# Film-Tech

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# THE CASE FOR TEST FILMS

In your day-to-day operation, questions about screen image quality and sound reproduction are bound to come up. Normally, theatre personnel judge the performance of their projection system on the somewhat subjective qualities of the particular release print being shown. This is not to say that projection prints are generally lacking in photographic and/or sound reproduction quality, but rather that they are not designed or intended to permit an accurate evaluation of projection system performance. Release prints are, in fact, products of a complex manufacturing process and can provide a very high level of quality for both picture and sound reproduction.

The purpose of the pictorial content of a release print is to convey the producer's story. As such, the print does not necessarily have to contain high resolution detail or yield an exceedingly steady image on the screen. Consequently, a test device, whether film, instrument, or meter, must be designed to measure and evaluate your projection equipment accurately and with a high degree of precision.

## LOOK, LISTEN, AND MEASURE

There are two main classifications of test films: *subjective*—that permit visual and aural evaluation, and *quantitative (objective)*—that permit a "scientific" evaluation when used with suitable meters and other measuring instruments. Some test films incorporate both means of evaluation. For this article, we are concerned mainly with those test films that can be used conveniently in the theatre for a subjective evaluation of your projection system. However, most sound test films provide a quantitative evaluation and require additional equipment for proper use in your booth.

## WHY CAN'T I SEE THAT?

You might ask the question, what am I going to look for that I can't see in the image of a regular release print? First of all, since a release print contains the photographic and sound representation of a director's artistic creation, the image on the film has only to fulfill those requirements. So the background is out of focus, so there is movement as the characters move across the screen . . . who cares? It's the illusion that counts! True, but how can you know if the screen image is in sharp focus, or equally focused on both edges? Or how much of the vertical image unsteadiness is built into the print? Or is your projector causing the problem? What causes the mushy sound in the high frequencies, or a loss of volume along with constant hissing? Is the print badly scratched in the sound track area, or, if magnetic, has it been near some magnetic field? Or is the trouble perhaps somewhere in the sound system?

These gnawing uncertainties can be easily relieved by using a test film whose image is designed to be as sharp as the current state of the art permits. A test film whose image positioning from frame to frame varies only to the extent of the capability of the equipment on which it was manufactured. A sound test film with known frequencies recorded to provide equal response, or a film that accurately determines the position of your scanning beam slit or magnetic heads in relation to the sound tracks. Many films of this nature have been designed and are available to help you diagnose projection and sound problems with a minimum of effort and expense.

## A FILM FOR ALL REASONS

Specific subjective test films can help you evaluate the following common problems in a projection system:

1. Optical performance.
2. Alignment (projector to screen).
3. Screen masking vs image size (aperture plate size).
4. Effect of projection angle (horizontal and vertical).
5. Vertical unsteadiness.
6. Horizontal weave.
7. Frequency response.
8. Scanning beam alignment.
9. Scanning beam uniformity.

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When originally printed in 1976, this issue of *Film Notes for the REEL PEOPLE* included a copy of the SMPTE* catalog, Test Materials for Motion Pictures and Television. You can obtain a free copy of the latest issue of the catalog by writing to

SMPTE
862 Scarsdale Ave.
Scarsdale, NY 10583

And please be sure to include the title of the catalog in your request.

