
GATES

INSTRUCTIONS FOR INSTALLING, OPERATING AND SERVICING THE GATES' MODEL BC-5P RADIO TRANSMITTING EQUIPMENT

IB-858

[GATES/ HARRIS
217 - 222 - 8200
~~X 35665~~]

PARTS - 7
SALES - 6

September 11, 1956
Price $10.00

Gates Radio Company,
Quincy, Illinois

ADDENDA SHEET

BC-5P TRANSMITTER

The stability of the crystals used to control the frequency of these transmitters is affected greatly by the air-gap adjustment. The air-gap should be adjusted as follows:

"The screw should be turned counter-clockwise until the top electrode rests on the crystal, causing it to stop oscillating. Then turn the screw clockwise approximately 1/8 of a turn which will make an air-gap of approximately .003 of an inch and the screw slot will then point to the mark on the oven".

2/13/57

Gates Radio Company
Quincy, Illinois

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SPECIFICATIONS

Rated Power Output:	5000 Watts	Frequency Response:	50-10,000 ±2 db at 95% Mod.
Capable Power Output:	5600 Watts	Audio Distortion:	50-7500 3% or less at 95% Mod.
Power Reduction:	Carrier reduction to 1 KW provided	Noise:	5KW output, 60 db or better below 100% modulation
Frequency Range:	535-1620 Kc (as ordered)		
Frequency Stability:	±5 cycles	Dimension of Transmitter:	73-3/8" lg. x 39-3/16" dp. x 78" high
R.F. Output Impedance:	40-270 ohms (as ordered)	Net Weight:	2180 pounds
Power Service:	230V. 3 phase, 50/60 cycle. Other voltages and frequencies on special order		
Power Line Demand:	Carrier, 10.2 KW Average Program 11.5 KW 100% Mod. 15.0 KW		
Power Factor:	90%		
Carrier Shift:	50-7500 cycles, 3% or less at 100% Mod.		
Audio Input Impedance:	600/150 ohms balanced		
Audio Input Level:	100% Modulation, -5 dbm ± 2 dbm		

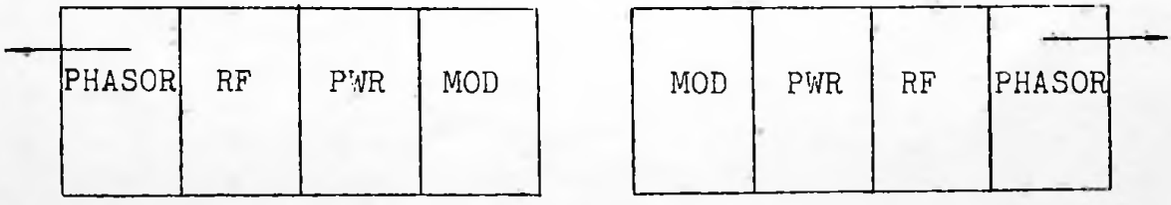
Tube Complement:

Oscillator	One	6AG7
Buffer	One	6146
R.F. Driver	One	4-250A
Power Amplifier	One	3X2500F3
1st Audio	One	6SN7
2nd Audio	One	6SN7
Audio Driver	Four	6550
Modulator	Two	3X2500F3
Oscillator Plate Rectifier	One	5U4G
Driver Hold Bias Rectifier	One	6W4
P.A. Hold Bias Rectifier	One	6W4
Audio Plate Rectifier	Two	5U4G
Modulator Bias Rectifier	One	5U4G
Main Rectifier	Six	8008

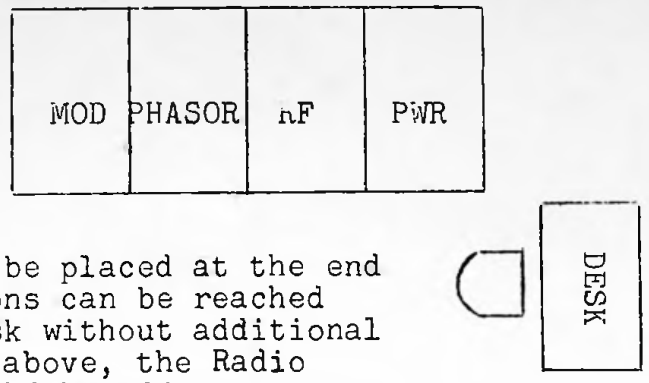
INTRODUCTION

The Gates' BC-5P 5 KW Broadcast Transmitter is designed for continuous duty operation. Many stations find a lucrative market in all night operation and maintain a "24" hour schedule except for brief weekly or semi-weekly shutdown periods for maintenance. Many stations are now being operated by remote control with no direct observation of the transmitting equipment during the majority of the operating time. The Gates' BC-5P 5 KW Broadcast Transmitter has been designed with these considerations in mind and every effort has been made to obtain the best quality components and conservative ratings so that this equipment will perform satisfactorily under severe operating conditions. The Gates BC-5P Broadcast Transmitter as herein offered is the culmination of a year and a half study by the broadcast section of the Gates Radio Company Engineering Staff. The close contact of the Engineering Department of the Gates Radio Company with those using various radio equipment has provided a guide as to those features that users of broadcast equipment now currently desire incorporated in equipment, and as far as practical, these features have been incorporated in the Gates BC-5P, 5 KW Broadcast Transmitter.

The Gates BC-5P, 5 KW Broadcast Transmitter, is completely self-contained in three cubicles each 24" wide, 36" deep and 78" high. The three units, when joined as a single assembly, with trim, doors, etc. makes a unit 73-3/8 inches long, 39-1/4 inches deep and 78 inches high. These three cubicles contain as separate units, a power supply, a modulator, and a radio frequency unit. As there are no mechanical inter-connections such as tuning drives, bus-work, supporting frames, etc., the cubicles may be arranged in respect with each other in any sequence as best suits the installation. With additional end bells, the cubicles may be installed as separate units. The inter-wiring requirements is only nine wires from the power cubicle to each of the other cubicles for standard operation. With the isolated unit operation, "High Voltage ON and OFF" switches would be desirable on each separated cubicle, requiring two additional wires. High voltage wiring is by means of ignition cable, approximately three per cubicle is required.



The arrangement of the cubicles may be in any sequence desired. It is recommended that the Power Cubicle be next to the Radio Frequency Cubicle so the high voltage control will be convenient for tuning adjustments.



The Power Cubicle may be placed at the end so the control functions can be reached from the operating desk without additional wiring. As suggested above, the Radio Frequency Cubicle should be adjacent to the Power Cubicle.

Currently, there has been considerable interest in "Conelrad" operation of broadcast transmitters. This is presently being done by: (1) an auxiliary transmitter, generally lower power, (2) manually retuning the main transmitter which is the source of income for the broadcasting station and (3) retune the main transmitter to a Conelrad frequency by means of contactors to preset adjustments. The Gates BC-5P, 5 KW Transmitter, is so designed that a second radio frequency unit tuned to the Conelrad frequency may be installed and switched into service in place of the standard frequency unit. As the radio unit is reduced to its minimum essentials, the filter, modulation components, etc., being in the Power and Modulator Cubicles, the Conelrad R.F. unit is economically more practical than a complete transmitter of lower power. The regular broadcast frequency unit may be operated at its maximum efficiency for the normal broadcast service, and the Conelrad frequency unit at its maximum efficiency and power. This latter unit will also serve as a spare radio frequency unit which can be tuned to the standard frequency very quickly, or serve as a check on performance, if desired. Also, in the case of remote controlled transmitters, the Conelrad unit may be started, switched in service, or shut down, by the addition of a simple relay system.

PRELIMINARY PLANNING

The initial planning of the transmitter arrangement is most frequently determined by individual conditions and requirements. These fall into five categories: (1) a completely new installation, (2) replacement of present equipment, (3) increase of power from present equipment and (4) unattended operation, (5) auxiliary or Conelrad transmitter for high power installation. The points brought out in this discussion are to call attention to features which experience has found to obtain the best efficiency of equipment and personnel. With a completely new installation, and due to the mechanical and electrical flexibility of the Gates BC-5P transmitter, no particular arrangement will be recommended other than have been already indicated. Also, such installations might require directional antenna systems with phasors of various sizes

and complexities, the possibility of remote control for a portion of the operating time, or perhaps the full operating time; that the station might have or contemplate other broadcast services from the same site, each installation must be considered for its own peculiar conditions.

Should a new building be constructed, whether for attended operation or remote control, consideration should be given for adequate storage space for tubes and spare parts. For attended operation, the room should be well ventilated with windows on all sides, with ventilation provisions during hot rainy weather. The windows and doors should be protected by screens, especially in climates where insects prevail. While the transmitter is well enclosed so insects will not get into the equipment, the operators efficiency and comfort will be greatly improved.

UNATTENDED OPERATION

When a transmitter is to be operated solely by remote control, there is a tendency to make the transmitter building only large enough to house the transmitter and whatever auxiliary equipment is required. It is suggested that consideration be given to allowing for storage facilities for tubes and spare parts, room for a small workbench, and most important of all, some room for permitting the setting up of test equipment as may be required at the original installation, and to make the periodic performance measurements as required by the Federal Communications Commission or other governing body of the country in which the installation is made.

VENTILATION

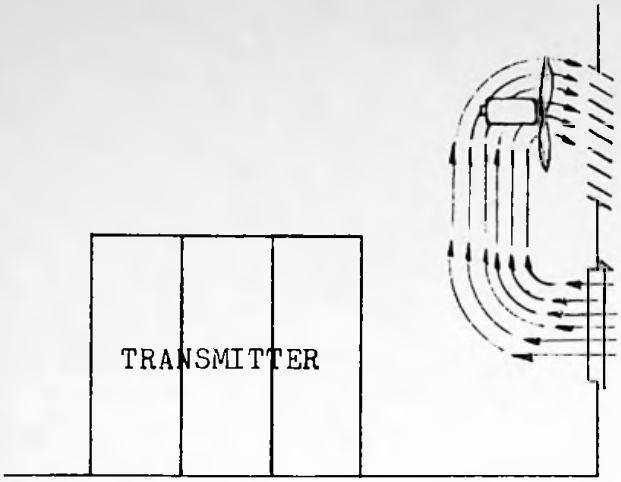
Ventilating the transmitter building presents a wide range of problems due to the climate, general weather conditions, the particular type of operation, etc. Some localities may be subject to sudden heavy rain storms; other, dry with dust or sand; other cold, and heavy snow during the winter. If the transmitter is located in a fairly large room, the volume will tend to dissipate the heat. If the room is small ceiling low, the exhaust heat may be trapped and built rather high by the end of the operating period. The heat given off by a radio transmitter is the difference of the power taken from the power lines and that put in the antenna system. The Gates BC-5P transmitter through careful design has eliminated many sources of power loss and consequently heat rise. The design has been, as in the case of previous Gates transmitters, to allow for unfavorable operating conditions. With previous models of transmitters, many so designed have given very satisfactory performance. A number of these installations have installed ventilating facilities for the building, and without exception report increased tube life and improved performance of the transmitter.

It is suggested that if a ventilating system is not planned at the time of the transmitter installation, such a possibility be considered, and provisions made at the time of building construction so that a

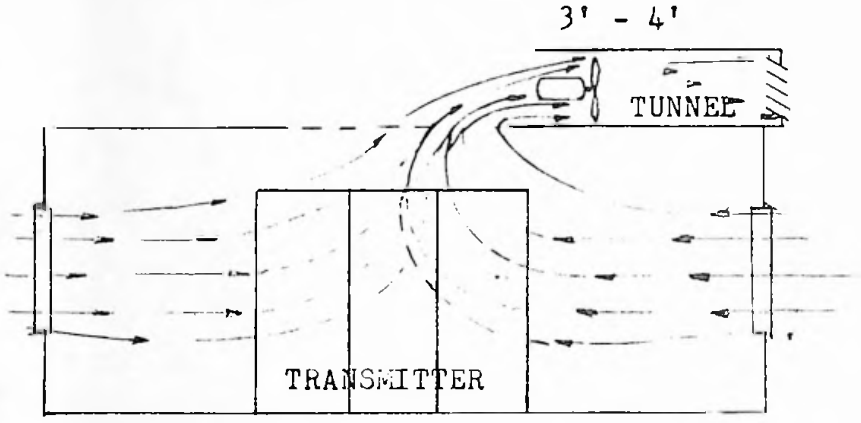
ventilating system might be added at a later date if this seems desirable without extensive remodeling of the building.

Many installations provide ducts from the top of the transmitter to the outside of the building. If this is done, the ducts should go straight up through the roof, and be capped with all-weather ventilators. Some provisions should be made to allow entry of outside air, should the building be sealed tight, efficient air circulation might not be obtained. The exhaust air might be arranged so as to be directed into the building during cold weather. The normal heat dissipation of the transmitter during program operation is six kilowatts.

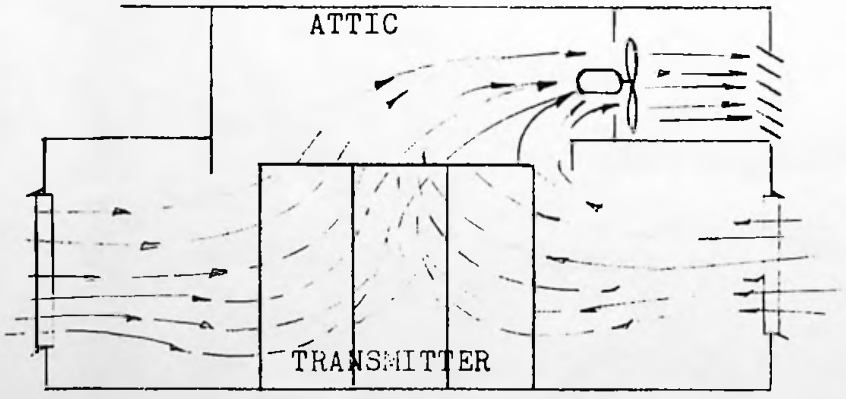
The exhaust ducts may also be supplied with a booster fan. This fan may be controlled from the transmitter blower or filament circuits, or by a thermostat in the exhaust duct. The rectifier tubes are subject to arc-backs if they are too cold, and the thermostat would allow these tubes to reach the proper temperature. This thermostat can be the type used for furnace control.



An open attic fan may result in unsatisfactory ventilation.



Attic fan in ceilinged room with opening above transmitter will draw air from and around transmitter with any windows open.



Attic fan or blower as booster in duct from transmitter draws all air through transmitter. Provisions should be made to turn off ventilating fan during cold weather.

VENTILATING THE GATES BC-5P
TRANSMITTER INSTALLATION

If the transmitter is not equipped with exhaust ducts, it is recommended that an attic fan of 2500 c.fm or larger be installed. This is most effective if the air flow can be directed as to pull air from across the top of the transmitter. That is, an attic fan in an unceilinged room such as might be used on a remotely controlled installation, would be ineffective if a window directly below it were open. However, if a window on the opposite side of the room were opened air would be drawn from around the transmitter taking away the exhaust air. With such installations, the exhaust fan should be so mounted as to be operative during inclement weather. This can be done by setting the fan back several feet from the exhaust opening, and building an exhaust tunnel. With louvres across the opening, no rain will be admitted except in the tunnel, and much of this will be deflected away by the air stream during the operating period.

If the room has a ceiling, and the fan installed in the attic, ceiling openings above the transmitter will allow air to be drawn from around the transmitter regardless of which windows are open.

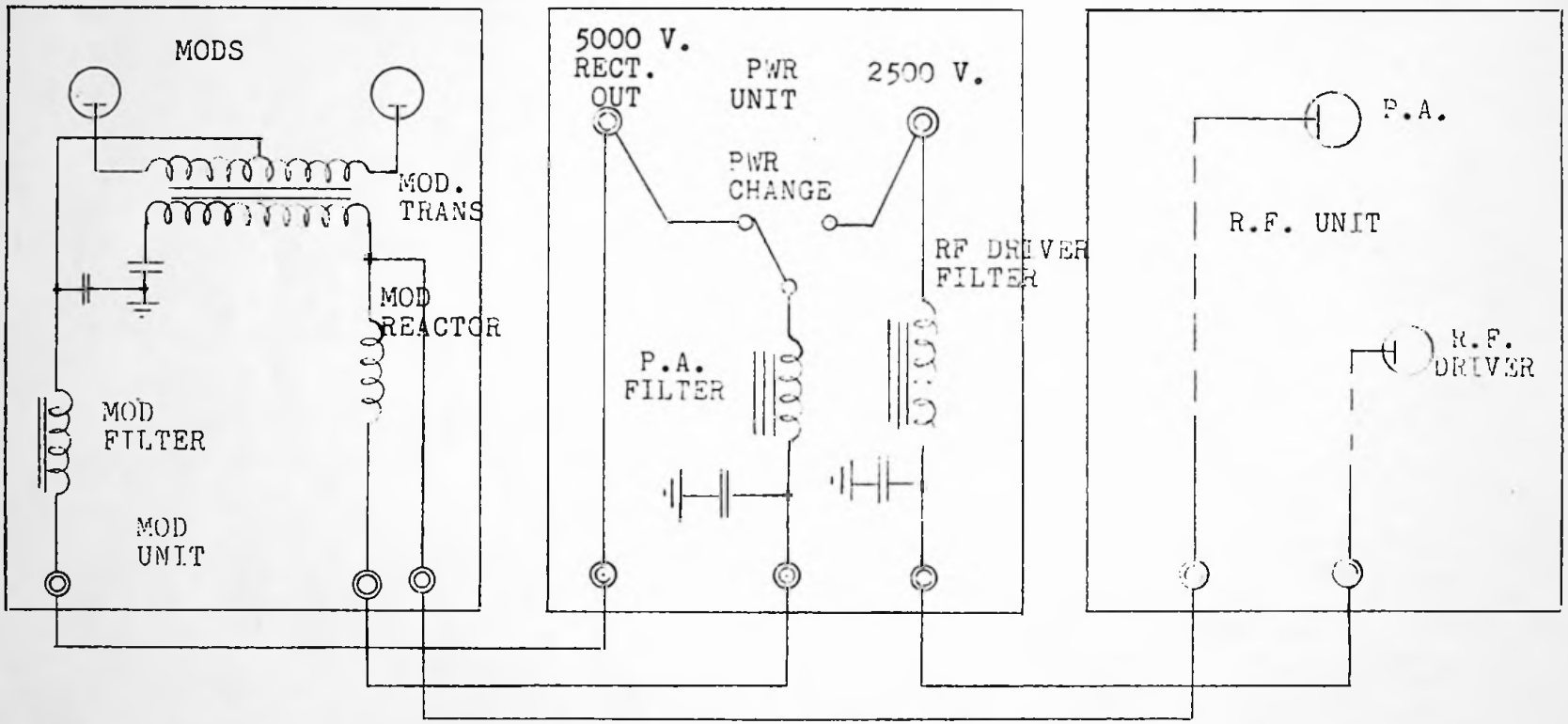
A practical form of installation is to build the transmitter into a wall. This wall should join the transmitter behind the front corner trim strips (from front edge of the base) so these trim strips may be removed. Doors should be preferably located at each end. Such an installation will then permit the use of a room air conditioner if climatic conditions so warrent.

Some installations have studio and transmitting facilities combined in one building. The question is sometimes asked as to whether a microphone might be used along side the transmitter. If a combined operation is desired, it is recommended that the transmitter be in a separate room, possibly with view windows for the observation of performance. High voltage ON-OFF switches could be readily run to the control desk.

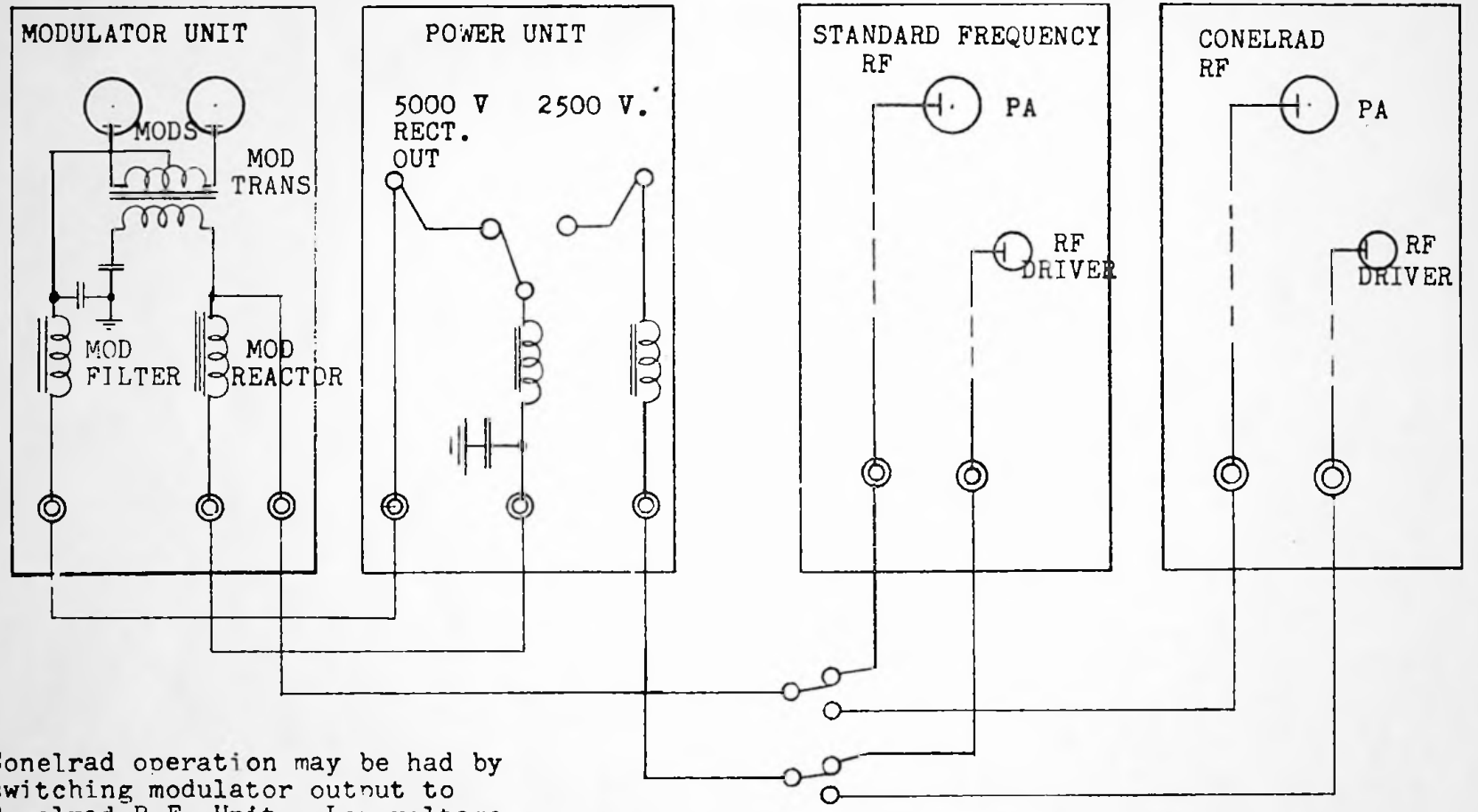
When the transmitter is replacing existing equipment, the installation is complicated in that transmitting facilities must be maintained during the installation. The Gates BC-5P transmitter is the ideal answer to the problem as the three cubicles may be placed wherever space is available, and connected by temporary wiring. When the transmitter performance has been checked, and the final position cleared, moving the transmitter and restoring it to operation is relatively simple and fast.

When the transmitter is to be used as an auxiliary or Conelrad transmitter at a high power transmitter site, the installation is dictated by the existant conditions. If the operation is anticipated for short durations, the ventilation considerations may be relaxed. The control circuits in the Gates BC-5P transmitter are so designed and arranged that interlocking with other facilities may be done without internal wiring changes.

The external wiring may be by means of conduit or wire troughs in the floor. The latter allows for future expansion, but with some floorings is sometimes hard to make a finished appearance. The drawing C-19628 shows the required external wiring and wire sizes. If the cubicles are arranged in a different order, the wiring is varied accordingly. If the cubicles are separated, provisions for inter-cubicle wiring should also be allowed.



HIGH VOLTAGE INTER-CUBICLE
WIRING

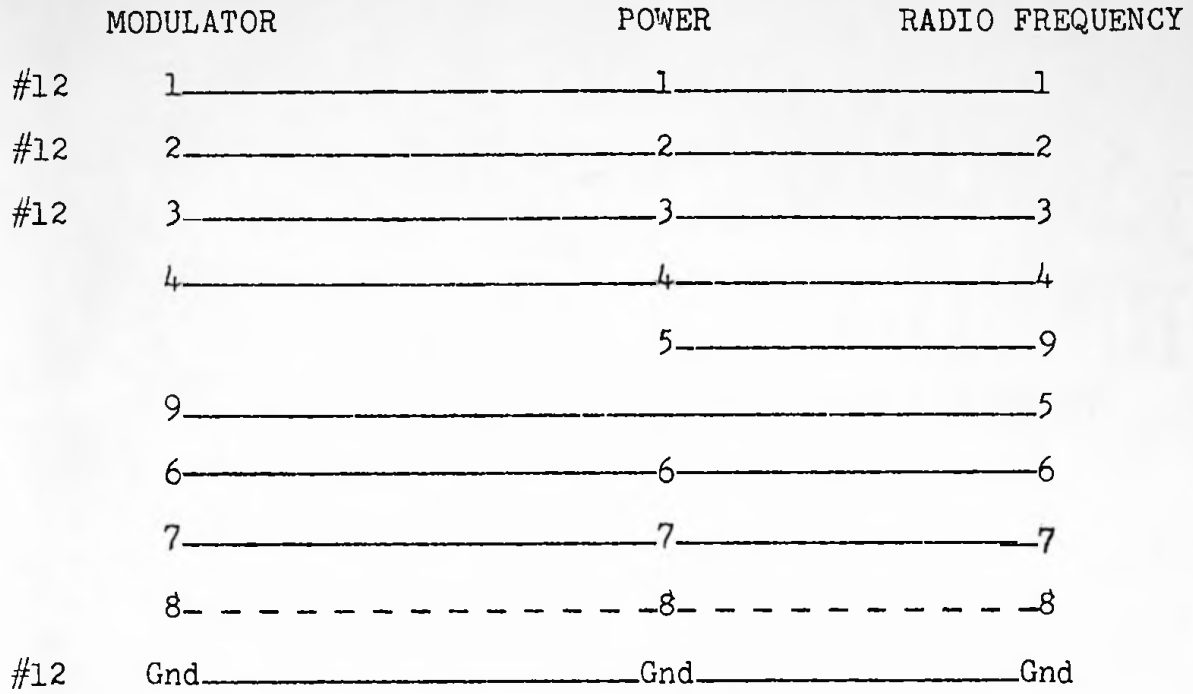


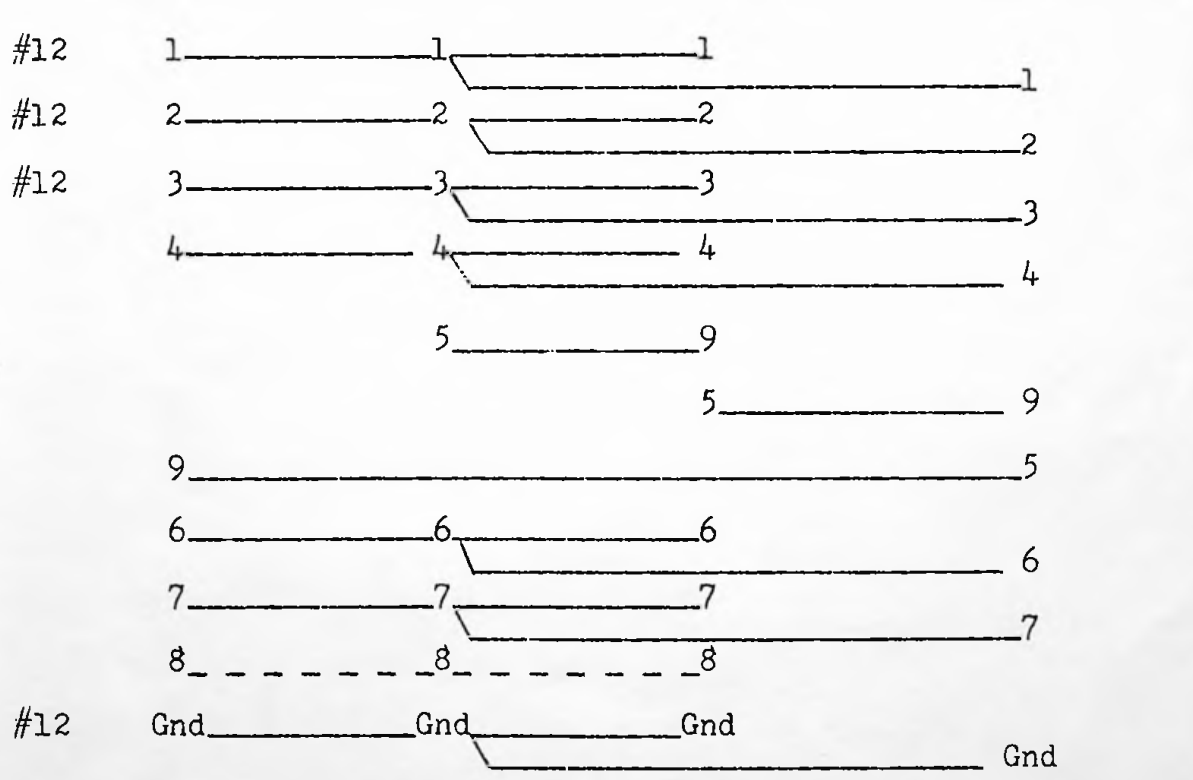
Conelrad operation may be had by switching modulator output to Conelrad R.F. Unit. Low voltage and control circuits are readily adaptable to addition of second unit.

High Voltage Contactor
May be installed in either RF or Modulator Cubicle

HIGH VOLTAGE INTERCUBICLE WIRING FOR ADDITION OF CONELRAD R.F. UNIT

LOW VOLTAGE INTERCUBICLE WIRING





Lines indicated should be #12 wire, others may be #14, but using #12 wire throughout simplifies procurement. Connections between terminals #8 required when audio level and/or monitor switching is used in power change.

POWER SUPPLY M-5182

This cubicle contains the power supply normally required for the Gates BC-5P transmitter M-5349.

In this unit are located the power transformer, a three phase full wave rectifier utilizing 8008 tubes, filters for the power amplifier and r.f. driver stages.

Also located in this cubicle is the central part of the control circuit, the transmitter control switches, the main high voltage contactor, and the rectifier output voltmeter.

The power cubicle has at the top a slanting meter panel for easy meter reading. The meters consist of a line voltage meter with a switch on the panel below it to select the line phase to be read, a voltmeter on the primary of the rectifier filaments to set the rectifier filament voltage, and a plate voltmeter reading the DC output voltage to the power amplifier. The rectifier filament rheostat is on the same panel with the line voltmeter switch. Below this panel is an access door interlocked with the high voltage, and is also provided with a high voltage grounding switch. This door, as are all the doors, is secured at the top by a screw pawl which pulls the door shut tight. The bottom of the door is pivoted on open slots so the door may be dropped open, or removed entirely, enabling the operating personnel to get close to the transmitter and reach all front components.

Below this door is the control panel with the Start-Stop, High Voltage On-Off and 5KW-1KW power selector switches, and the 5KW-1KW status lights.

Below the control panel are two access doors to the power panel. These are not interlocked, so inspection of the operation can be made any time.

On the power panel, at the top left, is the overload lockout relay with adjusting potentiometer, in the center, thermal time delays for running the blower two minutes after the filaments have been shut down, and a 30 second time delay on the main rectifier filaments. On the right side on the panel is the terminal board for internal connections. Below the thermal relays is a fuse block with fuses for two circuits. As the transmitter may be operated with various cubicle combinations, and consequently various loads on the lines, the fuses provide a readily changeable item to meet the individual requirements.

