standards and recommended practices

Draft USA Standards

Four draft USA Standards are published here for a trial period and public review. Comments should be addressed to Alex E. Alden, Staff Engineer, at Society Headquarters before December 31, 1969. The proposals have been submitted to the appropriate USA Standards Committees. Consequently, all comments received through Journal publication will be reviewed prior to conclusion of action by these committees.

C98.5, Dimensions of 2-In Video Magnetic Tape Reels, and PH22.157, Dimensions of Camera Aperture Image on Super 8 Motion-Picture Film, are revisions of earlier issues. The modifications are actually corrections of dimensions and tolerances to reflect accepted engineering practices. The published version of C98.5 now conforms entirely with the EIA standard of Magnetic Reels, USAS C83.31-1968.

PH22.177, Dimensions of Magnetic Striping of 35mm Motion-Picture Film for Four-Track Magnetic Sound Release Prints, although a new standard, actually reflects the dimensions of magnetic striping originally shown in PH22.137. PH22.137 now specifies only the sound record.

PH22.178, Dimensions for 35mm Motion-Picture Film Splices is a new standard specifying 35mm splices intended for laboratory printing or projection.

Proposed SMPTE Recommended Practices

Two proposed Recommended Practices are published here for a trial period and public review. Proposed SMPTE Recommended Practice RP 7, Density and Contrast Range of Black-and-White Films and Slides for Television, is substantially a reaffirmation of the earlier issue, editorially modified to clarify its usage.

Proposed SMPTE Recommended Practice RP 39, Specifications for Maintaining an Emulsion-In Orientation on Theatrical Release Prints, published here, is the result of investigation by a subcommittee of the Film Projection Practice Committee. During projection of motion picture film there is a focus drift from the head to the tail of the reel. The results of an investigation into the causes of this focus drift were published as, "Effect of Winding on the Projection Performance of 35mm Motion Picture Film," in the SMPTE *Journal*, June 1965.

Tests often showed that during the normal projection of 2000-foot reels the optimum focus position tended to change continuously. While the amount of focus varied with many factors, the change was always in the positive direction (film in aperture moving towards the lens). The same reel projected tail first caused the focus change to reverse itself, indicating that the focus was determined by some physical properties inherent in the piece of film being projected at any given moment.

Through accelerated tests, it became evident that some physical action due to winding has a major influence on projection performance. As a result of this factor, the projection properties of a roll of film deteriorate sharply as the winding diameter becomes smaller.

It was obvious from the results of these tests that film wound emulsion-out has poorer projection properties than the same film wound emulsion-in, and that this difference is greatly accentuated as the winding diameter becomes smaller.

The significant advantage of emulsion-in winding is not only that it improves the projection performance of a reel of print film, but that it also minimizes the difference in projection performance between the head and the tail end of the reel. While emulsion-in winding should not be looked upon as a panacea for all projection problems, it certainly enhances the film's resistance to projection and makes possible improved performance.

USA Standards Reaffirmed

On August 29, 1969, the United States of America Standards Institute, taking the recommendation of the SMPTE Engineering Committees and the USASI Standards Committee PH22, reaffirmed without change the following standards:

PH22.95-1963, Dimensions for Television Image Area on 35mm Motion-Picture Film (published in October 1963 *Journal*);

PH22.96-1963, Dimensions for Television Image Area on 16mm Motion-Picture Film (published in October 1963 *Journal*); and PH22.133-1963, Screen Luminance and Viewing Conditions for 35mm Review Rooms (published in June 1968 *Journal*).

Withdrawal of USA Standard

On September 11, 1969, the United States of America Standards Institute approved the withdrawal of PH22.50-1960, Reel Spindles for 16mm Motion-Picture Projectors. The withdrawal action has been undertaken because it was felt the subject was inappropriate as a standard and has been published as an SMPTE Recommended Practice RP 34, published in the December 1968 *Journal*. PH22.50 was published in the December 1952 *Journal*.

