switch operator places the line on which the test occurs in the control position. The switch operator controls this line, which the switch operator can manipulate. The user must post a line before the user places the line in the control position.

Product-specific test tools

Line maintenance cutover (LMCUT)

The Automatic Board-To-Board Testing (ABBT) feature uses the Line Maintenance Cutover (LMCUT) facility, with feature package NTX05. The ABBT, during commissioning, uses LMCUT to transfer or cutover in-service lines from a current switch to a DMS switch. This ABBT feature also provides message recording of all the LMCUT command executions in a progress file.

The LCMs support the LMCUT commands. The LMCUT commands are valid only on LCMs when a DN cuts over the switch. The cutover occurs according to DNs or to LENs. The commands for cutover by DN and LEN are separate with the exception of the commands OPRTCO, RLSCO, and NOBST.

The LMCUT commands allow the user to do the following:

- set or query the cutover mode of the switch (by DN or by LEN)
- enable, disable, clear, or query the progress message recording
- operate, release, or verify the cutover relays on a range of DNs or LENs
- operate, release, or query the HOLD relay setting on a drawer

11 Troubleshooting chart

The following table describes the basic troubleshooting procedures for Outside Plant Module (OPM) alarms.

Table 11-1 OPM alarm clearing (Sheet 1 of 3)

Alarm condition	Possible cause	Action
Critical	Defective line concentrating module (LCM) processor cards in both LCM units Defective power converter cards in both LCM units All DS30A message ports are closed.	Identify and post the system busy (SysB) LCM. Busy both units of the defective LCM. Return to service (RTS) the defective LCM. If an RTS fails, load the defective LCM. Test and RTS the defective LCM.

Table 11-1 OPM alarm clearing (Sheet 2 of 3)

Alarm condition	Possible cause	Action
Major	Defective LCM processor Defective digroup control card Defective power converter Defective ringing generator (RG) circuit Closed DS30A message port Line group controller (LGC) or line trunk controller (LTC) forces activity switch in LCM.	Identify and post the in-service trouble (ISTb) LCM. Identify fault indicators with QUERYPM FLT command. If the LCM is C-side busy (CBsy), identify central-side (C-side) links to host peripheral module (PM). Post host PM for defective P-side links. Busy, test, and RTS the defective P-side links. Post, busy, test, and RTS the defective LCM. If the LCM is system-busy (SysB), busy and test the defective LCM unit. If the test fails, with a card list, replace any defective cards. Test, and RTS the defective LCM unit. If the test fails, with no card list, test the defective LCM unit and RTS the LCM unit. If the LCM is manual busy (ManB), test the defective LCM unit. If the test fails, with a card list, replace any defective cards. Test, and RTS the defective LCM unit. If the test fails, with no card list, test the defective LCM unit and RTS the LCM unit.

Table 11-1 OPM alarm clearing (Sheet 3 of 3)

Alarm condition	Possible cause	Action
Minor	Defective RG frequency generator circuit Activity mismatch Data error Diagnostic failure Load file mismatch Self-test failure	Identify and post the ISTb LCM. Identify fault indicators with QUERYPM FLT command. If the LCM is CBsy, identify C-side links to the host PM. Post the host PM for defective P-side links. Busy, test, and RTS the defective P-side links. Post, busy, test, and RTS the defective LCM. If the LCM is SysB, busy and test the defective LCM unit. If the test fails, with card list, replace any cards. Test and RTS the defective LCM unit. If the test fails, with no card list, test the defective LCM unit again and RTS the LCM unit. If the LCM is ManB, test the defective LCM unit. If the test fails, with a card list, replace any defective cards. Test and RTS the defective LCM unit. If the test fails, with no card list, test the defective LCM unit again and RTS the LCM unit.

Refer to *Alarm Clearing Procedures* for complete troubleshooting methods for OPM alarms

12 Advanced troubleshooting procedures

A defective unit is normally busied and tested. The system displays a list of cards at the MAP terminal after the tests complete. The card at the top of the list often causes the problem.

After you replace the problem card, test the defective unit again. If the unit passes this test, return the unit to service. The troubleshooting procedure is complete.

If normal troubleshooting procedures do not restore a unit to service, the unit requires advanced troubleshooting procedures.

Operating company personnel can use MAP terminal responses from failed troubleshooting attempts to formulate a maintenance plan. Use more advanced step-action procedures to repair a problem.

Powering-up the OPM

If operating company personnel anticipate a power outage, operating company personnel must power-down the Outside Plant Module (OPM). An example of this type of power outage is an anticipated natural disaster. Operating company personnel power-down the OPM for the duration of the event to minimize equipment damage. This action allows the operating company to return the power in an ordered fashion.

To power-up the OPM, perform the following steps:

1. Post the OPM from the MAP terminal.
2. At the remote site, set the switch on the power converter to the ON position.
3. Hold in the reset button on the power converter, and flip the appropriate circuit breaker up. Do not hold the circuit breaker up. If the OPM receives

power, the circuit breaker stays in the ON position. If a problem occurs with the power, the circuit returns to the OFF position.

a. Repeat steps Item 2, "At the remote site, set the switch on the power converter to the ON position." on page 12-1 and Item 3, "Hold in the reset button on the power converter, and flip the appropriate circuit breaker up. Do not hold the circuit breaker up. If the OPM receives power, the circuit breaker stays in the ON position. If a problem occurs with the power, the circuit returns to the OFF position." on page 12-1 for the other LCM unit.

b. Busy both LCM units.

4. List the peripheral module (PM) loads at the input-output (I/O) device used to return the units to service. List the PM loads at the I/O if you did not perform this action during the power-up. To list the PM loads, type

   >DSKUT;LISTVOL volume name ALL

   and press the Enter key.

   If you load from a DMS Supernode, type

   >DISKUT;LV CM;LF volume name

   and press the Enter key.

   where

   volume name
   is the volume where the PM loads occur

   Note: List the PM loads one time only.

5. Use the LOADPM command to load the OPM.
6. Test the OPM.
7. Return the OPM to service.
8. This procedure is complete.

Powering-down the OPM

> **CAUTION**
> **Loss of service**
> Use this procedure in severe conditions like anticipated natural disasters. This procedure causes a complete loss of service to the subscriber.

Perform the following steps at the MAP terminal to power-down the OPM:

1. Post the OPM.
2. Identify the unit to power down.
3. Busy the OPM unit. To busy the unit, type

   `>BSY UNIT unit_no`

   and press the Enter key.

   where

   unit_no
   is the number of the to power down.
4. Set the switch on the power converter to OFF to remove power from the busied OPM unit. This action powers the OPM unit down.
5. Repeat this procedure for the mate unit.
6. This procedure is complete.

Common procedures

The following sections provide common troubleshooting procedures for loading, RTS, dial tone, and ringing generators.

Troubleshooting a loading failure

DANGER
Possible service interruption
Use caution when you use PMDEBUG on a peripheral that functions. Use only the commands shown.

The steps for troubleshooting a failure to load the peripheral program files for the OPM are as follows:

1. Verify that no blown fuses are present. Verify that the power converters are powered-up and supply the correct voltages.
2. Unseat the following cards:
   - 6X51, 6X52, 6X53 from unit 1
   - 6X50 (slot 20 of HIE shelf)
   - 6X73 (slot 18 of HIE shelf)
   - 2X70 (slot 22 of the HIE shelf)
3. Attempt to load unit 0.
4. If unit 0 fails to load, reseat the cards removed for unit 1. Unseat the following cards:
   - 6X51, 6X52, 6X53 from unit 0
   - 6X50 (slot 19 of HIE shelf)
   - 6X73 (slot 17 of HIE shelf)
   - 2X70 (slot 25 of the HIE shelf)

   Attempt to load unit 1.
5. If both units fail to load, attempt to load the PM from another device. Attempt to load the PM from the following devices in the order listed:
   - the input/output controller (IOC) disk drive
   - the system load module (SLM)
   - the original PMLOAD tape
6. Replace the 6X51, 6X52, and 6X53 cards in unit 0 and unseat the same cards in unit 1. Attempt to load unit 0.
7. If unit 0 fails, replace the 6X51, 6X52, and 6X53 cards in unit 1 and unseat the same cards in unit 0. Attempt to load unit 1.
8. If both units fail to load, replace the 6X73 (slot 17 of HIE shelf). Replace the 6X50 (slot 19 of HIE shelf) cards. Attempt to load unit 0.

9. If unit 0 fails to load, replace the 6X73 (slot 18 of HIE shelf). Replace the 6X50 (slot 20 of HIE shelf) cards. Attempt to load unit 1.
10. If both units fail to load, replace the associated 6X50 cards in the host XPM.
11. Power down and unseat the 2X59, 6X74, 2X09, and 2X06 cards in the remote maintenance module (RMM) shelf. Attempt to load each unit.
12. Perform the following to determine if links to the OPM are defective:
    a. QUERYPM the OPM. Note the node number of the OPM. Enter the command string TRNSL C and note the host XPM or RCC.
    b. Enter <pmdebug hosting XPM> to PMDEBUG the host XPM. An example is of the PMDEBUG command is pmdebug LTC 0.
    c. Enter <mp * * * * * cp e nn 0> to determine the internal node number. In this command, nn equals the external node number obtained from QUERYPM in step a.
    d. Enter <sp * * * * * n>. This command accesses the signal processor new messaging level.
    e. Enter <n>. This command accesses the netlayer sublevel.
    f. Enter <neta>. This command accesses the net address sublevel.
    g. When prompted, enter the internal node number obtained in step a.Item a, "QUERYPM the OPM. Note the node number of the OPM. Enter the command string TRNSL C and note the host XPM or RCC." on page 12-5
    h. Enter the unit that corresponds to the messaging link in question.
    i. Note the data link number specified as open.
    j. Enter <* d>. This command accesses the dl data level.
    k. Enter <v dl>. For this command dl equals the data link number obtained in steps h and i. This command verifies if you have the correct link. The output indicates the same type PM as the remote you work with. An example of output is opm_fmt.
    l. Enter <r dl>. This command displays hex values that correspond to control bytes received from the remote. Enter Return two times to halt the display.
    m. Remove the DS-1 interface card for the link at the remote end.
    n. Verify hex values equal #FF. If the hex values do not equal #FF, make sure you remove the correct DS-1 interface card and the correct data link number is monitored. If you removed the correct DS-1 interface card and the correct data link number is monitored, check for miswires or shorts on the link. To check for miswires or shorts on the link, remove repeater cards until values equal #FF. Correct the

problem. If all actions are correct, proceed to step o.Item o, "At the remote, loop back the link to test toward the host." on page 12-6

o. At the remote, loop back the link to test toward the host.

p. When the span loops back, verify the values equal one of the following DMS-X control byte values. The normal value is #1E.

Table 12-1

DMS-X control byte	Value	Meaning
MIS	#8D	May I send
SOM	#4B	Start of message
PACK	#1E	Positive acknowledgment
NACK	#55	Negative acknowledgment
EOM	#4B	End of message
ESC	#4B	Escape character

If the values are the same as the preceding values, the link functions.

If values are different than the preceding values, the link or host equipment is defective.

If the values are correct, remove loopback, verify values equal #FF, and reseat DS-1 interface card.

If the values are not correct, check loopback again to verify correct loop. Troubleshoot the link or switch the link with nonmessaging link at both ends. Verify if the hex values are correct.

q. Enter <* * mp>.

r. Enter <quit>.

s. Check for bent pins behind the 6X51, 6X52, 6X53, 6X73, and 6X50 cards. Verify the connector on slot 5 of each shelf on the backplane is tight.

t. If the OPM fails to load, SWACT the line group controller (LGC). Contact the next level of support.

Troubleshooting RTS failure

Enter the command string RTS FORCE if the OPM fails to RTS. The RTS FORCE procedure is as follows:

1. Check logutil for RTS failure reasons.
2. Replace any cards on the card list displayed at the MAP level or in the logs.

3. Unseat the following cards:
   - 6X51, 6X52, 6X53 cards from unit 1
   - 6X50 (slot 20 of HIE shelf)
   - 6X73 (slot 18 of HIE shelf)
   - 2X70 (slot 25 of the HIE shelf)

   Attempt to RTS FORCE unit 0.
4. If unit 0 fails to RTS, seat the cards into unit 1 again. Unseat the following cards:
   - 6X51, 6X52, 6X53 cards from unit 0
   - 6X50 (slot 19 of HIE shelf)
   - 6X73 (slot 17 of HIE shelf)
   - 2X70 (slot 22 of the HIE shelf)

   Reload unit 1 and enter the command string RTS FORCE.
5. The system can return the OPM to service and place the OPM in a C-side busy (CBsy) state. SWACT the LGC. Enter the command string RTS FORCE again.
6. The system can return the OPM to service and place the OPM in a system busy (SysB) state. In this event, a defective 6X54 card, line card, or drawer is present. Check logutil for a possible card list.
7. If any light-emitting diodes (LED) on the RGs are illuminated, refer to the procedure *Troubleshooting ringing generator problems*.
8. If both units fail to RTS, contact the next level of support.
9. This procedure is complete.

Troubleshooting dial tone problems

Power-up the OPM. When one or both LCM units are in service, check the line subgroups (LSG) to verify the LSGs have dial tone. If the LSGs do not have dial tone. To troubleshoot the source of dial tone failure use the following procedure:

1. If the even-numbered line subgroups (LSG) do not have dial tone, reseat and/or replace the 6X52 card in unit 0.
2. If the odd-numbered LSGs do not have dial tone, reseat and/or replace the 6X52 card in unit 1.
3. If LSGs 0 through 9 do not have dial tone, verify with a voltmeter that TB1 lug 7 reads -48 V. This terminal block is located on the back of the frame supervisory panel (FSP).

This voltage is the talk-battery supply for these drawers and comes from the power distribution center (PDC) for this frame. Check the fuse in the PDC if the voltage is not available.

4. If LSGs 10 through 19 do not have dial tone, verify with a voltmeter that TB1 lug 8 reads -48V. This voltage is the talk-battery supply for these drawers.
5. If you do not have dial tone, contact the next level of support.
6. This procedure is complete.

Troubleshooting ringing generator problems

One or both ringing generators (RGs) can fail. The LEDs on the 6X30 RGs can illuminate. To isolate and correct the problem perform the following procedure:

1. Replace the RG first.

   Note: When you power-down a RG, the system removes the associated OPM unit from service. When you power-down RG-0, the system removes unit 0 from service.

2. Remove the RA and RB fuses one shelf at a time and observe the LEDs. The RA fuse supplies ringing to the even-numbered subgroups for the specified shelf. The RB fuse supplies ringing to the odd subgroups for the specified shelf.

   If the LED disappears when you remove a fuse, proceed to step Item 4, "Reseat the cards in the troubled unit. Remove the fuses for each drawer in the shelf. Make sure you pull all three fuses (5 V, 15 V, and 48 V) for the drawer. If the cycling does not stop, replace the fuses for the drawer. Proceed to the next drawer until the cycling stops." on page 12-8. If the LED stays, proceed to step Item 3, "Busy one unit at a time. Unseat the 6X51, 6X52, and 6X53 cards and watch for the cycling to stop. This action isolates the trouble to the unit. Replace the 6X51, 6X52, AND 6X53 cards." on page 12-8.

3. Busy one unit at a time. Unseat the 6X51, 6X52, and 6X53 cards and watch for the cycling to stop. This action isolates the trouble to the unit. Replace the 6X51, 6X52, AND 6X53 cards.
4. Reseat the cards in the troubled unit. Remove the fuses for each drawer in the shelf. Make sure you pull all three fuses (5 V, 15 V, and 48 V) for the drawer. If the cycling does not stop, replace the fuses for the drawer. Proceed to the next drawer until the cycling stops.
5. If you remove all the fuses and the cycling does not stop, more than one drawer is defective. In this event, remove all fuses for all drawers in the shelf at the same time. Replace the three fuses for each drawer and note when the cycling starts.

When the cycling starts for a specified drawer, remove the fuses again. Proceed to the next drawer. This action isolates all the drawers that cause the problem.

6. When you isolate the drawer, insert the fuses back for the drawer or drawers. Unplug the controller cable on the back of the line drawer. The controller cable is the center cable, labeled C and D.
7. Replace the 6X54 card in the isolated drawer and connect the controller cable back into position.
8. If the cycling continues, unseat the line cards one at a time in the suspect subgroups to locate the defective line card. The line drawer can require replacement.
9. Contact the next level of support.
10. This procedure is complete.

13 OPM routine maintenance procedures

This chapter contains routine procedures for the Outside Plant Module (OPM). These procedures cover preventative maintenance tasks. Maintenance engineering and field personnel should perform these procedures on a regularly scheduled basis.

Battery capacity tests OPM

Application

Use this procedure to check the capacity of Yuasa (A037761) or Eagle-Picher (A0386201) batteries. Use this procedure to check the capacity of Yuasa or Eagle-Picher battteries in OPMs that have a line test unit (LTU) or multiline test unit (MTU).

Interval

Perform this procedure every six months when LTU or MTU measurements comply to specifications. Perform this procedure every 3 months if the LTU or MTU measurements are not in specified limits. Do not perform this procedure at the same time as the automatic battery testing.

Common procedures

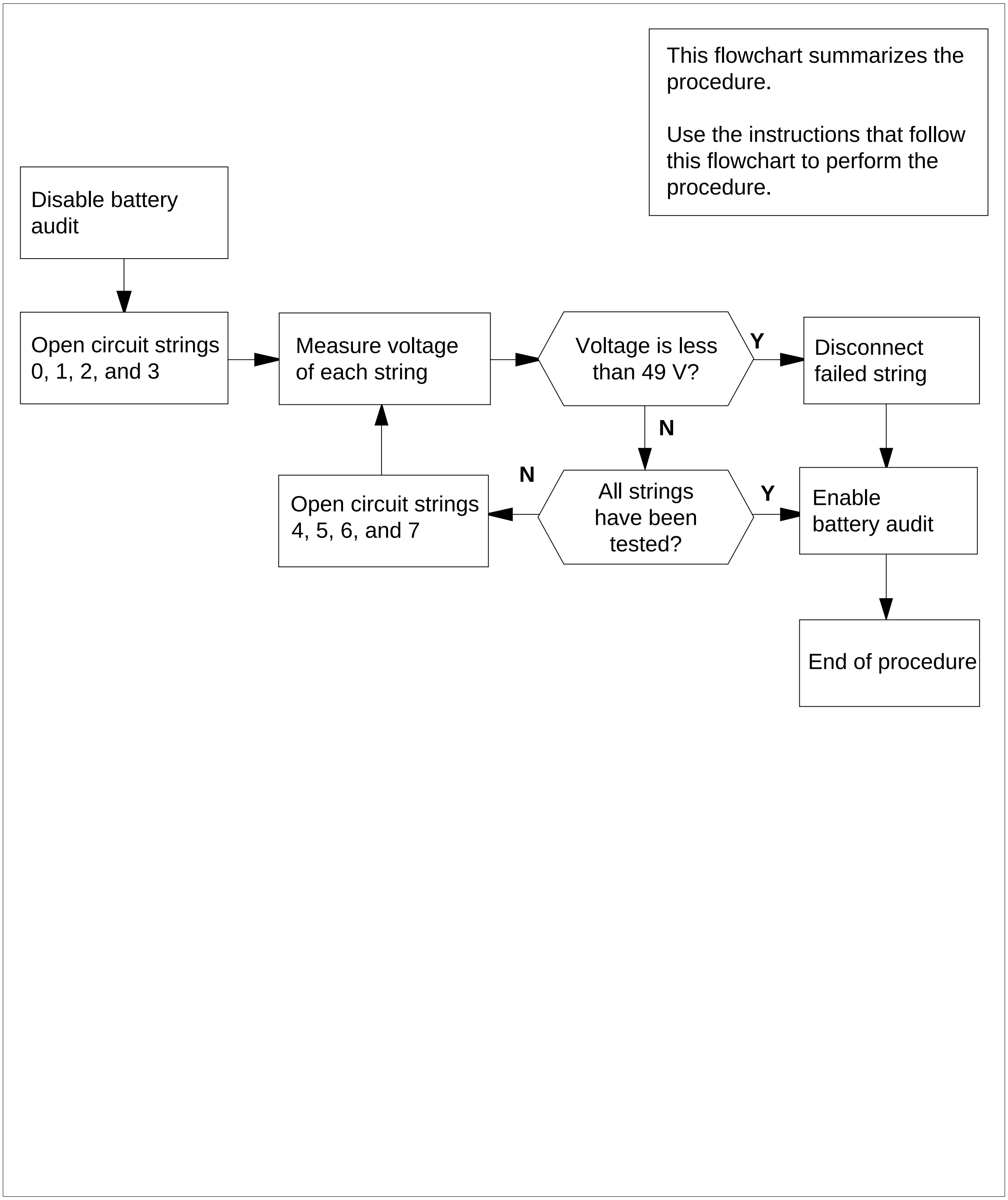
There are no common procedures.