Across the center of the panel are located the filament, blower, and high voltage control relays, and the power change control relay which is a latching type permitting the extension of this switching. Below the relays is the terminal board for external connections. At the bottom of the panel, on both sides, are two holes. The high voltage lines are fed through these holes to terminals on the back of the panel. A cover at the bottom over these cables protects the personnel.

In the center of the base at the front, and on both sides just above the base are holes through which the wiring may be routed. If the cubicles are joined, the low voltage inter-wiring is formed over to the side, down the side so as to be around the end of the shield through the matching holes to the adjoining cubicles. If conduit or wire ducts are desired, the wiring may be run through the hole in the base.

Inside the top access door, on the left facing from the front, is the high voltage contactor. This is shock-mounted to minimize the jar and vibration of its operation. Above this contactor are the two A.C. overload relays. Behind the contactor, within reach of both front and rear, is the safety high voltage disconnect switch. On the right hand side are the voltmeter multiplier resistors and dropping resistor for the unit fan, mounted in the top. Located below these is the step-start contactor and its associated resistor. Across the back at the top is the main rectifier tube assembly, consisting of the six rectifier tubes and filament transformer of six windings on a common core. Below this is the 5KW-1KW P.A. voltage change contactor. Below this contactor are bleeder resistors connected across the power amplifier filter condenser.

On a shelf across the unit towards the front and below the height of the power panel are on the right the power amplifier filter choke and on the left the R.F. driver filter choke. These chokes have more than adequate insulation rating for normal operation, but with overloads particularly as might be encountered with a gassy tube, an extremely high transient voltage might be developed so as an added precaution, the chokes are mounted on insulators.

On the base, on the right side, the P.A. filter condenser sets in a tray and behind it the R.F. driver filter condenser is secured to the floor. The power transformer mounts in the remaining space, the high voltage connections towards the inside.

The rear door is removable. The bottom sets in a guide channel, the top then secures by turn pawls. The bottom of the door has an air filter container, held closed by pawls. The air filter may be removed during operation. The inside of the filter retainer has a protecting screen so that access to the high voltage components is still blocked when the filter is removed.

The filter supplied is non-renewable type. Experience has shown that

the renewable or washable type are extremely difficult to properly clean. As the filters are a standard 16" x 20" size, the renewable type may be installed, if so desired.

MODULATOR CUBICLE

The modulator cubicle has at the top a slanting meter panel with individual modulator plate current meters and filament voltmeter. The rheostat for the filament voltage is on the panel directly below. Below this panel is an access door to the audio driver. As there is no voltages appearing in this section, and there is a screen in the rear, this door is not interlocked.

The audio driver panel in height and styling matches the control panel on the power cubicle. The driver panel contains two modulator bias controls, and driver filament and bias lights. On the top front right of the driver chassis is the terminal board for the driver operating service. Underneath, at the rear, is the terminal board for the feeds to the modulator grids. This consists of a four terminal board which allows drive balancing adjustment. On the right underneath side of the audio chassis is the feedback terminal board. The audio driver may be completely removed by removing the style strips from the cubicle, the right top door mounting angle. The panel is secured by four bolts, and the chassis itself is supported on side rails. By removing the panel bolts, the chassis can be removed for servicing. The weight of this chassis is 70 pounds.

On the left side of the audio chassis is the audio driver, at the front the input transformer, behind this an amplifier balancing control and to the left of this control a balancing control for the feedback. In line are two 6SN7 voltage amplifiers, then the driver consisting of four 6550 tubes in push-pull parallel. Air from the modulator plenum chamber directs air against these tubes. At the center rear of the audio chassis is the driver transformer, and at the right rear the plate transformer. In front of the plate transformer are two 5R4 rectifier tubes for the audio plate voltage. A single 5R4 provides the modulator bias voltage. In front of the rectifier tubes, in the front right corner is the bias plate transformer.

Above the audio chassis, on the right side panel of the cubicle, are located the modulator overload relays and the filament interlock relay.

Below the audio chassis, is a removable access door. On the left side panel is the step-start contactor for the modulator filter condenser and the associated limiting resistor.

Across the cubicle, at the lower part of the door, is the cubicle terminal board to which external connections are made. Wiring is brought in, either through the base opening or either side opening, up the side around the end of the shelf mounting the terminal board, then terminating at the terminal board.

Beneath this, is the high voltage compartment into which the high voltage connections are made. Space is allowed here to mount a high voltage changeover switch as might be used for a Conelrad radio frequency cubicle.

The modulator tubes are located on a plenum chamber across the rear of the cubicle. The tube connections are inside this plenum chamber. To facilitate servicing, the rear side of the plenum chamber is removable. On the front center is located the air interlock switch. This is a captive plate which under air pressure closes an interlock switch. Above the modulator tubes is a shelf mounting the filament transformer. On the right side of this shelf is a filament "Off" switch so the modulator filaments may be turned off for a tube change without shutting down all filaments.

Underneath the filament transformer shelf, on each side, is a triangular air box with a rubber nozzle directing air against the filament seals of the modulator tubes. These boxes obtain air from the main plenum chamber by an enclosure on the outside of the side panels, but staying within the corner post dimensions of the cubicle. The plenum chamber and audio deck, with component mounting angles, seal off the unit above the tube sockets. The blower mounts on a cross shelf under the plenum chamber, and draws air from the intake on the bottom of the rear door, around the modulation transformer and reactor, providing cooling for these components.

On the right side panel are mounted the feedback resistors. Mounting on the base, at the front right is the modulation condenser setting in a retainer, at the front left the modulator filter condenser in a retainer, at the rear right the modulation transformer and at the rear left the modulation reactor.

RADIO FREQUENCY UNIT M-5188

This cubicle with the M-5365 Frequency Control Unit, provides a complete radio frequency section. This comprises oscillator, buffer, driver and power amplifier stages, low voltage supply for the oscillator, buffer and driver screen grid, and holding bias for the driver and power amplifier.

The cubicle has at the top a slanting meter panel which mounts the plate current meter, filament voltmeter and the multi-meter.

On the panel below this, on the left side, is located the power amplifier loading control. Space behind this control is allowed for permitting the installation of a power control motor when remote control operation is used. Also on this panel, in the center, is the filament rheostat for the cubicle, and the R.F. driver tuning control is on the right side. An access door opens to the R.F. driver. This consists

of a 4-250A tube, the socket of which is enclosed and obtains air from the power amplifier plenum chamber for tube cooling. The driver tank coil is located on the right side panel, and the tuning is by means of a disc which threads into the coil and is directly connected to the panel dial.

Below the R.F. Driver is the frequency control unit. The panel of this matches the control panel of the power cubicle and the audio driver panel of the modulator. The controls on this panel are the crystal selector switch, buffer tuning condenser and the multi-meter switch. Adjustable by screwdriver from the front panel are the trimmer condensers for vernier frequency control, and an excitation control. The panel also has crystal heater lights, and filament and bias status lights. The frequency control chassis may be removed similarly to the audio chassis.

Below the frequency control unit is a panel mounting the power amplifier tank tuning control. This tuning, like the driver tuning, consists of a disc which is threaded in and out of the tank coil, and is directly connected to the tuning shaft. Below this, an access door opens to the unit terminal board, located and wired similarly as in the modulator unit. On the left side panel are located the power amplifier and R.F. driver overload relays, the filament interlock relay, and the driver screen grid relay. On the front of the power amplifier tank enclosure, which forms the rear of this section of the cubicle, is located on the left the adjusting resistors for the overload relays. In the center of this panel is the air switch, operating as described in the modulator description. On the right side panel are the power amplifier grid resistors.

At the bottom front, as in the modulator cubicle, is a high voltage compartment to which the high voltage connections are made, and in which a high voltage switch may be installed. In this compartment is a link in the power amplifier high voltage line so the power amplifier voltage may be removed for tuning and neutralizing.
In the rear, on the floor, is located the blower. Also on the floor is the power amplifier filament transformer and on the right side panel, the power amplifier cathode resistor. The blower is shock mounted and coupled to a plenum chamber by means of a canvas boot. This plenum chamber is of aluminum, and contains the power amplifier tank components. The rear of this chamber is readily removable by screw-pawl fasteners. To open, release the pawl fasteners, tip the top edge of the cover out about an inch, then lift up. The bottom edge of the cover has a locking flange which engages the lower fold of the plenum chamber. In this plenum chamber is the power amplifier tank coil, mounted so as to align with the tuning from the front panel. On the front right upper corner is a fixed vacuum condenser which is a part of the neutralizing circuit. On the right side panel are the plate blocking condensers and one plate choke.

On the base of the plenum chamber at the front is a second plate choke and on the right side, by-pass condensers. On the rear left side is provisions for two vacuum condensers for the tank capacity. One or two of these condensers are required as determined by frequency. In the upper front left side is the first coupling condenser. The blower inlet is covered by an aluminum screen. The screen serves not only for shielding, but also prevents accidentally dropping materials in the blower. The screen is held in place by a frame so it may be readily removed for cleaning.

The power amplifier tube retainer mounts on an insulating plate on the top of the tank plenum chamber. In this section are the filament bypass condensers, and grid parasitic suppressor. On the panel divider in front of the power amplifier tube, accessible from the power amplifier tube compartment, is the filament switch for this cubicle. This compartment has a removable aluminum shield.

Above the power amplifier tube compartment is the output coupling network. This shelf is perforated so as to allow the air to exhaust.

On the right side panel is the first section coil with fixed taps. Behind this is the coupling condenser. On the left side is the second line inductance which is a continuously variable coil, and is aligned with the power amplifier loading control on the front panel.

On the front center of the divider panel is a cutout behind which a line current meter may be mounted. As this line current meter is generally not required, it is not supplied as standard. At the rear center of the output network shelf in a modulation monitor pickup loop, the connecting terminal block is on the left side panel.

As many stations are being operated remote control, monitor level switching is not incorporated although the facilities are readily available. Such switching may be done by separate monitor pickup loops or by a gain dropping device from low power pickup level in the transmission line to the monitor.

The transmitter output is taken out the top. Connecting across the two side panels and across the top is a ground strap to allow the greatest possible flexibility to grounding the transmission line. This compartment is also closed off with removable aluminum door. It will be seen from the pictures and the description of the power amplifier tank and output circuits, the power amplifier tank and output networks are physically separated and shielded to give the most advantageous suppression of harmonic frequencies. If there were inductive or capacitative coupling of the power amplifier tank to the transmitter output circuit, no amount of filtering within the transmitter would give harmonic suppression.

INSTALLATION

The Gates BC-5P transmitter is dismantled for shipment, the extent of this will at times be varied dependent upon the manner of shipment.

In the installation, the power unit should be placed in position first if the main power supply is to come through a conduit through the floor opening in the cubicle, mainly because this location may be critical. However, if wire ducts are used so the wire entry is not critical, any cubicle might be positioned first. For example if a wall were on the right or left, this could be the first unit installed.

The primary power supply feed three, four or six wires, is brought into the power cubicle either through the base opening, or fed across from the other units through the side openings. The lines are then formed across the bottom of the cubicle, up the left side to up above the main plate contactor. The leads are then formed back in a loop, 12" - 18", connecting on the power contactor, making sure that these are opposite the load connections. Connections already on the contactor supply the other operations of the transmitter. The cable should be secured. As the contactor is shock mounted, the loops are to maintain the flexibility of the shock mounting.

Removed for shipping are the power transformer, high voltage filter condenser, and both filter reactors. The positions of these have been given in the mechanical description. Contactors, relays, resistors and wiring have been secured for shipment, and all such bondings should be removed.

In the radio frequency cubicle, the blower has been removed. All tuning capacities are generally removed. The two R.F. plate chokes are removed, and should be installed with the spaced ends of the winding connecting towards the tube. The plate blocking and vacuum neutralizing condensers are also removed.

The frequency control unit is also removed for safe shipment. To install, the trim strips are removed, and the right door guide. The chassis may then be slid into place on mounting channels, the front panel secured to the corner posts. The door guide slipped in place (the screws need not be completely removed) and with the door in place the guide is adjusted for easy latching and removing of the door, and the guide screws tightened.

The radio frequency cubicle should be thoroughly grounded to the station ground. This is best done by a four inch copper strap brought up either side of the cubicle and bolted to the aluminum plenum chamber. On a strap of this size, it is suggested four 10-32 bolts, and that over the copper be placed a stiffening plate so that the whole copper surface may contact with the aluminum. The aluminum is treated with a special conductive lacquer, the same type as is used on the R.F. coils. A strap across the top of the cubicle provides grounding facilities for the transmission line. As there are many variations as to how this might be done, it is essential that this connection be complete and adequate. It may be necessary to drill additional connecting holes through the cubicle top, or to fold a strap through at the grill.

In some cases, it might be desired to take the R.F. output through the bottom of the transmitter, a line, such as RG17U may be brought through the base opening in the front of the transmitter, or a hole may be cut through near the front left corner post. The line is then brought up in the front left corner post and in the R.F. driver, turned to the rear and pass over the top of the divider panel between the driver and output network, terminating as required on line meter or monitor loop. The outer shield should be thoroughly grounded so as not to introduce any R.F. feedback into the low power stages or frequency unit.

As shown in the floor plan layout drawing C-19628, the crystal heater line may be brought in with the main power line, and carried across in the interconnecting cable to the radio frequency cubicle, up the left corner post of this cubicle to terminals 501 and 502 on the frequency control chassis. These are the front two terminals of the board on the top, left side of the chassis.

The frequency monitor line of the small size RG/U type is brought in directly to terminals 517 and 518 on the board underneath rear of the frequency control chassis. The modulation monitor line is brought in, the radio frequency cubicle carried up the left corner post, across the top left corner of the cubicle to the terminal board in the output network compartment.

In the modulator unit, the audio driver chassis is removed, and installs in the same manner as the frequency control unit. The blower likewise is removed.

From the base are removed all components, modulation condenser, filter choke and filter condenser from the front part of the base and consequently the first to be installed. The modulation transformer and reactor are at the rear with the terminals towards the center.

The audio input line is brought in to the modulator cubicle, up the left corner post, to the terminal board on the front left top of the audio chassis.

High voltage connections to the other cubicles are brought in either through the side openings of base opening, through one of the openings at the bottom of the power panel, to the three high voltage terminals on the rear of the power panel at the top right. In the power cubicle a cable cover fits in the bottom over these high voltage cables. The low voltage interwiring should be brought to the left or right, or both, so as to clear the ends of this shield.

All wiring should be secured so there is no possibility of being pushed into high voltage terminals, high voltage grounding switches, or other components.

Provisions are made so that the cubicles can be bolted together by aligning holes in the corner posts. The rear of the radio frequency cubicle, because of the shielding, cannot be bolted. However, bolts may be used on the front and bottom rear. The units should be bolted together so as to maintain a neat appearance.

Provisions are made so that the cubicles can be bolted together by aligning holes in the corner posts. The rear of the radio frequency cubicle, because of the shielding, cannot be bolted. However, bolts may be used on the front and bottom rear. The units should be bolted together so as to maintain a neat appearance.

INSTALLATION INSTRUCTIONS FOR REMOTE CONTROL IN GATES BC-5P TRANSMITTER

M-5066 Load Control Assembly

The motor assembly is mounted on the left side of the RF driver compartment. The shaft from the front panel cyclometer to the loading coil is removed. The motor shelf is then mounted in front of the driver filament transformer. Motor mounts on this shelf. The vertical alignment is obtained by slotted holes in the shelf flanges the horizontal alignment by slots in the shelf plate. The motor is connected to the coil by means of a special shaft reduction coupling and shaft. A shield plate fits on the shelf lip, and should be installed to protect the motor from any field from the driver tank coil.

The M-4806 relay assembly mounts behind the cubicle terminal board TB301, to the left of the transformer, T301. The relay unit is connected to the motor according to the diagram A-9392, in the instruction book, for the relay assembly. The motor voltage source can be taken from the 115 volt secondary of the transformer, T301. In this way, the system will be completely de-energized during shut-down periods. The motor to relay connecting cable should be formed down the corner post and secured. External connections can be made direct to the terminal board on the relay assembly.

When the motor and relay assembly are interconnected, the motor stops should be adjusted. The motor is equipped with cam stops which permit 22 revolutions. This is not the full length of the coil, but the tuning should always be such as to include some turns in the coil.

Also, in operation the loading variations will be accomplished with relatively few turns, so it is always possible to obtain sufficient variation of the loading. If the operation is so that the slider is near the end of the coil, release the shaft and run the motor in that direction until the stop operates, rotate the coil manually to about two inches from the end of the coil, then fasten the shaft.

M-4720 Plate Current Extension Unit

The plate current extension unit mounts to the right of TB301 in the radio frequency unit, and is secured by screws through cleared holes accessible in the high voltage compartment. The power amplifier ground return is from the power amplifier plate current meter, M301, to ground at the terminal board. Two wires connect to this ground, one of them to the meter. This wire is removed, a short length spliced in and connected to the terminal board of the extension unit. The "G"

terminal on the extension unit then connects to ground.

M-4719 Plate Voltage Extension Unit

The plate voltage extension unit mounts in the power cubicle, on the right side panel in front of the fan resistor, R109. Tapped holes are provided for mounting. Screws may be run in from the outside if the units are separated at installation. The insulators mounting the extension unit may be loosened and threaded on the panel screws. If the installation is complete, studs may be cut and the insulators mounted in this manner.

A high voltage lead is then formed around to connect to the high voltage side of the transmitter meter multipliers, R110 and R111. The ground is made to the ground bolt adjacent to the unit mounting. Make sure the ground connection is secure. The meter lead may then be formed down the corner post.

Control Circuit Connections BC-5P Remote Control

Filament holding circuit. The jumper between terminals 104 and 105 on TB101 is removed, opening the holding contacts of the start-stop relay, K101. The remote "hold" is then connected to terminals 105 and 110 in TB101.

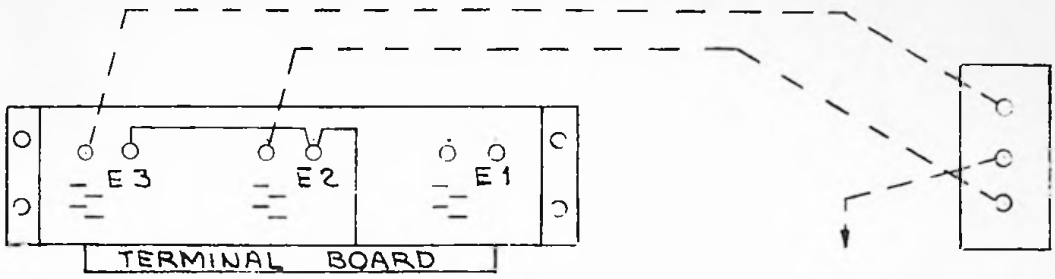
High Voltage Control: Terminals 13 and 14 on TB102 provides the high voltage on circuit. Removal of the high voltage may be accomplished by momentarily opening the "filament hold" circuit. The filament time delay is so arranged the plate voltage may be re-applied immediately if the filaments are restarted before the two minute shut-down period elapses.

If the remote control facilities provide for separate removal of the high voltage, this may be inserted by removing the external connection, to terminal 5 on TB102 and moving this to terminal 9. The remote control "High Voltage On" is then connected between terminals 5 and 9 on TB102.

INSTALLATION OF MOTOR CONTROL SWITCH

Dwg. A-12219

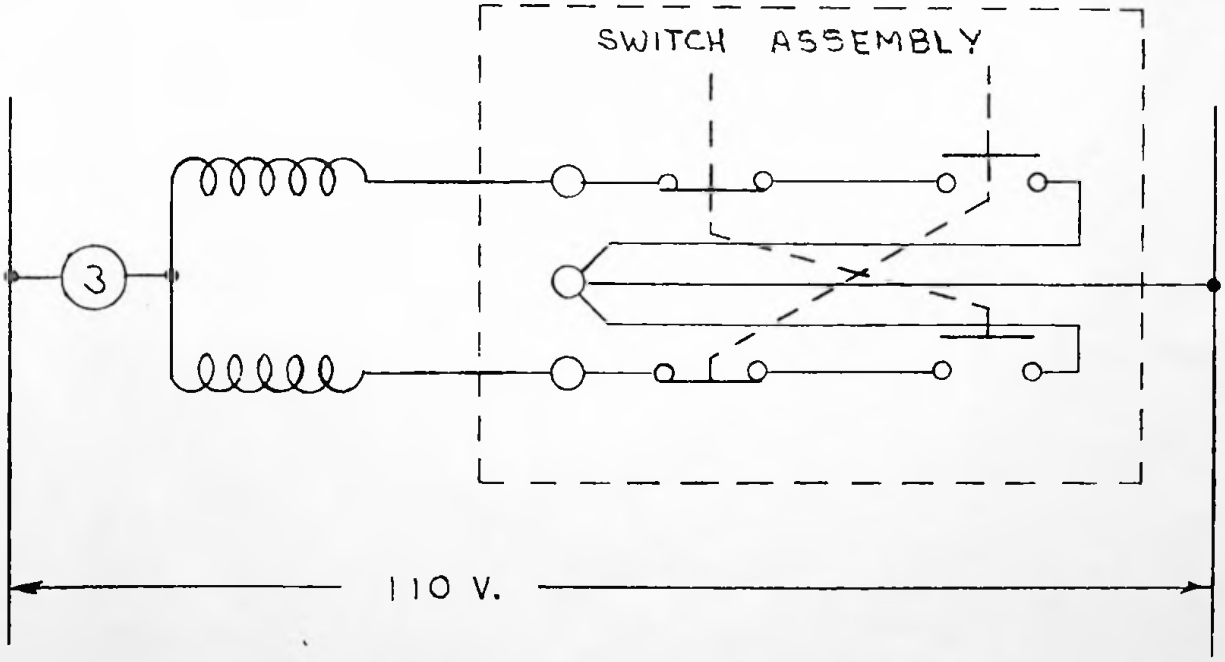
Remove turn counter, and install switch with lower switch in shaft hole and upper switch through counter window. The flat plate is on the outside. The assembly is secured by the switch bearings. The terminal board should be towards the window.



M4806 RELAY UNIT — TERMINAL #3 (COMMON)

Solder two leads to A.C. relay terminals opposite common connection, and connect to two outside terminals of motor switch.

The center connection of the switch is taken to the remote control unit and connected to the 110 volt supply opposite the side supplying terminal #3 of the relay unit.



9/24/56

Gates Radio Company
Quincy, Illinois
Drawing No. A-12219

Control Circuits

The operation of the control circuit can best be studied by the line diagram, D-21859. In this diagram all relays and switches are shown in the de-energized position, that is, as if all power were removed. The coils of the relays and contactors are shown in the diagram to best indicate the relative circuit location. The contacts are connected to the coil by dotted lines and the position of the contacts in the circuit diagram may be considerably removed from the coil as suits the clarity of the diagram. Normally open contacts are shown with the bar spaced away from the contacts, and when the relay is energized, this circuit closes. Normally closed contacts are shown with the bar touching the contacts, and when the relay is energized, the circuit opens. Time delay is indicated with an arrow in the direction of the delay.

All components within the power unit are of a "100" series; in the modulator, "200" series with the audio driver as a "400" series; and in the radio frequency unit all components are of a "300" series with the frequency control unit a "500" series. Each cubicle has a terminal board for inter-connecting with other cubicles, each terminal board being numbered 1, 2, 3, etc. For terminal designations for wiring within a cubicle, these terminals bear designations 101, 102, 201, 202, etc. When power is applied to the transmitter, pressing the "Start" switch S101 energizes the Start-Stop relay K101, the A-B contacts seal across the switch S101. The D-C contacts energize the blower contactor K102. The A-B contacts of this contactor across the D-C contacts of K101, seal in the blower contactor K102.
The C-D and E-F contacts of K102 energize terminals 1 and 2. The blower in each cubicle are connected in parallel across these terminals. Terminal 3 is supplied through the H-G contacts of relay, K101, the filaments of each cubicle are paralleled across terminals 2 and 3.

When the "Stop" switch, S103, is pressed, the relay, K101, is de-energized, breaking the seal-in. The normally closed E-F contacts then energize the thermal time delay, K113. After 60 seconds, this relay closes, beginning the timing of the second thermal relay, K114. At the end of another 60 second interval, the contacts of this relay open, breaking the seal-in of the blower contactor, K102, causing this to drop off, shutting off the blowers. It will be seen that the filament circuits supplied through the H-G contacts of K101 drop off immediately when S103 is opened, the blower continuing to run until K114 opens. After K114 opens, about 20 seconds will be required for this relay to cool and reclose. Pressing the Start switch, S101, will close K101, the blower contactor will close as soon as K114 recloses, but as this results in burning the contacts of K114 this procedure is not recommended.

Each cubicle requiring a blower has its individual air pressure switch (S201 & S301) protecting the tubes against insufficient air flow. These switches control the filament circuit through the filament interlock relays K201, K301. A second contact of these relays are in the high voltage control circuit as a precautional interlock. The main rectifier filaments are connected across the blower supply, and consequently are on until the blower shuts down. A thirty second thermal time delay, K109, provides a time delay before high voltage is applied to the rectifiers. In the modulator and radio frequency units, filament off switches (S202 & S302) permits the filaments of that cubicle to be turned off without shutting down the transmitter. High voltage may be applied simultaneously with filament voltage without damage to these tubes, so no time delay is required, but a slight delay is accomplished through the bias interlock circuit.

In the modulator and radio frequency units, all door interlocks except the high voltage compartment in the bottom front of these cubicles, are connected in the primary supply to the audio driver deck or the frequency control deck, so that opening any of these doors shuts off the respective deck with the attendant power bias supply. A bias interlock in each deck (K402, K501) prevents the application of high voltage before the protective bias has reached a safe value. Indicating lights on both of these decks shows the status of filament and bias circuits.

The high voltage auxiliary relay K104 controls the operation of the high voltage contactor, K105. The relay is sealed in by one set of contacts when the high voltage on switch, S102, is pressed, the other contact of K104 closes the circuit to the high voltage contactor, K105. In series with the high voltage auxiliary relay, K104, are the a.c. overloads, the door interlocks in the rectifier cubicle, and the interlocks in the high voltage compartments of the modulator and radio frequency cubicles, the bias and filament interlocks of these cubicles. This control line starts with the power cubicle on terminal #5 and connects to terminal #9 of one of the other cubicles, terminal #5 of this then connecting to terminal #9 of the third, and should this be the last cubicle, terminal #5 is then jumpered to terminal #3 of that same cubicle to complete the circuit. As it might be possible to have additional units, such as a second radio frequency cubicle, the series connection would be followed until the last cubicle, in which case the circuit is terminated back to terminal #3 of that cubicle. This is the only series connection required in the transmitter installation.

The two modulator overload relays, K202 and K203, the power amplifier overload relay K304 and the R.F. Driver overload relay, K303, all have normally open contacts in parallel. The closing of any one of these will energize the overload auxiliary relay, K103, normally closed contacts of which are in series with the main high voltage contactor, K105, causing the high voltage to drop off. As quick as the overload relay opens, the circuit to the main contactor is again completed,

and high voltage is reapplied. Connected across the coil of the overload auxiliary relay, K103, is a small dry rectifier, CR101, this in series with resistors, R106, R107 and R108, and the coil of a memory relay, K106. Connected across the coil of K106, R108 and to the arm of R107, is a large capacity condenser, C103. With each operation of the overload auxiliary relay, K103, the condenser, C103, receives a charge. If the overloads repeat in rapid succession, the charge on the condenser will build sufficiently to operate the relay, K106, a normally closed contact of which opens and drops out the high voltage auxiliary relay, K104, then necessitating manual resetting of the high voltage. In case the overloads do not build sufficient voltage to operate the relay, K106, the charge drains within a second or two, and the recycling is renewed for any subsequent overload series. The number of overloads before an outage occurs may be set by the adjustable potentiometer, R107, which should be then locked to prevent accidental misadjustment.

As already mentioned, the a.c. overloads are in series with the high voltage auxiliary relay, K104, so that any a.c. overload takes off the high voltage which must then be reapplied manually. It is considered that an a.c. overload may be serious, and should have the operator's attention, while a tube overload is in many cases routine, such as a modulation transient.

The high voltage filter condensers are provided with a step-start relay, K110, in the rectifier cubicle for the power amplifier filter, and K204 in the modulator cubicle. These connect on the load side of the high voltage contactor, K105, closing after this contactor closes. The mechanical delay is sufficient to provide the necessary delay required. The uncharged high voltage condensers present an almost virtual short circuit to the high voltage the moment the high voltage is applied. Connected in the ground side is a resistor which is shorted out by the contactors K110 and K204. This circuit is provided on terminals #6 and #7; in the radio frequency cubicle these terminals provide a supply for the relay, K302, which closes the screen supply to the R.F. Driver tube.

Power reduction is accomplished by transferring the power amplifier plate supply to the mid-tap of the power transformer, securing half voltage for the power amplifier. This is done by the power change contactor, K108. This is controlled by the latching relay, K107, and the momentary contact high-low power switches, S105 and S106. This latching relay cannot be operated unless the high voltage auxiliary relay, K104, is open and the back contact is closed. That is, before being able to make the power change, the high voltage must be dropped off, then the desired power switch pressed, after which the power may be reapplied. The latching relay holds the required power until intentionally changed, there can be no change in power by relays dropping out due to power failure.

Across the two change solenoids of the power change relay, K108, are two indicating lights to show the position of the power change relay. These lights are supplied on one side from the junction of the time delay contact of K109 and the high voltage auxiliary relay K104. Until this time delay closes, there is a circuit complete through both lights, so that both lights are on. When the time delay closes, only one light remains on, that one indicating the power position. This gives the indication that the filament time delay, K109, has closed.

From the low power side of the power change relay, K108, a line is brought to terminal #8 which may be carried across to the modulator unit to operate an input level relay, and across to the radio frequency unit to operate a monitor change relay.

Many stations have special control circuit problems. The most common is the use of directional antenna systems. Commonly used is normally closed contacts of the "DAY-NIGHT" switches to break the high voltage while switching. This may be most conveniently inserted in the high voltage auxiliary control line. Terminals #13 and #14 are provided for an extension of high voltage on facilities. Power change may be accomplished by paralleling the power switches, S105 and S106, with terminal #114 common, connecting to #113 and #114 respectively. A spare contact arm on the latching relay, K107, may be used to interlock the power with the directional pattern.

Operating facilities may be extended to a control desk similarly, as well as filament on by paralleling S101 from terminals #105 and #110, and for filament off by removing the jumper between terminals #104 and #105 and replacing with a normally closed switch.

The transmitter control circuits have been designed for operation with remote control systems with the consideration that many stations will be so operated. The Gates Radio Company provides units for remote control, and such units are being modified and improved as experience shows new desirable features. It is suggested that if remote control is contemplated, the Gates Radio Company be contacted for recommendations as to the latest developments and improvements.

Power Cubicle

The power transformer has ±5% voltage taps. The primary terminals 7, 8, and 9 are for 5000 volt output with 230 volts on the primary. Taps 4, 5 and 6 will increase the output voltage; 1, 2 and 3 will lower the voltage. The best transmitter operation will be with 5000 to 5200 volts on the plate of the power amplifier tube. Voltages below 5000 generally result in lower efficiency and higher drive requirements. Voltages above 5200 may result in excessive peak voltages generated in the power amplifier.

The incoming line voltage is metered by the top left voltmeter, and is switched between phases by the switch, S110.

The rectifier filament voltage is adjusted by the rheostat on the right side of the panel; the primary voltage is determined to give 5 volts on the filaments and the primary voltage maintained at this voltage.

The cubicle is cooled by a fan in the top, which runs while the rectifier filaments are on. It is considered that in the greatest majority of installations that the units will not cool during the shut-down period so that the cooling air will cause rectifier arc-backs during the early starting time. Should such a condition exist, such as in an unheated building common with remote control operation, it is suggested that a furnace thermostat be mounted in the cubicle and set to turn the fan on when the temperature reaches 80 to 90 degrees Fahrenheit.

The a.c. overload relays are of the time limit type. The tripping value is set by rotating the armature on the threaded shaft; a tab aligns with markers on the armature to indicate the tripping current. The armature is locked in position by a locknut. This should be tight so that the relay holds calibration.

