Room Cleanliness
Carefully look at the projection room and the inspection or storage area. Is it a clean, well lighted place? Any lack of cleanliness can be magnified thousands of times during projection of the film on the theater screen. Dust and dirt deposits that escape detection become very distracting at that level of magnification.

Ideally, you should handle motion picture film in a white room environment like that prevailing during its manufacture. But, in the real world conditions may be drastically different, resulting in dirt that can lead to abrasion. You should assess your own film handling situation by paying particular attention to the type and amount of ventilation, the materials used for floor surfaces, and possibilities for dust accumulation on the work benches and equipment. These are the main sources of dust and dirt that reach the film surfaces.

Moderm equipment is designed to transport film hundreds of times without producing abrasion or dirt that are visible on the screen, but that equipment must be properly maintained and in good repair. You invite dirt and abrasion every time you handle film carelessly, fail to maintain the equipment, or let slip the cleanliness of the work areas. Motion picture film, like many other plastic materials, has a tendency to build up static charges, especially under low humidity conditions. When the film is charged during inspections or projection, dust and dirt floating in the air are easily picked up by the film. This is particularly true when you project film on today's almost standard professional platter systems. High speed winding across the bench top, while assembling a long roll or during inspection, is also a major invitation to these invasions.

Definitions and Inspection Methods
Buckle, warp, flute, twist, spoke, emboss, and curl are all types of damage that are caused when motion picture film is pushed beyond its physical limitations during storage, handling, or projection.

Many different types of distortion are commonly referred to by projectionists and film handlers simply as warping or buckling. Film inspectors are often at a loss to understand the problem encountered by a projectionist because the condition is expressed in unspecific terms. Consider mastering the following specific terms for types of film deformations You can help yourself and others manufacturers, laboratories, exchanges, libraries, projectionists to bring all the best in films. The more accurately you apply these descriptive terms, the more you assist in locating and eliminating causes of damage.

Here we describe conditions and characteristics of triacetate base print films. Most of the conditions described also apply to ESTAR Base or other polyester base films. In either case careful handling helps keep films in top condition and provides audiences with superior screen images. Each description is keyed to an accompanying illustration.

Buckle-occurs when the edges (along the length) of a film are shorter than the center.

Temporary buckle is caused by the loss of moisture from the edges (emulsion and base) when the film is stored in very dry air for short periods.

Permanent buckle is caused by the loss of solvent from the edges when the film is stored in very dry air for extended periods.

Edgewave or Fluting occurs when one or both of the edges (again, along the length) are longer than the center. This is the opposite of BUCKLE.

Temporary edgewave or flute results from storage under moist conditions.

Permanent edgewave or flute results if a roll is wound under high tension or if one edge is stressed during film transport.

Twist-is caused by loose winding of new prints, emulsion in, under dry air conditions. If the film is wound emulsion out under the same conditions, the undulations do not alternate from one edge to the other, as in the illustration, but are directly opposite one another.

Curl-the departure from flatness caused by dimensional differences between the emulsion layer and the base.

Spoking -is caused by loose winding of film that has considerable curl.

Temporary spoking disappears when the film is unwound.

Permanent spoking is seen as TWIST when the film is unwound.

Embossing-is a permanent deformation that occurs when prints are projected with high intensity lamps and without proper heat absorbers. The excessive heat expands the picture area, and the frame stands out in relief. This distortion is usually not detrimental to the screen image because all film frames are equally affected.

Motion picture film must be thin in order to provide a sufficient quantity for practical use on reasonable size reels. It must also be flexible to negotiate the film path in some projection systems. If either of these characteristics was altered to permit more vigorous (or less than careful) handling, the practical uses of film might be seriously curtailed in existing equipment. The emulsion layer(s) that carry the image are only several tenths of a thousandth of an inch thick. While it is remarkable that a film emulsion can be resistant to scratches, great care is still necessary to prevent image degrading abrasion. Your knowledge of handling and maintenance of film makes it possible for films to perform satisfactorily during their useful life.