Action

This procedure contains a summary flowchart as an overview of the procedure. Use the steps that follow the flowchart to perform this procedure.

Battery capacity tests
OPM (continued)

Summary of battery capacity tests OPM



Battery capacity tests
OPM (continued)

Battery capacity tests in OPM

At your present location

1 Make sure that extended power failures did not occur at the OPM site in the last 72 hours. Verify that the OPM is not in post ac failure recovery mode.

At the MAP terminal

2 To access the OPMPES MAP display level, type

>MAPCI;MTC;PM;PES

and press the Enter key.

3 To post the appropriate alarm state, type

>POST alarm_state

and press the Enter key.

where

alarm_state
is GREEN, AMBER, RED or OFFL

Note: If required use the NEXT command to scroll through the post set to the appropriate PES.

4 To disable the automatic battery rotation and testing, type

>AUDIT DISABLE

and press the Enter key.

5 To open battery string pairs 0 and 4, type

>OPENCKT 0

and press the Enter key.

where

0
is the battery string pair 0 and 4

6 To open battery string pairs 1 and 5, type

>OPENCKT 1

and press the Enter key.

where

1
is the battery string pair 1 and 5

Battery capacity tests
OPM (continued)

Example of a MAP display

```
 CM     MS      IOD      NET      PM      CCS      LNS      Trks      Ext
 .      .        .        .      1PES      .        .        .         .
 PES                     SysB    ManB     OffL     CBSY     ISTB      InSV
 0 Quit      PM           0       3        4        0        4        30
 2 Post_
 3                        RED       AMBER      GREEN      OFFL
 4           PES          0          1          6          0
 5
 6 Tst_      PES       2 Cond:  RED     REM2      2   1   RMM    2
 7 Bsy_                                            Audit  Week   HBT
 8 Rts_        Common      Rectifiers                DIS     -     .
 9 OffL_        AC      FL0 FL1 CL0 CL1    BCCDVR  PESALRM   ECU FSP
10               .        .   .   .   .   .   .        .         .   .
11 Disp_       BCC     0     1     2     3     Temp      Door     BCCFUSES
12 Next      0= W    O/C   O/C    .     .   EHT ELT   FRNT SIDE    0   1
13           1= W    O/C   O/C    .     .    .   .     .    .      .   .
14 QueryPES
15 OpenCkt_
16 Charge_                Indicates the open-circuited
17 LoadB_                 string pairs
18 MEASure_
```

7 Go to step 10.

8 To open battery string pairs 2 and 6, type

>OPENCKT 2

and press the Enter key.

where

2
is the battery string pair 2 and 6

9 To open battery string pairs 3 and 7, type

>OPENCKT 3

and press the Enter key.

where

3
is the battery string pair 3 and 7

Battery capacity tests

OPM (continued)

Example of a MAP display:

```
 CM     MS       IOD     NET      PM      CCS      LNS      Trks      Ext
 .      .         .       .      1PES      .        .        .         .
 OPMPES                    SysB    ManB     OffL     CBSY     ISTB     InSV
 0 Quit       PM           0       3        4        0        4       30
 2 Post_
 3                          RED       AMBER      GREEN      OFFL
 4            OPMPES       0          1          6         0
 5
 6 Tst_       OPMPES     2 Cond:  RED     REM2      2   1   RMM   2
 7 Bsy_                                                Audit  Week  HBT
 8 Rts_        Common      Rectifiers                   DIS     -    .
 9 OffL_        AC      FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
10               .       .   .   .   .   .   .        .         .   .
11 Disp_       BCC    0     1     2     3    Temp      Door    BCCFUSES
12 Next       0= W    .     .    O/C  O/C EHT ELT  FRNT SIDE    0   1
13            1= W    .     .    O/C  O/C  .   .    .    .      .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 MEASure_
```

Indicates the open-circuited string pairs

Battery capacity tests
OPM (continued)

At the OPM cabinet

10

DANGER
Possible system damage
You can add or remove battery strings from an active OPM. If you perform this action make sure the battery strings are in the open-circuit state from the MAP terminal. Turn off the associated battery charger controller card BCC NT8X02. Connect or disconnect the battery cables at the back of the cabinet. When you connect the affected battery strings, return the battery strings to the load bus one string at a time. If there is no MAP control, turn off the BCC before you connect or disconnect any battery strings.

WARNING
Possible loss of service during battery replacement
Do not turn off more than one BCC NT8X02 at a time. If you turn off more than one BCC NT8X02 service is lost if ac power is interrupted. Turn off BCC0 when you perform work on battery strings 0, 1, 2, or 3. Turn off BCC1 when you perform work on battery string 4, 5, 6, or 7.

DANGER
Risk of batteries cracking
Disconnect the battery string immediately. If you do not disconnect the battery string immediately the batteries can crack before you install new batteries.

Use a voltmeter with 0.2% or greater accuracy to measure the voltage of battery strings 0, 1, 2, and 3. Measure the voltage at the battery terminals, not at the faceplate of the NT8X02 BCC card.

Note: If you enter this procedure from step 7, you are testing battery strings 4, 5, 6, and 7.

The voltage must measure 50.4 V (80% capacity). If the voltage measures less than 50.4 V, you must place the battery string in less than one month.

If measured voltage	Do
is less than 49 V	step 11

Battery capacity tests
OPM (continued)

If measured voltage	Do
is greater than 49 V	step 12

11 Disconnect the battery string immediately. If you do not disconnect the battery string immediately the batteries can crack before you install new battery strings. Refer to the battery replacement procedure to replace the pair of batteries as soon as possible.

12 Continue this procedure based on the battery strings tested.

If the strings tested	Do
are 0, 1, 4, and 5	step 13
are 2, 3, 6, and 7	step 16

At the MAP terminal

13 To return battery string pairs 0 and 4 to the load bus, type

>LOADB 0

and press the Enter key.

where

0
is the battery string pair 0 and 4

14 To return battery string pairs 1 and 5 to the load bus, type

>LOADB 1

and press the Enter key.

where

1
is the battery string pair 1 and 5

15 Go to step 8.

16 To return battery strings 2 and 6 to the load bus, type

>LOADB 2

and press the Enter key.

where

2
is the string pair 2 and 6

17 To return battery strings 3 and 7 to the load bus, type

>LOADB 3

and press the Enter key.

where

Battery capacity tests
OPM (end)

3
is the string pair 3 and 7

18 To activate automatic battery rotation and testing, type

>AUDIT ENABLE

and press the Enter key.

19 This inspection procedure is complete.

Note: If an ac failure lasts for greater than 5 min when you perform this procedure, repeat the complete procedure.

Battery, physical inspection OPM

Application

Use this procedure to inspect the batteries in an OPM.

Interval

Perform this procedure every 6 months.

Common procedures

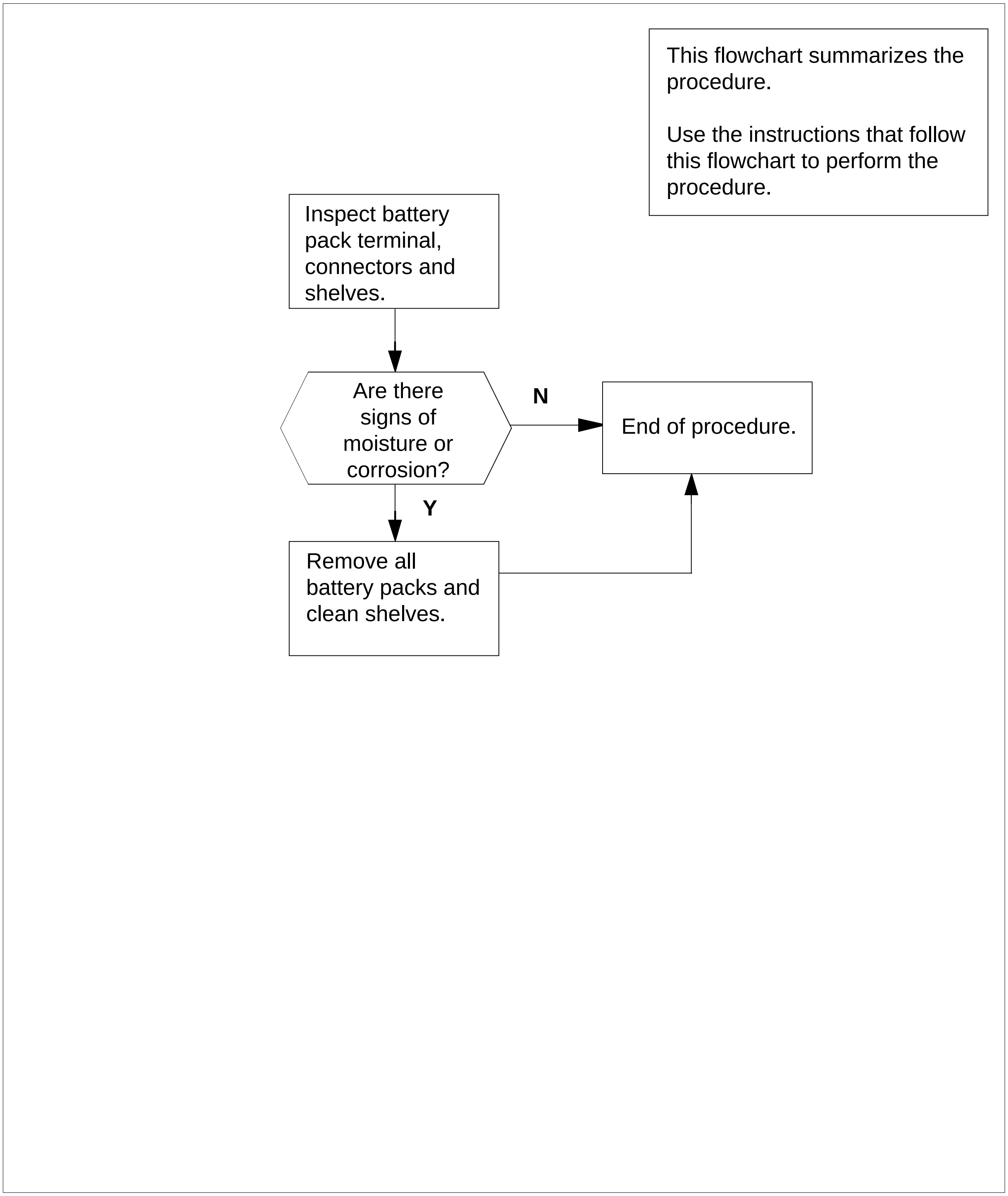
Does not apply

Action

This procedure contains a summary flowchart as an overview of the procedure. Follow the steps to perform this procedure.

Battery, physical inspection
OPM (continued)

Summary of battery, physical inspection of OPM



Battery, physical inspection
OPM (end)

Battery, physical inspection of OPM

At the OPM cabinet

1

> **DANGER**
> **Hazardous chemicals**
> Battery chemicals can be hazardous and can explode. Proceed with caution.

Inspect battery pack terminal, connectors and shelves for moisture or corrosion.

2 Are there signs of moisture?

If signs of moisture	Do
are present	step 3
are not present	step 6

3 Remove battery packs from the affected shelf.

4 Clean the affected areas with sodium bicarbonate and water. Continue until the cleaning liquid does not foam.

5 Make sure the cleaned area is completely dry. Replace the battery packs on the shelves.

6 The inspection procedure is complete.

Battery replacement
OPM

Application

Use this procedure to replace batteries in an OPM.

Interval

Follow this procedure when you perform one of the following operations:

- install the OPM cabinet
- replace battery strings for maintenance
- add battery strings

Common procedures

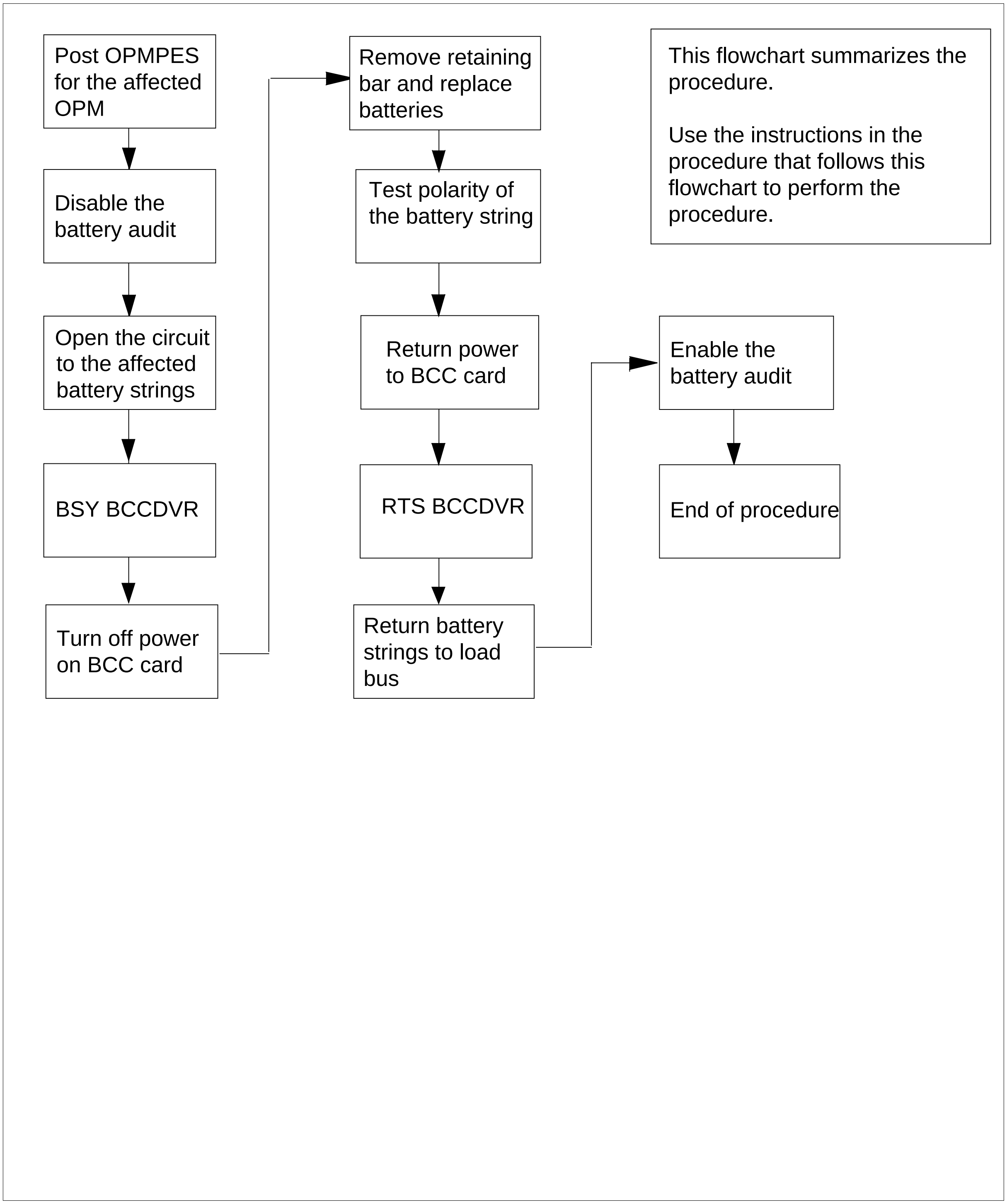
There are no common procedures.

Action

This procedure contains a summary flowchart. Use the summary flowchart to review the procedure. Follow the specified steps to perform this procedure.

Battery replacement
OPM (continued)

Summary of battery replacement in an OPM



Battery replacement
OPM (continued)

Battery replacement in an OPM

At the MAP terminal

1 To access the PES MAP display level, type

>MAPCI;MTC;PM;PES

and press the Enter key.

2 To post the alarm state, type

>POST alarm_state

and press the Enter key.

where

alarm_state
is RED, AMBER, GREEN or OFFL

3

DANGER
Possible system damage
When you add or remove battery strings from an active OPM, make sure the battery strings are in the open-circuit state. Check the state of the battery strings at the MAP terminal. Turn off the associated battery charger controller card BCC NT8X02. Connect or disconnect the battery cables at the back of the cabinet. When the affected battery strings are connected, return the battery strings to the load bus one string at a time. If there is no MAP control, turn off the BCC before you connect or disconnect any battery strings.

WARNING
Possible loss of service during battery replacement
Do not turn off more than one BCC NT8X02 at a time. If you turn off more than one BCC NT8X02 at a time, service is lost if ac power is interrupted. Turn off BCC0 when you work on battery strings 0, 1, 2 or 3. Turn off BCC1 when you work on battery strings 4, 5, 6, or 7.

To disable the automatic battery rotation and testing, type

>AUDIT DISABLE

and press the Enter key.

4 To open the circuit to the battery strings to replace, type

>OPENCKT n

Battery replacement
OPM (continued)

and press the Enter key.

where

n
is the string pair 0-3, as follows:

pair 0
is strings 0 and 4

pair 1
is strings 1 and 5

pair 2
is strings 2 and 6

pair 3
is strings 3 and 7

Example of MAP display:

```
 CM     MS      IOD     NET     PM     CCS     LNS     Trks    Ext
 .      .       .       .      1PES     .       .       .       .
 OPMPES                SysB    ManB    OffL    CBSY    ISTB    InSV
 0 Quit      PM          0       3       4       0       4      30
 2 Post_
 3                      RED       AMBER     GREEN     OFFL
 4           OPMPES      1          0         3        1
 5
 6 Tst_      OPMPES    2 Cond:  RED    REM2     2   1   RMM   2
 7 Bsy_                                          Audit  Week  HBT
 8 Rts_       Common     Rectifiers               DIS     -    .
 9 OffL_       AC     FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
10             .       .   .   .   .   .    M        M       .   .
11 Disp_      BCC    0    1    2    3    Temp      Door    BCCFUSES
12 Next      0= W   O/C  BSY  BSY  BSY   EHT ELT   FRNT SIDE    0   1
13           1= W   O/C  BSY  BSY  BSY    .   .     O    .      .   .
14 QueryPES_
15 OpenCkt_
16 Charge_                 Indicates the open-circuited
17 LoadB_                  string pair
18 MEASure_
```

5 To busy the battery charger controller, type

>BSY BCCDVR

and press the Enter key.