The normal current for 100% modulation at 1000 cycles is approximately 30 amperes per phase, and slightly higher at the high frequency end of the range.

On the low frequency end of the audio range, the relatively long duration of the load cycle may cause the overloads to open. The proper tripping current is just high enough the relays do not trip with modulation. This will be approximately 50-60 amperes.

When high voltage is applied, the transformer charging current may cause the overloads to trip. A small amount of oil supplied for the relay should be added. This should not be more than a drop or two of oil, just enough to hold the relay during the starting surge. Too much oil will delay the operation of the relays and result in blowing service fuses during high current surges which should be removed by the overloads.

In the cup at the bottom of the armature are three small holes of differing sizes. A vane exposes one of these holes, the size of the hole used determines the delay as well as the amount of oil. The largest hole should be used.

The voltage change relay, K108, is designed that when the solenoids are fully closed, the arm does not rest against the spacer plates of the switch jaws, but make the electrical contact through the side pressure of the switch jaws. Should the contactor be noisy in either position, examine the closure in this position that the arm is not

holding the armature slightly open by pressing against the spacer plate.

Another cause for noisy operation is that the solenoid is slightly out of alignment, pulling the armature to the side when the solenoid is energized. A light application of grease on the armature will facilitate the movement of the armature, dry metal surfaces at times bind and causes the solenoids to be noisy.

The step-start relay, K110, (and K204 in the modulator) uses the same type solenoid as the voltage changer, K108, and the solenoid alignment and lubrication also applies. When checking the closing of the relay and closing manually, use a screwdriver to apply pressure against the end of the armature. As the linkages are loose, application of pressure any other way gives false indications to the operation. The contact alignment should be so that the contacts first make slightly short of center, further closure causes the two contacts to wipe and in the fully closed position to be centered or a little past center. The contact pressure should be firm, the contact arm lifting against the pressure spring. In installing new contacts, care should be taken that the contacts meet with a substantial surface. If they meet too close to the edge, the edges will eventually break down and lock so that the solenoid cannot fully close.

M-5365 FREQUENCY CONTROL UNIT

This unit provides for two crystals, a 6AG7 oscillator tube, a 6146 buffer tube, a plate supply for these tubes as well as screen voltage for the R.F. driver tube, and holding bias for both the R.F. driver and power amplifier.

The oscillator consists of an impedance loaded stage driving the 6146 tube. This tube is shunt fed, and shunt feed is taken to the grid of the R.F. amplifier, enabling the 6146 plate tank coil to be grounded. The frequency monitor may be tapped directly on the 6146 tank coil, L506. A small piece of insulation should be slipped under the tap so as not to short-circuit turns. This tap may be moved along the coil to get the required drive for the frequency monitor, but should not be more than to give adequate drive. As the output is greatly effected by the position of the "Excitation Control", the final adjustment for the frequency monitor pickup should be left until the transmitter has been satisfactorily tuned.

The frequency monitor line should be brought in on small size coax to terminals 517 and 518 underneath the chassis. Terminal 518 is the shield ground.

Terminals 519 and 520 are in the 6146 cathode, and are provided for carrier suppression and arc-quenching circuits. If such are not used

these terminals should be jumpered together.

Besides the standard rectifier circuit to provide plate power for the oscillator, buffer and R.F. driver screen grid, each side of the power transformer feeds to a rectifier tube (6W4) which has half wave rectifiers provide holding bias for the r.f. driver and power amplifier. As soon as these tubes have normal grid drive, this bias voltage is cancelled, and these two holding bias tubes draw no current from the plate transformer. In the holding bias supply for the power amplifier is a bias interlock relay to hold off the high voltage until adequate holding bias is obtained. The front panel has an indicating light for the filaments, and a second light which is on when the bias relay closes.

The power amplifier bias, which may reach considerable voltage, is terminated on a separate terminal to the left of the terminal board under the chassis. As these holding bias supplies work against ground, before excitation is applied, the holding bias current flows through the power amplifier plate meter causing this meter to read reversed, and also through the grid current meter to read up on this meter. These readings serve to indicate the operation of the holding bias before high voltage is applied. These bias currents do not effect the accuracy of the meters during operation. The holding bias on the power amplifier is adjusted so that approximately .2 amperes current flows. This is far within the dissipation rating of the tube, and helps hold the plate voltage from becoming excessive were the tube biased to cutoff.

The 6146 buffer output tuning covers the broadcast band in several ranges. Two padder condensers, of 200 and 400 mmfd. capacity are brought out in the center of the chassis to a three connection terminal board, the center terminal providing ground. The tank coil is tapped at approximately 2/3 the number of turns. For the high frequency end of the band, this tap will be required, especially if a frequency monitor line is connected to the coil. The unused portion of the coil should not be shorted. From approximately 950 Kc to 730 Kc, the full coil will be required as well as 200 mmfd. padding capacity. This is obtained by connecting the left and center terminals. From 720 to 620, 400 mmfd. capacity will be required, this connecting the right and center terminals. From 610 to 540 Kcs, both capacities will be required and obtained by connecting all three terminals together. As it is possible to double frequency in this stage, the tuning should be observed as being reasonable for the desired frequency.

The crystal heater transformer, T502, may be connected for either 230 or 115 volt operation. The normal connections supplied at the factory is for 115 volts. This line should be provided through a separate disconnect switch, and since the wattage required is very low, may be fused with a low value fuse. This heater line is brought up to terminals 501 and 502 on the top of the chassis. Thus, if the transmitter is being serviced, with the main disconnect open, there is no other voltage appearing except on these two terminals and the heater transformer terminals.

On the right side of the panel is a multi-meter switch by which currents of the oscillator cathode, buffer grid and cathode, R.F. driver grid and cathode, and power amplifier grid may be measured. The meter is located on the cubicle meter panel on the right. The crystals supplied may be of various types. The standard crystal is the James Knight JK57M. This crystal is normally shipped with the gap closed. The cover should be removed, the adjusting screw turned until the thread engages, and then turned approximately 1/8 turn additional.

With the filaments on, the plate supply for the oscillator is on. With the proper buffer tank capacity for the frequency, and with the excitation control at mid-range, switch the multimeter switch to "Driver Grid", and tune for maximum grid current. The frequency monitor tap on the buffer coil can then be tentatively set for pick-up for the frequency monitor. Care should be used so as not to short any of the tank turns with the clip. Insert insulation under the clip between the adjoining turns. The amount of pickup will be largely determined by the "Excitation" control which is determined in the final adjustments of the transmitter. The proper setting of the "Excitation" control is that at which the power amplifier grid current no longer increases as the excitation is increased.

No setting of the frequency should be tried until the crystal has been heating at least four hours, and for longer if possible. With the trimmer condensers set at mid-scale, the frequency should be set as close as possible by the crystal adjusting screw. A non-metallic screwdriver, such as used for tuning radio receivers, should be used if available. There will be a slight shift in frequency when the cap is replaced on the crystal holder. The frequency can then be brought in exactly by the trimmers accessible on the front panel.

When the buffer is tuned, grid current should be obtained on the "Driver Grid" position of the multimeter. This will be from 20 to 30 milliamperes with full excitation.

R.F. DRIVER

The R.F. Driver utilizing a 4-250A tube, is mounted on a shelf above the frequency control unit. The socket, with bypass condensers, grid parasitic and choke, is covered underneath and coupled to the main plenum chamber, thus providing the cooling air as required for the tube. The filament transformer is mounted on the shelf on the left side. The tube is shunt fed, the plate choke on the rear panel on the left, the blocking condenser right of center. The tank coil L303 is mounted on the right side panel, the tuning is by a vane within the coil, and this is directly coupled to a turn counter tuning control on the front panel.

The tank condenser is of a fixed type, mounting below the tank coil. The coil is center-tapped, and grounded through a bypass condenser. The power amplifier grid tap is taken from the 4-250A plate end of the coil, the neutralizing tap from the opposite end, the end mounting the tuning vane.

The stage is tuned by (1) installing the tank condenser C304, setting the coil tap on L303 according to frequency, setting the center-tap C306 to the mid-point of the number of turns of the coil that are used, setting the power amplifier grid and neutralizing taps at 1/2 the turns between the center-tap and the connections of C304, (2) open the power amplifier disconnect switch S307, (3) turn the "Excitation" control to mid-position, (4) set the multimeter switch to the "Power Amplifier Grid".

Watching the multimeter on the power amplifier grid current position, apply plate voltage. If no current is indicated, cut the plate voltage and tune over a range before re-applying voltage. If an indication of grid current is obtained, it can be quickly determined the direction of tuning, and if the inductance should be changed. The vane moving into the coil decreases inductance, moving out, increases inductance. When the final tuning adjustments have been made, the vane should, if possible, be about opposite the first turn of the coil. In this position, it has no noticeable effect on the neutralizing. It is best to start with the tuning at one end of the range, and in case of excessive tube heating, after cutting the plate voltage, run the tuning to about mid range and reapply the high voltage, and again to the other end of the range if necessary. The equivalent tuning range is one to two turns variation on the coil, depending on frequency and tank capacity. The L-C ratio of the tank is not critical, except that for high capacity with low inductance, it is difficult to match the tube to the power amplifier grid, and the 4-250A tube will run considerably warmer than if lower capacity and more coil were used. A low capacity in this tank might indicate a source of R.F. harmonic generation, but tests show that this has very little effect. Also the low capacity might indicate the loss of the "flywheel" effect, the carry-over of power during the positive drive cycle. Measurements show the lower capacity tank will actually give better performance due to better matching of the load. However, caution should be observed that the current rating of the tank condenser is not exceeded.

The excitation control should be brought up, the 4-250A grid current will read approximately 20 to 25 milliamperes on the multimeter.

The power amplifier grid tap should be adjusted to give a power amplifier grid current reading of approximately 180-220 milliamperes. Increasing the number of turns to the grid tap will eventually reach the point where the grid current will not rise, but the heating of the 4-250A will increase considerably. The tap should be moved back

to the maximum most efficient operating point. The 4-250A tube plate will show color. It is normal for these to show a bright cherry red, in many applications are so operated. For the operation in the Gates BC-5P transmitter, the color generally is only a dull red. The plate current as given on the multimeter is between 250-300 milliamperes. If the loading is kept high on the stage, the tube shows slightly more color, but the tank currents are lower because of the lower "Q", and heating of these components will be reduced.

Power Amplifier

The power amplifier consists of a 3X2500F3 tube. This tube is completely enclosed in a compartment to the rear of the driver stage. The socket assembly mounts on top of a plenum chamber. Inside the plenum chamber is the power amplifier tank. The underneath of the tube socket connects to the plate blocking condensers, C318 and C320. The stage is shunt fed through two radio frequency chokes, L306 and L307, with a bypass condenser at the junction of the two chokes to ground. This effectively keeps radio frequency voltages from feeding back into the modulation components. The tank coil, L308, is tuned by a movable vane within the coil, and is mounted so that this tuning is in line with a turn counter on the front panel. The tank capacity is one or two fixed vacuum condensers as required by frequency. These should be installed with outside plates to ground. The neutralizing condenser, C313, is mounted in the front top right hand corner of the chamber. The first coupling condenser C314 mounts in the upper front left corner, a lead from this going up through the tube compartment to the output network in the top compartment.

On the center of the front panel of the chamber is the air switch, the operation of which is described in the "Modulator" section of this instruction book. The plenum chamber must be closed to get this switch to operate. The air intake is at the bottom of the chamber, and is covered by an aluminum screen. This is readily removable, and should be periodically cleaned.

The output line from the power amplifier tank enters the output network compartment in the front left corner, then passed across to connect to the first line coil, L309, then to the variable output coil, L310. A coupling condenser, C316, connects between the two coils to ground. This coupling arrangement is for line impedances up to 100 ohms. When the line impedance is higher, such as 250 ohms, the variable output coil, L310, used as a loading adjustment, will have very little effect on the loading. If the transmitter is to be operated into a high impedance load, a condenser across the load side of the line coil, L310, will allow the loading to be effectively controlled by L310. As an emergency matching, the line from the tank can be moved to L310 with L309 as the output coil. This arrangement results in considerable interaction between the loading and tank tuning. The operation and

adjustment will be more critical than the standard low ohmage output circuit.

After the driver stage has been tuned, the power amplifier may be tuned in the following manner: (1) install the tank and loading condensers C311, C315 and C316 according to the frequency and load, (2) set the tank coil L308 according to frequency; with either low or high ohmage lines, set both line coils at mid-position, (3) close the link S307 and (4) put the power switch in the 1 KW position. Apply plate voltage, watching the plate current meter. If this is over 1.2 amperes, cut the plate voltage and tune, turning on the plate voltage momentarily to see if the current is changing looking for a reduction of plate current. By starting with the tuning vane at one extreme of its travel, the tuning is equivalent to one or two turn changes of the tank coil, depending on frequency and tank capacity. With grid and neutralizing taps set as instructed, there is no tendency for oscillations in the power amplifier. When the power amplifier is tuned and load adjusted, then the final neutralizing adjustments may be made.

When the resonance point has been achieved as indicated by minimum plate current, the loading can then be adjusted. This may be accomplished only by the variable coil L310, or readjustments of L309 may be required. When the final tuning is obtained, the tuning vane in L308 should be about even with the first turn of the coil. The first line coil L309 will have considerable effect on harmonic radiation, and should have the most number of turns possible, and still be able to control the loading within limits by the coil L310. As L309 is increased, there generally will be reached a point at which the loading goes up rapidly and L310 will be near maximum. Neutralizing may be done "dynamically" by going back and forth through the power amplifier tuning, at the same time watching the power amplifier grid current. When the power amplifier is neutralized, the grid current will drop on both sides of plate resonance. In some instances, the current may not drop immediately, but require a little detuning. Should the grid current increase on either side of resonance, cut the power and move the neutralizing tap on L303 a turn, continuing until the desired effect is achieved. This is usually a turn or two less than the grid tap.

Other means of neutralizing indication may be used. The front bottom of the plenum chamber has several ventilating holes, leads may be brought out through one of these to an oscilloscope from a pick-up loop near the tank. In such cases, the power amplifier disconnect link S307 should be opened.

The final tuning of the power amplifier should be that the loading is approximately 100 milliamperes below the desired loading, and the tank tuning turned clockwise from resonance until the correct current

is obtained. The effect of tuning to both sides of resonance will be quickly noticed on a line current meter, common point meter, or other output indicating device. The explanation is that maximum impedance, as indicated by minimum plate current, is not exactly the same as unity power factor as indicated by increased output current.

The efficiency of the power amplifier stage should be very close to 80%. The unit is factory tested, and the first test is to achieve this efficiency, using a water cooled antenna. By measuring the water flow and the temperature rise of the water, the actual power dissipated in the dummy antenna can be accurately measured. Efficiencies above 85% should be regarded with suspicion, and may be due to defective input current and/or voltage meters, line current meter, or to an error in measuring the radio frequency load at the measuring point. With the transmitter in tune, and reasonably matched to the load, the poorest efficiency is seldom less than 75%. In the case of low efficiency, all power that is not going into the radio frequency load will be dissipated in the tube, tank and coupling components. Thus, one indication of low efficiency is that the tubes and sometimes tank components will show considerable heating. The effect will be most prominent in the heating of the tubes. One check is to set the modulator static current at 250 milliamperes per tube, representing a dissipation of 1250 watts. After running for ten or fifteen minutes with no signal, cut the power, feel the heating on the plates of the modulator tubes and quickly compare with the heating of the power amplifier tube.

In measuring true efficiency, the plate voltage reading should have subtracted from it the voltage drop in the cathode resistor and modulation reactor. These are each 50 ohms, the total is 100 ohms, and if the plate current is 1.25 amperes the voltage drop is 125 volts, which should be subtracted from the meter reading. Thus, if the meter reading is 5125 volts at 1.25 amperes, the actual voltage would be 5125 minus 125, or 5000 volts.

The meter is connected across the supply so that multiple unit operation may be had without additional meters. If single unit operation is to be used, the voltmeter could be connected directly across the power amplifier by transferring the high voltage lead to the "RF" side of the modulation reactor (using high voltage cable) and the ground side to the center-tap of the P.A. filament transformer, using 600 volt wire.

Arc Quench Circuits

Arc quench circuits operate generally on the principle of a low current supply of 200-300 volts being connected through a suitable relay to the transmission line. When an arc occurs, the direct current path is completed, the relay energizes and normally closed contacts open, dropping excitation until the arc is quenched.

It is apparent this system cannot be applied when there is a conductive ground on the transmission line such as might be obtained with grounded phasor tank, or static drain resistors or chokes. Also, in many directional antenna systems, lines or towers may be blocked to direct current by series capacitors. To obtain complete and adequate arc protection will in most cases require a study of the particular antenna system being used.

Tuning Charts

The tuning charts for the R.F. driver and power amplifier are given to serve as a guide for tuning the transmitter and are not to be construed as unalterable values. For example, L308 might be indicated to have 20 turns, but at final tuning might have 18 or 22 turns.

The output circuit offers considerable flexibility to values of components, and at timesvalues of capacities might be used other than given in the charts, this being done perhaps as a result of procurement or as the result of additional operational information. Lower capacities will result in a corresponding increase in inductance values to compensate for the changes.

TUNING CHART 250 OHM OUTPUT
BC-5P

FREQ.	DRIVER		POWER AMPLIFIER							
	G2	Approx. Turns	Jennings		Approx. Turns	G3		Approx. Turns	G3	
	C304	L303	C311	C312	L308	C314	C315	L309	C316	C317*
1600	0003	22	M500	None	11	002	None	6	0015	0015
1550	0003	22	M500	--	11	002	--	7	0015	0015
1500	0003	24	M500	--	12	002	--	8	0015	0015
1450	0003	24	M500	--	13	002	--	9	002	002
1400	0003	26	M500	--	14	002	--	9	002	002
1350	0003	28	M500	--	15	002	--	9	002	002
1300	0005	22	M500	--	16	002	--	10	002	002
1250	0005	24	M500	--	17	002	--	10	002	002
1200	0005	26	M500	--	18	002	--	11	002	002
1150	0005	28	M500	--	19	002	--	11	002	002
1100	0005	30	M750	--	16	003	--	8	002	002
1050	0005	32	M750	--	17	003	--	8	002	002
1000	0005	34	M750	--	18	003	--	9	002	002
950	0005	36	M750	--	19	003	--	9	002	002
900	0008	28	M1000	--	17	003	--	10	002	002
850	0008	30	M1000	--	18	003	--	10	002	002
800	0008	32	M1000	--	19	003	--	11	002	002
750	0008	34	M1000	--	20	003	--	11	002	002
700	0008	40	M1000	--	21	003	--	12	002	002

Dwg. No. A-12198
Sht. 1 of 2 Shts.

A-12198

TUNING CHART 250 OHM OUTPUT

FREQ.	DRIVER		POWER AMPLIFIER							
	G2	Approx. Turns	Jennings		Approx. Turns	G3		Approx. Turns	G3	
	C304	L303	C311	C312	L308	C314	C315	L309	C316	C317*
650	001	40	M1000	--	22	003	--	14	002	002
600	001	42	M1000	--	23	004	--	8	003	003
550	001	44	M750	M750	24	005	--	8	004	004

*C317 connected to load side of L310

Tuning Chart for BC-5P
Dwg. No. A-12198
Sheet 2 of 2 Sheets

TUNING CHART 50 AND 70 OHM OUTPUT
BC-5P TRANSMITTER

FREQ.	DRIVER		POWER AMPLIFIER							
	G2	Approx. Turns	Jennings		Approx. Turns	G3		Approx. Turns	G3	
	C304	L303	C311	C312	L308	C314	C315	L309	C316	C317
1600	0003	22	M500	None	11	002	None	6	0006	0006
1550	0003	22	M500	--	11	002	--	7	0006	0006
1500	0003	24	M500	--	12	002	--	8	0006	0006
1450	0003	24	M500	--	13	002	--	9	002	None
1400	0003	26	M500	--	14	002	--	9	002	--
1350	0003	28	M500	--	15	002	--	9	002	--
1300	0005	22	M500	--	16	002	--	10	002	--
1250	0005	24	M500	--	17	002	--	10	002	--
1200	0005	26	M500	--	18	002	--	11	002	--
1150	0005	28	M500	--	19	002	--	11	002	--
1100	0005	30	M750	--	16	003	--	10	003	--
1050	0005	32	M750	--	17	003	--	10	003	--
1000	0005	34	M750	--	19	003	--	11	003	--
950	0005	36	M750	--	20	003	--	11	003	--
900	0008	28	M1000	--	17	004	--	10	003	--
850	0008	30	M1000	--	19	004	--	10	003	--
800	0008	32	M1000	--	21	004	--	10	004	--
750	0008	34	M1000	--	22	004	--	11	004	--
700	0008	40	M1000	--	23	005	--	13	005	--
650	001	40	M1000	--	24	005	--	13	005	--
600	001	42	M750	M750	22	006	--	14	006	--
550	001	44	M750	M750	24	006	--	14	006	--

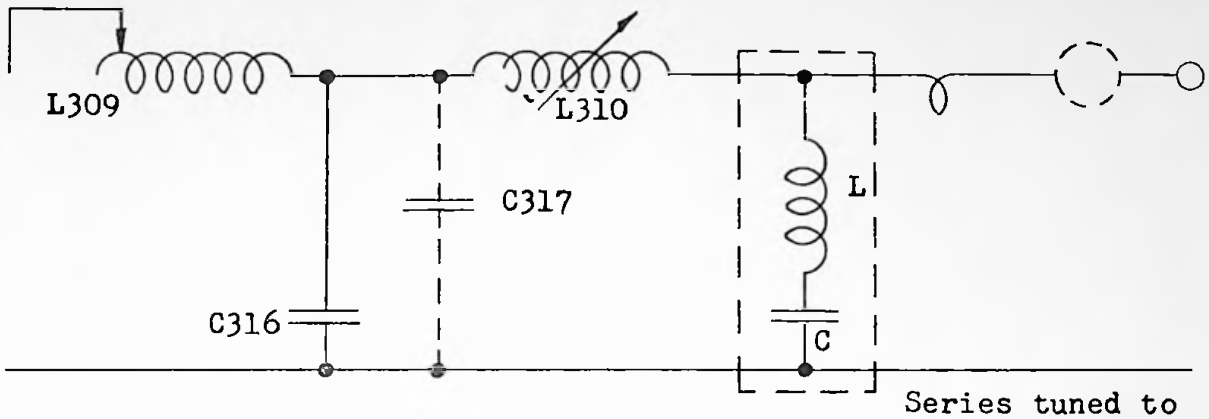
Harmonic Reduction

The Gates BC-5P transmitter has been designed to reduce harmonic radiation as much as possible. High order harmonics may be strongly radiated if there is coupling between the power amplifier tank and the output. The physical arrangement of the BC-5P transmitter eliminates this stray coupling, and actual measurements on several frequencies and operating conditions show that harmonics of the order of the fourth and higher are of very low strength.

The second and third harmonics are the only harmonics which show signs of reaching objectionable intensity. The strength of these are greatly affected by the tuning. The opinion that increasing all capacity values throughout the power amplifier tank and coupling network to reduce harmonics is fallacious, the best harmonic reduction is obtained by the proper relationship of the various inductive and capacity values. As a general rule, the greater the inductance used in the first coupling coil, L309, the greater the harmonic reduction.

In the case of harmonic trouble, the first step should be to determine whether the harmonic radiation originates in the transmitter or externally such as in the antenna system. Tower guy lines might resonate at some harmonic frequency and be shock excited to radiate an objectionable signal.

Should the harmonic originate in the transmitter, and not adequately respond to normal tuning procedures, circuit revisions may be made. In some instances, a harmonic might be directly on some frequency, such as airways or police, where a very small signal will interfere, and require far more than normal suppression.



Series tuned to unwanted frequency

The condenser C can be the same type and capacity as at C316/C317. The circuit is tuned to normal loading on the fundamental without L. The coil L is tuned to the unwanted frequency when connected in parallel to C, using a grid dip meter. The coil L should be of 1/4" or 5/16" copper tubing. The mounting should be for minimum coupling to other circuit elements. With careful adjustment 20 to 30 DB attenuation may be obtained.

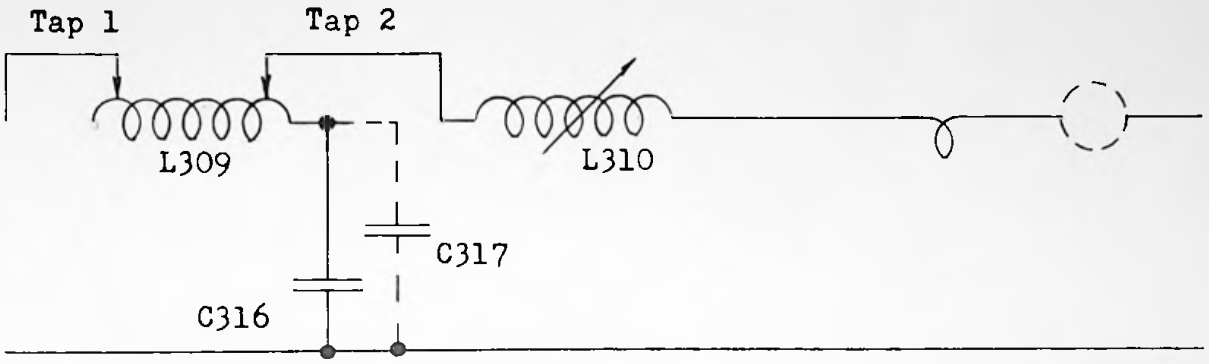
A.C. OVERLOADS

These relays are the time limit type. The tripping value is set by rotating the armature on the threaded shaft; a tab aligns with markers on the armature to indicate the value.

The amount of delay is determined by the amount of oil in the dash-pot. As power transformers from several suppliers are used, these vary in "charging current", or the initial surge current required to magnetize the core, the delay time will vary. No more oil should be used than required to keep the contactor from pumping when voltage is applied. Thus, if no pumping is incurred, no oil should be used. The relays may be observed through the front window.

To adjust the relay, the cup under the solenoid is unscrewed, the armature and piston removed. The armature is slotted, and inside this slot will be seen a brass shaft with a groove around it. This groove aligns with the tripping current marked on the armature for tripping at that current. A nut on the brass shaft determines the distance the armature sets in the solenoid which establishes the current required to trip the overload.

The overload tripping current should first be set so that the a.c. overloads barely hold in with 100% modulation at 30 cycles. This will generally be between 50 and 60 amperes. Then add oil only if the contactor pumps when voltage is applied, and add only enough oil to stop the pumping. This should be only a drop or two, barely moistening the plunger. Do not use any more oil than necessary to stop the pumping.



Tap 2 is adjusted so that the inductance between this tap and the end of the coil connecting to the coupling condensers, with the coupling condensers C316/317 form a series resonance circuit at the unwanted frequency. The position of tap 2 may be critical to 1/4". The normal loading is then adjusted by the position of tap 1. This circuit shows 10 to 20 DB attenuation to the undesired signal.

Should attenuation be required on two frequencies, these two circuits can be both used.

AUDIO DRIVER

The audio driver consists of two 6SN7 voltage amplifiers and four 6L47 6550 tubes in push-pull parallel. The audio input is direct to the input transformer, with provisions that a level change relay pad may be installed when it is desired to have automatic level change for 1 KW operation. The cathodes of the first audio stage has a balancing control R413 in the cathodes. The main feedback is returned to the first stage, and a balancing control R409 is provided for this. Before starting measurements, both controls should be centered. From the plates of the 6550 driver stage to the cathodes of the second audio stage, is another feedback loop. The driver transformer has 40% voltage taps to which the screens of the tubes are connected. Grids, plates and screens all have parasitic suppressing resistors. The driver stage is cathode biased by the resistor, R434. On a board on the side of the chassis by the tube sockets is a set of four individual 10 ohm resistors, a voltmeter reading across these will give the individual tube currents. This voltage is normally .65 volts.

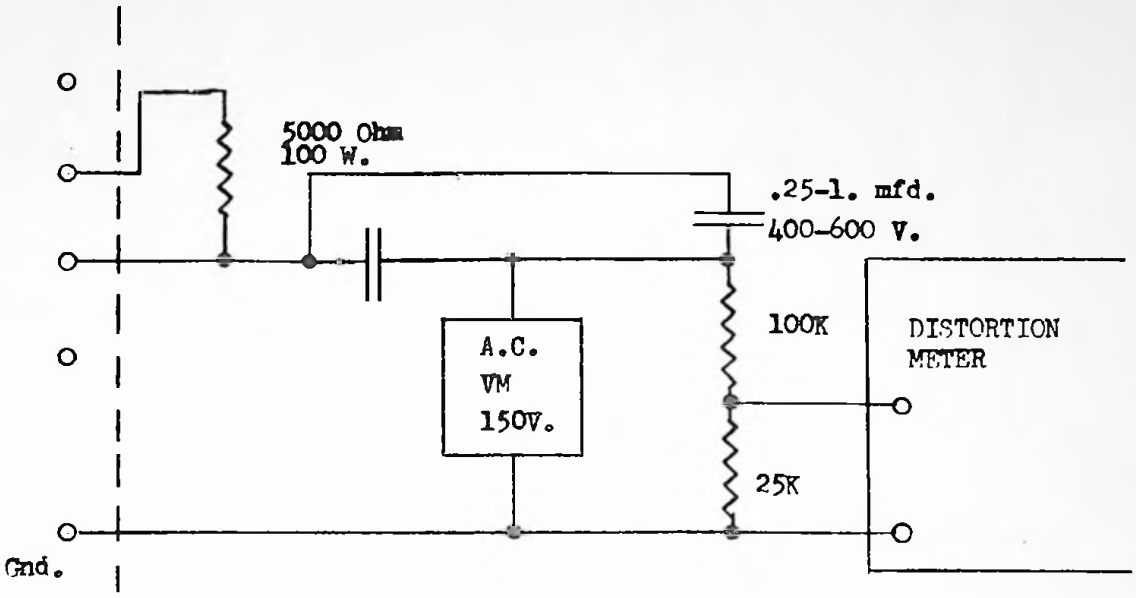
The driver transformer secondary has drive balancing taps, on one side plus 5% and on the other minus 5%, enabling the drive to be balanced to 10%. In some cases it may be desirable to reverse these, in which case the main feedback should also be reversed. Normally, the testing can be started with both sides on equivalent voltages, changing the balance if indicated.

The plate supply is self-contained. The rectifiers are two 5R4GY tubes with paralleled plates as a full wave rectifier. The normal voltage is 450 volts, the normal current to the four 6550 tubes is 300 to 325 milliamperes. The supply for the first two audio stages is obtained through a divider and separate filter system eliminating any tendency to motorboat.

A separate rectifier supplies the bias for the modulator tubes. This is well filtered, and the bias controls on the front panel give adequate control of modulator bias. Provided in the bias circuit is the bias interlock relay, K402, which closes the high voltage control circuit when the bias voltage has built to the proper value. A second contact of this relay closes the circuit to the pilot light indicating the bias is applied. A pilot light across a filament circuit indicates the filaments are on.

The power required for the audio chassis is 115 volts, obtained in the transmitter by a step-down transformer, T203. The primary of this transformer is controlled by the door interlock switches, so that opening the doors removed bias voltages. Should it be desired to check the audio deck by itself, the deck can be removed, 115 volts connected to the input supply. The driver transformer secondary should be loaded with 5000 ohms grid to grid, 100 watt resistor rating should be used. The bias voltage may be blocked off by a .25 to 1.0 mfd.

400-600 volt condenser. An A.C. voltmeter should be connected from this to ground and a reference level of 150 volts (RMS) should be used. The signal may require a divider to reduce the level for the distortion meter, for example, 100,000 ohms, 1 watt to the blocking condenser, 25,000 ohms, 1 watt on the ground side, the distortion meter being taken across this.


5000 Ohm
100 W.
.25-1. mfd.
400-600 V.
100K
DISTORTION
METER
A.C.
VM
150V.
25K
Gnd.

MODULATORS

The modulators are operated on both 5 Kw and 1 Kw at full rectifier output voltage of approximately 5000-5200 volts. For 5 Kw operation, the modulator grid current excursion is very low, permitting the use of a low power driver stage.