New Prints

In some ways, film toughens with use. The emulsion surface of newly processed film is a bit more susceptible to abrasion than film that has been in service. Therefore, when you

mount new prints, be careful to avoid contact with the picture area, even while using proper gloves. Professional motion picture release prints are usually sent by the laboratories to a distributor as large rolls wound on 3 inch cores in lengths of about 2,000 feet. Each roll can be considered to be in pristine condition if it has been properly processed and handled in the laboratory. The distributor mounts the rolls onto 2,000 foot capacity shipping reels for theater use. The projectionist transfers the film from shipping reels to house reels for projection or splices all the individual reels together for use on the platter transport system or other systems that may be in use. Prints on 16 mm or 8 mm are usually mounted on reels at the laboratory prior to shipping. All prints, 8 mm, 16 mm, and 35 mm should be lubricated by the laboratory prior to shipping.

Generally, new prints don't need to be cleaned. But if you must remove lint or dust later, use a plush dampened with an approved film cleaning liquid, and hold it lightly against the film as it is wound. Attempt this procedure only if adequate ventilation is available to prevent possible toxic effects. A 35 mm release print should be relubricated by edge waxing after cleaning; otherwise, serious perforation damage can occur, especially during initial projection. New 16 mm prints should be cleaned and relubricated using a film cleaner that contains lubricant.

Winding (Smooth Roll)

It is extremely important to wind film evenly and with sufficient tension to provide a tight roll. If the roll is not tight and smooth, it can suffer edge breakage during shipping and handling. When you rewind, be careful that the winding machine is properly lined up so that the film feeds smoothly and squarely from one reel to the other, leaving no protruding edges. With console type motor rewinds, proper alignment should be part of the original design, but check the appearance of a wound reel to determine whether some further adjustment is necessary. If winding for long term storage, always wind emulsion in to minimize stress.

There are some winding habits that seem deceptively helpful. Is one edge of the film riding against the reel flange during the winding operation.

Some bench rewinds are deliberately set out of line to obtain even winding by this method. Occasionally, shipping reels are sprung so much out of shape, that you may again be tempted to achieve even winding by flange binding.

Historically, 35 mm release prints in the United States have been wound emulsion out when ready for projection. In this orientation, the film comes off the supply reel in a counterclockwise rotation but winds onto the projector take up reel in a clockwise rotation with the emulsion in. When 35 mm film is kept wound emulsion in exclusively, there is a tendency for reduced focus drift and other screeming problems.

There is no preferred emulsion orientation for 16 mm and 8 mm films since they are used in both emulsion positions. Original reversal films, such as those used in cameras, are wound emulsion out. Prints from negatives and reversal dupes are normally wound emulsion in. And, because thermal energy levels are only a fraction of what is

encountered in theatrical projection, focus drift and other screen image problems are not apparent.

The problem with the edge binding method is that sharp points are sometimes left on the rims of some metal reels when, for example, someone used pliers to remove a reel of film from a tight shipping case. A sharp point of this kind may cut the edge of the film on each turn of the reel.

Sometimes reels are bent or sprung to less than or considerably more than the film's width. If so, the reel should be replaced. Much of the damage occurs when the reels are forced into shipping cases that are themselves damaged. If you must use defective reels and cases until replacements arrive, make every effort to restore them to a reasonably usable condition.

Inspection of the Film

Don't assume that film arriving from a distributor or library doesn't need inspection. Damage that can be diagnosed early and repaired extends the film's life and maintains the implied contract with viewers that films will be presented in their best condition.

The problem is not the intention or even the fact of inspection but the manner and place of some inspections. You are frequently rushed for time, so the inspection remains superficial. The fast winding of film creates dust gathering static electricity; the heads and tails of the film get whipped across the bench or even the floor and pick up further abuse and dirt. The final insult is often that the splices you attempt are out of alignment or fail to register properly in relation to perforations, or simply are so poorly prepped that they separate the next time around. If a film breaks during projection, it may get mangled further, but it also means that viewers are annoyed, inconvenienced, or even deprived of their belief in the illusion being projected on the screen. The results are criticism from viewers and even a financial loss.