At the OPM cabinet

6 Turn the BCC NT8X02 power switch to the OFF position.

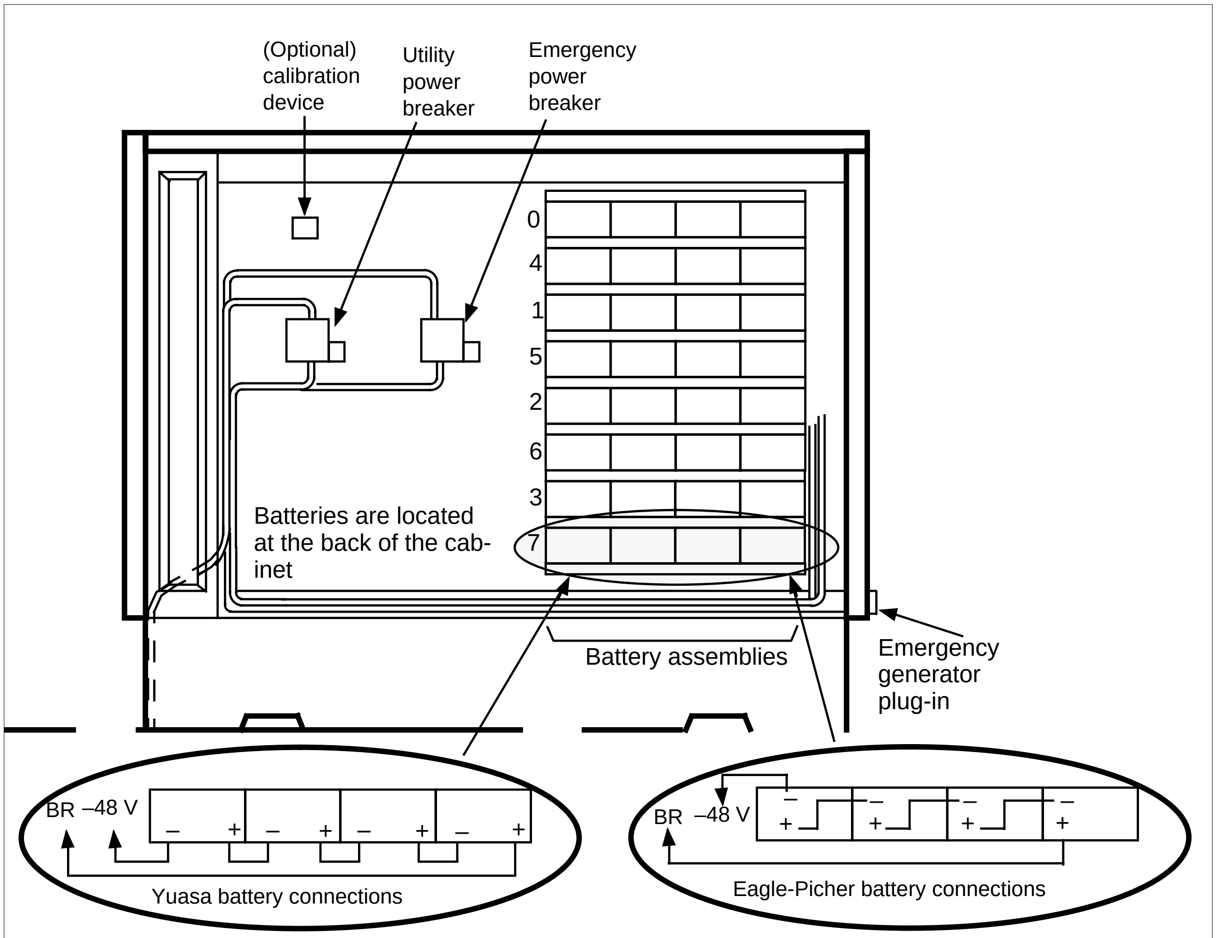
7 If you must replace the battery string, remove the retainer bar and the matched battery string that corresponds.

Battery replacement
OPM (continued)

8

DANGER
Hazardous chemicals
Battery chemicals can be hazardous and explosive. Use caution.

Install and interconnect the battery units. There are four matched battery units for each string in the shelf location that corresponds to the battery set number. Refer to the following figure for battery arrangement.

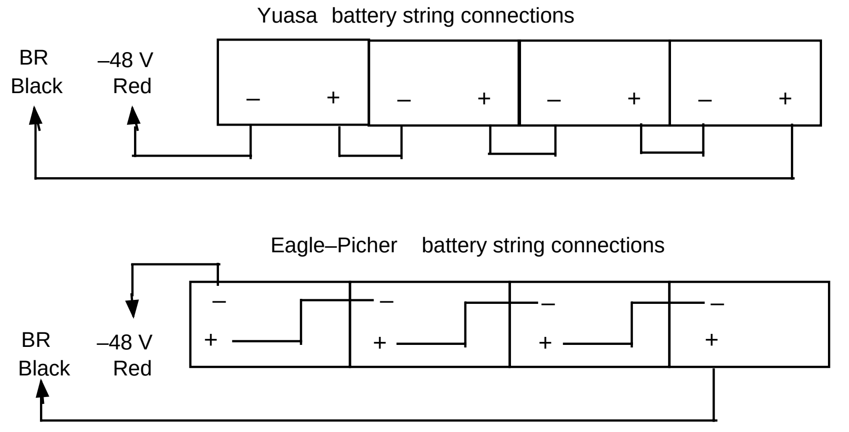


Note: Battery strings 3 and 7 are not provisioned for OPM-256 or when Eagle-Picher batteries are provisioned.

Battery replacement
OPM (continued)

9 Replace the retaining bar.

10 Use an ohmmeter to test the polarity of the string. Test the polarity at the end of the replaced battery string



Note: Use a digital ohmmeter to test the string. The meter should read –48 V dc when you connect the RED lead to black terminal and BLACK lead to red terminal.

11 Connect the battery string installed in step 6 to the connector cable assembly.

12 Turn the BCC NT8X02 power switch to the ON position.

At the MAP terminal

13 To return the battery charger controller to service, type

`>RTS BCCDVR`

and press the Enter key.

14 To return the battery strings to the load bus, type

`>LOADB n`

and press the Enter key.

where

n
is the string pair 0-3, as follows:

pair 0
is strings 0 and 4

pair 1
is strings 1 and 5

pair 2
is strings 2 and 6

pair 3
is strings 3 and 7

Battery replacement
OPM (end)

Example of a MAP display:

```
 CM     MS      IOD      NET      PM      CCS      LNS      Trks     Ext
 .      .        .        .      1PES      .        .        .        .
 OPMPES                  SysB    ManB     OffL     CBSY     ISTB     InSV
 0 Quit      PM            0       3        4        0        4       30
 2 Post_
 3                        RED       AMBER      GREEN      OFFL
 4           OPMPES        1          0          3         1
 5
 6 Tst_      OPMPES    2 Cond:  RED    REM2      2   1   RMM   2
 7 Bsy_                                          Audit  Week  HBT
 8 Rts_       Common     Rectifiers               dis     –     .
 9 OffL_       AC     FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
10              .       .   .   .   .   .   .        .      .   .
11 Disp_       BCC    0     1     2     3     Temp     Door    BCCFUSES
12 Next      0= .     .     .     .     .   EHT ELT  FRNT SIDE    0   1
13           1= .     .     .     .     .    .   .     o    .       .   .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 MEASure_
```

Indicates the string pair is no longer in the open-circuit state.

15 To activate the automatic battery rotation and testing, type

>AUDIT ENABLE

and press the Enter key.

16 This battery replacement procedure is complete.

Testing dampers
OPM

Application

Use this procedure to test the temperature control dampers in an OPM.

Interval

Perform this procedure when local policy directs you to this procedure.

Common procedures

There are no common procedures.

Action

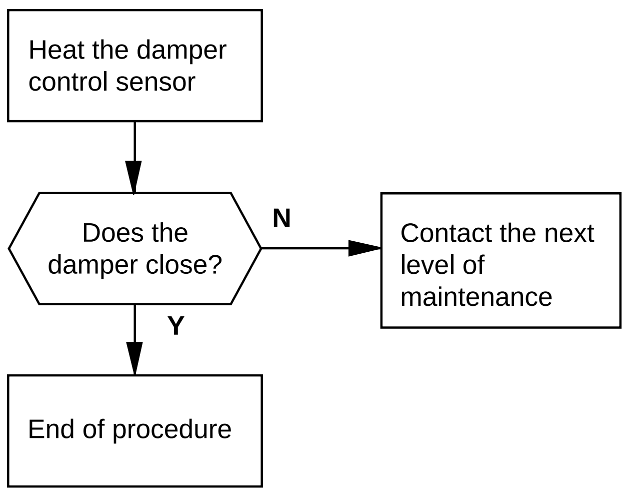
This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Testing dampers
OPM (continued)

Summary of Testing dampers in an OPM

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.

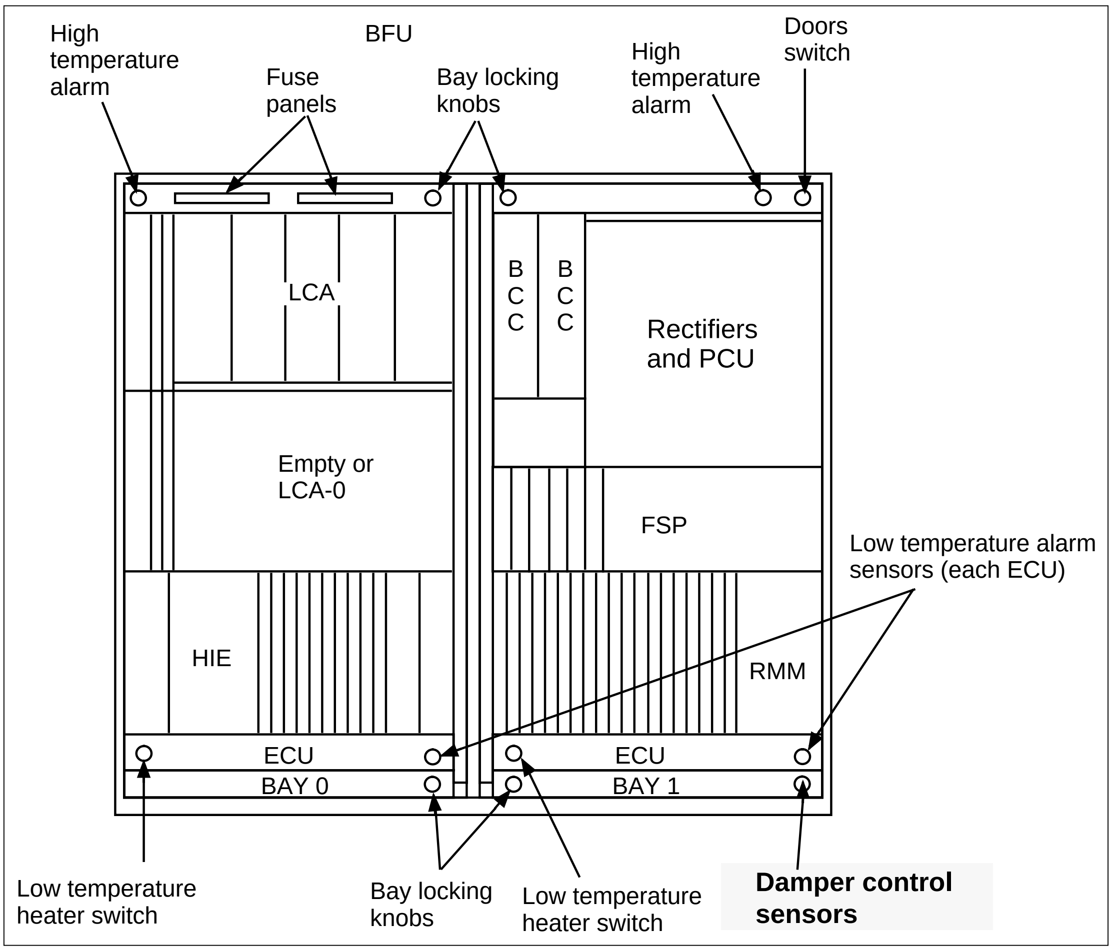


Testing dampers
OPM (continued)

Testing dampers in an OPM

At the OPM cabinet

1 To verify damper closure, cool the damper sensor with Freon to +5°C ± 2.8°X (41°F ± 5°F). To verify damper opening +15°C ± 2.8°C (59°F ± 5°F), blow warm air on the sensor.



2 Determine if the damper opens and closes.

If the damper	Do
opens and closes	step 4
does not open and close	step 3

Testing dampers
OPM (end)

3 Contact the next level of maintenance.

4 The procedure is complete.

Door alarms testing
OPM

Application

Use this procedure to test the door alarms in an OPM.

Interval

Perform this procedure as local policy directs.

Common procedures

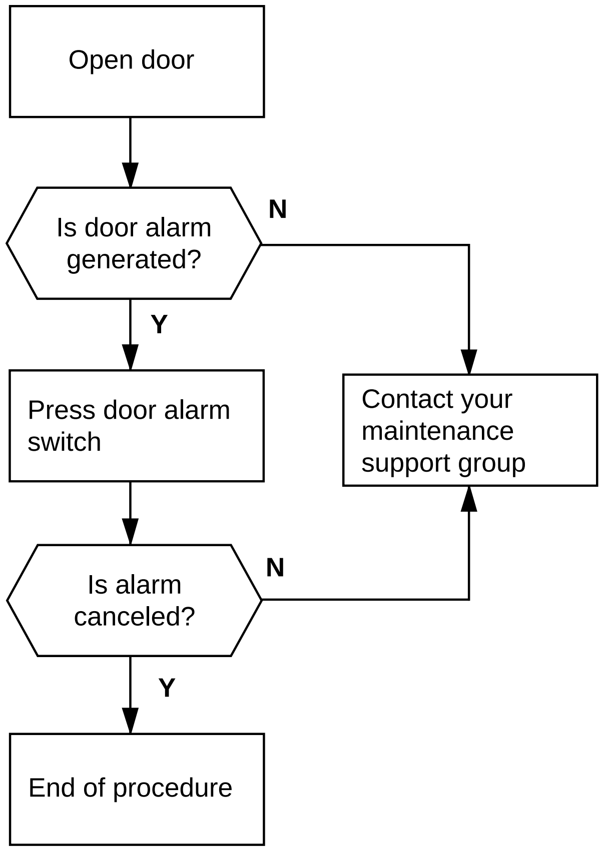
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform this procedure.

Door alarms testing
OPM (continued)

Summary of Testing door alarms in an OPM



This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform this procedure.

Door alarms testing

OPM (continued)

Testing door alarms in an OPM

At the OPM cabinet

1 Open the front and side doors.

2 Set up a telephone link with personnel in the host office at a MAP terminal. Use the telephone link to monitor the alarms this procedure generates. Make sure that the procedure generates a door alarm at the MAP terminal.

Example of a MAP display:

```
 CM     MS     IOD     NET     PM     CCS     LNS     Trks     Ext
  .     .      .       .      1PES     .       .       .        .

OPMPES              SysB   ManB    OffL    CBSY    ISTB    InSV
 0 Quit     PM         0      3       4       0       4      30
 2 Post_
 3                    RED      AMBER     GREEN     OFFL
 4          OPMPES     1         0         3        1
 5
 6 Tst_     OPMPES    2 Cond:  RED    REM1     01   0   RMM   3
 7 Bsy_                                          Audit  Week  HBT
 8 Rts_       Common     Rectifiers                 .      2    .
 9 OffL_       AC     FL0 FL1 CL0 CL1   BCCDVR  PESALRM  ECU FSP
10              .      .   .   .   .   .   .       .        .   .
11 Disp_      BCC    0    1    2    3    Temp          Door     BCCFUSES
12 Next           0= .    .    .    .   EHT ELT      FRNT SIDE    0   1
13                1= .    .    .    .    O   O          .    .
14 QueryPES
15 OpenCkt_
16 Charge_
17 LoadB_
18 MEASure_
```

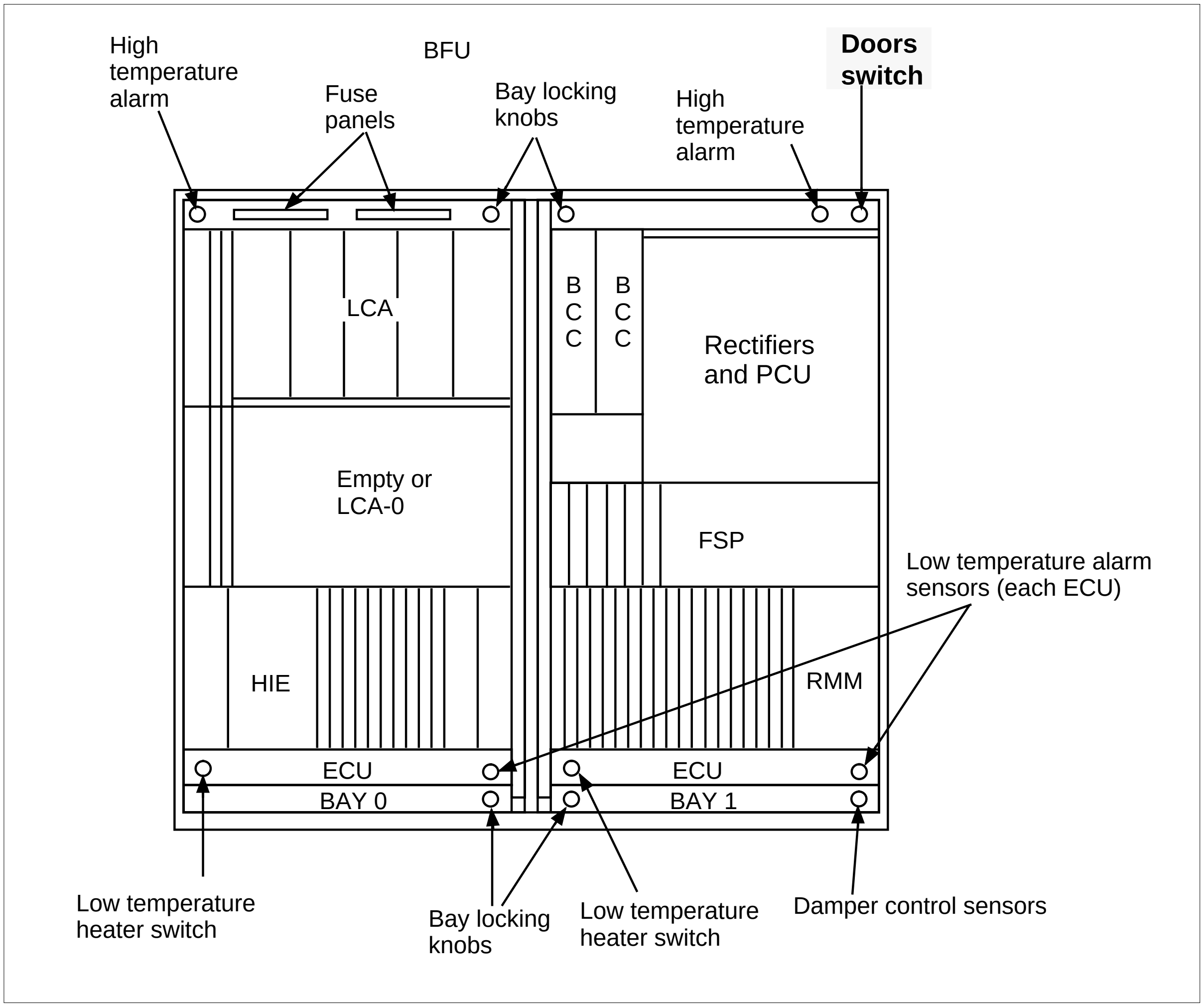
Indicates open doors

3 Make sure that the procedure generates a door alarm at the MAP terminal.

If the door alarm at the MAP terminal	Do
generates	step 4
does not generate	step 6

4 Press the door switch and check the cancelation of the door alarm. Refer to the following figure.

Door alarms testing
OPM (end)



5 Make sure the alarm clears.

If the alarm	Do
clears	step 7
does not clear	step 6

6 Contact your maintenance support group.

7 This inspection procedure is complete.

Dust removal
OPM

Application

Use this procedure to remove dust in an OPM.

Interval

Perform this procedure when local policy directs you to.

Common procedures

There are no common procedures.

Action

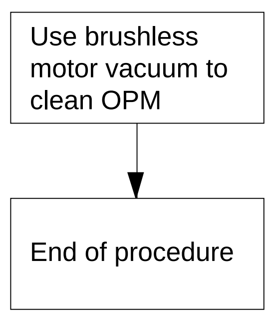
This procedure contains a summary flowchart as an overview of the procedure. Follow the appropriate steps to perform this procedure.

Dust removal
OPM (continued)

Summary of dust removal in an OPM

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.



Dust removal
OPM (end)

Dust removal in an OPM

At the OPM cabinet

1

> **WARNING**
> **Possible service degradation due to electrical interference**
> Series-wound motors cause electromagnetic interference.

Vacuum OPM frames to prevent the increase of electrostatic discharges that dust causes. Use a vacuum cleaner with an induction-wound (brushless) motor and with plastic or rubber attachments. You can use battery-operated vacuum cleaners. Vacuum the inside and around the frames at each inspection of the OPM filters. Do not bump any part of the frame, and avoid any metal-to-metal contact.

2 The inspection procedure is complete.

Discharge test failure
OPM

Application

Use this procedure after a discharge test fails to determine if you must replace batteries.

Interval

Perform this procedure each time a discharge test fails.