During initial test procedures, disconnect the feedback, either by removing the connections at the terminal board, or by removing one resistor on each side of the feedback divider. The resistors removed would be one of the 100,000 ohms on each side. NEVER APPLY HIGH VOLTAGE WITH THE 5000 OHM RESISTORS ON THE GROUND END OF THE DIVIDER REMOVED.

When audio tone is applied, the input signal level will be about -10 DB. When the operation has been checked, the feedback can be connected, and the input level should be approximately 0 DB for 100% modulation. If the feedback is reversed, the modulator may oscillate. If it does not go into oscillation, the level for modulation will be very low, -20 DB.

The static current on the modulators normally should be 50 milliamperes per tube. However, they can be operated up to 300 milliamperes per tube without damage, but this means that considerable heat will be generated in the modulator unit. Operate the modulators at the lowest static current as is compatible with performance, generally 50 milliamperes.

After the transmitter has been placed in operating condition, unless the performance is exceptionally good, several checks can be made. The primary of the modulation transformer can be reversed. This frequently has an effect on distortion, mainly on the high frequency end of the range. Also, addition or cancellation of noise usually results from the polarity of the transformer. If the primary lines to the transformer, or connecting on the transformer, are changed, the feedback will be uneffected. The secondary should always have the #5 terminal connected to the power amplifier, the #4 terminal to the modulation condenser. With the plate currents statically balanced, when signal is applied it will be noted that frequently the plate currents will differ. If the modulation transformer is reversed, it may be noticed that the unbalance is also transferred, indicating that the loading is slightly different between the two halves of the primary. Some balance may be achieved by means of the balance drive taps provided on the driver transformer. The unbalance need not be of great concern if the distortion is within limits. Generally, then the modulation transformer or driver transformer are reversed, the two balancing controls R409 and R413 will generally require changing. Preliminary testing can be done with 50, 1000 and 7500 cycles. The effect of the two controls varies, depending on the type of unbalance, but generally the cathode balance R413 will have the main effect on the low audio frequencies, and the feedback balance R409 on the high frequencies.

DISTORTION

The Gates BC-5P transmitter is tested thoroughly as possible at the factory to assure proper and satisfactory service and performance for the customer. Should the distortion be high, the following items should be checked and tests made.

1. The proper connecting of the feedback, the modulation transformer, reactor, condenser, also that the filter condensers are connected on the load side of the filter chokes.

2. The step-start contactors K110 and K204 are closing properly.

3. Sufficient R.F. drive on the power amplifier. A slight increase in drive may make noticeable improvement.

4. Proper test procedure. The diode may be sensitive to amount of pickup, try varying coupling. The location of pickup may be such that harmonics are also included, or that pickup may be from two sources of different phase. The use of a modulation monitor for modulation reference may result in high percentage of modulation than desired. An oscilloscope is the best means for obtaining the reference level.

5. Remove or disconnect feedback, use audio divider on modulator grids as described in the audio driver section, determine if the distortion to the modulators is high. This normally will be under 2-3%. The divider might also be applied across the grounded feedback resistors R208 and R209 for measuring modulator output. Also, the divider might be used across the 50 ohm power amplifier cathode resistor R302, the power amplifier tube acting as the load element on the modulator. This test, however, may not be conclusive, as the power amplifier might not be presenting a linear load to the modulators.

INITIAL TEST PROCEDURE

When the transmitter has been completely installed, all connections made, all blocks and ties removed from the contactors and relays, and to the best knowledge of the installation engineer the transmitter is ready for test, the following outline as developed in the factory for testing is recommended. The engineer should have studied the operation as outlined in this instruction book so that when he begins the initial testing, the proper performance will be recognized. He has the assurance that before the transmitter was dismantled for shipping, all circuits were functioning properly. Any failure to do so may be due to damage in shipment or minor mechanical failures such as a breaking. Any faults should be corrected before proceeding to the next step.

1. Install all tubes. Individual filament switches S202 and S302 should be "off".

2. Open the high voltage primary disconnect switch S107.

3. Close the crystal heater service switch. The crystal heater lights should show while crystals are heating.

4. Close the transmitter service switch. Press the "Start" switch. Both power tube blowers should run as well as the rectifier unit fan. The rectifier filaments should be on.

5. Press the "Stop" switch. The blowers should shut down after two minutes.

6. After the thermal time delays have recycled (about 15 seconds), reapply the "Start". Turn on Modulator and R.F. filaments by means of their individual switches. Check filament voltages.

7. If the modulator unit is closed, the filament light will show on the audio driver panel and after a few seconds, the bias light. If the power amplifier is closed, the filament light will show on the oscillator panel and after a few seconds the bias light. The multimeter on the "P.A. Grid" will show some current reading. The power amplifier plate current meter will read in a reversed direction due to the holding bias in reversed direction.

8. The first R.F. buffer can be tuned as given in the instructions on this unit.

9. With the primary high voltage switch S107 open, press the "H.V. ON." The main contactor should close.

10. Open the top modulator panel (not interlocked), and with some insulating material, tap the overload relay armature, checking the action of the overload recycling.

11. With the high voltage control closed, open various doors and check action of door interlocks.

12. Open the power amplifier disconnect link S307, close the high voltage primary disconnect switch S107, turn the modulator bias controls to the mid position. Disconnect the modulator feedback. Set up the driver tuning as outlined in the section on this stage. If possible, when tuning the driver check the modulator static current. If this is not possible, it would be well to first disconnect the R.F. driver high voltage line and apply high voltage and set the modulator static current to 100 milliamperes per tube.

13. With the R.F. driver tuned, the power amplifier high voltage can then be applied by closing the link S307, and the power amplifier tuned in accordance with the instructions on this stage.

14. With the transmitter now operating with full power, final tests and adjustments can be made.

RADIO FREQUENCY CUBICLE

TOP LEFT - Power amplifier loading, indicated as D.C. current to power amplifier on meter directly above this control, or as R.F. output by line meter or common-point current meter. Use to adjust output as required, approximately 1.24 amperes plate current, or R.F. line current as required for specific installation.

TOP CENTER - Filament rheostat for filament voltage in unit. Maintain to read 7.5 volts on filament meter directly above.

TOP LEFT - R.F. Driver tuning, adjust to maximum multi-meter reading when this meter is on "Power Amplifier Grid" position.

OSCILLATOR PANEL LEFT - Crystal selector switch to select crystal to be used. On each side of selector switch is a vernier frequency adjustment for the corresponding crystal.

OSCILLATOR PANEL CENTER - Buffer tuning. Tune for maximum current when multi-meter is set on "Driver Grid".

OSCILLATOR PANEL CENTER - Excitation Control. Turn clockwise beyond point P.A. grid current remains constant. Observe distortion measuring equipment on "Noise" position for region of low noise reading.

LIMITS ON BC-5P TRANSMITTER

	Minimum	Normal	Maximum
6146 Plate Voltage	340	350	370
6AG7 Plate Current	7	11	15
6146 Grid Current	1.5	2	3
6146 Plate Current			
Driver Hold Bias	70	75	80
P. A. Hold Bias	230	250	270
Driver Grid Current	17	20	25
Driver Plate Current	260	280	300
P. A. Grid Current	175	200	220
P. A. Plate Current (Ip)		1.3	
P. A. Plate Volt (Meter) (E_b)	5100	5200	5300
P. A. Input Ip x (E_b-100Ip)		6650W	
P. A. Output		5300W	
P. A. Efficiency	79%	80%	83%
Carrier Shift 100%, 1000 cy.	2%	3%	4%
6550 Plate Voltage	440	450	460
Modulator Bias Minimum			
Modulator Bias Maximum			
Air Pressure	1.4	1.5	1.7
Response 50-10000 95%			±2 DB
Distortion 50-7500 95%			3%
Noise 100% Modulation, 1000 cy.			60

OSCILLATOR PANEL RIGHT - Multi-meter selector switch. Most useful indicating position is on "Power Amplifier Grid".

P.A. TUNING PANEL - Power amplifier tuning, tune for minimum current on top left meter (Power Amplifier Plate Current), at 5 KW output, turn counter-clockwise to raise the current .1 to .2 amperes above the minimum value, then adjust "Power Amplifier loading" to give required output.

POWER CUBICLE

TOP LEFT - Line meter switch by which the voltages of the three phase power supply may be read.

TOP RIGHT - Rectifier filament voltmeter, measuring the primary voltage on the filament transformer, to be maintained at a specific value as measured to give 5 volts on the rectifier filaments.

CONTROL PANEL LEFT - Start and stop switches from left to right, to start and shut down transmitter.

CONTROL PANEL CENTER - Low and high power selector switches with lights above, from left to right.

CONTROL PANEL RIGHT - High voltage on and off switches respectively.

MODULATOR CUBICLE

TOP CENTER - Filament rheostat for filament voltage in unit. Maintain to 7.5 volts filament on meter directly above.

AUDIO DRIVER - Two bias controls, adjust to read equally .05 to .1 amperes static current on the two plate current meters on the top panel. Use lowest current to give satisfactory performance.

MAINTENANCE

RELAYS

The RBM contactors used in the control circuits and as power contactors of all but the high voltage, are of the same type and rating, reducing the need of a wide variety or replacement items. Normal expectancy is for long life; the oils are rated 220 volt, 50/60 cycle for continuous operation plus 10% to minus 15% of rated voltage. The contacts operate variously up to 10 amperes and have a 15 ampere rating. The magnet frame and coil assembly are readily removable by

two screws. The coil may be replaced by removing the screw which holds the coil retaining clips. No spring adjustments are required for various contact arrangements.

The contacts are of silver-palladium alloy to give long mechanical and electrical life. It is not necessary to clean or file the contact tips at any time during the life of the contacts.

The contacts may be readily reversed by taking off the stationary contacts, then the removable contacts, and reinstalling in the opposite position.

Quite frequently extra contactors are desired for auxiliary components at the transmitting station, to be operated by various functions of the transmitter, or to be independent of the transmitter operation. A wide variety of relays and contactors may be obtained from the Gates factory. Specify coil voltage and contacts. In the case of the RBM contactors, the most satisfactory way is to order four pole normally open contacts, which arrangement is a stock item, and alter the contact arrangement as desired.

ADJUSTMENT OF OVERLOADS

The overload relays, with the exception of the a.c. overload relays, are 6 volt D.C. type which pulls in at approximately 4.5 volts. These relays are shunted by appropriate resistances which at the desired overload current will develop the required operating voltage. Decreasing the amount of shunt resistance increases the overload tripping point.

The power amplifier overload may be adjusted by detuning the power amplifier momentarily to 1.5 or 1.6 amperes. If the overload does not trip, then the amount of shunt resistance should be increased. The R.F. driver may be adjusted in a similar manner, detuning until the tube shows more than normal heating, if the current is in excess of the plate current meter reading. The tube need not be left in this operating condition more than a second or so. When this relay is set, the application of high voltage may cause tripping or pumping of the overloads, in which case the overload should be set slightly higher. The modulator overloads may be set by applying 7500 cycle tone, then decreasing bias on one modulator tube until the plate current increases further by .2 or .3 amperes, and setting this relay for tripping. The other modulator tube is adjusted similarly.

With this method of adjustment, the overload need be applied only for a couple of seconds, and as such no damage will be done the tubes. The power amplifier, driver and modulator overload relays, as explained in the control circuit discussion, must close their contacts on an overload to energize the auxiliary control relay K103 which in turn opens the high voltage control circuit. This prevents chattering

on modulation peaks. The rapidity of the operation depends on the rapidity at which the overload occurs. The manner of setting the overloads as described brings the current to the value at a relatively slow rate. An actual overload applies the tripping current suddenly and as such supplies a much heavier closing torque, so that the actual tripping current will be under that as set in the manner prescribed.

Approximate overload tripping currents should be as follows:

Power Amplifier	1.6 Amperes
R. F. Driver	.35
Modulators	1.2

TRANSFORMERS

The power tube and main rectifier filament transformers have voltage range taps. Primary Terminal #1 is always connected to one side of the supply line. The other side, connecting to terminal #2 delivers the highest secondary voltage, to terminal #4 the lowest voltage. The voltage range used depends on the line voltage and line voltage variations and the most suitable connection to keep the filament voltages correct by means of the rheostats. When the line voltage is regulated, the taps should be used that allow the rheostats to be operated near the minimum resistance, reducing the heating from these components.

BLOWER

It may be expected that the blower motor will vary from time to time as to details of construction, but will be the proper speed and power for 230 volt single phase 50 or 60 cycle operation to deliver the required air volume and pressure. It is suggested that the chief engineer, if not thoroughly familiar with motor maintenance, to avail himself of any opportunity to discuss fully such maintenance with any qualified person as may be found in a motor repair shop or electrical shop.

The motor may be equipped with grease cups or oil cups. Grease cups should be given a partial turn every three months, refilling with a good grade of cup grease when necessary. DO NOT use graphite grease. Bearings requiring oil should be oiled lightly when received. As these motors are tested with the equipment, some oil will already be applied. Use a good grade of machine oil S.A.E. 10, and oil lightly about every three months.

CE & CY TYPE MOTORS

A capacitor start induction run motor has a condenser in the starting circuit. This starting circuit is opened by a switch or relay when the motor has attained a speed of about 75% of the rated speed, which it should do in a few seconds.

TROUBLE CHECK LIST

1. The motor will fail to start if the starting circuit is open which may result from an open condenser or failure of the cut-out device to make contacts. An opening in this circuit can be determined by connecting a test lamp in series with C1 and C2.

2. IF THE MOTOR OVERHEATS: Check the motor speed to see that the motor is not overloaded and operating at reduced speed. Check the line voltage at the motor terminals; it should be within 10% of the name plate voltage. Make sure the cooling air is free to flow through the motor. Check for a shorted stator. Motor usually hotter at one spot or smokes.

3. IF MOTOR FAILS TO COME UP TO SPEED: Check load and voltage as above. Condenser may be shorted; if so, replace condenser with one of same rating, voltage and microfarads.

4. MOTOR HUMS OR GROWLS: Probable causes - shorted stator, worn bearings, or excessive end play. Shorted stator will be indicated by high watts and overheating.

AIR PRESSURE SWITCH

The air pressure switch consists of a captive plate, held against the force of the air pressure by the spring tension of the switch. The switch mounting, outside plate and spacer plate are held together by bolts threading through the spacer plate, and held on the inside of the plenum chambers by nuts.

The switch mounting plate is slotted, so the switch may be loosened, and by changing the angle of the switch, the switch will operate by the movement of the plate to the pressure position. When the air pressure is released, the switch arm spring presses the plate to the no-pressure position, at the same time opening the circuit.

If the action of the switch becomes erratic, examine the air filters for stoppage due to dirt collection. In the power amplifier, if the screen on the bottom of the plenum chamber becomes clogged, the air switch will fail to operate.

AIR PRESSURE

At times it is desirable to measure the air pressure. Numerous heating companies have inexpensive pressure indicators which are used across the filters. One such is the "VISIFLOAT" by the F. W. Dwyer Company.

A "Manometer" for measuring air pressure may be easily made. Two pieces of glass tubing, about 1/4" diameter and 6 to 10 inches long, and connected together by tubing, rubber or plastic such as spaghetti sleeving, and the two pieces of glass tubing mounted side by side an inch or inch and half apart, making a "U" tube. Clear plastic tubing could be formed in the shape of a "U" for this without requiring glass tubing. The "U" tube is filled with water to about midway on the straight sides. A length of tubing fits on one leg of the U and this is then placed inside the chamber under pressure. The air pressure is then measured in inches as the difference in water level in the two legs of the U tube.

When making measurements, the U tube should be held vertical. The tube in the plenum chamber should not be pointed towards the air stream, as the impact of the air will give a higher reading. It is convenient to have some solid tubing on the end of the hose. If this tubing is bent on the end, the end may be very easily turned away from the air stream.

AIR FILTERS

The air filters should be examined regularly. The 20" x 20" size is rated for 800 c.f.m., giving over twice the recommended area for the blower capacity. This allows a reasonable amount of dust collection without loss in efficiency. The frequency with which the filters should be changed depends entirely upon the conditions at the transmitter, and with close observation, a replacement schedule can be established. The non-renewable type of filter is furnished, as experience shows that the renewable or cleanable type is generally difficult to clean, and as the dirt becomes deeply imbedded and cannot be removed by the usual available methods, the filtering action is greatly impaired. As the filter is of a standard size, and as such, obtainable from local heating supply firms, either type may be used.

MODULATION MONITOR PICKUP

The modulation monitor pickup L313 is best adjusted after the installation is complete and the transmitter is tuned. As many variables enter into the adjustment, no effort is made at the factory to set the coil. The line to the modulation monitor should preferably be small size concentric like RG-U. Shielded audio wire introduces severe losses and difficulty will be had getting sufficient pickup to operate the monitor. The amount of pickup can be adjusted by rotating the coil. Should the pickup be insufficient, a new coil can be tried. It is suggested that temporary coils be first used, as additional turns on the coil does not always mean more pickup. In some instances, it may be necessary to replace the single turn line coil by a two turn coil.

As many stations are operated remote control, monitor changing with power change is not provided, but if desired, a second coil may be installed opposite the coil supplied, and a relay which will select the proper coil for the power. The wiring for the relay control is shown in the line diagram D-21859.

PLEXIGLAS

The plastic windows should have a certain amount of care and there is included a plastic polishing kit shipped with the transmitter. Plastic surfaces attract dust. This is because plastics tend to accumulate electro-static charges that act as a magnet to attract the particles of dust flying constantly in the air.

Dust is not only unsightly, but causes scratches when improperly wiped off. The plastic windows in the BC-5P transmitter have already been waxed and hence constant dusting is unnecessary.

If in six months or a year it may be necessary to rewax the plastic, it is a simple matter using the following procedure.

One bottle is marked "Cleaner" and is nothing more than a highly concentrated wax soap that cleans by saturation. As it is highly concentrated, it should be diluted by pouring a small quantity into a receptacle and adding ten parts of water by volume. Then saturate a soft cloth in the solution and wipe freely over the surface of the plastic. Allow one or two minutes for the cleaner to absorb the dirt and then wipe off. Rinse with clean water using a clean cloth. Let dry and this should leave you a clean sparkling surface after which you may apply the wax.

If there are any scratches present, apply "Burnisher". Use full strength and do not rub too long in one place, as excess heat is not good for the plastic. Allow to dry and wipe off the residue with a soft cloth. Then apply wax.

To apply the wax, pour a small quantity on a dry, clean, soft cloth. Spread over the surface of the plastic in a thin continuous film by rubbing back and forth with gentle strokes until the wax covers the entire surface. Then allow the film to set for about two minutes. Before it is thoroughly dry, polish with a clean dry cloth. This final polishing requires hardly a minute and produces a hard glossy film of beauty. (Note: The thinner the film, the more efficient the wax). If additional quantities of wax, burnisher and cleaner are needed, we have these available in kit form at a very nominal cost.

POWER TUBES

All tubes should be inspected carefully immediately on receipt. Power tubes should be given close attention, particularly to the glass around the plate, filament and grid seals for flaws. Tubes should be tested as soon after receipt as possible, operating first for fifteen minutes at rated filament voltage without plate voltage. By testing in the power amplifier, the tube can be operated normally of reduced power for fifteen minutes, and then fifteen minutes at full power. As normal for Class "B" operation, for the absolute minimum of noise and distortion, the tube should be matched, but in practice, random mixture of tubes will not give noise or distortion detectable by aural means.

The tubes should be kept clean, and no foreign matter allowed to collect between the filament terminals. The tube should not be subject to vibration or shock, the 3X2500F3 tubes should be handled by holding to the fins, and supporting the filament leads as much as possible. The best storage is a cabinet not used for storage of other equipment, built with the proper support and cushioning. Such a cabinet may be obtained from the Gates' factory.

The tube locates in the socket with the outside terminal lead away from the filament air seal nozzle. The leads should be formed towards the connectors by holding the top of the tube so as not to place a strain on the glass. The tube is then inserted in the socket, and the leads placed in the terminal clamps. The wing nuts should be firmly tight by hand. The spring clamp on the grid should be loosened so the ring can be turned to allow the grid connection to be made between the two clamping plates. The clamp need not be tightened, as the pressure remains fairly firm.

The filaments should be turned on and off as few times as possible. The delay time of the blower should not be shortened after a sustained period of operation. The operating personnel should familiarize themselves with the tube temperature at normal shutdown, so that on intermittance testing, or filament only, the blowers can be cut when the tubes have cooled sufficiently.

The tube life of a thoriated tungsten filament tube cannot be extended by reduction of filament voltage as with bright tungsten filament tubes, as actual filament evaporation is negligible. During operation, emission is obtained from the thorium coating of the tungsten filament. To maintain balance of the coating of thorium, the filament should be operated close to specified voltage, that is, plus or minum 5%. Filament voltage should be measured on each tube, and the voltage balanced by the primary taps on the transformer if necessary. This normally should not be required. The ranges of the taps are given in the information on transformers. When tubes are changed, the filament voltage should be checked as soon after as possible. The operating range is not materially narrower than bright tungsten filaments, as this latter cannot be operated over-voltage without great loss of

life, and with under-voltage, the emission may not be sufficient for satisfactory operation.

Filament operation plus or minus 10% is occasionally permissible for periods of short duration, but for all intent and purpose, the filament should be operated at rated voltage. The tube life is not materially affected by filament operation within this range, if the periods of such operation are of relatively short and infrequent duration.

The thoriated tungsten filament normally holds emission throughout life, and very close to the end of life, the emission starts to fall off rapidly. This gives the station personnel a chance to anticipate the end of life and to replace the tube without suffering transmitter outages. Once the emission has started to go, it is only a matter of a few days until the tube will be completely unsatisfactory.

The loss of emission will be indicated the same as with any other type of filament. One of the earliest indications is the falling off of grid current in the case of a power amplifier tube. This results from the fact that a very small reduction in output power and consequent reduction in R.F. voltage developed in the plate circuit causes a drop in control grid current. In fact, the control grid current acts as a monitoring vacuum tube voltmeter for the developed R.F. plate voltage. By referring to constant current curves and noticing that as the operating line fails to push into the region of equal grid and plate voltages, the grid current falls off rapidly.

Other indications are failure to hit the modulation peaks on both the positive and negative. The positive peaks are not reached because there is a lack of space current, and the negative peaks are not developed because there is insufficient grid current to develop the necessary variations in grid leak bias to drop the output power momentarily to zero.

In the modulators, failure of emission of one of the tubes may result in unbalance of the modulation peaks. Loss of emission by the modulator supplying the positive modulation peak would show as failure to attain full modulation on the positive peaks; where failure of the modulator supplying the negative peak would give a similar indication for this modulation cycle. There may also be present a quality breaking, or oscillating, during the peak of the cycle. Suspicious modulator tubes could be checked in the power amplifier position and the results compared with a known good tube. In the case of unbalance of modulation peaks, the performance should be checked that there is not some fault existent in the audio driver giving unbalanced drive. A modulation monitor which is picking up radio frequency harmonics will show unbalance on the modulation peaks, although the transmitter has been adjusted and performing normally with no indication of change, this possibility does still exist. As the tubes are easily changed, it can be noted if the condition changes with a replacement, or rearrangement, of tubes.

It is suggested that no tube remain idle more than three months. One procedure is to rotate tubes, placing spare tubes in service, and more or less equalizing the usage of the tubes.

An alternate method is given, that is to place the spare tubes in service only for a day or so at three or four month intervals. Thus, tubes are kept conditioned, and when tube trouble or loss of emission is suspected, a practically new set of conditioned tubes will be available for comparison.

3X2500F3

Filament Voltage	7.5
Filament Current	48
Maximum Start Current	100
Amp. Factor	20
Interelectrode capacity:	
Grid-plate	20 mmfd.
Grid-fil.	48 mmfd.
Plate-fil.	1.2 mmfd.
Transconductance	20,000 mmhos. (3000V. - .83A)
Net Weight	7.5 Lbs.
Maximum Rating:	
DC Plate Voltage	5500
DC Plate Current	2.0
Plate Dissipation	2500 Watts (1) 1670 Watts (2)
Plate Cooler Core Temp.	150° C.
Grid Dissipation	150 Watts

(1) Minimum air flow 120 c.f.m. at 1.0" water. 6 c.f.m. directed at filament seal. Class "B" audio.

(2) Class "C" radio frequency, plate modulated. Same air requirements as (1).

MERCURY VAPOR RECTIFIER TUBES

The tubes as received have in transportation had the mercury scattered throughout the tube and on the elements. For the initial service, the filaments should be allowed to heat for fifteen minutes, after which plate voltage may be applied. After tubes are conditioned for operation, always keep and store vertically with base down, otherwise the mercury may again be scattered on the elements, causing the tube to give poor performance when placed in operation.

The main rectifier tubes are visible through the front window. In case of arc-back, it will be frequently noted that two or more tubes flash, making it difficult to determine definitely which tube is the offender. One tube failing places full voltage on one or two others, depending on the portion of the power cycle, causing these in turn to arc back.

MAINTENANCE SCHEDULE

A hard and fast maintenance schedule cannot be set up in this instruction book. Each installation will have its own problems and conditions which effect the schedule. Thus, a location which is dusty, where mud is tracked in during inclement weather to become dust on drying, will require more often cleaning of the air filters, and this dust and mud may be carried inside the transmitter by the personnel to require more frequent cleaning of components.

After each signoff, the personnel should give the transmitter an inspection. This inspection should include:

1. All condensers in power amplifier and R.F. Driver.
2. All coils in the power amplifier tank and coupling circuits for undue heating, also the clips on the coils for heating.
3. Components of phasor (if used).
4. Filament connections of power tubes for heating.
5. Bearings of blowers. Note if any vibration is present in blower as might indicate a loose wheel.

This inspection will only take a few minutes, and may anticipate a failure which would lose valuable program time. The BC-5P transmitter is like any machine, for the best performance it should be properly maintained.

The following are given to serve as a guide in planning maintenance. Each installation may require modification to suit the local condition. A transmitter weekly maintenance schedule is suggested as follows:

1. Inspect all relays and clean contacts as required.
2. Clean internally all parts of the transmitter including insulators.

3. Inspect power amplifier tank coils, connections, etc.
4. Inspect blowers for vibration.
5. Test operation of overload relays.
6. Test door interlocks.
7. Inspect sliding contacts of variable coils.

A monthly maintenance routine is suggested as follows:

1. Clean with crocus cloth low power and rectifier contacts.
2. Clean all socket and tube prong contacts.
3. Check all filters, and clean if required.
4. Tube rotation according to schedule.
5. Give a general detailed close inspection of each unit in the transmitter with whatever test of components seems advisable.
6. Check all connections for tightness and heating.
7. Check tube radiators and clean any dust accumulation.
8. Test air pressure switch.

TEST EQUIPMENT

The operating performance of broadcasting equipment may be kept to high standards by having and using certain items of test equipment. It is impossible to say which should be had in preference to others, but the utility of each will be pointed out.

PORTABLE VOLT-OHMMETER to use for quick checking of voltage, continuity and resistance. The self-contained type is preferable for convenience.

VACUUM TUBE VOLTMETER to use for checking audio signal voltages and d.c. voltage where low current drain of the meter is essential. At least one meter either VTVM or volt-ohmmeter should be available which would read 3000 volts d.c.

AUDIO OSCILLATOR to use to obtain a signal source for checking audio equipment.

VU METER AND PAD to obtain input level readings for frequency response measurements.

NOISE AND DISTORTION ANALYZER to use for checking both radio frequency and audio units for distortion and noise. If the unit does not contain a diode, a diode unit will be required.

OSCILLOSCOPE to use for observing wave shapes, calibrating modulation monitor, etc.

This test equipment can be used not only for transmitter maintenance but also in keeping the studio equipment at peak of performance. Most of these items are listed in the GATES RADIO COMPANY catalog "SPEECH

INPUT EQUIPMENT", and all are obtainable through this company. Where test equipment is available, a regular check should be made of the equipment as a part of the maintenance schedule.

TOOLS

A list of desirable tools would probably include everything on the store counter. Where station personnel build part of the station equipment, or construct equipment for home or amateur use, the tool rack will usually be found to be well equipped. Where tools are used strictly for maintenance, the tool supply is too frequently lacking important tools. The design and construction of the transmitter has been to use "standard" parts wherever possible, and no special tools are required.

The recommended tool list is as follows:

1. Screwdrivers - 5 or 6 ranging from 1/16" bit to 7/16". An offset screwdriver is frequently time saving. A full set of Phillips screwdrivers should also be included.

2. Wrenches - 3 or 4 from 4" to 10" adjustable. These can well be augmented by sets of open end box wrenches, and socket sets.

3. Spintite wrenches are exceedingly convenient in working close quarters, such as transformer terminal boards.

4. Soldering irons - 2, one small, fairly rapid heating, the other heavy duty for soldering tubing, large lugs, etc.

5. Pliars - needle nose medium and heavy duty side cutters, Bernard and vise grip types are frequently very useful. Also, one or two sizes of cutters should be included.

6. Electric drill - The 1/4" medium duty is probably the best for general use. A light duty drill may fail at an inopportune time; a heavy duty drill is generally too heavy and cumbersome for average station use.

7. Among the miscellaneous tools, at least standard hacksaw should be included, as well as tin shears, vise, hammer, etc.

8. Allen wrenches from 6-32 to 1/4-20 sizes.

To complete the workshop, an assortment of nuts, bolts, lockwashers and washers, some wire, #12 and #14 flameproof, hookup wire, bus wire #8, #12 and #16, some Packard cable, an assortment of soldering lugs should be on hand. Many other items suggest themselves.

SPARE PARTS

Except for tubes, frequently a station has no spare parts. The Gates' BC-5P has been designed with the intention that there should be no part failures. This, of course, must be qualified "in normal operation". The most common sources of damage are perhaps electrical storms which may damage condensers in the antenna system, power amplifier tank and coupling and the R.F. meters. Accidental short circuits are damaging to switch and relay contacts. Breakage may occur to resistors especially of the ferrule type.

The location would also be a determining factor. Near large cities many substitute parts may be obtained should such be required. Stations located near smaller cities often do not have access to substitute replacement parts.

The problem then reserves itself to one of individual conditions. The Gates' BC-5P transmitter has been designed as far as practical for the duplication of parts. The engineering department of Gates Radio Company will be glad to cooperate to work out a spare parts inventory to meet the customer's requirements and desires.

SAFETY PRECAUTIONS

Rigid rules for safety should be established and enforced.

Any time the enclosures must be entered, if some circuits are energized, such as the filaments, the "HIGH VOLTAGE DISCONNECT" (S107) should be opened. There are several ways these circuits could be closed, such as accidental short of test prods, or grounding stick, across certain terminals that would energize a contactor; a second operator might forgetfully push closed one of the contactors. If the transmitter is fully shut down, the service disconnect should be opened unless checking is being done on some circuit, then at least the procedure above should be followed.

The rectifier filters are equipped with grounding relays, which normally give protection from high voltage, but even then enough voltage may be passed to give a severe shock. Condensers in the BC-5P have been so arranged that they are shorted by the grounding switches, or have some form of drain. However, in event of a fault, or some phase of maintenance, a condenser might be left with a dangerous charge. Always test the high voltage condensers with a grounding stick before handling components.

Do not try to make repairs on a "hot" circuit. The accidental slip of a tool might cause far more damage than to shut completely down in the first place, or result in physical harm to the operator.

A good many times an operator will be working alone. This calls for continuous caution on his part, that he use tools sensibly, that if he needs to reach the top part of the transmitter he have a safe stepladder, that if he has to move a heavy unit he has the work so organized to require the minimum of physical strain such as having blocks and rest positions ready.

Extreme care should be used around the power tubes. In working around them, if there is any possibility that a tool may slip and hit the tube, remove it to a safe place. Such a blow may shatter the glass and cause severe injuries to face and eyes.

When more than one operator is working on the transmitter, make sure that everyone is clear before applying any voltages. The best way is to get verbal clearance from everyone, then announce the voltage is being applied. Before closing any units to apply high voltages, make sure all personnel are out of the enclosure.

