HOW TO USE

YOUR AURICON 16MM SOUND-ON-FILM

RECORDING EQUIPMENT

LITHO IN U.S.A.

K #3656

BACH AURICON, Inc.

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Telephone HO 2-0931

MANUFACTURERS OF SOUND-ON-FILM RECORDING EQUIPMENT SINCE 1931

IMPORTANT INSTRUCTIONS BEFORE USING CAMERA

Auricon Cameras and associated Equipment are thoroughly inspected and tested at the Factory before shipment, and a film test is made on all Cameras and Recorders to insure correct operation. They are packed by proven methods to stand rough handling but regardless of our precautions, damage may occasionally occur in shipping.

When you receive your equipment, whether through your Dealer or direct from the Factory, it should be inspected for concealed damage. If obvious damage is present such as bent or broken parts, a claim should immediately be filed with the Carrier. This can be done by telephoning the Airline, Express Company, or Truck Line that delivered the Equipment.

UNDER NO CONDITION SHOULD IMPORTANT FILMS BE SHOT, without first making a picture and sound-test to be sure the Equipment is in perfect working order and has not been damaged, or the Camera Finder has not been thrown out of alignment from rough handling in transit. This film can include a sound-track exposure test for checking your processing Laboratory to determine the correct sound-track exposure as described in the Auricon Instruction Book. This film test will also enable you to check your lenses for proper focus, alignment, and picture exposure.

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K# 3655

GENERAL

16mm talking-pictures consist of a motion picture and a synchronized sound-on-film recording. Photographic technique is well known and is similar to silent pictures. However, the 16mm sound film must run at 24 frames per second, or 36 feet per minute. This standard is used all over the world, and is correct for all 16mm sound-on-film projectors.

Also, the noise that the camera makes should not be recorded, therefor the camera must be housed in a sound-deadening case called a "blimp", or the camera must be placed in another room and the picture photographed through a glass panel or window. The fundamental idea is to place the microphone as close as possible to the source of sound (even concealing it in the set if necessary) and the camera as far away as possible.

Auricon Cameras and Recorders are driven by synchronous motors which maintain 24 frames-per-second speed accurately, when operated from 115 volt alternating current of the correct frequency, as indicated on the camera or recorder nameplate. With a shutter opening of 175 degrees, this equals an exposure of 1/50 second, and all exposure meter readings should be made at this setting.

The portion of the 16mm sound-track which belongs to any given picture-frame, is always 26 frames ahead of it. This is also standard, and is maintained so that the picture which is moving intermittently in the picture gate, is projected on the screen at the same time the corresponding sound is moving with constant smooth motion through the sound head.

MICROPHONE PLACEMENT AND ACOUSTICS

Sound-waves are set up in the atmosphere by any very rapid mechanical vibrations, such as the larynx in the human throat, the string of a violin, etc. These waves act very much like water waves in a pond, when a pebble is dropped in, except that the sound-waves travel away from the source in all directions, unlike water-waves which travel only on the surface of the water. The sound waves in the air vibrate the diaphragm in the Auricon microphone and cause varying electrical current to be generated in the microphone. These tiny electrical variations are fed into the input of the Auricon amplifier, which amplifies them until sufficient power is available to audio-vibrate the mirror of the sound-on-film recording galvanometer in the Auricon Camera or Recorder.

The amount that the mirror moves determines sound "volume". The number of times it moves from one side to the other, and back again, in a second, is called "frequency", (cycles per second). The frequencies recorded are determined by the character of the sound source. The faster the source vibrates, the higher in pitch will be the sound.

We can control the recorded volume (the modulations on the sound-track) to within the prescribed limits which a sound-film projector optical system will scan, by means of the Auricon amplifier volume controls provided, and by watching the Visual Sound Volume Indicator. This meter is, in effect, measuring the recorded volume.

The Auricon equipment is capable of recording a greater frequency range than most 16mm projectors can reproduce. However, to obtain full advantage of the Auricon recorded sound-tracks, it is necessary that certain film processing losses be overcome, and therefore frequency compensation is introduced which will strengthen the higher frequencies. This is a permanent feature and

is designed into the Auricon amplifier.

No measure of any individual part of a recording channel means very much. It is necessary that the entire equipment be taken into consideration, if the final result issuing from the loudspeaker is to be satisfactory and pleasing. The microphone, amplifier, galvanometer, film, processing, and printing, and reproducer characteristics must all be taken into account in recording sound-on-film.

In the Auricon 16mm sound-on-film recording equipment, the overall frequency characteristic is permanently fixed so that almost any voice or music will be satisfactory when reproduced on a projector which is in good operating condition.

Sound-waves reflect from hard surfaces such as plaster walls, and if the reflections, as well as the original sound-waves, were allowed to strike the microphone, they would interfere with the original sound and cause hollowness, or lack of intelligibility in the reproduced sound. It is for this reason that walls in studios are covered with soft sound-absorbing material, low-density acoustic board, or acoustic tile. Actually, any rugs, upholstered furniture, or drapes will serve to reduce the reflection of sound from the walls.

Ideal recording conditions are found outdoors since there is no sound reflection, but undesirable sounds such as planes and automobiles may be picked up. It is therefore best, at all times, to have the microphone as close as possible to the source of sound, either by suspending it overhead, just out of the picture, or just beneath the picture on a stand.

In desk and table scenes, the microphone may be concealed close to the actors, behind a vase or some books. By doing this, the volume control can be turned down, and less reverberation picked up indoors, and less unwanted sound outdoors. The desk or table should be covered with a soft cloth, to prevent sound reflections into the microphone.

GENERAL PROCEDURE FOR MAKING SOUND FILMS

There are three general methods of making sound films.

1. The first and probably the most widely used is fully synchronized pictures, where the sound and picture are photographed simultaneously, either by single-system or double-system recording.

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2. The second method, called "Post Recording", is the technique often used for industrial and educational films. The picture is photographed silent at 24 frames per second, and when completely finished and edited, it is projected on a screen in view of a narrator who, after rehearsal, will describe or explain the scenes as they are being projected. This is recorded on a separate sound-track, and is printed together with the picture in proper relationship.

For travelogues and similar subjects, background music can be recorded in addition to the narrator's voice. This is also done with some technical films. In many films it may be desirable to have introductory and closing music, with narrations only, during the scenes.

3. A third method of "Post Recording" is sometimes used, and is included because it serves some purposes. The picture is photographed on single

perforated film in the Camera as a silent picture at 24 frames per second. When the roll of film has been exposed, but before processing, it is rewound in a photographic darkroom and threaded again in the Camera. It is important that the film be rewound in total darkness, especially with the fast films and color films, otherwise the picture will be fogged.

Appropriate music or speech is then recorded on the same film. If there should be close relationship between the sound and the picture previously photographed, then a record of the scenes and footages should be made during the photography to serve as a guide in Post-Recording. The perforated film-emulsion numbers found at the start of most rolls of film can be used as a synchronizing mark for "zero" feet, at the start of both picture and sound runs.

This method does not permit editing of the picture before recording. Also, after the track is recorded, it is difficult to edit the picture without cutting into the sound-track if music is used.

However, if it is desired to keep both the picture and sound intact, and yet editing is necessary, the film laboratory can make a duplicate of the sound-track, the picture can then be edited ignoring the original sound-track, and a combined print of picture and duplicate sound-track made.

HOW TO SET UP THE AURICON AMPLIFIER FOR RECORDING

1. Open bottom two latches on front of Amplifier case, and remove head-phones and cables. Close case, and open top cover.

