

Operating Instructions  
*for the*  
**hallicrafters**  
**HT 12 Radiophone**



Manufactured By

*the* **hallicrafters** *co.*

2611 Indiana Avenue

Chicago, U. S. A.

# MODEL HT-12 MARINE RADIOPHONE INSTRUCTIONS FOR INSTALLATIONS AND OPERATION

## I - UNCRATING

Unpack the transmitter and accessories and carefully inspect for any damage which might have occurred during shipment. If any damage is found, file a claim immediately with the local office of the transportation company. It is recommended that the original packing material be preserved.

## INSTALLATION

Included with the complete radiophone equipment are the main cabinet housing the transmitter and receiver, a separate cabinet housing the power supply, a ten foot inter-connecting cable, and a 4 contact power plug. The main radiophone unit should be mounted in a position as close to the antenna lead-in and ground connections as possible. It is important that the ground lead be kept short.

## WALL MOUNTING

The back cover to which the unit is attached by brackets serves also as the mounting plate for the transmitter. After the back cover has been bolted into position the lower half of the radio cabinet may be set into place with the top cover removed for tuning. After tuning adjustments have been made the top cover may be put on and the transmitter tuning trimmed if necessary through the holes which are concealed by the cover plate. In mounting the transmitter to a bulk-head the back cover may be bolted directly to the bulk-head by means of four one-quarter inch bolts.

## TABLE MOUNTING

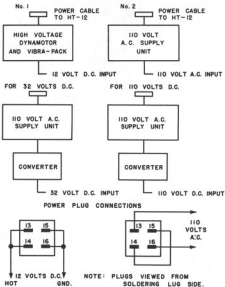
The bulk-head model may be mounted on a table if so desired. If it is necessary to anchor it, small angle brackets may be bolted to the sides along the bottom.

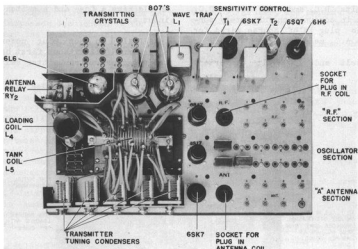
## POWER SUPPLY

The small power supply unit can be mounted in any convenient place on the deck, in a locker or in the engine room up to

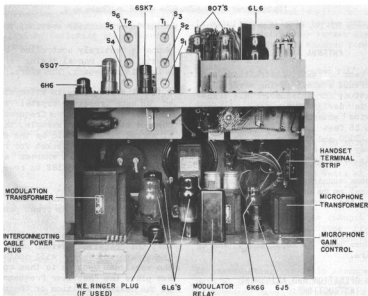
ten feet away from the main unit. A ten foot inter-connecting cable plugs into the power supply at one end and into the lower chassis of the main unit at the other end, passing through a protecting grommet in the side of the cabinet. If the power supply is located close to the main unit the connecting cable may be shortened up to make a ship-shape job. If the power supply unit must be bolted down, its cover may be removed and bolts passed through four of the holes in the end. Ordinarily no shock-proofing is needed for the power supply but if it is felt that the vibration is too severe, it may be mounted on a pad of sponge rubber.

NOTE: Two types of power supplies are available for the HT-12 to allow operation on four different sources of power. Either type may be used without making alterations in the transmitter-receiver or in the interconnecting cable. Each power supply is designed for a specific voltage and cannot be used on any other.





Radiophone HT-12, Top view



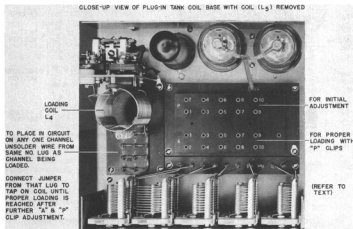
Radiophone HT-12, Rear view

For 32 volts D.C. and 110 volts D.C. operation in conjunction with rotary converter the plug is of course wired for 110 volts A.C. as shown.

The 32 volt and 110 volt converters

should have a fuse and a switch in their input circuit.

**IMPORTANT:** Do not plug power supply cable into HT-12 without first being sure the receiver and transmitter switches are turned OFF.



Radiophone HT-12, view showing adjustment points in transmitter section, top view.

## ANTENNA AND GROUND

In the back of this instruction book will be found a sheet giving several recommendations for antennas. This transmitter is designed to work with any single wire antenna between the lengths of 28 to 85 feet in the frequency range between 2000 and 3000 kc. Shorter antennas may also be tuned, but the result is likely to be decreased efficiency.

