

4-22-82

 **MOBILE RADIO**

# MASTR<sup>®</sup> II

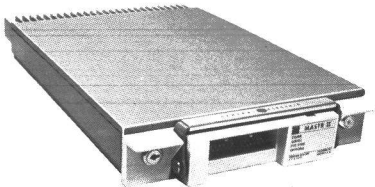
**MAINTENANCE MANUAL LBI 30250C**

DATAFILE FOLDER — DF 9031

*Includes*

*1 Com strapping*

*12 channel model.  
(pg 7 - front system board)*



**MOBILE RADIO**



**CONTROL UNIT**

**406-512 MHz  
20/40/75/100-WATT  
TWO-WAY FM  
MOBILE  
COMBINATIONS**



**SPEAKER**

**GENERAL  ELECTRIC**

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## WARNING

Although the highest DC voltage in MASTR II Mobile Equipment is supplied by the vehicle battery, high currents may be drawn under short circuit conditions. These currents can possibly heat metal objects such as tools, rings, watchbands, etc., enough to cause burns. Be careful when working near energized 12-Volt circuits! High-level RF energy in the transmitter Power Amplifier assembly can cause RF burns upon contact. KEEP AWAY FROM THESE CIRCUITS WHEN THE TRANSMITTER IS ENERGIZED!

## EQUIPMENT INDEX

| EQUIPMENT                                                                                                                                                               | MODEL OR TYPE NUMBER                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Transmitter and Receiver                                                                                                                                                | Refer to the Applicable Maintenance Manual                                               |
| Exciter/PA Cable                                                                                                                                                        | 5491689P86                                                                               |
| Receiver Antenna Cable<br>Standard<br>With RF Pre-Amp (UHS)                                                                                                             | 5491689P83<br>5491689P77                                                                 |
| Control Unit                                                                                                                                                            | Refer to Applicable Control Unit<br>Maintenance Manual                                   |
| Microphone                                                                                                                                                              | Refer to Applicable Control Unit<br>Maintenance Manual                                   |
| Speaker                                                                                                                                                                 | Refer to Applicable Control Unit<br>Maintenance Manual                                   |
| Antenna                                                                                                                                                                 | Refer to Applicable Control Unit<br>Maintenance Manual                                   |
| Power/Control Cable                                                                                                                                                     | Refer to Applicable Control Unit<br>Maintenance Manual                                   |
| 12-Volt Fuse Assembly                                                                                                                                                   | Refer to Applicable Control Unit<br>Maintenance Manual                                   |
| Ignition Switch Cable Assembly                                                                                                                                          | 19B219537G4                                                                              |
| Microphone Bracket                                                                                                                                                      | 7141414G2                                                                                |
| Channel Guard Microphone Hookswitch                                                                                                                                     | 19C320318G1                                                                              |
| Extractor Tool Kit                                                                                                                                                      | 19B227456G1                                                                              |
| Mounting Hardware                                                                                                                                                       | 19A129474G1                                                                              |
| Key (BF10A)                                                                                                                                                             | 5491682P8                                                                                |
| Alignment Tools                                                                                                                                                         | 19B219676G1<br>19B219678P1                                                               |
| OPTIONS                                                                                                                                                                 |                                                                                          |
| Power/Control Cables<br>9-Foot, 18-Conductor<br>9-Foot, 30-Conductor<br>9-Foot, 38-Conductor<br>27-Foot, 18-Conductor<br>27-Foot, 30-Conductor<br>27-Foot, 38-Conductor | 19D423424G1<br>19D423424G7<br>19D423424G13<br>19D423424G3<br>19D423424G9<br>19D423424G15 |
| Handset<br>Hookswitch                                                                                                                                                   | 19C320478G1<br>19B219846G1                                                               |
| 12-Volt 3-Wire Ignition Switch Cable<br>Assembly                                                                                                                        | 19B219537G1                                                                              |