2. Plug the Microphone into the Microphone Cable, and screw down the collar which secures it. Place the microphone near the scene of action and unwind the cable as you return to the Amplifier. Insert the connecting plug into the No. 1 input, which is always used for the low-impedance Microphone. Channel No. 2 has one stage less gain and is compensated for music. This channel should only be used for high impedance phonograph pickups. A second plug is furnished with the Auricon recording equipment which may be used to connect the phono pickup, which should be so wired that the ground or shield is connected to the heavy or No. 1 pin.

3. Insert one end of the short 4 wire cable into the Amplifier "output" plug, and insert the other end into the receptacle on the rear of the Camera (or Recorder if recording in double-system).

The 10 foot molded-rubber power-Cord is used to supply the motor current, and should only be connected to 115 volt alternating current of the proper cycle or frequency, as shown on the equipment name-plate.

(When house current of the correct frequency is not available, or when no A.C. current is available, 115 volts 60 cycle A.C. is obtained from the Auricon Portable Power Supply Unit, and the 115 volt power-cord is plugged into this unit. The Camera switch is then left "on", and the Portable Power Supply and Camera are started and stopped with the Power Supply switch.)

4. Plug in the monitoring headphones to complete the connections.

5. Turn the Amplifier on by turning the "Sound-Track Exposure" Knob clockwise. A distinct click will be heard when the switch turns "on". Further advance of the knob will turn on the exciter lamp, and then vary the brilliance of the lamp. The Sound-Track Exposure Meter will read the value of the exposure

current when the lamp is "on".

If the "Sound-Track Exposure" knob is turned only enough to throw the switch, rehearsals may be made without the Exposure Lamp burning, and the battery and lamp life will be extended.

It is good practice to check the sound-track exposure just before the "take", turning the lamp on at that time, and setting to the correct value.

Batteries should be checked each time the equipment is used, and replaced if necessary.

The $1\frac{1}{2}$ volt "A" battery is used to light the tube filaments, and its condition is shown by turning the center switch to the "A Batt" position. On the lower left face of the Sound-Track Exposure Meter, will be found the "A Batt" scale. Good batteries will show readings into the word "Good". When the batteries drop in voltage to the line between the words "Good" and "Discard", they are becoming doubtful. When the readings fall below the line into "Discard", they should definitely be replaced.

The two 6 volt batteries supply the Sound-Track Exposure lamp. These 6 volt batteries have reached the end of their useful life when the exposure-meter needle drifts during a "take" or when it is no longer possible to obtain the desired reading on the Sound-Track Exposure scale, even though the Sound-Track Exposure control knob is advanced all the way clockwise.

Battery tests should be made with both ends of the Amplifier-Camera (or Amplifier-Recorder) cable connected.

It is false economy to run any of the batteries beyond their normal life, since they cost less than the film or time used in making a scene.

In an emergency, it is sometimes possible to record at a lower Sound-Track Exposure than recommended, but this will yield a noisier track or print, due to the transmission of light through the portions of the sound-track which should have been black.

On reversal films, insufficient Sound-Track Exposure will cause noise in the sound-track reproduction because the exposed part of the track will not "clear" completely in processing. The residual grey fog left in the high-lights of the track causes a loss of volume. Thus the projector volume has to be turned up higher, which makes noise from dust or dirt on the track much louder and also increases the noise from the projector itself, such as photo-cell hiss and mechanical noises which reproduce through the projector amplifier.

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Sound should be heard in the monitor earphone, if all connections are made as follows:

A. Microphone to microphone cable
B. Microphone cable plugged into input No. 1
C. Volume control of input No. 1 turned clockwise, to about 7
D. Amplifier-Camera cable plugged in at both ends
E. Amplifier turned on by turning Sound-Track Exposure knob clockwise until switch clicks

The Camera is set up to photograph the scene. The Amplifier is placed nearby, and the camera-motor power-cord is plugged into 115 volts A.C.

The volume of sound being recorded is regulated by the volume control for each channel. If two sources of sound are being recorded, as for instance, a microphone in channel No. 1 for speech, and phono-pickup in channel No. 2 for musical background, then the volume of each is individually regulated, and the two will be combined or "mixed" and recorded onto the sound-track. These sounds may also be heard in the monitor phone, and judged for balance.

The sound volume has to be regulated so that the image on the film will not exceed the dimensions scanned by the reproducer optical system. On the Auricon equipment, this is shown on the "Visual Sound-Volume Indicator" meter, and is calibrated "low", "correct range", and "over". For correct recording, the needle should swing up to the top of the "correct range" (figure 7) for the loudest passages of music, or the loudest words in talking, with an occasional swing to 8 or 9. The average setting of the volume control to get the correct swing of the Indicator meter can be found by rehearsal of the sound before recording. If the sound is dialogue, the actors should be in the positions they will occupy and the microphone placed as it will be in the "take", as mentioned in "Microphone Placement and Acoustics".

If the sound to be recorded is on a phonograph record, it should be played before recording, and the volume control set so that the loudest passages of the record do not exceed the correct range. The volume control should remain at this setting during the recording.

If the record is to serve as background music for narration, the loudest passages should not exceed figure No. 3 on the meter. This may also be preset by a rehearsal of the record, and left there. The average volume control setting of channel No. 1 can then be found by a rehearsal of the narration.

It is sometimes necessary to adjust the volume controls during the recording. It will be found that, in speaking, people will raise or lower the volume of their voices as they go along. When this happens, as indicated by the Visual Volume Indicator, adjustment of volume should be made slowly and slightly. Abrupt changes in the middle of a word or a bar of music are very disconcerting when reproduced.

Radio programs and records are already somewhat compressed and it will be found that no further adjustment is usually necessary if the loudest portions do not exceed the upper limit of the "correct range" on the Visual Volume Indicator. Sound-track background noise is kept at a minimum during recording by keeping the volume controls not in use, turned down, advancing them only as needed to obtain recording level. If only one input channel is used, turn the other control to zero.

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AURICON DOUBLE-SYSTEM RECORDING

For double-system recording, the Camera cord is plugged into the 115 volt outlet on the Recorder, and the Recorder is connected to the 115 volt A.C. current. The Camera switch is left "on", and the Recorder switch is used to start and stop both Camera and Recorder motors.

When double-system recording is done with the Auricon Portable Power Supply Unit as the source of current, leave the Camera and Recorder switches both in the "on" position, using the switch on the Portable Power Supply to start and stop all three units: Camera, Recorder, and Power Supply.

Starting and stopping of both Camera and Recorder motors by a common

switch keeps the two machines in step, but they are not "interlocked". When starting and stopping they vary in the time required to get up to speed, and in coming to a stop.

To overcome this drift in synchronism during starts and stops, the "clap-stick" is used. At the start of each scene, about one second after the Camera and Recorder motors are started (when they will be up to synchronous speed) someone steps into the area being photographed, and brings the ends of the "clapstick" together. The "Clap" may be seen where the sticks come together by examination of the picture frame. It is also recorded and causes a short "blob" on the sound-track, which is quite characteristic and easily recognized.

The clapstick picture frame and sound-track "blob" are placed together in editing, and the balance of the scene will then be in synchronism, and may be run back and forth on a double-sprocket for editing.