The antenna connects to the top insulated terminal on the upper left side of the cabinet - the ground to the lower terminal.

As stated before, it is important that the ground lead be kept short and of heavy wire.

## RECEIVER OPERATION AND ALIGNMENT INSTRUCTIONS:

The frequency of operation of the receiver section of the model HT-12 Radio-

phone is entirely controlled by quartz crystals. No manual tuning of the receiver is necessary, therefore.

**NOTE:** The frequency in kilocycles stamped on each receiver crystal is 455 kc lower or higher than the frequency of the desired signal. For example, the crystal marked 2285 kc would be the one plugged into the crystal socket for reception of a 2738 kc signal whereas a 2637 kc crystal is used for 2182 kc reception.

Each receiver crystal socket position is numbered to correspond to the same number appearing on the front panel channel switch.

Should you desire to receive a signal, snap the "receiver" switch until the red light appears which will indicate that the receiver section is then operating. Now place the "Receiver Frequency" knob to the desired position or channel. Adjustment of the "Volume" control will allow you to bring the signal to the proper audio level.

NOTE: The switch directly to the left of the loudspeaker escutcheon is for disconnecting the loud speaker. It should be used when you wish the signal to appear only in the receiver section of the handset.

**SENSITIVITY CONTROL:** This control is located at the center rear of the top chassis in the form of a screw driver slot adjustment. This control is connected in the cathode circuit of the r-f and i-f amplifier tubes and sets the sensitivity of the receiver. When receiving weak signals under bad atmospheric conditions it may be necessary to advance this control to increase the sensitivity of the receiver. Initial adjustment of this control is made at the factory, but may be altered to suit the installation requirements.

### ALIGNMENT INSTRUCTIONS

It will prove advisable to have the receiver section of the HT-12 Radiophone checked for alignment at least once a year. Any competent Radio Serviceman can align the receiver, or make the necessary adjustments when a new receiving crystal is installed by following the procedure outlined below:

#### Equipment needed for alignment:

- \* A Signal generator which will provide a signal at the test frequencies indicated.
- \* Non-Metallic screw driver.
- \* Output meter connected across speaker voice coil (green wire to switch terminal) and ground.

#### I.F. ALIGNMENT

1 - Connect hot side of signal generator with a 455 kc output signal to the control grid of the 6SA7 tube (#8 socket terminal); cold side of generator to chassis. Be sure the signal is 455 kc.

2 - Adjust S1-S3; S4-S6, roughly on T1-T2.

3 - Detune third windings (tertiary) S2-S5 by rotating the adjusting screw as far as it will go in either direction.

4 - Align primary and secondary of T1-T2; S1-S3-S4-S6 accurately for maximum gain.

5 - Adjust S2-S5 for maximum. Do not re-adjust S1-S3; S4-S6.

#### R.F. ALIGNMENT

Connect the hot side of the signal generator, through a 200 mmfd condenser to the Antenna post - ground of generator to Ground Post of HT-12. Tune generator to Signal frequency.

NOTE: No oscillator adjustment of the receiver is necessary because it is crystal controlled by quartz crystals ground to 455 kc higher or lower in frequency than the desired signal (IF difference).

The adjustment per channel will be identical in each case; A<sub>3</sub>-RF<sub>3</sub>; A<sub>4</sub>-RF<sub>4</sub> will be the screws adjusted for channels and crystals 3 and 4 respectively and so on for remaining channels.

Channels 1 and 2 in the plug-in coil assembly are for higher frequency crystals outside the 2 to 3 mc range. After insertion, the assembly with its crystals is adjusted similarly to the other channels by adjusting the screws associated with that particular channel for maximum gain.

**WAVE TRAP** - With generator still connected as before to antenna and ground posts, tune the generator to the 455 kc i-f frequency. Adjust the screw on top of L<sub>1</sub> for minimum output - the trap is then correctly adjusted.

#### TRANSMITTER OPERATION AND ADJUSTMENT

The transmitter section of the HT-12 Radiophone develops 50 watts of carrier power on ten crystal controlled channels or frequencies.

Selection of the proper channel is made by placing the "transmitter frequency" switch, or knob, at the numbered position.

