

PHILCO SERVICE SUPERVISOR



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INDEPENDENT PHILCO SERVICE-
MEN THROUGHOUT THE NATION

June, 1952

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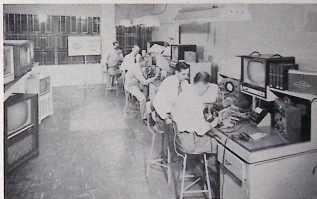
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PRACTICAL SERVICE ASSISTANCE FOR THE SERVICEMAN



Philco-Los Angeles TV Service Clinic

AS A PERMANENT, personal contact between factory headquarters and the serviceman, the distributor is often called upon to supplement the flow of technical material and assistance from the factory. This he does through the medium of service clinics and troubleshooting advice to servicemen in his territory. It's been proven over and over again that a well-run service clinic is worth its weight in gold to the serviceman.

Philco has pioneered establishment of its Distributor Service Clinics for one reason—to acquaint the Philco Factory-Supervised Serviceman with new techniques and to help him "over the barrel" with tough service problems. The combined efforts and years of practical experience of our distributor personnel are at his disposal as a permanent and valuable feature of his membership in Philco Factory-Supervised Service.

Philco - Los Angeles knows the important role service clinics play in helping the serviceman and the industry. And if the amount of service people it attracts is an indication of effectiveness, the California branch clinic is more than doing its part for Far Western servicemen!

Philco - Los Angeles has constantly encouraged its members to use service clinic facilities freely. On this page you will see a typical Philco - Los Angeles TV Service Clinic. The test benches here were designed and built entirely by their Service Department. The service manuals, clinic aids, training aids, and test gear displayed are all avail-

(Continued on Page Two)

PRACTICAL SERVICE ASSISTANCE . . .

(Continued from Front Cover)

able to any Philco Factory-Supervised Serviceman in need of technical assistance.

To the left of the photograph (on the cover) note the unusually high test bench with the table models on top and the room allowed for consoles below. This not only conserves floor space, but avoids possible damage to the sets. Here servicemen are also instructed in following efficient shop practices to protect their customers' appliances.

The illustration at the lower right of this page shows a typical Philco-Los Angeles classroom. A September-to-June TV course sponsored by the Los Angeles Trade Technical Junior College is currently being conducted here under the guidance of Philco-Los Angeles' own clinic instructor. Both lecture classes and practical shop periods are conducted in this clinic. A record attendance of 99% speaks for itself about the interest being displayed in television by California servicemen.

Wherever Philco Factory-Supervised Servicemen are located, they are sure to find a Distributor's Service Clinic in operation, anxious to be of assistance. Like Philco - Los Angeles these clinics have been set aside for members' use whenever they need them. With new and sometimes puzzling conditions cropping up in servicing, it is necessary to pool mental resources and technical facilities to come up with the answers. Your local Philco Distributor has done that and will continue doing it for your benefit.

When a tough "fix" comes up, don't try to tackle it alone, losing valuable business in the bargain. Look to your distributor for the assistance he's set up to give you. He'll find a way — or make one!

Typical Service Classroom at
Philco-Los Angeles ➔

EVALUATING THE EFFICIENCY OF YOUR TV SERVICE DEPARTMENT

NAME <i>John M. Doe</i>		DATE <i>5/20/52</i>		
PROBLEM	SUGGESTED AVERAGE TIME	TIME ACTUALLY REQUIRED	SUMMARY	
			ABOVE AVERAGE	BELOW AVERAGE
POOR HORIZ. SYNC.	45 min.	30 min.	15 min.	
POOR VERTICAL SYNC.	15 min.	25 min.	10 min.	
POOR PICTURE	1 hr.	1 hr. 30 min.		30 min.
POOR SOUND	45 min.	1 hr. 15 min.		30 min.
NO HIGH VOLTAGE	1 hr.	45 min.	15 min.	

It is vitally important that the individual serviceman or service department owner be able to evaluate the efficiency of himself or his employees. In so doing, the serviceman or shop owner can easily determine just where he needs to focus his attention to increase his productivity. We feel that the following suggested outline will aid everyone concerned in the service business to determine his weak points thereby permitting a shop owner to get more productivity and help the individual focus his efforts of learning where they are most needed.

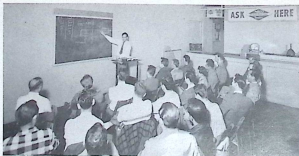
- (1) Work up a job time sheet as shown above.
- (2) Determine the average time needed per job similar to the one shown in column 2 in the above illustration.
- (3) Over a period of time determine the amount of time required for yourself or your

employees to complete those tasks.

(4) Focus the efforts of employees on jobs for which they are most suited.

(5) Focus training efforts toward individuals on subjects most needed.

In summarizing the job card shown above, we can quickly see that this man is very efficient in troubleshooting Horizontal and Vertical Sweep sections as well as high voltage. However, we see that he has taken longer than the allotted time to repair picture and sound sections. The man himself can concentrate his study efforts toward sound and picture sections while his employer can use him for jobs concerning sync and high voltage. In so doing, the individual will be strengthened and the employer will benefit by having a more efficient business.



SHOP PRACTICES AND SERVICE TECHNIQUES—TELEVISION

HORIZONTAL OSCILLATOR

HARMONIC RADIATION

Today there are complaints of a television receiver causing interference to radio receiving sets. These complaints mainly come from areas where radio reception is difficult to receive under normal conditions, because of a weak signal. It is possible when a person purchases a television set in one of these areas, that the harmonics of the horizontal oscillator will be strong enough, to radiate, and cause interference to neighboring radio sets.

When first considering the problem of horizontal oscillator radiation, it probably is best to review how it is possible for this low line frequency to radiate and cause interference on the broadcast band. The standard broad-

cast band covers a range from about 550 KC to 1600 KC. The horizontal line frequency is 15,750 cycles. The only possible way for the horizontal line frequency to radiate and cause radio interference is through its harmonics.

Let us take a simple example of how this occurs: If we choose a frequency which falls in the broadcast band near the low end and divide it by the horizontal line frequency (15,750) we will be able to determine what harmonic of 15,750 is causing the trouble. $600 \text{ KC}/15,750 = 38$. harmonic.

Once you have convinced yourself that it is actually horizontal oscillator radiation and is caused by harmonics of 15,750, the job of isolating the interfering set becomes necessary. If you know where the set is that is causing the

interference your problem is somewhat simplified. If you have to trace it down, it may be necessary to go from house to house and ask each owner of a television set if they have their set on, and if they do, ask them to please turn it off so you can test for interference. This job should be done very tactfully for you need each television owner's cooperation to successfully clear up the problem. An alternate method of finding the interfering set, is to use a portable radio. By tuning in the interference on the portable and taking a walk, it will not be too hard to spot the homes which are causing interference. This will be much faster than checking each home that is in the neighborhood. Your portable radio will act as your detector. When considering a portable radio for this job there are certain specifications that must be fulfilled.

1. Operate on A.C. and batteries.

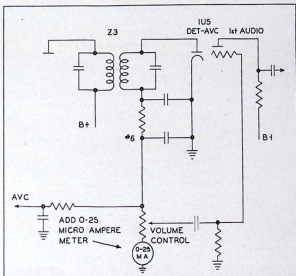


FIGURE 1

2. Good Selectivity and Sensitivity.

3. Highly directional antenna.

The Philco Model 52-643 fulfills these specifications very nicely. First it operates on A.C. and batteries, second, it has good selectivity for it has a stage of RF and is very sensitive. Number three, the Model 52-643 has the Magnecor high impedance loop, which is highly sensitive and very directive.

A slight modification of the receiver is necessary to make it into the type of test equipment which is necessary for this work. By opening the connection between the low side of the volume control and ground, and inserting a 0 to 25 micro ampere meter, we can make an instrument which will indicate relative signal strength. See figure 1.

We know that this receiver will help us locate an interfering set but let us see how it can be used in the home once the interfering set has been located.

It might be wise at this point to examine a television receiver and determine what points would actually radiate an interfering signal. We know number one, that the horizontal output tube develops great power and therefore would be the major source of the interference. It is then logical to assume that if this were shielded we would reduce the interference by great amount. Two, power from the horizontal output tube is then fed to the deflection yoke. The deflection yoke fits into the deflection housing which shields the yoke to a point where radiation from it is negligible. However, it is quite possible that the leads from the deflection yoke will have sufficient energy induced in the leads that radiation from this point will be quite large.