It is usually advisable to notch the film at these "synch" marks, and leave them in the film as long as possible while editing, removing them at the last editing cut before printing. These "synch" marks are equidistant during the editing and wherever possible, splices should also be matched on the two films. When all the editing is complete and the films are ready to be printed in combination on a common film, the sound-track is advanced 26 frames and new "synch" marks are placed on the film leader. When printed together according to these "synch" marks, the film will have the sound advanced 26 frames ahead of the picture.

This single combination print film is used for final projection, inasmuch as the picture is projected from the picture aperture at the same time as the sound which belongs to each frame of picture is passing through the sound scanning-system of the projector.

If the double-system sound and picture film, complete with synchronizing marks, is sent to the laboratory with the sound advanced 26 frames ahead of the picture, it should be so marked on the leader.

If the sound and picture films are sent to the laboratory with the synchronizing marks even, as in editing -- this should be so marked on the leaders, in order that the laboratory can make the necessary 26 frame sound advance before printing.

When the clap-stick is used, it may also be desirable to photograph a slate with the scene number on it, and to announce the scene so that it will record on the track. Holding the slate and clap-stick up in front of the camera, with the stick apart, the assistant says, "Scene 1, take 1" and immediately brings the clapstick together - doing it in that sequence. The material not actually used in the final picture is before the synch marks, and is easily removed in editing.

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RECORDING FROM PHONOGRAPH RECORDS

Besides choosing the music recording which would be appropriate for any given scene, the phonograph record should be new. A record that has never been played (even at the store selling the record) is best. The choice can be made from old records, and a new copy of the same record purchased for the actual recording. Old records are noisy, and become noisier with every playing. This background noise will be recorded on the film. Also, records are damaged and distorted by worn needles. Any record noise of this kind is

permanently recorded into the sound-track, so both record and needle should be new to keep record surface-noise to a minimum.

It is also important that the phonograph turntable used is free of mechanical variations. "Wow" or flutter in the turntable will be permanently recorded onto the sound-track.

Any high impedance, or crystal pickup, may be connected directly into input No. 2 on the Amplifier, connecting the pickup ground or shield to the No. 1 or heavy pin of the extra plug furnished.

MICROPHONE

It is necessary to use a low impedance microphone, for Auricon sound-on-film recording Amplifiers (Models RA-31 and NR-25) have a low impedance (50 ohm) input No. 1, to prevent high-frequency audio loss in the microphone cable.

The Auricon microphone is designed and matched to the Auricon equipment for high-fidelity results, and its use is highly recommended, to the exclusion of other microphones. Cardioid and Ribbon microphones are to be avoided for talking picture use, unless under professional control, as these microphones have a directional pick-up pattern.

LOUD-SPEAKER MONITORING

For studio recording, where the Auricon recording equipment is in a Monitor Room behind a glass window, it is often desirable to hear the sound on a loud-speaker instead of earphones.

Any high quality monitor amplifier and speaker can be used, by plugging into the Auricon monitor headphone jack, but the input of the monitor amplifier should be 1000 ohms or higher, preferably a 500,000 ohm input such as is usually used for connecting a crystal pickup. Any lower resistance or impedance plugged into the Auricon monitor jack, will upset the coupling circuit to the Auricon galvanometer and will result in inferior recording. The ground side of the monitor amplifier input must be connected to the sleeve of the jack, and shielded wire is usually necessary to avoid hum. It may also be necessary to ground the chassis of the monitor amplifier to a water pipe or other physical ground.

HUM

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Sometimes, when set up for recording, an A.C. power-line hum may be picked up, and can be heard in the Auricon earphones. If loud enough to move Volume Indicator Meter to 1 on the dial, the hum will be recorded on the track.

The following should be done to eliminate this trouble:

1. Separate the Microphone cable from all light and power cables. Do not allow the rubber coverings to touch each other. If the hum is being picked up from the Microphone cable, it will cease when the microphone plug is pulled out, and this provides an easy means of testing the microphone and cable for hum pickup.

2. Reverse the A.C. plug in the socket supplying the Camera or Recorder

motor. One of the two positions will usually give less (or no) hum, as heard in the phones.

3. If the hum still persists after completing steps 1 and 2, run a ground wire from a water pipe or from the BX power-line conduit to some point on the Amplifier case. A convenient connection is the cable clamp on the Microphone input plug. (This is grounded to the Amplifier case when plugged into the Amplifier.)

"WOWS" AND "HUNTING"

When recording sound-on-film, do not plug the Auricon Recorder or Camera motor into the same 115 volt A.C. outlet which supplies photographic lights or a motion picture projector (such as in scoring pictures).

Photographic lights and projectors draw enough current from ordinary 115 volt A.C. wiring to cause a voltage drop in the power lines. This lowered voltage will not operate the synchronous motors properly, which may then run at non-synchronous speed and cause "wows" in the recording. If shooting double-system and a motor falls out of synchronous speed, it will cause loss of synchronism between sound and picture.

Use a separate outlet furnishing proper 115 volt A.C. on an isolated line, for your Auricon Camera and Recorder motors, to prevent "hunting" of the synchronous motors. When in doubt, operate from the Auricon Portable-Power-Supply, which is independent of power-line voltage drop.

NOISE REDUCTION

On the Auricon "NR" Amplifier equipment, which has "Noise-Reduction" incorporated, there are two additional "B" batteries which supply the Noise-Reduction biasing current. These batteries are connected to the white and yellow wires of the battery cable.

The condition of these Noise-Reduction batteries is indicated as follows: When new, the "Visual Volume Indicator" may easily be set at zero by means of the control knob provided for that purpose. As these batteries become discharged, the zero control knob must be turned further to the left (counter-clockwise) to obtain zero setting, until finally the meter can no longer be set at zero. These "B" batteries connected to the yellow and white wire leads should then be replaced.

ALWAYS CHECK THE "A" BATTERY FIRST as the same indications will take place if the amplifier tube filaments are not getting sufficient voltage.

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Sound-tracks without Noise-Reduction leave half of the sound-track on the film open when there is no signal or modulation. The light from the projector exciter lamp projecting through the track will produce photocell hiss and reproduce film dirt and scratches as background noise.

If the sound-track is recorded so that only enough clear area is allowed to accommodate the sound-wave, then the background noise will be reduced. This is known as a "Noise-Reduction" track, and is obtained automatically when using Auricon model "NR" series Amplifiers.

The Auricon Model "NR-A" Amplifiers have a push-button-switch marked "Lab

Test" which, when pressed, will reverse the bias. This allows the galvanometer to produce a track-width wide enough to obtain a densitometer reading. The "biased-down" Noise-Reduction track, otherwise, is not wide enough. Both volume controls should be turned to zero when the film laboratory test is being made. Model "NR-VD" Amplifiers remove the bias when the "Lab-Test" button is pressed, for unmodulated, un-biased variable-density tracks.

Usually a lab-test is put on the start of the sound-track for about the first eight feet of each roll. The fact that the test is provided is marked on the can for the film processing laboratory's information.

The Lab-Test serves no purpose on standard reversal processing, but is used on Negative sound-tracks processed and printed by commercial laboratories. (See notes on Exposure and Processing)

NEGATIVE SOUND-TRACKS

When making sound-tracks only (and you do not have the use of a double-system Recorder) for the purpose of scoring films, or for any other application where no picture is being taken, Sound-Recording Positive film (B wind) may be used in the Auricon Camera. This film is much lower in cost than the picture-taking type of film.

WHEN USING THE CAMERA AS A SOUND RECORDER ONLY, WITH SOUND RECORDING POSITIVE FILM, DO NOT THREAD THROUGH THE GATE OF THE CAMERA.