## SYSTEM SPECIFICATIONS\*

## FREQUENCY RANGE

406-512 MHz

## BATTERY DRAIN

## Receiver

Squelched  
Unsquelched

0.250 Amperes  
2.40 Amperes

## Transmitter

20 Watt (KT-35B,D)  
40 Watt (KT-36B,D)  
75 Watt (KT-112A,C)  
100 Watt (KT-37A,C)

6.0 Amperes at 13.8 VDC  
12.0 Amperes at 13.6 VDC  
19.0 Amperes at 13.6 VDC  
27.5 Amperes at 13.4 VDC

## FREQUENCY STABILITY

-40°C to +70°C +0.0005%  
0°C to +55°C +0.0002%  
-40°C to +70°C +0.0002%

KT-35-B, KT-36-B, KT-112-A, KT-37-A  
KT-35-B, KT-36-B, KT-112-A, KT-37-A  
KT-35-D, KT-36-D, KT-112-C, KT-37-C

## DIMENSIONS (H X W X D)

Two-Way Radio  
C-500 Series Control Unit (less  
bracket)  
Speaker (less bracket)

2-1/2" x 11-3/4" x 18-3/4"

2-1/4" x 6-11/16" x 5"

5-1/8" x 5-1/8" x 2-13/16"

## WEIGHT

Two-Way Radio (includes mounting  
plate)  
C-500 Series Control Unit  
Speaker

26 pounds  
1-1/4 pounds  
1-1/2 pounds

## TEMPERATURE RANGE

-40°C to +70°C (-40°F to +158°F)

## DUTY CAPABILITY

Intermittent  
Continuous

20% Transmit, 100% Receive  
100% Transmit at reduced power

\* These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

## COMBINATION NOMENCLATURE

| 1st Digit            | 2nd Digit                                  | 3rd Digit             | 4th Digit          | 5th Digit            | 6th Digit                                | 7th Digit                                   | 8th & 9th Digits         | 10th Digit                      |
|----------------------|--------------------------------------------|-----------------------|--------------------|----------------------|------------------------------------------|---------------------------------------------|--------------------------|---------------------------------|
| Mechanical Package   | System Voltage                             | Power Output          | Channel Spacing    | Frequency Capability | Number of Freq.                          | Options                                     | Frequency Range          | Oscillator Stability            |
| <b>M</b><br>Standard | <b>C</b><br>±12-VDC                        | <b>4</b><br>20 Watts  | <b>5</b><br>25 kHz | <b>A</b><br>1-Freq.  | <b>A</b><br>1-Freq. Xmit<br>1-Freq. Rec. | <b>S</b><br>Standard                        | <b>77</b><br>406-420 MHz | <b>A</b><br>±5 PPM<br>(±.0005%) |
|                      | <b>X</b><br>±12-VDC<br>Less<br>Accessories | <b>5</b><br>40 Watts  |                    | <b>C</b><br>2-Freq.  | <b>B</b><br>2-Freq. Xmit<br>1-Freq. Rec. | <b>U</b><br>Channel Guard                   | <b>78</b><br>420-450 MHz | <b>B</b><br>±2 PPM<br>(±.0002%) |
|                      |                                            | <b>6</b><br>75 Watts  |                    | <b>K</b><br>8-Freq.  | <b>C</b><br>2-Freq. Xmit<br>2-Freq. Rec. | <b>P</b><br>UHS Receiver                    | <b>88</b><br>450-470 MHz |                                 |
|                      |                                            | <b>7</b><br>100 Watts |                    |                      | <b>D</b><br>1-Freq. Xmit<br>2-Freq. Rec. | <b>Q</b><br>UHS Receiver &<br>Channel Guard | <b>89</b><br>470-494 MHz |                                 |
|                      |                                            |                       |                    |                      | <b>E</b><br>3-Freq. Xmit<br>3-Freq. Rec. |                                             | <b>91</b><br>494-512 MHz |                                 |
|                      |                                            |                       |                    |                      | <b>F</b><br>4-Freq. Xmit<br>4-Freq. Rec. |                                             |                          |                                 |
|                      |                                            |                       |                    |                      | <b>G</b><br>5-Freq. Xmit<br>5-Freq. Rec. |                                             |                          |                                 |
|                      |                                            |                       |                    |                      | <b>H</b><br>6-Freq. Xmit<br>6-Freq. Rec. |                                             |                          |                                 |
|                      |                                            |                       |                    |                      | <b>J</b><br>7-Freq. Xmit<br>7-Freq. Rec. |                                             |                          |                                 |
|                      |                                            |                       |                    |                      | <b>K</b><br>8-Freq. Xmit<br>8-Freq. Rec. |                                             |                          |                                 |

## DESCRIPTION

MASTR II mobile radio combinations are compact, highly reliable and ruggedly-constructed units that are designed to meet the most stringent requirements in the two-way radio field.

