RECOMMENDATION ITU-R BR.1219*

HANDLING AND STORAGE OF CINEMATOGRAPHIC FILM RECORDING

(Question ITU-R 109/11)

(1995)

The ITU Radiocommunication Assembly,

considering

a) that programme production for international exchange release is largely based on film;

b) that programmes stored on 35 mm cinematographic film provide a high-quality source input required with future conventional 16:9 television and HDTV services;

c) that such programmes are archived for a very long period of time;

d) that during archival storage such films may be reused many times for the transfer of the programme from film onto tape;

e) that loss of technical quality during the lifetime of the archived programme must be avoided;

f) that proper care when handling the film before, during and after each archival interval is a pre-requisite for the successful retrieval of the programme;

g) that the vinegar syndrome affecting the film base may require special attention in this respect,

recommends

1 that the handling and archival storage of programmes on cinematographic film should be carried out following the guidelines given in Annex 1.

NOTE 1 – A glossary of special terms offering a more detailed analysis concerning this subject can be found in Annex 2.

ANNEX 1

Handling and storage of cinematographic film

1 Handling of cinematographic film

– The manufacturers recommendations for processing and drying should be carefully followed.

– The film must be properly washed and stabilized to prevent stains, dye fading etc.

– Cleanliness is essential. The incoming air should therefore be adequately filtered. Smoking, eating or drinking should not be permitted during film handling (see Note 1).

– Films should be handled carefully by the edges using thin cotton gloves.

– Cleaning operations should be applied gently and solvents should be checked for purity and stabilization prior to use.

– Film should be kept either in tinned/polyethylene coated metal cans or in plastic cans (see Note 2). Rusty cans must be replaced immediately.

– Film should not be wound under extreme tension.

– Film intended for long-term archival storage should not contain mechanical joins (see Note 3).

* This Recommendation should be brought to the attention of the Telecommunication Development Sector (ITU-D).

NOTE 1 – Gelatine emulsion layers are sensitive to physical scratches. Dust and dirt particles tend to adhere to the film surface and can cause film wear.

NOTE 2 – Preferred materials for plastic containers are polyethylene and polyolefins (polypropylene).

NOTE 3 – It is recommended to make an interpositive of the film intended for long-term storage. If splices cannot be avoided, conventional cement joins should be made. Tape splices should not be used. After some period of time joins can stretch apart when film is rewound and adhesive can ooze out and migrate to adjacent turns, causing winding and replay problems.

2 Storage of cinematographic film (see Note 1)

– Cleanliness is absolutely necessary. The incoming air must be filtered and should develop a positive pressure in the storage area.

– Temperature and humidity should be kept as stable as possible (see Note 2), and preferably below those in the operating environment. Suitable values are in the range:

  for medium-term storage with immediate access to programmes (see Note 3):

  – temperature: 15 °C maximum

  – relative humidity: 30-40%

  for long-term storage for archival preservation of valuable films (see Note 3):

  – temperature: 2 °C or lower

  – relative humidity: 25-30%

– Film should be stored either in tinned/polyethylene coated metal cans or in plastic cans. Rusty cans must be replaced immediately.

– The cans should be stored horizontally to prevent crushing of the film.

– Films and containers should be inspected at regular intervals.

– Storage rooms should be protected against fire, flooding and industrial fumes.

NOTE 1 – The base of triacetate films and magnetic tapes can be affected by the “vinegar syndrome” and therefore require strict observation of the recommendations given above. The typical indication for the syndrome is the smell of vinegar.

For triacetate based films that appear to be affected by the vinegar syndrome, the following procedure is recommended:

– Isolate any films and tapes that show signs of degradation and store them away from unaffected materials.

– Do not store films affected by the vinegar syndrome in rusty metal containers or in air-tight bags.

– Avoid contact between film or tape and certain types of paper or plastic material. Use acid free paper.

– Check the suspected films and tapes at regular intervals (2-3 years) to determine whether they show signs of advanced degradation.

– Preserve the programme content of affected films or tapes for future use by copying onto polyester based films and magnetic tapes. Affected programmes could also be transferred to videotapes.

NOTE 2 – Condensation should be avoided: Care should be taken to avoid temperature and humidity variations during storage and handling.

NOTE 3 – These climate conditions correspond to European Broadcasting Union (EBU) Recommendations prepared by Sub-group G3, taking into account the specific storage requirements of broadcast organizations to access archived film at short notice. They therefore differ in some parts from the conditions given in the Society of Motion Picture and Television Engineers (SMPTE) Recommended Practice RP 131 and in ISO 5466.

3 Splicing of film productions for long-term storage

Film splices are either made using cement or tape. The cement splice is the industry standard method for negative handling and storage, while the tape splice is only suitable for editing and should never be used on material for laboratory, telecine or archival purposes. The characteristics and properties of cement and tape splices are very well described in the paper "Film Splices" by Harold Brown, FIAF Preservation Commission.

3.1 Cement splices

These splices are generally reliable, even after many years storage, however, they can deteriorate for the following reasons:

– human error, i.e. the splice was incorrectly made, e.g. the emulsion layer not removed correctly,

– the film cement used was of poor quality,

– the film splicing machine was incorrectly adjusted,

– the splice has suffered "wear and tear" damage due to mishandling,

– the cement has deteriorated due to the action of solvents.

The experience of broadcasters, together with the film laboratories, is that conventional cement splices rarely give problems provided that the splices are properly made and inspected before any operations such as printing or telecine transfer. The usual problem is that splices "dry out" causing them to separate. This occurs if the splice was not made correctly in the first place. If a splice does fail during printing, it rarely causes damage to the negative and can normally be remade.

