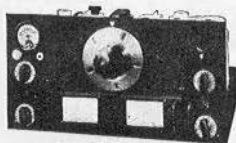


The COMMUNICATION RECEIVER

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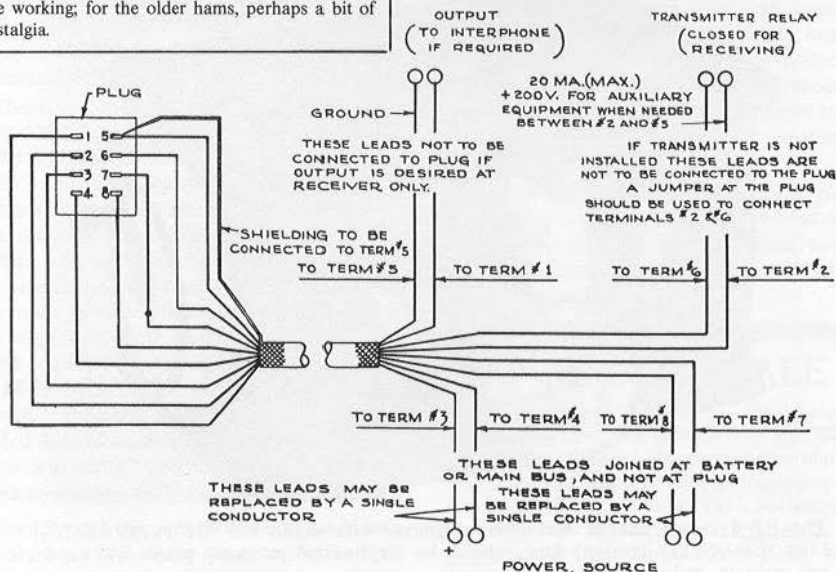
RESTORING THE BC-348 WORLD WAR II HIGH FREQUENCY AIRCRAFT RECEIVER TO OPERATING CONDITION

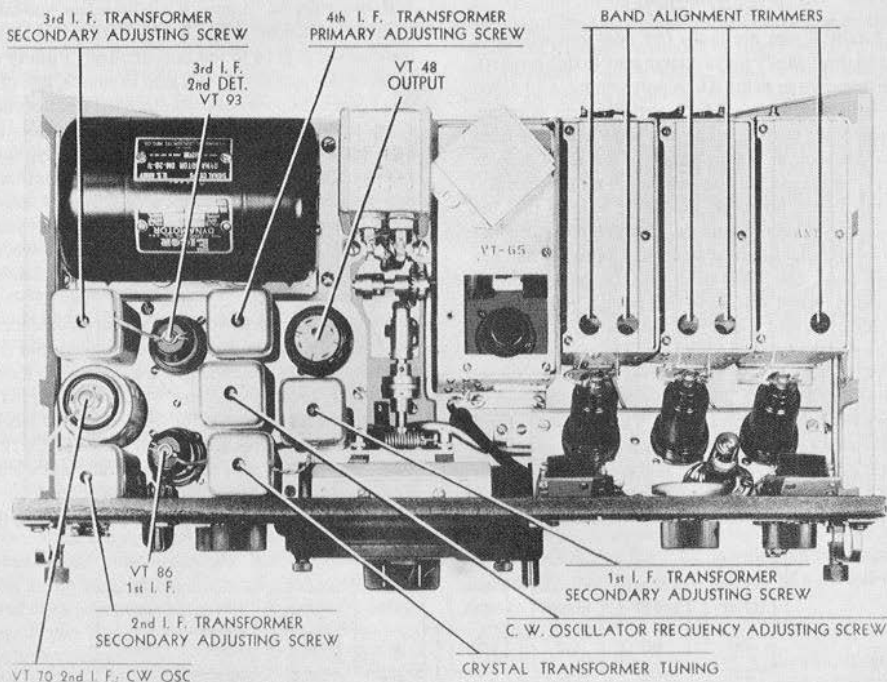
Collectors of old radios, like collectors of old cars, have a distinct advantage over those who accumulate bottles and other passive artifacts. The early radios and cars, those romantic, shining creations of glass instruments, polished wood, and shining brass can be made to work; they actually can be made to do something! Furthermore, the collectors of old radios and cars who do their own restoring invariably derive a great deal of satisfaction in the process.