Common procedures

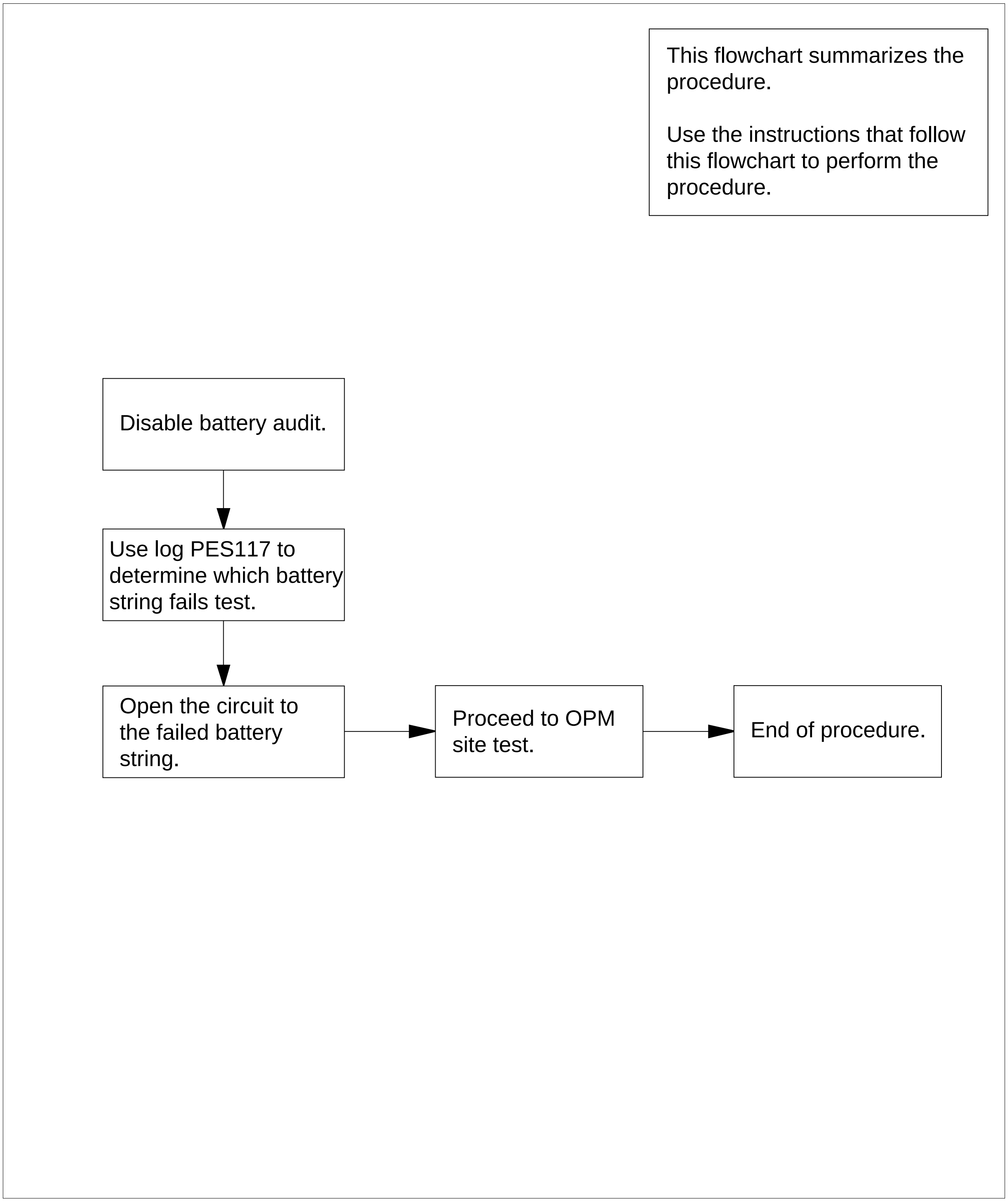
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform this procedure.

Discharge test failure
OPM (continued)

Summary of discharge test failure OPM



Discharge test failure
OPM (end)

Discharge test failure

At the MAP terminal

1 To access the PES MAP display level, type

>MAPCI;MTC;PM;PES

and press the Enter key.

2 To post the appropriate alarm state, type

>POST alarm_state

and press the Enter key.

where

alarm_state
is RED or AMBER

3 To disable the automatic battery rotation and testing, type

>AUDIT DISABLE

and press the Enter key.

4 From log PES117, determine the battery string voltage that tests below OPM_VOLT_TST_DIS. If the log marks strings 1 and 5 as failed, determine if string 1, 5, or both cause the alarm.

Note: For OPMs with MTU: Default OPM_VOLT_TST_DIS = -495 or -49.5 Vdc for Eagle Picher and Yuasa batteries. For OPMs with LTU: Default OPM_VOLT_TST_CHG is offset by OPM_VOLT_TST_LTU ADJUSTMENT (default=10) and then truncated. -495+10 = -485 Trunc (-485)= -480 or -48 Vdc for Eagle Picher and Yuasa batteries.

5 To open the circuit to the failed battery string pair, type

>OPENCKT n

and press the Enter key.

where

n
is the number of the string pair (0-3)

6 Perform the OPM site tests.

7 The inspection procedure is complete.

Open-circuit test failure
OPM

Application

Use this procedure after an open-circuit test failure to determine if batteries need replacement.

Interval

Perform this procedure after every open-circuit test failure.

Common procedures

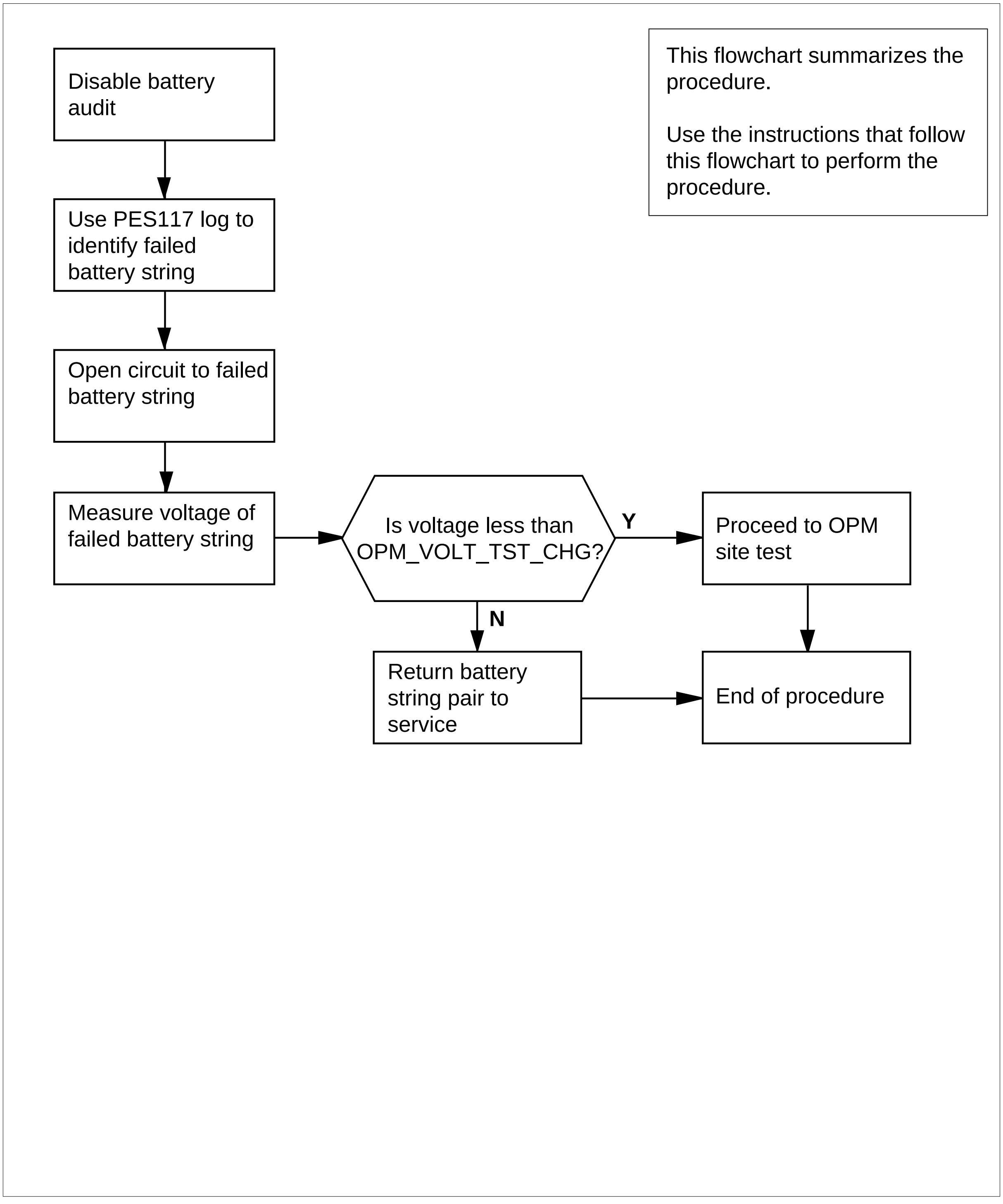
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Open-circuit test failure
OPM (continued)

Summary of open-circuit test failure OPM



Open-circuit test failure
OPM (continued)

Open-circuit test failure

At the MAP terminal

1 To access the PES MAP display level, type

>MAPCI;MTC;PM;PES

and press the Enter key.

2 To post the appropriate alarm, type

>POST alarm_state

and press the Enter key.

where

alarm_state
is RED or AMBER

3 To disable the automatic battery rotation and testing, type

>AUDIT DISABLE

and press the Enter key.

4 From the PES117 log, determine which battery string had voltage that tested below OPM_VOLT_TST_DIS. If the open-circuit test marked strings 1 and 5 failed, determine if string 1, 5, or both, caused the alarm.

Note: OPMs with MTU default OPM_VOLT_TST_DIS = -495 or -49.5 Vdc for Eagle Picher and Yuasa batteries. OPMs with LTU default OPM_VOLT_TST_CHG is offset by OPM_VOLT_TST_LTU ADJUSTMENT (default=10) and then truncated. -495+10 = -485 Trunc (-485) = -480 or -48 Vdc for Eagle Picher and Yuasa batteries.

5 To open the circuit to the failed battery string pair, type

>OPENCKT n

and press the Enter key.

where

n
is the number of the string pair (0-3)

Note: Leave the string pair in the open-circuit for at least 6 hours before you proceed to the next step.

6 To measure the voltage of the failed battery string pair, type

>MEASURE PAIR n

and press the Enter key.

where

n
is the number of the string pair (0-3)

Open-circuit test failure
OPM (end)

7 Compare measured voltage to OPM_VOLT_TST_CHG.

If voltage compared to OPM_VOLT_TST_CHG	Do
is less negative	step 8
is equal to or more negative	step 9

Note: The OPMs with MTU default OPM_VOLT_TST_CHG = -509 or -50.9 Vdc for Eagle Picher and Yuasa batteries. The OPMs with LTU default OPM_VOLT_TST_CHG is offset by OPM_VOLT_TST_LTU ADJUSTMENT (Default=10) and then truncated. -509+10=-499 Trunc(-499)=-490 or -49 Vdc for Eagle Picher and Yuasa batteries.

8 If the voltage is less negative than OPM_VOLT_TST_CHG, leave the battery string pair open-circuit and proceed with OPM site tests.

9 If the voltage is equal to or more negative than OPM_VOLT_TST_CHG, the string can accept a charge. To return the battery string pair to service, type

>BSY bccdvr

and press the Enter key.

10 To return the battery string pair to service, type

>RTS bccdvr

and press the Enter key.

Note: If the open-cirucit test marks the same string failed within the next 2 months, proceed directly to the OPM site tests.

11 To enable the automatic battery rotation and testing, type

>AUDIT ENABLE

and press the Enter key.

12 This procedure is complete.

Failure of post charge test
OPM

Application

Use this procedure after the failure of a post charge test to determine if the replacement of batteries are necessary.

Interval

Perform this procedure after each post charge test failure.

Common procedures

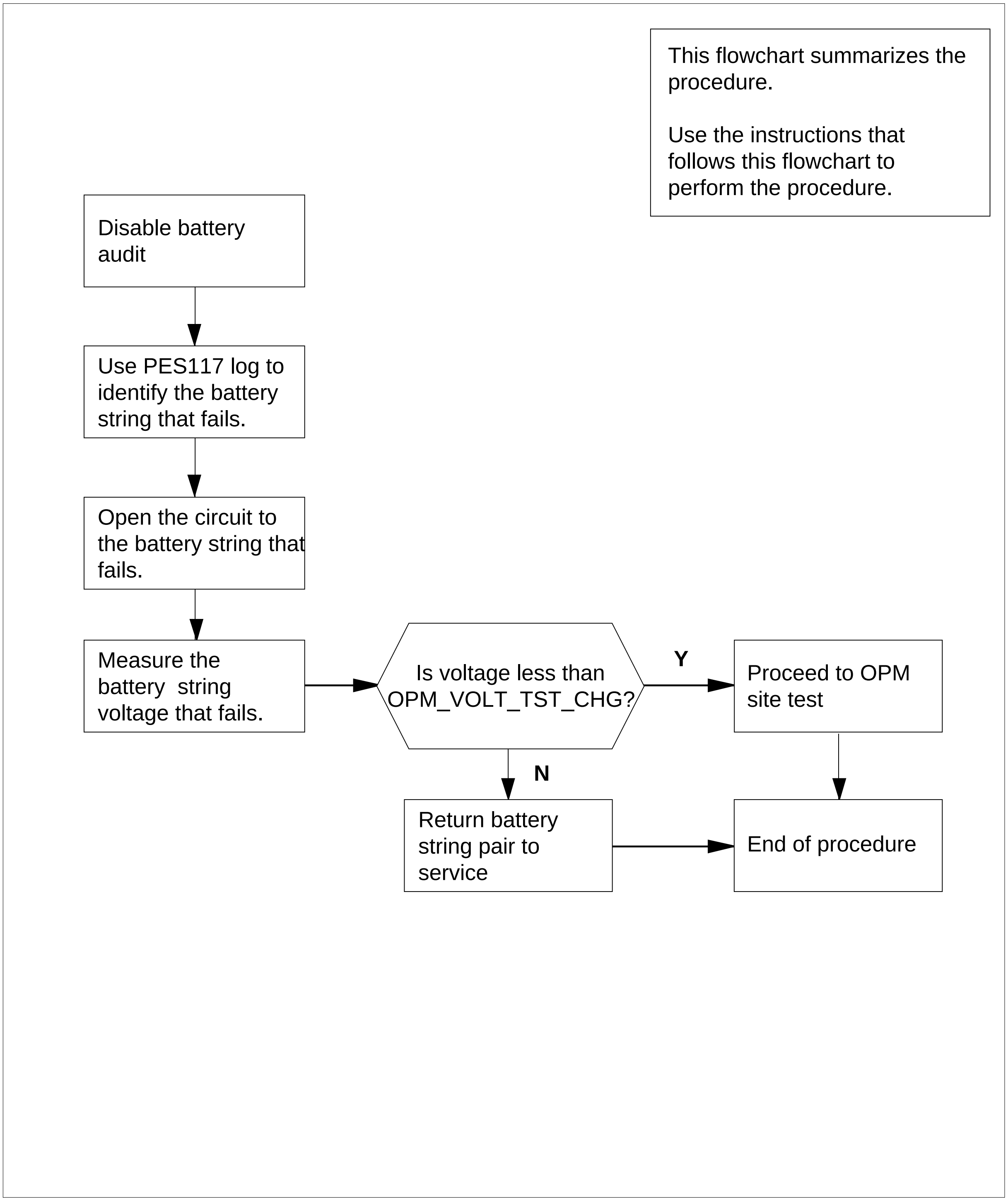
There are no common procedures.

Action

This procedure contains a summary flowchart as an overview of the procedure. Follow the appropriate steps to perform this procedure.

Failure of post charge test
OPM (continued)

Summary of failure of post charge test in an OPM



Failure of post charge test
OPM (continued)

Failure of post charge test in an OPM

At the MAP terminal

1 To access the PES MAP display level, type

>MAPCI;MTC;PM;PES

and press the Enter key.

2 To post the appropriate alarm, type

>POST alarm_state

and press the Enter key.

where

alarm_state
is RED or AMBER

3 To disable the automatic battery rotation and testing, type

>AUDIT DISABLE

and press the Enter key.

4 Use the PES117 log to determine which voltage of the battery string tested below OPM_VOLT_TST_DIS. If strings 1 and 5 are marked failed, determine if string 1, 5, or both cause the alarm.

Note: OPMs with MTU Default OPM_VOLT_TST_DIS = -495 or -49.5 Vdc for Eagle Picher and Yuasa batteries. OPMs with LTU default OPM_VOLT_TST_CHG is offset by OPM_VOLT_TST_LTU ADJUSTMENT (default=10) and truncated. -495+10 = -485 Trunc (-485) = -480 or -48 Vdc for Eagle Picher and Yuasa batteries.

5 To place the failed battery string pair on the charge bus, type

>CHARGE n

and press the Enter key.

where

n
is the number of the string pair (0-3)

Note: Leave the string pair on the charge bus for 6 hours or more before you proceed to step 6.

6 To open the circuit to the failed battery string pair, type

>OPENCKT n

and press the Enter key.

where

n
is the number of the string pair (0-3)

Note: Leave the string pair in the open-circuit state for 6 hours or more before you proceed to step 7.

Failure of post charge test
OPM (end)

7 To measure the voltage of the failed battery string pair, type

>MEASURE PAIR n

and press the Enter key.

where

n
is the number of the string pair (0-3)

If voltage compared to OPM_VOLT_TST_CHG	Do
is less negative	step 8
is equal to or more negative	step 9

Note: OPMs with MTU default OPM_VOLT_TST_CHG = -509 or -50.9 Vdc for Eagle Picher and Yuasa batteries. OPM_VOLT_TST_LTU ADJUSTMENT (Default=10) offsets OPMs with LTU default OPM_VOLT_TST_CHG and truncates. -509+10=-499 Trunc(-499)=-490 or -49 Vdc for Eagle Picher and Yuasa batteries.

8 If the voltage is less negative than OPM_VOLT_TST_CHG, leave the battery string pair open circuit and proceed to OPM site tests.

9 If the voltage is equal to or more negative than OPM_VOLT_TST_CHG, the string can accept a charge. To return the battery string pair to service, type

>BSY bccdvr

and press the Enter key.

10 To return the battery string pair to service, type

>RTS bccdvr

and press the Enter key.

Note: If the open-circuit test marks the same string failed in the next 2 months, proceed directly to the OPM site tests.

11 To enable the automatic battery rotation and testing, type

>AUDIT ENABLE

and press the Enter key.

12 The inspection procedure is complete.

Fan alarms testing
OPM

Application

Use this procedure to test the fan alarms in an OPM.

Interval

Perform this procedure when local policy directs you to.

Common procedures

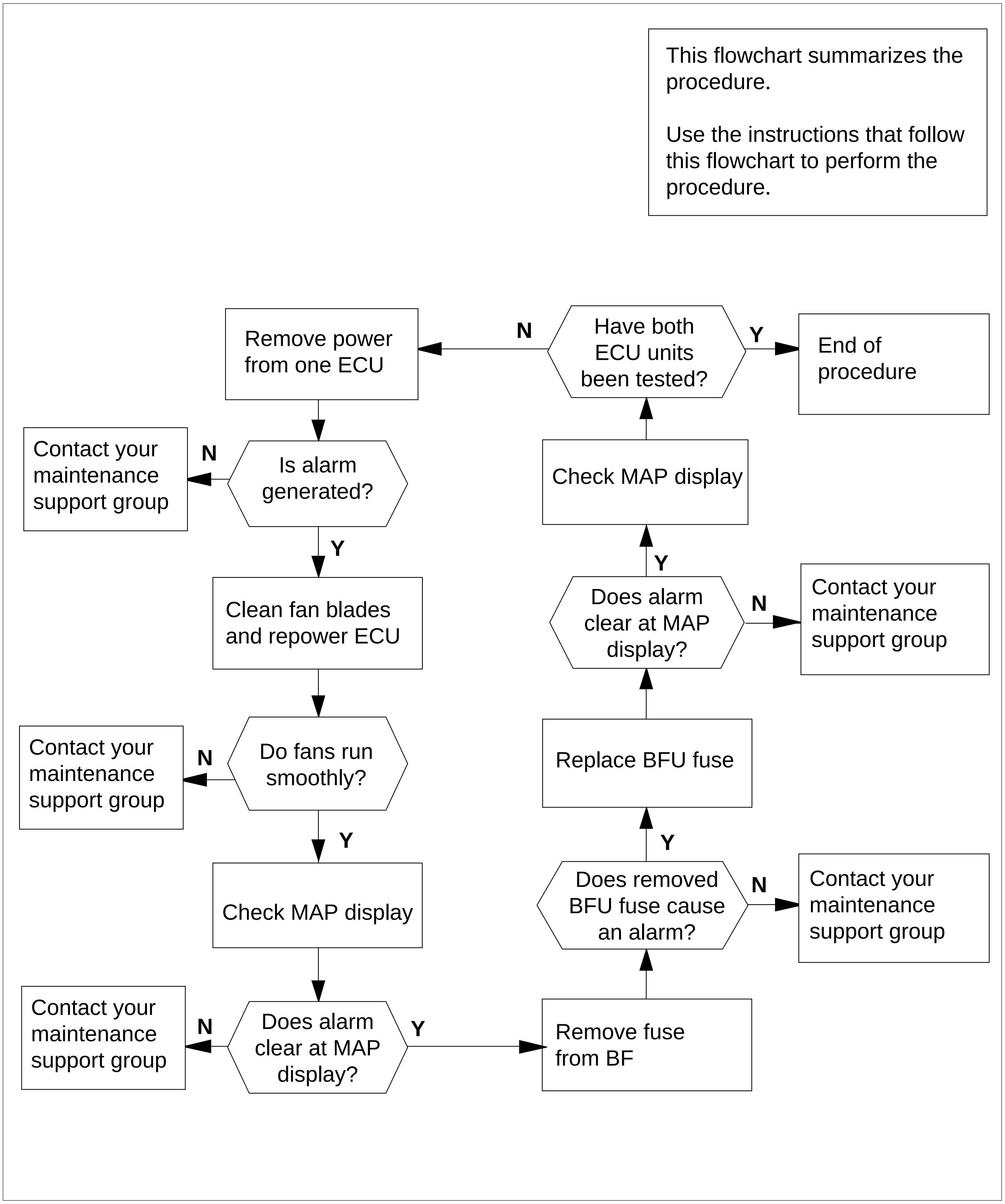
There are no common procedures.