The one unknown factor at the moment is the long-term effects of the increased use of solvents in wet-gate printing. It is thought that, if the splice is correctly made, then there should be no problems. However, there is growing evidence that splices can be weakened by solvent action, but only if the splice was not perfect in the first place. A cement splicer (Hamman) is now available which produces "butt" cement splices without the increased thickness as for a conventional splice. As this is a recent development, there is as yet little experience of how well these splices survive.

3.2 Tape splices

Tape splices are made with a clear adhesive tape, and provide a quick and convenient method of joining film, which is especially suitable for editing. However, problems will occur if a film with tape splices is stored for any length of time. These problems relate to the properties of the adhesive used on the joining tape and include:

– joins can stretch apart when the film is wound in rolls,

– adhesive can ooze and may stick to adjacent turns causing winding problems,

– after a long period of storage, adhesive can ooze from the edge of the tape joins to form a layer between the edge of the film and the film can.

Stretching normally happens slowly, over a period of weeks or months, but if the film is wound too tightly or stored at too high a temperature, it can happen in a matter of days. If a film with stretched splices is run on a machine then it may be damaged. An affected film may need to be cleaned with an approved solvent to remove any traces of the adhesive. The old tape joins should be removed and replaced.

If this oozed adhesive is still soft, the film can be treated with an approved solvent so that it can be unwound. The old tape joins should be removed and replaced.

In some cases, however, the layer may have hardened and solvent treatment may not be possible. This means the film is not recoverable.

In view of the above problems, tape joins should not be used for material which will be stored for long periods, and especially on archive material which may need to be reused.

If any archive material is known to have been joined with tape splices, then the splices should be remade and the film should be copied by making:

– a master positive on intermediate film if the film was a negative,

– a reversal copy if the film was a reversal master,

– a videotape copy of either.

3.3 The current situation

Over many years, the film industry has produced a large number of different 35 mm mechanical splicing machines which are more or less demanding on the skill of the operator for good results.

For 16 mm, the situation is different because there is not sufficient area between film frames to make a solid, durable splice that is invisible, as can be done with 35 mm film. Therefore, the chequerboard A/B roll method of negative assembling was developed to get round the problem and it is now the established method for cutting 16 mm negative for making prints.

However, if a chequerboard negative is run on a telecine for video transfer, there will be picture unsteadiness at the scene changes since the increased thickness at the splices creates unwanted movement. Therefore, the A/B rolls assembled for telecine transfer have to have the scenes extended at the beginning and end. The cut to black is made electronically. This can be a problem if both video transfers and film prints have to be made from the same negative because overlaps are present in the cut negative which cannot be used on a film printer.

Many broadcasters have established production methods where the programme is shot on film and the processed negative is transferred to video on telecine. Post production takes place wholly on video. If it is decided to preserve this programme on film, the question arises – how should the negative be assembled for future use? There are three main possibilities:

Option 1 : make a traditional chequerboard negative for printing.

Option 2 : make an A/B roll negative with picture overlaps for telecine transfer.

Option 3 : assemble the selected takes as a “rough cut” single negative roll so that the programme can be re-assembled at some future time. A computer logging system will have to be used at the telecine transfer stage so that an edit decision list, EDL, and negative cutting list can subsequently be made.

Option 1 results in a conventional chequerboard cut negative and prints for projection or telecine transfer. Further prints can be produced later on but the negatives will not be able to be transferred to video without picture instability at the splices. This is the most expensive solution, but the most flexible.

Option 2 results in two rolls of negative that can be re-transferred using an A/B auto assembly process from telecine to tape. If a print is required then the negative will need to be re-cut to a normal printing chequerboard.

Option 3 is the least expensive way of archiving the programme. The programme can be reassembled using the EDL lists. All the “out takes” of the negative originals can be discarded and the rough cut negative can be re-transferred on a telecine without a wet-gate because it will not suffer from dust and dirt near the splices. This option will also give the possibility to re-cut the negative to make a chequerboard negative for printing.

3.4 The future

The conventional cement splice is still the best way to join acetate film for production and storage. The introduction of polyester film base would be good because of its better storage properties but producing a splicing system that is invisible is a challenge for the commercial industry. For the broadcaster, there are several options when using film as the recording medium. The ideal is to provide a film for archiving with no joins as can be done by making an interpositive. However, this is very costly. The most practical way is to choose one of the options above which use conventional cement joins and to ensure that the joins are correctly made. Which option is chosen will probably depend upon the funds available for the production.

ANNEX 2

Glossary of special terms

Dye fading of print films

The change in colour-balance resulting from a density loss of 0.1 in one or two of the three layers at a density of 1.0 is just perceptible, especially under television viewing conditions.

The change in a regraded image after a density loss of 0.2 may be perceptible to a trained eye, but is normally not noticeable to the average viewer.

The net result of a density loss of 0.4 is definitely noticeable and is generally considered unacceptable.

Short-term storage

For films in post-production, distribution, broadcasting, etc., storage should preferably be below room temperature with controlled relative humidity and clean surroundings.

Medium-term storage

Storage time up to about ten years.

Films still accessible within short notice. Temperature certainly below room temperature and also controlled humidity.

Long-term storage

Storage of up to about one hundred years.

Films are no longer accessible on short notice. Strictly controlled temperature and humidity.

Archival storage conditions

Archival storage conditions are those which are suitable for the preservation of films having permanent value, e.g. more than one hundred years.

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