The two essentials of a satisfactory inspection are a well designed inspection area and proper film handling. The area needs to be laid out so that all needed equipment, splicers, tape splices, cleaners, etc., are handy. Can the area be kept clean floor, walls, ceiling, and especially work surfaces? The air must be free from harmful chemicals and the relative humidity should be at least 40 percent or higher.

Sight Inspection involves a careful look at the film. This way you may detect substantial defects or damage, like major scratches and color fading. But, even at its best, sight inspection is either relatively slow but thorough, or faster but somewhat more superficial.

Hand Inspection is really a gloved* inspection. The film is run between the thumb and forefinger as it is rewound. Sometimes inspectors hold it in the closed hand from above and apply pressure with the thumb and forefinger to cup the film. With this technique, if the other fingers are pushed upward, they may rub against the film surface and cause a considerable amount of abrasion particularly if the glove is dirty. While contact with the edges of the film is a necessary part of inspection, a little cupping is better than too much.

Film should be run between the thumb and forefinger with very little pressure while remaining in contact. Bearing down can also develop a running kink up the middle of the film, particularly in low relative humidity. If the film is too dry or cold, it may even crack or split. Ragged edges, perforation damage, and any physical damage on the surface will tend to snag the cotton glove. That's one reason for wearing the glove, but the other is that these same defects may nick the unprotected skin. Another reason for wearing gloves is skin oils and possibly other chemicals may transfer to the film and ruin it. Frequent changes and thorough washing of gloves are vital.

Note: Never tap the reel against a bench or wall to smooth out a poorly wound reel of film. If there is loose dirt on the film, it will lead to abrasion.

* Not all gloves are alike. Lint free cotton gloves are the best choice. But gloves made from polyester or nylon are just fine if they do not generate static. For film editing, most editors prefer to work without gloves but are respectful of the film surfaces.

Machine Inspection is done by specially designed equipment that transports the film by electric motors through a damage detection system designed to stop the film when damage is located. While these machines relieve an operator to do other work, they require proper adjustment or they could become too sensitive or insensitive to do a good job. Machines must be tested daily because static electricity build up can generate static and attract dust and dirt. The best inspection is done carefully by hand.

Visual inspection can be projecting the film and playing its sound track to be able to observe problems. But this type of inspection should only be done after hand inspection. Scratches, abrasions, burns, color shifts, and loss of footage can be detected this way. A bench type viewer will also show picture damage. Even though visual inspection may be quite tedious, it will be worth the time to conduct on an occasional basis.

Film Damage
Types of Damage There are countless ways to damage motion picture film. Much of the damage is repairable, but careful analysis of it must precede any such repair. Useful communication about the damage is helped by an agreed upon vocabulary. The following sections are an effort to establish some common understanding and terms for that purpose.

Abrasion
Scratches that we call abrasions can be found on both the emulsion and base sides of motion picture film. In the image area, abrasions are recognized as any disturbance not normal to the picture area. These may be longitudinal or transverse scratches or very small cinch type marks caused by the action of embedded dirt somewhere on sliding film convolutions in loosely wound reels. During rewinding, handling, and shipping, the loose film convolutions can slip against each other to cause abrasions. Continuous scratches along the length of film are generally caused by external means such as contact with equipment components, or dirty and worn rollers in the film path. Regardless of the cause, excessive abrasions in the film image can distract from the film's created illusion

and cause distracting noises in the optical sound track. Emulsion abrasions on color film are less tolerable than base side abrasions. If there are a few fine black lines with little sign of emulsion damage, they may be described as minimal base damage. Heavier and more frequent lines could be described as moderate. Major abrasion damage would exhibit many lines and would probably be present throughout the reel. Scratches are severe examples of abrasions. They physically damage the surfaces of the film and can cause the removal of a print from service.

A scratch the width of a human hair will project on a 6 foot screen almost 3/4 inch wide with super 8, 3/8 inch wide with 16 mm, and nearly 1/4 inch wide with 35 mm films. A scratch is a single definite line.

Again, scratches can be found on the emulsion or base side. Base scratches show up on the screen as black lines, because light shining through the clear base layer is refracted by the uneven surface of the scratches. Emulsion scratches on black and white film normally appear as black lines on the screen. On color film, a very light scratch on the emulsion generally appears neutral. But going deeper into the three color layers, it will project as most any color depending on the scratch depth, or even white if all the emulsion was removed. Scratches are best detected by visual observation on projection.