Another consideration is the focusing assembly which is in close

proximity to the deflection yokes and it too can cause a great deal of radiation and it is therefore necessary to make sure that the focusing assembly is at A.C. ground potential, and is not floating above chassis ground.

In order to save precious metals, the support arms on the bracket assembly for the cathode ray tube are made of heavy canvas belting. The front bracket which the canvas belting support arms are tied to is made of aluminum and is returned to ground through a resistor. However, we have found that the front band is not at A.C. ground potential and therefore it is possible to get some horizontal oscillator radiation from this point.

Another source of radiation can be through the A.C. power line. In order to reduce the radiation on the power line both sides of the line should be bypassed to the chassis ground through .01 condensers so that the line will not carry any radiation.

Once we have located the set causing the interference tune the portable detector for the maximum interference on the meter. A loud 15,750 whistle will be heard plus some video buzz. After you have the receiver set for maximum do not retune but leave it set, noting the meter reading. The next step is to turn the television receiver off, and note two things, one, has the interference disappeared, (where you tuned in correctly), and two, if you were what does the meter now read. When the set is turned on the interference signal will squag back and forth, until the sync locks the horizontal oscillator on frequency. Once again the interfering whistle will be heard.

We have checked and found a set causing interference and have determined it will take parts as-

sembled under part no. 45-1784 to correct this problem.

INSTALLING 45-1783

Philco has assembled two different groups of parts under the following part numbers 45-1783 and 45-1784. To know which package of parts has been assembled the power supply number must first be known. The enclosed list should be followed when ordering the horizontal harmonic radiation package.

POWER SUPPLY MARKING

45-1783: C1, C2, CP1, F2, FR2.

45-1784: D1, D4, D1A, D1B, D4A, G1, G1A, G2.

Step number one is to install the metal tube shield which is provided to shield the horizontal output tube.

This shield is fabricated so as to screw onto the high voltage cage. Holes are provided in the cage, and no drilling will be necessary. At this point turn the receiver on and check the amount of interference. To help evaluate this problem lets assign some given meter reading. No interfering signal in-

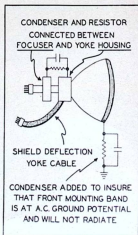


FIGURE 2

put to receiver 4 micro amperes. With the television receiver on the meter reads 9 micro amperes. With the shield on the horizontal amplifier tube the meter reads about 6.5 micro amps. This has done some good but not enough to be satisfactory. The next thing we will wrap the deflection cable with aluminum foil tape, and clamp or bond both ends, so they are at chassis potential. A check of the meter reading indicates about 6.5 micro amps and would appear that wrapping the cable did nothing to help reduce the interference. However, each little bit helped and we will find regardless of meter reading it has helped. The next thing we will try is connecting a condenser and resistor between the deflection yoke housing and focuser which will put the focus assembly at A.C. ground potential. It is quite possible without this .01 condenser and 100,000 ohm resistor connected between these points the focuser will radiate. After this has been installed, check the meter reading and note the amount. This probably will reduce the interference by about .5 micro amp. but will do a lot to help reduce the over all interference.

The basket which holds the cathode ray tube has canvas belt-

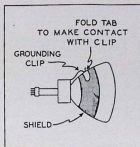


FIGURE 3

ing straps which mount the deflection yoke shield, and the front band on the cathode ray tube. The front band is returned to ground through a 100,000 ohm resistor. The reason for this resistor is to allow any charge which builds up on the aluminum band to leak off to ground. By adding a .01 mfd. condenser in parallel with the resistor we are sure it is now at A.C. ground potential and will not radiate. See figure 2.

The next step is to shield the cathode ray tube with aluminum foil which is also provided in the package. When you have reached this stage, check to see what cathode ray tube is used in the model you are working on. After you have checked the tube and deter-

mined which line should be followed, cut out the shield. This shield should be placed under the canvas belting and make sure the aquadag grounding clips make contact with the aluminum foil.

The shield will act like one plate of a condenser. The other plate of the condenser will be the inside coating of the cathode ray tube.

One of the most necessary things to do is to ground each side of the A.C. power line through .01 condensers. This is done in most cases, however, it is wise to check and make sure each side of the line is bypassed to chassis ground. This will help prevent the power line from radiating, see figure 4.

It may be found that by adding line bypass condensers they will eliminate the interference, however in most cases are already in the circuit.

After all of the necessary changes have been made a final check for interferences should be tried. Turn the television set off and note the meter reading. Then turn the television set back on and note the reading. With the portable detector resting approximately ten feet away there will be no difference in meter readings. You may still be able to hear the whistle at this location but returning to the home of the complaining customer you will find sufficient reduction in interference that they no longer have a complaint.

There are other things which should be tried if the points mentioned do not help sufficiently. They would be such things as grounding both sets. Checking the power source to make sure it is grounded properly. These are the refinements which are left to the skill of the technician on the particular job he is working. Each case will be different and no given set of rules can be set down.

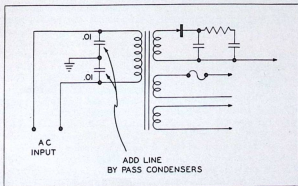


FIGURE 4

SHOP PRACTICES AND SERVICE TECHNIQUES—AUTO RADIO

ELIMINATION OF TIRE STATIC

Now that summer is just around the corner, more cars are going to be sold and this means more auto radio installations. This also means more installation troubles, and it is then that five minutes of reading will sometimes save three hours work of the trial and error variety.

Frequently, an auto radio installation is made that sounds good in the shop, but as soon as the car travels on a concrete highway, reception is ruined by continuous static. At first it might seem to be some sort of ignition interference or atmospheric static. However, if it is not present during rainy or damp weather, or if applying the foot brakes or stopping the car and leaving the motor running eliminates the noise, the trouble is tire static.

Usually, static does not develop on tires until a speed of about 20 miles per hour has been reached and it is especially prevalent while driving on re-enforced concrete or other hard surfaced roads. To locate the offending wheel, drive with both right wheels off the road on the dirt. If the static stops when the wheels leave the concrete it is the right front wheel. If it does not stop, drive with the left wheels on the dirt and note results. The rear wheels are grounded to the frame of the car through the axles and rear end, providing a continuous discharge path for the static. The front wheels are normally grounded to the car frame through the front-wheel bearings and axles, but, since the bearings are packed with grease, the path to the car frame is very often of high resistance, and may even be intermittently open. It is, therefore, only the static discharge in the **FRONT** wheels that affects the radio and causes the interference. In order

to eliminate this static, some method of providing a low-resistance electrical path between the wheel and axle must be used.

Several remedies have been tried with varying degrees of success. One early method was to change the grease in the front-wheel bearings to a type of grease containing graphite. Another remedy was to paint the outside walls of the tires with a graphite-base paint. However, the most reliable method is to install static-eliminating springs in

cap. Before replacing the cap, be sure the end of the axle cotter pin will not interfere with the spring. Place a small amount of grease in the indent on the end of the axle; this will prevent undue wearing of the spring tip. Replace the cap, adjusting the tension of the spring, if necessary, so that its tip bears firmly in the indent on the end of the axle.

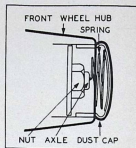


FIGURE 2

Sometimes a front wheel alignment may materially reduce or remove tire static by reducing the amount of scuffing of the tread against the road. Switching tires frequently helps but this is liable to be only a temporary cure as the replacement tire eventually wears down to the same point as the original, and static starts up again.

An additional aid to tire-static elimination in very stubborn cases, is the use of powdered graphite which is available either in a metal tube or envelope. To use the graphite, deflate the tire, remove the valve core and squeeze in or, by use of an injector, blow the prescribed amount of graphite into the inner tube. When the tire is again inflated this powder tends to coat the inside of the tube thus reducing the static charge created in the tire. In extreme cases it may be necessary to insert this powder between the tire and the tube and also in the tubes of the rear tires.

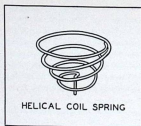


FIGURE 1

the front wheels. These springs are obtainable from your Philco Distributor.