*Society of Motion Picture and Television Engineers

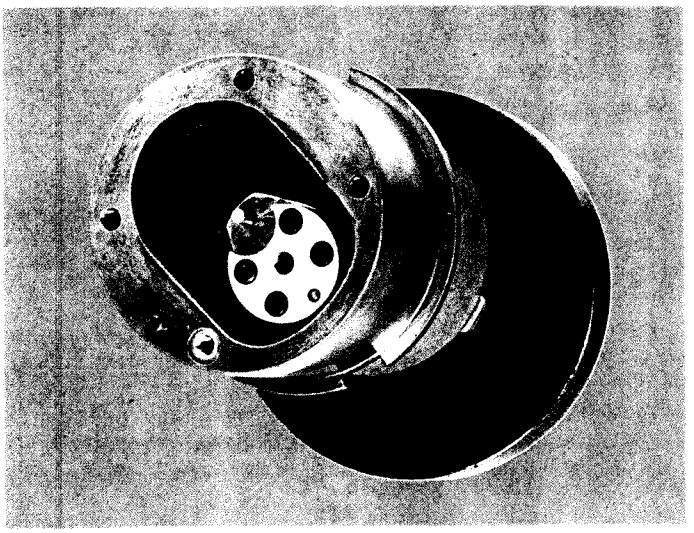


**Figure 4.**
Partially disassembled Geneva movement showing the CAM and PIN mechanism.

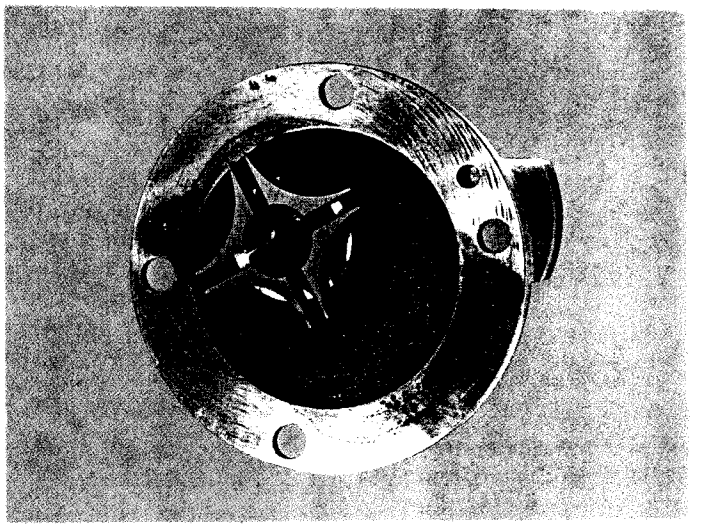


**Figure 5.**
Partially disassembled Geneva movement showing the STARWHEEL.

## THE TEN-YEAR PLAN

Modern intermittent movements are designed to operate at least 10 years with little attention other than keeping the oil level where it belongs. So, tinkering with this equipment is not necessary. In-house maintenance of the unit should be restricted to changing the intermittent sprocket when required. Even this operation should be undertaken carefully, and only when you have your manual open for step-by-step guidance. A previous Kodak publication (H-50-4), relating to maintenance and troubleshooting, describes the various types of sprocket damage that require sprocket replacement.

If your projectors are maintained as recommended by the manufacturer, there should be very few problems that cannot be easily resolved by a combination of alert theatre personnel and good housekeeping practices. The one area that is best left to the experts is the heart of the projector . . . the intermittent movement . . . a marvelous device that accelerates the film to a maximum of nearly ten times its normal speed 24 times each second, several hours per day, for 10 to 12 years!

Remember that these forces and accelerations are absorbed by a thin ribbon of plastic (the film) that is less than seven thousandths of an inch thick. It is amazing, perhaps, that the leading edge of only two perforations (one on each edge of the film) bears the greater part of the initial high acceleration of the intermittent sprocket. And if the framing knob is not changed in position during projection (on rotating movement systems), the same two perforations on each frame will bear these forces throughout the running of the show.

Extensive wear tests and observations in actual trade use verify that film can physically withstand the rigors of projection much beyond the useful life of the average release print. Usually it is only improperly maintained equipment, poor splices, or other externally caused conditions that lead to perforation failure before the useful life of the print is fully realized. It is vitally important, therefore, that the intermittent movement—and particularly the intermittent sprocket—be kept in good operating condition and free from wear.

## LOOK FOR THE SYMPTOMS

In all fairness, it should be pointed out that there are other reasons why a release print may not reach its full potential of usefulness. Many of these reasons are familiar to you and some of them have been described in previous issues of "Film Notes for the REEL PEOPLE."

In review, here are a few symptoms to look for that will alert you to potentially harmful intermittent movement and sprocket conditions before they become very serious:

- Vertical image unsteadiness that cannot be attributed to other causes such as damaged perforations, improper gate tension, and deposits on the projector trap rails.
- A ticking noise as the film leaves the intermittent sprocket. This is best observed as you run down by hand after threading up. Usually signifies worn or damaged teeth.
- Low oil level in reservoir, as indicated by the oil gauges on the intermittent, or at the front of the projector head.
- Metallic scraping sounds in the sprocket area. Look for sprocket shoe misalignment or damaged teeth rubbing against a component.
- A clicking sound just before the intermittent sprocket begins to move. Could mean wear and/or improper adjustment of the cam/pin wheel interface. Time to have somebody take a look before real trouble starts.
- Damage to corners of perforations on the pulldown side that cannot be attributed to other sprockets or to misalignment. Oftentimes caused by lateral misalignment of sprocket on the shaft in systems using a fastening screw that allows for lateral adjustment. Not applicable to systems using taper pins to secure the sprocket to the shaft.

Other, more obscure symptoms can develop, but our experience shows that those listed above are the most widely found in theatres.