Do not short out door interlocks to get inside of a unit in operation.

GUARANTEE

This equipment is fully guaranteed by the Gates Radio Company of Quincy, Illinois, to be free from all defects in materials and workmanship and will be repaired, replaced or adjusted in accordance with the manufacturer's option and terms as outlined below.

1 - Gates believes the purchaser has every right to expect first-class quality materials and workmanship and has created rigid inspection and test procedures plus excellent packing methods to assure good arrival at destination.

2 - Gates agrees to supply daily factory service, and will make emergency shipments at any time where possible.

3 - Gates fully guarantees, under normal and proper usage, all component parts in Gates equipment, except as noted. These parts will be replaced or repaired at the option of Gates as follows:

Transmitter Parts: main power or plate transformer, modulation transformer, modulation reactor, main tank condensers.

(replacements or repairs) - where less than 1 year old...no charge, between 1 and 2 years old 50% or new price

Moving Parts: Guaranteed for six months.

Electron Tubes: Subject to manufacturer's warranty at the time of shipment. Adjustment will be made to the customer as given to Gates Radio Company by the tube manufacturer.

All other component parts: (Except as listed above or below) Guaranteed for one year.

Abuse: Damage resulting from an Act of God, or by fire, wind, rain, hail, or any other condition other than normal usage is not covered by the guarantee.

4 - Date of invoice to original user-purchaser and date of receipt by Gates Radio Company of notification from the customer will determine the age of equipment or parts.

5 - In case of adjustment, as on certain transmitter parts listed above "new price" is Gates' current price at time of replacement and/or adjustment.

6 - This guarantee covers only Gates manufactured parts and complete Gates equipments including all parts therein, with exceptions as noted. Any purchased part not manufactured by Gates will be subject to the manufacturer's guarantee, unless such part is a unit incorporated in Gates manufactured equipment.

7 - Transcription pickups, regardless of make, are guaranteed for ninety days - said guarantee including every associated part of the pickup except the stylus, which because of its fragility is not guaranteed by Gates.

8 - Where the replacement part in question must be supplied under the guarantee before the defective part can be returned for inspection, as might sometimes be required, the customer will be billed in full and credit or adjustment will be given on receipt of the defective part in accordance with this guarantee and the terms herein. In order for credit adjustment to be received in line with this guarantee the defective or replaced part must be shipped prepaid to Gates Radio Company or to any other destination requested by Gates within two weeks of the date of the invoice covering the replacement part. Any item alleged defective shall not be returned to Gates until after written permission has been first obtained from Gates' home office at your request.

9 - All shipments under this guarantee will be made f.o.b. Quincy, Illinois and all materials returned will be shipped prepaid by the customer f.o.b. Quincy, Illinois

10 - As a material part of this guarantee the customer agrees to employ capable technical personnel to maintain all equipment under this guarantee in good, normal condition, properly serviced and cleaned and to use said equipment as and for the purpose intended by seller. This guarantee does not extend to the supply by Gates of any personnel to make any replacement, repair or adjustment.

11 - Gates shall not be responsible for damages to items in transportation or careless handling; or injuries to persons or damage to property arising out of the use or operation of Gates equipment or parts, but Gates will supply repair or replacement items speedily, which will be billed to the customer who, in turn, will place claim with the carrier, with assistance from Gates if necessary and when so requested.

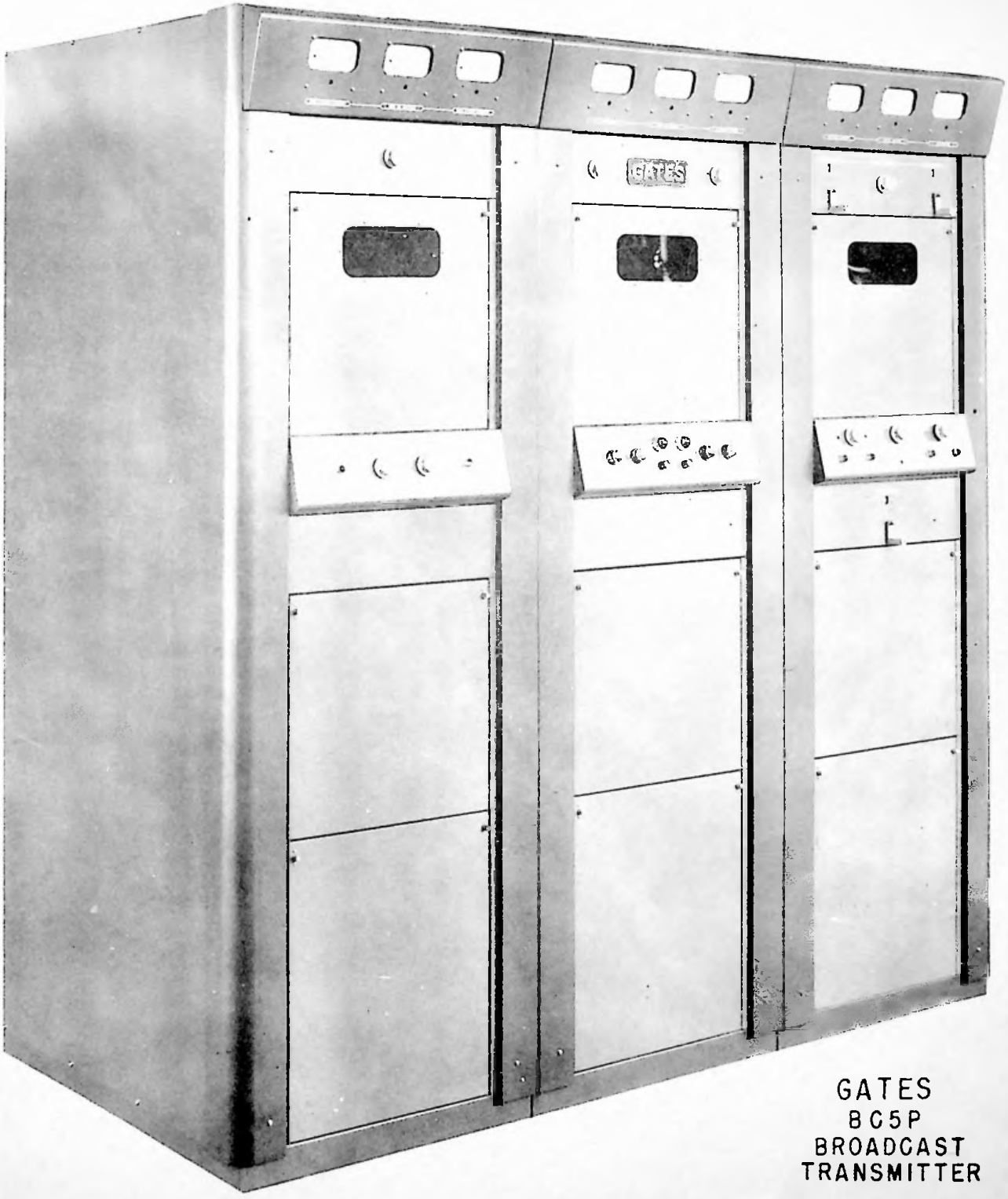
12 - Delays in fulfilling any part of this guarantee because of depleted stock, floods, war, strikes, power failures, transportation delays, or failure of suppliers to deliver, or because of Acts of God or any other conditions beyond the control of Gates, does not in any way render Gates liable under this guarantee; however, every effort will be made to render prompt service.

13 - Gates agrees that this equipment sold is manufactured, where need be, under Royalty License Agreements with Western Electric Company and Radio Corporation of America.

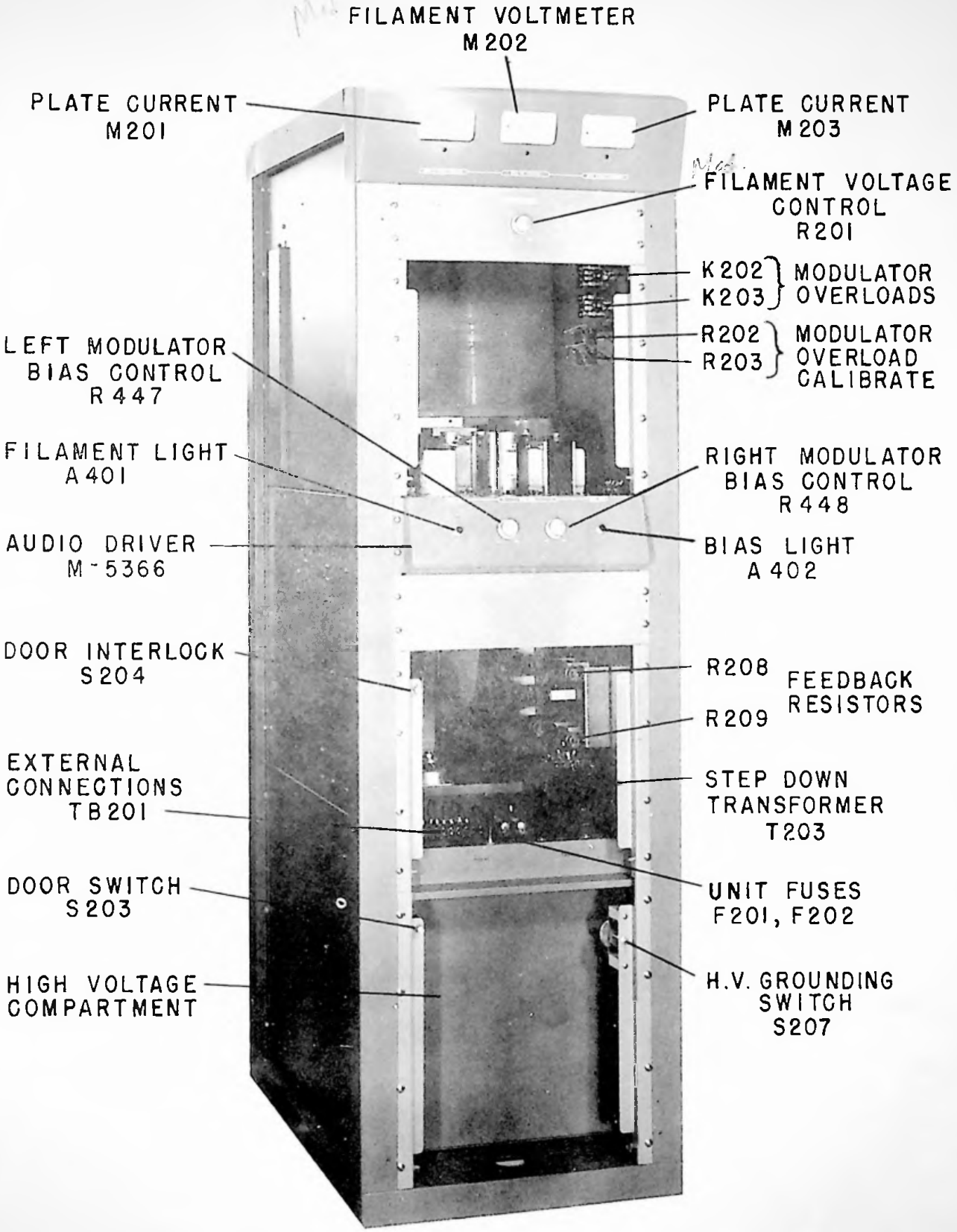
14 - This Guarantee is not transferable from the original user-purchaser, and no right of subrogation is given herein.

15 - This Guarantee is effective on all standard Gates cataloged items sold after June 11, 1951.