It will be found that the Camera can be threaded with a slack loop in place of threading through the gate. Threading the gate will not serve any useful purpose when no picture is being taken.

We advise that all negative tracks be recorded with sufficient exposure for the type of film being used to obtain a density of at least 1.6, which will yield satisfactory prints when printed to the correct density to cancel distortion.

For a negative picture, this negative sound-track is printed directly on the composite print.

For reversal duplicates from an original reversal picture (whether black and white or Kodachrome) a "master-positive-track" is printed from the sound negative. This "master-positive-track" is printed onto the duplicate reversal black and white or Kodachrome projection print.

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Inverse and "master-positive-sound-track" prints can be made optically by:

The Calvin Company
26th & Jefferson Streets
Kansas City, Missouri

Precision Film Laboratories
21 West 46th Street
New York City, New York

Some other laboratories can print the picture optically, allowing a "B" wind print to be made from "B" wind original picture, etc., instead of printing the sound optically.

EXPOSURE AND PROCESSING OF NEGATIVE "VARIABLE-DENSITY" SOUND-TRACKS

Variable density sound tracks require exact processing, with particular attention paid to both gamma and density. When using a film emulsion such as Eastman 7230 Background X, which is a special low gamma film, designed to be processed in ordinary negative picture developer, individual film laboratories will vary somewhat in their treatment of the film and it is desirable to make a short test run to determine proper exposure and development. The film laboratory can usually recommend the optimum biased and unbiased sound track densities which will produce best results.

To make a test film, we recommend approximately ten-foot long exposures be made at Auricon 14, 14½, and 15, without modulation, both biased and unbiased. Unbiased track is produced when the laboratory test button on the amplifier panel is pressed. When making the biased test run, it is important to have both volume controls closed down to zero position and the volume output meter needle accurately set to zero on the meter.

If the film laboratory, which is to do your film processing work will put this test film through the processing machine, using their standard developer and processing machine speed, measurement of the resulting sound track should determine which of the Auricon exposures produces the most desirable density for making prints. An unbiased density of .70 to .75 is recommended for the 7230 negative track. This includes the film base density of about .22. Other panchromatic films such as DuPont 930 or Eastman Plus-X require about the same density.

Variable Density Reversal Tracks:

Films recommended for single system reversal picture and sound tracks are DuPont 914, 930, 931, Eastman Plus-X, Super-X, and Kodachrome. Sound track exposure for DuPont 914, 930, 931, Eastman Super-X and Plus-X is about 15. Kodachrome requires an exposure of about 19. Super-XX can be used if necessary to overcome inadequate lighting and requires a sound track exposure of 14 to 14½, depending on processing.

Variable Density Negative Sound Tracks only:

Films recommended for double system or post recorded tracks are DuPont 802-A or Eastman 7373. The negative overall unbiased density including film base should be between .70 to .75. A test as described in paragraph 2 should be made to determine proper exposure for these densities. DuPont 802-A will require a sound track exposure of around 16 and Eastman 7373 requires an exposure of approximately 20.

Our past experience has shown that an exposure of about Auricon 14½ on Eastman 7230 usually results in maximum noise reduction being obtained on the sound track, under average laboratory processing conditions. If any difficulties are experienced in setting up the proper exposure value for variable density recording, we suggest the user contact BACH AURICON, INC. and outline in detail the method of recording and the film emulsion which are to be used, so that we can make recommendations covering the particular exposure problem encountered.

K#3684

LITHO IN U.S.A.

KODACHROME TALKING-PICTURES IN NATURAL COLOR

For Single-system-recording, the results of Kodachrome Type "A" are far superior over any other for sound, and excellent results are obtained with this type of film.

The same Type "A" Kodachrome film can be used outdoors by using a correcting filter for picture. This means you can work outdoors and indoors without changing film, and get the best sound at the same time. Black and white or color duplicates can be made from Kodachrome, as desired. The difference in cost between using original black and white or color film is small, and the better result obtained on Kodachrome Type "A" is well worth the difference, with the color available in the original for future use, even though black and white prints are to be made for immediate projection.

EXPOSURE AND PROCESSING OF VARIABLE-AREA SOUND-TRACKS

(A) GENERAL ...

In discussing negative and positive variable-area sound-tracks, reference is always to the type of image and not to the type of film. Thus a negative sound-track is used to produce positive prints and is called a negative sound-track even if the sound-track is recorded on sound-recording positive-film, or ordinary positive film, rather than negative film. A sound-track positive image is obtained by printing from a negative sound-track or by reversal processing of a negative-image recording.

A positive sound-track is necessary for Noise-Reduction sound reproduction, because in the positive track the major portion of the unmodulated sound-track area is black, thus reducing the reproduction of noise due to dust, dirt and scratches on the film. To obtain this positive image sound-track with Noise-Reduction, it is necessary that the original sound-track be recorded as a negative image which is clear in all the unmodulated sound-track area. Therefore, the images formed on the film by the recording optical systems in both the Camera and the Recorder are negative images. Printing of the original negative sound-track, or reversal processing of the original sound-track, turns this original negative sound-track image into a positive suitable for playback.

A positive sound-track image obtained by recording on reversal film and reversal processing, can be used to make a duplicate sound-track, if the exposure and reversal processing of both original and duplicate are correct.

The exposure, development and printing, or the reversal processing, of a single-system variable-area sound-track, determines the volume and signal-to-noise ratio of the sound-track on reproduction. Incorrect technique and processing result in low sound level and excessive background noise.

(B) EFFECTS OF FILM PROCESSING ON VOLUME OF REPRODUCED SOUND ...

The ideal variable-area sound-track would be completely transparent in the clear portion and completely opaque in the dark portion. Reduction in the transparency of the clear portion of the sound-track will reduce volume. Fogging of the clear area in an original negative sound-track may be caused by over-exposure in recording, an unsatisfactory safelight in the laboratory, or aerial fog in developing.

As measured by a Densitometer, the fog in the clear portion of a sound-track print, or in a reversal-positive-track, should be less than .2 density. The opaque portion of the negative track should be 1.6 to 1.8 density, otherwise too much light will be transmitted through the opaque portion during printing, resulting in more noise and less volume. It is important to remember that a fog in the clear part of the variable-area sound-track print cuts down the sound volume much more than a slight transparency in the dark parts.

(C) HOW PROCESSING AFFECTS BACKGROUND NOISE ...

When a sound-track being reproduced on a Projector has a low volume-level, it becomes necessary to increase the volume of the sound-on-film Projector amplifier above normal. When this is done, the background noises caused by dust particles and scratches in the sound-track area of the film, by photocell hiss, and by mechanical vibrations picked up by the Projector photocell exciter lamp, become more noticeable. In addition to this, most sound-tracks which have a low volume-level are also inherently more noisy than sound-tracks which have good volume. When the sound-track has a gray deposit or fog in the clear area, or when the part that should be black is only dark gray, the graininess (that can also be seen in the picture on the screen) produces a rushing or hissing type of background noise. This does not occur when the sound-track print has unfogged clear areas and good blacks, because in the case of the clear portions, there are very few silver grains present, while in the dark parts, the sound-track density is so great that very little light penetrates the film to affect the photo-cell.

(D) HOW EXPOSURE AND PROCESSING CAN PRODUCE DISTORTION IN SOUND REPRODUCTION ...