Proposed Withdrawal of SMPTE Recommended Practice

The Film Dimensions Committee and the SMPTE Standards Committee have proposed the withdrawal of SMPTE Recommended Practice RP 28-1968, Dimensions for 35mm Motion-Picture Film, Perforated 8mm, 5R-1500. The withdrawal has been recommended because the specifications were not being followed. RP 28 was published in the SMPTE *Journal* of March 1968.

If no adverse criticism is received by December 31, 1969, the recommendation will be forwarded to the SMPTE Board of Governors for consideration.—A. E. A.

Draft USA Standard Dimensions of

2-In. Video Magnetic Tape Reels

C98.5

Revision of C98.5-1965

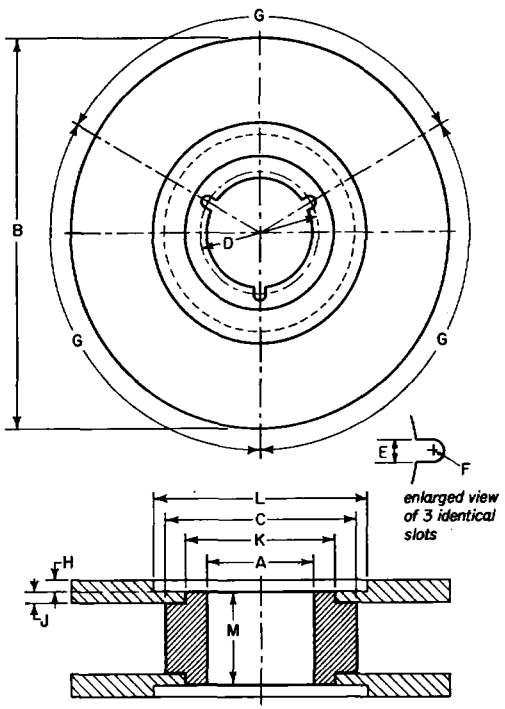
1. Scope

This standard specifies the dimensions of reels in maximum capacities of 750, 1650, 3600, 5540, and 7230 ft designed to accommodate the maximum thickness of 2-in. wide magnetic tape for television recording, as specified in USA Standard Dimensions of 2-In. Video Magnetic Tape, C98.1-1963.

2. Reel Dimensions

2.1 The dimensions of the reels shall be as specified in the figure and tables.

2.2 Flange-fastening members shall be flush with or below the outer surface of the flanges.



2.3 The outside cylindrical surface of the hub (C diameter) shall be concentric with the center bore (A diameter) within 0.002 in. (0.05mm) and shall have a maximum taper of 0.0016 in. (0.040mm).

2.4 The outside diameter of the flanges (B diameter) shall be concentric to the center bore of the hub (A diameter) within 0.015 in. (0.38mm).

Table 1

Reel Dimensions

Dimensions	Inches	Millimeters	Degrees
A	3.000 $^{+\ 0.004}_{-\ 0.000}$	76.20 $^{+\ 0.10}_{-\ 0.00}$	
B	See Table 2	See Table 2	
C	4.500 ± 0.010	114.30 ± 0.25	
D	3.250 ± 0.002	82.55 ± 0.05	
E	0.219 $^{+\ 0.006}_{-\ 0.000}$	5.56 $^{+\ 0.15}_{-\ 0.00}$	
F	0.109 ref	2.77 ref	
G			120 ± 0.1
H*	0.025 max	0.64 max	
J*	0.098 max	2.49 max	
K†	3.600 min	91.44 min	
L†	6.000 min	152.40 min	
M‡	2.212 ± 0.003	56.18 ± 0.08	

* The surface of the flanges from B to L shall lie between the planes defined by H and J.
† Outside surfaces of reel flanges between diameters K and L shall not extend beyond the surfaces defined by Dimension M.
‡ The hub surfaces defined by M shall be parallel within 0.0008 in. (0.020mm) and square with the hub outside diameter C within 0.003 in. (0.08mm) at maximum diameter.