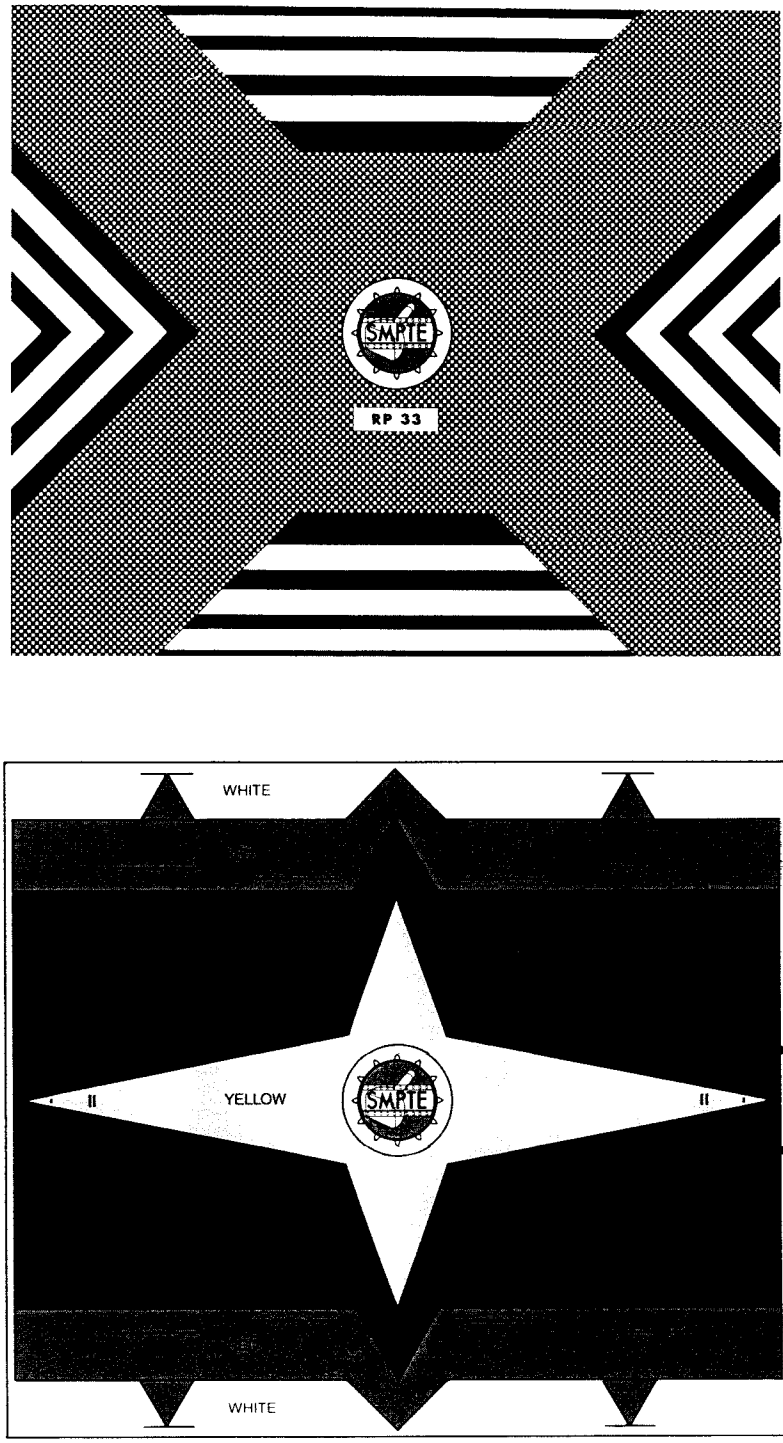



**Figure 1.** 35 mm Subjective Picture Test Film (SMPTE No. P35-MR).

For those in management or nontechnical situations, a test film is available that can provide a rather simple evaluation of the general performance of a projection system. The film is designated as *35 mm Subjective Picture Test Film* (SMPTE No. P35-MR), and is fully described in the SMPTE Recommended Practice RP 33. As shown in Figure 1, the film is supplied in two parts. A sound narration accompanies the visual text and describes the evaluation procedure. The focus test target contains a checkerboard background pattern to facilitate evaluation of overall focus. Special design areas on the edges and at the top and bottom provide a quick check of image steadiness and weave. The second section, or color zone target, shows clearly the actual area of the film image being projected on the screen and is used to determine the aspect ratio or size of the projector aperture plate opening. Wrong combinations can result in significant portions of the film image being deleted from the screen.

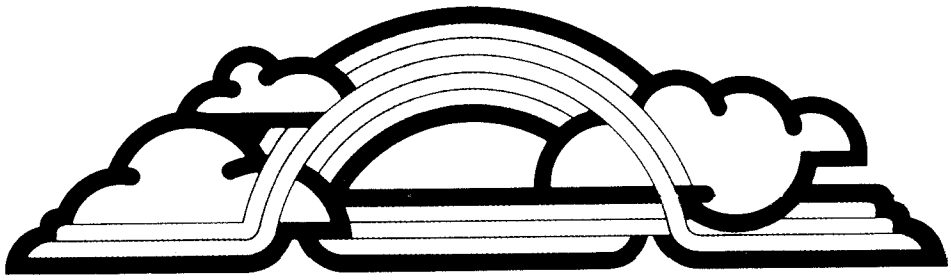
### TOO HOT FOR ACCURACY!

With all visual image test films, there is a temptation to make up short loops so the image can remain on the screen long enough to permit a leisurely evaluation. In most cases, we do not recommend this practice because the satisfactory performance of film during projection depends a great deal on a sufficient recovery period after it has been subjected to the high heat energy emitted from most projection lamps. Continuous projection of a short loop prevents proper recovery and may affect the performance of the film, and hence, the quality of the screen image. (With sound test films, and, where only the sound track is important, loops can be used without a problem.)

### EMULSION-IN BENEFIT

Any picture test film that is to be used to evaluate the quality of the projected screen image should be strictly maintained as specified in SMPTE Recommended Practice RP 39-1970, *Specifications for Maintaining an Emulsion-In Orientation on Theatrical Release Prints*. Film wound tightly and emulsion-out on small cores can develop internal stresses that cause screen image problems, so all SMPTE picture test films are supplied to the user wound tail-out and emulsion-in. Before use, they should be rewound *emulsion-in* on a 3-inch core, or on a reel having at least a 3-inch hub diameter. In some older projectors, the projection of film coming off the supply reel in a clockwise rotation may cause some film problems due to a narrow film magazine opening and/or the location of the upper rollers. In those cases, we recommend modification to the projector. In fact, universal use of emulsion-in projection in the United States, for release prints as well as for test films, would provide the industry with better screen images and longer lasting, stress-free prints. Many other parts of the world are already benefitting from this emulsion-in projection technique.