If high volume and absence of background-noise were the only characteristics to be sought, it would obviously be desirable to give all variable-area sound-track negatives heavy exposure and development to make them as dense and contrasty as possible. But this is not practical for it leads to serious distortion of the recorded sound wave-form. Heavy exposure causes the sound-track image to spread slightly in the film emulsion. This is known as the "Eberhard Effect", and can cause serious wave-form distortion. In particular, the "valleys" between the "peaks" of recorded high-frequency sound waves on the sound-track are filled in, or "blocked".

(E) COMPENSATION OF "EBERHARD EFFECT" DISTORTION IN PRINTING ...

The original sound-track negative image diffuses or spreads slightly from the exposed area into the unexposed area. When a positive sound-track is printed, it is exposed through the clear areas of the sound-track negative. When the sound-track print is developed, these exposed areas become the black area. If the print is exposed and developed to the proper density (degree of blackness) the spreading of the printed sound-track image in the opposite direction will be the same in amount as the spreading in the original sound-track negative, and thereby the image-spread in the positive will cancel out the negative image-spread. By this means, the original recorded sound wave-form light modulations are restored in the print so that the sound reproduced from the print is free from "Eberhard Effect" distortion.

(F) RECORDING ON REVERSAL FILM ...

Reversal film is processed by developing the variable-area sound-track

image formed on the film by the audio-modulated beam of light, then removing this developed image chemically and exposing the remaining undeveloped silver grains and developing this image to form the positive. When exposing reversal types of film, sufficient exposure must be given so that the entire originally exposed image will be developed and removed and there are no remaining silver grains in the portion of the sound-track which should be clear when processing is completed. However, over-exposure will cause distortion. This is due again to the "Eberhard Effect", which ordinarily does not produce noticeable distortion on reversal sound-tracks which have been exposed and processed correctly.

(G) TYPES OF SOUND NEGATIVES ...

With low exposure and development, the variable-area sound-track negative is thin, but there is not very much "spreading" of the image. This type of sound negative serves well for playing back directly on the projector, but it is not suitable for printing. Greater exposure and development produces sound-track negatives which show objectionable distortion when an attempt is made to play them back directly on a projector. A properly made sound-track print from this type of negative, however, plays back without distortion, because the "Eberhard Effect" of image spreading has been cancelled. These sound-track prints also give good volume in reproduction because the clear area of the sound-track is fully transparent, and the black area is practically opaque. Excessive exposure, or normal exposure with excessive development, produces an amount of image spreading in the negative sound-track which is too great to permit satisfactory correction in making the print. Therefore, excessive sound-track exposure is to be avoided.

(H) OPTIMUM NEGATIVE DENSITY FOR
VARIABLE-AREA SOUND-TRACKS ...

With any given type of film, there is a certain density (degree of blackening) in the variable-area sound-track negative which gives the best overall result. There is also a considerable range of density, both above and below the optimum, from which fairly satisfactory results can be obtained by proper printing. Sound-track negatives of extremely high (2.2) or extremely low (1.1) density cannot be made to give satisfactory prints, except with special film emulsions. For example, Eastman 5372 variable-area recording film will make satisfactory prints with negative densities as high as 2.5, in combination with a 1.8 print density.

(I) OPTIMUM PRINT-DENSITY FOR
EACH NEGATIVE DENSITY ...

K #3672

An extremely important requirement in printing variable-area sound-tracks is the proper matching of the sound-track density to the original sound-track negative density. It is upon this correct matching of densities that the cancellation of the distortion resulting from "Eberhard Effect" negative-image spread depends. This "S" sound in speech is extremely sensitive to this spreading distortion, or, as it is more often called, sound-wave "envelope" distortion. The "S" sound is made up of high-frequency waves, which naturally are very small on the sound-track. If the valleys of these high-frequency waves are filled in and blocked by negative-image spreading which has not been fully cancelled in the sound-track print, the reproduced "S" has a most unnatural and unpleasant sound, commonly called "spitting", or "blocked S's".

(J) HOW OPTIMUM PRINT DENSITY CAN BE DETERMINED ...

(1) Assume that a variable-area sound-track-negative of speech is made, and that the density of this negative-track lies within the density limits which are permissible for good results. If a series of prints is prepared from this sound-track negative, using exposures ranging in small steps from low to high, and all these prints are given the normal print development, a series of print densities ranging from much lower to much higher than that of the negative will be obtained. On playing back these sound-track prints, it will be found that both the prints of low density and those of high density give badly distorted "S" sounds, while only those prints which have densities a little lower than the negative sound-track density, do not exhibit distortion.

(2) The print density which gives freedom from distortion also produces satisfactory volume, if the original negative sound-track density is 1.6 or above. The optimum positive sound-track print density cannot be stated with absolute accuracy because it depends somewhat on the type of film, composition of the developer, and on the quality of the film sound-track printing machine, but is approximately as follows:

Negative Sound-Track Density	Optimum Sound-Track Print Density
1.60	1.40
1.80	1.60
(E.K. 7372) 2.40	1.70

(K) SUMMARY OF GENERAL PRINCIPLES ...

(1) For any particular type of sound recording film, there is an optimum or ideal negative sound-track density.

(2) There is, however, a range of negative sound-track densities which permit the making of satisfactory prints.

(3) For any particular negative sound-track density, there is an optimum sound-track print density, usually .2 lower than the negative density, which must be obtained by the film laboratory within close limits in order to have maximum volume and freedom from distortion. Eastman 5372 variable-area sound recording film is an exception to this general rule, as this particular film requires a greater difference in negative and print densities than other sound recording positive emulsions, for satisfactory "Eberhard Effect" cancellation.

K #3673

(L) USE OF DENSITOMETER IN THE FILM LABORATORY TO CONTROL PROCESSING ...

The density or opacity of a sound-track negative or print is measured with a film laboratory instrument known as a "Densitometer". The recommendations that are made in these instructions are given in terms of the density measurements made with this instrument.

(M) APPROXIMATE EXPOSURES for negative sound tracks (unilateral variable area) ...

IMPORTANT: Read information below before recording.

Film	NR-25 Sound-Track Exposure Meter Setting
Eastman 7375 Variable-Area Sound Recording	20 (maximum)
DuPont 802-A Sound Recording	18
Ansco High Resolving Sound Recording	20
All Ordinary Positives	19 - 20

(1) The absolute values cannot be stated for exposing variable-area sound-track negatives because the densities obtained are dependent upon the processing available. To find the best-sound-track exposure for any given film and processing laboratory combination, a test should be made having a series of exposures, starting below the recommended value and increasing by one-half divisions on the Sound-Track Exposure Meter scale each time, to some point above the recommended values. This test film should then be processed with normal development by the laboratory under consideration, and the resulting densities measured to find the best working exposure. Variable-density type tracks require exposure tests as described above, and it is impractical to give approximate meter settings.

(2) When making a test sound-track of this type, or when making a test on the end of a reel of recording, adjust the Noise-Reduction bias by pressing the "Lab Test" button so that a wider sound-track is obtained which can be measured on the Densitometer. It is also necessary that this track be unmodulated. Therefore, both volume controls on the Amplifier should be turned to zero when making these tests. The fact that a test strip has been provided must be marked on the can of the film, together with the fact that it will be found on the outside or inside of the roll of film, as the case may be. A punch mark can be put into the edge of the film, to separate test and recording, if desired, for the convenience of the processing laboratory.