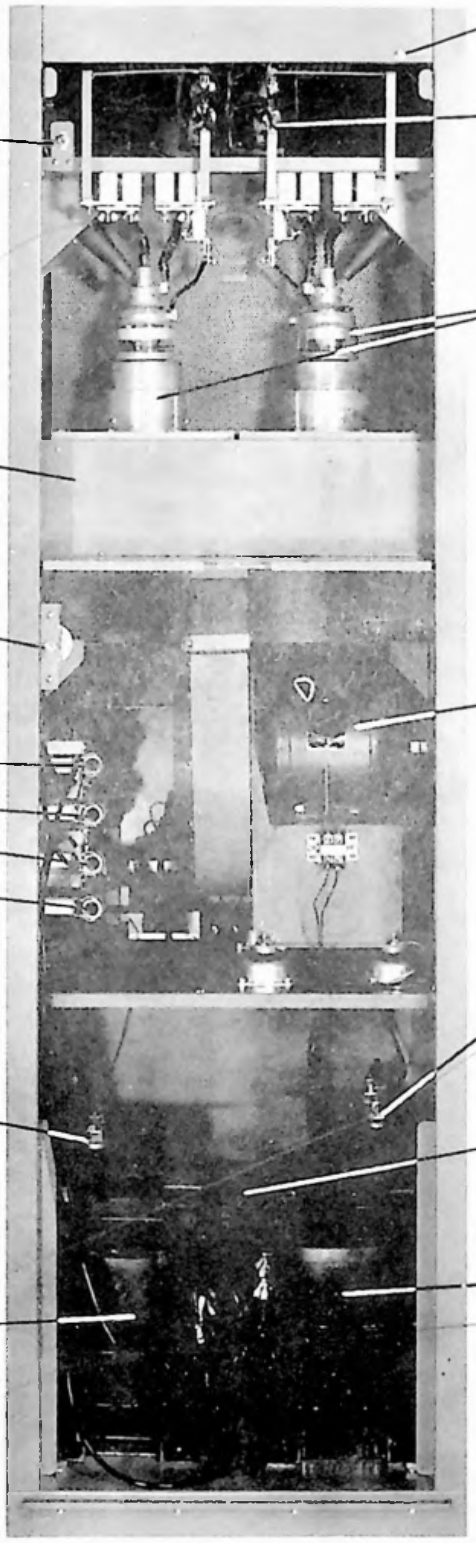
Gates Radio Company
Quincy, Illinois



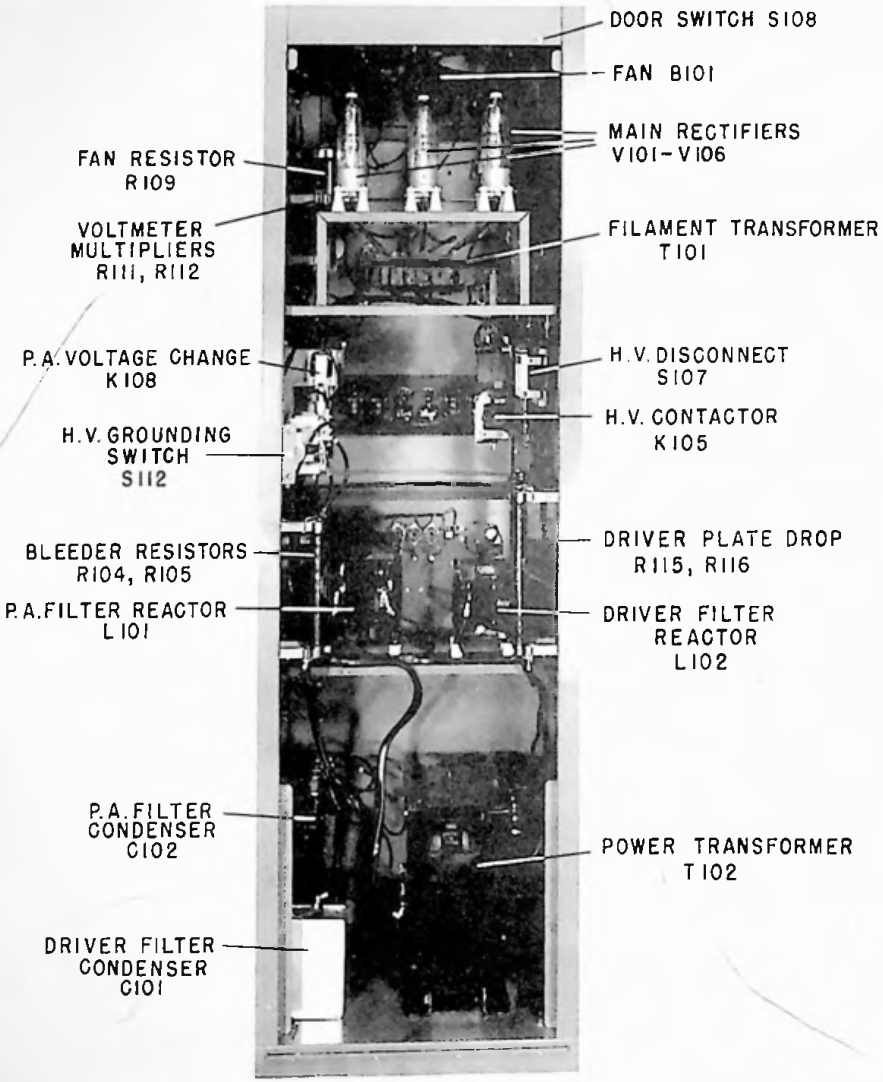
GATES
BC5P
BROADCAST
TRANSMITTER



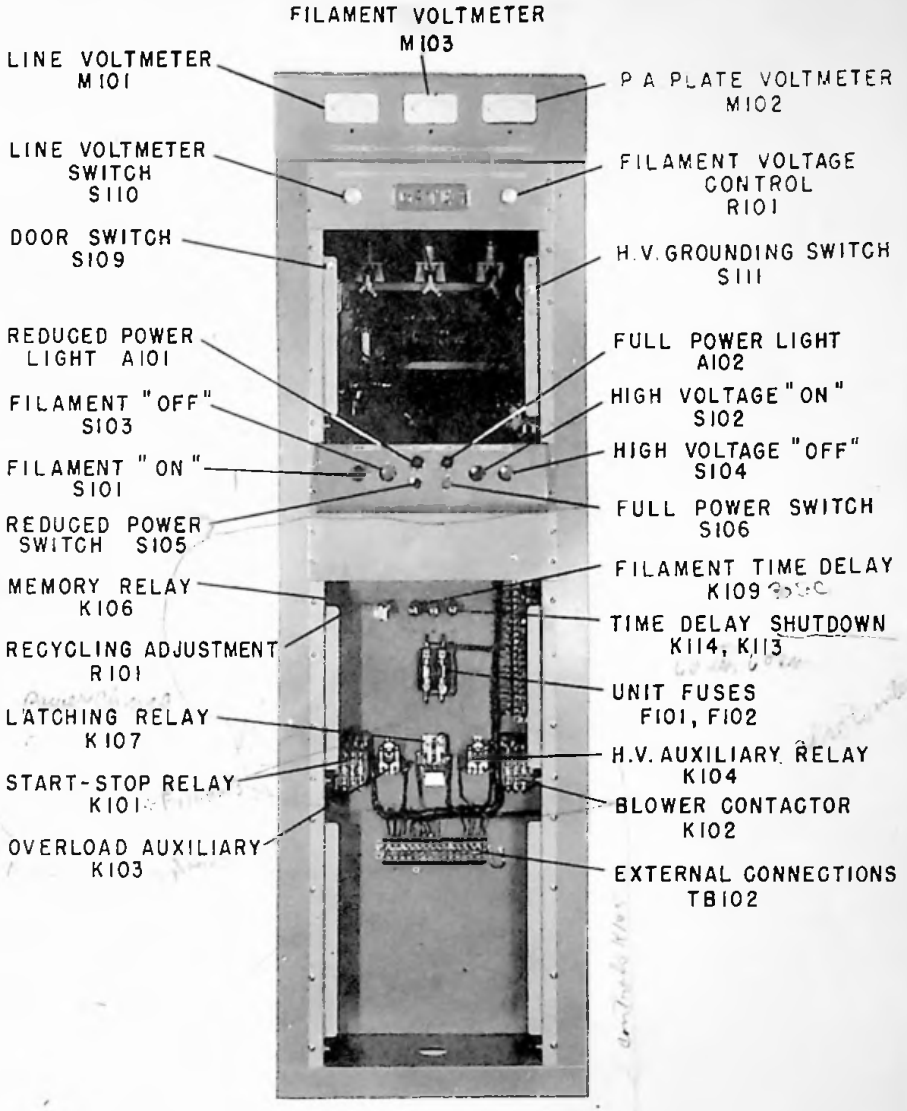
BC5P
MODULATOR UNIT
M-5184



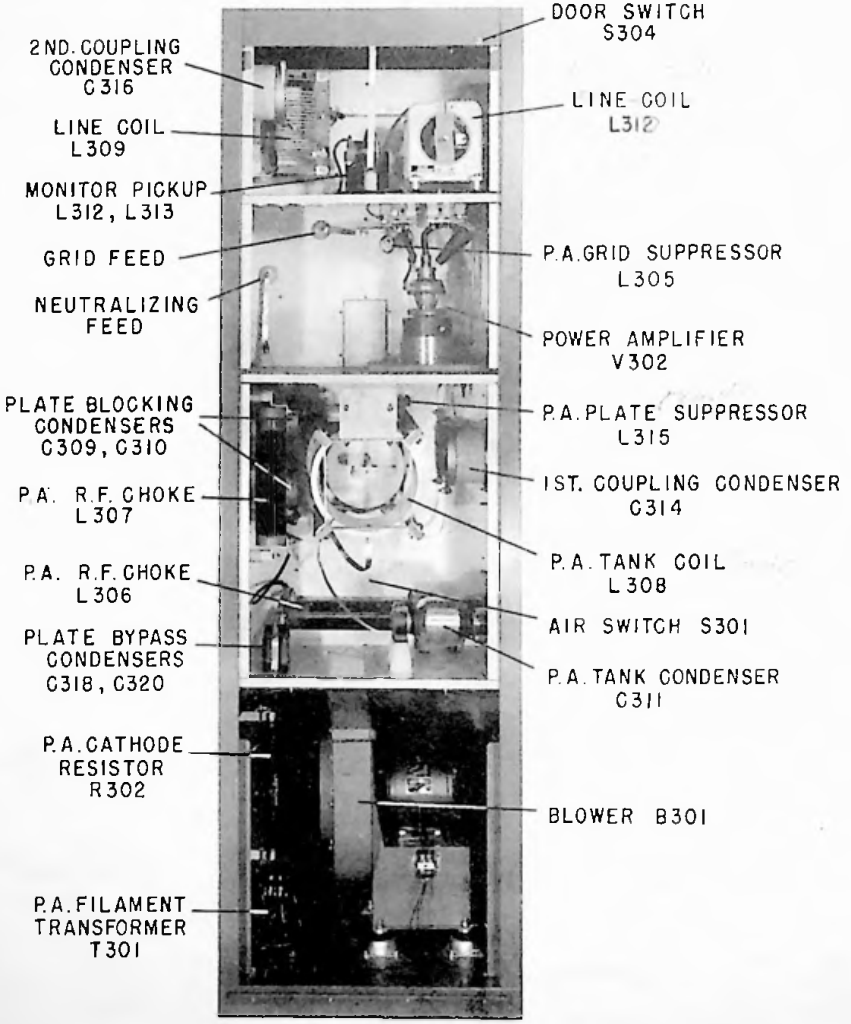
BC5P
REAR VIEW MODULATOR UNIT
M-5184



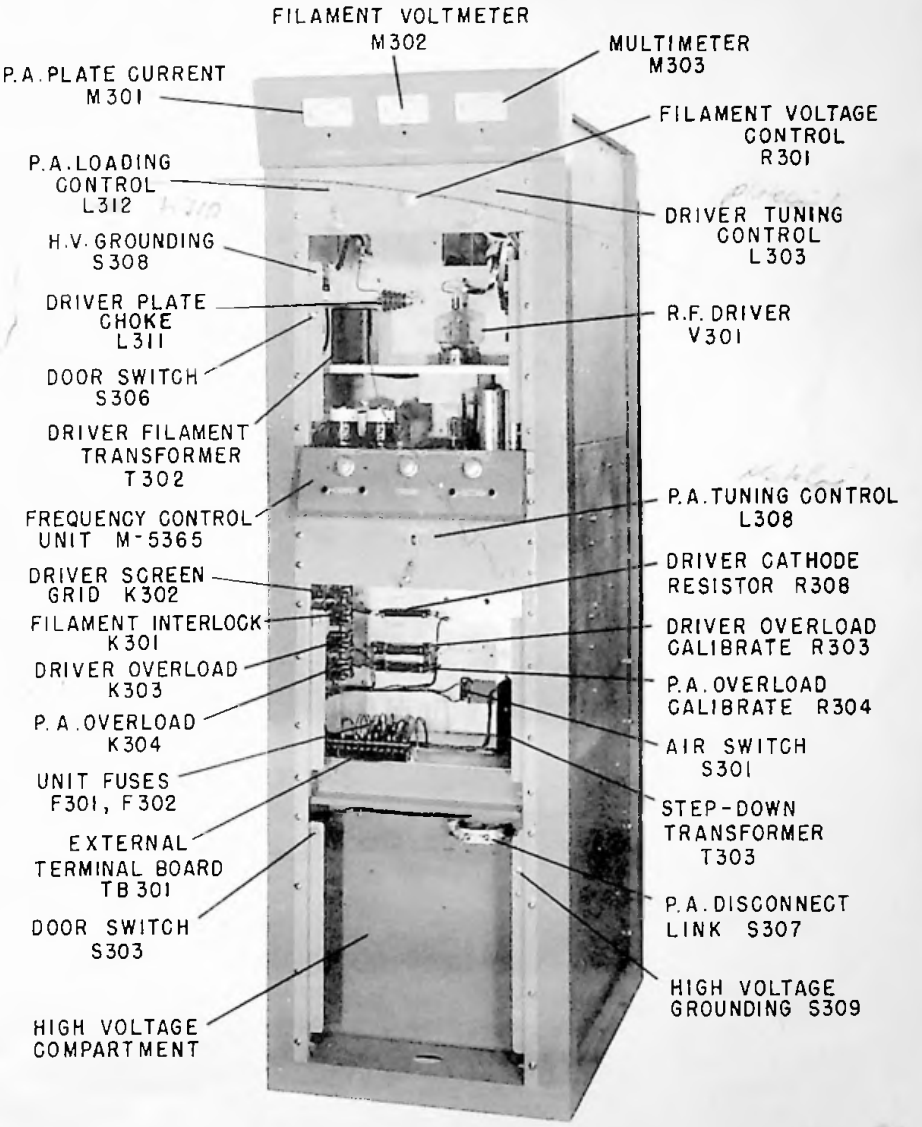
BC5P
REAR VIEW POWER UNIT
M-5182



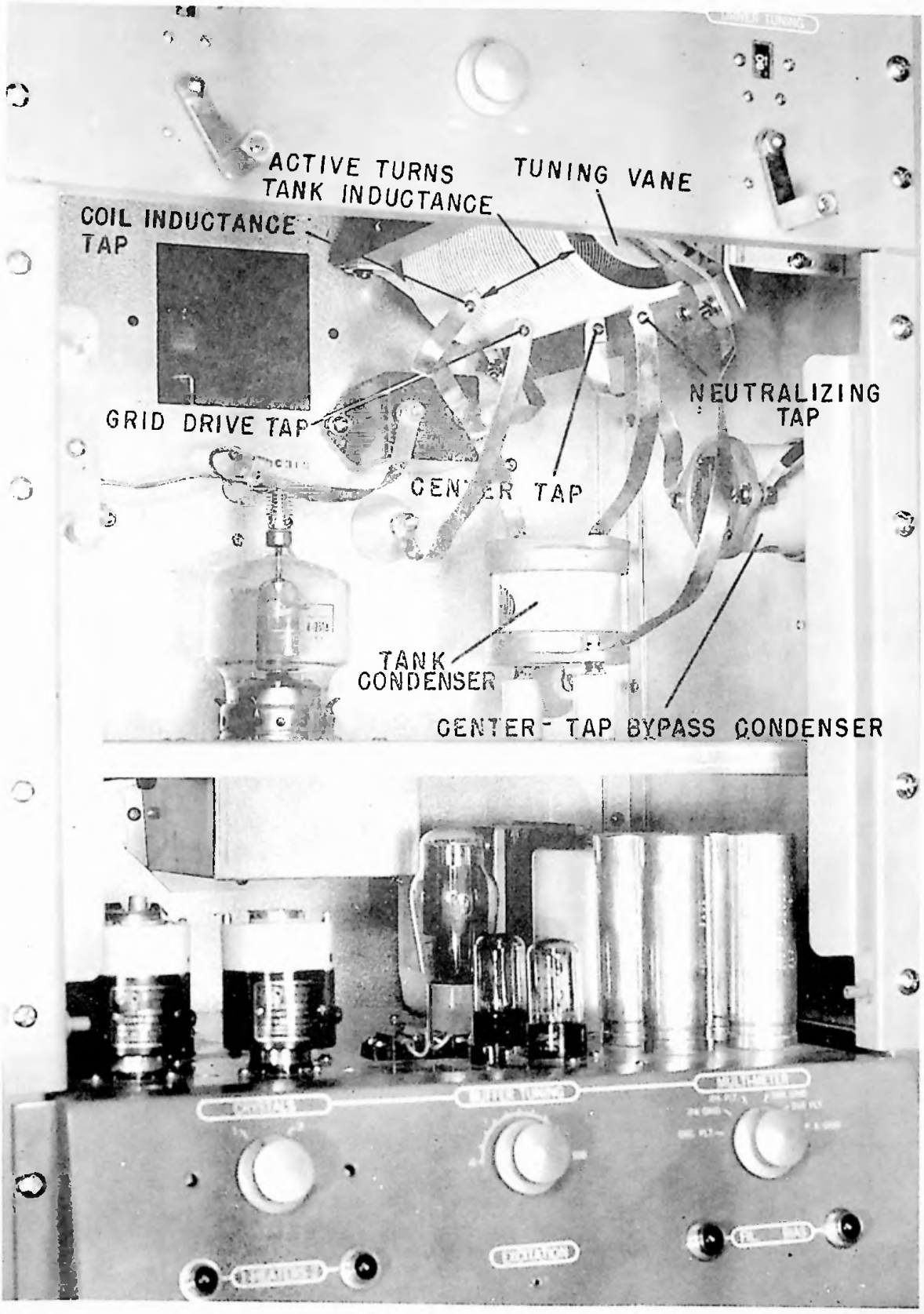
BC5P
POWER UNIT
M-5182



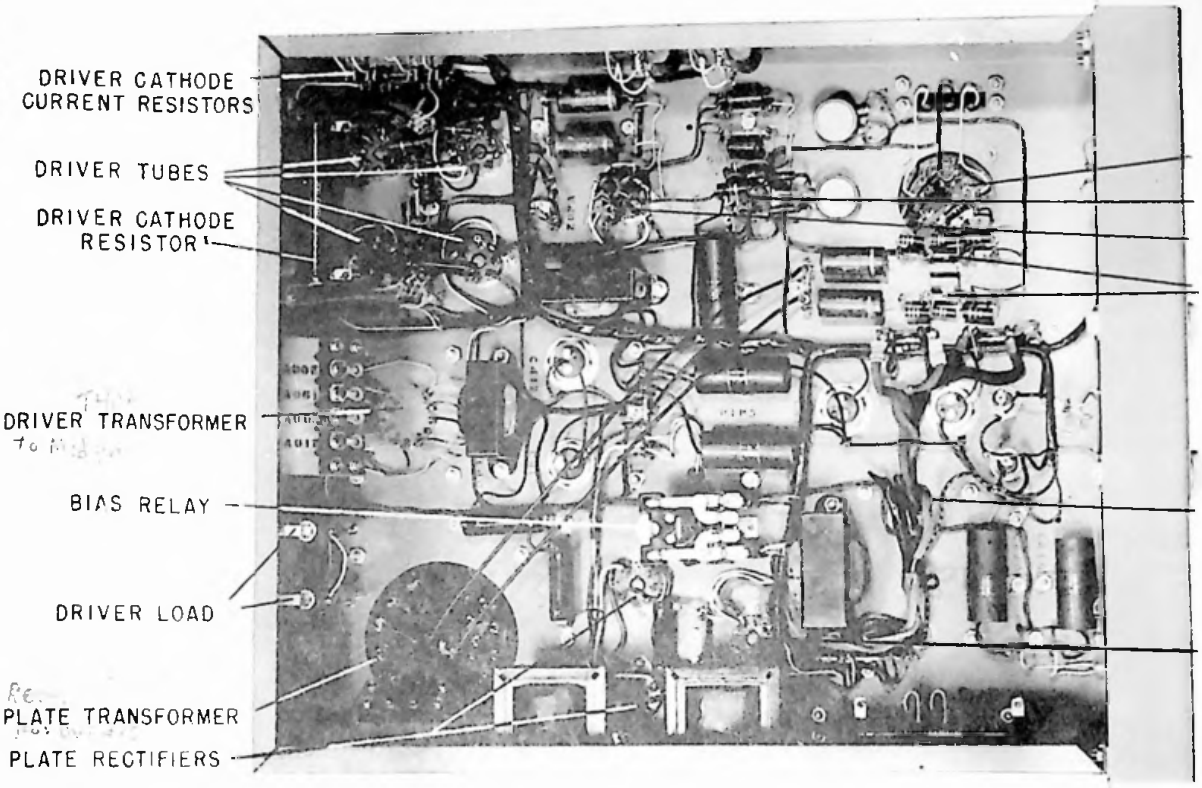
BC5P
REAR VIEW R.F. UNIT
M-5188



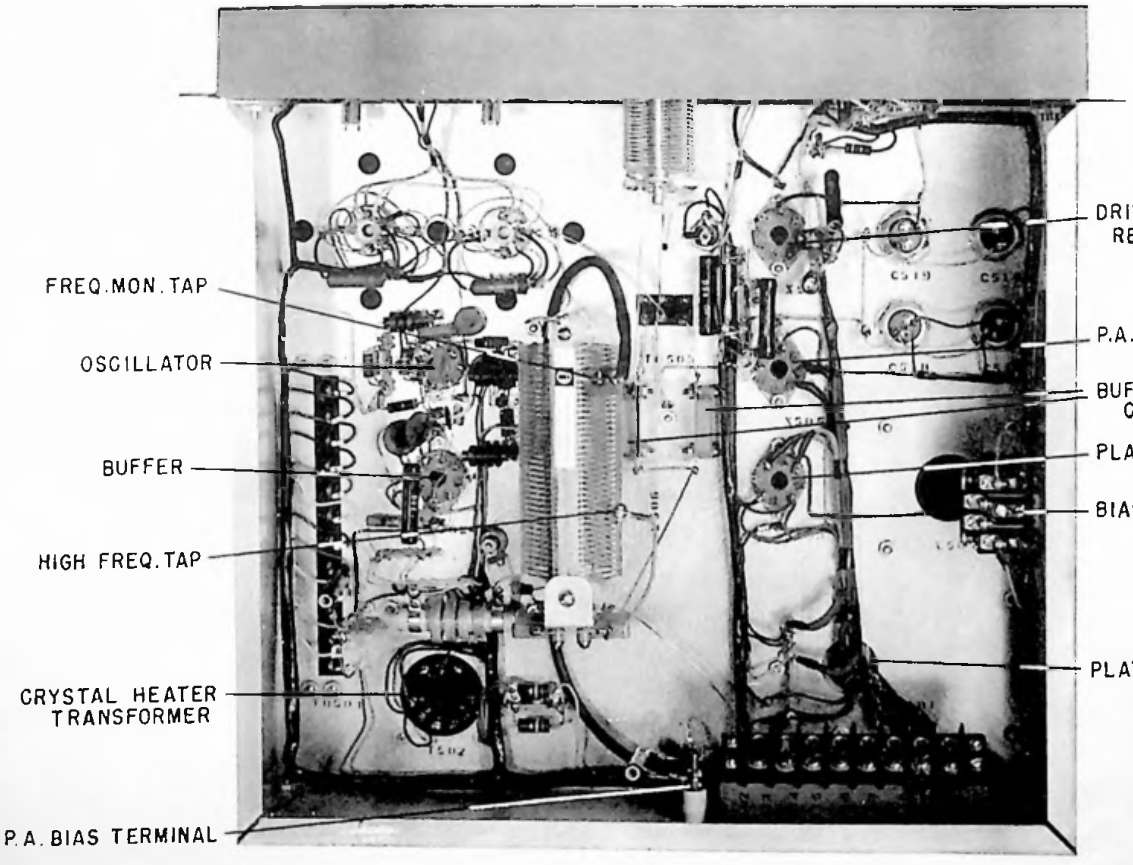
BC5P
R.F. UNIT
M-5188



BC5P
R.F. DRIVER
M-5188



BC5P
AUDIO DRIVER UNIT
M-5366



BC5P
FREQUENCY CONTROL UNIT
M-5365

PARTS LIST

POWER SUPPLY SECTION, M5182

SYMBOL NO.	DWG. NO.	DESCRIPTION
A101,A102		Lamp, 10W., 230V., Screw
B101		Fan, 115V., 50/60 Cy. 1450 RPM 6W.
C101		Cap., 8 mfd., 3000V.
C102		Cap., 4 mfd., 7500V.
C103		Cap., 16 mfd., 450V.
CR101		Selenium Rectifier, 25 MA D.C.
F101,F102		Cartridge Fuse, 10 amp., 250 V.
K101,K102		Start-Stop & Blower Contactor, 220V., 50/60 cy.
K103,K104		O.L. & H.V. Aux. Contactor, 220V., 50/60 cy. 574
K105		H.V. Contactor, 220V., 50 Amp.
K106		Memory Relay, 1-B, 230V., D.C.
K107		Latching Relay, both coils 230V., 50/60 cy., D.P.D.T.
K108	D-20133-103	Voltage Change Relay
K109		Fil. Time Delay Relay 57A0022000/3179
K110	C-19430-101	Step-Start Magnetic Contactor Assembly
K111,K112		A.C. Overload Time Limit Relay, 60-120 amp. Contact N.C.
K113		1st Shut-Down Time Delay Relay
K114		2nd Shut-Down Time Delay Relay 2195
L101	AC-3143E	Filter Reactor.
L102		Filter Reactor, 8 hy. 600 MA
M101,M103		A.C. Line & Rect. Fil. Voltmeter, 0-300 V. A.C.
M102		P.A. Plate Voltmeter, 0-1 MA D.C. movement with 0-6 KV Scale
R101		Fil. Voltage Rheostat, 16 ohm 100W.
R102		Res., 3000 ohm, 10W.
R103		Res., 10K ohm, 110W. Ferrule Type
R104,R105		Res., 100K ohm, 160W. Ferrule Type
R106		Res., 4700 ohm, 2W., 10%
R107		Control, 5K ohm
R108		Res., 12K ohm. 1W., 10%
R109		Res., 200 ohm, 160W Ferrule Type
R110,R111		Meter Multiplier, 3 megohm 3 KV 1 MA
R112,R113,R114		Res., 6000 ohm, 10W.
R115,R116		Res., 1000 ohms, 190W. Ferrule Type
S101,S102		Fil. & H.V. On Pushbutton Switch (Black)
S103,S104		Fil. & H/V. Off Pushbutton Switch (Red)
S105		Low Power Pushbutton Switch, Black
S106		High Power Pushbutton Switch (Red)
S107		H.V. Disconnect Three Pole Knife Switch 60 amp.

SYMBOL NO.	DWG. NO.	DESCRIPTION
S108,S109		Door Interlock Switch
S110		Line Voltmeter Tap Switch
S111,S112	2230-PM-101	High Voltage Grounding Switch Assembly
T101	AF-10432E	Fil. Transformer
T102	AP-8000E	Power Transformer
TB101		Terminal Board
TB102		Terminal Board
TB103		Fan Terminal Board
V101,V102,V103, V104,V105,V106		Rec. Tube, 8008
XA101		Lower Power Pilot Light Assembly (Green)
XA102		High Power Pilot Light Assembly (Red)
(XF101 & XF102)		Dual Fuseblock
XK109,XK113,XK114		Relay Socket
XV101,XV102,XV103 XV104,XV105,XV106		Tube Socket

MODULATOR SECTION

B201		Blower, CW Rotation, 1/4 H.P. 1450 RPM 115/230 V. Single Phase 50/60 Cycle Cont. Duty Oiler, Non-sealed Bearing 270 CFM at 1.4" Static pressure, Upblast.
C201		Mod. Cap., 2 mfd., 7500V.
C202		Filter Cap., 4 mfd., 7500V
F201,F202		Cartridge Fuse, 10 amp. 250V.
K201		Filter Interlock Contactor, 230 V. 50/60 cy.
K202,K203		Overload Contactor, 6 V.D.C.
K204	C-19430-101	Step-Start Magnetic Contactor
L201	AC-7719E	Mod. Reactor
L202	AC-3143E	Mod. Filter Choke
M201,M203		Mod. 1 & 2 Plate Current Meter 0-2 amp D.C.
M202		Mod. Fil. Voltmeter, 0-10 V. A.C.
R201		Fil. Voltage Rheostat, 5 ohm, 150 W.
R202,R203		Adj. Res., 5 ohm, 50W.
R204,R205, R206,R207		Res. 100K ohm, 160W. Ferrule Type
R208,R209		Feedback Res., 5000 ohm, 38 W. Ferrule Type
R210		Surge Suppressor Res., 10K ohm 110W. Ferrule Type
S201		Air Switch, N.O.
S202		Fil. Disconnect Switch, S.P.S.T.
S203,S204,S205		Door Interlock Switch
S206,S207	2230-PM-101	High Voltage Grounding Switch Assembly
T201	AM-7718E	Mod. Transformer
T202	AF-10546E	Fil. Transformer
T203	AS-11278E	Stepdown Transformer

SYMBOL NO.	DWG. NO.	DESCRIPTION
TB201		Terminal Board
TB202		Blower Terminal Board
V201,V202		Mod. Tube, 3X2500F3
(XF201,XF202)		Dual Fuseblock
XV201,XV202	2247-PM-101	Tube Socket Assembly

R.F. SECTION

B301	Peerless CEW56C 1/4hp 1450RPM 5/2.5A - 115/230V →	Blower, C.W. Rotation, 1/4 H.P. 1450 RPM, 115/230V. Single Phase, 50/60 cy. Cont. Duty, Oiler, Non-sealed Bearing 270 cfm at 1.4" Static Pressure Upblast
C301,C302,C303		Cap., .01 mfd., 600(w)V.
C304		4-250A Driver Tank Cap. (Det. by oper. freq.)
C306		Capacitor, .02 mfd.
C307,C308		Cap., .02 mfd., 1000(W)V.
C309,C310		Cap., .004 mfd.
C311,C312		PA Tank Vacuum Padder Cap. (Det. by oper. freq.)
C313		Vacuum Cap., 25 mmfd., 20KV
C314,C315		1st Coupling Cap., (Det. by oper. freq.)
C316,C317		2nd Coupling Cap., (Det. by oper. Freq.)
C318,C319,C320		Cap., .002 mfd., 12.5 KV
C321,C322,C323		Meter Bypass Cap., .006 mfd., 500(W)V.
F301,F302		Cartridge Fuse, 10 amp., 250V.
K301,K302		Fil. & SG Contactor, 230V. 50/60 cy.
K303,K304		Dvr. & P.A. O.L. Contactor, 6 V.D.C.
L301		R.F. Choke, 2.5MH
L303	87FA4634	Driver Plate Coil
L311		R.F. Choke
L305	A-11358-101	P.A. Parasitic Suppressor Ass'y
L306,L307	C-19560-101	P.A. Plate Choke Assembly
L308	78FC2568	P.A. Plate Coil Assembly
L309	17FC1654	Loading Coil Assembly
L310 26 μh / 20 Amp.	26VC2144	Variable Loading Coil Assembly
L312	A-11792-1	Mod. Mon. Loop
L313	A-11790-101	Mod. Mon. Coil Assembly
L315	A-11358-102	PA Plate Parasitic Suppressor Assembly
M301		P.A. Plate Current Meter, 0-2 amp. D.C.
M302		PA Fil. Voltmeter, 0-10 V. a.c.
M303		Multi-meter, 0-1 ma. D.C. Movement with 0-30 and 0-300 MADC Scale
R301		Fil. Voltage Rheostat, 10 ohm, 150W.
R302		Res., 50 ohm, 190W. Ferrule Type
R303		Dvr. O.L. Adj. Res., 50 ohm, 50 W.
R304		P.A. O.L. Adj. Res., 5 ohm, 50 W.
R305,R306		Res., 2000 ohm, 160W. Type (Ferrule)
R307		Res., 100 ohm, 10W.
R308		Res., 250 ohm, 50W.

SYMBOL NO.	DWG. NO.	DESCRIPTION
S301		Air Switch, N.O.
S302		Fil. Disconnect Switch
S303, S304, S305, S306		Door Interlock Switch
S307	A-8060-1	PA Disconnect Switch Blade
S308	2231-PM-101	H.V. Grounding Switch Assembly
S309	2230-PM-101	H.V. Grounding Switch Assembly
T301	AF-7782E	PA Fil. Transformer
T302		RF Driver Fil. Transformer
T303	AS-11278E	Stepdown Transformer
TB301		Terminal Board
TB302		Terminal Board
TB303		Blower Terminal Board
V301		Driver Tube, 4-250A
V302		PA Tube, 3X500F3
(XF301, XF302)		Dual Fuseholder
XV301		Driver Tube Socket
XV302	2247-PM-101	PA Tube Socket Assembly

AUDIO DRIVER UNIT (MODULATOR SECTION)

A401, A402	Lamp, 6-8V.
C401, C402	Cap., .5 mfd., 400(W)V.
C403, C414, C415, C419, C420	Cap., 16 mfd., 450V.
C404, C405	Cap., .05 mfd., 400(W)V.
C406, C407, C408, C409	Cap., .5 mfd., 600(W)V.
C412, C413, C416, C417	Cap., 4 mfd., 600V.
C421, C422	Cap., .0005 mfd., 500(W)V.
F401, F402	Fuse, 3 amp., 250V.
K402	Bias U.V. Relay D.P.D.T., 115V. D.C.
L401	Filter Choke
L402, L403	Filter Choke
L404, L405	Bias Filter Choke
R405, R406	Res., 51K ohm, 1W., 5%
R407, R408, R424, R425	Res., 27K ohm, 2W., 5%
R409	Control, 5000 ohm
R410, R411	Res., 560K ohm, 1W., 10%
R412, R414, R419, R420	Res., 2000 ohm, 1W., 5%
R413	Potentiometer, 1000 ohm, 2W.
R415, R416, R422, R423	Res., 33K ohm, 2W., 10%
R417, R418	Res., 100K ohm, 1W., 5%
R426, R427, R428, R429	Res., 1000 ohm, 1W., 10%

SYMBOL NO.	DWG. NO.	DESCRIPTION
R430,R431, R432,R433		Res., 10 ohm, 1W., 5%
R434		Res., 200 ohm, 50W.
R435,R436, R437,R438		Res., 100 ohm, 2W., 10%
R439,R440, R441,R442		Res., 100 ohm, 10W.
R443,R444		Res., 75K ohm, 1W., 5%
R445,R446,R449		Res., 5000 ohm, 20W.
R447,R448		Rheostat, 1500 ohm, 25W.
R450		Res. 15K ohm, 20W.
R451		Res., 22K ohm, 2W., 10%
R453		Res., 2500 ohm, 50W.
R454		Res., 15K ohm, 10W.
R455,R456		Res., 180K ohm, 1W., 10%
T401	AI-3002	Audio Input Transformer
T402	AD-11770E	Driver Transformer
T403		Rect. Fil. Transformer
T404	AP-9653T	Bias Power Transformer
T405		Rect. Plate Transformer
TB401		Terminal Board
TB402		Audio Input Terminal Board
TB403		Feedback Terminal Board
TB404		Terminal Board
V401,V402		Tube, 6SN7GTA
V403,V404, V405,V406		Tube, 6550
V407,V408,V409		Tube, 5R4GY
XA401,XA402		Fil. & Bias Pilot Light Assembly (Green)
XF401,XF402		Fuseholder Assembly
XV401,XV402		Turret Socket
XV403,XV404,XV405, XV406,XV407,XV408, XV409		Socket

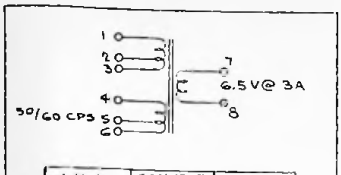
FREQUENCY CONTROL UNIT

A501,A502, A503,A504	Lamp, 6-8V.
C501,C502	Variable Crystal Trimmer Cap., 3-20 mmfd.,
C503	Cap., .00015 mfd., 500V.
C504	Cap., .00068 mfd., 500V.
C505,C506, C521	Cap., .005 mfd., 1 KV Disk
C507	Cap., 47 mmfd., 1.5 KV Disk
C508,C520	Cap., .01 mfd., 1KV Disk
C509	Cap., .002 mfd., 600(W)V.
C510	Variable Cap., 12-300 mmfd.
C511	Cap., .0004 mfd., 600(W)V.

SYMBOL NO.	DWG. NO.	DESCRIPTION
C512		Cap., .0002 mfd., 600(W)V.
C513		Cap., .005 mfd., 600(W)V.
C514,C515		Cap., .1 mfd. 400 (W)V.
C516		Cap., 2 mfd., 1000 (W)V.
C517,C518,C519		Cap., 4 mfd., 600(W)V.
F501		Fuse, 3 amp. 250V.
K501		Bias Undervoltage Relay, 115V. D.C. DPDT
L501,L502,L503		RF Choke, 2.5 MH
L504	A-11371-101	Plate Parasitic Suppressor Assy.
L505		RF Choke 2 MH
L506	B-13834-101	Coil, 100 microhenry
L507	AC-3123	Filter Choke, 8 henry
R501		Res., 51K ohm, 1W., 5%
R502		Res., 470 ohm, 1W., 10%
R503,R508,R518		Res., 10 ohm, 1W., 5%
R504,R507		Res., 33K ohm, 1W., 10%
R505		Res., 27K ohm, 2W., 10%
R506		Res., 15K ohm, 10W.
R509		Res., 360 ohm, 10W
R510,R514,R515		Res., 1 ohm, 1W., 5%
R511,R520		Res., 51K ohm, 2W., 5%
R512		Potentiometer, 25K ohm
R513		Res., 240 ohm, 1W., 5%
R516		Res., 2000 ohm, 10W.
R517		Res., 10K ohm, 10W.
R519		Res., 20K ohm, 10W.
R521		Res., 450 ohm, 10W
R522		Res., 20K ohm, 20W.
R523		Res., 1500 ohm, 10W.
S501		Rotary Switch D.P.D.T.
S502		Selector Switch
T501		Power Transformer
T502		Crystal Heater Transformer
TB501		Terminal Board
TB502		Terminal Board
TB503		Terminal Board
V501		Tube, 6AG7
V502		Tube, 6146
V503		Tube, 5R4GY
V504,V505		Tube, 6W4
XA501,XA502		Pilot Light Assembly (Red)
XA503,XA504		Pilot Light Assembly (Green)
XF501		Fuseholder
XV501,XV502,XV503, XV504,XV505		Socket
XY501,XY502		Crystal Socket
Y501,Y502		Crystal & Oven (Det. by customer order)

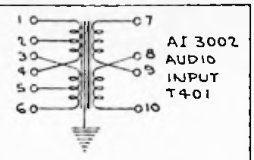
C-19858 ON DWG

478-0142-000

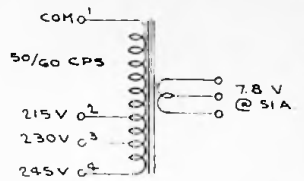


LINE	CONNECT TO	JOIN
115 V	1 + 3	1+6, 3+6
210 V.	1 + 5	2 + 4
220 V	1 + 5	3 + 4
230 V	1 + 6	3 + 4

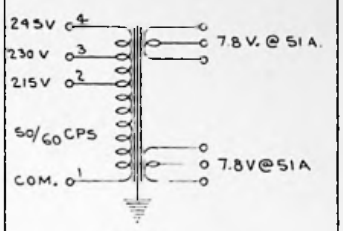
UTC-CG33
T502-CRYSTAL HEATER



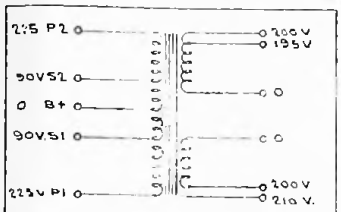
INPUT Z	CONNECT TO	JOIN
500 OHMS	1 + 6	3 TO 4
333 OHMS	1 + 5	3 TO 4
250 OHMS	1 + 6	2 TO 3
200 OHMS	2 + 5	3 TO 4
125 OHMS	1 & 4	1 TO 3 & 4 TO 6
50 OHMS	2 & 4	2 TO 3 & 4 TO 5



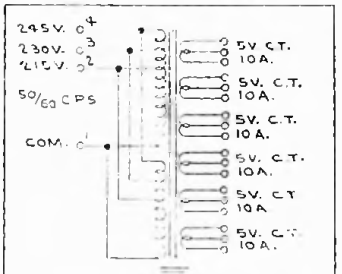
AF 7782
T301 POWER AMP FILAMENT



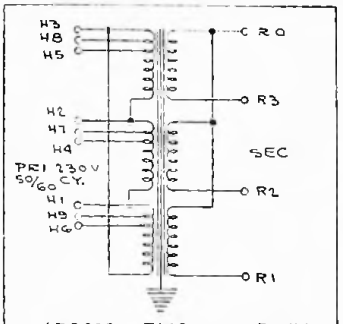
10546
T202-MODULATOR FILAMENT



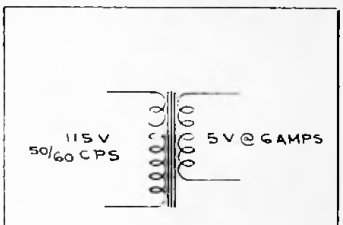
AD 11770
T402 AUDIO DRIVER



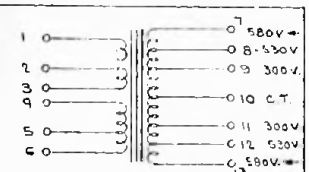
T101 AF 10432
MAIN. RECT. FIL.



AP8000 T102 MAIN POWER
CONNECT TO 7,8,9 NOMINAL 5000 VDC
CONNECT TO 1,2,3 - 5% D.C VOLTAGE
CONNECT TO 4,5,6 +5% DC VOLTAGE

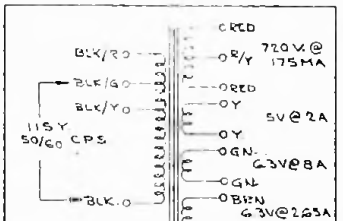


T403
TRIAD F8X
AUDIO RECTIFIER FILAMENT

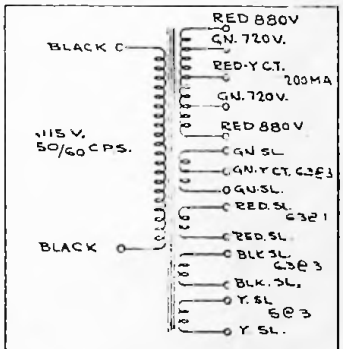


PRI. VOLT	CONNECT	JOIN
105	1 + 2	1+4, 2+3
115	1 + 5	1+4, 3+6

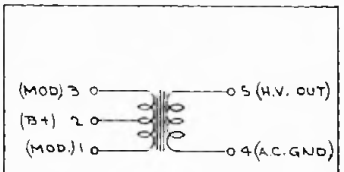
UTC-CQ301
T405 AUDIO PLATE



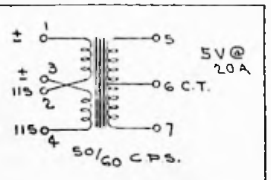
AP 9653
T404 MODULATOR BIAS AND
AUDIO FILAMENT



T501
TRIAD R2GA
FREQ. CTL. SUPPLY

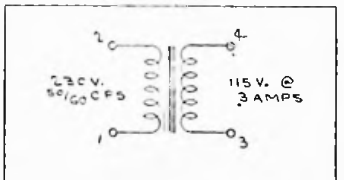


AM 7718
MOD. TRANS.

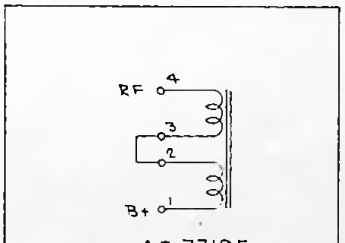


LINE	CONNECT TO	JOIN
115 V.	1 + 2	1+3, 2+4
230 V.	1 + 4	2+3

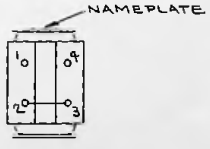
CHITRAN
T303 DRIVER FILAMENT



STEPDOWN TRANSFORMER
AS 11278
T203, T303



AC 7719E
MOD REACTOR
30 HENRIES



BLACK & BLACK PRIMARY

GN. SL GN. Y - CT. GN SL	6.3 @ 8 AMPS
BLK. SL BLK. SL	6.3 @ 3 AMPS
RED SL RED SL	6.3 @ 1 AMP
YELLOW SL YELLOW SL.	5V @ 3 AMPS

H. V

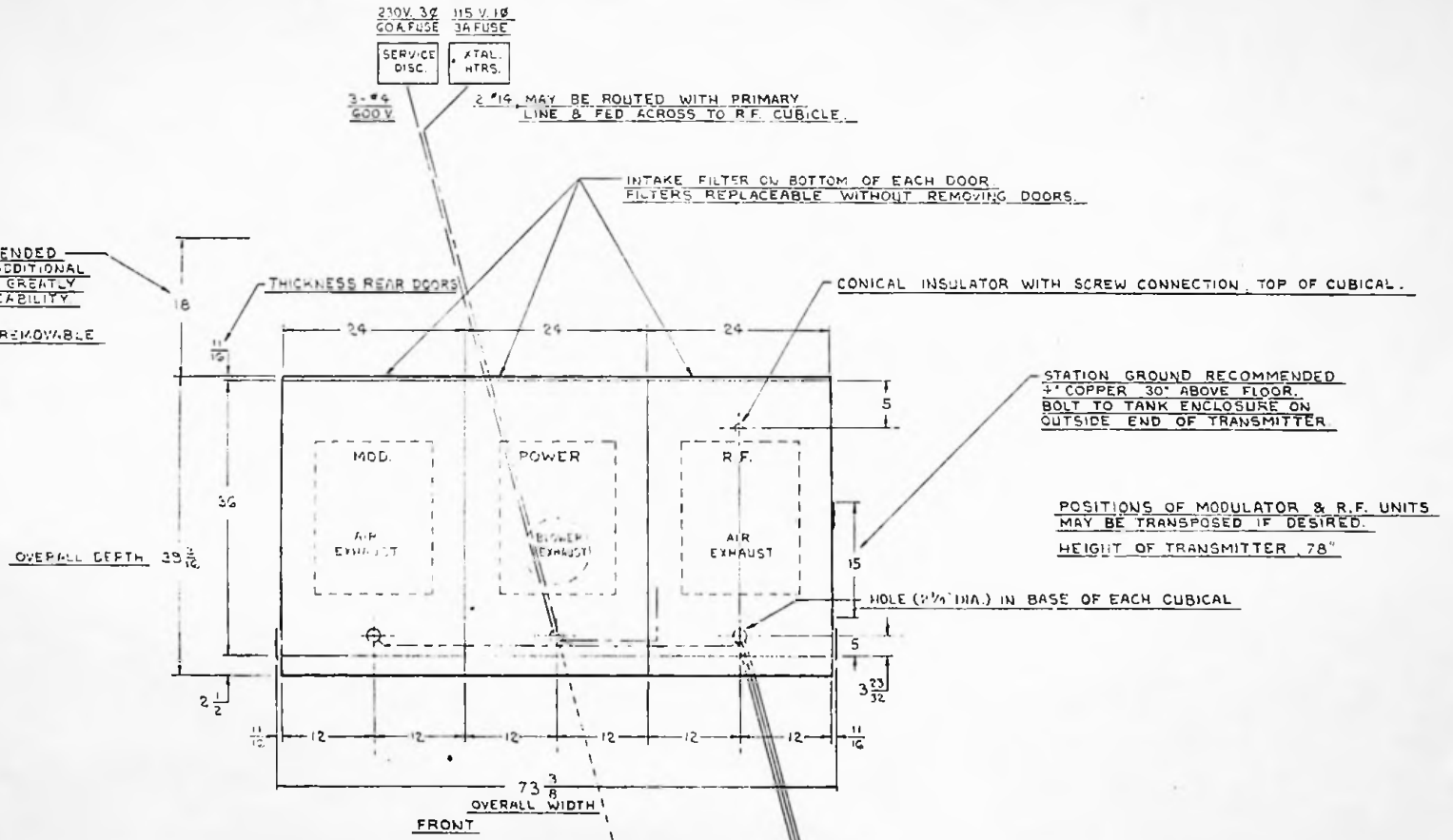
RED TO RED 880 V. @ 200 MA
GN. TO GN. 720 V @ 200 MA
RED & YELLOW CT.

FILTER REACTORS				
SYMBOL	NUMBER	INDUCTANCE	CURRENT	INSULATION (RMS TEST)
L101	AC 3143	4 HY	1.5 A	8000 V.
L202				
L102	EG422	8 HY	600 MA.	4000 W.V.
L401	C19A	10 HY	300 MA.	3000 V.
L402	C5X	12 HY	75 MA.	1500 V.
L403				
L404	C12X	6 HY	160 MA.	1500 V.
L405				
L507	AC 3123	8 HY	200 MA.	1500 V.