To install the spring, remove the hub cap from the wheel; then remove the dust cap. On most cars, the cap can be pried off; on a few cars it is threaded and must be removed with a wrench. Clean out all the excess grease from the dust cap and force the large end of the spring all the way into the

NEW SERVICING METHODS

PART THREE—The Power Supply

The oscilloscope analysis of a power supply quickly identifies a failure which otherwise might only be found by checking each individual part. True, the experienced service man can sometimes guess which part is at fault such as suspecting a faulty filter condenser if there is an unusual amount of hum, etc., but an oscilloscope allows you to see which part is not doing a job. Voltage indications do not always show faulty parts as frequently the voltage difference noted may be little and such variations can occur between different sets.

Again, however, it is necessary to understand the meaning of each waveform as viewed at certain points of the circuit.

Figure 1 is a typical rectifier circuit with which we will first observe the waveforms at points "A" and "C" as they appear with a normally operating set. Connect the "Ground" terminal of the oscilloscope to the radio chassis. Attach a shielded test lead to the "Vertical" terminal that you can use as a probe. (Check your oscilloscope to determine if there is a blocking condenser built in series with this terminal. If not,

connect a .1MFD condenser in series with this lead to protect the oscilloscope from D.C.)

Adjust the "rough" timing circuit to cover the 115 cycle frequency.



FIGURE 2

First connect the probe to point "A" the cathode of the rectifier tube. The normal waveform response will be like figure 2, as the "Fine" adjustment is made a single waveform will be had like figure 3.

This is the rectified pulsating D.C. output before filtering, the pulses, of course, appearing at the same rate as the vibrator frequency.

Next connect the probe to point "C" the waveform will now appear as figure 4. This shows the filtering action of the input con-



FIGURE 3

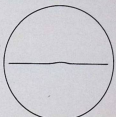


FIGURE 4

denser, filter resistor and output condenser. Note that it appears to be practically pure D.C. and unless the gain of the oscilloscope is advanced will represent almost a straight line.

Now connect the probe to point "B" and observe the waveform to be the same as point "A". Disconnect the input filter condenser and observe the increase in height of the waveform — in most cases 3 to 1. It is a good plan at this point to start the use of a viewing screen or disc. Most oscilloscopes are provided with a transparent disc that fits over the cathode ray tube on which are engraved lines so that reference points may be established for comparative purposes. With the screen in place again obtain the waveform as shown in figure 5 with the condenser in the circuit and adjust the height of the waveform between two lines as "A" in figure 5. Now remove the condenser lead and without changing the gain control of the oscilloscope note the waveform to appear as in "B" of figure 5. You can see from this that

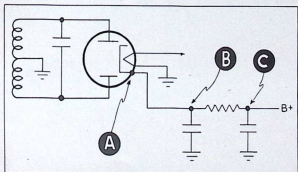


FIGURE 1

with a knowledge of what a normal condition is like, it is possible to immediately tell that the trouble is with the input filter being open. Observation at point "C" with the output filter disconnected will be like figure 6. Note that because of the filtering action of the input filter the hum is reduced considerably over that had when the input filter is open. Similarly, note the comparison between figure 6 and 7. In figure 7 the filter resistor has broken down to low ohmage eliminating its filtering action. As it does not have quite as much effect on filtering as the output condenser the hum amplitude is less.

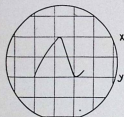


FIGURE 5A

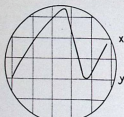


FIGURE 5B

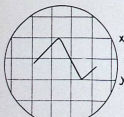


FIGURE 8

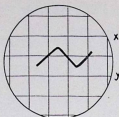


FIGURE 7

THE AUDIO SECTION

Checking the audio section requires the use of a signal generator. An audio signal generator with 400 cycle modulation should be connected to the grid of the first audio tube at point "A" as shown in figure 8. This is a typical auto radio audio circuit including phase inversion. This circuit was selected because not only is it commonly used but peculiarities occurring only with phase inversion can be analyzed in addition to conventional audio problems.

To establish the normal waveforms that will appear at various places in the circuit connect the oscilloscope as follows:

Attach the shielded test lead referred to before to the "Vertical" terminal of the oscilloscope and

the shield to the "Ground" terminal. The probe lead should be connected to point "B", the plate of one output tube, and the shield grounded to the chassis.

In making these tests the volume control of the radio should be on full, and the tone control in the most brilliant or minimum bass position.

The output of the signal generator can now be advanced until the sound from the speaker is that of normal listening volume.

Set the "coarse" timing of the oscilloscope to 400 cycles and adjust the "Fine" tuning until the pattern on the oscilloscope stands still.

The waveform will appear as shown in figure 9.

The "Vertical" gain of the oscilloscope should be adjusted so

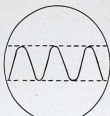


FIGURE 9

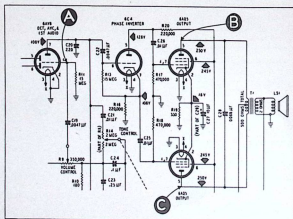


FIGURE 8

that the waveform extends between two reference lines between the viewing screen covering 3/4 of the screen distance.

Now remove the shield lead from the chassis and connect it to point "C". The oscilloscope is now connected plate to plate. Without changing the signal generator or oscilloscope gain control, it will be noted that the waveform has not changed in shape, but has increased in amplitude considerably as shown in figure 10.

Increase the output of the signal generator and note that the tops of the waveforms flatten out as in figure 11 to almost a square wave waveform. This represents an overloading condition.

Two more observations should be made which show waveforms peculiar to phase inversion. Reconnect the oscilloscope leads to chassis and point "B" and with normal signal generator output. Note the waveform to be as "A" in figure 12. Then remove the lead from point "B" and connect to point "C". Note that the waveform is inverted. This is important

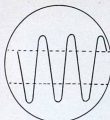


FIGURE 10



FIGURE 11



FIGURE 12A

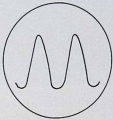


FIGURE 12B

to remember when making service tests as this is peculiar to phase inversion.

With other methods of testing, a difficult thing to discover is where 1/2 of a phase inversion circuit is not operating properly, because the voltages may be normal. The volume is hard to tell from normal unless you are very familiar with a particular set. Also distortion may not be a clue for the same reason yet it is easily discovered with an oscilloscope.

Connect the oscilloscope lead to point "B" and chassis. Advance the signal generator output to produce an overload waveform. If the waveform is as shown in "A" and figure 12 the opposite section of the circuit is not producing an equivalent signal to that being tested.

Now connect the probe lead to point "C". An inverted waveform "B" will mean again that it is the opposite phase of the circuit that is not working.

Let us examine another difficult item. The symptoms are — The reception is normal except a slight high frequency whistle. There is

no voltage change and this whistle may easily be misinterpreted to be in the R.F. or I.F. section. Actually it is the result of plate to plate condenser C28 being open. It is easily detected by an oscilloscope. Connect the oscilloscope leads with ground lead to point "C" and probe lead to point "B". The pattern will resemble "A" of figure 13 if the volume of the set is wide open and "B" of figure 13 if the

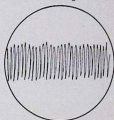


FIGURE 13A

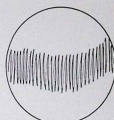


FIGURE 13B

volume is retarded. The latter pattern giving the clue to what is happening as the audio waveform is shown saturated by R.F. not being by-passed in the plate circuit.

If the cathode by-pass condenser for the two output tubes is shorted, in this case C27, a normal waveform with an R.F. component, as shown in figure 14, will be produced. If the output of the signal generator is high the waveform may be flat topped but will still have the R.F. component.

If this condenser is open the wave shape will reflect the change in time constant and will be that shown in figure 15.

Not all leaky condensers cause waveshapes to change. In most

cases, they reduce amplitude which would necessitate a before and after observation to detect. In the case of the coupling condenser, C26, it both changes shape and amplitude. See figure 16.

It is probably obvious by now that the oscilloscope can also be used to measure gain per stage

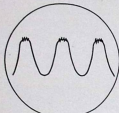


FIGURE 14



FIGURE 15

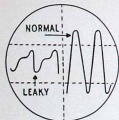


FIGURE 16

and as a signal tracer. For example in figure 8. With the audio signal applied to the grid of the first audio it is possible to pick off waveform response in any part of the circuit which not only will give information from a continuity standpoint, but when observations are analyzed as we have just described, the condition of the components can also be determined.