(3) When a test strip is provided, the film laboratory removes this strip and develops it prior to developing the roll of film. The density of the sound-track on the test strip is then measured, and if it is found that a variation from the normal developing time is required, the time is so adjusted in order to obtain as nearly as possible the optimum density. Do not neglect to specify the density that is desired when sending sound-tracks to the film laboratory for development.

(N) APPROXIMATE EXPOSURES for Variable-Area Reversal Sound-Tracks.

IMPORTANT: Read Paragraph (1) following before recording.

FILM	NR-25 Sound-Track Exposure Meter Setting	
Eastman Plus-X Reversal	15 - 15½	(USING A PAIR OF 6 VOLT BATTERIES FOR SOUND TRACK EXPOSURE.)
DuPont 300-SX ...(Formerly 930-A).....	14 - 14½	
Kodachrome Outdoor Type	18½ - 19	
Kodachrome Type A (Recommended for all single-system sound-on-film recording. If used in daylight, employ proper filter for picture.)	18 - 18½	

NOTE: For a more complete list of films, see chart (page 4 of 4) in NR-40 Amplifier Instructions section of this book.

(1) Since processing of reversal films varies in different laboratories, it may be necessary to find the best sound-track exposure for the combination of a given reversal film and laboratory. This can be done by making a series of sound-track exposures, starting below the recommended value and progressing by one-half divisions on the Sound-Track Exposure Meter scale, to some point

above the recommended value, recording a piece of music or a short speech, repeated at each exposure test. After processing, the film is played back on a good sound projector and the best result chosen. The test which gives the greatest sound volume, together with the least distortion and the lowest background noise, will be the correct sound-track exposure to use when recording on the particular type of film being tested. Variable-density and dual-lateral type tracks require tests as described above.

(O) TYPES OF DEVELOPER FOR SOUND-TRACK NEGATIVES ...

Variable-area sound-track negatives on "positive" type or "sound recording" type film should be processed in a developer of the type which is commonly used for positive prints. In general, the developing time for sound-track negatives will be about one and one-half times that used for picture prints. It is possible to compound special developing solutions for sound-track negatives which produce higher density and less fog with a lower original sound-track exposure, and some progressive laboratories maintain this type of service. However, the regular "positive" type of developer, properly used, is capable of giving satisfactory results.

(P) EFFECT OF FOG ON SOUND-TRACK NEGATIVES ...

At some time it may be necessary, because of sound-track under-exposure, to carry the development time of a variable-area sound-track negative to twice or even three times that used for positive picture prints. This may result in fog densities as high as 0.10, or in extreme cases, 0.15. If a sound-track print density of 1.30 or higher is obtained by this treatment, the negative fog does no serious harm, provided due allowance is made for it in determining the printing exposure. Negative sound-tracks that have received this sort of forced development, however, generally require a sound-track print density slightly higher than usual, and it is necessary to make a number of short test-prints covering a range of densities in order to find the density which gives minimum distortion.

(Q) DENSITY AN EXTREMELY IMPORTANT FACTOR IN VARIABLE-AREA PROCESSING ...

Control of the density of the variable-area sound-track negatives and print is of great importance for good sound-quality. It is good practice to adjust the sound-track exposure in the Recorder so as to obtain the desired density without unduly prolonged development. This produces sound-track negatives free from fog, and also gives cleaner negatives, since long immersion in the developer softens the emulsion of a film so much that it tends to pick up any fine suspended matter that may be in the developing or fixing baths.

K #3675

"GREEN" FILM SOUND-DISTORTION (A TEMPORARY CONDITION)

"Green" film, that is film which has just been processed, never runs well in a projector, and the sound quality cannot be judged until the film has had time to dry completely.

Film when processed and artificially dried is still somewhat damp, and is stretched as much as one foot per hundred feet. This causes the film to hang loosely on the sound reproducing drum in projectors having this type of scanning. The film is then out of absolute focus at the sound-track scanning point, and it is usually unsteady, with ripples in the sound. If you wind the film very

loosely on an open reel and leave it out of the can so that air can penetrate the layers, it will completely normalize in about two days, according to experience. The drying time required depends somewhat on the moisture content (humidity) of the atmosphere. Longer drying under ordinary atmospheric conditions will do no harm, and seems to still further improve the sound quality. This applies to green prints, as well as negative or reversal originals.

BENT DAYLIGHT-LOADING SPOOLS

After threading the film into the Camera, or Recorder, always check the flow of film by turning on the switch and running a few feet of film. A bent spool will catch at each turn and jerk the film. Do not use bent spools as they will ruin a recording.

With each Auricon equipment is a spool-checking gage which should be used to check spools before using them. If a spool-checking gage is not at hand, one may be improvised by using about 10 feet of film leader-track made into a small roll, which is used to test for film pinching by inserting this roll along the edges of the spool between the flanges.

Some of the film manufacturers furnish daylight-loading rolls of film on heavy steel (wartime) spools. These heavy spools should not be used as a take-up spool in the sound camera. The extra weight may cause a lag in starting and build up too much of a slack film loop.

These steel spools are satisfactory for use as feed reels, and may be used to spool stock from bulk film rolls, if aluminum spools are not available. However, the use of steel spools is not recommended.

CLEANING AND CARE OF CAMERA GATE

The camera gate should be inspected and cleaned after each reel. Lint or other foreign matter in the aperture should be removed with a small camel hair brush. The Auricon Cameras are equipped with a new type "Chrome-Ball" or "Sapphire-Ball" gate which will not collect emulsion or scratch film during normal use. However, if "soft emulsion" type film is run through the gate, such as some of the fine-grain sound-recording films, a slight amount of emulsion may gather around the "Balls" in the gate. This type film is not designed as a picture taking film and should not be run through the gate, except for specific test purposes, after which the gate should be carefully cleaned.

NEVER USE ANY METAL ARTICLE TO REMOVE EMULSION FROM THE GATE. It may scratch and ruin the gate. Use a pointed toothpick, or other wood stylus. Do NOT use a pencil point.

K #3676

The aperture plate may be easily inspected by removing the pressure plate. Hold the edge of the pressure plate in the gate with the left thumb and raise the hinged pressure member with the right hand, away from the pressure plate, and over the finger grip. Hold the pressure bar away and lift out the pressure plate completely. Do not allow the spring member to snap down against the aperture plate. Lower it gently.

To replace the pressure plate, hold the pressure bar away and set the film pressure plate in the gate with the small pin up, engaging the lower edge of the pressure plate in the notch in the shoe over the movement, simultaneously. Let the pressure bar down slowly over the finger grip until it again presses on

the pressure plate. Lift the pressure plate a few times by grasping the finger grip, and see that the shoe over the movement is opened by the pressure plate.

FOR CAMERAS WITH "SPORT-FRAME" FINDER ONLY

Finder Mattes

The Finder frame aperture on the Auricon Sound Camera indicates the field covered by a 1-inch lens. The outside of the frame approximates the field covered by a 17mm wide angle lens. The finder frame is grooved for inserting lucite mattes which show the fields covered by lenses of longer focal length.

Standard mattes are available which coincide with most lenses. However, anyone who has done lens work which is critical, has found that lenses vary. They do not magnify exactly alike nor do they center optically alike. In other words, if two lenses of 4-inch focal length are mounted in turn in the "C" mount of the Auricon Camera, and the image examined on ground film in the aperture, it will sometimes be found that they are not covering the same field.

If very critical work with telephoto lenses is to be done, where exact field is important, it's sometimes necessary to make a special matte for the particular lens which is used on the Camera. This can be done at the factory if we have the lens and the Camera. If Camera and lens cannot be sent to us, the following procedure should be followed by the user.