Test films that are used infrequently should be kept in sealed cans, if possible, and in a cool place. After each use, the can should be resealed with fresh tape. Extremes of heat and humidity should be avoided because they can degrade the quality of the screen image, as described in the second issue of *Film Notes for the REEL PEOPLE, Film Handling* (H-50-2).



## Editor's Mailbox

This new feature of *Film Notes for the REEL PEOPLE* has been added because we are concerned about printing truly helpful information. We encourage our readers to write to the editor with technical comments or questions that cover topics of wide interest to our readership. We will then publish what we feel is useful to the greatest number of *REEL PEOPLE* readers. Send your letters or postcards to:

Eastman Kodak Company
Editor's Mailbox, *Film Notes for the REEL PEOPLE*
Dept. 642, Rochester, New York 14650

So, for our first "letter to the editor," we have a helpful hint to pass along from James Duncan, the operator at Prairie Lake Drive-In Theatre in Altamonte Springs, Florida. His comments concern what we feel is an effective way to handle the repair of misframed splices when projecting films from platter-type transport systems.

Rather than disassemble the entire show to get to the splice (which is usually somewhere in the middle of the show), simply follow these instructions:

1. Keep about eight pieces (approximately 2 inches square) of clean sponge rubber (or other soft sponge material) in a container somewhere near the platter assembly. No other material is required.
2. As the misframed splice is taken up on the platter, place four pieces of sponge, evenly spaced, between the wound-up portion and the section that contains the bad splice.
3. As the platter continues to rotate, insert the other four pieces of sponge on the other side of the section with the bad splice. (See Figure 2.)
4. Take up the remaining film normally. After the show is over, carefully lift out the section of film between the two sets of sponges, make the repair, and remove the sponges.
5. When the film has been properly repaired, slip the section back onto the platter. The entire operation takes less than 5 minutes.

*Editor's Note:* We tried this simple procedure sent in by Mr. Duncan and found it works quite well. Thanks for the tip—we're happy to pass along this bit of helpful information to all our *REEL PEOPLE*.