Table 2

Reel Capacities

Maximum Capacity,*		Maximum Playing Time in Min at 7.5 In. (19.05 Cm) 15 In. (38.1 Cm) Per Second		Dimension B	
Feet	Meters			Inches	Millimeters
750	228	20	10	6.500 ± 0.010	165.10 ± 0.25
1650	503	44	22	8.000 ± 0.010	203.20 ± 0.25
3600	1097	96	48	10.500 ± 0.010	266.70 ± 0.25
5540	1689	148	74	12.500 ± 0.010	317.50 ± 0.25
7230	2203	192	96	14.000 ± 0.010	355.60 ± 0.25

* Maximum capacity is based on a minimum distance of 0.2 in. (5mm) from the reel periphery to the tape stack, utilizing maximum thickness tape.

Appendix

(This Appendix is not a part of this Draft USA Standard, but is included to facilitate its use.)

The outside diameters of the flanges, B, will give reels the capacities suggested in Table 2. These capacities should be regarded as maximum.

It is recommended that both flanges have air escape holes. If provided, these holes should extend to the hub periphery and be of such size at this point as to facilitate easy threading.

Draft USA Standard Dimensions of

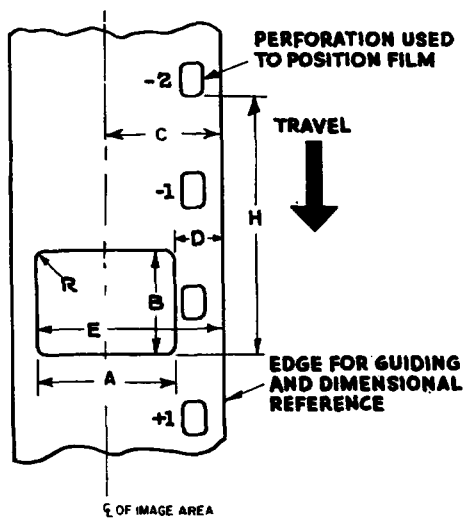
Camera Aperture Image on Super 8 Motion-Picture Film

PH22.157

Revision of
PH22.157-1967

1. Scope

This standard specifies the dimensions of the image area produced by the camera aperture on super 8 motion-picture film. It also specifies the position of the image relative to the reference edge of the film and the perforation used to position the film.



Film as seen from inside camera looking toward lens.

Dimensions	Inches	Millimeters
A	0.228 nom	5.79 nom
B	0.163 min	4.14 min
C	0.170 ± 0.002	4.32 ± 0.05
D	0.037 min	0.94 min
	0.058 max	1.47 max
E	0.282 min	7.16 min
H	0.393 ± 0.005	9.98 ± 0.13
R	0.005 max	0.13 max

2. Dimensions

2.1 The dimensions shall be as given in the figure and table and shall apply to measurements of the image as formed on freshly exposed and processed film.

2.2 The angle between the horizontal edges of the image and the reference edge shall be 90° ± ½°.

2.3 Dimension H is the distance from the bottom edge of the picture frame to the bottom of the perforation which is two pitches above the perforation adjacent to that picture frame.

Appendix

(This Appendix is not a part of this Draft USA Standard, but is included to facilitate its use.)

A1. If the aperture plate is not in the plane of the emulsion, the physical dimensions of the aperture in the camera will be slightly different from the dimensions given in the figure. The exact amount of this difference will depend upon the f/ value and focal length of the camera lenses used and upon the distance between the emulsion and the physical aperture. This separation should be no greater than is necessary to prevent scratching of the film.

A2. It is the intent of this standard to provide a camera image such that the exposed area will always be larger than the area of the projector aperture. Observance of the dimensions given in the standard meets this objective without causing double exposure of the area between the frames.

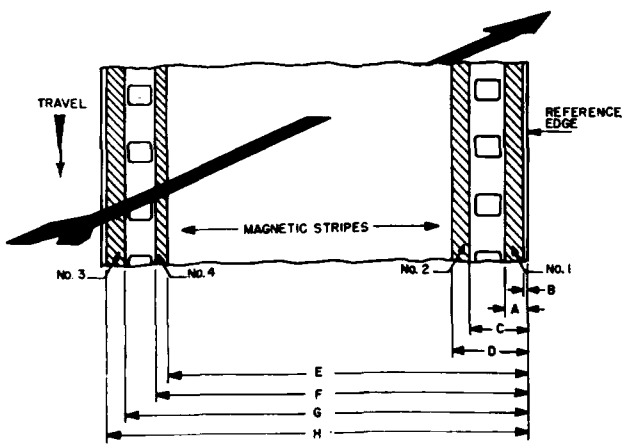
Draft USA Standard Dimensions of

Magnetic Striping of 35mm Motion-Picture Film for Four-Track Magnetic Sound Release Prints

PH22.177

1. Scope

This standard specifies the location and dimensions of the magnetic recording stripes on 35mm motion-picture film used for four-track magnetic sound release prints having an anamorphic-type picture image.