If transmitting crystals accompany the unit at the time of purchase, the proper adjustments have been made to the clips on the plate tank inductance L<sub>5</sub> and the tuning condensers for those frequencies.

**NOTE:** When these adjustments are made at the factory, the output of the transmitter is fed into a "dummy" antenna. In view of the fact that the dummy antenna will not have the same electrical characteristics as the antenna to which the unit will be connected in actual operation, it will be necessary to have a suitably licensed commercial telephone operator adjust the "A" and "P" and perhaps the "L" clips until the transmitter is properly resonated.

### ADJUSTMENT

Naturally, the transmitter must be left on for sustained periods when making the following tuning adjustments.

**CAUTION:** Place handset on the hook before making any adjustments or handling clips with the transmitter switch ON.

Remove "A" clip for particular channel being tuned.

Place the transmitter frequency switch in the position to check the channel being adjusted. (Be sure the transmitting crystal is in the similarly numbered socket).

Put "Plate-PA Grid" switch in "PA Grid" position. This switch and two meter switches will be found behind the removable face plate directly below the meter escutcheon.

Put Transmitter in operation by placing "Transmitter" switch in "ON" position. Lift handset off hook and press press-to-talk switch on handset.

Note the value of grid current - it should be approximately 4 to 8 MA depending on the activity of the particular crystal being used.

Set the "PLATE PA" switch in the plate position and the "MOD-PA" switch in the "PA" position. Check parallel 807 final amplifier plate current.

Rotate the similarly numbered tuning condenser and adjust it until minimum plate current is reached as shown on the meter. If it is impossible to get a dip in current, or if the dip occurs at either maximum or minimum condenser capacity, move the colored "P" lead bearing the same number as the crystal socket and transmitter frequency switch either

right or left on the tank inductance L5. Move this lead the number of turns required to evidence a dip in current when the tuning condenser is adjusted. Proper adjustment of this clip will result in the tuning condenser hitting resonance at approximately 50% capacity.

Connect the clip of the "A" lead which is connected to the coil mounting strip lug bearing the same number as the channel in use, to the tank coil close to the right hand end, and put the transmitter into operation by lifting the handset off the hook and pressing the press-to-talk switch on the handset. Re-establish resonance in the tank circuit by adjusting the tuning condenser to the position of minimum P.A. plate current as noted by the meter reading. Proceed in the above manner, moving the "A" lead clip toward the left on the tank coil, and re-establish resonance with the tuning condenser, until a position is found where the P.A. plate current reads approximately 200 M.A. at the plate current dip. The transmitter is then loaded to its rated power output at that particular frequency.

In some installations where the antenna length is such as to present a reactive load to the transmitter, it will be noted that when the "A" load clip is connected to the tank coil, at various positions, it will change the resonance setting of the tuning condenser. When this condition occurs it will be necessary to reset the "P" lead clip on the plate coil so as to bring the resonance position of the tuning condenser back to center of its capacity range.

**NOTE:** Should it be necessary to increase the excitation to the final amplifier stage on any of the higher frequency channels, connect the open end of resistor  $R_{33}$  (marked x on schematic) to the lug on switch section  $SW_{8.6}$  which corresponds to the channel number being used. This connection raises the oscillator voltage and should be again disconnected when the excitation increase is no longer required.

### LOADING COIL

Should the characteristics of the an-

tenna be such as to present a highly reactive load, it may be impossible to find a position for the "A" lead clip on the tank coil which will bring the P.A. plate current at resonance up to 200 M.A. If this condition occurs it will then be necessary to use the loading coil  $L_4$ . To do so, unsolder the jumper wire, which connects the lugs on the loading coil lug strip located beneath the loading coil, from the particular "1" lug on the strip bearing the same number as the channel in use; and connect this lug to the top lug on the loading coil. Then proceed as outlined above, again beginning the loading adjustment by setting the "A" lead clip at the right hand of the tank coil, and moving it toward the left, until the plate current at resonance is approximately 200 M.A. and at the same time keeping the resonance setting of the tuning condenser close to the center of its range, by re-setting the "P" lead clip.

The inductance of the loading coil is increased as the connecting wire is moved toward the bottom. To insert the entire

coil in the circuit, do not jumper a wire from the unsoldered lug to the loading coil.