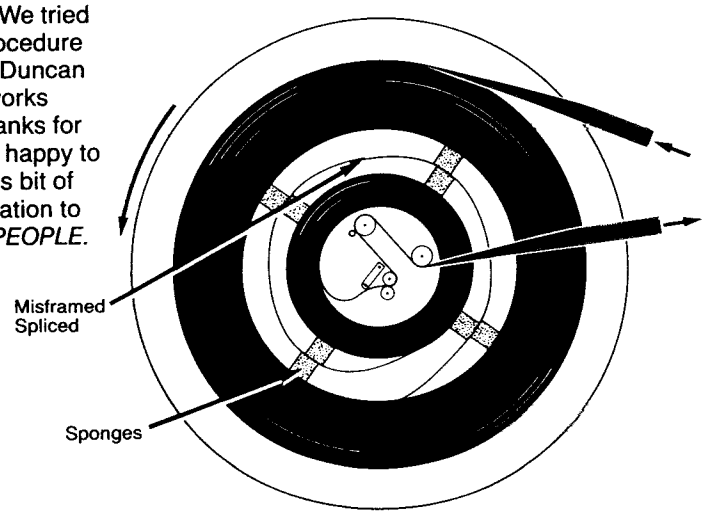



**Figure 2.** Takeup platter showing the sponges in place to isolate a misframed splice.

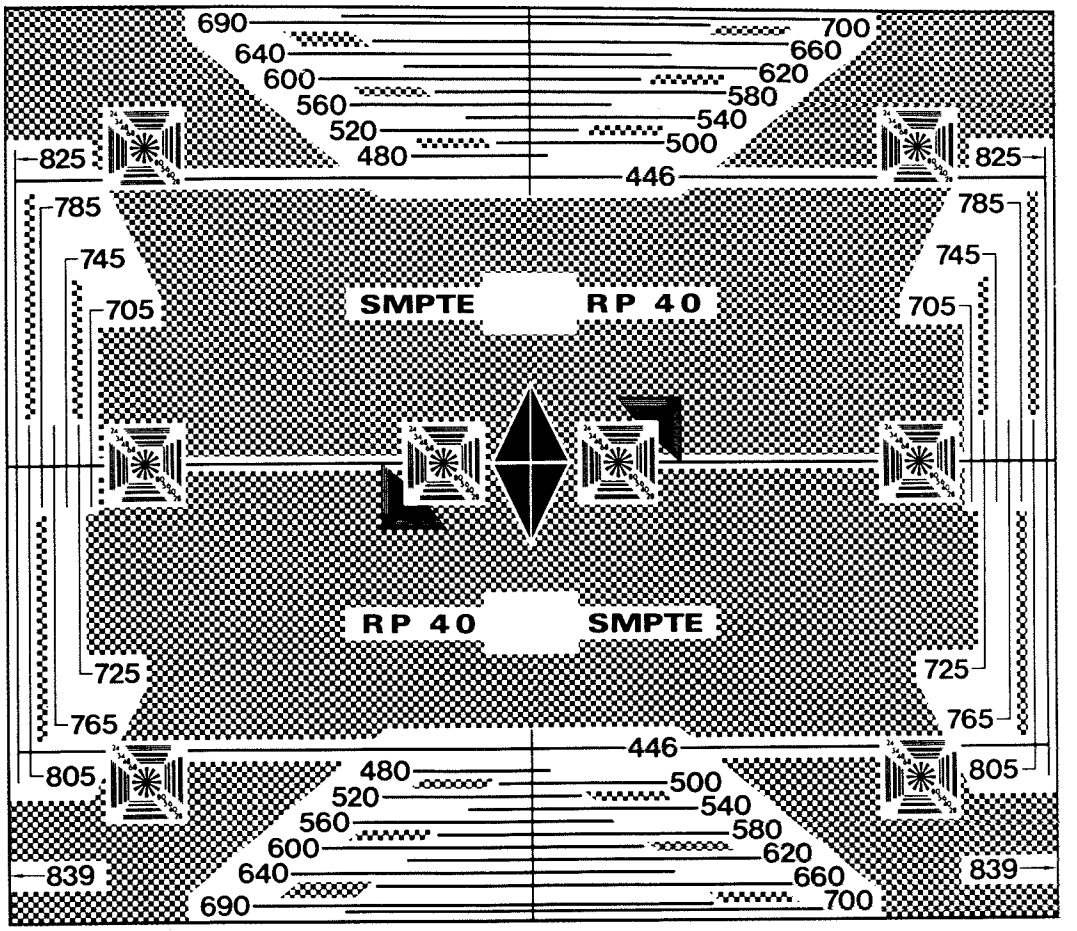



**Figure 3.** 35 mm Projector Alignment and Image Quality Test Film (SMPTE No. 35-IQ).

## VERSATILITY PLUS PRECISION

Probably the most versatile and popular test film is the *35 mm Projector Alignment & Image Quality Test Film* (SMPTE No. 35-IQ), usually referred to as the "RP 40 test film." As can be seen in Figure 3, this film is an example of dual capability. It is widely used for subjective evaluation; but because of the precision of the design, it can also be used for objective evaluations. The versatility of the film is best described in the SMPTE Recommended Practice RP 40 and in the instructions that accompany the film, but a less detailed description is warranted in these notes.

The complete test film consists of one pattern supplied on two different film stocks for a very special reason. A black-and-white section provides for the evaluation of the screen image under conditions that more nearly coincide with regular release print performance. The second section is printed on only the top magenta layer of a color print film stock and provides for the evaluation of the ultimate ability of the system to reproduce (on the screen) the information contained in the film image. This evaluation can be realistically achieved because most of the heat energy from the lamphouse that could affect the screen image quality is transmitted, rather than absorbed, by the very thin dye image. The top layer alone is used so that the precise detail in the original test pattern can be recorded on the film image.

The background consists of precisely made checkerboard squares that provide for about 50 percent absorption of the incident radiant energy. This value corresponds closely to an average scene in a release print. Because of the several aspect ratios that have become popular in recent years, it seemed more practical to have an even number (200) of squares placed along the width of the pattern since that dimension varies very little, regardless of the aspect ratio chosen for projection. The design proved worthwhile because it was the custom some years ago to specify vertical unsteadiness as a percentage of the screen width. This means that vertical movement equal to one square is 0.5 percent of the screen width. To be more accurate, however, the following table shows the actual percentage that one square represents of each of the various image heights. Dimensions given are from American National Standards Institute (ANSI) PH22.195 (1977).

| Aspect Ratio | Aperture plate | % Movement (One Square) |
|---|---|---|
| 1.37:1 | 0.600″ x 0.825″ | 0.7% |
| 1.66:1 | 0.497″ x 0.825″ | 0.8% |
| 1.75:1 | 0.471″ x 0.825″ | 0.9% |
| 1.85:1 | 0.446″ x 0.825″ | 0.94% |
| 2.35:1 | 0.700″ x 0.839″ | 0.6% |