1. Obtain a blank Auricon matte, (available from your photo dealer or the Auricon factory).

2. Insert blank matte in sport frame finder, with lettering in reading position as seen through the eyepiece.

3. Install lens on Camera for which matte is to be made. Open iris wide.

4. Remove pressure plate from camera aperture. The pressure bar can be tied back to the roller with a piece of string or a small rubber band.

5. Insert a piece of ground film in the film gate, in position over the aperture, with the ground side to the lens. Hold in place with two small pieces of scotch tape. (Ground film, or sandblasted clear stock, was formerly used as leader on processed reversal films by Eastman Kodak and is to be found in almost everyone's collection of films.)

Ground film can be made from a piece of clear developed 16mm film. Lay it on a flat surface and lightly rub in small circles with a piece of fine emery cloth on the emulsion side, until a section of the film about an inch long is completely covered with fine scratches. When you cannot see anything through the ground film, it is ready for use. If properly done, a lens held in front of the film will form an image which will go in and out of focus sharply when the lens is moved to and away from the film. If it doesn't, you are looking through the film at an aerial image formed by the lens. In this case grinding the film surface more completely is necessary, until this condition is corrected.

NEVER PUT A PIECE OF GROUND-GLASS IN THE APERTURE. Glass is sharp and will permanently scratch the film path in the aperture.

6. Set up the Camera six feet from a bright window. BE SURE TO SET THE EYEPIECE PARALLAX AT SIX FEET.

7. Focus the image on the ground film and swing the camera so one edge of the window or doorway is exactly at the left of the aperture image. Close the camera door (without disturbing position) so that the finder is in operating position, and stick a strip of slack scotch tape on the finder matte marking the same window edge that you lined up in the gate. Remember that the ground-film image in the Camera aperture is upside down and reversed right-to-left.

8. Repeat this procedure for the right edge of the image, and then top and bottom edges.

You will finally have the four edges of the field outlined with strips of scotch tape. If the tape has been placed on the side toward the eyepiece, the matte may be inserted and withdrawn without disturbing the tape.

If a more permanent marking is desired, you can scratch lines with a sharp instrument along the inside edges of the scotch tape using a ruler to guide the scriber, and then remove the tape.

Now mark the focal length on the matte corresponding to the lens. If you want the scratched lines or lettering to appear black, rub crayon or china marking pencil into the scratches and wipe off the excess.

Remove the ground film and scotch tape from the camera aperture. If any of the sticky compound from the scotch tape remains in the aperture, wipe it off with a soft rag, and if necessary slightly moisten the rag with a little Carbona, to get the gate perfectly clean.

Restore the pressure plate as described in the beginning of this section.

AUTOMATIC PARALLAX VIEW-RANGE FINDERS

The Automatic Parallax View-Range Finder is the most modern of studio-type finders. The one simple operation of focusing the subject, by means of the lever on top, provided for the purpose, corrects the parallax error automatically, by internal optical means.

The Finder focusing lever operates over a calibrated scale marked from infinity to four feet. This scale provides a range-finder, which indicates the footage at which the lens may be set, after the subject has been sharply focused on the finder viewing screen.

The full field of the finder with no matte inserted is equivalent to a wide angle 17mm lens field.

Auricon mattes supplied with the Finder indicate the areas of the 1", 2", and 3" lens fields. Other mattes can be supplied on request.

The mattes click-lock into the matte slot. When a matte is inserted in the matte slot, be sure that it is pushed all the way in so that the outer end of the matte is flush with the finder, and only the tab protrudes. If the matte will go only half way in it is upside down, and a safety-stop prevents it from being inserted in this incorrect position.

The finder should not normally be removed from the camera on which it is installed. The automatic-parallax actuating cam is designed for a specific displacement distance between Camera and Finder lenses, and each Finder is checked to the aperture of the Camera on which it is mounted.

AURICON PORTABLE POWER SUPPLY UNIT

The Auricon Portable Power Supply Unit is used to drive the synchronous motors of the Camera and Recorder when no 115 volt power-line current is available, or when the power-line current is not of the correct frequency or voltage.

The Power Supply Unit consists of a 12-volt non-spill Aircraft Battery driving a rotary-convertor generating 115 volts of 60 cycle alternating current (A.C.). 50 cycle units are available for use with 50 cycle Camera equipment.

The convertor is supported on rubber suspension mounts beneath a panel having a Frequency Control Knob and a Frequency Meter for exact control of the output frequency. The Model PS-20 unit is contained in a single case carrying both battery and convertor. The Model PS-21 employs separate cases for battery and convertor.

Should the Camera and Recorder synchronous motors start "hunting" while operating from the Portable Power Supply, or if it is not possible to get the unit up to 60 cycles under load, it is because the 12-volt battery is low and needs charging. A synchronous motor when "hunting" will run with a galloping effect and the resulting sound-track reproduces with a vibrato effect. When operating double-system, "hunting" in one or both motors will also cause loss of synchronism between sound-track and picture.

The 12-volt battery should be charged once a month, whether it is used or not, or it will deteriorate by action of the acid on the plates. It should also be brought to a full charge before shooting, and charged each night during periods of shooting, if possible.

The charging rate should not be higher than four amperes, preferably less. Auricon can supply tapering chargers for these 12 volt batteries. If charged by a regular battery service station, warn the operator about the charging rate. The high rates used for automobile batteries will ruin the 12-volt non-spill aircraft battery.

The water level in the non-spill type of battery is about halfway down the battery. The plates should just be covered. Never fill the battery any higher, as the empty upper half of the battery is safety space to contain water when the battery is inverted.

K #3679

If the Battery Unit is to be shipped, remove the battery from the case and ship it separately in a wooden crate. This will avoid any damage to the carrying case if acid should seep out. When you transport the unit yourself, be sure the battery is being kept upright.

When charging the battery, set it in an enamel or hard rubber photographic tray. These trays will not be affected by any water overflow. The vent caps on Exide batteries, and some Willard batteries, should be loosened when charging. The battery water which bubbles out can be blotted dry with toilet tissue and discarded in the drain. Do not get battery water on your clothes as it will eat holes in clothing materials. Also wash your hands after handling the storage battery.

For heavy film production shooting schedules beyond the capacity of the single 12 volt storage battery, two batteries may be alternated; one charging, one running.

In an emergency, a pair of six volt automobile storage batteries can be used in series, positive on one battery connected to negative on the other. Heavy No. 10 wires should be used to make extensions by bolting to the regular battery connecting lugs on the Portable Power Supply cables, taping the connections, and terminating in heavy alligator clips at the other ends of the No. 10 wires for clipping on the automobile batteries.

All cable extension connections must be clean and bolted tight, and the wires should be kept as short as possible to avoid voltage drops in the 12-volt D.C. circuit which would cause low 115 volt A.C. output.

IMPORTANT:

Occasionally under certain conditions, when using the Portable Power Supply Unit, a crackling or humming noise may be heard in the headphones when the Amplifier volume control is turned up toward the maximum position. This is caused by the normal sparking of the brushes in the motor generator. It can be eliminated by moving the Power Supply Unit several feet away from the Amplifier, or by grounding the unit at the negative (-) storage-battery terminal. A ground clamp is supplied which may be attached to a water pipe if the equipment is used in a studio or may be attached to a screw driver stuck in the damp earth during field use. It may also be necessary to ground the microphone-cable plug at the point where it is plugged into the Amplifier, or the amplifier chassis itself. A suitable length of wire should be used between the ground clamp and the negative (-) storage-battery terminal.