Action

This procedure contains a summary flowchart as an overview of the procedure. Follow the appropriate steps to perform this procedure.

Fan alarms testing
OPM (continued)

Summary of fan alarms testing in an OPM



Fan alarms testing
OPM (continued)

Fan alarms testing in an OPM

At your present location

1 Remove power from one of the environmental control units (ECU).

Note: Set up a phone link with the host office at a MAP terminal to monitor the alarms this procedure generates.

2 Verify the MAP display produces an ECU alarm.

If an alarm	Do
generates	step 3
does not generate	step 12

3 Clean the blades of the fans.

4 Return power to the ECU where power was removed in step 1.

5 Verify all fans turn smoothly.

If the fans	Do
run smoothly	step 6
are noisy or obviously not running correctly	step 12

6 Verify the alarm step 1 generates is clear.

If the alarm	Do
clears	step 7
does not clear	step 12

7 Remove the fuse from the booster fan unit (BFU).

8 Verify that the MAP display generates an alarm.

If an alarm	Do
generates	step 9
does not generate	step 12

9 Replace the fuse in the BFU.

10 Verify that the alarm step 7 generates is clear.

If the alarm	Do
clears	step 11

Fan alarms testing
OPM (end)

If the alarm	Do
does not clear	step 12

11 Have both ECU units been checked?

If both ECUs are	Do
not checked	step 1 for other ECU
checked	step 13

12 Contact your maintenance support group.

13 The procedure is complete.

Filters inspection for cooling unit OPM

Application

Use this procedure to inspect cooling unit filters in frame cooling units.

Interval

Perform this procedure every two weeks.

Common procedures

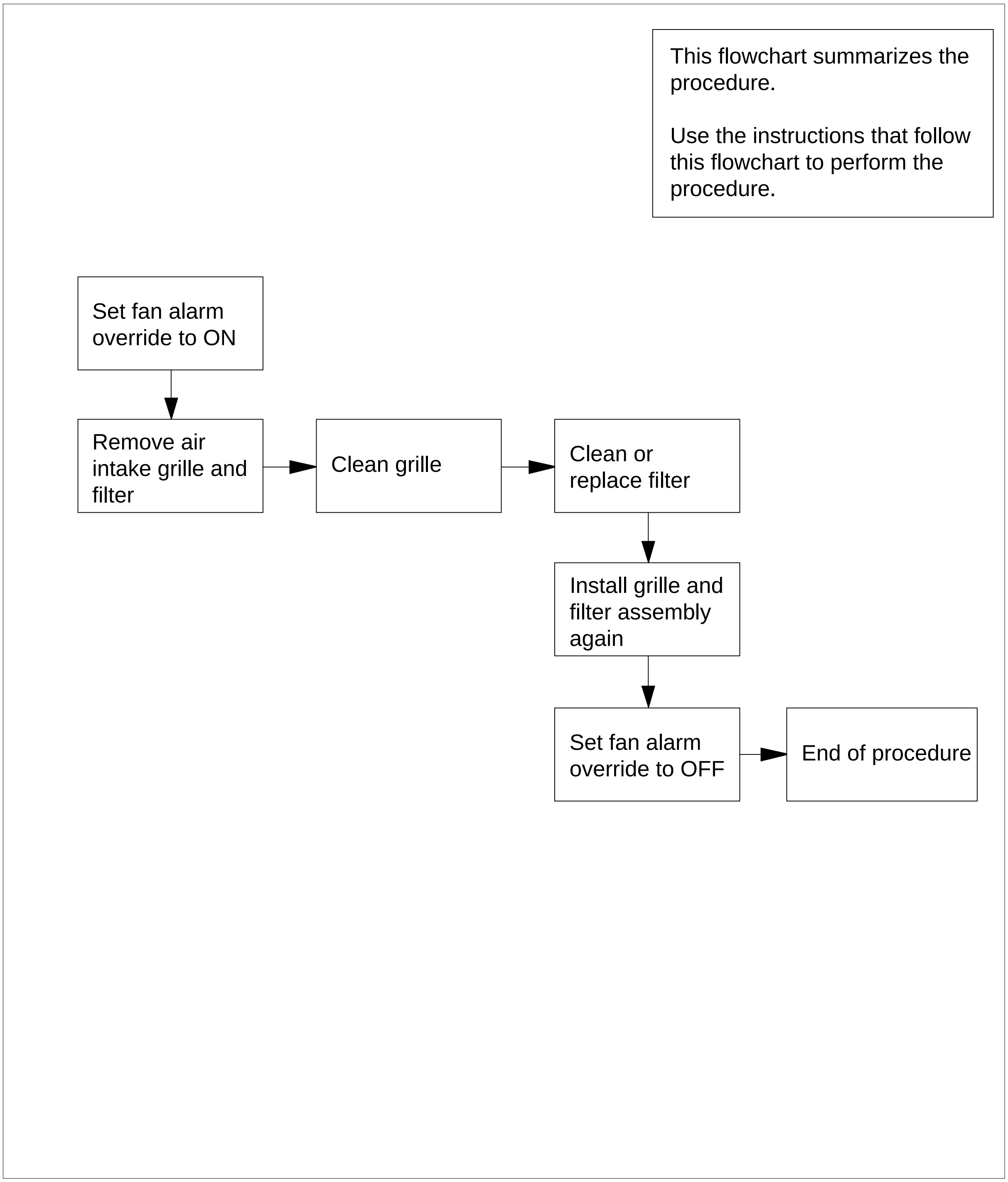
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform this procedure.

Filters inspection for cooling unit
OPM (continued)

Summary of filters inspection for cooling unit



Filters inspection for cooling unit
OPM (continued)

Filters inspection for cooling unit

At the FSP

1

DANGER
Rotating fan blades
Do not reach in more than 15.24 cm (6 in) beyond the upper lip of the air-intake grille. If you reach in more than 15.24 cm, your fingers can contact the rotating blades of the cooling unit fans.

On the frame supervisory panel (FSP), set the fan alarm override switch to ON.

2 Inspect the frame trim panels.

If frame trim panels	Do
overlap side edges of intake grille	step 3
do not overlap side edges of intake grille	step 5

3 Remove the frame trim panels.

4 Grip both sides of the grille. Pull the grille toward you to separate the grille from the magnetic catches.

Go to step 6.

5 Carefully pry the upper half of the grille away from the frame to remove the grille.

6 Go to a work area outside the room that contains the switching system. To clean the grille, use a dust cloth or a vacuum cleaner.

7 Inspect filter surfaces.

If filter surfaces	Do
appear dirty	step 11
appear clean	step 8

8 Shine a trouble light through the filter.

If light	Do
is visible through the filter	step 9

Filters inspection for cooling unit OPM (end)

If light	Do
is not visible through the filter	step 11

9 Install the filter in the grille again.

10 Install the filter and grille assembly in the frame again.

Go to step 21.

11 Check the filter part number.

If filter part number	Do
is A0344437	step 12
is P0558302	step 15
is P0623539	step 17

12 Get replacement filter material.

13 Trim a new filter to fit around the magnetic latches. Use the old filter as a guide.

14 Install the filter and grille on the frame.

Go to step 21.

15 At an area outside the room that contains the switching system, vacuum the filter.

16 Install the filter and grille on the frame.

Go to step 21.

17 At an area outside the room that contains the switching system, remove excess dirt and lint. To remove excess dirt and lint, rap the dirty side down or vacuum the dirty side.

18 Wash the filter in cleaner and water.

19 Rinse the filter and allow the filter to dry before you install the filter again.

20 Install the filter and grille on the frame.

21 On the front of the FSP, set the fan alarm override switch to OFF.

22 The procedure is complete.

Secondary (diffuser) filter replacement in cooling unit OPM

Application

Use this procedure to replace cooling unit filters in frame cooling units.

Interval

Perform this procedure every 3 months.

Common procedures

There are no common procedures.

Action

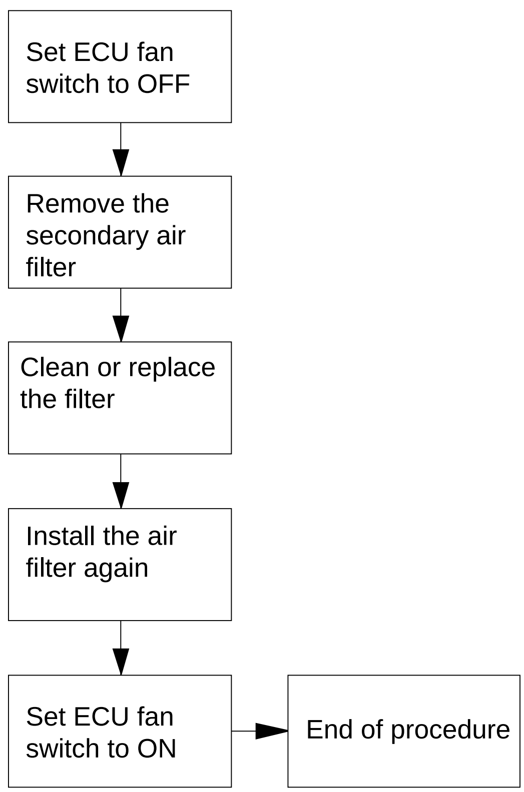
This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Secondary (diffuser) filter replacement in cooling unit OPM (continued)

Summary of filter replacement in cooling unit

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.



Secondary (diffuser) filter replacement in cooling unit OPM (continued)

Secondary (diffuser) filter replacement in cooling unit

At the ECU

1

> **WARNING**
> **Damage to airflow sensor blades**
> Turn the ECU fans OFF before you remove or insert the secondary (diffuser) filters. Removal of these filters while the fans are ON can damage the air flow sensor blades.

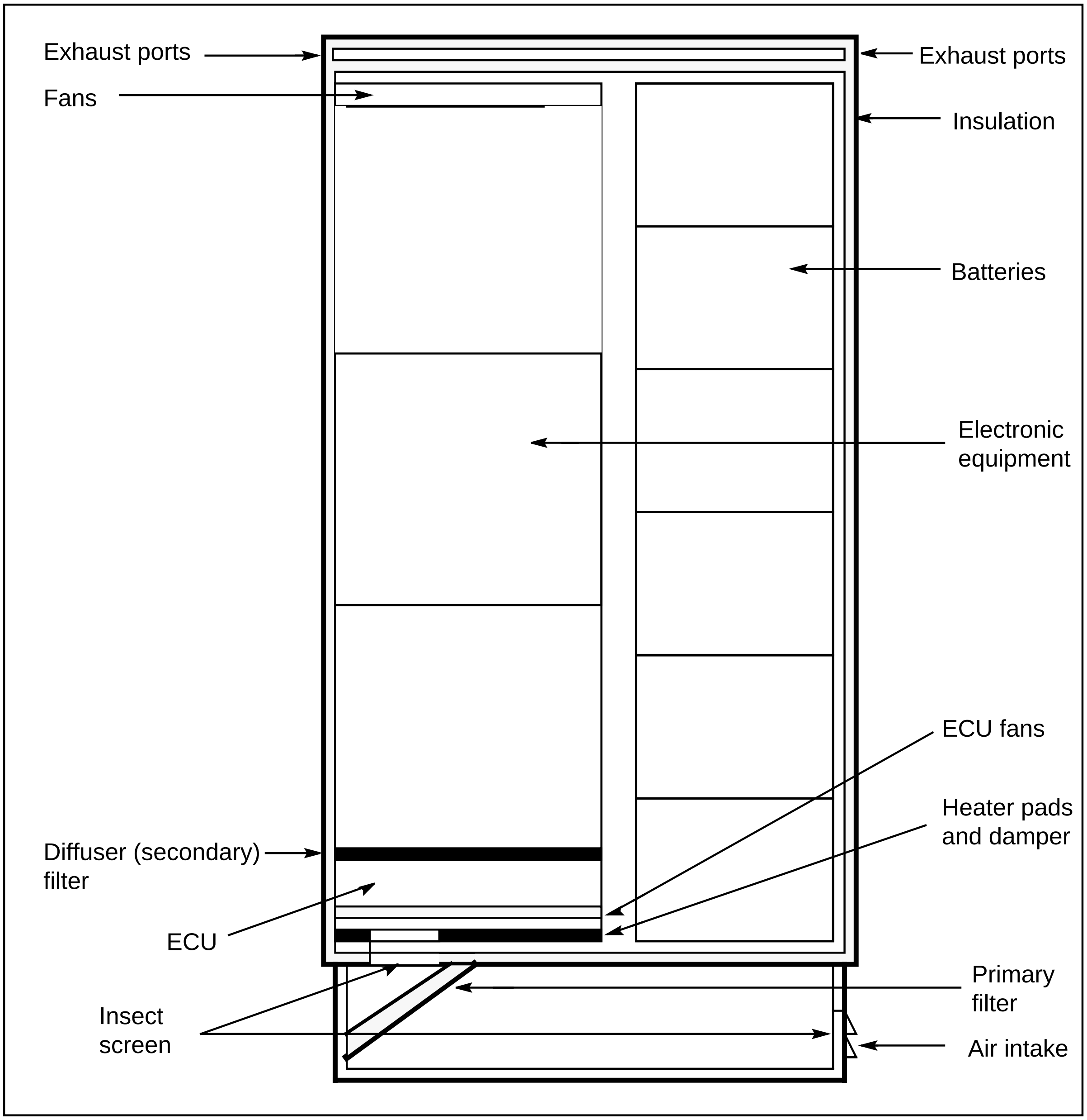
> **DANGER**
> **To prevent burns to fingers or hands**
> Use caution when you remove ECU secondary (diffusers) filters, because the ECU is warm when the heaters are in use.

> **DANGER**
> **Rotating fan blades**
> Do not reach in more than 15.24 cm (6 in.) beyond the upper lip of the air-intake grille. If you do reach in this far, your fingers can contact the rotating blades of the cooling unit fans.

On the environment control unit (ECU), set the fan switch to OFF.

2 Pull out and remove the diffuser filter. Refer to the following figure for the location of the diffuser filter.

Secondary (diffuser) filter replacement in cooling unit OPM (end)



3 Clean or replace the filter.

4 Insert the cleaned filter or replacement filter in the ECU.

5 Set the ECU fan switch to ON.

6 This replacement procedure is complete.

Filter replacement
OPM

Application

Use this procedure to replace an air filter in an Outside Plant Module (OPM).

Interval

Follow local policy when you perform this procedure.

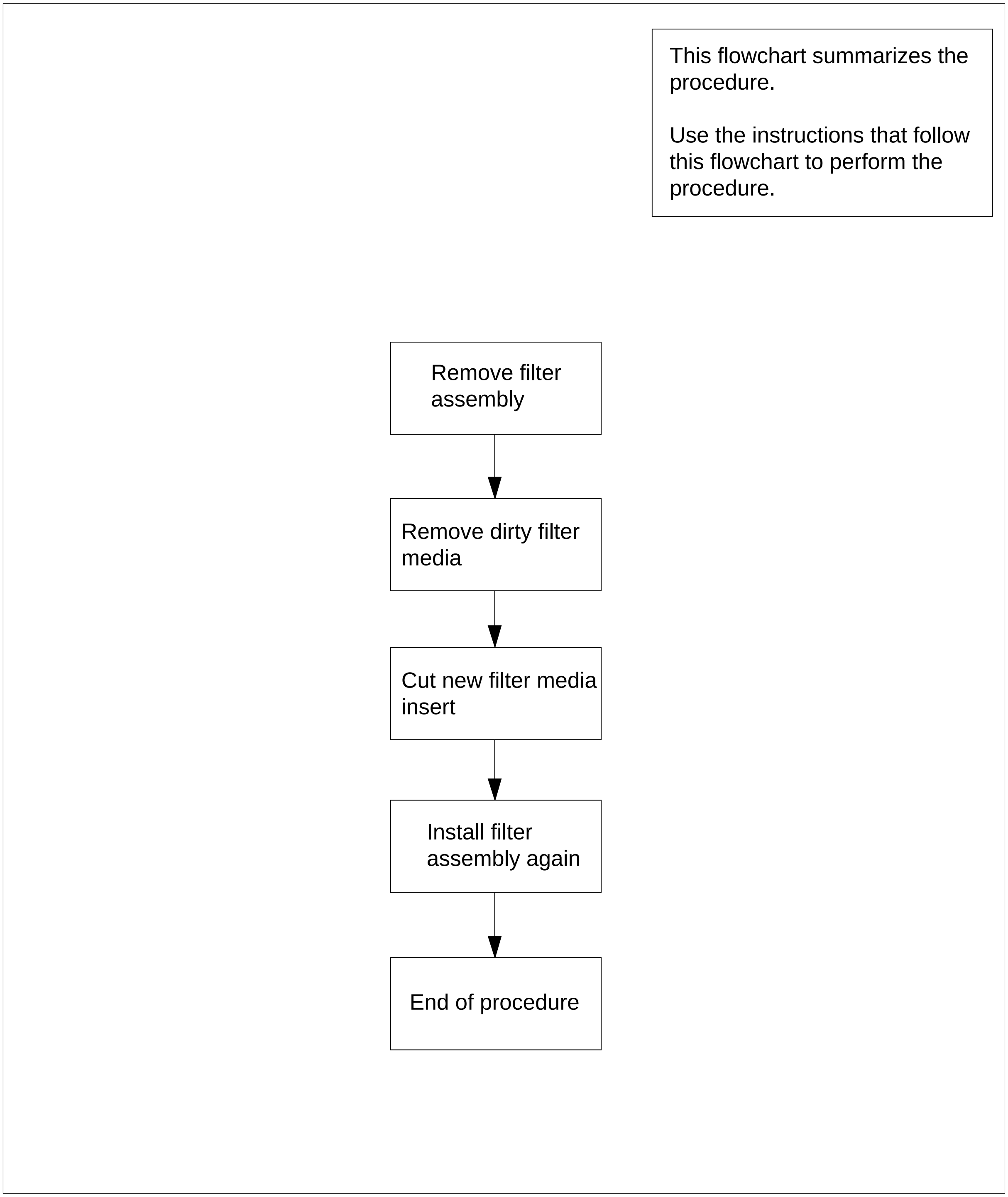
Common procedures

There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Summary of filter replacement OPM



Filter replacement
OPM (end)

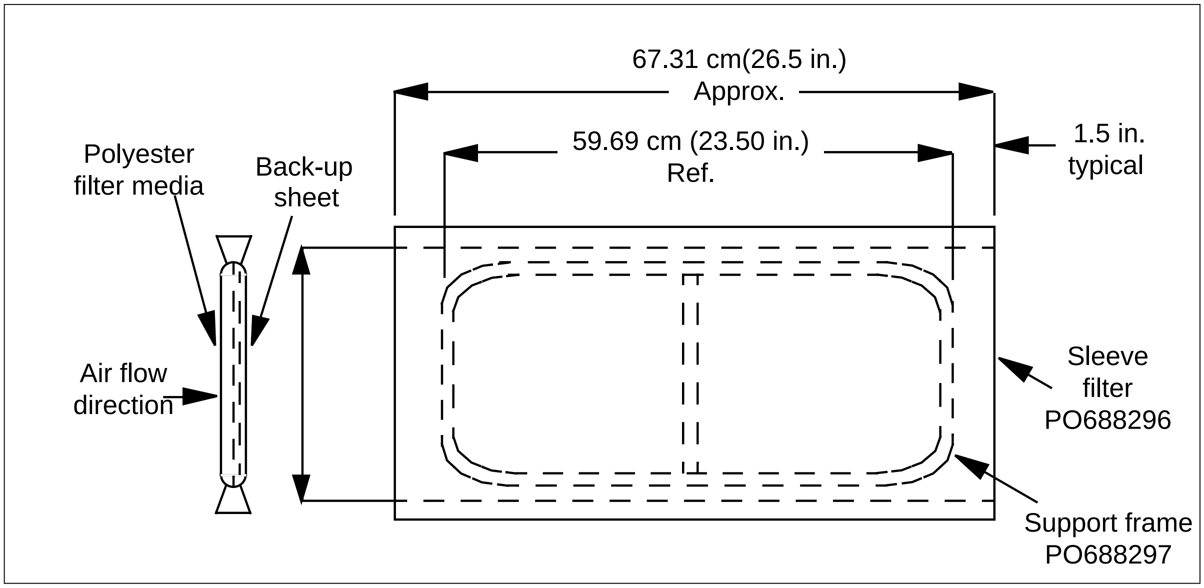
Filter replacement OPM

At the OPM cabinet

1 Remove the filter insulation strip and sleeve filter assembly.

2 Pull the dirty sleeve filter media from the sleeve filter support frame and discard.

3 Slip the sleeve filter support frame into the sleeve filter media roll, A0336991, and cut the material as shown here.



4 With the back-up sheet facing you, fold the left and right margins at the lower corners toward you. Fold the back-up sheet around the frame.