A few emulsion scratches can be tolerated if they do not materially detract from the film presentation. No scratch is desirable, but short, light intermittent scratches can be regarded as minor. Heavy scratches on either the base or emulsion should be cause to consider replacement of a print.

Minor base scratches can sometimes be rejuvenated, but heavy scratches usually mean replacement of the footage or withdrawal of the film. The presence of scratching should lead you to investigate all aspects of the operation rollers, gates, handling room, and any equipment with which the film comes into contact.

Perforation Damage

Most perforation damage is caused by the film users. Perforation damage is often found on the first few feet of film, because it frequently results from improper threading. When you inspect the perforations through a magnifying glass or pass the film through your fingers, you will often find damage progressing from cracked, chipped, or elongated holes to tom holes. with severe damage, you will find holes that are torn completely through or even missing from the perforated film edge. Some perforation damage can be repaired with perforation repair tape, but major damage must be spliced out.

Your best bet for avoiding perforation damage, in addition to proper threading and a sufficient loop, is to be sure that the film isn't brittle, that it's properly lubricated, that damaged film reels are not producing a jerky take up action on the projector, and that your projector sprocket teeth and pull down claws are not worn out.

Edge Damage

A nick, crack, cut, or tear to the edge of a motion picture film greatly increases the film's

chance of breaking. Film damage must not go unchecked. The leading causes of edge damage are damaged film reels, wobbles from bent spindles, and dry or brittle film. Nick for nick, convolution after convolution, the reel's damage transfers itself to the edge of the film.

Replacing damaged reels is the best preventative measure. Careful tape splicing is your best repair. Edge damage obviously threatens the sound track as well as the image. If the damage can fit comfortably under the splicing tape, and if the film doesn't show signs of physical distortion, creases, or wrinkles, a perforated tape may be applied over the damaged area without removing any frames. Anything too extensive must be completely replaced.

Breaks

Breaks leave the film in two or more pieces that should be joined together. Film separations can be caused by dry, brittle, shrunken film, poor splices, or by mishandling of film and/or projection equipment. When a break is repaired, be sure that the next break is not built in by inadequately preparing or misaligning the splice. If a film keeps breaking for whatever reason, it eventually begins to lose sound and image segments and becomes very distracting. Those gaps are clear clues to carelessness or stretching a product beyond its physical limits.

Surface Contamination

Soil, minerals, and oil are greatly valued, but not on motion picture films. Films can become contaminated by mishandling and a lack of cleanliness in work areas. Coffee, sodas, glue, and other perfectly useful substances will soil film permanently. We alone can guard against the assault of these substances on film.

Color Shift

Capturing earth's rainbow in the dye layers of motion picture film is a modem miracle. State of the art color film carefully processed, handled, and stored is hardly a fly by night phenomenon. Considerable longevity is built into the product, but it still demands the best from each of us in the film handling chain.

Color shifts in a projected print are usually caused by something other than projection or film handling and are most likely due to misprinting.

If a radical color shift is noted for any reason, the decisions about replacement should reflect how crucial the color content is (in art and medical films, for example), the degree of fading, the standards of viewers, the film's potential use, and the budget.

Creases

A crease is defined as a distinct sharp fold line or crack in a piece of film. We should always splice out a sharp crease because it can lead to further film damage and screenimage deterioration. Creases and folds often occur in leaders and trailers, particularly when poor winding, untaped film ends, use of inadequate reels, or some other filmhandling deficiency spills film onto the floor.

Blistering (Burns)
Very much like human skin, film burns start as swellings, grow into blisters, and then progress to the destruction of film. A bum spot on the surface of the film causes the emulsion to get hard and crusty and may easily separate from the surface of the base. The base may also become distorted and brittle. Extensive bum damage must be removed. The stopping of the film in a projector, even for a short time and for any reason, will cause film bums. Equipment malfunction is the cause.