AS SEEN FROM INSIDE PROJECTOR LAMPHOUSE LOOKING TOWARD THE LENS

Dimensions	Inches	Millimeters
A	0.072 ± 0.003	1.83 ± 0.08
B	0.008 max	0.20 max
C	0.179 ± 0.003	4.55 ± 0.08
D	0.242 ± 0.003	6.15 ± 0.08
E	1.169 ± 0.003	29.70 ± 0.08
F	1.207 ± 0.003	30.66 ± 0.08
G	1.306 ± 0.003	33.17 ± 0.08
H	1.369 min	34.77 min

2. Dimensions

2.1 The location and dimensions of the recording stripes shall be as specified in the figure and table.

2.2 The magnetic stripes shall be on the side of the film which is away from the light source when used on a projector arranged for direct front projection on a reflection-type screen.

3. Film Stock

The film stock used shall be safety type, cut and perforated in accordance with USA Standard Dimensions for 35mm Motion-Picture Film, CS-1870, PH22.102-1964.

Appendix

(This Appendix is not a part of this Draft USA Standard, but is included to facilitate its use.)

A1. The dimensions specified in this standard are predicated on the use of unshrunk film. It is recognized, however, that some shrinkage may occur when striping a processed print. Specific measurements should take into account the overall width of the film as specified by Dimension A in USA Standard PH22.102-1964. Should the film width fall outside the permissible tolerance, all dimensions specified in this standard may be multiplied by the ratio of nominal dimensions determined as follows:

$$\frac{\text{Measured width}}{\text{Specified width}} = \text{Ratio of nominal dimensions}$$

A2. The outer edge of the magnetic striping ideally should be coincident with the edge of the film and, for this reason, Dimension B is specified as maximum and Dimension H as minimum.

A3. Prints conforming to this standard are prepared in accordance with USA Standard Specifications for Projector Usage of 35mm Release Prints with Four-Track Magnetic Sound Records, PH22.103-1966, and USA Standard Dimensions of Four-Track Magnetic Sound Records for 35mm Release Prints, PH22.137-1963.

Draft USA Standard Dimensions for

35mm Motion-Picture Film Splices

PH22.178

1. Scope

This standard specifies the dimensions for splices on processed 35mm motion-picture film with DH, BH, CS, or KS perforations intended for laboratory printing or projection.

2. Dimensions

2.1 The dimensions shall be as given in the figure and table and shall apply to processed films and leaders.

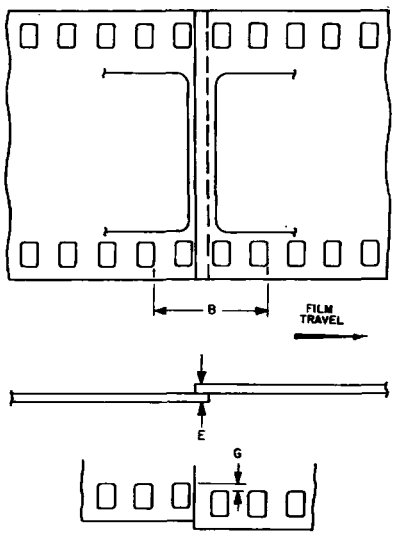
2.2 The critical dimension requiring control during splicing is pitch (Dimension B). The direction of intended travel during use of the film determines the perforation edges used for this measurement. A value of 0.2 percent has been assumed for aging and processing shrinkage in the calculation of Dimension B.

2.3 The film width at the splice shall not exceed 1.379 in. (35.03mm). If the film has been widened during splicing, the extra material shall be removed.