## RINGER

All HT-12 transmitters are equipped with a socket for connecting to an external ringer. The following additions are necessary to adopt the set for ringer.

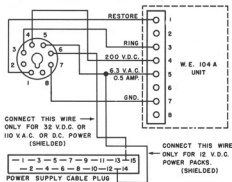
When used with a 110 volt AC power supply unit, connect a wire from the #6 contact on the ringer plug to the #15 contact on the plug at the power supply end of the power cable.

For use with a 12 volt DC power supply unit, connect a wire from #6 contact on the ringer plug to the number 14 contact on the plug at the power supply end of the power cable.

The connections from the ringer to the octal ringer plug are shown in the accompanying diagram.

If a selective ringer is used the speaker switch at the left of the speaker should be turned off during standby periods.

CONNECTIONS FOR ADAPTING W.E. 104 A  
SELECTIVE RINGER TO HT-12

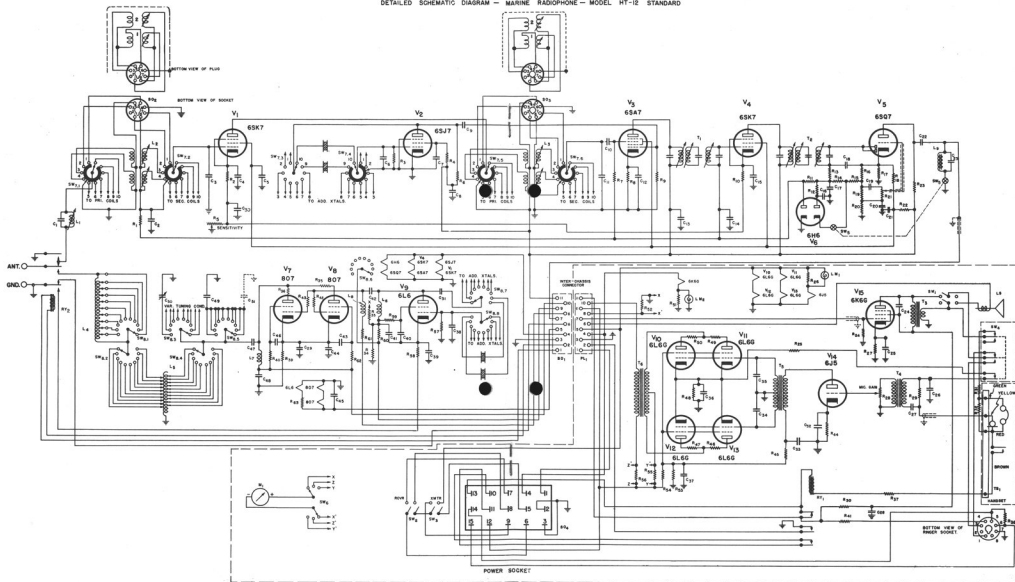


Dimensions of Model HT-12; 20 $\frac{1}{2}$ " high, 19 $\frac{1}{4}$ " wide, 12" deep.

## Current Consumption:

	<u>12 VDC</u>	<u>32 VDC</u>	<u>110 VDC</u>
Receiving	5.2	2.5	1.00 amps.
Transmitting	34.	16.6	4.8 amps.

DETAILED SUBCIRCUIT DIAGRAM — MACHINE RADIO







# HT-12 RADIOPHONE PARTS LIST

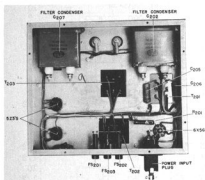
## RESISTORS

R	VALUE IN OHMS	WATTAGE OR TYPE	R	VALUE IN OHMS	WATTAGE OR TYPE
1	100,000	1/2	33	35,000	10
2	300	"	34	20,000	"
3	47,000	"	35	10	2
4	220,000	"	36	10	"
5	15,000	#25-033 Variable	37	39,000	"
6	27,000	1	38	15	10
7	470,000	1/2	39	50	"
8	300	"	40	20,000	10
9	22,000	"	41	15,000	2
10	300	"	42	50	1/2
11	2,200,000	"	43	50	"
12	1,000,000	"	44	1,000	"
13	47,000	"	45	15,000	2
14	100,000	"	46	50	1/2
15	220,000	"	47	50	1/2
16	220,000	"	48	125	10
17	100	"	49	50	1/2
18	15,000	1	50	50	"
19	2,700,000	1/2	51	25	10
20	2,200,000	11	52	100	1/2
21	500,000	#25-065 Variable	53	30,000	20
22	10,000	1	54	5,000	20
23	220,000	1/2	55	.351	meter shunt
24	1,000,000	1/2	56	.351	meter shunt
25	1,000	10	57	47,000	1
26	40	2	58	250	1/2
27	500	"	59	47,000	1
28	1,000,000	#25-076 Variable	60	18,000	10
29	100	1/2	61	6,800	2
30	1,000	10	62	20,000	10
31	100	1/2	63	7.5	10
32	470	"			