Sprocket Marks, Visual Damage
Sprocket marks showing along the edge of the film will be very distracting, just like scratches. Sprocket damage shows more on the emulsion side than on the base because in most cases some emulsion has been removed, leaving colored or white areas. The usual cause for sprocket damage is faulty threading, misaligned splices, worn or misaligned parts in the projector, or some similar projection deficiency. Severe damage should be removed.

Sprocket Marks, Sound Track The perforations of a 16 mm sound film appear along only one edge. Given a silent projector with sprockets containing teeth on both sides, you can see how it is possible, maybe barely, but possible nevertheless, to pass the sound film through a double sprocket projector. This results in the projector trying to punch perforations where the track is. Even though there may be damage in the sound track area, it may not severely affect the sound, and the damage should be removed only if continuity is seriously impaired.

Brittleness
You can't restore a brittle film to its original quality. Acetate film that has lost much of its moisture and solvent becomes brittle. Much of the moisture can be restored by proper storage and rejuvenation, but it's probably only temporary. Polyester films are more resistant to brittleness.

Brittleness can be generally recognized when it's no longer possible to bend the film over sharply on itself (with the emulsion on the outside) without having the film snap or break. On old nitrate films, the film would probably break regardless of the bending orientation. Since shrinkage often accompanies brittleness, the film perforations may also fit more snugly over the pins of film splicers and other similar devices that may cause damage to the perforation edges. Because you may damage the film, make these simple tests only at the beginning of a film (not on the leader) where such damage will be less noticeable. Whenever you notice many splices or considerable edge damage in a film roll, you should be alert for brittleness. You may also observe that the section of film normally stored on the outside of the reel is often more brittle than the film towards the center because the outside convolutions have been more fully exposed to the atmospheric causes.

Degrees of brittleness range from the slight amount in which the fold can be reversed without breaking or cracking the film, through signs of cracking or breaking, to the extreme case in which the film snaps, perhaps even before being folded. A brittle film

may already be scheduled for retirement because of other damages and losses. Extremely brittle film should be withdrawn from circulation, whatever its apparent wholeness, because it's very Ulikly to break, more than once, during projection. But, with care, it can be duplicated successfully to make another copy.

Shrinkage

Film shrinkage cannot be fully recovered. That fact is troublesome because perforations are carefully placed along the length of the film, and any change in their spacing can become a problem. As with brittleness, the loss of moisture and solvents in the acetate base is the root cause. Again, polyester is less susceptible to moisture loss and has no residual solvents. You can often replace lost moisture by proper conditioning and storage; you cannot restore solvent losses. Therefore, you must be concerned about any storage or handling condition that leaches either moisture or solvents from the film.

You may notice shrinkage because the film does not fit properly over the registration pins in the film splicing block, or because it resists threading. You can determine the extent of shrinkage only with precise measurements. Films are not considered acceptable for projection with more than 1 percent shrinkage for most projectors.

Emulsion Deterioration

Emulsion deterioration results from fungus, mold, and mildew. These micro organisms attack the organic part of the film emulsion especially at relative humidities above 60 percent.

Fungus and mold are most often found on the emulsion side as dull spots or irregular areas. The spots increase in size and number if you leave them unattended. Eventually, they can deteriorate the emulsion to the point of uselessness.

In the tropics, fungus is especially a problem. These growths are most common in the summer in temperate zones that have a drastically high relative humidity. Rain or snow that wets the film may also set up conditions that encourage fungus to grow.

Growths are often found at the beginning of film rolls between loose convolutions. In extreme cases, the emulsion can be soft and sticky. Handling film in this condition is very critical and care must be taken not to damage the emulsion further.

After first examining for tackiness (and the film must be dried if tacky), it must be thoroughly cleaned to remove all possible surface fungi. After that, you may encounter anything from a slightly mottled image, to the beginnings of slight deterioration, to excessive visual distraction and softened emulsion. You must judge if the projected image passes your standards, but you should splice out major damage.

Common Repairs

Probably the most all purpose approach to repair is a good fundamental cleaning followed by careful splicing. Let's look at some aspects of the latter.