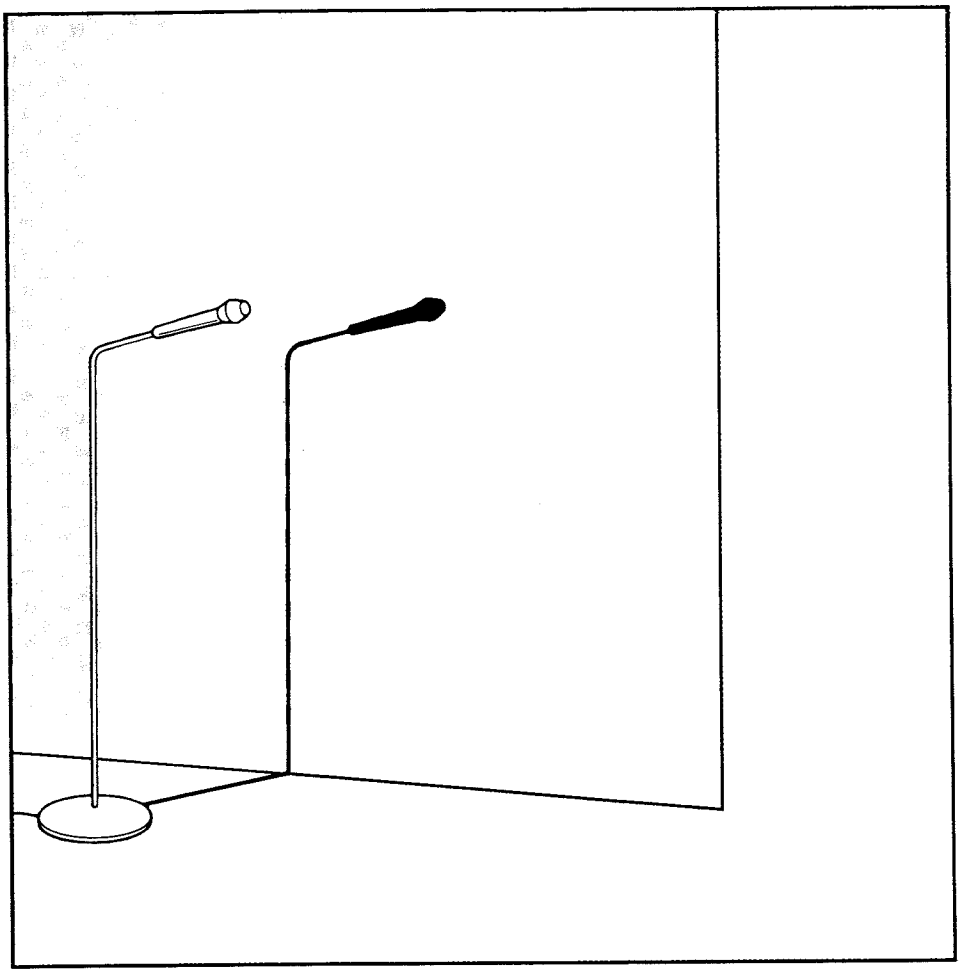


**Figure 4.** Vertical unsteadiness can be checked easily by observing image movement next to a shadow of some object placed near the screen (see text below).

## WATCH THE SHADOW

By placing some object, such as a mike stand, near the screen to cast a sharp shadow on the image adjacent to a square (Figure 4), it is easy to determine how much the square is moving. Let's say that you are using the test film with an aperture plate designed for 1.85:1 wide-screen projection. On observing the movement of the square adjacent to the sharp shadow, it averages about one-fourth of the square. If you look back at the table opposite aspect ratio 1.85:1 and take one fourth of 0.94 percent, you come up with a respectable 0.23 percent vertical unsteadiness value. Obviously, if you were projecting an image with more height, say 1.37:1 (at the same magnification), your result would be even more impressive at only 0.18 percent. On the basis of many observations, an arbitrary steadiness aim of 0.125 percent has been established as an achievable performance.

## HOW GOOD IS GOOD?

The checkerboard pattern also serves to provide a quick check of the overall focus of the image. The edges or the top and bottom may not be as sharp as the center of the image, depending on a variety of conditions, but a serious problem exists if sharp focus cannot be achieved at the center of the image. For a more critical determination of the projection system performance, the specially modified National Bureau of Standards focus test charts should be used to provide a quantitative evaluation. The numbers on these charts refer to the actual number of lines per millimetre contained in the film image. You can understand, therefore, the precision required in making a test film in which *80 lines* per millimetre can be clearly resolved in the film image. The ability of a projection system to transfer that information to the screen involves a combination of factors very difficult to achieve in the average theatre. As a matter of fact, we know of only one or two installations that are able to produce this kind of optical performance. Reports from many users of the RP-40 test film indicate that 56 lines per millimetre is readily achievable, and in some cases, 68 lines per millimetre have been observed. But a system that cannot achieve at least 48 lines per millimetre should be thoroughly checked for optical and mechanical performance as described in H-50-4 (the fourth issue of *Film Notes for the REEL PEOPLE*), entitled *Troubleshooting and Prevention of Damage*.

## WIDE SCREEN ON TELEVISION

The 35 mm test film is somewhat more complex than similar test films designed for other formats. The complex design was necessary to include the many wide-screen ratios that have become popular. Currently, it would appear that the 1.85:1 version is the most popular, along with some CinemaScope releases at 2.25:1. It should be noted, however, that a feature release designed to be shown in a wide-screen format can also be scheduled for television viewing and therefore contain a full-frame image that is completely usable. This provision is made so that eventual television release will not require reprinting to prevent the loss of image width but still provide the necessary image height for the television screen. The typical television receiver has a picture aspect ratio of about 1.33:1 which is similar to the regular sound movie format.