The communications receivers of the mid-1930s were more often black boxes than polished wood and brass, but none the less romantic, in that they represented a distinctive technology which was emerging during an era of world upheaval. Military communications equipment, designed during the 30's, played a large part in the decades of the 40's and 50's in two major wars. The classic items of military surplus, in the unaltered condition, are now becoming scarce, and interest in them is reviving. The BC-348 receiver is a classic, and for a few years after WW II was widely used in amateur stations in the US and Europe. The younger generations of collectors and radio buffs may be interested in getting one working; for the older hams, perhaps a bit of nostalgia.

It is assumed that the reader who wishes to continue has a BC-348, either version, in decent shape. As promised, we will give an outline to follow in restoring this receiver to operating condition. Note, however, that the key word is "operating". If you wish to turn the 348 into a modern sideband communications receiver, you have a problem which will not be addressed here.

But before you do anything to your venerable BC-348, stop a minute and take a good look at it. If you have a mint version, that is, with no changes from the original, then you might consider strongly cleaning it up, tagging it, and putting it on the display shelf. Such are becoming relatively scarce, and their monetary value is sure to appreciate in the years ahead. And **DO NOT** attempt to operate any of these receivers without first going over them very carefully; too many of the components will not take the punishment after all this time, and they will fail the smoke test.





However, by following a few basics and applying some specifics picked up by the writer in reworking a number of these units, the job can be accomplished without too much trouble, and you will end up with an interesting general coverage receiver (more or less) of the late 1930s, in working condition.

If you have to purchase a unit, the prices are still reasonable. Try to get one that appears decent, has all the parts on it, and in which all the tubes are present. Also, there should be no major changes in the RF, IF or audio circuits. The basic philosophy is to end up with a BC-348 which is essentially the original, with major changes only in the power supply circuits. While you're at it, since we don't have room to reproduce the diagrams in this column, try to get a copy of the *Handbook of Maintenance Instructions*, and if you are real lucky, a copy of the *Handbook of Bench Test and Alignment Procedures for Radio Receiver AN/ARR-11*. Circuit information can also be obtained from a number of other sources, including MARS bulletins, surplus handbooks, and back files of *CQ*, *QST* and *73*. The November 1947 issue of *QST* has several good articles.

Because these receivers were designed with circuit boards and rather complex wiring harnesses in which the color coding has faded, it is often difficult to work on them without a detailed wiring diagram. It is also helpful, though not essential, to have an FT-154 mounting rack with the PL-103 attached

connector. If you can't get one, attach some mounting feet to the bottom of the cabinet and carry on.

If you are fortunate in your purchase, you will have an original appearing receiver with an AC supply built in. If you can get the original dynamotor, by all means grab it. If any of the original parts which might have been removed in the conversion process are still available, get them also. If the name plate has been removed and lost, keep the receiver for parts and look for another. Most hams, by the way, did build in an AC supply; very few used the dynamotor.

First give the receiver a good cleaning. If it is necessary to remove the front panel, unsolder the antenna and dial light leads, remove the knobs, the control retaining nuts, and the assorted screws, and lift the panel off. Check to see just what changes, if any, have been made in the conversion process. Comparison with an unchanged receiver of the same style is helpful.

Block diagrams of the two styles are given for reference. The J, N, and Q series was developed later and used single-ended tubes throughout, including a combined 1st detector/oscillator. Externally the receiver resembles the earlier H, K, L, and R version, and the operating parameters are the same, but the tubes are in different locations, the circuitry is simpler, and the under-chassis area is easier to work with.