5 Fold the bottom margin over the frame and insert the sleeve filter assembly into the guide rails.

6 Push down until the top is level with the opening.

7 Replace the filter insulation strip and sleeve filter assembly.

8 The procedure is complete.

High temperature alarms testing
OPM

Application

Use this procedure to test the high temperature alarms in an OPM.

Interval

Local policy directs when to perform this procedure.

Common procedures

There are no common procedures.

Action

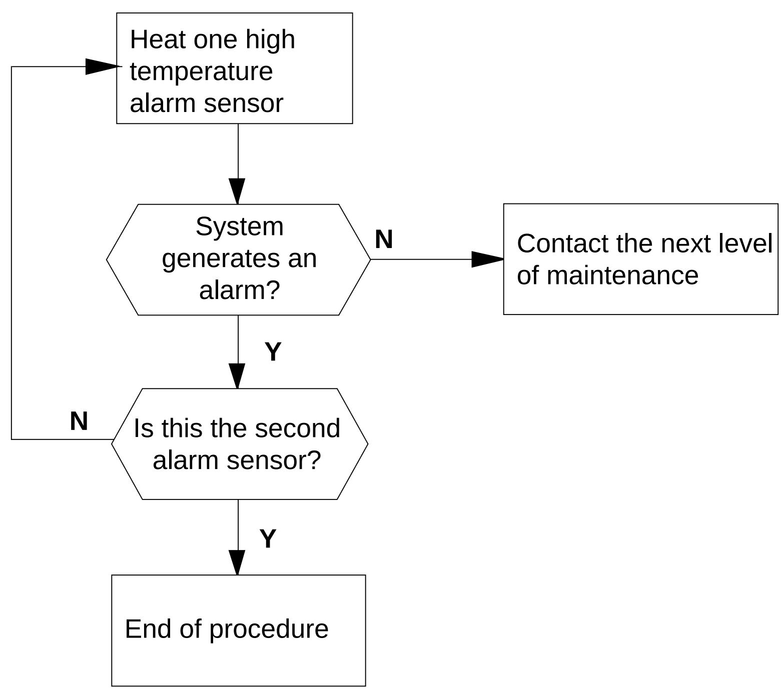
This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

High temperature alarms testing
OPM (continued)

Summary of Testing high temperature alarms in an OPM

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.

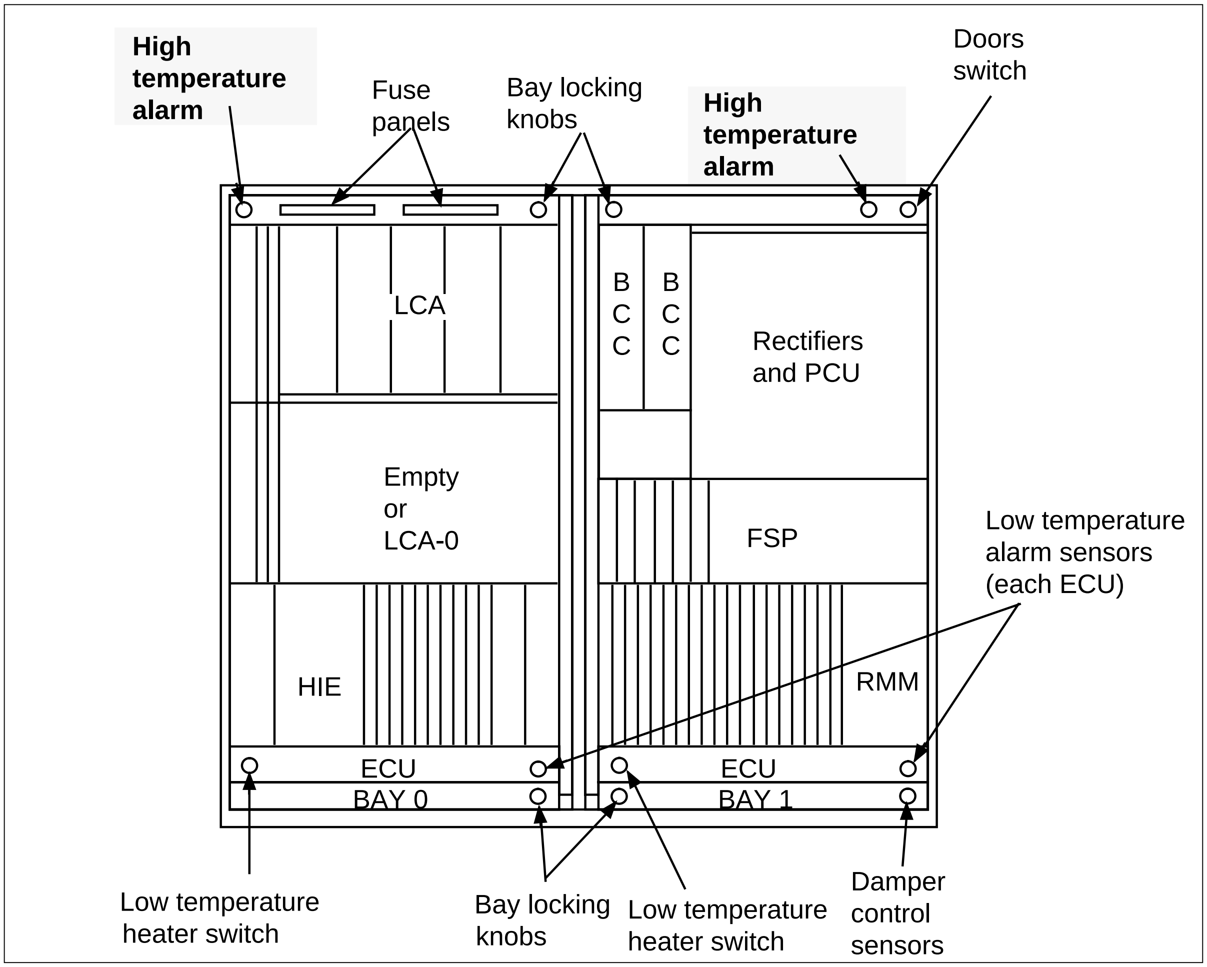


High temperature alarms testing
OPM (continued)

Testing high temperature alarms in an OPM

At the OPM cabinet

1 To activate the high temperature alarm, blow hot air from a heat gun or a blow-dryer at the high temperature sensor. Refer to the following figures for the locations of the high temperature alarm sensors.



2 Verify that the system generates an alarm. The sensor turns on at +75°C ± 2.8°C, (+167°F ± 5°F) and turns off at +65°C ± 2.8°X (+149°F ± 5°F).

Note: Set up a telephone link with the host office at a MAP display to monitor the alarms that this procedure generates.

If	Do
the system generates an alarm	step 4

High temperature alarms testing
OPM (end)

If	Do
the system does not generate an alarm	step 3

3 Contact the next level of maintenance.

4 Make sure to check the two high temperature alarm sensors.

If	Do
you did not check the sensors	step 1 for other sensor
you did check the sensors	step 5

5 The procedure is complete.

Heaters testing
OPM

Application

Use this procedure to test the heaters in an Outside Plant Module (OPM).

Interval

Local policy directs you to perform this procedure.

Common procedures

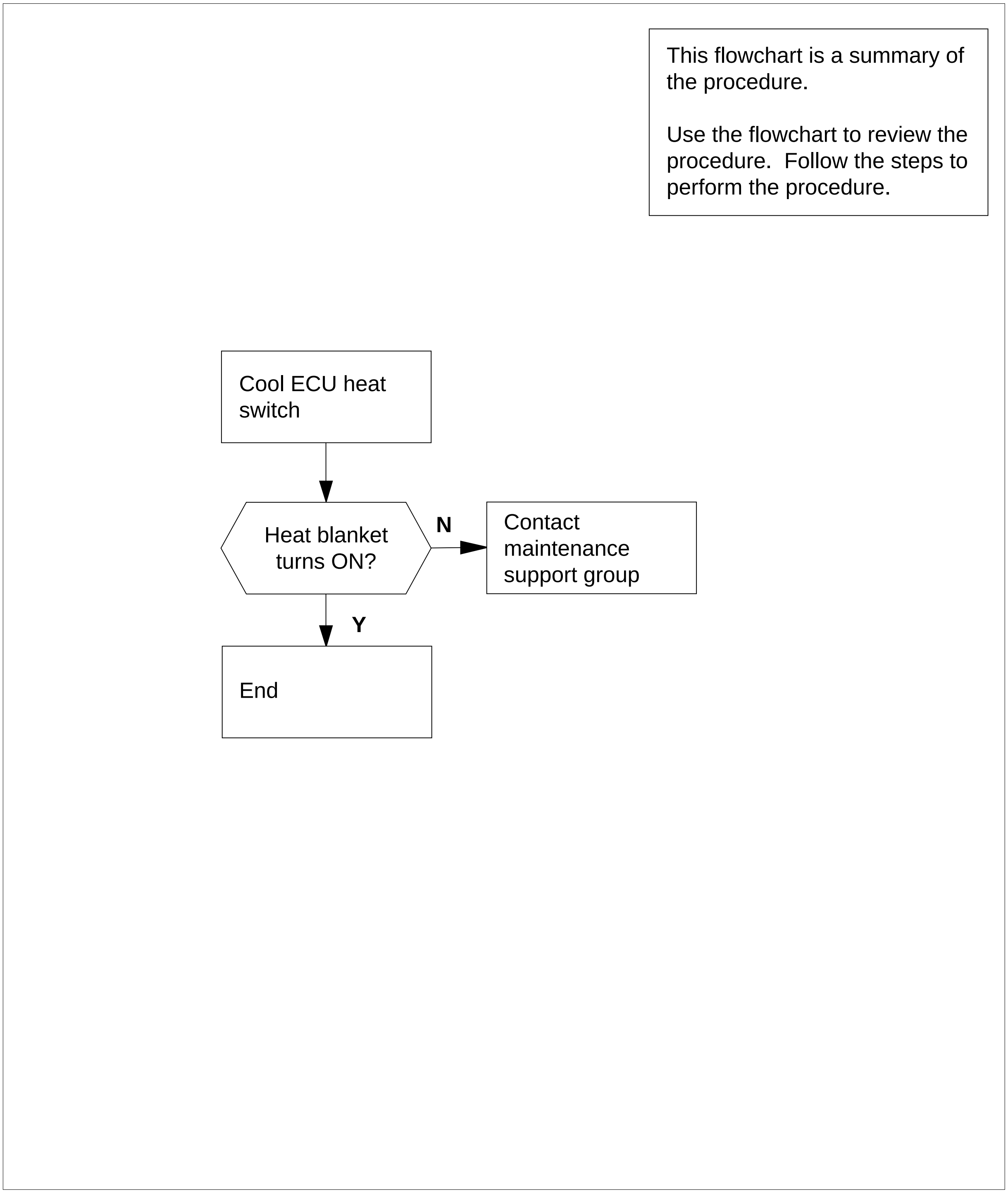
Does not apply

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Heaters testing
OPM (continued)

Summary of Testing heaters in an OPM

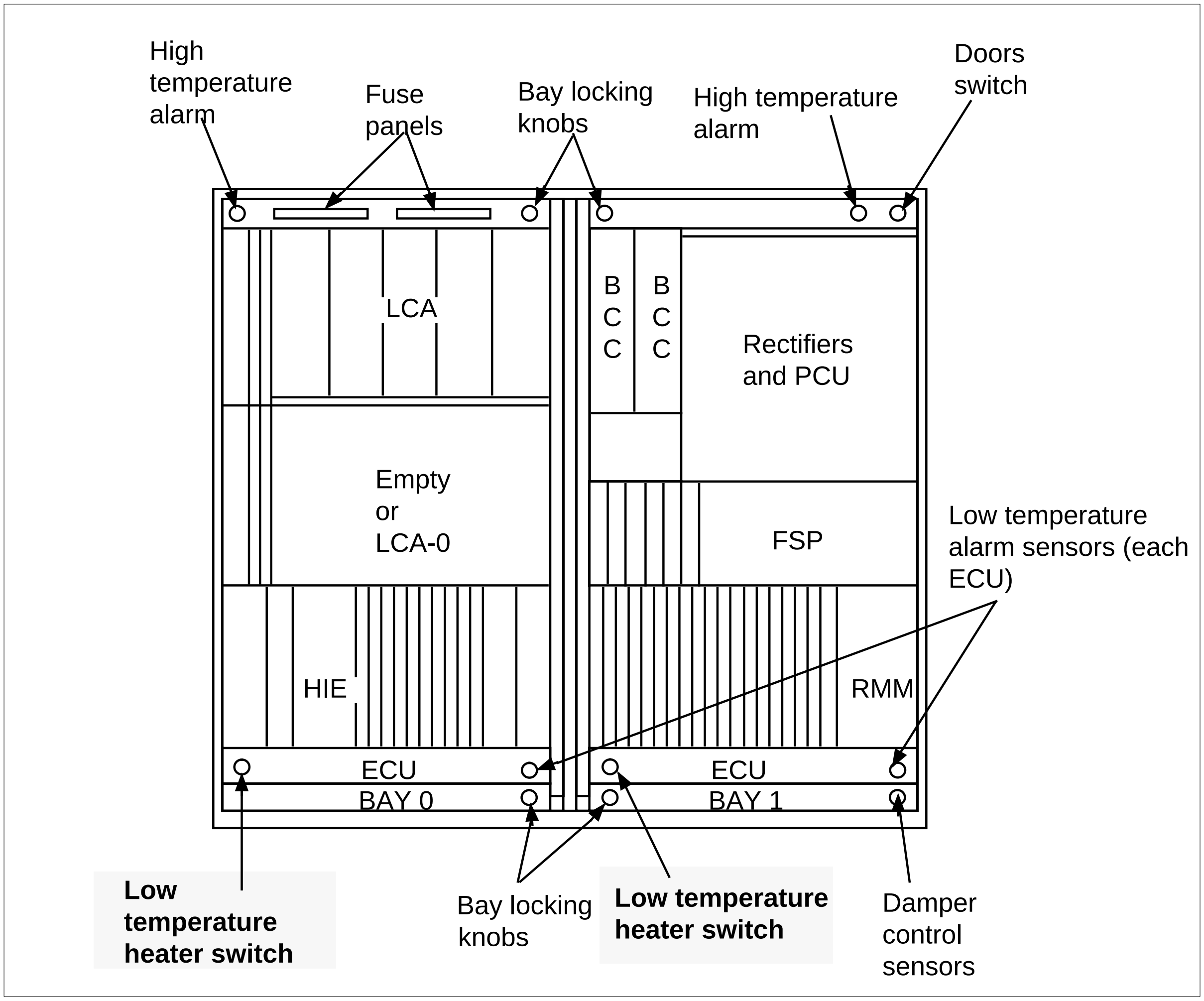


Heaters testing
OPM (continued)

Testing heaters in an OPM

At the OPM cabinet

1 Cool the low temperature heater switch located in the environmental control unit (ECU) with Freon. Refer to the following figure for sensor location:



2 Make sure that the heat blanket turns on. The heat blanket turns ON at +5°C ± 2.8°C (+41°F ± 5°F) and turns OFF at +15°C ± 2.8°X (+59°F ± 5°F).

If the heat blanket	Do
turns ON	step 4
does not turn ON	step 3

Heaters testing
OPM (end)

3 Contact your maintenance support group.

4 This procedure is complete.

Low temperature alarms testing OPM

Application

Use this procedure to test the low temperature alarms in an OPM.

Interval

Perform this procedure according to local policy.

Common procedures

There are no common procedures.

Action

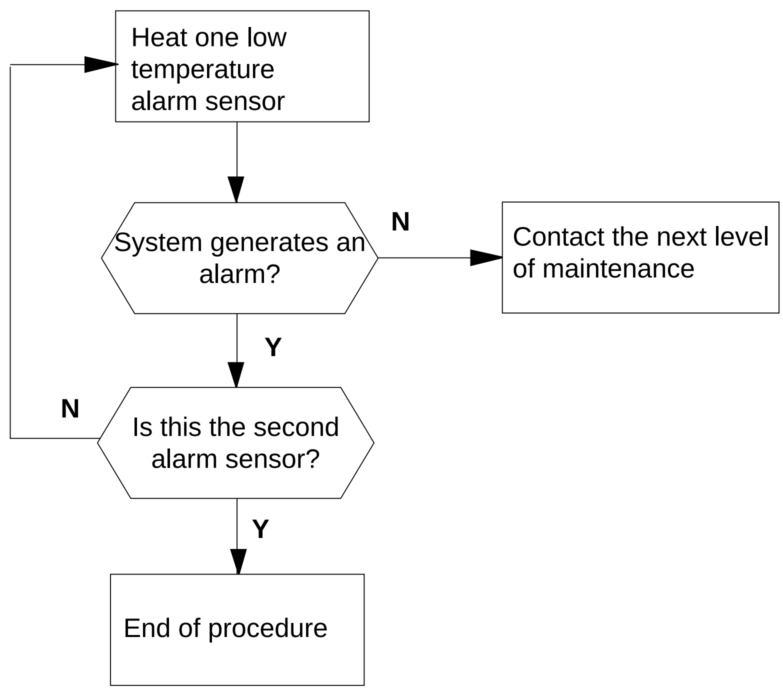
This procedure contains a summary flowchart and a list of steps. Use the flowchart to reveiw the procedure. Follow the steps to perform the procedure

Low temperature alarms testing
OPM (continued)

Summary of low temperature alarms testing in an OPM

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.