The radios are fully transistorized -- utilizing both discrete components and Integrated Circuits (IC's) for highest reliability. Since no tubes are used, the radio is ready to use the instant it is turned on. The standard combination may be equipped with the following:

- One through eight frequencies
- Plug-in oscillators for  $\pm 0.0002\%$  or  $\pm 0.0005\%$  oscillator stability
- Channel Guard (tone squelch)
- Ultra High Sensitivity (UHS) pre-amplifier

The radio set is housed in a drip-proof case only 2-1/2 inches high. The radio mounts to the vehicle by a bottom mounting plate, and is tamper-proof when locked into the mounting plate. When unlocked, the handle can be pulled down and the radio pulled out of the mounting plate or the top cover removed for servicing. When the handle is pulled down 90 degrees, the radio can be locked to hold the handle in the carrying position.

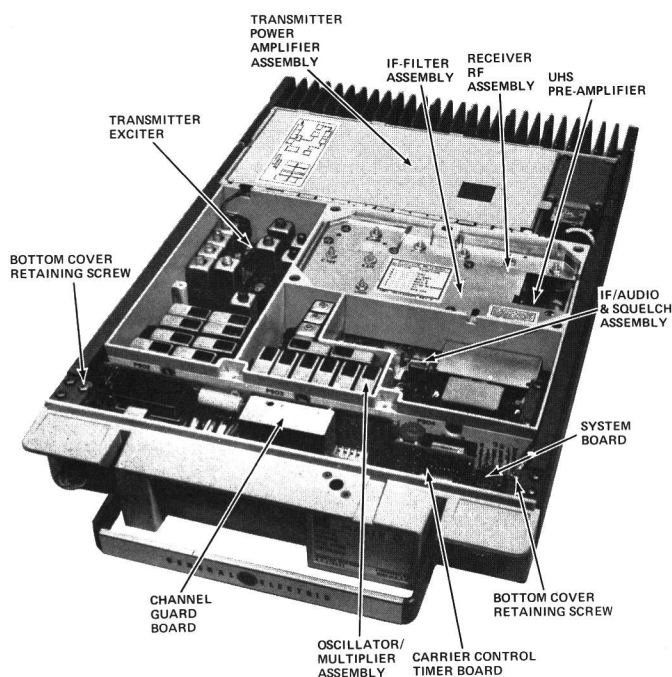


Figure 1 - Module Layout

No power supply is required since the highest supply voltage used in the radio is supplied by the vehicle battery.

The radio is of single-layer, modular construction with all major modules and tuning adjustments easily accessible from the top of the radio (see Figure 1).

Centralized metering jacks for the transmitter, receiver and system board are provided for simplified alignment and troubleshooting.

Both the transmitter and receiver are electrically isolated from the radio chassis to permit operating in 12-Volt, positive or negative ground vehicles without the use of a polarity converter. The transmitter exciter and receiver modules are mounted in a Lexan® frame for isolation. Simply changing four leads to the control unit and reversing the power leads at the plug end allows the radio to be used in negative or positive ground vehicles. No changes are required in the radio.

### TRANSMITTER

The transmitter consists of an exciter board located in the mounting frame, and a power amplifier assembly. The PA assembly consists of a PA board(s) and a Low Pass Filter Board (with a hermetically sealed antenna switch) mounted on a heat sink casting.

### RECEIVER

The receiver consists of an oscillator/multiplier assembly (Osc/Mult), RF assembly, IF-Filter assembly, and IF-audio and squelch assembly (IFAS). In UHS receivers, the pre-amplifier mounts in the area near the antenna input board.

### C-500 SERIES CONTROL UNIT

The control unit contains the power on-off rocker switch, volume and squelch controls, channel selector switch in multi-frequency models, a red transmit indicator light and a power on/frequency indicator light. Space is provided for an optional rocker switch, and two optional indicator lights.