During field use, if the earth is too dry to provide a good ground, attach the clamp to the frame of a car or sound truck. The condenser effect between the car-frame and earth, will usually provide a satisfactory ground.

K #3680

OPERATION TROUBLES AND REMEDIES

TROUBLE	PROBABLE CAUSE	REMEDY
Camera and/or recorder power switch is turned on but motor is not running.	115 volt 60 cycle power-line fuse blown	Locate power-line fuse box Replace fuse
	115 volt 60 cycle power-cord not properly connected or contacts defective.	Plug into another outlet or try another power-cord
Camera and/or recorder, operating from power-line source, runs slower than regular speed.	Power supply source not 60 cycle.	Connect to power source known to be 60 cycle
Camera and/or recorder, operating from portable-power-supply runs slower than regular speed.	12 volt storage battery in portable-power-supply is discharged.	Recharge or replace 12 volt storage battery.
Camera and/or recorder synchronous drive motors "hunting" (motor runs with a galloping effect and resulting soundtrack reproduces with a quivering vibrato effect).	60 cycle power-line current has dropped below 110 volts.	Connect equipment to a power line that tests not less than 110 volts under load
		Remove all lighting equipment from the power outlet and feeder line supplying the camera and/or recorder.
	If motors are running from portable-power-supply, output has dropped below 110 volts.	Recharge or replace 12 volt storage battery. check for 110 volt minimum output under load
	Equipment lubricated with heavy grade of oil.	Put light grade oil (sewing machine type) into all lubrication points.
	Low temperature has hardened oil in mechanism.	Run camera and/or recorder without film until oil is warm and mechanism operates freely
	Emulsion collected on aperture-plate in camera causes film to bind.	Clean emulsion from aperture-plate with a soft wooden stylus or toothpick
Camera takes out-of-focus pictures with one particular lens (even though object distance is measured with ground glass focus device, rangefinder or tape, and lens footage-scale set accurately).	Fingerprint on front OR REAR element of lens.	Clean lens surfaces thoroughly
	Lens is not seated correctly.	Clean lens seats on turret and lens; screw lens firmly into turret.
	Lens has been subjected to mechanical shock and elements are displaced.	Return lens to manufacturer for readjustment.
Camera takes out-of-focus pictures with all lenses (even though object distance is measured with rangefinder or tape, and lens footage-scale set accurately)	A dot of emulsion has formed on aperture-plate pushing film back out of focal plane.	Clean emulsion from aperture-plate with a soft wooden pick.

K #3681

TROUBLE	PROBABLE CAUSE	REMEDY
No sound in headphones.	Headphones not plugged in.	Connect headphones.
	Microphone not connected.	Plug in cable between microphone and amplifier.
	4 wire cable not connected at both ends.	Plug in cable at both ends.
	Amplifier not turned on.	Check amplifier switch.
	Volume control turned down.	Turn volume control up.
	Dead batteries.	Test No. 741 and No 482 "A" and "B" batteries and replace if necessary.
	Defective tube in amplifier.	Test all tubes and replace any found defective
	Tubes in amplifier not making contact.	Seat tubes securely in tube-sockets.
	Battery test switch in "A Test" or "B Test" position.	Rotate battery test switch to center, "exposure" position
Microphonic-tube ringing in headphones.	Amplifier touching a source of vibration.	Move amplifier out of contact with source of vibration.
	Tubes out of position in sockets.	Test tubes and reseat, or replace if necessary
	Flexible-leads to tube-shelf touching.	Arrange leads.
	Microphonic amplifier tube.	Turn on amplifier and listen in headphones while lightly tapping individual tubes. Replace any tube which rings for more than 2 or 3 seconds
Squeal in headphones.	Feedback of sound from headphones into microphone.	Increase distance between headphones and microphone. Wear headphones in good contact with head
	Bad connections in mike or output cables.	Wiggle cables at connectors to locate faulty unit. Clean or replace connector
Noise in headphones.	Noisy location.	Locate microphone as close to desired sound as possible, so volume control can be turned down
	Dead batteries.	Test & replace if necessary.
	Loose connection.	Check cables and plugs.
	Noisy amplifier tube.	Check tubes and replace if necessary
	Wind (low-frequency rumble).	Shroud microphone.
Hum in headphones. Equipment connected but camera and/or recorder not running.	Microphone cable near A.C. power-cords.	Move microphone cable away from power-cords and lighting equipment cables
(cont. on next page)	Apparatus which is not grounded (phono turn-tables, etc.) connected to input of amplifier.	Ground apparatus.

K #3682

TROUBLE	PROBABLE CAUSE	REMEDY
Hum in headphones. Equipment connected but camera and/or recorder not running	Unshielded input cable, or cable not of the high impedance type used to connect apparatus (phono turntables, etc) to amplifier input	Use best quality shielded high-impedance cable
	Broken shield connection in microphone cable	Replace microphone cable or repair shield connection.
	Portable-power-supply or other A C equipment too close to amplifier	Rearrange placement of apparatus
(cont from preceding page)	"Singing" lamp-filament in lighting equipment	Replace lamp
Hum in headphones when camera and/or recorder is running.	Operating from unbalanced A C power-line	Reverse power-cord plug in A C. outlet and use plug position where hum is minimized.
"A" battery test reads discard on meter.	End of useful life of No 741 (1-1/2 volt) battery	Replace No 741 battery
"B" battery test reads discard on meter.	End of useful life of the two No 482 (45 volt) batteries connected to red and green wires	Replace both No 482 batteries connected to red and green wires
Sound-track exposure reading low.	Sound-track exposure control knob not advanced sufficiently	Advance control knob.
	End of useful life of the two No. 744 (6 volt) batteries	Replace both No 744 batteries
	Exposure lamp aged beyond useful life	Replace exposure lamp
Volume-indicator meter does not read zero when amplifier is turned on.	Volume-indicator zero adjustment knob not set	Adjust knob so that meter reads "to zero"
Volume-indicator meter needle cannot be brought to zero with adjustment knob.	End of useful life of the two No 482 (45 volt) batteries connected to yellow & white wires.	Replace both No 482 batteries connected to yellow and white wires
	Defective amplifier tube	Test tubes and replace if necessary
Sound-track exposure meter does not read	Exposure-lamp in camera or recorder burned out.	Replace exposure-lamp.
	Sound-track exposure-control knob not rotated sufficiently clock-wise	Advance sound-track exposure-control knob
	4 wire cable not connected between amplifier and camera or recorder	Connect cable between amplifier and camera or recorder
	Exposure-lamp batteries not connected or dead	Check No 744 (6 volt) batteries and connections Replace both No 744 batteries if necessary.
Sound-track exposure meter will not read sound-track exposure, and moving exposure-control knob does not cause any movement of the meter needle.	Meter test switch is in "A" or "B" bat test position	Return meter test switch to "sound track exposure" position

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EXPOSURE AND PROCESSING OF NEGATIVE VARIABLE DENSITY SOUND TRACKS

Suggested references:

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Page 50, etc.

"Motion Picture Laboratory Practice"
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Pages 191-194, etc.

"Photographic Sensitometry"
by Loyd A. Jones
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"Control Techniques in film processing"
Society of Motion Picture and Television Engineers
55 West 42nd Street, New York 36, New York
1960, Page 123, etc.

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