2.4 In the plan view, the angle between the respective edges of the spliced films shall be $0° \pm 4'$. (See Appendix A4.)

2.5 Tape material may be added to reinforce butt, taper, or overlap cement splices, provided the reinforcing tape does not extend beyond the edges of the film and the total thickness is within Dimension E. (See Appendix A5.)

2.6 If new perforation holes are punched into tape splices or reinforcing materials after application to the film or if preperforated material is used, the film shall retain its perforation pitch in its intended direction of travel.



Dimensions	Inches	Millimeters
B	0.559 ± 0.002	14.20 ± 0.05
E	0.013 max	0.33 max
G	0.002 max	0.05 max

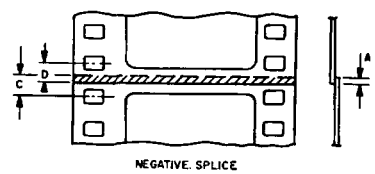
NOTE 1: When butt splices are joined by tape, cement or welding, the gap between the film ends at any point across the width of the film shall be less than 0.002 in. (0.05mm).

NOTE 2: Carefully made splices for laboratory printing or projection use shall be capable of 3,000 passes over an idler roller of 5/16-in. diameter with a wrap of at least 160 degrees, including an average tension of at least 2 pounds. (Idler rollers of less than 5/16-in. diameter may be used to meet the requirements of this specification.)

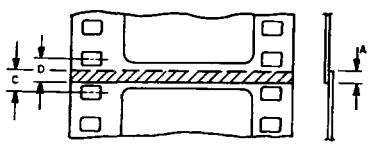
Appendix

(This Appendix is not a part of this Draft USA Standard, but is included to facilitate its use.)

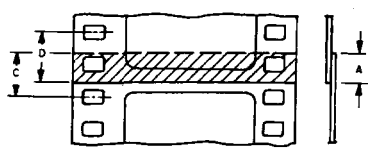
A1. There are several methods of forming the film overlap or joint for splices used by laboratories and film exchanges. The most common methods are usually referred to as negative splices, positive splices, full-hole positive splices, and butt splices. In addition, tape splices have been used for amateur films for projection purposes, but are currently used only on 35mm films for reinforcement of one of the types of splices mentioned above or to join film prior to processing. Splices made on an Automatic Kidde Machine are a positive type with a crescent-shaped cut and overlap. CinemaScope splices can be made with an overlap of as little as 0.030 in. (0.76mm). The usual dimensional specifications for the width of splices mentioned above, except butt and Kidde splices, are as follows:



NEGATIVE SPLICE



POSITIVE SPLICE



FULL HOLE POSITIVE SPLICE

Dimensions*	Negative		Positive		Full-Hole Positive	
	In.	Mm	In.	Mm	In.	Mm
A	0.050	1.27	0.072	1.83	0.156	3.96
C	0.118	3.00	0.114†	2.90	0.250	6.35
D	0.118	3.00	0.145†	3.68	0.280	7.11

* All dimensions are nominal.

† Older combination splicers make non-symmetrical positive splices. Many laboratories use centered positive splices with Dimensions C and D equal to 0.129 in. Both shall be considered satisfactory within this standard.

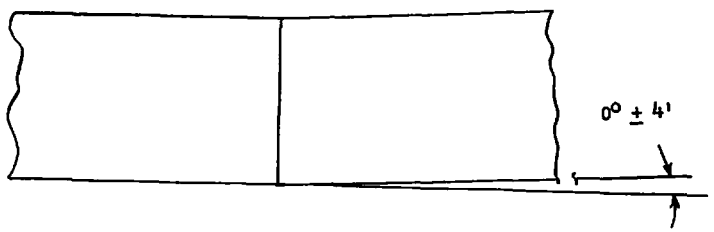
This specification assumes only one splicer for negative, positive, and raw stock. In laboratories with step printers, this may not be acceptable. Where machines can be used for each individual purpose, Dimension B must bear the tighter tolerance:

Dimension B	Inches	Millimeters
Processed negative	0.559 ± 0.001	14.20 ± 0.03
Processed positive	0.560 ± 0.001	14.22 ± 0.03
Raw negative	0.560 ± 0.001	14.22 ± 0.03
Raw positive	0.561 ± 0.001	14.25 ± 0.03

A2. When cement splices are made, the usual recommended splicing techniques apply. This document does not cover all the steps necessary to achieve good splices; however, items requiring special attention are: The cement should be applied to the full width of the splice after all traces of emulsion have been removed. Cement should be applied sparingly, and any excess should be removed after joining.

