RECOMMENDATION ITU-R BR.782-1*

AREA OF 35 mm PRINT FILM USED FOR 4:3 CONVENTIONAL TELEVISION SYSTEMS

(Question ITU-R 113/11)

(1992-1994)

The ITU Radiocommunication Assembly,

considering

a) that telecines are sometimes used as a television post-production tool, and it is necessary to be able to position the scanned area anywhere on the film frame area for this application; however they are also used to televise film programmes with no image post-processing, and it is desirable that the areas to be used on the film frames be specified for this application;

b) that many frame formats exist for 35 mm feature films, as listed below, and preferred dimensions for the area used on the frame of all those formats should be recommended:

- 1.37:1 (“Academy” format, close to 4:3)
- 1.66:1 (European wide-screen format, close to 16:9)
- 1.85:1 (United States wide-screen format, close to 16:9)
- 2.35:1 (anamorphic “Cinemascope” format);

c) the content of ISO Standard 2907 “Maximum projectable image area on 35 mm motion picture film” which specifies the dimensions of the projectable area for all these film formats and 2939 “Picture image area and photographic sound record on 35 mm motion picture release prints, position and dimensions”;

d) that two methods are currently used in the world to scan wide-screen film programmes in conventional television:

- the letter-box method in which the width of the film frame fills the width of the television image, leaving black bars at the top and bottom of the television image if the film aspect ratio is wider than the television aspect ratio; this method is used when it is desired to preserve the original image composition of the film;
- the pan-scan method in which the height of the film image fills the height of the television image, and the area scanned on the film frame is made to travel as appropriate over the width of the frame if this is wider; this method is used when it is desired that programme material should fill the television screen,

recommends

1. that a number of pre-set areas to be scanned on 35 mm release print films should optionally be selectable at choice; Table 1 proposes the nominal dimensions of the areas used on the various film formats with the pan-scan method and with the letter-box method; in the latter case the used areas should be centred on the film projectable area;

2. that, for operational reasons, the area scanned on 35 mm release print films in the case of television systems with a 4:3 aspect ratio should preferably be adjustable over the whole film frame. The maximum area of a film frame on 35 mm film, which applies to release prints, has the following dimensions:

- with non-anamorphic picture: 21.77×16.50 mm
- with anamorphic picture: 21.77×18.80 mm.

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* This Recommendation should be brought to the attention of the International Organization for Standardization (ISO).

TABLE 1

Nominal 4:3 area used on 35 mm release print film frames

(Further sets of dimensions for the area used on film are under consideration for inclusion in future issues of this Recommendation)

Film (intended projection aspect ratio)	Projectable image dimensions (mm)	Used frame area dimensions (mm)	Notes
1.37:1	21.11 × 15.29	20.12 × 15.10	(1) (7)
1.66:1	21.11 × 12.62	16.83 × 12.62 (pan-scan)	(2)
1.66:1	21.11 × 12.62	20.12 × 12.62 (letter-box)	(3) (7)
1.85:1	21.11 × 11.33	16.83 × 11.33 (pan-scan)	(2)
1.85:1	21.11 × 11.33	20.12 × 11.33 (letter-box)	(3) (7)
2.35:1 (anamorphic)	21.29 × 18.21	12.14 × 18.21 (pan-scan)	(4)
2.35:1 (anamorphic)	21.29 × 18.21	16.85 × 18.21 (compromise)	(5)
2.35:1 (anamorphic)	21.29 × 18.21	21.29 × 18.21 (letter-box)	(6)

(1) According to ISO Standard 1223; in this case the used area practically covers the film frame.

(2) These dimensions apply when the pan-scan method is used; the same scanned width is specified for release prints in both 1.66 and 1.85 aspect ratios for reasons of operational convenience. In both cases about 80% of the film frame width will be displayed, the remaining 20% being covered by pan-scanning; in the case of prints in the 1.85 aspect ratio there will be two black bars at the top and bottom of the image, each of them 5% of image height; these black bars will be concealed by the normal overscan of television sets.

(3) These dimensions apply when the letter-box method is used; the same scanned width is specified for films in both 1.66 and 1.85 aspect ratios for reasons of operational convenience; it will cause two black bars to appear at the top and bottom of the display; for a film in the 1.66 aspect ratio their width will be 8% of picture height; for a film in the 1.85 aspect ratio their width will be about 12% of picture height.