In Part Four we will discuss alignment of R.F. and I.F. circuits with attending problems.

NEW PRODUCT NEWS—ELECTRIC RANGE

GIVE CUSTOMERS THE ADDED CONVENIENCE OF THE JIFFY LIFT UNIT



Jiffy Lift Unit and Well Assy. 3750-3

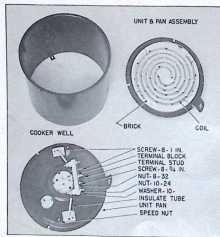
Not all Philco Electric Ranges include the Jiffy Lift feature in the Deep Well Cookers as standard equipment. And, there are many people who desire the added convenience of a fourth surface unit. Philco can provide you with the parts necessary to make this conversion and at a special trade value. You should see your Philco Distributor about this.

Both the Jiffy Lift and the stationary cookers use the same six

quart kettle so that the Jiffy Lift can be used to replace the stationary model by replacing the unit and well only. These can be ordered under part number 3750-3.

Jiffy Lift means just what the name implies. When in the lower position, it is a deep well cooker. Remove the cooker kettle, raise the unit and in a jiffy you have a fourth surface unit. It is a 1250 watt mono-tube unit and will provide five different heats.

To install the Jiffy Lift well and unit, first disconnect the range from its power source. Then pull up on the flange of the well until the units that hold the wiring to the terminal block can be removed. Remove the wiring and connect it to the mono-unit terminal block. Follow the color code wiring of any one of the other units. Then guide the well into position and the job is done.



Stationary Deep Well Unit and Well Assy. 3800-2

SHOP PRACTICES AND SERVICE TECHNIQUES—AIR CONDITIONING

MODEL 106-H INSTALLATION

The importance of the proper installation of the Air Conditioner cannot be emphasized too much. The location of the unit will play a very important part in the efficiency of operation. It is always advisable to install the Air Conditioner in a window which is situated on the shaded side of the building, provided satisfactory air distribution can be obtained for the room that is to be conditioned. It will be economical and will greatly assist the air conditioner if all windows are sealed against the infiltration of hot outside air. It is impractical to attempt to reduce the temperature and humidity in a room if an excessive amount of air is permitted to enter. The room should be made as air tight as possible before installing the Air Conditioner.

A great amount of heat is transmitted through window glass. Awnings or shades should be installed where the sun directly strikes the windows for any length of time during the day.

When installing the window model 106-H, the cradle and its supports must be securely fastened to the window sill, and must be rigid enough to prevent vibration, which will also eliminate objectional noises. The standard installation equipment supplied, permits installation of the Air Conditioner in a double hung window of the sash type, up to a width of 48 inches. This installation can be made by using window filler board of sufficient width to fit the openings at the side of the unit. Extra lengths of window sash seal gasket can be used to seal off the complete width of the window, as shown in figure 3.

The installation procedure is as follows:

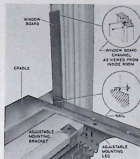


FIGURE 1

1. Secure the window board channels to the inside of the window frame, as shown in figure 1.

2. Assemble each of the adjustable mounting legs to its support angle.

3. Measure and mark the center of the window sill. Place the cradle on the sill (figure 2), and pull the cradle inward until the locating lip on the cross member is tight against the outer edge of the sill, and mark the three screw holes. It is good practice to drill holes for the mounting screws, using a drill that is undersize with respect to the diameter of the screw. This method will prevent splitting of the sill.

4. Using the three screws provided, mount the cradle on the sill.

5. Locate the mounting support angles on the cradle so that the adjustable legs rest against the outside of the apron. Install two bolts in each adjustable mounting leg to fasten it to the cradle.

6. Tip the outside of the cradle down approximately 1/4 inch overall or about one-half bubble on a carpenter's level. When the proper cradle tilt is obtained, install lag screws through the adjustable legs into the apron. Tilt-



FIGURE 2

ing the cradle in this manner causes rain water to drain to the outside.

7. When the proper cradle position is obtained, tighten all bolts and nuts that secure the adjustable mounting legs and support angles to the cradle.

8. Slide the air conditioner onto the cradle, and push it back as far as it will go. Check the alignment of the air conditioner inside and outside.

9. Measure the width of the window boards to be installed on each side of the air conditioner. If the window is less than 48 inches wide, the window boards must be cut to the proper widths (the height is correct as supplied). To determine the proper widths, measure the distance on each side of the air conditioner between the bottoms of the grooves in the window-board channels and side mounting angles. The boards should be cut accurately to these dimensions.

To cut the boards to the proper widths, first mark off the distance, then, using a straightedge as a guide, score the board deeply with a sharp knife. Place the score line along the edge of a table, and break the board along the score.

If the sill is higher than 3/8 inch, drive a nail into the sill, midway



FIGURE 3

between the unit and the window frame (see figure 1). The shank of the nail should be $3/8$ inch below the top of the sill. When the window board is installed, the nail should hold the board $3/8$ inch to $1/2$ inch below the upper edge of the top mounting angle, to insure a good fit of the sash seal gasket.

10. Install the two window boards, check the alignment of the two boards, and, if necessary, make corrections by adjusting the side mounting angles.

11. Cut the sash seal gasket to the exact width of the window frame. Install the gasket (see figure 3) and bring the window down so that it rests on the gasket.

12. If the window does not fit properly on the seal gasket, loosen the screws in the top mounting angle, adjust the angle until it seals perfectly, then tighten the angle mounting screws making sure the outside of the cradle is tipped down.

13. Use the felt strip provided to seal the opening between the upper and lower sashes. Cut the felt as required to make an airtight seal against the window, and tack it in position. A number of light-gauge, 1-inch nails, placed 4 inches apart near the top outer edge of the lower sash, will insure a satisfactory seal.

WINDOW LOCKS

The lock on the window becomes ineffective when an air conditioner is installed; therefore, other provisions must be made to prevent the window from being opened from the outside. This is particularly necessary for installations on the ground floor. The use of Philco Window Locks, Part No. 1SD-379, is recommended. These locks, which can be quickly installed on the inside sash, will lock the sash rigidly at any height above the sill. The locks may be released to allow the sash to be raised or lowered for window-cleaning or other purposes.

SHOP PRACTICES AND SERVICE TECHNIQUES—HOME RADIO

MICROPHONICS

Microphonics, microphony or acoustic feedback is not only a very annoying condition but one which is often difficult to track down and cure. It is the intention of this article to familiarize the service technician with the causes, tests and correction for microphonics.

Microphonics are usually caused by the feedback of the audio speaker output to the receiver's front end, there modulating the incoming carrier wave. This secondary modulation of the incoming signal is caused by the change of electrical value of various components due to variations in their structure or spacing caused by vibration. This vibration may be directly transferred from the speaker by mechanical coupling through the chassis or may be induced in the affected part by the alternating pressures of the sound waves. This latter condition is most troublesome when the area surrounding the radio's R.F. circuits is resonating at a frequency near or at the mechanical resonant point of the affected part.

As an example, let us consider the case of a set which is microphonic due to vibration of the oscillator plates of the tuning condenser. As these condenser plates vibrate at an audio frequency they are changing the frequency of the oscillator about its center point at an audio rate. This in turn changes the intermediate frequency at the same audio rate. The audio sound waves, by mechanical or acoustical coupling through the chassis or enclosed cabinet air to the oscillator, have now accomplished frequency modulation of the intermediate frequency signal by the process of varying the frequency of the oscillator tank. This frequency modulation is resolved into amplitude modulation by the slope of the selectivity curve of the intermediate frequency amplifier. The second detector then performs de-

modulation, including the portion induced by acoustic feedback and the total signal is then amplified by the audio section of the receiver and passed on to the speaker. If the conditions are such that the sound produced in the loud speaker by this modulation will exceed the sound causing the original modulation, the process then continues in a cumulative manner, and a sustained audio-frequency howl results.

From the above example it can be extended to show that any part connected with the determining of the oscillator frequency, will cause microphonics if its electric value in relation to the established values of the tank circuit is caused to change by sound produced vibra-

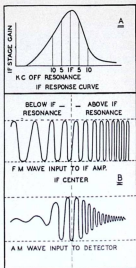


FIGURE 1

tions. We can now list those parts which may bring about microphonics in the local oscillator.

Usual Causes

Tube—Microphonic elements, especially oscillator grid.

Tuning Condenser—loose plates or gang not floating properly.