The control unit is enclosed in a two piece molded Lexan® housing, and is supplied with a Lexan® mounting bracket and Safety Release assembly. The Safety Release assembly breaks away under impact for passenger safety. This mounting assembly also permits the control unit to be swiveled as desired for the convenience of the operator.

Three connectors are located on the rear of the control unit. Two of the connectors are for the control cable(s), and one (Vehicle Systems Jack J701) is for power, accessories and external options.

## MICROPHONE AND HANDSET

MASTR II mobile combinations use a dynamic microphone with a built-in transistorized microphone pre-amplifier. The microphone is housed in a sturdy Lexan® case, and the extendable coiled cord plugs into the microphone jack on the bottom of the control unit. The plug is secured to the jack by a retaining screw.

An optional telephone-type handset is available for use with the radio. The handset uses a dynamic microphone with a built-in microphone pre-amplifier. The extendable coiled cord plugs into the microphone jack on the bottom of the control unit, and is secured to the jack by a retaining screw.

## HOOKSWITCHES

In Channel Guard applications, a microphone or handset hookswitch is supplied with the radio. The hookswitches are equipped with a Channel Guard disable switch.

Placing the switch in the "up" position (towards the small speaker symbol) disables the receive Channel Guard. With the switch in the "down" position, the Channel Guard is disabled when the microphone or handset is removed from the hookswitch.

## SPEAKER

A five-inch speaker contained in a Lexan® housing provides an audio output of 12 Watts. The speaker impedance is eight ohms. The speaker leads are terminated in Vehicle Systems Plug P701 which connects to J701 on the rear of the control unit.

The speaker is supplied with a Lexan® mounting bracket and Safety Release assembly. The Safety Release assembly breaks away under impact for passenger safety, and permits the speaker to be swiveled as desired to direct sound to the operator.

## PRE-INSTALLATION CHECK

MASTR II radios are shipped from the factory completely connected to permit the serviceman to perform system checks on the transmitter and receiver without removing the radio from its shipping container. Simply removing the lid on the internal packing case provides access to the battery cables, ignition switch cables, microphone, control unit and radio antenna jack. The radio is shipped connected for 12-Volt, negative ground operation.

## CAUTION

Before bench testing the MASTR II Mobile Radio, be sure of the output voltage characteristic of your bench power supply.

To protect the transmitter power output transistors from possible instant destruction, the following input voltages must not be exceeded:

Transmitter unkeyed: 20 Volts  
Transmitter keyed  
(50 ohm resistive load): 18 Volts  
Transmitter keyed  
(no load or non-resistive load): 15.5 Volts

These voltages are specified at the normal vehicle battery terminals of the radio and take the voltage drop of standard cables into account. The voltage limit shown for a non-optimum load is for "worst case" conditions. For antenna mismatches likely to be encountered in practice, the actual limit will approach the 18 Volt figure.

Routine transmitter tests should be performed at EIA Standard Test Voltages (13.8 VDC for loads below 6 amperes; 13.6 VDC for loads of 6 to 16 amperes; 13.4 VDC for loads of 16 to 36 amperes). Input voltages must not exceed the limits shown, even for transient peaks of short duration.

Many commonly used bench power supplies cannot meet these requirements for load regulation and transient voltage suppression. Bench supplies which employ "brute force" regulation and filtering (such as Lapp Model 73) may be usable when operated in parallel with a 12-Volt automotive storage battery.

## INITIAL ADJUSTMENT

After the MASTR II Radio has been installed (as described in the INSTALLATION MANUAL), the following adjustments should be made by an electronics technician who holds a 1st or 2nd Class FCC Radio-telephone license.

Make sure that a RADIO TRANSMITTER IDENTIFICATION form (FCC Form 452-C or General Electric Form NP270303) has been filled out and attached to the transmitter.

## TRANSMITTER ADJUSTMENT

The adjustment for the transmitter includes measuring the Forward and Reflected Power and adjusting the antenna length for optimum ratio, then setting the transmitter to rated power output (or to the specific output or input which may be required by the FCC station authorization). Next, measuring the frequency and modulation and entering these measurements on the FCC-required Station records. For the complete transmitter adjustment, refer to the ALIGNMENT PROCEDURE in the MAINTENANCE MANUAL for the transmitter.