(4) These dimensions apply when the pan-scan method is used; in this case 57% of the frame width will be displayed, the remaining 43% being covered by pan-scanning.

(5) This area is sometimes used for Cinemascope films; it represents a compromise between the pan-scan and the letter-box methods; it displays 79% of the film frame width and causes two black bars to appear at the top and bottom of the displayed image, each being 14% of image height.

(6) These dimensions apply when the letter-box method is used; in this case two black bars will appear at the top and bottom of the display, each of them about 21% of picture height.

(7) In the future, it is expected that new types of telecines should be capable of scanning the full width of the maximum projectable image area as specified by ISO 2907.

Note 1 – The maximum projectable image area and area used in HDTV are shown in Annex 1.

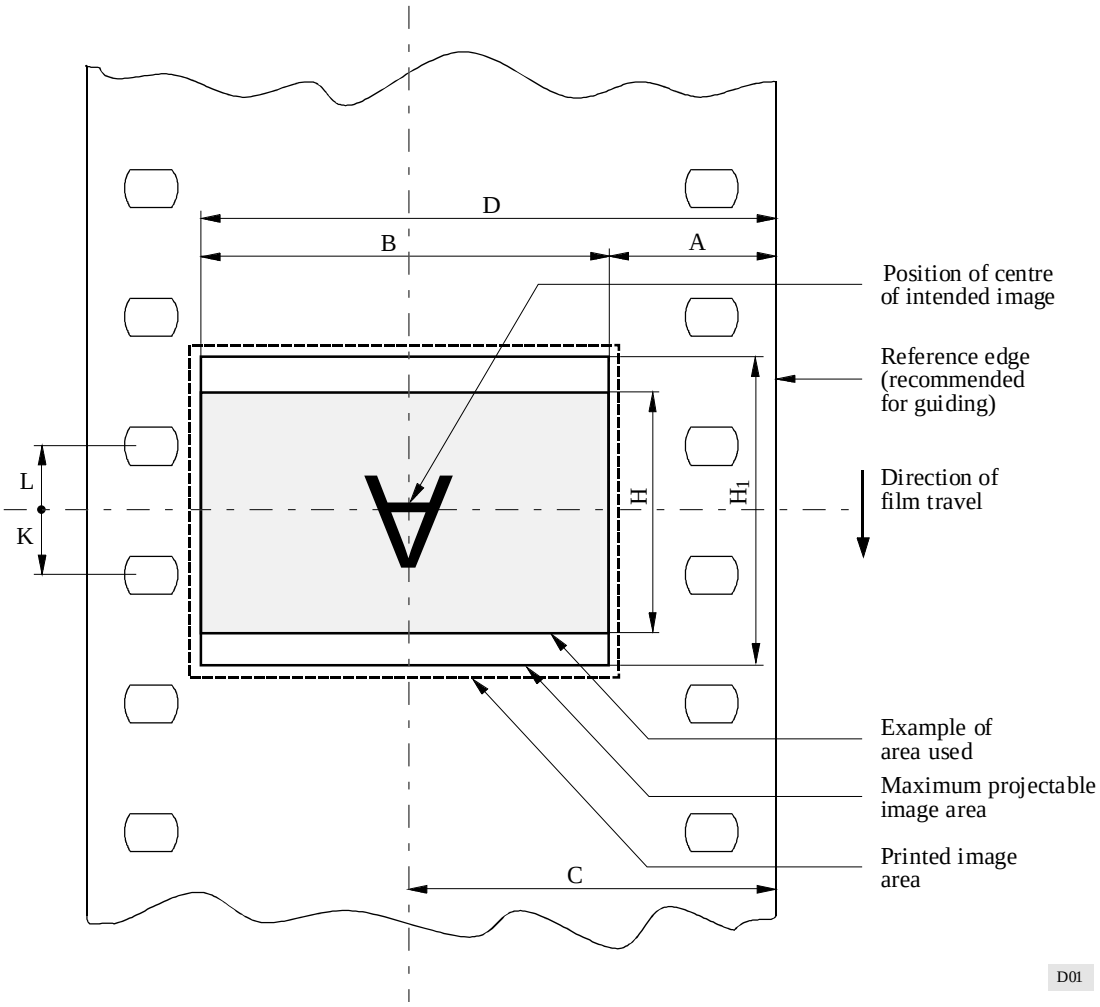
Note 2 – Information on scanning formats is given in Annex 2.