Possible Causes

Wiring—in oscillator grid circuit. Condensers—in oscillator grid circuit or in parallel with oscillator tank.

Through change in value, the above parts directly contribute to the frequency modulation of the carrier. Many other parts can play contributing roles by helping the vibrational transfer. Considering the parts above, the actions are quite similar—they all will tend to vary the oscillator frequency. The tube used as the oscillator or as combined oscillator-mixer (converter) is a very common source of microphonics. The spacers and supports of the tube elements may be loose or the element itself may not be firmly attached to its supports. In either case the spacing between electrodes is permitted to change due to mechanical shock or vibration and thus change the interelectrode capacitance between cathode and grid and between grid and plate. Since the values of the external circuit components take the interelectrode capacitances into consideration and the fact that the cathode-grid capacitance is, in effect, across the tank, in parallel with the tuning condenser, trimmer, and coil primary, any change in the tube's value will cause a change in oscillator frequency in proportion to the tube's share of tank capacity.

Tuning condensers can be a troublesome source of microphony due to loose members causing capacity changes and affecting the oscillator tank in the same manner as the loose tube elements. However, since the gang contains a major portion of the circuit capa-

city, its effect will probably be the greatest of any possible components. The portions of the gang which may be at fault are, in order of probability: loose plates in either the stator or rotor; loose shield plates between sections; or loose plates of the trimmers. These cases of mobility are caused by poor mechanical connections between parts such as loose swedging or staking. Also possible causes would be loose rotor bearing points which allow relative motion between stator and rotor plates; because of play between the end limits or suspension points of the rotor shaft; loose trimmer adjusting screws of the oscillator padders. This latter may be caused by wear or stripping of the screw threads.

Of minor importance, it should also be noted that condenser and lead components, connected with or in very close proximity to major oscillator circuit parts may cause or induce microphonics. As an example, consider the case of an oscillator coupling capacitor connected between the high side of the oscillator tank primary and the oscillator grid of the converter. If the condenser is quite rigidly mounted by long, tightly drawn leads and in such position that the unit is closely spaced to the chassis, vibration of the unit will cause considerable variation in relation to ground and thus inversely vary the capacitance to ground. The effect on the oscillator tuning is identical to the examples cited above.

Since each of the examples shows that the final effect is that of varying the oscillator frequency in direct response to an audio impulse, the case of microphonics in oscillator stages is analogous to a method of frequency modulation by use of a capacitor microphone. Indeed, a loose plate in a tuning condenser is just that—a capacitor microphone.

Mention was previously made concerning the conversion of the frequency modulated intermediate frequency signal to one which is amplitude modulated. This is accomplished in the following manner. The average I.F. response curve, as shown in figure 1, is rather sharply peaked, exhibiting a great degree of amplification at its resonant frequency with the amplification falling off rapidly as the frequency goes above or below the center point. As the oscillator frequency varies, the I.F. varies by an equal amount, so that a rather small percentage of change of the oscillator causes an important variation of the I.F. To demonstrate this, let us consider a signal of 1000KC and an I.F. of 455KC. The oscillator is tuned to 1455KC and under microphonic conditions will vary ± 45 KC. The percentage of change of the injection frequency is approximately 3%. Under these conditions, since the signal is constant and only the oscillator varies, the I.F. would be moving between the limits of 410-KC and 500KC. This represents a change of almost 10%, an increase of microphonic effect of 3-1/3 times; as the oscillator frequency becomes higher, as in short wave, FM, TV, etc., this difference of percent of change becomes greater.

This FM signal, now going through the I.F. amplifiers will be experiencing a wide range of amplification, ranging from full gain at resonant frequency to possibly only 10% at the widest frequency deviations. The resultant signal is then caused to be amplitude modulated in accordance to the degree of deviation at the feedback from center I.F. This is also shown in figure 1.

Having shown that the extent of oscillator frequency deviation is a factor in determining the degree of microphonics, it can easily be demonstrated that there are several

other factors which also exercise control of the acoustic feedback. One of these factors is the relative selectivity of the I.F. stage. Since the conversion of the FM wave to one of AM is accomplished by the slope of the I.F. response curve, a broadening of the response will tend to decrease the microphonics while sharpening the curve to one exhibiting steep sides and narrow peak will cause a very slight change of oscillator frequency to result in more pronounced microphonics.

The other factor determining degree of microphonics is stage gain and over-all gain following the oscillator. While this has no effect on the generation of microphonics it has a great deal to do with whether the disturbance will be transitory in nature or will be cumulative, building up to an audio howl.

The discussion to this point has dealt only with microphony generated in the oscillator stage. In the usual radio receiver, this is the only stage that will exhibit this trouble. The antenna and R.F. stages are almost never thus affected. This is due to the fact that such a great change in capacitive or inductive value is necessary to cause any appreciable drop in amplification that rarely do vibrations of any sort cause trouble. Theoretically, this form of microphony would be amplitude modulation caused by the shift of the tuned circuits past the broad top of the response curve. Since each individual circuit is quite broad, such circuits need not be considered.

I.F. stages are normally not sharp enough, in home receivers, to cause trouble as their relatively low frequency is also against the generation of microphonics. These circuits may also be ignored when considering this trouble.

There is, however, one stage we haven't covered that may be microphonic. This is a high gain audio

amplifier with a microphone input stage or a phono pre-amplifier used with low output phonograph pickups such as the beam-of-light or the dynamic. Here the troublesome wave component is strictly amplitude modulation. This is caused by the vibrations of the speaker output, either transmitted through the chassis or by sound waves impinging against the tube envelope. In this case it is the tube elements which move in relation to each other, especially the grid in relation to the cathode. This movement modulates the signal in accordance with the movement. With a normal, medium gain stage where the input signal is considerable, this is no problem since the relative motion is quite small, producing only a very slight change in signal current. However, in high gain stages, this slight change and the small input signal are amplified so that, in the resultant output, the microphonic portion is quite considerable, possibly exceeding the input.

It should also be noted that voltage producing apparatus, such as phonograph pickups, can produce microphony. This is caused by vibrational transfer from the speaker to the motor board and turntable and thence to the pickup needle. The output is governed by the movement of the needle so that, under these conditions, the output will include the acoustic audio feedback. Crystal cartridges are not prone to this trouble; although, under exceptional conditions of volume and stiffness of mounting, they may be microphonic. Units such as the beam-of-light pickup which have the moving members loosely mounted can be relatively easily affected. In the beam-of-light unit, a mirror is mounted, in a floating manner, in the tip of the tone arm. Since the movement of a light beam reflected from the mirror determines the audio output, any vibrations will cause a

signal so that the phonograph output will, under conditions of microphonics, include both the included signal and the spurious modulation. In this case, the vibrations are transmitted from the speaker, through the cabinet to the motor board.

The cure for microphonics of phonograph pickups is to make sure the changer base is floating freely, this is done by loosening the cradle mounting. The speaker can be shock mounted as explained below. In very stubborn cases, phonograph microphonics can be eliminated by enclosing the speaker in a cellophane box. One can be made easily by taping the sides together and securing to the cabinet with masking tape. Be sure to add relief holes as shown in figure 2.

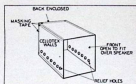


FIGURE 2

The cure of microphony is two-fold: First, the cause of the trouble must be found, and second, the path of vibration must be lessened or eliminated. A good method of determining which component is at fault is to feed an unmodulated signal into the antenna and, with volume control full on, advance the signal generator output control until the set is just microphonic. At this point, the set will appear to ring when the chassis is jarred. Now, various parts associated with the local oscillator may be gently tapped with a fiber tuning stick or the eraser end of a pencil: do not strike hard as such jolts will be transmitted to other parts and will cause the microphonics even if the part struck was not at fault. The first component to test is the tube. If there is any doubt about its be-

ing the seat of trouble, replace with one which is obviously not microphonic. Under certain conditions of abnormal vibration, high gain, high frequency and critical circuits, it may be difficult to find an oscillator or converter tube which is absolutely free of microphonics. In this case a heavy, lead-covered tube shield may prove of help. The action here is to tightly encase the tube envelope with a rigid, high mass structure which will dampen any vibrations which would otherwise cause the tube to vibrate. These lead shields have been used successfully on many FM and TV tuner converter tubes. It is occasionally necessary to include in the design of equipment shock mounted tube sockets to prevent the transference of shock or acoustic vibrations to the local oscillator. When such sockets are used, never do anything to defeat their purpose. If replacement is necessary, the new part should be identical with the old and care should be taken to see that components and leads from this socket are not pulled tight, but left loose to preserve the spring suspension. In existing equipment microphonics can usually be cured without using shock mounted sockets, but for that one-in-a-thousand tough one, it will pay to remember the trick.