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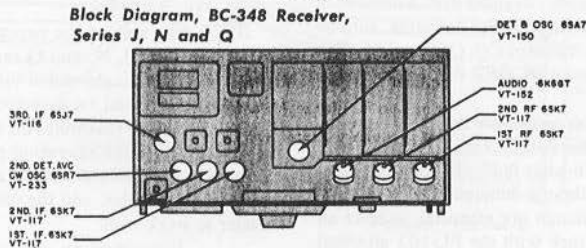
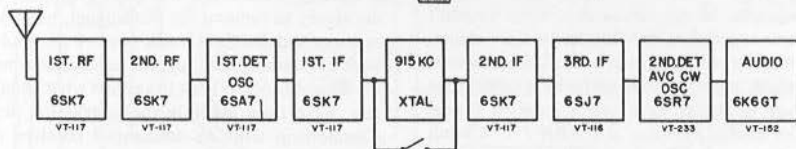
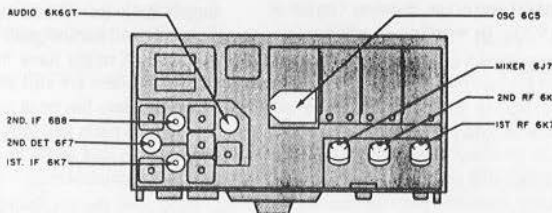
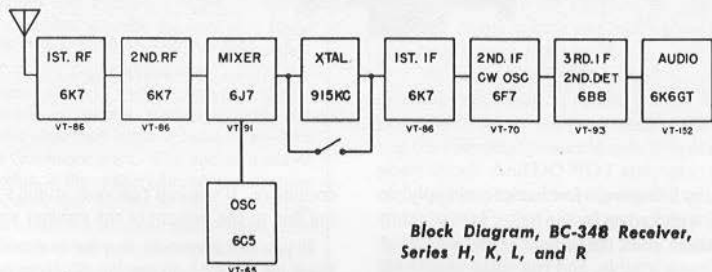
ELECTRICAL

Again, if you are lucky (by now you will have noted that "luck" plays a large part in this project), the transformer in the AC supply you have inherited or built will have a 24-28 volt filament winding. These were custom made and were available from sources such as Radio Shack in the early surplus days, and made the conversion job relatively easy. Many hams, however, not being able to find the necessary filament voltage, converted the original series-parallel filament string to 6 volts. If this has been done, the job is neat, and the tubes light up properly (when you get to that point), you have the option of leaving it as is and continuing, or putting it back into the original condition. The dial lights, two 6.3V, 250 ma lamps, are in series with a 60 ohm resistor and a 4 watt, 200 ohm pot, and designed to work from the 28 volt source. The dimmer control makes for a great night light when you do some late-night casual band cruising. If you decide to go with the 6 volt supply, replace the dimmer control with a dummy and continue.

Remove the AC supply, if you have one, and take a very good look at it. The B- IS NOT grounded to the chassis; it goes to the bias circuits. Failure to observe this precaution will lead to smoke, lots of it (the voice of experience). Replace the electrolytics if necessary, keeping the negative lead isolated from ground. If you have to build a supply, consider putting it in the speaker cabinet to cut down heat inside the receiver, since an AC supply with a 5Y3 puts out considerably more heat than the dynamotor did. Alternately, use some diodes. However you do it, the supply, under load, should not deliver more than 250 VDC.

Note that there are two sets of power connections; the main plug at the back of the receiver, and the five wires which attached to the dynamotor. Refer to the diagram for the former, noting that terminals 2 and 6 must be shorted for the receiver to work. The dynamotor wires are: B+, B-, 28 VDC +, 28 VDC - (which is also chassis ground), and a lead which delivers 28 V to the filaments.

Switching the AC supply can be neatly done by



using the MVC-OFF-AVC switch. It is only necessary to unsolder the lead from the pilot lights from the switch and reattach it to any convenient filament point of the correct voltage. Then run the transformer primary through the original fuse and the switch. Refer to your wiring diagram.