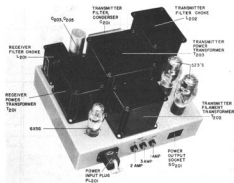
## CONDENSERS

C	CAPACITY	VOLTAGE AND TYPE	C	CAPACITY	VOLTAGE AND TYPE
1	200 mmf	Mica	15	.05 mfd	Molded paper, 200 V.
2	.01 mfd	Molded paper, 400 V.	16	.05 mfd	Molded paper, 200 V.
3	35 mmf	Ceramicon	17	56 mmf	Mica, 500 V.
4	.02 mfd	Molded paper, 400 V.	18	56 mmf	Mica, 500 V.
5	.1 mfd	Molded paper, 400 V.	19	.02 mfd	Molded paper, 400 V.
6	100 mfd	Mica, 500 V.	20	.05 mfd	Molded paper, 200 V.
7	.02 mfd	Molded paper, 400 V.	21	.1 mfd	Molded paper, 400 V.
8	.1 mfd	Molded paper, 400 V.	22	.02 mfd	Molded paper, 400 V.
9	51 mmf	Mica, 500 V.	23	7,500 mmf	Mica, 300 V.
10	470 mmf	Mica, 500 V.	24	.01 mfd	Molded paper, 600 V.
11	35 mmf	Ceramicon	25	20 mfd	Elect., 100 V.
12	.02 mfd	Molded paper, 400 V.	26	20 mfd	Elect., 100 V.
13	.1 mfd	Molded paper, 400 V.	27	5 mfd	Bathbub paper
14	.02 mfd	Molded paper, 400 V.	28	8 mfd	Elect., 450 V.

# 115 VOLT A-C HT-12 POWER SUPPLY

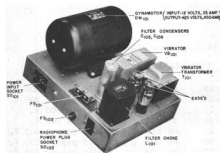


115 volt power supply-bottom view

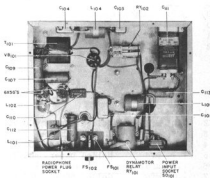


115 volt power supply - top view

# 12 VOLT D-C HT-12 POWER SUPPLY



12 volt d-c power supply, top view



12 volt d-c power supply, bottom view

# HT-12 RADIOPHONE PARTS LIST

## CONDENSERS

C	CAPACITY	VOLTAGE AND TYPE	C	CAPACITY	VOLTAGE AND TYPE
29	620 mmf	Mica, 600 V.	40	1800 mmf	Mica, 500 V.
30	.1 mfd	Molded paper, 400 V.	41	1800 mmf	Mica, 500 V.
31	1800 mmf	Mica, 500 V.	42	47 mmf	Mica, 500 V.
32	20 mfd	Elect., 100 V.	43	2000 mmf	Mica, 500 V.
33	8 mfd	Elect. V.	44	6,200 mmf	Mica, 500 V.
34	1800 mmf	Mica, 500 V.	45	6,800 mmf	Mica, 300 V.
35	1,800 mmf	Mica, 500 V.	46	2000 mmf	Mica, 500 V.
36	20 mfd	Elect., 100 V.	47	.0022 mfd	Mica, 1,200 V.
37	8 mfd	Elect.	48	.0022 mfd	Mica, 1,200 V.
38	100 mmf	Mica, 500 V.	49	360 mmf	Mica, 2500 V.
39	6,200 mmf	Mica, 600 V.	50	100 mmf	Variable