## DEFINE LINES

The horizontal or vertical lines at the top, bottom, and sides of the test pattern indicate the size of the film image being projected. The numbers, expressed as decimal parts of one inch (825 = 0.825), give the actual dimensions of that image. While there has never been an established limit for allowable film image cutoff, a value of 10 percent is generally regarded as the outer limit, particularly if it includes both the width and the height. For instance, if you are projecting a wide-screen release with a 2.35:1 ratio and are using the proper aperture plate and backup lens, you should see the entire test pattern on the screen. The lower screen edges should show the figures "839" and should include the arrows that indicate the projector aperture width. Likewise, the top and bottom of the screen should just reveal the lines marked "700." If the vertical lines marked "745," or the horizontal lines marked "640," cannot be seen, you are losing more than 10 percent of the film image width, or height. Complete instructions that accompany each reel describe the uses and scope of this film.

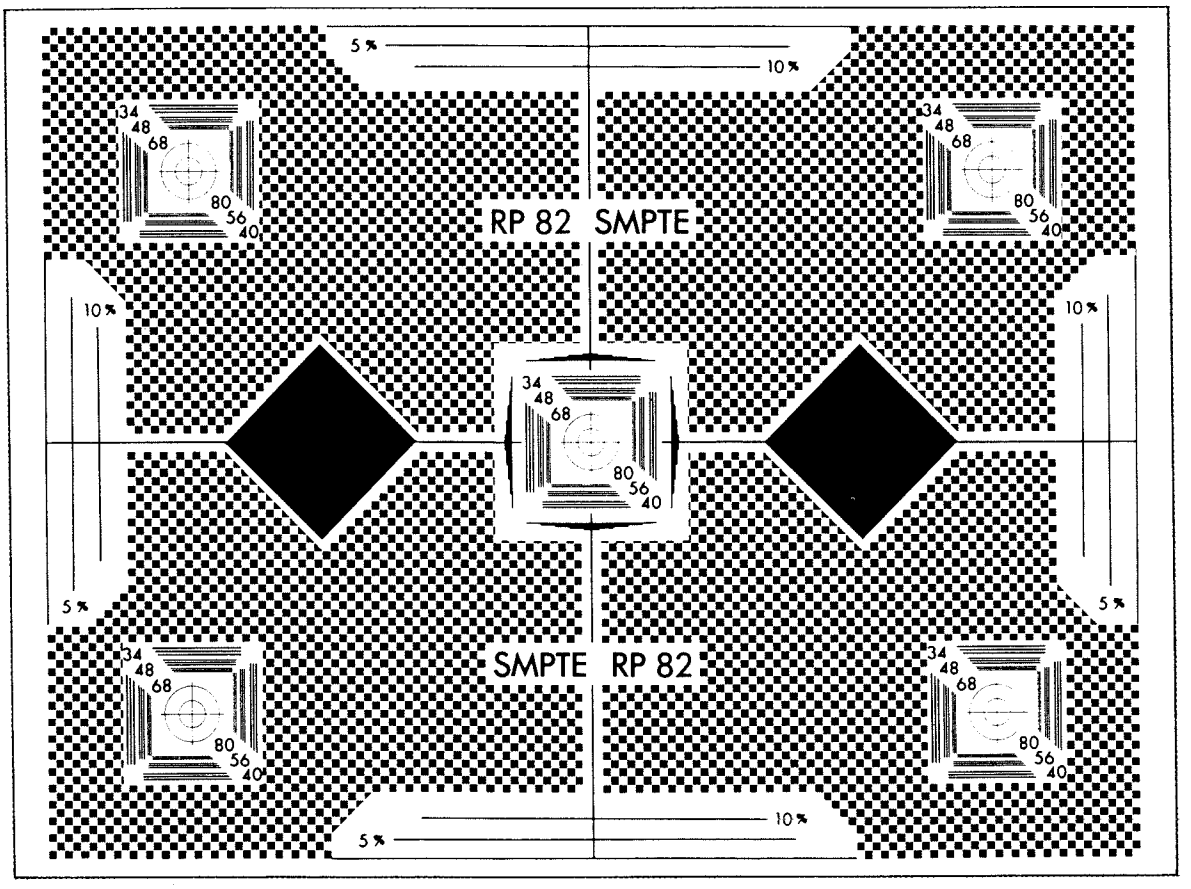



**Figure 5.** 16 mm Projector Alignment and Image Quality Test Film (SMPTE No. 16-PA-100).

## 16 MM AND 70 MM TOO!

At the present time, a 16 mm version of RP 40 is being manufactured. It is best described in the proposed SMPTE document, Recommended Practice RP 82. Because only one projector aperture size (0.284 x 0.380 inches) is generally used for 16 mm projection, the design is simplified but its usefulness is not. As can be seen in Figure 5, the horizontal and vertical lines at the edges of this chart express loss of image size directly in percent. When projected with the proper lens, aperture plate, and screen masking, the full test pattern should be seen on the screen. As with RP 40, the resolution charts used in RP 82 contain up to 80 lines/millimetre to enable you to make direct comparison with the performance of other projection systems. Unlike large 35 mm theatrical installations, however, the low heat energy levels often found in 16 mm projectors make it possible to attain 80 lines/millimetre resolution on the screen. As the heat energy increases on the film (especially with xenon or carbon arc lamps), the probability of seeing 80 lines in the screen image diminishes. Since there is only one film image height to contend with, the background contains 100 squares vertically to simplify measurement of vertical unsteadiness (1 square = 1 percent). Horizontal and vertical wedges (in increments of 0.2 percent) have been added around the central resolution chart to facilitate these quantitative measurements.