## RECEIVER ADJUSTMENT

The initial adjustment for the receiver includes tuning the input circuit to match the antenna. For the Receiver Initial

Adjustment Procedures, refer to the FRONT END ALIGNMENT PROCEDURES in the MAINTENANCE MANUAL for the receiver.

## OPERATION

Complete operating instructions for the Two-Way Radio are provided in the separate OPERATOR'S MANUAL. The basic procedures for receiving and transmitting messages follows:

### TO RECEIVE A MESSAGE

1. Turn the radio on by pressing the POWER-ON rocker switch to the ON position.
2. Turn the SQUELCH control clockwise (to the right) as far as possible.
3. Adjust the VOLUME control until the noise is easily heard, but is not annoyingly loud.
4. Now, slowly turn the SQUELCH control counterclockwise (to the left) until the noise just fades out.

The radio is now ready to receive messages from other radios in the system.

### TO TRANSMIT A MESSAGE

1. Turn the radio on as directed in the "To Receive a Message" section.
2. Press the push-to-talk button on the microphone and speak across the face of the microphone in a normal voice. Release the button as soon as the message has been given. The red indicator light on the control unit will glow each time the microphone button is pressed, indicating that the transmitter is on the air. The receiver is muted whenever the transmitter is keyed.

## MAINTENANCE

Removing IC's (and all other soldered-in components) can be easily accomplished by using a de-soldering tool such as a SOLDA-PULLT® or equivalent. To remove an

IC, heat each lead separately on the solder side and remove the old solder with the de-soldering tool.

An alternate method is to use a special soldering tip that heats all of the pins simultaneously.

### PREVENTIVE MAINTENANCE

To insure high operating efficiency and to prevent mechanical and electrical failures from interrupting system operations, routine checks should be made of all mechanical and electrical parts at regular intervals. This preventive maintenance should include the checks as listed in the table of Maintenance Checks.

### TEST AND TROUBLESHOOTING PROCEDURES

The individual Maintenance Manual for the transmitter and receiver describe standard test procedures which the serviceman can use to compare the actual performance of the transmitter or receiver against the specifications of the unit when shipped from the factory. In addition, specific troubleshooting procedures are available to assist the serviceman in troubleshooting the transmitter and receiver.

#### NOTE

In positive ground operation only, A- is "hot" with respect to vehicle ground. Shorting the receiver front end casting or any printed wiring board ground patterns to the radio case may cause one of the in-line fuses to blow.

### MECHANICAL PARTS BREAKDOWN

A mechanical parts breakdown diagram of the two-way radio is provided in this manual. The diagram shows the placement and GE Part Number of mechanical items on the Two-Way radio set (see Table of Contents).