Note 3 – It would be beneficial if the telecine were capable of a considerable range of zoom ratios and horizontal/vertical positioning.

ANNEX 1

Maximum projectable image area on 35 mm motion picture film

Adapted from ISO 2907-1984



Dimensions

(The film is shown as seen from inside the projector looking towards the lens)

Dimension	Non-anamorphic pictures (mm)	Anamorphic pictures (mm)
A (min.)	8.20	8.10
B[(1)] (nominal)	21.11	21.29
C (nominal)	18.75	18.75
D (max.)	29.31	29.39
H_1 (max.)	15.29	18.21
K and L[(2)]		

(1) B: derived value given for information.

(2) K and L: approximately equal.

Projectable image height, *H*, of a non-anamorphic print

Aspect ratio	Image height, *H* (nominal) (mm)
1.85:1	11.33
1.66:1	12.62
1.37:1	15.29

ANNEX 2

Telecine scanning formats of 35 mm feature films

1. Introduction

For many years, motion picture film has been an important source of programme material for television services and it is expected that it will maintain a leading role as a programme medium in the future. In particular, feature films, which are normally composed for a wide-screen showing in the cinema, are expected to be a valuable source of high-quality programme material which will be readily available for future television transmission in the 16:9 aspect ratio.

In recent years television programmes originated on film have increasingly been exchanged in the form of video tape. More and more often the film-to-tape transfer for this has no longer been carried out by the broadcasters themselves, but by post-production and facilities houses. This is especially true in the case of the transfer of feature films, for which the transmission rights are normally purchased for only a limited period of time and which, after the transfer, are returned to the production house or studio for archival storage.

There are a number of film formats and aspect ratios in common use throughout the world, not only for the image capture, but also for the release of feature films. It is important, therefore, to consider the ways in which telecine scanning formats are best applied for the transfer of films.

2. Release print formats

Various film formats are in general use worldwide for the release of feature films on 35 mm film gauge. In the United States of America, most of the feature films for both cinema or TV showing are shot and released either in full aperture (1.33:1) or, more frequently, in the Academy format (1.37:1). In some cases, the original size of the exposed camera aperture is reduced in the intermediate printing stage with a hard matte in the optical printer. This produces an aspect ratio of 1.85:1 on the release print for cinema showing.

In Europe, however, cameramen nowadays usually photograph their motion pictures with a hard matte in the camera which is close to an aspect ratio of 1.66:1. Consequently, the release print is also delivered in this format. If a feature film is intended for showing predominantly on conventional 4:3 television, the Academy format with an aspect ratio of 1.37:1 is generally chosen.

To achieve an extra wide-screen format, feature films are sometimes shot worldwide in the Cinemascope format (2.35:1). An anamorphic camera lens squeezes the image horizontally (by a factor of 2), but does not change the image height.

The Academy format can be found in vintage archive films, and also in recent films which are intended for both wide-screen cinema and conventional television presentation and are therefore photographed according to the “shoot and protect” concept. Vertical cropping of the film frame should be avoided in the former case, while it is legitimate in the latter.

3. Transfer of feature films to TV

Wide-screen feature films for the cinema are normally made without special attention being given as to how they might best be presented on the television screen. Thus, in general, there will be a need to set up the telecine scan characteristics to interpret the desires of the original producer, within the constraints of the TV format. To meet these requirements with regard to the picture content, one possibility is to scan the full or nearly the full width of the wide-screen image on the release print. For conventional television this would normally result in a “letter-box” presentation with black areas at the top and bottom of the screen. In cases, however, where it is desirable to utilize the full area of the display screen the full height of the image on the release print has to be televised. This aim can best be achieved by allowing the area reproduced within the film frame to be panned over the aperture available on the print (pan-scan method).