If, after testing and possibly replacing the tube, microphony still exists, the next point of attack should be the tuning condenser. Figure 3 shows a typical variable condenser with possible causes of microphonics indicated. Carefully tap one plate at a time in the oscillator section. The stators are most apt to cause trouble but the rotors should not be ignored. Often one or more plates are slightly loose in their mounting where the plate ends are staked into the end frame. This can be repaired by carefully flowing solder over the joint between the

plates and the end section or between the rotor plates and the gang shaft. The shield plates themselves may be loose enough to cause trouble. These separating plates between gang sections can also be soldered.

Even after all plates have been secured at their mounting points it may still be possible for the plates to vibrate at their free edges to a sufficient degree to cause microphonics. These vibrations can be dampened out by inserting, between the troublesome plates, small pieces of Vinyl spaghetti.

The inter-plate spacing should be checked and at the same time make sure there is sufficient bearing pressure to prevent end play. Parts mounted on the gang frame, on shield plates, or between trimmer and frame should be checked to ascertain whether they are vibrating so as to cause movement of the member on which they are mounted. Check the trimmers across the oscillator sections to be sure the screws are firmly engaged in their threads and that they are

not open so far that the plates have lost tension against the screw. Either of these conditions can cause microphony.

If the microphonics still persist after the above items have been checked, carefully tap the various sections of the gang to determine if this unit is still at fault. If it is, the gang should be removed and remounted using rubber grommets to absorb the interfering vibrations. In cases where the gang was originally shock mounted, check the condition of the rubber to see if there is any life left. If not, replace the grommets. Be sure the gang is not pulled down too tightly as this may so compress the rubber that mechanical transfer will still be possible. Even if the gang is properly mounted on good, live rubber, tight lead or component dress from gang to chassis will defeat the purpose of shock mounting. These parts should be disconnected and the leads lengthened to allow more freedom of motion to the gang. Of particular

(Continued on Page 24)

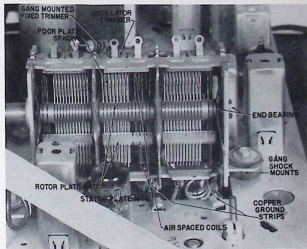


FIGURE 3

SHOP PRACTICES AND SERVICE TECHNIQUES—REFRIGERATION

THE PHILCO AUTOMATIC DEFROST ELECTRICAL SYSTEM SIMPLIFIED

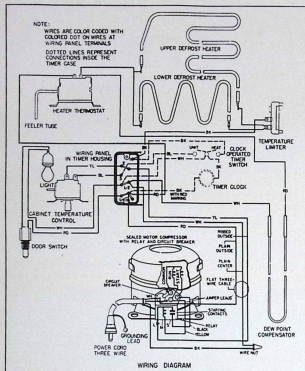


FIGURE 1

used in conjunction with the additional control, heater and safety devices that are incorporated into the Automatic Defrost model refrigerator (figure 1), he immediately thinks that the electrical system is quite complicated. This isn't so, as you can readily see by spending a few minutes to trace the electrical paths through the various control and operational circuits.

Design engineering has added a set of defrost heaters, a heater thermostat and a temperature limiter which are automatically energized through a clock operated switch. A dew point compensator has been added to prevent condensate from forming around the door and its seal gasket through thermal leakage. In some models, a food compartment heater has been incorporated to act as a thermal damper which operates in conjunction with the mechanical damper to better control cabinet temperatures. All electrical components are fed through two distribution points, the wiring panel in the timer housing and the motor compressor terminal box.

THE SUPER POWER SYSTEM

The efficient sealed unit refrigeration system which is used in the Automatic defrost model refrigerators is the same as the conventional models with the exception of increased cooling capacity for more adequate refrigeration and the wiring harness is terminated at the time housing wiring panel. As shown in figure 3, the electrical circuit is the same except that the timer clock switch is in series with the A.C. line. Trouble shooting

The appliance serviceman who is increasing the scope of the service he can render to the potential customer is somewhat hesitant about accepting a call to service the newer De Luxe refrigerators. He has done service work on the conventional standard models and found them to be quite simple operationally and electrically. There is a sealed relay and overload pro-

tector with the operation of the refrigerator controlled by an adjustable thermostat or cold control. The only other electrical component is the cabinet light and switch which is wired into the A.C. supply. The wiring diagram for the standard model, as shown in figure 2, is easily understood due to its simplicity and lack of inner acting components. And yet when the serviceman sees these same circuits

procedures on this sealed unit assembly are exactly the same as the conventional models. For exact procedures, refer to the Philco Factory-Supervised Service manuals. To check the sealed unit assembly, a test harness should be used, to further determine internal trouble an ohmmeter is very useful. Continuity will show from the common terminal through the run winding, there will also be a resistance reading from the common terminal to the start terminal. From the run terminal to the start terminal, the resistance should be more than half but slightly less than that of the run winding. It is impossible at this time to quote motor winding resistance readings due to the large number of motors in use. A reading taken from the run winding to physical ground will show infinity on the meter.

The overload protector may be checked with a voltmeter from the common terminal of the motor compressor to wire nut connections. A normal indication would be shown by a reading of the line voltage. An alternate procedure would be to use a test jumper across the circuit breaker to operate the motor compressor.

A continuity check of the starting relay is standard procedure. Remove the three relay leads from the compressor terminals. A closed circuit will be indicated between L and M. An open circuit will be indicated between L and S and M and S. The relay used in the current line of refrigerators is of the magnetic type which has an electro magnet in series with the run winding, as shown in figure 3. The start contacts which are normally open, close during the start period, due to the increased current flowing through the run winding at the instant of starting. This increased current flow through the relay field winding sets up a strong magnetic field which causes the relay con-

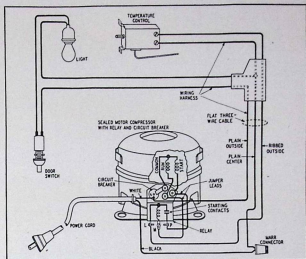


FIGURE 2

tacts to close and energize the start winding. As the motor increases its speed there is less resistance and the current gradually decreases until the magnetic field will no longer hold the starting contacts closed. This switch release occurs at about 85% of normal operating speed. With the opening of the start contacts the start winding is no longer energized and is out of the circuit until the next start cycle.

Since there are various types of relays which operate on the motor starting current and the motor starting current varies with motors of different power ratings make sure that the replacement relay has the same part number as the one that is being removed.

The temperature control may be checked by various means. If the terminal panel is exposed, remove the A.C. plug and make a continuity check between terminals 2 and 3. With the cold control in the off position, an open circuit will be

indicated, with the control on position 5 a closed circuit will be indicated.

A test jumper may be used to by-pass the temperature control. A click test of the control may be made by rotating the control from off to a high temperature setting. Remember that a temperature control that has lost its charge from the bellows and feeler tube will check open whether the knob is positioned in the off position or all the way up to its highest setting. When the click test is made on a control with a defect of this nature, no switch action will occur. The temperature control, if found defective, should be replaced with an exact replacement. If you are located in an area that is situated more than a thousand feet above sea level, the temperature readings, as specified in the service manual, will be approximately one degree colder for every thousand feet of increased altitude.

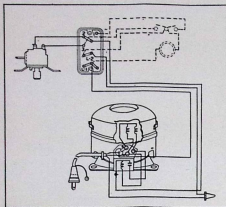


FIGURE 3

This circuit, when simplified, becomes a series circuit during the operating cycle and a series parallel circuit during the initial starting period. During the starting period, current flows from the source through the clock switch, then through the temperature control switch contacts and divides into a parallel path to flow through the relay field winding and the motor run winding, and at the same time through the relay starting contacts and the motor start winding. It then takes a common path through the overload protector back to the source. During the normal running period of the motor compressor, the start contacts are open; therefore, the current flows through a series circuit.