### RE-INSTALLATION

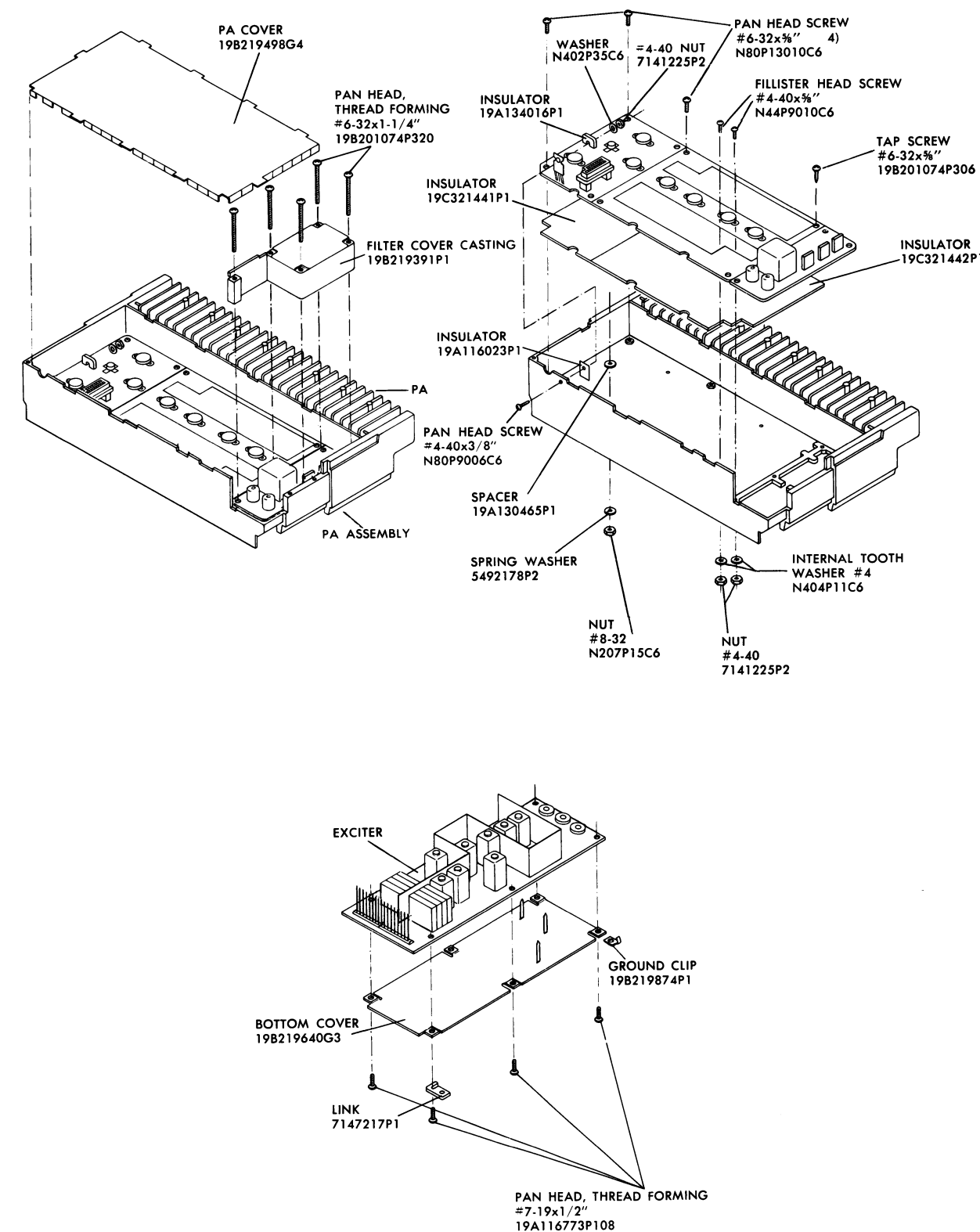
If the radio is ever moved to a different vehicle, always check the battery polarity and voltage of the new system before using the radio.

| MAINTENANCE<br>CHECKS                                                                                                                                                                                                                                                                                                                            | INTERVAL    |                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------|
|                                                                                                                                                                                                                                                                                                                                                  | 6<br>Months | As<br>Required |
| <b>CONNECTIONS</b> - Ground connections and connections to the voltage source should be periodically checked for tightness. Loose or poor connections to the power source will cause excessive voltage drops and faulty operation.                                                                                                               | X           |                |
| <b>ELECTRICAL SYSTEM</b> - Check the voltage regulator and alternator or generator periodically to keep the electrical system within safe and economical operating limits. Overvoltage is indicated when the battery loses water rapidly. Usage of 1 or 2 ounces of water per cell per week is acceptable for batteries in continuous operation. |             | X              |
| <b>MECHANICAL INSPECTION</b> - Since mobile units are subject to constant shock and vibration, check for loose plugs, nuts, screws and parts to make sure that nothing is working loose.                                                                                                                                                         | X           |                |
| <b>ANTENNA</b> - The antenna, antenna base and all contacts should be kept clean and free from dirt or corrosion. If the antenna or its base should become coated or poorly grounded, loss of radiation and a weak signal will result.                                                                                                           | X           |                |
| <b>ALIGNMENT</b> - The transmitter and receiver meter readings should be checked periodically, and the alignment "touched up" when necessary. Refer to the applicable ALIGNMENT PROCEDURE and troubleshooting sheet for typical voltage readings.                                                                                                |             | X              |
| <b>FREQUENCY CHECK</b> - Check transmitter frequency and deviation as required by FCC. Normally, these checks are made when the unit is first put into operation, after the first six months, and once a year thereafter.                                                                                                                        |             | X              |

GENERAL ELECTRIC COMPANY • MOBILE COMMUNICATIONS DIVISION  
WORLD HEADQUARTERS • LYNCHBURG, VIRGINIA 24502 U.S.A.