Removing Footage Removing damaged footage from a film without replacing it often involves an esthetic decision. Presumably, every foot of furnished film is there because it contributes to the total message. Therefore, simply extracting damaged footage may have noticeable consequences; the story punch line or other key phrases may never be known.

Film sections that are seriously damaged or footage with garbled sound must be removed. Any removal of film footage in education, in any kind of serious exposition, in musical presentations, and in carefully wrought dramatic films, can be a crucial loss. Don't splice out footage lightly. It is far better to avoid the need to remove any footage by careful maintenance and storage.

Nevertheless, we will find times when footage must be removed because it truly distracts or because the damage is such that it may lead to further damage. Before removing that section, consider the effects on the continuity and the future uses of the film. View the film to check the impact of the cuts on sight and sound. Missing footage that exceeds 6 feet should always be replaced. Always keep maintenance records on any footage removal.

Replacement Footage

There probably will be a time when you have a film that just doesn't seem complete with a particular chunk missing. Most distributors will sell replacement footage at a relatively modest cost, but the minimum orders may be for more than 100 feet. Also, delivery time may not be very timely. Before ordering replacement film, consider the physical quality of your print. Is it worth replacement footage in terms of its abrasion, color quality, number of splices, and so on? And, is the film used often enough? Is there a better version?

In ordering replacement sections, be very precise about what you need. Measure the film exactly from the beginning including credits. Replacement footage is identified by stating the footage numbers where damage begins and ends. It is advisable to order extra footage on both ends of the replacement section to compensate for splices and short sections that have been removed. Here is where the maintenance log comes in, because removal of extra sections could make the measurements incorrect.

If you need to use a damaged reel of film, remove the unusable section, replace it with a short section of leader, and keep careful track of how much film you cut out. The leader marks the spot and allows you to run the film without further damage.

Perforation Repair Tape

Perforation repair tape, a thin, narrow and very flexible strip of polyester base adhesive tape with perforations identical to those of the film. When applied over damaged perforations with a specially designed machine, the tape makes a strong bond which is quite resistant to cleaning solvents and temporary high temperatures.

Before using any of the tape, instruct yourself carefully in the proper operation, adjustment, and maintenance of the perforation repair tape machine. Also, remember that

dirt and dust tend to collect on the edge of the tape. Even though it is a good but somewhat expensive product, the tape may still shift in time, and it is not as stiff as the film base.

Do not apply more than 10 feet of perforation repair tape for permanent repair and be sure to apply it to both sides of the film. Seat it thoroughly by drawing it between a cotton gloved finger and thumb.

Blooping Tape
Blooping tape is an opaque adhesive tape designed for the deletion of sound errors, improprieties, and poor sound. In lieu of the older blooping ink, it can also be used to eliminate the annoying snap usually associated with splices. When blooping tape is applied over the sound track (at the junction of the splice) in a triangular or semicircular pattern, the photo cell or diode response is both attenuated and then increased gradually so that no audible noise is heard.

Notching and Trimming
Notching and trimming out certain types of film damage is a bad habit that should be avoided because much of the film strength lies in its full width up to and including the edges. Notching and trimming reduce the film's ability to resist tears and increase its chances of catching in a projector.

Film Damage Evaluation
Failures of communication between you and others with whom you deal in handling a shared film, put that film at hazard. Imprecise or incorrect terminology, as we have emphasized here, is one such failure, but another is simple lack of communication. If you don't tell anybody about the bad sound or the large number of splices, you seriously reduce the chance of having these problems corrected and contribute to film breakage and viewer dissatisfaction.

In film exchange and library operations, a feedback form is a very important source of such information, but only if everyone who handles the film takes it seriously. Have we answered all your questions? Did you check the film reel and shipping identification systems? Will it always be clear what reel it is? Where should it go next?

Discard, Replace or Repair?
You can replace buckled and misaligned splices with new splices. Also, you can ruin film by poor splicing. Splices that are wide, stiff, buckled, or out of alignment can cause the film to jump the projector sprockets and tear the perforations or break the film. Perforations next to these splices are generally subject to strain and eventual breakage.