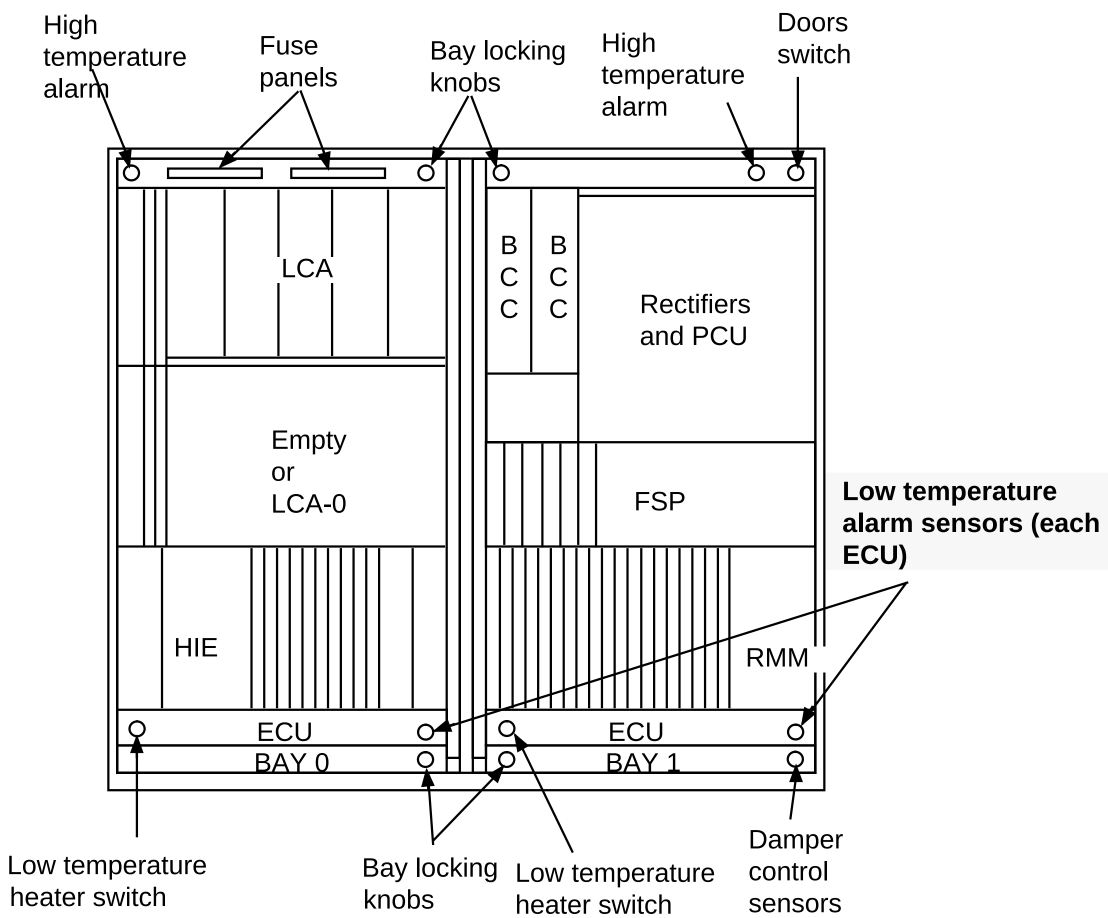


Low temperature alarms testing
OPM (continued)

Low temperature alarms testing in an OPM

At the OPM cabinet

1 To select and activate one high temperature alarm, blow coolant (like Freon) on the low temperature sensor. Locate the low temperature alarm sensors in the following drawing.



Low temperature alarms testing
OPM (end)

2 Verify that the system generates an alarm. The sensor turns on at -5°C ± 2.8°C (+23°F ± 5°F) and turns off at +5°C ± 2.8°X (+41°F ± 5°F).

Note: Set up a telephone link with the host office at a MAP display to monitor the alarms that this procedure generates.

If the system	Do
generates an alarm	step 4
does not generate an alarm	step 3

3 Contact the next level of maintenance.

4 Did you check the two low temperature alarm sensors?

If	Do
you did not check the alarm sensors	step 1 for other sensor
you did check the alarm sensors	step 5

5 The procedure is complete.

Rectifier voltage adjustment
OPM

Application

Use this procedure to adjust the rectifier voltage in an OPM equipped with an LTU.

Interval

Perform this procedure every 3 months.

Common procedures

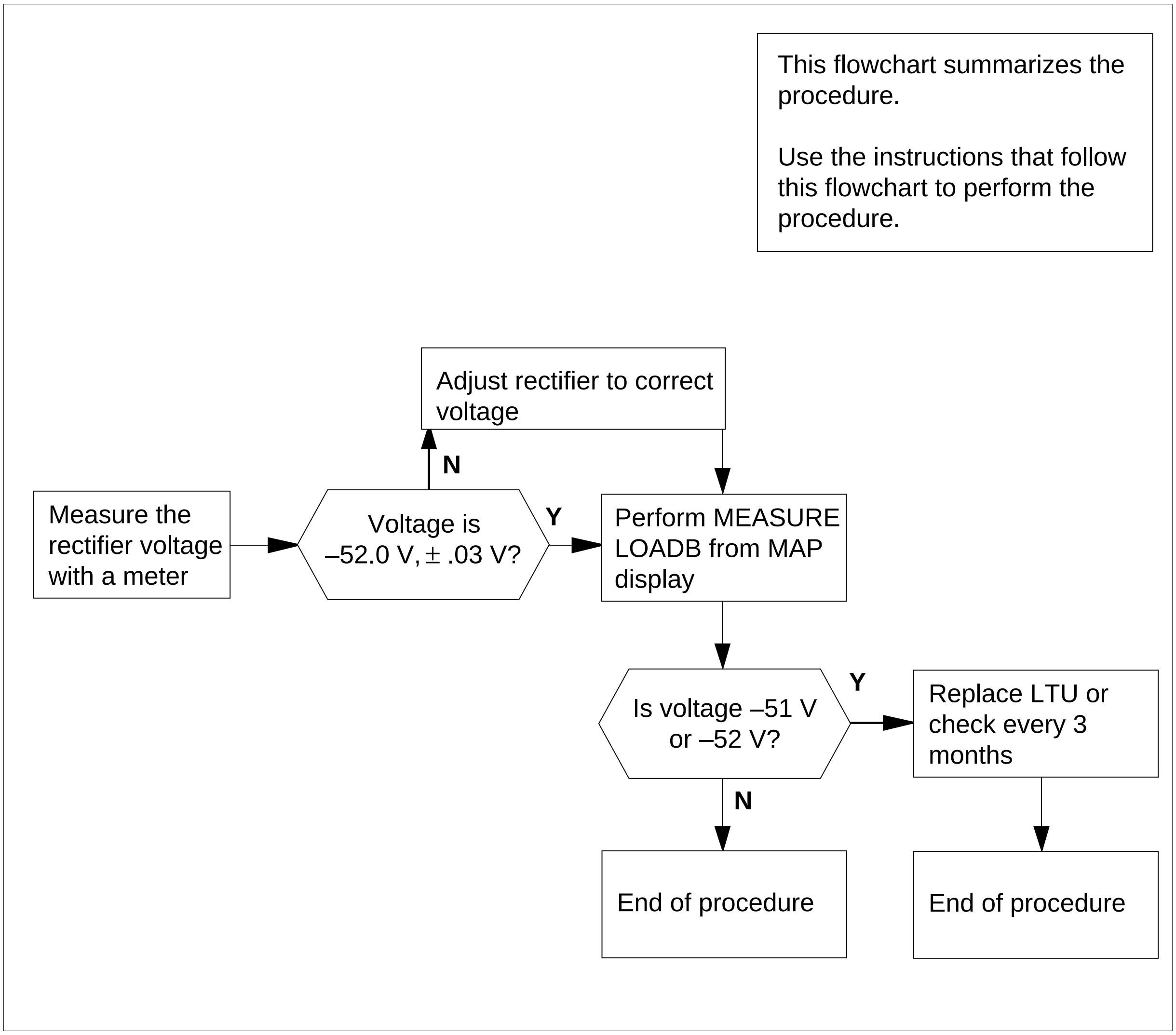
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Rectifier voltage adjustment
OPM (continued)

Summary of rectifier voltage adjustment in an OPM



Rectifier voltage adjustment in an OPM

At the OPM cabinet

1 Use a voltmeter with a minimum 2% accuracy to measure the rectifier output voltage.

If voltage	Do
is not equal -52.0 Vdc, ± 0.3 ς	step 2
is equal -52.0 Vdc, ± 0.3 ς	step 3

Rectifier voltage adjustment
OPM (end)

2 Adjust the rectifier voltage until the voltage is in specification (-52.0 Vdc, ± 0.3 V) and the currents from the two rectifiers are balanced. If the rectifier voltage is low before adjustment, wait 24 h before you proceed with battery capacity tests.

At the MAP terminal

3 To access the OPMPES MAP display level, type

>MAPCI;MTC;PM;PES

and press the Enter key.

4 To post the appropriate alarm, type

>POST alarm_state

and press the Enter key.

where

alarm_state
is RED or AMBER

5 To disable the audit facility, type

>AUDIT DISABLE

and press the Enter key.

6 To measure the voltage of the load bus, type

>MEASURE LOADB

and press the Enter key.

7 Repeat step 6 two more times. Make sure the voltage measurement is always -51 or -52 V.

If LTU voltage measurements	Do
are -51 V or -52 V	step 10
are not -51 V or -52 V	step 9

8 To enable the audit facility, type

>AUDIT ENABLE

and press the Enter key.

9 To replace the LTU, use the procedure for the NT2X10 or NT2X11 in *Card Replacement Procedures*.

10 The procedure is complete.

Rectifier voltage check
OPM

Application

Use this procedure to adjust the rectifier voltage in an OPM equipped with an MTU.

Interval

Perform this procedure in three month intervals.

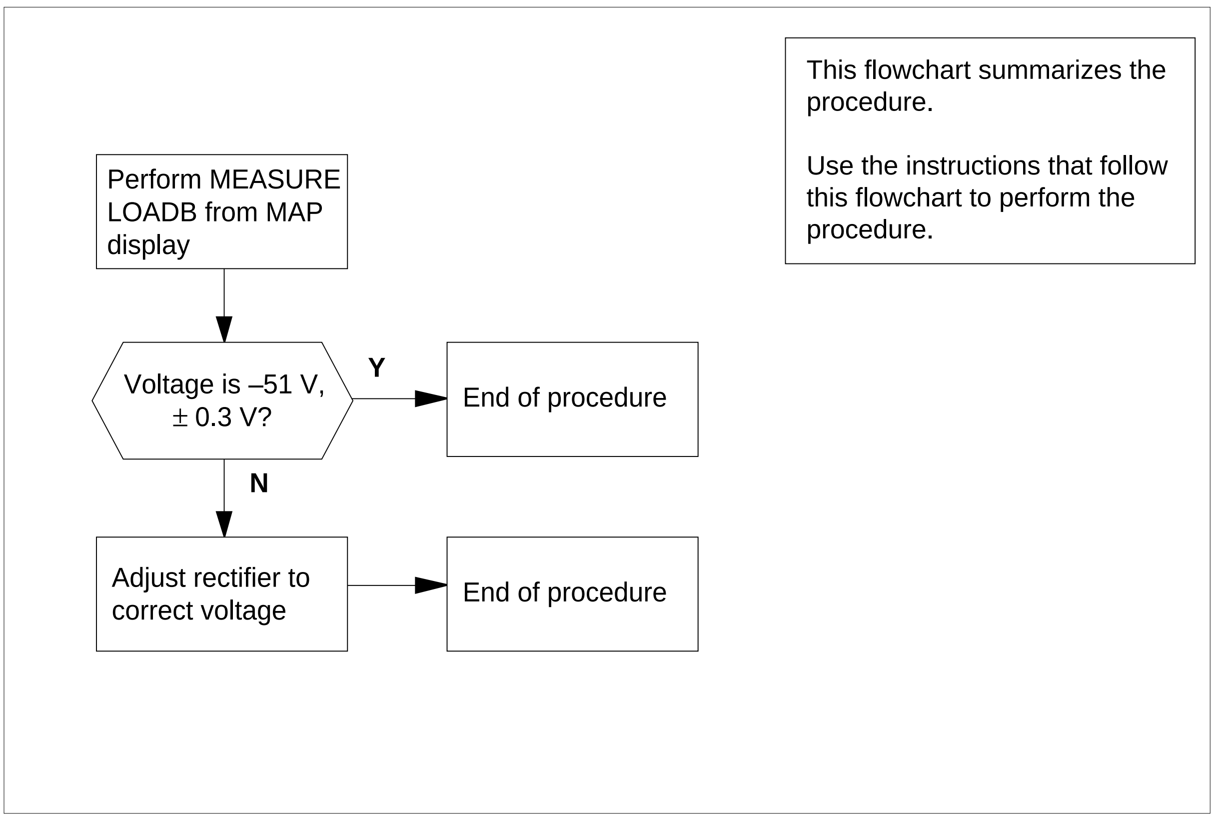
Common procedures

There are no common procedures.

Action

This procedure contains a flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Summary of rectifier voltage check in an OPM



Rectifier voltage check
OPM (end)

Rectifier voltage check in an OPM

At the MAP terminal

1 To access the OPMPES MAP level, type

>MAPCI;MTC;PM;PES

and press the Enter key.

2 To post the correct alarm, type

>POST alarm_state

and press the Enter key.

where

alarm_state
is RED or AMBER

3 To measure the load bus, type

>MEASURE LOADB

and press the Enter key.

At the OPM cabinet

4 Use a voltmeter with at least 2% accuracy to adjust the rectifier voltage until the rectifier voltage is within specification (-52.0 Vdc, ± 0.3 V). The currents from the two rectifiers must be balanced. If the rectifier voltage was low before adjustment, wait 24 h before you proceed with the battery capacity testing.

5 The procedure is complete.

Rectifier replacement in an NT8X01AA, AB, BA, BB OPM

Application

Use this procedure to replace a rectifier in an NT8X01AA, AB, BA, or BB OPM cabinet.

Interval

Perform this procedure as required.

Common procedures

There are no common procedures.

Action

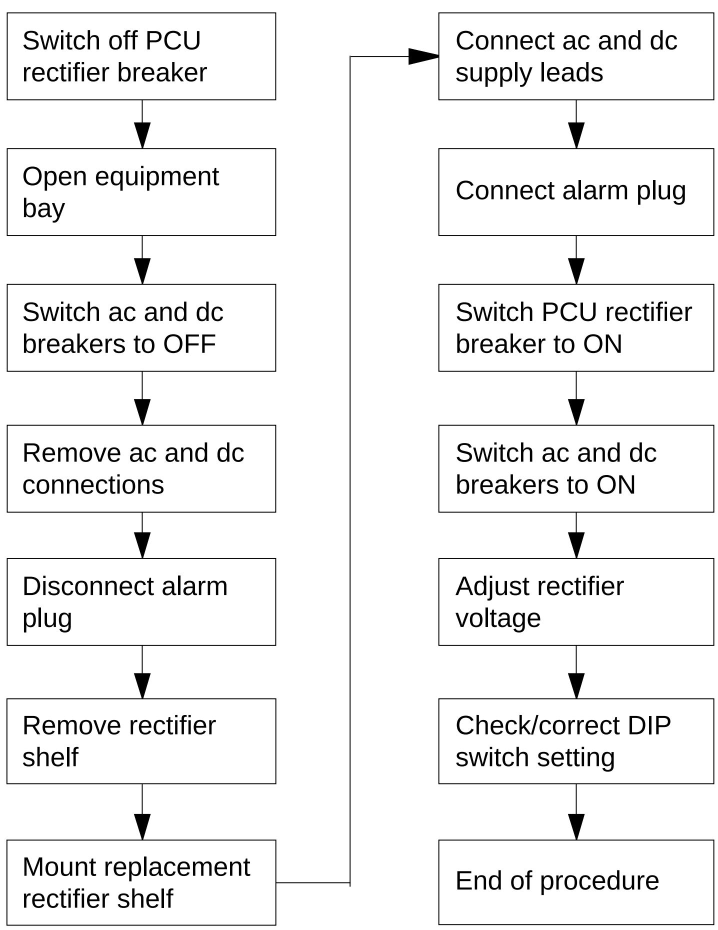
This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Rectifier replacement in an NT8X01AA, AB, BA, BB OPM (continued)

Summary of rectifier replacement for NT8X01AA, AB,BA, BB in an OPM

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.



Rectifier replacement in an NT8X01AA, AB, BA, BB OPM (continued)

Rectifier replacement for NT8X01AA, AB, BA, BB in an OPM

At the power control unit

1 Switch the correct rectifier breaker to OFF.

2 Open the right equipment bay to access the front of the rectifier.

> ***Note:*** The rectifiers located in the right equipment bay frame are installed with the rectifier front facing the back cabinet wall. To access the front of the rectifiers, open the right equipment bay frame.

3

DANGER
Electrical hazard
When you disconnect the power leads from the binding posts of the rectifier, power can still be connected. You must apply tape around the bare copper ends of the power leads.

At the front face of the rectifier, set the ac and dc breakers to OFF.

4 Remove the ac connections from their termination point at the left of the rectifier.

5 Remove the dc connections on the right side of the rectifier.

6 Disconnect the alarm plug at the right of the rectifier.

7 Remove the retainer screws and remove the rectifier shelf.

8 Mount the replacement rectifier and install the retaining screws.

9 Set rectifier ac and dc breakers to OFF.

10 Connect the ac and dc supply leads.

11 Connect the alarm plug.

12 Make sure the current limiting (CL) DIP switch is set to the setting indicated in the following table.

RECTIFIER	SW1	SW2	SW3
Rectifier 0	open	open	open
Rectifier 1	open	open	open

Rectifier replacement in an NT8X01AA, AB, BA, BB OPM (end)

13 Check that the sequence settings (Seq. Set) DIP switch is set to the setting indicated in the following table.

RECTIFIER	SW4	SW5	SW6
Rectifier 0	open	open	closed
Rectifier 1	open	open	open

14 Open the rectifier door and verify that fuses F1, F2, F3, and F4 are in place.

15 To reconnect the load to the rectifier, switch the rectifier breaker on the PCU to ON.

Note: You can have to toggle the PCU breaker.

16 Remove fuse F4 and operate the rectifier ac breaker to ON.

Note 1: Do not remove fuse F4 if without a battery.

Note 2: You can have to toggle the ac breaker.

17 At the front face of the rectifier, set the dc breaker to ON.

Note: You can have to toggle the dc breaker.

18 Insert again the fuse F4 removed before in step 16.

19 Adjust the rectifier voltage screw (VA) so that both rectifiers supply an equal amount of current. Check the voltage and make sure the voltage is 52.0 Vdc, ±0.3 V.

20 This inspection procedure is complete.

Rectifier replacement in an NT8X01AC, BC OPM

Application

Use this procedure to replace a rectifier in an NT8X01AC or BC OPM cabinet.

Interval

Perform this procedure as required.