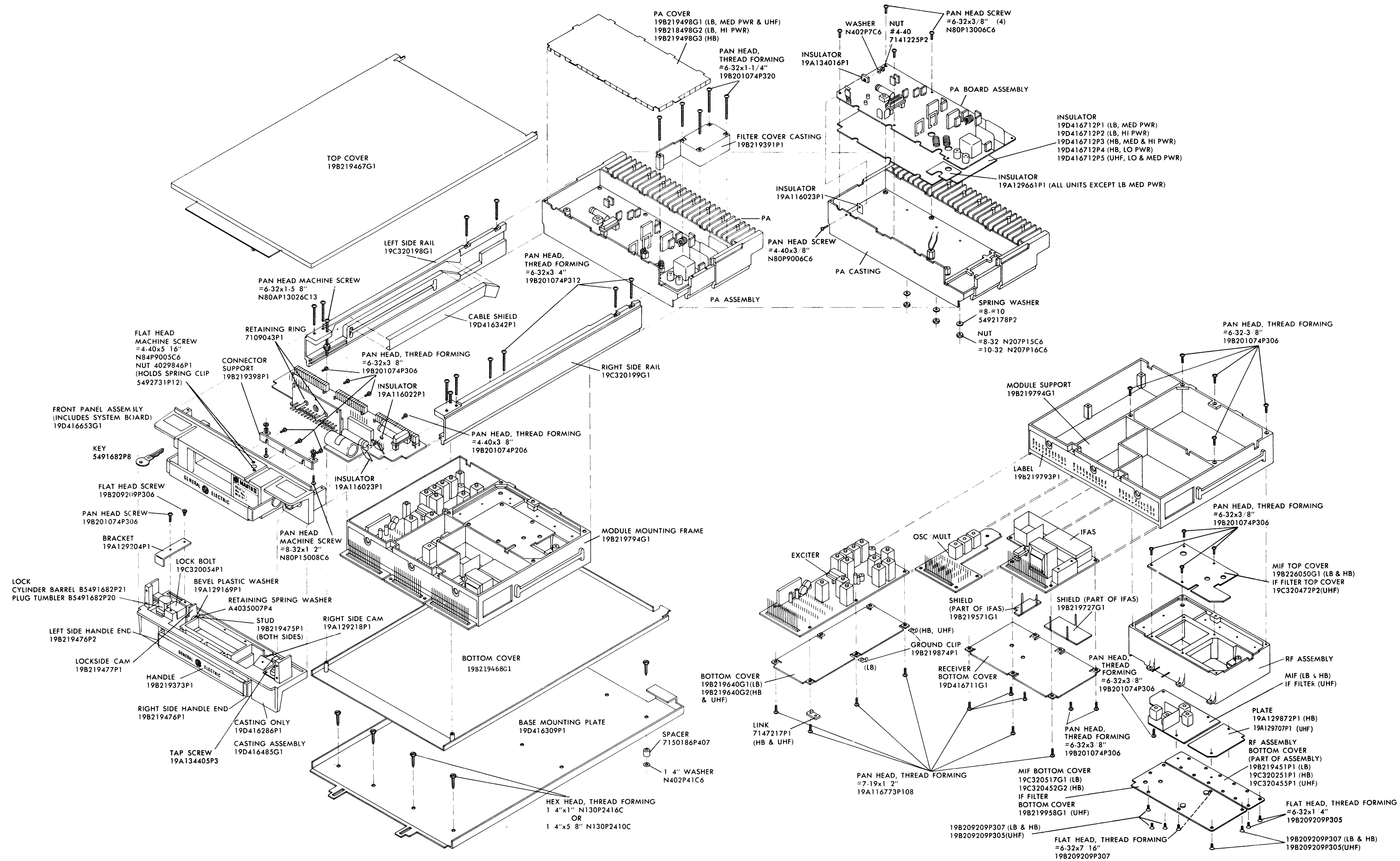






## MECHANICAL PARTS BREAKDOWN

## UHF TRANSMITTER MODULAR PA ASSEMBLY



## MECHANICAL PARTS BREAKDOWN

MASTR II STANDARD COMBINATIONS

## Issue 3