Now take a good look at the molded black caps which resemble large micas, which they are not. They are paper, and usually bad, especially in the high voltage circuit. The best way to handle them is to snip the connecting leads and wire in 0.01 ceramics, point-to-point. You will find several stacked up on top of the slanted tube shelf. Cut the leads under the tube shelf and wire in the replacements, leaving the old capacitors in place for appearance. Under the main chassis it may be necessary to replace only the high-voltage bypasses; the cathode caps will usually work. While you are in there, replace any interstage coupling caps in the audio circuits.

For loudspeaker operation proper impedance matching to the output transformer is very important, since the audio system was not designed for speaker operation in aircraft. It is best to leave the tap at the high setting, approximately 4500 ohms, and use a second transformer to match to the speaker. If you feel an absolute need for more audio, a simple voltage pre-amp should do the job. Be careful, however, of the bias circuits.

The alignment procedure follows the usual pattern ... set the IF to 915 kc, then the oscillator, mixer, and RF stages in that order. The oscillator is tuned to the high side of the signal, that is, to 915 kc above the input signal. Alignment of the crystal and the IF for optimum performance is somewhat tricky, however, and it is best to have the receiver manual for the precise procedure. One interesting point was made by W4WM in the August 1947 *QST* H&K column, where he pointed out that ex-

cessive heat from internal AC supplies would sometimes lead to crystal filter failure due to the deposit of a gummy material on the crystal. When this happens, take it apart, clean it with soapy water, and reassemble.

Hardy souls and purists may decide that the only way to go is to make the unit work with the original dynamotor. If you feel that venturesome, you will need a newly lubricated, possibly refurbished dynamotor and a power pack with good dynamic regulation delivering 28 VDC at 5-8 amps. Be sure the cable wires are adequate for the current. Lubricating instructions for the dynamotor are found inside the end bells. Check to see that the original wiring is intact and that the low-voltage filters are good. As with any small motor device, do not overlubricate, and check the brushes and the commutator. If the brushes have hard spots they should be replaced, and if there are grooves on the commutator surface, it should be smoothed down. The nominal rating of the dynamotor is 1.23 amps input at 27.9 VDC, although it will operate as low as 24 volts with reduced output. Output at rated input is 220 VDC at 70 ma. When you fire it up, monitor both the input and output voltages, under load, for a period of time.

CONCLUDING

After all this, you may have a BC-348 up and running. Now all you have to do is locate and polish for display a BC-375 transmitter, and you will have two of the Basic Components (that's what BC—stands for, I am told) from the larger aircraft, such as the B-17, used in WW II. However, don't attempt to put the 375 on the air ... as a ham transmitter it is worse than useless.

And if you want to get some of the flavor of the golden surplus days, look at a Radio Shack ad from the late 1940s ... they sold the BC-348 for \$49.50, a rock-bottom price.

Can you read

GERMAN? DUTCH?

AWA exchanges publications with the large German and Netherlands clubs. The clubs have 300 to 500 members and print excellent club journals covering a wide variety of subjects of interest to the radio historian and collector. The German club, under the guidance of Rudiger Walz, has printed a fine series of articles on vacuum tube development and identification and other related subjects.

The Netherlands journal has a 8 1/4 x 11 1/2" format with similar subject matter. A recent

issue covered early transatlantic stations and an article on loudspeaker development. Both papers have member's "Want Ads".

There is one problem, however. Both publications are printed in their native language. If you would like to borrow a copy from the AWA Library, arrangements can be made to loan a few issues. A deposit will be necessary. Write: AWA, Main Street, Holcomb, NY 14469.

German club: FUNKGESCHICHTE

Zeitschrift für die Nachrichtentechnik von gestern

Netherlands club: RADIOHISTORISCH TIJDSCHRIFT

Nederlandse Vereniging voor de Historie de Radio