TRANSFORMER & REACTOR
CONNECTIONS & DATA
BC5P M5349

C-19858 ON DWG

DRAWING NUMBER
C-19628



FLOOR PLAN LAYOUT, 5 KW XMTR.
M 5349

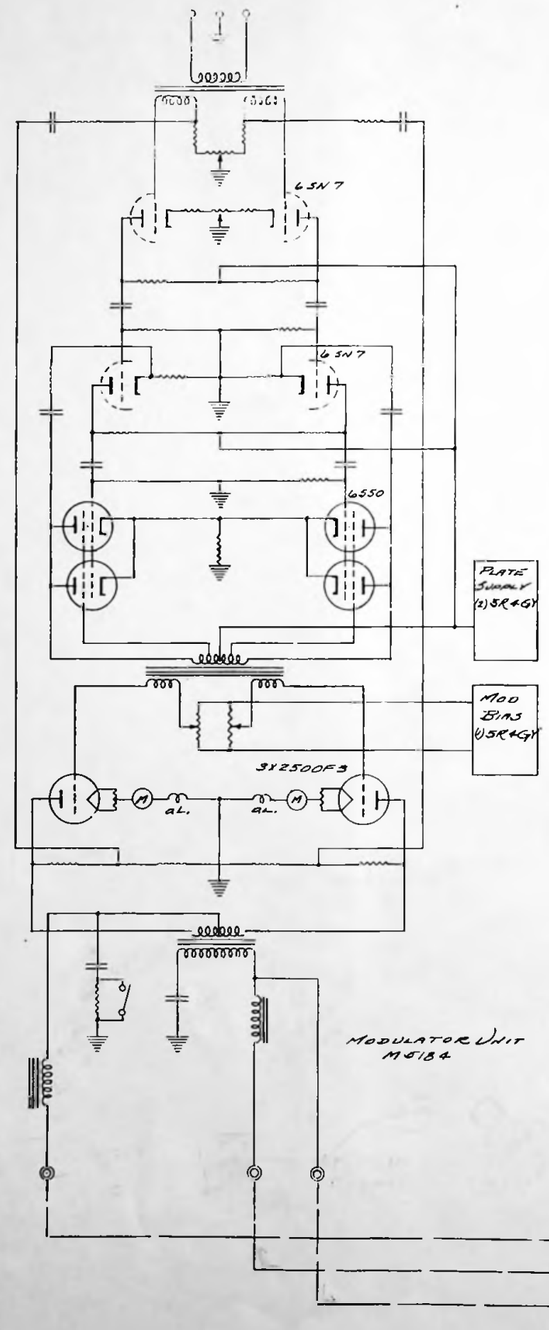
DR.	REL.	
DR. BY STREK DATE 2-24-56	CH. BY DATE	THR. APP. DATE 5-2-56

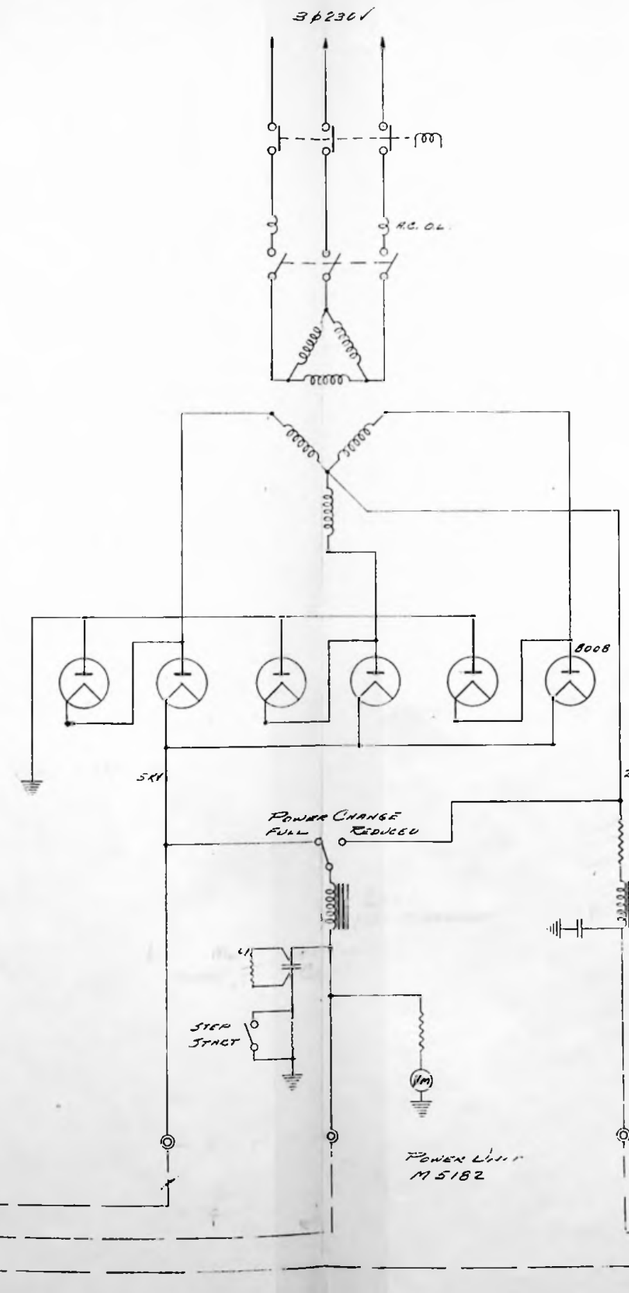
GATES RADIO COMPANY
QUINCY, ILLINOIS

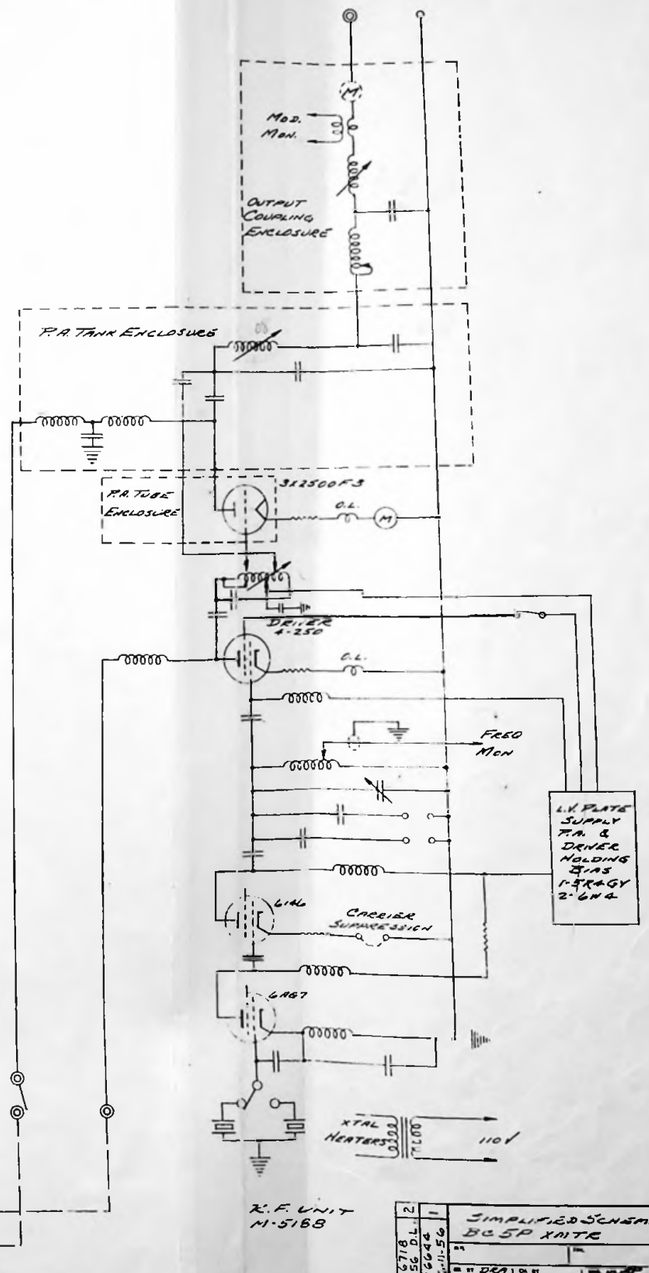
UNLESS OTHERWISE SPECIFIED, ALL TOLERANCES PER GATES SPEC 004100.

DRAWING NUMBER
C-19628

D-21858

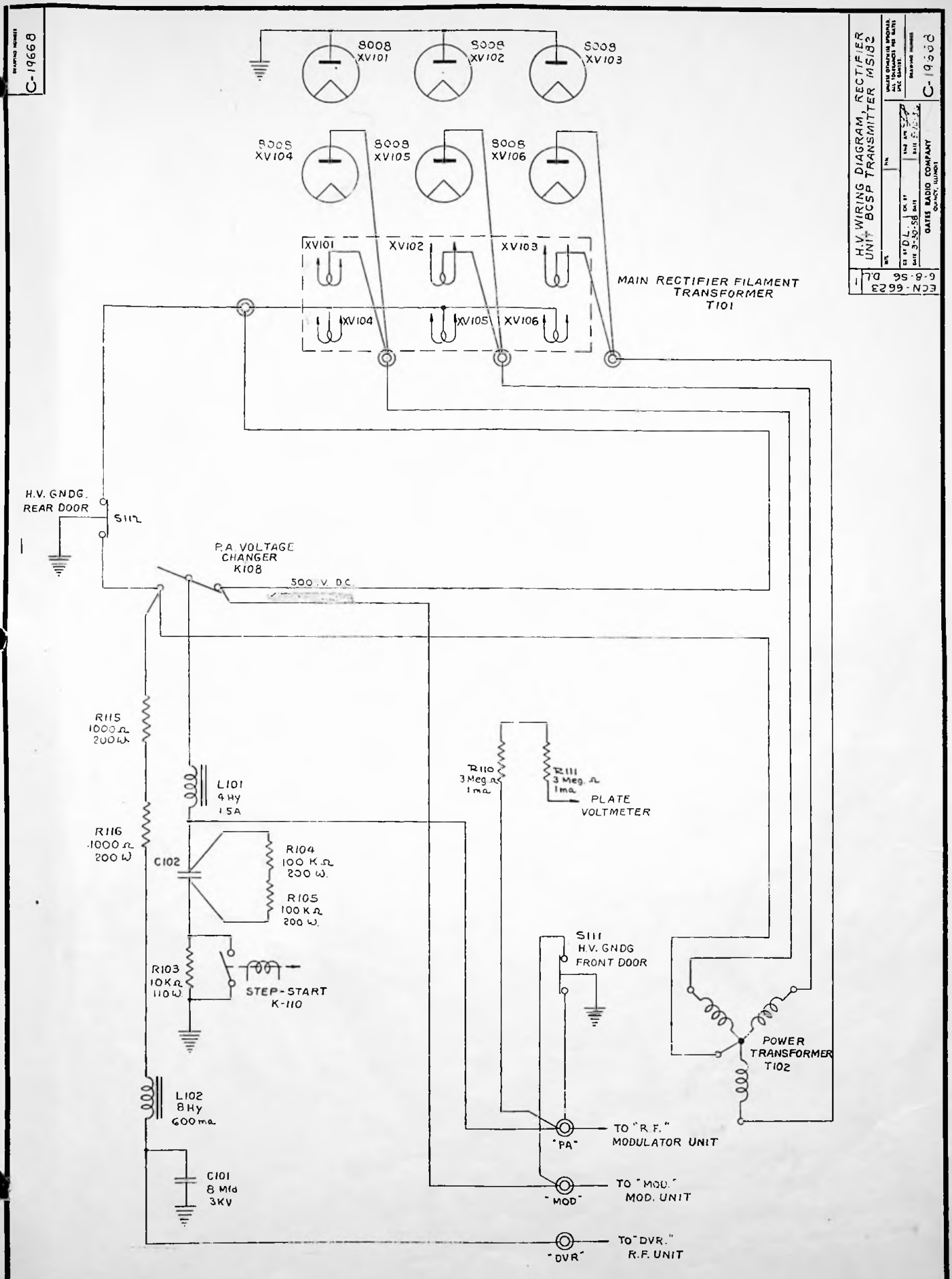






ECN 6718 8-1-56 DL	2	SIMPLIFIED SCHEMATIC BC 5P XMTR M5349	
ECN #6644 7 MK 6-11-56	1	DR. BY DRA DATE 8-4-56	CH. BY DATE
		GATES RADIO COMPANY	D-21858

C-19668



H.V. WIRING DIAGRAM, RECTIFIER UNIT BCSP TRANSMITTER MS182

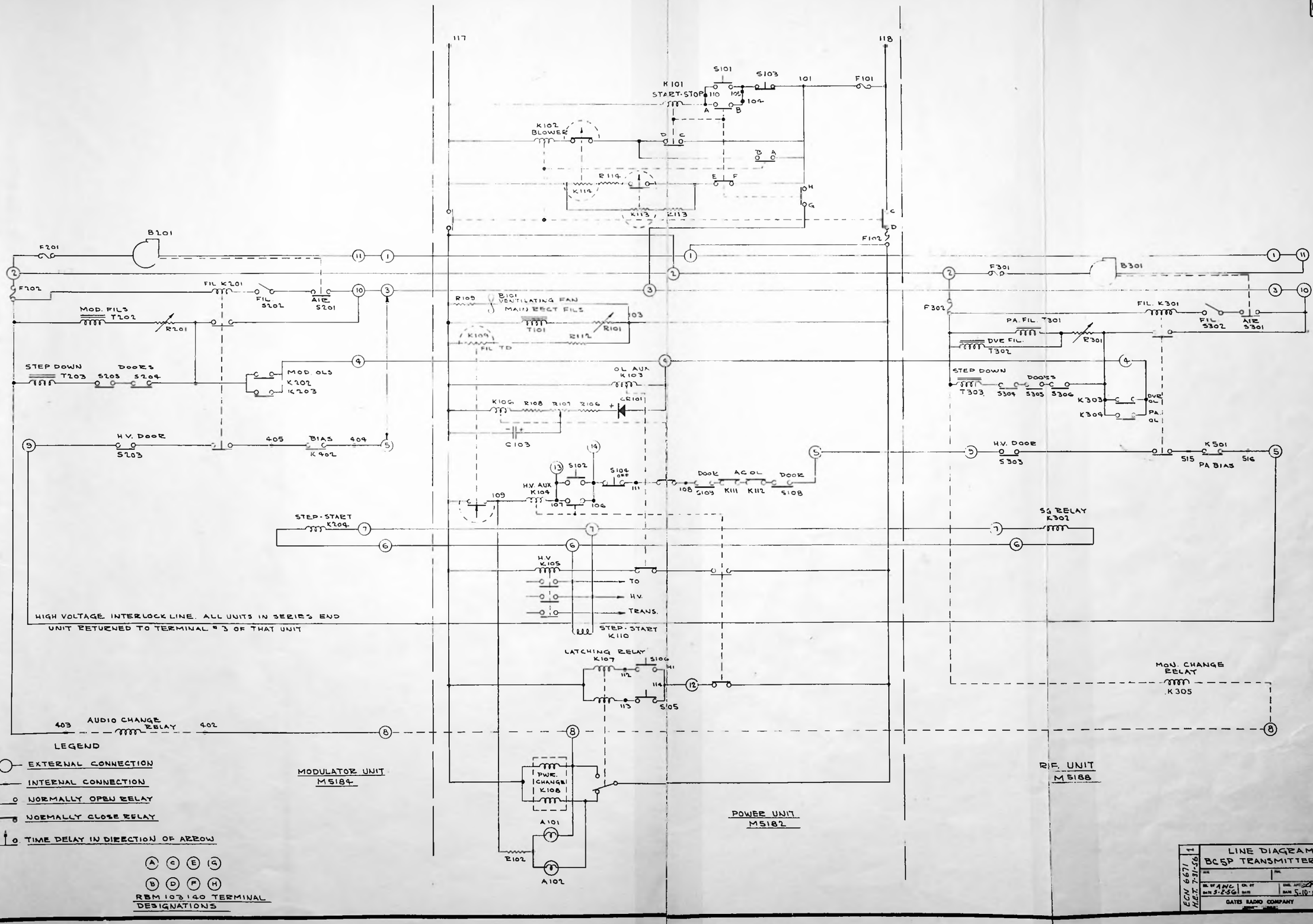
C-19668

ECN-6623 6-8-56 D.L.

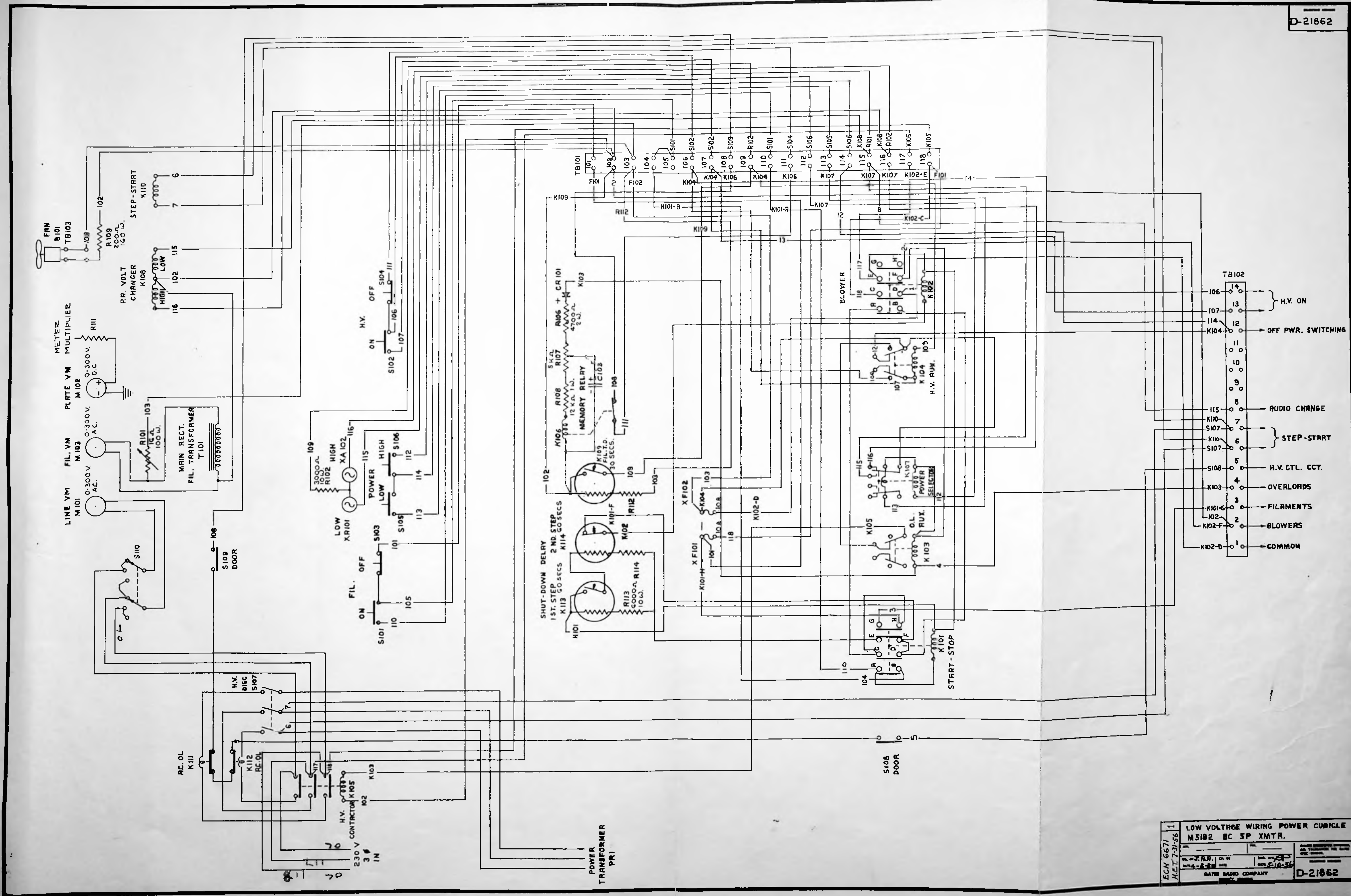
GATES RADIO COMPANY QUINCY, ILLINOIS

DRAWN D.L. 3-30-56

D-21859



1	LINE DIAGRAM BC5P TRANSMITTER M5349		
ECN 6671 H.E.T. 7-31-56	BY ANC DATE 5-25-66	CH. BY DATE	APP. DATE 5-10-66
	GATES RADIO COMPANY		D-21859



D-21862
TB101
TB102
H.V. ON
OFF PWR. SWITCHING
AUDIO CHANGE
STEP-START
H.V. CTL. CCT.
OVERLOADS
FILAMENTS
BLOWERS
COMMON
BLOWER
K102
K104
H.V. RUN.
K107
POWER SELECTOR
O.L. AUX.
K103
K105
START-STOP
K101
S108
DOOR
S109
DOOR
MEMORY RELAY
SHUT-DOWN DELAY
1ST. STEP
K113
60 SECS
2 ND. STEP
K114
60 SECS
K109
FIL. T.D.
30 SECS.
FAN
B101
TB103
R109
200 Ω
100 W.
STEP-START
K110
P.R. VOLT CHANGER
K108
HIGH
LOW
METER MULTIPLIER
R111
PLATE VM
M102
0-300 V. D.C.
FIL. VM
M103
0-300 V. A.C.
LINE VM
M101
0-300 V. A.C.
MAIN RECT. FIL. TRANSFORMER
T101
R101
12 Ω
100 W.
H.V.
ON
OFF
S102
S104
POWER
HIGH
LOW
S106
S105
FIL.
ON
OFF
S101
S103
LOW
XR101
HIGH
XA102
R102
3000 Ω
10 W.
S110
H.V. DISC
S107
P.C. OL
K111
K112
P.C. OL
H.V. CONTACTOR
K105
230 V
3 Φ
IN
POWER TRANSFORMER PRI
LOW VOLTAGE WIRING POWER CUBICLE
M5182 BC 5P XMTR.
GATES RADIO COMPANY
D-21862

TRANSFORMER SPECIFICATION SHEET

TYPE GATES BC-5 MODULATION TRANSFORMER

CORE A-563 12 Mil Hipersil

STYLE NO. 9

DIMENSIONS:

H 17 3/4 IN.

W 13 IN.

D 9 1/4 IN.

MD 6 3/8 IN.

MW 10 IN.

MH 3/8 x 3/4 IN. Slot

WEIGHT 160 LBS

PRIMARY 5000 VCT 30-10,000 Hz

8000 Ohms PP for PP 3X2500F3's.

SECONDARY 3500 VRMS @ 1.0 AMP

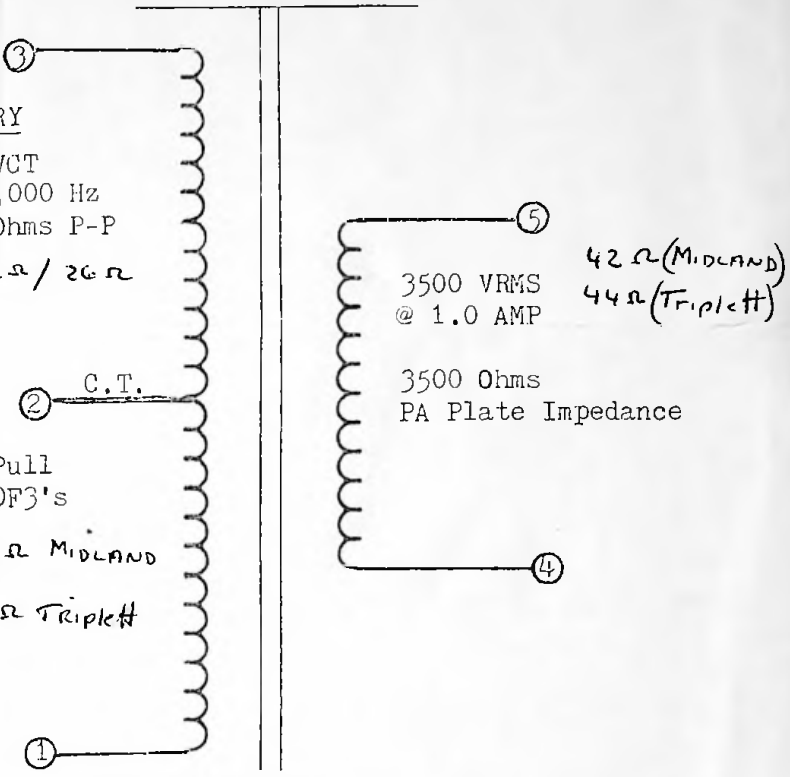
3500 Ohms PA Plate Impedance

for single 3X2500F3

TEMP RISE 40 °C

INSULATION 10 KV

WIRING DIAGRAM:



CONNECTIONS Top mounted terminal board with porcelain feed-thru insulators for primary and secondary connections.

VARNISH EC-346A Vacuum Impregnate and Bake.

NOTES This transformer replaces Gates P/N 478-0284-000. 12 Month Guarantee.

PETER W. DAHL CO., INC. • 4007 FORT BOULEVARD • EL PASO, TX. 79930 • (915) 566-5365

QUOTED TO

DATE QUOTED

PRICE $1350.00

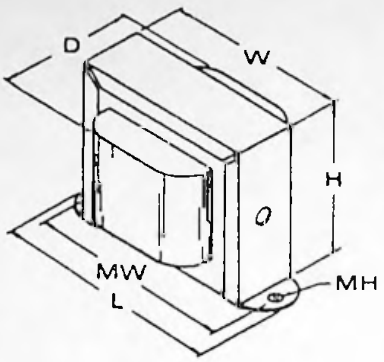
DELIVERY Nominal 1 Week ARO

FOB El Paso, Texas

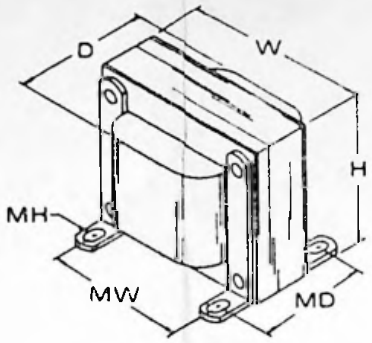
TERMS Check with Order, COD or Net 30 to qualified accounts.

SPECIAL NOTES:

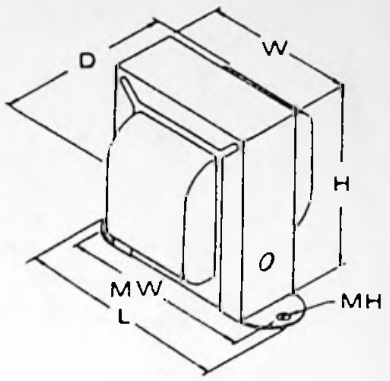
1. Primary and Secondary windings are interleaved for minimum leakage inductance.
2. Frequency Response: 1 DB, 30-10,000Hz.
3. Phase Shift: Negligible to 10,000 Hz, but not over 90° at 20,000 Hz.
4. Transformer core gapped for 5% unbalanced modulator current (DC).
5. This transformer also available in oil filled steel cased version @ $1,850.00



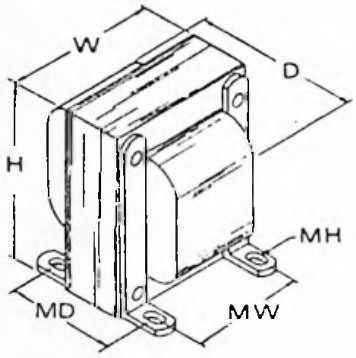
STYLE 1 HORIZONTAL CHANNEL



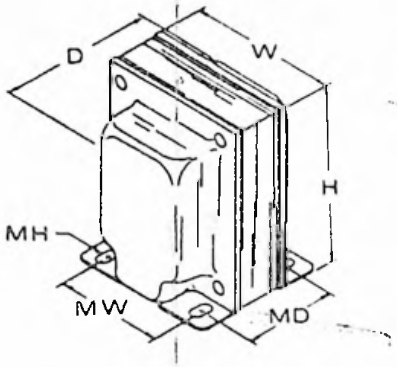
STYLE 2 HORIZONTAL BRACKET



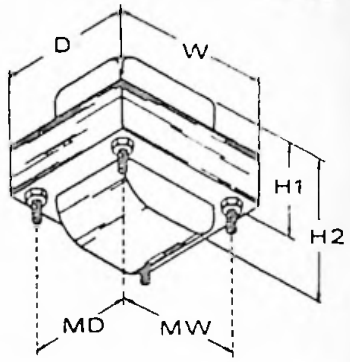
STYLE 3 VERTICAL CHANNEL



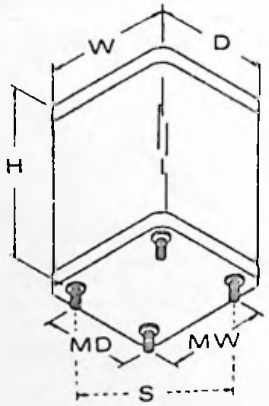
STYLE 4 VERTICAL BRACKET



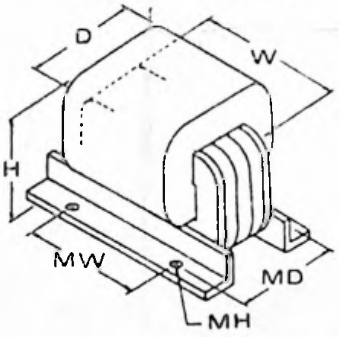
STYLE 5 ENDBELL



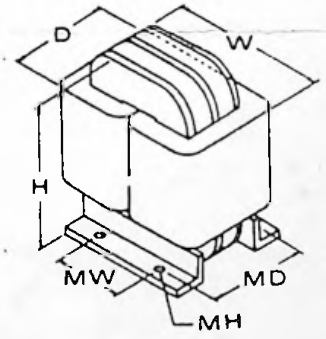
STYLE 6 HALFSHELL



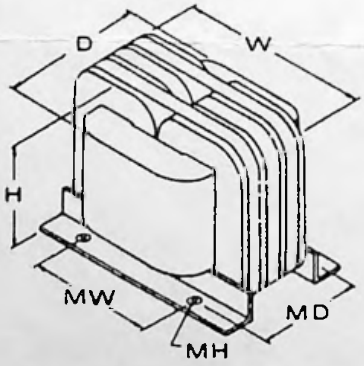
STYLE 7 METAL ENCASED



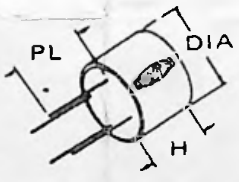
STYLE 8 SIMPLE TYPE



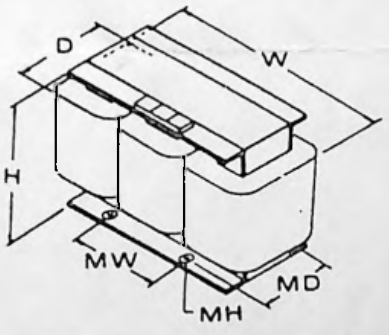
STYLE 9 CORE TYPE



STYLE 10 SHELL TYPE



STYLE 11 CUP TYPE

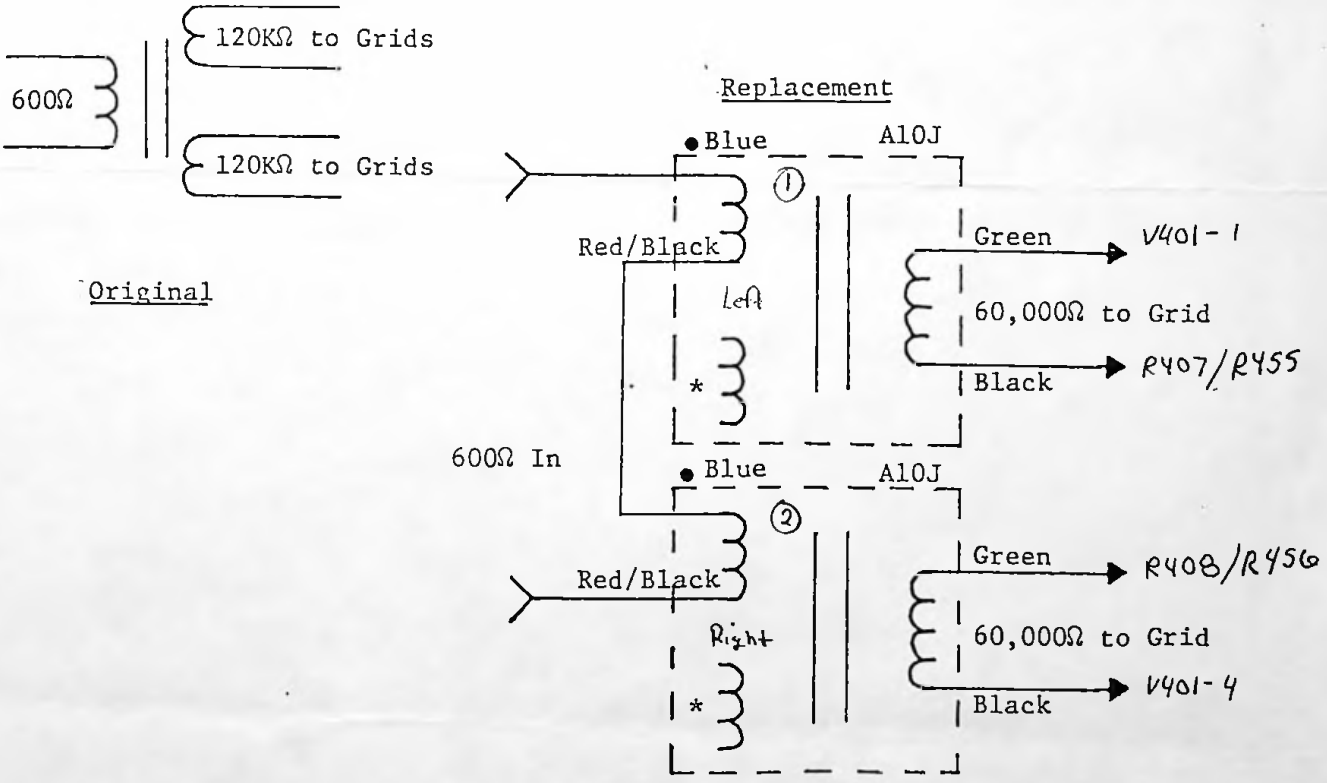


STYLE 12 THREE-PHASE

Audio Input Transformer Used On BC500GY and Other Models 478-0142-000

Old one is obsolete and the new replacement is a triad A-10J. This replacement is not an exact replacement either mechanically or electrically. The old transformer was multiple impedance primary with dual 120K ohm secondaries. The triad replacement is 600 ohm / 150 ohm primary with one 60,000 ohm secondary.