L	INDUCTANCES	PART NO.	T	TRANSFORMERS	PART NO.
1	Wave Trap	#51B229	1	IF Transformer	#51B070
2	Antenna coils	51B309	2	IF Transformer	51B071
3	R.F. Coils	51B310	3	Receiver Output	55B023
4	Loading Coil	51B238	4	Microphone Input	55B026
5	Tank Coil	51C563	5	Interstage coupling	55B025
6	RF Choke	53A038	6	Modulation	55C024
7	RF Choke	53A038	RY	RELAYS	PART NO.
8	RF Choke	53A038	1	Modulator	#21B005
9	Static and noise filter	56B009	2	Antenna	21B004

## 115 V. A-C POWER PACK PARTS LIST

R6	VALUE IN OHMS	WATTAGE OR TYPE	L	INDUCTANCES	PART NO.
201	10	10	201	Filter choke coil	56B037
			202	Filter choke coil	56B036
C	CAPACITY	VOLTAGE AND TYPE	T	TRANSFORMERS	PART NO.
201	8 mfd	600 V.	201	Receiver power	52C071
202	8 mfd	600 V.	202	Trans. Filament	52C069
203	8 mfd	(Elect.,	203	Trans. Power	52C070
204	8 mfd)	(475 V.			
205	.05 mfd	600 V.	F	FUSES	TYPE
206	.05 mfd	600 V.	201	2 amp.	3AG
207	8 mfd	600 V.	202	1 amp.	3AG
			203	3 amp.	3AG
					PART NO.
					39A307
					39A306
					39A301

## 12 V. D-C POWER PACK PARTS LIST

R	RESISTORS
101	500 ohm $\pm$ 10%, 1/2 watt; carbon; insulated; part of vibrator assembly
102	Same as R101; part of vibrator assembly

# CONDENSERS

C	CAPACITY	VOLTAGE AND TYPE
101	.5 mfd	Bathtub, 400 V.
102	.5 mfd	Tub. paper, 200 V.
103	.5 mfd	Bathtub, 400 V.
104	.5 mfd	Bathtub, 400 V.
105	8 mfd	DUAL Elect.
106	8 mfd	

C	CAPACITY	VOLTAGE AND TYPE
107	.03 mfd	Tub paper, 1600 V.
108	.02 mfd	Molded paper, 400 V.
109	1 mfd	Tub. paper, 400 V.
110	.1 mfd	Molded paper, 400 V.
111	2. mfd	Molded paper, 1000 V.
112	.03 mfd	Tub. paper, 1600 V.
113	.5 mfd	Tub. paper, 200 V.

L	INDUCTANCES	PART NO.
101	Filter choke coil	#56B037
102	Filter choke coil	53A005
103	Filter choke coil	53A005
104	Filter choke coil	56A024
105	Filter choke coil	56A024

T	TRANSFORMER	PART NO.
101	Vibrator transformer	#52C078

RY	RELAYS	PART NO.
101	Dynamotor start	#21B052
102	Vibrator start	21B053

FS	FUSES	TYPE	PART NO.
101	50 amp.	1118	#39A319
102	10 amp.	3AG	39A139

VB	101	Vibrator Elect. Lab. S-703	#27C115
DM	101	Dynamotor Eicor #5225	#20C011

Pilot light 6.3 V. .15 amp.

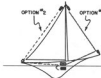
Speaker FM5LS - B9617

Handset #27C

the hollcrafters inc. Chicago, U.S.A.  
SUGGESTED MARINE ANTENNA INSTALLATIONS

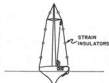


Note that on this gaff rigged ship an insulated forestay antenna is the preferable installation since it affords the maximum available height for this type of ship at the same time keeping the antenna clear of the canvas.



The insulated forestay is still the preferable installation even on a Marconi Ripped Ship, however, if the main sheet is completely inboard, option No. 2 may be used and will be easier to install.

Because of the strain imposed with this type of antenna, wire of sufficient strength should be used to support the mast. Heavy stranded copper-weld wire or other wire with good conducting qualities is recommended.



Wherein the rigging is such that it is inadvisable to erect the antenna as shown in "B" the antenna may be supported directly from the cross arm.

Note: So installed, the antenna is close to the wire stays which must then be insulated every 15 feet with egg type strain insulators to reduce absorption and re-radiation.



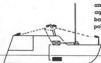
Where there is more than one mast, this style of antenna should be used if it does not interfere with the rigging because it gives considerably more antenna length than any previously described type.

Note that the vertical and semi-horizontal sections must be individually insulated and jumpered as shown.