Repair or replace any long sections of a print that are structurally damaged or show heavy abrasion. Before removing long sections of film from the reel, determine whether replacement footage can be ordered and whether the remaining use of the print warrants the expense. Replacement footage does cost money, and somewhere along the line, someone will pay, whether it's a direct charge or increased cost of rental.

During regular inspection and checking, do not neglect to check the protective leaders and trailers. Keep them at full length to aid the projectionist in proper threading for smooth changeovers from reel to reel. A 1000foot roll of this leader trailer replacement film will cost less than other subject matter replacement film.

There is no clearly defined rule of what to discard or replace. The following are some suggestions that you can use as a guide. However, the presenter is the ultimate judge.

Missing footage. If there is no visual or sound loss of continuity (usually 5 frames or less), then replacement isn't needed.

Visual distractions. The length of time that visual damage remains on the screen is important. A distraction of 10 seconds or longer is considered major, and rejuvenation or replacement should be considered. If it is barely perceptible and not visually distracting, it is minor and probably acceptable.

Sound distortions. Same criteria as for visual distractions.

Perforation damage. How much has been repaired, and what is the potential for film breakage? This should be quite easy to evaluate, but, if in doubt, you should replace or discard the footage.

To discard, replace, or repair film takes a lot of personal judgment and should be carefully looked at from the viewer's perspective

Film Cleaning

Solvent Safety and Static Electricity

Spinning film reels can build up static electricity which sends out powerful invitations to any dust or dirt in the work area, especially when the relative humidity is low. This buildup is also particularly prevalent in the large platter systems. There are antistatic devices that can be used, but the essence of prevention Ues instead in being sure that work areas are as clean as they can possibly be.

Film cleaning at the theater, the library, or at the film exchange should be concerned with the removal of dust and other loose particles, gritty dirt, and oil mottle. All of these lead to minor film base scratches. There are some relatively simple cleaning devices that can do this job adequately, but, for occasional cleaning, many choose the simplicity of moistened, soft, Untfree pads. These wet cleaners lessen the chance of abrasion from gritty dirt particles that build up on a dry cloth during the cleaning process.

Before beginning to clean any print (or negative), try the technique on some expendable film and check the results with a magnifying glass. Additional surface abrasions may be caused by cleaning if not properly done.

A Word to the Wise: Verbum sapientia sum est is the Latin translation for our warning. The form of advice may be ancient, but some of what we're warning you about is very serious.

There are some liquid film cleaners that are hazardous and flammable; most film cleaners are toxic. Some may even be banned, so local codes must be examined before their use. All directions must be closely followed, especially adequate ventilation, and prolonged or repeated skin contact must be avoided.

Non solvent Cleaning
A dry method of cleaning incorporates a specially developed material that picks up dirt, dust, hair, and other unwanted particles from the film by contact with one or more Particle Transfer Roller(s) (PTR). The PTR is made from an inert polyurethane with no adhesives, silicones, or leachable plasticizers and is environmentally sound, unlike the liquids. It has a 95 percent average cleaning efficiency and can, itself, be easily cleaned with soap and water. It is available from FPC Inc., 6677 Santa Monica Blvd., Hollywood, CA 90038. Telephone (213) 4650609.

Cloth/Solvent Sandwich
Thoroughly moisten (but not dripping wet) a pad of deep pile, lint free plush with an approved film cleaner and fold it around the film. Draw the film through the sandwich of cloth at a speed that is slow enough to allow the cleaner to evaporate before the film reaches the take up reel.

Winding up wet film causes spots and blotches. If ceiling space permits, you might consider installing an idler roller above the cleaning station to provide a longer film path from the cleaning cloth to the take up reel, thus enabling the winding speed to be increased. As the cloth begins to dry, or when a complete layer of cleaning solution can no longer be seen on the film surface as it emerges from the folded pad, stop, refold the cloth to provide a clean surface to the film, add more cleaner, and resume winding.

Be sure to wear plastic or rubber gloves to protect hands against the solvent's ability to draw the natural oil from the skin. If a print must be cleaned, remember that the filmcleaning solution can remove the lubrication from the 35 mm release print. Film cleaning solutions containing lubricants are not adequate for the lubrication of 35 mm prints but are used for 8 mm and 16 mm prints. It is important to lubricate 35 mm prints by edgewaxing prior to use and after cleaning. In all but an emergency situation, film can best be cleaned by a laboratory where suitable cleaning machines are available and proper techniques are used.