The next section of the electrical system in order of importance is that group of components that control and cause the refrigerator to be automatically defrosted. The parts that may be isolated to simplify this circuit are the timer clock and switch assembly; the heater thermostat; the upper and lower defrost heaters; and the temperature limiter. All are inter-

connected through the timer housing wiring panel as illustrated in figure 4.

The timer clock is a standard electric clock motor, which operates on 115 volts, 60 cycle current, and is wired into the A.C. line before any of the control devices of the refrigerator, so that immediately upon plugging the service cord into the A.C. outlet, the clock motor operates. The motor drives a gear train and set of camming gears through a slip clutch to rotate the indicator knob, which shows the actual time of day on a 24-hour clock face (after it has been set upon installation or after any period of power failure). The camming gears actuate the timer switch contacts, which permits current to either flow to the motor compressor assembly or to the defrost heaters. These gears are cut in such a manner so that heater circuit is energized for a period of approximately 25 minutes every 24 hours between 1 A.M. and 3 A.M.

To determine if the clock motor is operating, remove the refrigerator rear cover plate and the cover-

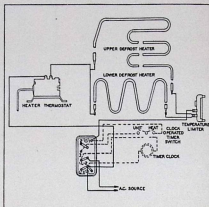


FIGURE 4

ing insulation, and observe the motor rotor through the inspection window in the rear of the motor housing. To check the clutch assembly for proper drive a pencil mark that can be removed or a piece of tape should be placed on the clock face corresponding to the position of the indicator knob. After a period of time has elapsed, the position of the pointer in reference to the index mark should be made; the difference will be the actual time that has elapsed. A manual rotation of the indicator will not check the clutch assembly.

To determine if the switch contacts are operating properly, the refrigerator should be plugged into a wattmeter, which is plugged into the A.C. outlet. With the temperature control in position one, and the timer clock indicator set on any position other than one to three, when the sealed unit is operating the wattmeter will show a reading of 150 to 375 watts in accordance with what model is being checked. For specific wattage for a given model, refer to the electrical section of the Service Manual.

The only difference is that in this control the expanding gasses in the feeler tube and bellows assembly open the switch contacts instead of closing them as in the cold control. This control is activated to open its contacts between 50 degrees to 55 degrees Fahrenheit. For each 1000 feet in elevation, the control will open its contacts one degree lower.

The simplest means of checking this control is to utilize the wattmeter in the overall circuit and run the refrigerator through a defrost cycle. If the control is suspected of faulty operation it should be removed and a continuity check made, first with the feeler tube submerged in a container of ice. The normal reading will be that of a closed circuit. The second check should be made with the feeler tube in a container of hot water. The normal indication would be that of an open circuit.

It can be seen in figure 4 that this portion of the circuit can be simplified into a simple series parallel circuit with the three control devices in series with the parallel heater elements and the clock motor is across the line. From the source at terminal L-2 of the wiring panel, current flows through the closed contacts of the timer switch back through terminal one, through temperature limiter contacts, then divides into a parallel path through the heater elements, then coming together to follow a path through the closed contacts of the heater thermostat, back to the power source at terminal L-1 of the wiring panel.

The remainder of the components, which comprise the electrical circuit, are convenience and control devices, two of which are shown in figure 5.

The cabinet lamp and door switch assembly are a simple series circuit tied into terminals L-1 and L-2, which is the source voltage.

The dew point compensator is a heater element of the resistance wire type of approximately 12 watts. This heater element is tied into the cabinet interior in close proximity to the door seal gasket around the freezer compartment. It serves to eliminate condensate forming on the outside of the cabinet in the area of the door seal gasket. This dew point compensator is in series with the heater thermostat so that if, for any reason, the cabinet temperature is abnormally high, the heater thermostat will open the circuit.

The dew point compensator can be checked by disconnecting the lead from terminal L-1 and L-2 of the terminal strip. Connect a unit test cord to the compensator leads and plug into a wattmeter to read the amount of power being used. If no power indication is shown, a check should be made from the lead at the heater thermostat.

In addition to all the aforementioned electrical components, the G line double door refrigerators utilize a thermal damper installed in the rear portion of the food tank in close proximity to the rear bottom edge of the evaporator. This damper is energized by a switch in the mechanical damper, which is located in the front portion of the refrigerator. When the mechanical damper is closed, the switch is also closed which energizes the heater setting up an effective heat block which retards cold air circulation down the back of the refrigerator compartment. This cabinet heater is connected to terminals L-1 and 3 of the wiring panel so that at any time during the refrigerator cooling period, it may be energized by positioning the mechanical damper to its closed position. This heater draws approximately 15 watts, so to check it the leads should be removed from terminals L-1 and 3, connect a test cord to the two leads, feed through a wattmeter, with the damper switch closed.

New!

PHILCO Summer Weight UNIFORMS



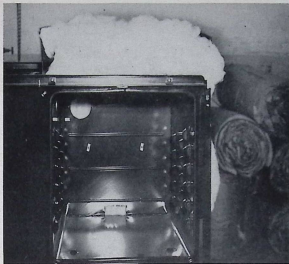
You'll be cool as a breeze, even on the hottest days ahead, in this neat attractive uniform of lightweight, short sleeved shirt and green gabardine trousers.



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New!

ADVANCES IN ELECTRIC RANGE INSULATION



The research of yesterday developed the insulation pictured here, three standard layers are used on the top of Philco ovens.

Without the use of insulation, a great amount of modern society's utilization of fuels would seriously drain our natural resources and greatly increase the cost of their use. For example if an attempt was made to cool all our nation's refrigerators or heat all our electric ranges without the use of insulation, the increased cost would be tremendous and prohibitive.

The term "cold" is relative but the word heat is something tangible which can be measured. The British Thermal Unit B.T.U. is the amount of heat required to raise one pound of water, one degree Fahrenheit. Heat travels from a hot body to a cooler body either by conduction, convection or radiation. A screen or awning can prevent some heat transfer by radiation, but insulation is needed to

hold back intensive heat transfer by convection or conduction.

The use of mud and straw to insulate caves or huts reaches back as far as history records. The Eskimos also use snow as an insulator. With the advent of the machine age, the waste sawdust from lumber mills found great usage in insulating ice houses all over our country. Later when ice refrigerators came generally into use, it was found that layers of cork made excellent insulators and they were extensively used.

While sawdust and cork could be used to insulate and keep out moderate heat temperatures, they were inflammable and useless to entrap and keep in higher heat temperatures. When our ancients discovered rock from which we get asbestos, then was found the first

insulator against high temperatures. Asbestos has been used for years by the heating industry and later it was discovered that a rock wool or slag wool could be made from other types of rock minerals. These forms of rock wool are produced by melting the raw rock or slag with coke in revolving tanks and forming the fibers by steam jets which collide with the molten streams as they emerge from holes in the equipment.

Up to about 1939 most modern refrigerators and electric ranges were insulated with rock wool. This insulation has very good insulating qualities but it has two unfavorable factors. It has a high density and weight is quite a consideration in modern production methods. Rock wool is also not impervious to water and can become soggy from condensation.

Along about November of 1939 after years of research a commercially satisfactory way of producing glass fibers was developed and glass wool became available for insulation purposes.

The actual history of glassmaking is lost in antiquity. Probably some nomadic tribesman found molten glass beneath the bed of a hot campfire built upon sand of the proper composition. If his curiosity led him to poke the glowing, viscous pool with a green-wood stick or some handy weapon, it is probable that he drew a glass fiber on the end of his implement. Molten glass has much the same consistency as honey or molasses; it strings out tenuously. Thus, it is quite possible that the first form of glass shaped by man's action was a glass fiber.

Prior to 1914 a number of patents were issued in Germany and some in England for various processes of drawing glass fibers. There were two basic approaches to the problem. One, used by Libbey and known as the spun-glass process, drew fibers from the



The insulation cutting board.

heated ends of glass rods winding them at the best possible speed on large revolving drums. In Germany the drums were sometimes the rims of bicycle wheels pedalled by girls. The second approach sought to form fibers by centrifugal action on molten glass within a revolving retort having a suitable orifice in the perimeter. These processes gave glass fibers that were too coarse and too costly for use as textile fibers, but they quickly found use as thermal insulation and some were used later as retainer mats in electric storage batteries.

American production by the drum-winding or "spun glass" process began under license about 1925, the product being largely utilized in the manufacture of retainer mats for storage batteries. Relatively high production costs retarded growth of the industry here and abroad.