A3. If moisture is used to remove the emulsion, the film ends must be dry before applying cement and making the splice.

A4. A simple, practical check of the alignment of the film can be made when one portion of the film is placed against a straight edge; the other portion should not deviate more than 0.006 in. in 5 in.



A5. If the splice consists of a tape material, it is recommended that consideration be given to transparency characteristics. All air bubbles should be removed, and the edges of the tape should make firm contact. The tape length should be selected to provide low visibility, which for some tapes may allow the tape edge to fall within the frame.

PROPOSED

SMPTE RECOMMENDED PRACTICE

RP 7

Revision of RP 7-1962

Density and Contrast Range of Black-and-White Films and Slides for Television

1. *Scope*

1.1 This recommendation specifies important density values of black-and-white 16mm and 35mm motion-picture films and slides intended for television transmission.

2. *Density Requirements*

2.1 The minimum diffuse density of highlight areas shall have a normal value of 0.4 to 0.3 but not less than 0.3 for optimum reproduction in the television system. This value is not intended to apply to glint, specular highlights or other small areas where details need not be reproduced.

2.2 The maximum diffuse density of lowlight areas shall have a normal value of 1.9 to 2.0 but not greater than 2.0 for optimum reproduction in the television system. This value is not intended to apply to small areas where details need not be reproduced.

2.3 The density of human faces, usually observed more intently than other picture areas, shall be greater than the measured minimum density as specified in 2.1 above by a value not less than 0.15 or more than 0.5, unless special effects are desired. These density values are important in order to preserve the proper density relationships between face tones and highlights.

2.4 Density values on film intended for television, having a dyed or other base of significant minimum density, must be increased in all cases by the amount that such base density exceeds clear base density.

3. *Measurement*

3.1 The method of density measurement shall be in accordance with USA Standard Method of Determining Transmission Density of Motion-Picture Films, PH22.27-1960.

PROPOSED

SMPTE RECOMMENDED PRACTICE — RP 39

Specifications for Maintaining an Emulsion-In Orientation on Theatrical Release Prints

Introduction

As the result of investigational work by members of the Society, a paper was published in the June 1965 issue of the SMPTE Journal, Effect of Winding on the Projection Performance of 35mm Motion-Picture Film, documenting the improvement in screen image quality to be gained when theatrical release prints are wound, used, and stored consistently in an emulsion-in orientation. Other advantages include minimal focus drift and a much lower tendency toward flutter and in-and-out of focus.

It is recognized that many details of the projection process can influence screen image quality, and that the print winding procedures are but one part of this process. On the other hand, prints normally circulate through a large number of theaters and maintenance of the film in good condition has always been a responsibility shared among many. Therefore, it is proposed to describe this element of good projection in a recommended practice so that it can be more widely utilized, and its advantages added to the many other beneficial practices that can be independently controlled in each theater.

The specifications mentioned herein are designed to provide a simple and smooth transition from the traditional emulsion-out handling to the recommended emulsion-in orientation and its advantages.

1. *Scope*

1.1 This recommended practice specifies the necessary handling changes in the laboratory, film exchange, and projection room to achieve the emulsion-in orientation of theatrical release prints.

1.2 The practice also describes the advantages to be gained by the change to emulsion-in orientation of theatrical release prints.

1.3 The practice further discusses the consequences of returning to the emulsion-out orientation during the exhibition life of theatrical release prints.

1.4 The practice suggests, in the appendix, the various minor modifications that might be necessary in equipment used for projection, film rewind, and film inspection.