### Power Cruiser

On the options shown, the vertical antenna is much to be preferred. Where the height of this type of antenna would obstruct the passage of the boat under bridges, the base insulator can be hinged or the pole may be of the collapsible type.

For the horizontal type of antenna, it should be kept as high above the boat as possible for most efficient radiation.

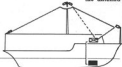


### Fishing Boat

Because of the boom used on fishing boats, the antenna should be of the insulated forestay type. With such an installation, reasonably free movement of the boom can be expected. If possible a metal rod should be mounted on the top of the mast so that the antenna can be jumpered to it and greater effective height obtained.

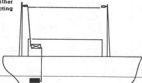


For larger type power cruiser with only one mast either of the two methods shown can be used for connecting the antenna to the transmitter.



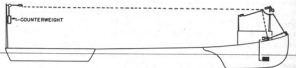
The best antenna for the two mast craft is shown. When greater effective capacity to ground is desired the flat-top portion of the antenna can consist of one or more wires.

Note: Should the hull of the boat in this class be metal the ground plane will be unnecessary the ground post of the transmitter should be connected directly to the metal hull itself.



### Tug Boat & Barge

If the desired radio range of the tug boat is small in area, the antenna installation should be kept on board the tug. When the distance over which signals are to be desired is increased, the alternative horizontal antenna running to a mast on the barge is recommended. The antenna insulator should be in front of the pulley on the mast and connected to a suitable counterweight by a rope. This arrangement will keep the antenna under constant tension. Should a transmitter be mounted on the barge itself, a vertical antenna is advisable and installed as shown.



When an antenna is installed on board ship the following points should be given primary consideration.

1. Maximum possible height above water.
2. Maximum length consistent with uniform height.
3. Good insulation of antenna and lead-in to transmitter.
4. Use a reasonably short ground lead to the ground plate which must be mounted on the outside of the hull below the water line.

Each of these requisites for good performance are treated in detail below.

No. 1 - Both the antenna proper and the lead-in constitute the antenna system. Since the transmitter will always be located in the hull it is obvious that one end of the antenna system will be close to the water line. It is imperative that the free end of the antenna be as high as possible above water. (Note that each of the illustrations shows the free end of the antenna at the maximum height above water.)

No. 2 - It is improbable that in the smaller type of craft the antenna length will ever be sufficiently long enough to eliminate the use of the "loading coil".

The loading coil makes up for a deficiency in antenna length - as encountered on small craft. The loading coil dissipates rather than radiates power, so consequently the ideal installation utilizes as much antenna and as little loading coil as possible consistent with maximum radiation and proper loading of the transmitter.

No. 3 - Strain or egg shaped insulators are not recommended for antenna insulation. Any good tension insulator of glass or glazed porcelain with a leakage length of at least 8 inches should be used. The antenna wire should be solid #12 enameled copper wire. The lead-in, which can be of the same type wire as the antenna, connects directly to the lead-in bushing and must not touch any portion of the boat or rigging.

No. 4 - A ground plate at least 20 square feet in area should be of copper or equivalent rust-resisting metal, preferably 20 gauge in thickness. This sheet, which may be of any convenient shape, should be fastened tightly against the outside of the hull below the water line. The ground lead of size 8 copper wire must be as short and direct as possible from the ground plate to the transmitter, and should be securely soldered to the plate. After installation the ground plate may be left bare or painted as you prefer.

## GUARANTEE

This Radiophone is guaranteed to be free from any defect in workmanship and material that may develop within a period of ninety (90) days from date of purchase, under the terms of standard guarantee, as designated by the Radio Manufacturers Association.

Any part or parts that prove defective within this period will be replaced without charge when subjected to examination at our factory, providing such defect, in our opinion, is due to faulty material or workmanship, and not caused by tampering, abuse or normal wear. All such adjustments to be made F.O.B. the factory. Should it be necessary to return any part or parts to the factory, a "Return Material Permit" must be obtained in advance by first writing the Adjustment Department, who will issue due authorization under the terms of the guarantee. The Hallcrafters Co. reserves the right to make changes in design or add improvements to instruments manufactured by them without incurring any obligation to install the same in any instrument purchased.

ALL HALLCRAFTERS Radiophones are built under Patents of the Radio Corporation of America and the American Telephone and Telegraph Company.