Common procedures

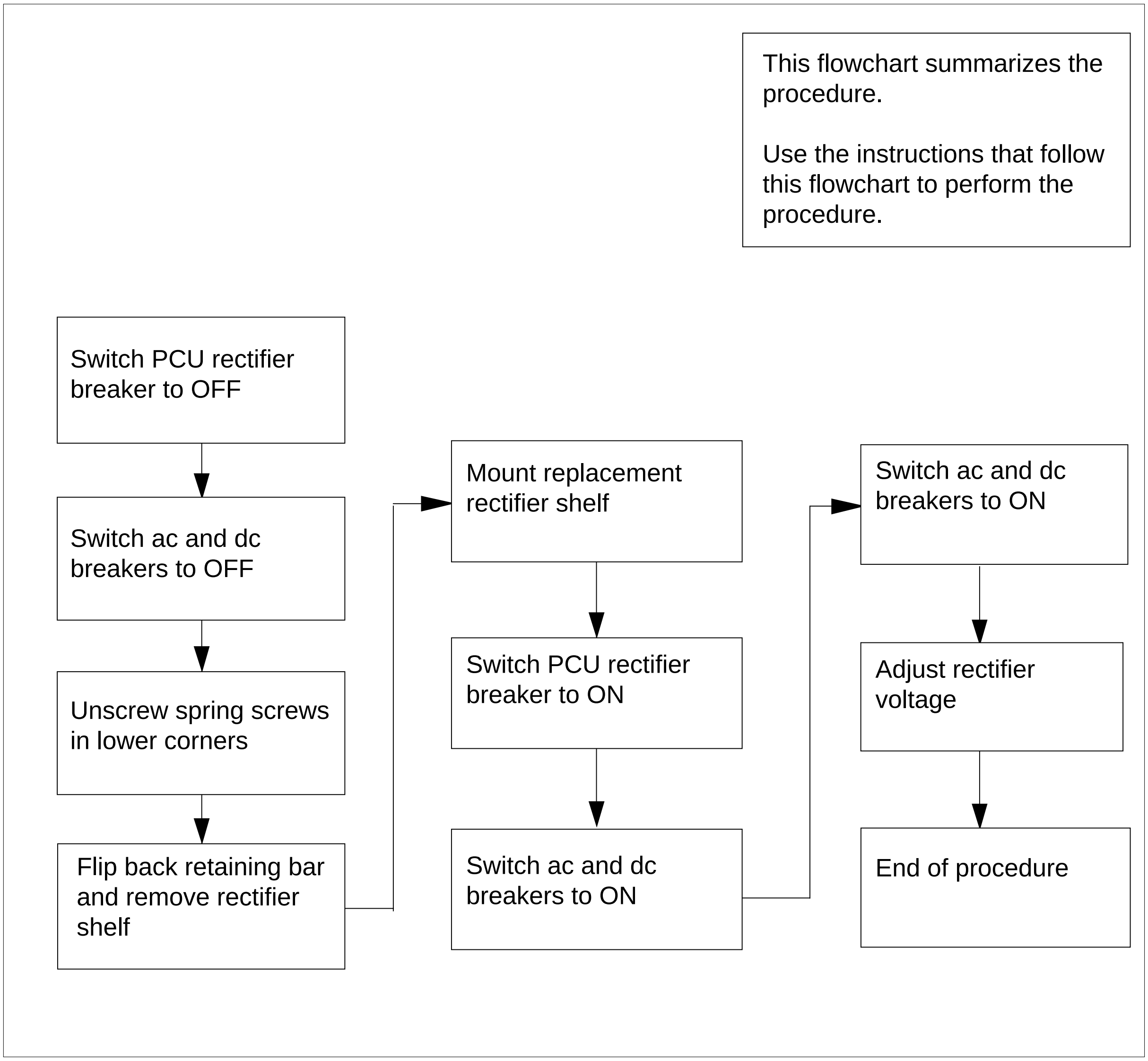
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Rectifier replacement in an NT8X01AC, BC OPM (continued)

Summary of rectifier replacement in an NT8X01AC, BC OPM



Rectifier replacement in an NT8X01AC, BC OPM

At the power control unit (PCU)

1 Switch the appropriate rectifier breaker to OFF.

2 At the front face of the rectifier, set the ac and dc breakers to OFF.

3 Unscrew the large spring screws in the lower left and right corners of the rectifier shelf.

4 Flip back the hinged retaining bar and remove the rectifier.

Rectifier replacement in an NT8X01AC, BC OPM (end)

5 Mount the replacement rectifier and install the retaining screws.

6 Switch the rectifier breaker, on the PCU, to ON. Reconnect the load to the rectifier.

7 At the front face of the rectifier, set the dc breaker to ON.

8 At the front face of the rectifier, set the ac breaker to ON.

9 Adjust the rectifier voltage screw (FLT) so the two rectifiers supply an equal amount of current. Check the voltage. Make sure the voltage is 52 Vdc, ±0.3 V.

10 The procedure is complete.

Site test
OPM

Application

Use this procedure to perform site tests for battery strings that fail automatic tests in an OPM.

Interval

A test failure will indicate when to perform this procedure.

Common procedures

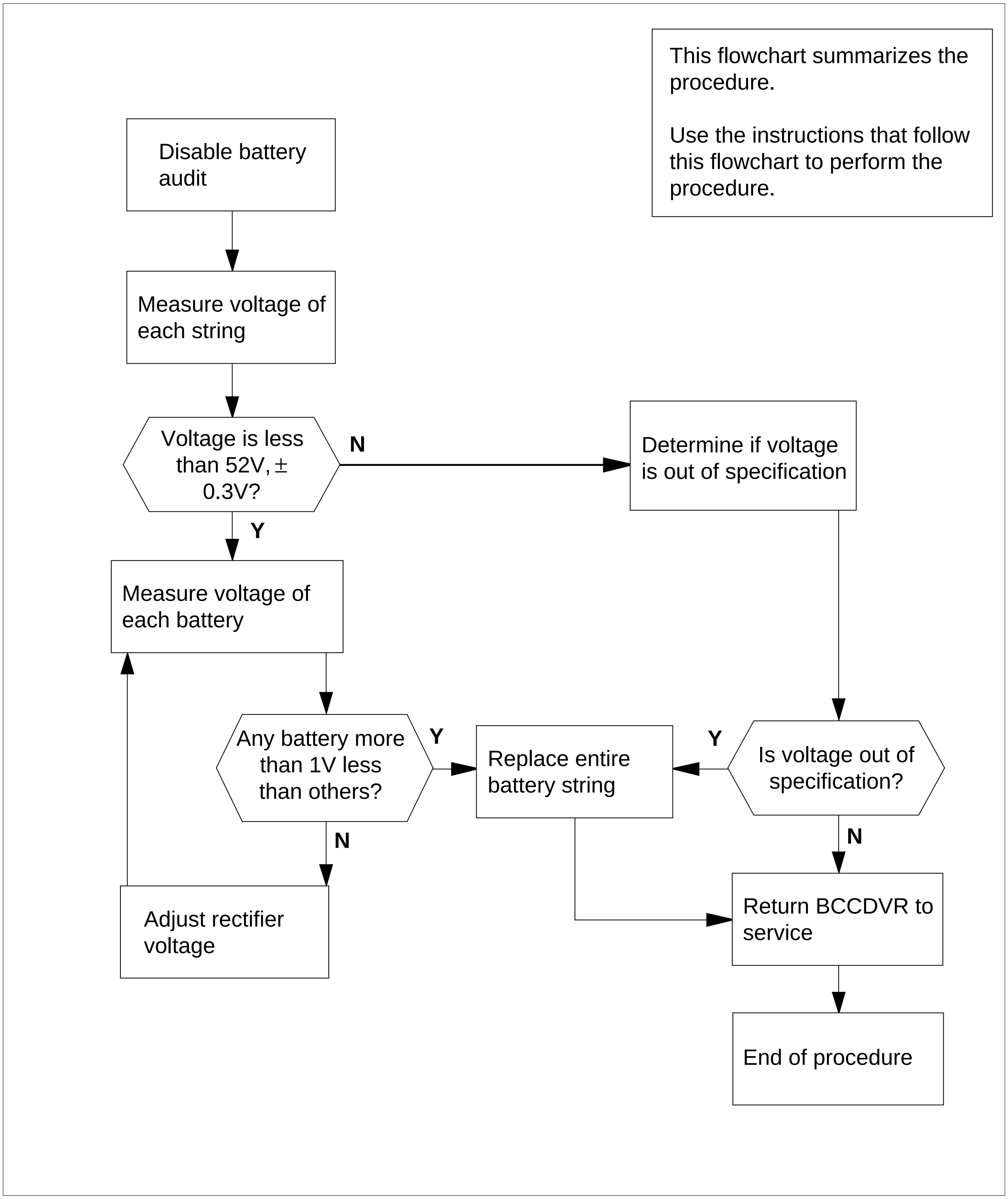
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Site test
OPM (continued)

Summary of site test in an OPM



Site test in an OPM

At the MAP display

1 To access the OPMPES MAP level, type

>MAPCI;MTC;PM;PES

and press the Enter key.

2 To post the appropriate alarm, type

>POST alarm_state

and press the Enter key.

where

alarm_state
is RED or AMBER

3 To disable the automatic battery rotation and tests, type

>AUDIT DISABLE

and press the Enter key.

At the OPM cabinet

4 Use a voltmeter with at least 0.2% accuracy to measure the voltage of both rectifiers. Use the test jacks on the rear of the rectifiers.

For OPMs with Yuasa batteries, the voltage must be 52.0Vdc, ± 0.3V. Low rectifier voltage can cause a battery string to fail other tests.

If the voltage	Do
is in specification	step 6
is not in specification	step 5

5 Adjust the rectifier voltage screws (VA) until the voltage is in specification and the current from each rectifier balances.

6 Measure the voltage of each battery in the failed battery string. The voltage of any battery can be more than 1V less than the voltage of the other batteries in the string. If this condition occurs, replace the entire string.

If voltage for	Do
any battery is greater than 1V less than any other	step 9
all batteries in strings are in 1V difference	step 7

Site test
OPM (end)

7 Measure the voltage of the entire battery string.

If the battery string voltage	Do
is less than OPM_VOLT_TST_ OCC (-50.4 Vdc for Yuasa and Eagle Picher batteries)	step 9
is less than OPM_VOLT_TST_ DIS (-49.5 Vdc for Yuasa and Eagle Picher batteries)	step 9
measures OK	step 8

8 Measure voltage of all strings.

If	Do
all strings appear OK	step 12
any string continues to fail the audit test, while other strings pass	step 9

9 To busy the BCCDVR, type

>BSY BCCDVR

and press the Enter key.

10 Replace the entire string.

11 To return to service the BCCDVR, type

>RTS BCCDVR

and press the Enter key.

12 To enable the automatic battery rotation and tests, type

>AUDIT ENABLE

and press the Enter key.

13 The inspection procedure is complete.

Testing wrist strap grounding cords
OPM

Application

Use this procedure to verify the correct resistance of the wrist strap grounding cord. This resistance must be low enough for static electricity to discharge from a person. This resistance must be high enough to prevent electrocution if the equipment develops a short-circuit while the person wears a wrist strap.

Interval

Perform this procedure every month.

Common procedures

There are no common procedures.

Action

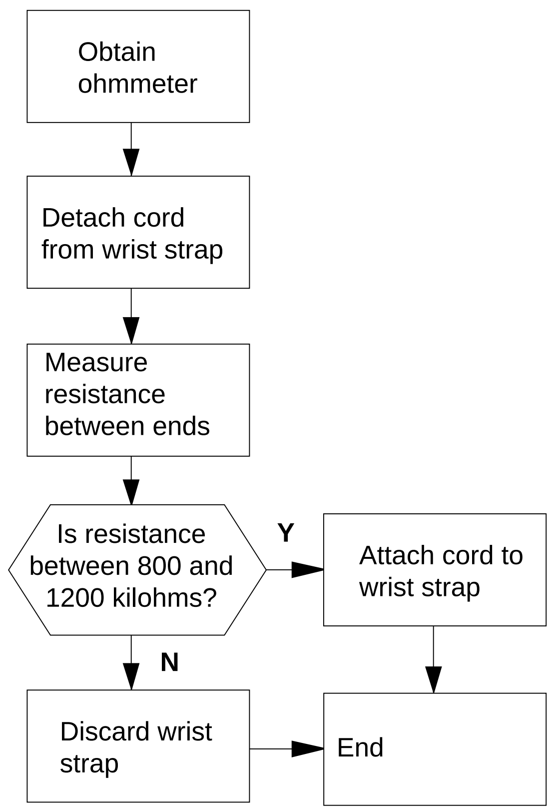
This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Testing wrist strap grounding cords
OPM (continued)

Summary of Testing wrist strap grounding cords

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.



Testing wrist strap grounding cords
OPM (end)

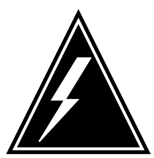
Testing wrist strap grounding cords

At your current location

1 Obtain an ohmmeter.

2

DANGER
Risk of electrocution
The grounding cord is safe to use if the cord resistance measures higher than 800 kilohms. A lower resistance exposes the person that wears the wrist strap to the risk of electrocution if equipment short-circuits.



WARNING
Damage to electronic equipment
A grounding cord that has a resistance higher than 1200 kilohms cannot conduct enough static charges to ground adequately. The cord does not protect sensitive electronic equipment against build-ups of static charges that can cause damage

Detach the grounding cord from the wrist strap.

3 Measure the resistance between opposite ends of the grounding cord with the ohmmeter.

If resistance	Do
is between 800 kohms and 1200 kohms	step 4
is not between 800 kohms and 1200 kohms	step 5

4 You can use the grounding cord and wrist strap assembly. Assemble the wrist strap to the grounding cord.

Go to step 6.

5 Discard the complete assembly. *Do not attempt to use the assembly.*

6 The inspection procedure is complete.

Testing power converter voltages
HIE

Application

Use this procedure to test power converter voltages for power converters in the host interface shelf (HIE).

Interval

Perform this procedure every six months.

Common procedures

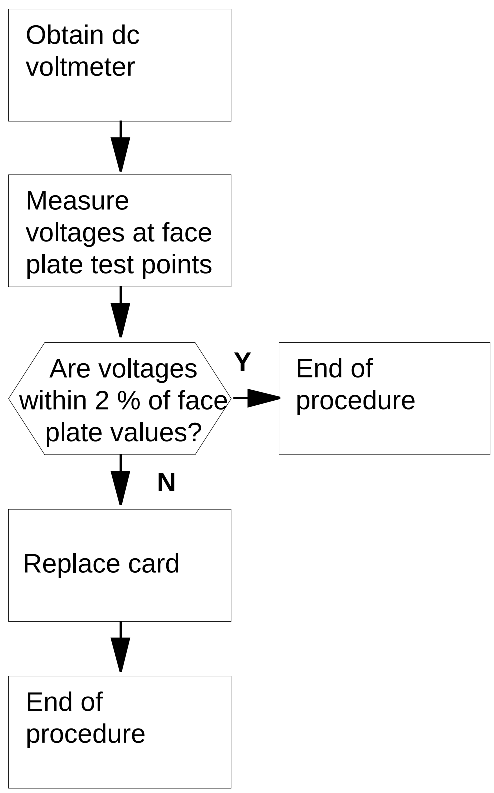
There are no common procedures

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Testing power converter voltages
HIE (continued)

Summary of Testing power converter voltages



This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.

Testing power converter voltages
HIE (end)

Testing power converter voltages

At your current location

1 Obtain a dc voltmeter.

2 Measure the voltage at the test points on the faceplates of all NT2X70 power converters in the HIE frame.

3 The voltages must be within 2 percent of the nominal values printed on the NT2X70 faceplate. Compare the voltages measured with the acceptable voltage ranges given below.

Test point voltage	Acceptable range
+12 V	+11.76 V to + 12.24 V
-12 V	-12.24 V to -11.76 V
+ 5 V	+4.9 V to +5.1 V
-5 V	-5.1 V through -4.9 V

If test point voltages are	Do
within acceptable range	step 5
not within acceptable range	step 4

4 Replace the NT2X70 power converter as directed in *Card Replacement Procedures*.

On returning to this procedure, go to step 5.

5 The procedure is complete.

Returning a card for repair or replacement OPM

Application

Use this procedure to return a circuit pack to Nortel for repair or replacement. Your location, Canada or the United States, determines the documents you must complete. Your location determines to which address you must return the card.

Interval

Perform this procedure as required.

Common procedures

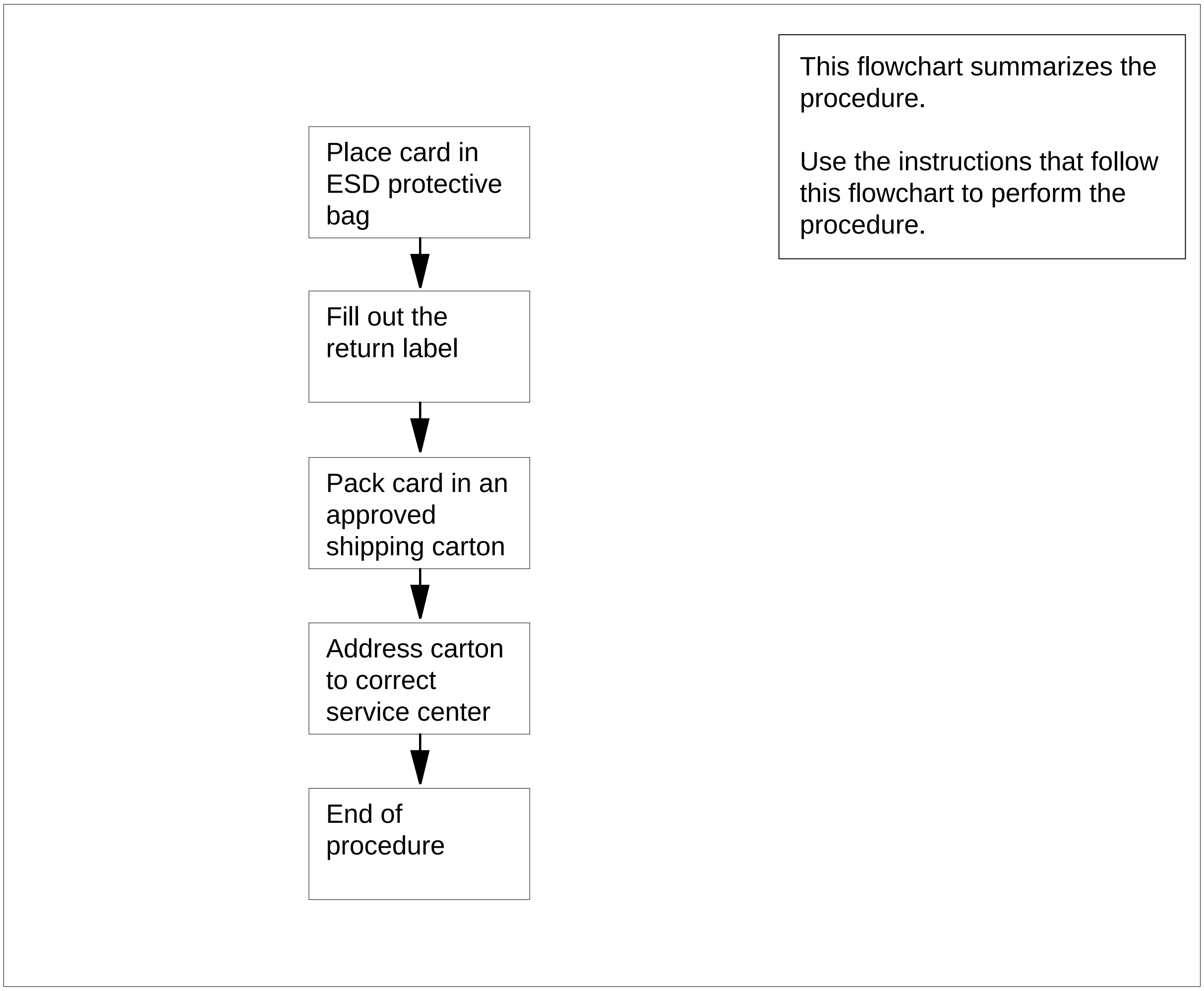
There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Returning a card for repair or replacement
OPM (continued)

Summary of Returning a card for repair or replacement



Returning a card for repair or replacement

At your current location

1 Place the card in an electrostatic-discharge protective bag.

If your location	Do
is in Canada	step 6
is in the United States	step 2

2 Fill in the return label for each card you return. For help to fill out the label, call 1-800-347-4850.

Returning a card for repair or replacement
OPM (continued)

3 Pack the card or assembly in a Nortel card shipping carton and seal the card or assembly.

If a Nortel shipping carton is not available, use another carton. Make sure you perform the following actions:

- enclose each card or assembly in packing paper
- surround each card or assembly in bubble pack or foam
- secure each card or assembly in the carton so that no card or assembly can shift

4 Address the carton to: Nortel Customer Service Center, 4600 Emperor Blvd., Morrisville, North Carolina, 27560

5 Go to Step 11.

6 Fill in one return label (form 24-115) for each card or assembly that you return.

Make sure you include the following information:

- return authorization number from customer service
- NT product engineering code (PEC)
- serial number
- release number
- BCS release software in use at the time of replacement
- peripheral module load name
- description of the failure and action taken to repair
- fault code that describes the fault best (see the bottom of the label)
- name of your company
- office identifier code
- your name
- site name

For help to fill out the label, call 905-454-2808. In the event of an emergency, call 905-457-9555.

7 Attach one copy of the card label to a card latch.

8 Keep the other copies of the label for your records.

9 Pack the card or assembly in a Nortel shipping carton and seal the card or assembly.

If a Nortel shipping carton is not available, use another carton. Make sure you perform the following actions:

- enclose each card or assembly in packing paper
- surround each card or assembly in bubble pack or foam
- secured each card or assembly in the carton so that card or assembly can shift.

Returning a card for repair or replacement
OPM (end)

10 Address the carton to: Nortel Customer Operations, c/o Wesbell Transport, 1630 Trinity Road, Unit #3 Door #4, Mississauga, Ontario, L5T 1L6

11 This procedure is complete.

Index

F

H

I

L

O

P

R

S

T

W

DMS-100 Family

Outside Plant Module

OPM Maintenance Manual

Product Documentation-Dept. 3423
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Publication number: 297-8361-550
Product release: XPM14 and up
Document release: Standard 04.01
Date: September 2000
Printed in the United States of America

NORTEL NETWORKS

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