However, such a selective scanning can lead to difficulties in achieving an accurate and repeatable framing within practical telecine equipment. In the future, an increasing proportion of feature films can be expected to be produced using the "shoot and protect" method. Material of this type is amenable to reproduction using fixed telecine scan positions and sizes. Thus, in addition to the fully flexible scanning mode, it is also desirable to have a number of fixed scanning modes available in telecine equipment. Such fixed scanning modes can be accurately pre-set during normal maintenance procedures and give a reliable way of quickly achieving the chosen optimum conditions for the particular material being reproduced.

The use of a number of fixed scanning options is mainly attractive for reasons of operational convenience. However, at the start of a transfer operation, it may not be known which option best suits the local production preference and the artistic needs of a particular film. The scanning option may therefore need to be changed during the running of the film. Even if these changes are synchronized with cuts in the action, the resulting changes to the black borders at top and bottom may be disturbing to the viewer. The option of continuous changes of pan, tilt and zoom during transfer (preferably to preprogrammed instructions) would therefore be an advantage.

The present conception of the European broadcasting organizations concerning the transfer and display for feature films on conventional 4:3 television systems is given below.

4. Conventional 4:3 television

Displaying a film with an Academy aperture image on a conventional 4:3 TV screen presents little difficulty as both have nearly the same aspect ratio. However, some films released on the Academy format have been shot on the assumption that a mask will be used in the projection, printing or television scanning process. This can lead to unwanted items, such as microphones, appearing in shot if this is not taken into account during transfer.

A survey within members of the European Broadcasting Union on the transmission of non-anamorphic wide-screen feature films has shown that it is normal practice at most of the broadcasters in continental Europe to transfer release prints which have an aspect ratio between 1.66:1 and 1.85:1 in the original aspect ratio. That means that black bars appear on the top and bottom of the picture on the display screen; the total percentage size depending on the actual film format on the release print. This letter-box method is normally preferred by production staff because it maintains the director's framing, even though the height of the picture on the screen and consequently, the vertical resolution of the picture details are lower. Cinemascope films with an aspect ratio of 2.35:1 are also often transmitted – if the scene content allows – with an aspect ratio of 1.85:1. This gives some cropping on both sides ($2 \times 11\%$) and with black areas on top and bottom (in total nearly 30% of screen area). In exceptional cases, Cinemascope films are televised in nearly the original aspect ratio (e.g. 2.2:1), leaving about 40% of the total screen area unused, but this gives severe losses in vertical resolution.

Where sub-titles are used, a letter-box or semi-letter-box presentation can be an advantage. The film image can be moved to the top of the television frame and the sub-titles put in the bottom black area which keeps them from obscuring the action in the film.

Most broadcasting organizations in the United Kingdom have traditionally shown both anamorphic and non-anamorphic wide-screen feature films at full image height. The main action is followed if possible by panning the area scanned by the telecine. This process normally requires a rather time-consuming post-production exercise and is not always successful as far as the artistic presentation is concerned. However, this procedure is not usually followed during the running of trails, titles and credit sequences of anamorphic films, when a letter-box presentation is used. A compromise letter-box setting is often applied to particularly critical material, where there is a large amount of action at the edges which makes panning difficult.

5. Conclusion

For the exchange of recorded television programmes transferred from feature films, it is common practice to come to an arrangement – prior to the film to tape transfer – on the scanned area and aspect ratio on the film. In this, not only the various film formats which are normally used for release prints have to be taken into account, but also the aspect ratio of the actual television system which will be used for transmission.

In this Annex, the different possibilities which are conceivable and which are already used at broadcasting organizations are described from the European point of view. In order to facilitate the future exchange of programmes originated on film, it is suggested that:

– telecine scanning should be as fully flexible as possible,

– a limited number of fixed scanning rasters are agreed,

for the transfer of feature films to conventional television systems.

ANNEX 3

Future considerations

Electronic blanking (hard-masking) should be enabled on horizontal and vertical edges. This is considered to be a necessary facility for cleaning up the pictures edges when overscanning the exposed film image area.

When the letter-box method is used a shifting of the picture area to the top or bottom of the television raster is regarded as desirable by some broadcasters to allow sub-titles to be placed outside the picture area. In Japan, a shift of 12 horizontal lines of picture area to the top of raster is selected for some programmes, which are converted from HDTV to conventional television standard, in order to accommodate captions.