## COMING SOON— FOR YOUR THEATRE!

Currently under design consideration and approval is a 70 mm test film that resembles the RP 82 (16 mm) and RP 40 (35 mm) versions. Again, since there is only one film image size in current use for 70 mm theatrical projection, the test pattern will be simplified, yet will provide all the necessary information. Also to be available in the future, is a quantitative 35 mm test film to measure stray light hitting the screen during actual projection. The significance of this proposed test film lies in the fact that under certain conditions the screen image itself contributes to the unwanted stray light.

## SOUND TEST FILMS

With the exception of the Buzz Track Test Films, most sound test films are designed for quantitative measurements using suitable meters. Each film has a specific function and is clearly described in the SMPTE catalog, *SMPTE Test Materials for Motion Pictures and Television,* included with this issue of *Film Notes for the REEL PEOPLE.*

Sound test films are divided into two categories: photographic (or optical) and magnetic. Both categories contain several films designed for checking specific elements of a sound system. Here is a brief description of each.

**Buzz Track Test Film:** A photographic sound film designed to determine the proper lateral placement of the scanning beam slit in relation to the sound track during film travel. The test track is opaque with a square wave record of 300 Hz on the inside edge and a 1000 Hz record on the outside edge. When the scanning beam is correctly placed, no sound will be heard. If the scanning beam is too far from the film edge, the 300 Hz tone will be heard . . . if too close, the 1000 Hz tone will be heard. This film does not need measuring instruments because it is subjective in design. (see Figure 6.)

**Scanning Beam Test Film:** A photographic sound film designed to check the uniformity of illumination across the scanning slit. The sound track contains a 0.003-inch-wide variable-area record of 1 kHz frequency which travels at a uniform rate across the width of the sound track. A suitable meter, such as the Standard Volume Indicator, is needed for use with this test film. (See Figure 7.)

**Multifrequency (Frequency Response) Test Film:** A photographic sound film, available in either 16 mm or 35 mm, designed to establish proper frequency response. A suitable meter is necessary to make full use of this film. A similar film is available for testing magnetic sound systems.

**Signal Level Test Film:** This photographic sound film is also available in either 16 mm or 35 mm and is designed for measuring and balancing the power output level of a motion picture sound reproducer. An output level meter is necessary when using this film. Similar films are available for super 8, 16 mm, and 35 mm magnetic sound systems.

**Flutter Test Film:** A photographic sound film designed to measure the amount of flutter introduced by sound reproducers in either 16 mm or 35 mm sound systems. A flutter meter is required when using these films. Similar films are available for testing the flutter characteristics of magnetic sound systems.

**Channel-Four (Switching Channel) Test Film:** A 35 mm, 4-track magnetic film designed to check the operation and adjustment of the switching circuit of the fourth channel in a four-channel sound system.

**Azimuth Alignment Test Films:** A series of super 8, 16 mm, and 35 mm films designed to determine the correct angular position of the recording and reproducing heads with respect to the direction of film travel for magnetic sound systems. These films can be used subjectively; but since the human ear is not a very good instrument to measure relative loudness between low and high frequencies, a suitable output level meter should be used for best performance.

## SERVICE IS AVAILABLE

In most locations, a sound equipment service representative is likely to have the most useful of these films and can assist you in checking out your system. It is probably more practical for an independent theatre to rely on an outside sound service technician for these tests even though many of the sound test films are relatively inexpensive. But where there are several theatres or a theatre chain to be serviced, it becomes practical to have the test films available because the expense can be amortized by the savings in service calls. The same reasoning can be applied to the somewhat more expensive visual test films. Just remember this: All types of precision machinery require adjustment and maintenance. And the use of test films can be a most important link to successful presentations, whether in the installation of new equipment, the diagnosis of screen image and sound problems, or in normal periodic maintenance.

If you need more information or assistance in using any of the test materials or films described in this article, contact your Kodak Sales and Engineering Representative at the nearest Motion Picture and Audiovisual Markets Division office listed on the back cover.

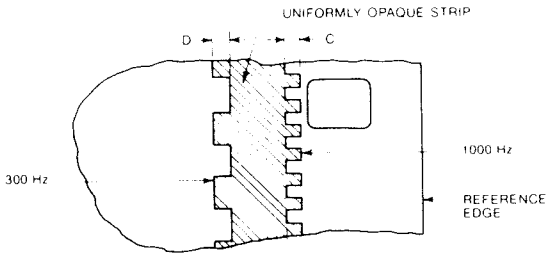



**Figure 6.** 35 mm Photographic Buzz Track Test Film (SMPTE No. P35-BT-400).

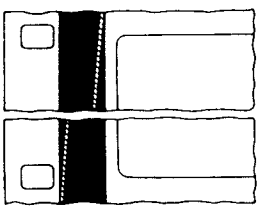


**Figure 7.** 35 mm Photographic Scanning Beam Test Film (SMPTE No. P35-SB).