Therefore two triad A-10J transformers are required to replace one of the originals. The primary windings are then connected in series to keep the 600 ohm impedance. The proper wiring is shown below.

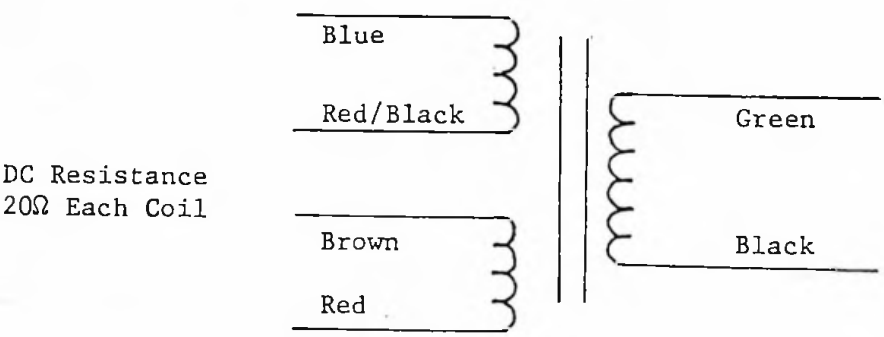


*One half of the Primary is not used.

The new transformer only uses one half of its primary which equals 300 ohm and this is put in series with 300 ohm of the second transformer to equal 600 ohm.

The pin out of the new transformer is below:

Triad A10J

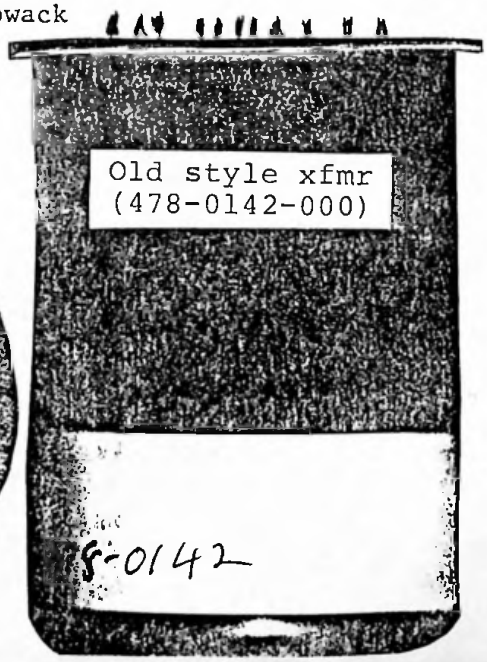


Old style xfmr has 11 solder terminals on this end.

New style xfmr (478-0142-000) uses 7 wire leads

Jeff Malec/Mike Nowack
June 1986

lkh



D-21864

MAIN FEEDBACK
411 412 TB403
400 W.V. C401 .5
400 W.V. C402 .5
R410 360 KΩ 1 W.
R411 360 KΩ 1 W.
R455 180 KΩ 1 W.
R456 180 KΩ 1 W.
C421 .0005
C422 .0005
1.7 V RMS
T401
TB402
408 409 410
AUDIO INPUT -30 DB
R401 R402 R403 R404
R405 51 KΩ 1 W.
R406 51 KΩ 1 W.
R407 27 KΩ 2 W.
R408 27 KΩ 2 W.
R409 5000 Ω
REDUCED POWER AUDIO CHANGE (NOT SUPPLIED) M5414 -7 DB 5KΩ - 1KΩ
XV401 CSN7GTA
R412 2000 Ω 1 W. +V.
R413 10000 Ω
R414 2000 Ω 1 W. +V.
C404 .05 Mfd. 400 W.V.
1.7 V RMS
R416 33 KΩ 2 W.
R418 100 KΩ 1 W.
C403 16 Mfd 450 V.
R415 33 KΩ 2 W.
R417 100 KΩ 1 W.
C405 .05 Mfd. 400 W.V.
XV402 CSN7GTA
R420 2000 Ω 1 W.
R419 2000 Ω 1 W.
C406 .5 Mfd.
18 V RMS
R422 100 KΩ 1 W.
R424 27 KΩ 2 W.
R423 100 KΩ 1 W.
R425 27 KΩ 2 W.
C407 .5 Mfd. 600 V.
R443 75 KΩ 1 W.
C409 .5 Mfd. 600 V.
XV403 G550 - 6CA7
R426 1000 Ω 1 W.
R430 10 Ω 1 W. .6 V.
R435 100 Ω 2 W.
R439 100 Ω 10 W.
R440 100 Ω 10 W.
XV404 G550
R427 1000 Ω 1 W.
R431 10 Ω 1 W.
R434 200 Ω 50 W. 48 V. DC.
R436 100 Ω 2 W.
XV405 G550
R432 10 Ω 1 W.
R428 1000 Ω 1 W.
R437 100 Ω 2 W.
R441 100 Ω 10 W.
XV406 G550
R433 10 Ω 1 W.
R429 1000 Ω 1 W.
R438 100 Ω 2 W.
R442 100 Ω 10 W.
R444 75 KΩ 1 W.
C408 .5 Mfd. 600 V.
T402
180 V RMS +10%
R445 500 Ω 20 W.
R446 500 Ω 20 W.
C419 16 Mfd 450 V.
R447 1500 Ω
R448 1500 Ω
C420 16 Mfd 450 V. -10%
TB404
0413 0414 0415 0416
MOD. GRID
MOD. GRID
+170 R451 22 KΩ 2 W. +280
L401 10 Hy 300 ma +450
PLATE RECTIFIER
XV407 5R4GY
XV408 5R4GY
R449 5000 Ω 20 W.
+350 V
L402 12 Hy 75 ma.
L403 12 Hy 75 ma.
R450 15 KΩ 20 W.
C412 4 Mfd. 600 V.
C413 4 Mfd. 600 V.
C415 16 Mfd. 450 V.
C414 16 Mfd. 450 V.
BIAS RECTIFIER
XV409 5R4GY
L404 6 Hy 160 ma.
L405 6 Hy 160 ma.
R452 500 Ω 20 W.
R453 2500 Ω 50 W.
R454 15 KΩ 10 W.
C416 4 Mfd. 600 V.
C417 4 Mfd. 600 V.
-190
-260
XA401 FIL.
XA402 BIAS
K402
T405
T403
T404
3A XF401
3A XF402
GND.
J401 401 402 403 404 405 406 407 FRONT

SIGNAL VOLTAGE OBTAINED 100% MODULATION 1000 N NORMAL OPERATION

ALL D. C. MEASUREMENTS WITH 20K Ω/V. METER
ALL R.M.S. SIGNALS (ESS) MEASURED WITH V.T.V.M.
ALLOW 20% ERROR ON MOST READINGS.

SCHEMATIC, MS366 AUDIO DRIVER BCSP 5K.W TRANSMITTER

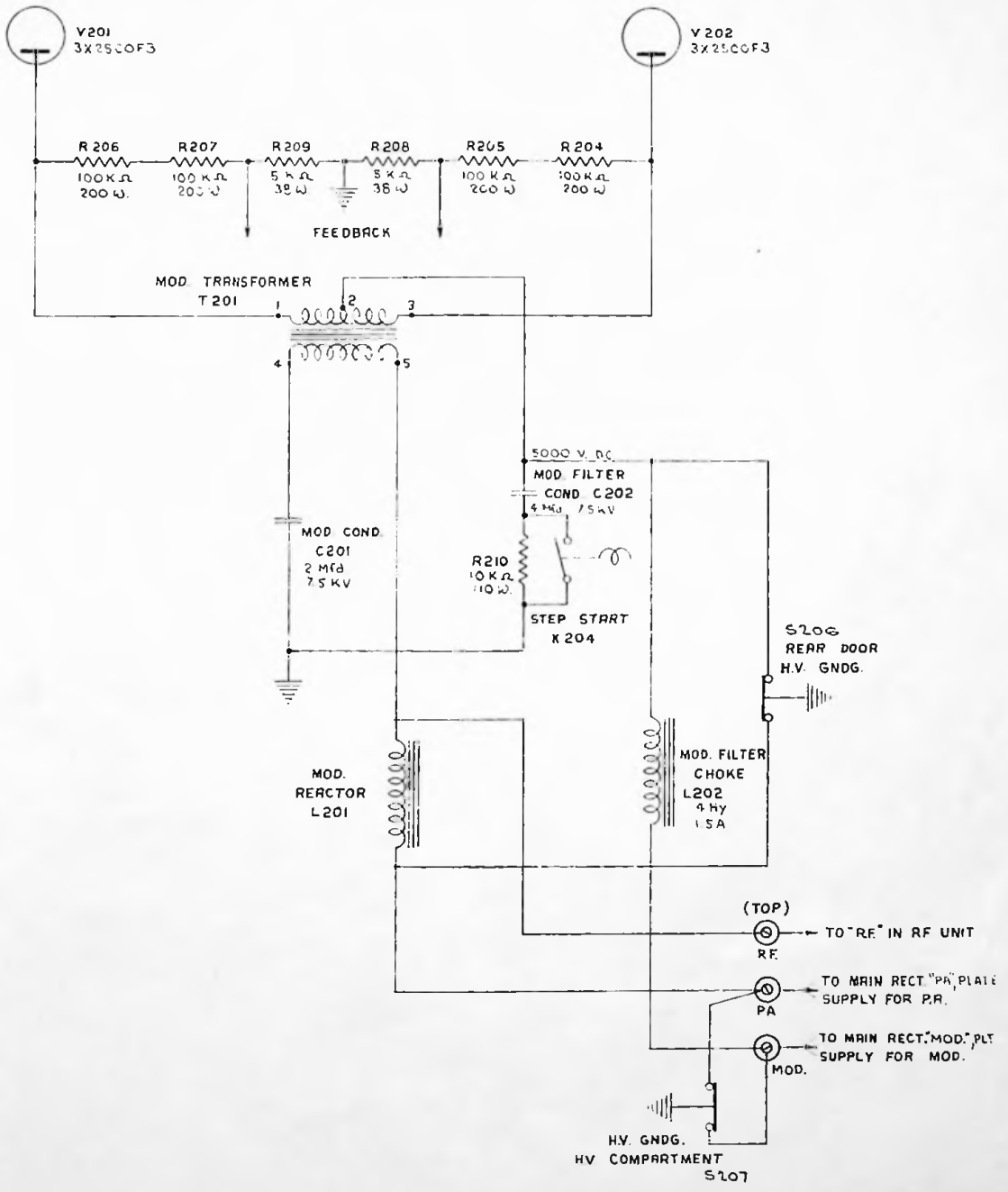
DR. BY D.L. DATE 4-12-58
GATES RADIO COMPANY
D-21864

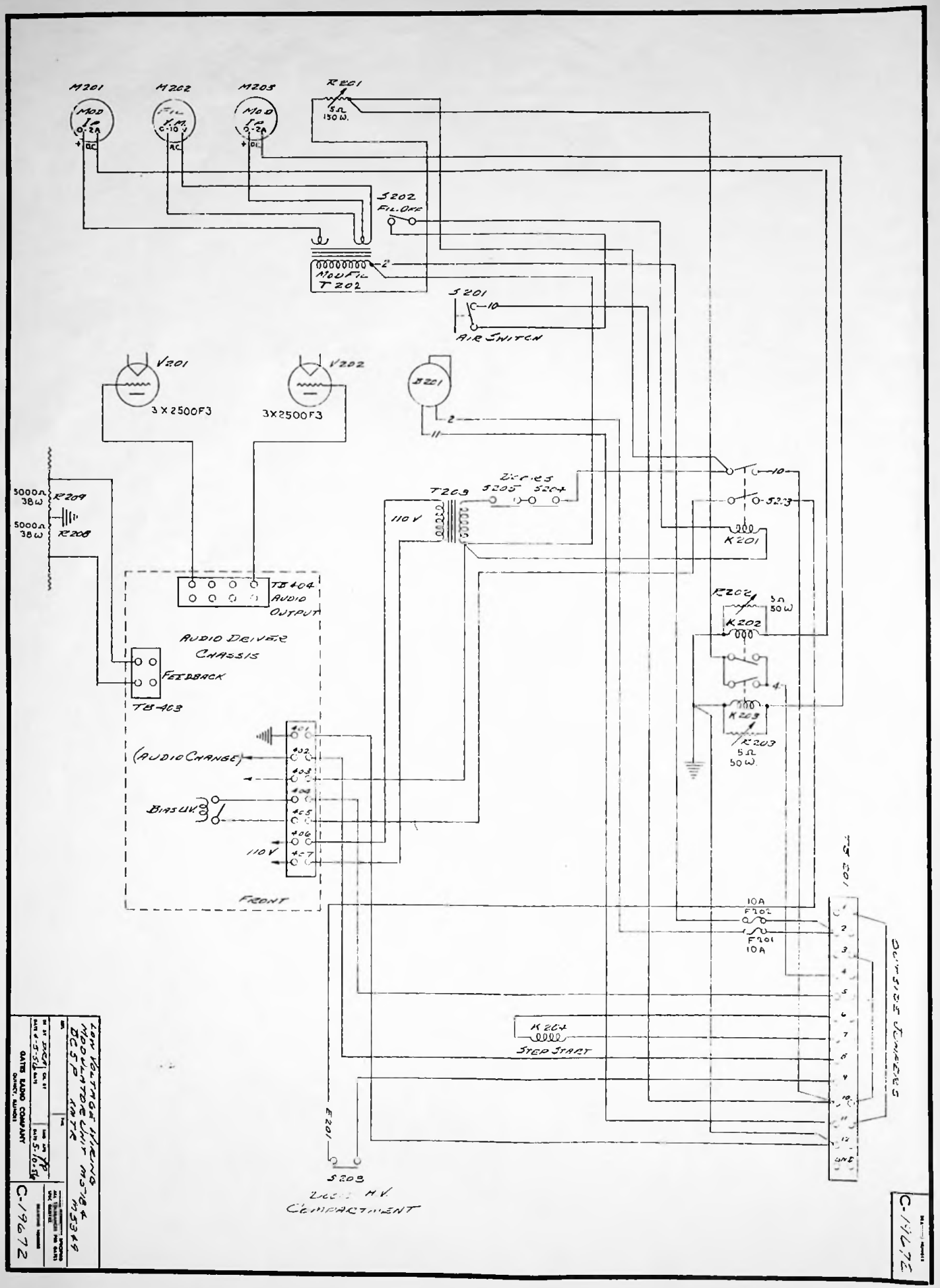
C-19669

HIGH VOLTAGE WIRING,
FOR MODULATOR M5184

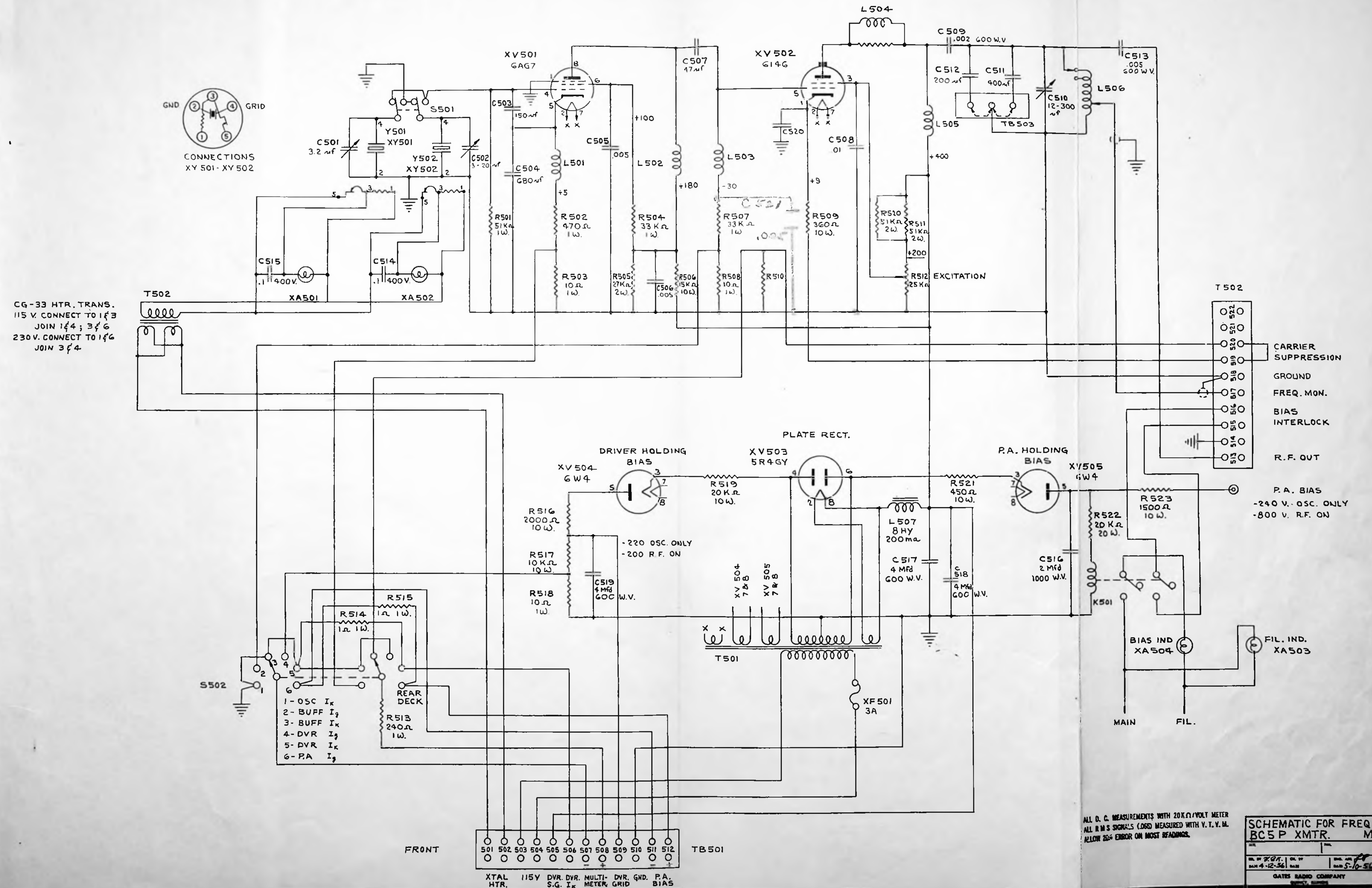
GATES RADIO COMPANY
QUINCY, ILLINOIS

C-19669




M201
M202
M203
R201
5Ω 150 W.
S202
FIL OFF
MOD TR
T202
S201
AIR SWITCH
V201
3X2500F3
V202
3X2500F3
S201
5000Ω 38W
R209
5000Ω 38W
R208
T203
110 V
S205
S204
K201
R202
5Ω 50W
K202
K203
5Ω 50W
TB404
AUDIO OUTPUT
AUDIO DRIVER CHASSIS
FEEDBACK
TB-403
(AUDIO CHANGE)
BIAS UV
110 V
FRONT
10A
F202
F201
10A
TB 201
K204
STEP START
E201
S203
H.V. COMPARTMENT
LOW VOLTAGE WIRING
MODULATOR UNIT MC-78A
DC SP UNITS
GATES RADIO COMPANY
QUINCY, ILLINOIS
C-19672

D-21863



CONNECTIONS XY 501 - XY 502
GND
GRID
XV501 6AG7
S501
C501 3.2 μf
Y501 XY501
Y502 XY502
C502 3-20 μf
C503 150 μf
C504 680 μf
L501
C505 .005
L502
C507 47 μf
+100
+180
XV502 6146
C520
C508 .01
L503
-30
L504
C509 .002 600 W.V.
C512 200 μf
C511 400 μf
TB503
C510 12-300 μf
C513 .005 600 W.V.
L506
L505
+400
+200
R501 51KΩ 1W.
R502 470Ω 1W.
R503 10Ω 1W.
R504 33KΩ 1W.
R505 27KΩ 2W.
C506 .005
R506 15KΩ 10W.
R507 33KΩ 1W
R508 10Ω 1W.
R509 360Ω 10W.
R510
R520 51KΩ 2W.
R511 51KΩ 2W.
R512 25KΩ
EXCITATION
C515 .1 400V.
XA501
C514 .1 400V.
XA502
T502
CG-33 HTR. TRANS.
115 V. CONNECT TO 1 & 3 JOIN 1 & 4 ; 3 & 6
230 V. CONNECT TO 1 & 6 JOIN 3 & 4
T502
CARRIER SUPPRESSION
GROUND
FREQ. MON.
BIAS INTERLOCK
R.F. OUT
PLATE RECT.
DRIVER HOLDING BIAS
XV504 6W4
XV503 5R4GY
P.A. HOLDING BIAS
XV505 6W4
R516 2000Ω 10W.
R517 10KΩ 10W.
R518 10Ω 1W
C519 4 Mfd 600 W.V.
-220 OSC. ONLY
-200 R.F. ON
R519 20KΩ 10W.
L507 8 HY 200 ma
C517 4 Mfd 600 W.V.
C518 4 Mfd 600 W.V.
R521 450Ω 10W.
R522 20KΩ 20W.
R523 1500Ω 10W.
C516 2 Mfd 1000 W.V.
K501
P.A. BIAS
-240 V. - OSC. ONLY
-800 V. R.F. ON
XV504 7 & 8
XV505 7 & 8
T501
XF501 3A
BIAS IND XA504
FIL. IND. XA503
MAIN
FIL.
S502
R514 1Ω 1W.
R515 1Ω 1W.
REAR DECK
R513 240Ω 1W.
1 - OSC Ik
2 - BUFF Ig
3 - BUFF Ik
4 - DVR Ig
5 - DVR Ik
6 - P.A Ig
FRONT
TB501
501 502 503 504 505 506 507 508 509 510 511 512
XTAL HTR.
115V
DVR. S.G.
DVR. Ik
MULTI-METER
DVR. GRID
GND.
P.A. BIAS

ALL D. C. MEASUREMENTS WITH 20KΩ/VOLT METER
ALL RMS SIGNALS (.065) MEASURED WITH V. T. V. M.
ALLOW 20% ERROR ON MOST READINGS.

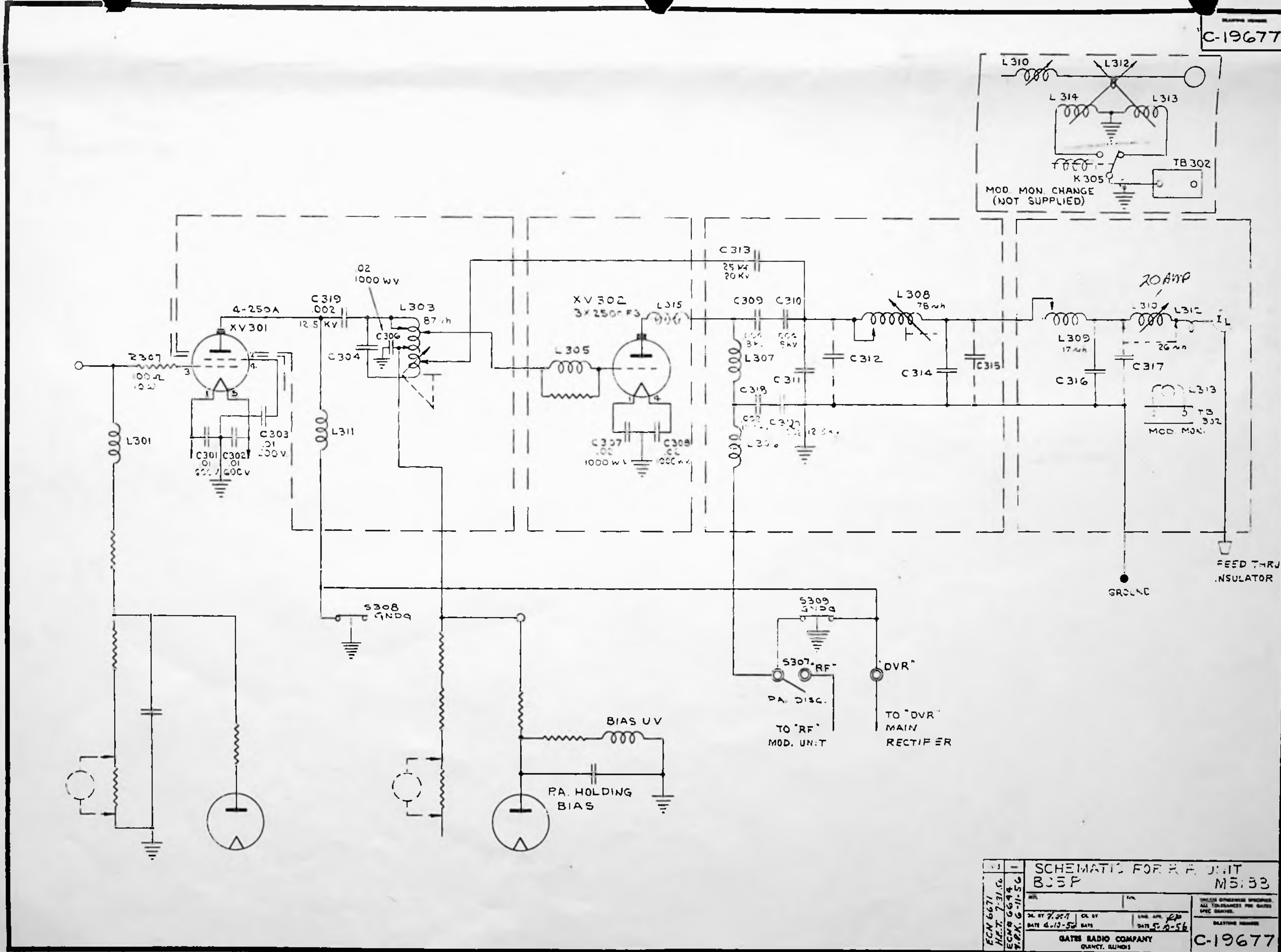
ECN # 6644 6-11-56

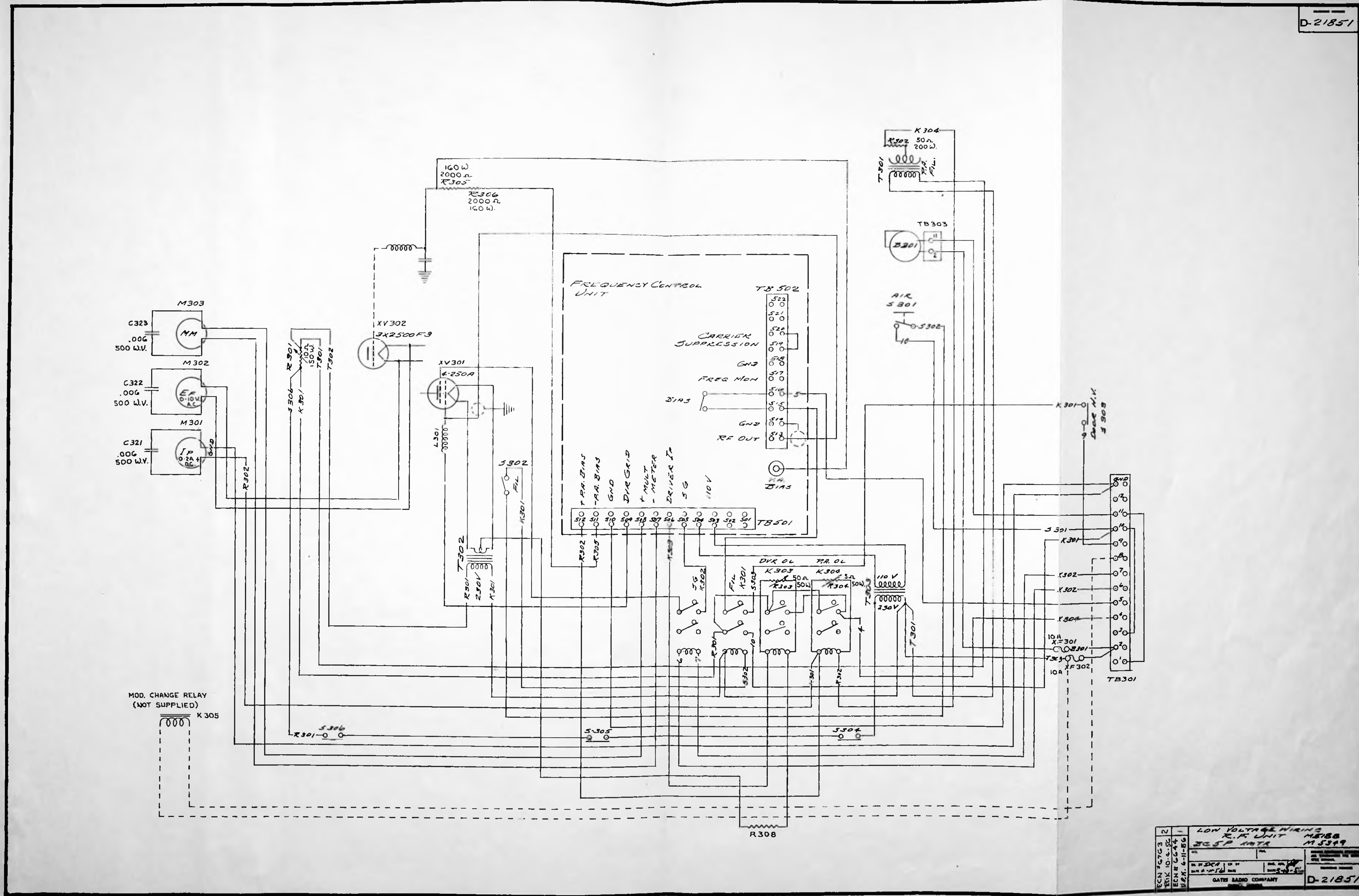
SCHEMATIC FOR FREQ. CTL. UNIT
BC5P XMTR. M5365

4-12-56
5-10-56

GATES RADIO COMPANY
QUINCY, ILLINOIS

D-21863


C-19677
L310
L312
L314
L313
TB302
K305
MOD. MON. CHANGE
(NOT SUPPLIED)
C313
25 Kv
20 Kv
XV302
3X2500F3
L315
C309
C310
L308
78 uh
20 AWP
L310
L312
26 uh
C319
.002
12.5 KV
.02
1000 WV
L303
87 uh
4-250A
XV301
R307
100 Ω
10 W
C306
C304
L305
L307
C312
C314
C315
L309
17 uh
C316
C317
L313
TB 302
MOD. MON.
C318
C311
L301
C301
.01
600 V
C302
.01
600 V
C303
.01
600 V
L311
C307
.002
1000 WV
C308
.002
1000 WV
FEED THRU
INSULATOR
GROUND
S308
GNDG
S309
GNDG
S307
"RF"
"DVR"
P.A. DISC.
TO "RF"
MOD. UNIT
TO "DVR"
MAIN
RECTIFIER
BIAS UV
P.A. HOLDING
BIAS
ECN 6671
ECN 6644
SCHEMATIC FOR P.A. UNIT
BC5P
M5133
GATES RADIO COMPANY
QUINCY, ILLINOIS
C-19677



D-21851
K304
K302 50Ω 200W.
T301
P.A. FIL.
TB303
B301
AIR S301
S302
160 W. 2000 Ω R305
R306 2000 Ω 160 W.
FREQUENCY CONTROL UNIT
TB502
CARRIER SUPPRESSION
GND
FREQ MON
BIAS
RF OUT
P.A. BIAS
TB501
+ P.A. BIAS
- P.A. BIAS
GND
DVR GRID
+ MULT
- METER
DRIVER IP
SG
110 V
M303
C323 .006 500 W.V.
MM
M302
C322 .006 500 W.V.
EF 0-10V. AC
M301
C321 .006 500 W.V.
IP 0-2A DC
XV302 3X2500F3
XV301 4-250A
L301
T302
S302 FIL
DVR OL
P.A. OL
K303
K304
110 V
230 V
K301
S301
K302
X302
X304
F301
F302
10A
TB301
DOOR N.O. S303
MOD. CHANGE RELAY (NOT SUPPLIED) K305
S306
S305
S304
R308
LOW VOLTAGE WIRING R.F. UNIT M6188 M5349
BC-5P XMTR
GATES RADIO COMPANY
D-21851