In 1931 the Owens-Illinois Glass Company began a serious study of glass-fiber production. Within the year they succeeded in developing the first of three distinctly new American processes that formed the foundation of the present industry. The first fibers were coarse but were immediately developed into an air filter that was marketed in February, 1932, less than nine

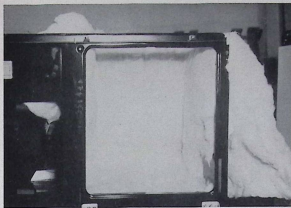
months after the first attack on the problem. Finer fibers, suitable as a thermal insulating wool, were soon produced, and before the end of 1932 the Navy began exploratory tests and applications of the wool as a low-density thermal insulation for horizontal spaces. Other uses for wool expanded rapidly in the ensuing years — as house insulation and for many industrial applications.

The same group of inventors and research men developed the first of two textile-fiber processes in 1936 and the second in 1937, thus inaugurating the commercial production of all glass fabrics.

In the production of glass mineral wool silica sand, limestone and other mineral ingredients of the glass are unloaded into large elevated storage bins, each equipped with a weighing hopper connected to an automatic recording scale. Batches are prepared by collecting, in a travelling batch car, the precise quantities required of each material and mixing them thoroughly in a rotary batch mixer. This, in turn, unloads into a batch can that is thereafter handled on a mono-rail system until the batch reaches the proper glass tank or melting furnace. All batch preparation is largely automatic to assure uniform and exact formulation of the glasses.

After the batch is melted and refined in large tanks that hold 40 tons or more of glass, it reaches the "forehearth" where there are perforated bushings through which the glass flows in thin streams. As the glass emerges, it is caught by the impact of high pressure steam jets that attenuate the glass at rifle-bullet speed into long resilient fibers. These fibers are gathered at the base of the forming chamber on a traveling conveyor as a white fleecy mass of fine fibers intricately interlaced with each other. Fiber diameter and length are subject to control by temperature and viscosity of the glass, orifice size and steam pressure; the depth of the wool mass is controlled by the speed of the conveyor.

We receive our Fiberglass insulating wool in compressed rolls wrapped in protective paper. The wool has a nominal density of three pounds per cubic foot in thicknesses to 3-1/4 inches. It is resilient, light in weight and has countless entrapped air spaces to provide high insulating efficiency. It is designed for use at temperatures from sub-zero to 1000°F. Its thermal conductivity, *k*, at 75°F. mean temperature is .26 when installed at its nominal density of three pounds per cubic foot.



Oven insulation before the oven liner is installed.

Fiberglass is durable and will not rot or oxidize. Since the fibers are non-cellular, they cannot absorb moisture beyond surface wetting. Moisture pick-up in a humid atmosphere is less than 1% by weight. They will not expand or contract or buckle under widely varying conditions of humidity and temperature.

Our cutting table where the rolls of insulation are opened and cut into the proper size batt to fit the oven, is illustrated on the preceding page. A small batt to fit the back of the oven is first cut and then a long wrap-around batt is

cut next. This wrap-around batt is cut long enough to extend across the bottom of the oven, up both sides and then overlap in double thickness across the top of the oven. The above picture shows the insulation installed in the range frame before the oven liner is installed. The overhanging side insulation is folded over the top after the liner is installed.

After the insulation is placed in the frame, the oven liner is ready to be installed. Obviously if the insulation became shifted or bunched up during the placement of the liner, some insulation effect would be lost and surfaces in front of the voids would tend to heat up. To prevent shifting of the insulation, shields are used to keep it in place. In factory production where the liner is installed before the table top is mounted, we use two vertical shields as shown in the picture on page 24.

After the liner is inserted the shields are lifted out, the top layers of insulation folded over each other and the range moves along the conveyor where the table top is then mounted.

When a liner has to be replaced

in the field and to save time lifting the table top to drape the top folds of insulation, three shields similar to the ones shown in the illustration on page 24, can be used to hold the insulation in place. The two side shields should be approximately 10" x 27" and the top shield 16" x 27". All shields should be as thin gauge as practical and when inserted, the top shield can rest on the two side shields, until the liner gets started into position and then supports the top shield. All three shields should be pulled out before they bind too tightly as the liner moves near its final position.

The National Electrical Manufacturers Association set up recommended limits and specifications for temperatures of wires, heaters, switches, etc. However, as we are interested in the requirements of the range insulation, the following which is also approved by the American Standards Association is taken from their 1950 Publication under the section Electric Range Surface Temperatures. "The temperature of metallic surfaces designed to be handled should not exceed 130°F., and the temperature of non-metallic surfaces designed to be handled should not exceed 150°F. based on an ambient temperature of 75°F."

The picture at the left of this page shows how the temperature of a side panel is being taken with a pyrometer. In addition to the pyrometer which is a handy portable heat reading meter, more accurate heat tests are made in our laboratory. Here a range is heated up with surrounding screens to keep the ambient temperature from dissipating too rapidly to make the test more severe. Attached to the range in various locations are thermocouples connected to a master critical temperature recording meter. In this way our laboratory



Measuring side panel temperatures with a pyrometer.



Shields are used in production to assure proper position of insulation when oven liner is installed.

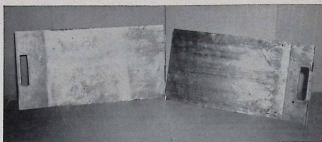
staff can get an accurate reading of temperature of any spot on the range under usage load.

In addition to insulation the range is also designed to entrap the oven heat and prevent escape of heat by conduction. Small thermal bumps are provided on the front frame to break the heat conduction from the liner flange to the range frame. Proper mounting of the oven door has considerable effect on heat loss and heating of the upper side panels and front of table top. The door should fit so there is no undue escape of heat around it.

Doors should be mounted so circulating air can enter thru a slight crack across the bottom of the door. As the air is heated and rises in the oven, the vent at the top of the liner, allows the heated moisture to escape and evaporate in the air.

Doors are also insulated with Fiberglas, the same as the oven. Before the outer and inner door panels are screwed together a full standard thickness batt of insulation is placed between them which completely insulates the oven all around.

You can understand now that Philco Corporation does all it can to use the most efficient and economical insulating material. As advances continue to be made, Philco will continue to provide its customers with the best components available.



Shields for use when installing oven liner.

MICROPHONICS . . .

(Continued from Page 15)

importance are the small lengths of copper braid or strip that are used to provide good grounding of the frame and shield plates of the gang. If these ground leads are too short to allow proper floating of the gang, they will permit considerable vibrational transfer from chassis to gang. These ground straps should be loosened and lengthened or replaced with ones allowing more freedom. It is possible for excess solder to coat one or more of these ground straps so that, even with proper length they will have lost much of their original flexibility and will transfer the vibrational cause of microphony.

Light sheet metal shields or shield cans near or around the gang may cause trouble if they tend to vibrate excessively. This may be stopped by cementing a pad of rubber or such material to them to act as a dampener.

Last, but by no means of least importance, consideration should be paid to the mounting of the speaker. If the speaker is mounted directly to the chassis or to a bracket connected to the chassis, it will be advantageous to use rubber pads or grommets between the speaker and its mounting. This will greatly cut down on the vibrational coupling between speaker and chassis and thence to component parts. Where the speaker is mounted to the cabinet, the speaker can be removed and either rubber grommets placed over the mount-

ing stud between the speaker and cabinet with fiber washers under the nuts, or a gasket of felt or rubber may be placed between the speaker rim and the baffle. In either case, care should be exercised not to move the speaker too far to the rear of the baffle as the acoustic coupling between speaker and baffle may be seriously affected. This would lessen the usefulness of the baffle and would cause loss of tone quality. A quarter of an inch separation between speaker and baffle would be ample for all cases.

For cases where the microphonics are caused by direct acoustic coupling, whereby the vibration is set up in the affected part by the alternating air pressures rather than by vibrational transfer through the chassis, a means can be found to control the sound waves. A baffle, partition, or shield of cellulot or some similar material may be so placed that the sound waves will be dampened or eliminated in the vicinity of the vibrating oscillator component. As an example of this, we can consider a console radio with the speaker mounted against the cabinet front and the chassis mounted on a shelf directly above the speaker. The obvious point at which to place a sound baffle would be on the complete underside of the chassis mounting board. Of course, in a case such as this, the chassis itself should be shock mounted by the use of rubber feet or pads between the chassis and mounting platform.