2. *Definitions*

2.1 Emulsion-in. When the film is examined on the reel, the emulsion side of each lap faces toward the hub of the reel.

2.2 Emulsion-out. When the film is examined on the reel, the emulsion side of each lap faces toward the rim of the reel.

2.3 Current procedures. This recommended practice represets a change from the common U.S. practice *of having the projector supply reel emulsion-out*, the projector take-up reel emulsion-in, and in the rewinding, converting to emulsion-out. This recommended practice specifies that the film be kept emulsion-in throughout its processed life.

3. *Description*

The following procedures are recommended if maximum benefit is to be derived from the proposed change in release print winding orientation:

3.1 The release print must be wound emulsion-in at the first winding after processing, and must be wound emulsion-in every time thereafter. A single winding in the emulsion-out orientation, even briefly, will reduce the benefits very noticeably.

3.2 Specifically, the release print film should be wound emulsion-in on standard cores, as it exits from the processing machine. The emulsion-in orientation should be maintained when the new print is mounted onto shipping reels at the film exchange. Any subsequent handling of the release print in the film exchange, whether for inspection or rewind, should also be in the emulsion-in orientation only.

In the projection room, the film reel should be loaded in the upper projector magazine so that the film will come from the front of the reel in a clockwise rotation. It should be emulsion-in on the take-up reel (as is now common practice). During rewinding, the film should be wound from top to top, or bottom to bottom, to maintain the emulsion-in orientation.

4. *Objective*

4.1 Data and experimentation have shown that when a reel of print film has been maintained in an emulsion-in orientation from the time it was originally processed, its behavior during projection and the resultant screen image quality are greatly improved. There is a negligible amount of focus drift, and a much lower tendency toward flutter and in-and-out of focus.

4.2 If the print film should inadvertently be wound emulsion-out, its physical properties quickly revert to the current level of performance in evidence now, and its projection properties and screen image quality would become the same as if the film had never been wound emulsion-in.

4.3 Unless the film is wetted and dried, as by reprocessing, the disadvantages of even a single emulsion-out winding are self-correcting only over a long period of many weeks.

4.4 The benefits derived from emulsion-in winding, however, should not be minimized. It should be stressed that the increase in screen image quality is a significant one, particularly in large, first-run theaters.

4.5 A complete changeover to the emulsion-in winding orientation of release prints by the motion-picture industry would be a formidable task. The breaking of deeply ingrained film-handling habits would not be easy to accomplish. It is hoped, however, that the recommended emulsion-in winding orientation will be accepted by leaders in the industry, and that this will become the first step toward the eventual complete changeover.

Appendix

(This Appendix is not part of this SMPTE Recommended Practice, but is included to facilitate its use.)

1. In some projection equipment, it may be necessary to make minor modifications in the upper film magazine to accommodate the new clockwise rotation. Before changes are made in the mechanical parts of projectors, local municipal fire codes must be checked to determine that such changes are not inconsistent with the requirements of applicable law. If the modification of the upper film magazine on the projector has necessarily eliminated the valve rollers, the back wall of that magazine must contain a label or decal specifying the current Underwriters' Laboratories requirements and also a warning against the use of flammable films in the modified equipment. Since there is the possibility of abrasion as the film enters the upper valve rollers from a different angle, some projector manufacturers have made available a simple conversion kit for providing the proper film guidance at that location. It is also feasible to install a small roller just above the valve rollers to accomplish the same objective.

   For those installations which have reel-end alarms, a kit is available for making the proper modifications to clockwise rotation. Reel alarm systems are also available for clockwise use.

2. Projection rooms which are using commercial automatic rewind systems that will not allow top-to-top rewinding without causing film abrasion against the outer case, can modify their equipment by installing a flanged, undercut idler roller just beneath the case obstruction. Another method, which may be more expedient, is to introduce a twist in the film and rewind in the previously accustomed manner.

   Commercial, foot-operated power rewinds, which are employed in some film exchange facilities, can be used without modification if there is no need to wind in both directions. Under present conditions, utilizing the emulsion-out winding orientation, it is possible to wind in both directions under power. Inspection *of these units has indicated that the reversal of the* motor rotation in the film reel magazine on the left side of the unit would provide the necessary modification to allow power wind in both directions.