Investments in Clean Film The material cost for cleaning an average release print is quite reasonable. But considerable time may be spent if the rewind cleaning method is used. It's a good idea to recognize all the requirements for doing a proper cleaning job before actually attempting it.

The only real solution for dirty, oily, and scratched release prints is to realize that most of the problems are caused by people and that it's up to us to assess and correct our contribution, if any, to these problems. Properly handled release prints projected with equipment that is conscientiously serviced and maintained can easily achieve 1000 or more runs without the need for cleaning or repair (more on PTR use on projectors later).

Film-Cleaning Checklist
Here are some things to remember when cleaning films:

- Use only well-known, high-quality film-cleaning solutions. Do not use alcohol of any kind because some types can soften the emulsion, or the base, and can increase the risk of abrasion during the cleaning process. Alcohols are not good oil solvents because they can remove magnetic striping, are highly flammable, and can lead to moisture condensation.
- On film with magnetic tracks, first check the cleaning solution on a short section of film. If a brown color appears on the cloth, stop! An approved film cleaner is suitable for use with most magnetic striping, provided contact is brief.
- Use a soft, lintless cloth such as a deep-pile plush. Avoid using hardsurfaced textiles or exerting excessive pressure on the cleaning pad as these tend to abrade film and hold any ant in contact with the film surface. Also, do not use cloths from which dyes bleed. Fold all cut edges inside the pad to prevent depositing lint on the film.
- Refold the cloth pad frequently so that a clean surface is always in contact with the film. Advance impregnated dry-tape webs frequently for the same reason.
- When cleaning with cloth pads and solvent, wear protective gloves and make sure there is adequate ventilation in the work area.
- If you need to clean a 35 mm print, be sure to relubricate it properly by edgewaxing, because cleaning solvents remove the lubricants along with the dirt. Make sure that the film-cleaning solvent is evaporated from the film surface before you wind the film onto the reel or core. Place some sort of lamp on the table so that it will reflect light from the film surface as you clean. This way, you can observe the solvent on the film and the point where it evaporates.
- To speed cleaning, lengthen the film path between the cloth pad and the take-up reel. Use idler rollers near the ceiling or place the reels far apart. Remember, the faster the film is wound, the more frequently you will need to replace the cleaner on the cloth and rotate the pad. Never let the pad become so dry that wet cleaner is no longer seen on the film surface.

A cleaned print will remain that way only as long as the contributing factors that cause dirt problems are known and remedied-or prevented. To begin with, oil acts as a lubricant when applied to bearings and other mechanisms to reduce friction and wear. Otherwise, oil on film acts like a magnet, drawing dust, dirt, and gritty particles to the film surfaces and keeping them there. Oil can come from an over-oiled projector, worn bearings, or from inadequate or improper equipment cleaning. In every case, the oil finds its way to projector-component surfaces that come into contact with the film. Once on the film

surface, oil continues to migrate and film mottle develops. Contact with dirty surfaces and airborne dust and dirt, with the help of static buildup, does the rest.

General Guidelines
Try to do the best you can to prevent dirt buildup in the work area. If cement splices are made, be sure the film particles from scraping are cleaned away from the film before it is wound up. Also keep the splicer and bench top clean. Dirt particles that look like large chunks of debris on the screen are almost microscopic in size when viewed on the film surface. You can't see most dirt particles on a bench top with the naked eye.

Not a Cure All Simple film cleaning does nothing to eliminate scratches and cinch marks because all such marks are actually forms of physical damage to the film surface. Therefore, preventative maintenance and cleanliness are the keys. Once the damage is done, efforts to recover a print can be very expensive and can produce results that are only marginally satisfactory. A film will look best to viewers if it has been properly cared for and has always been in a clean environment on carefully maintained equipment.

Lubrication
All motion-picture films destined for projection are required some level of lubrication. The lubricant incorporated in some 8 mm or 16 mm films may be sufficient, even after processing. Since all films may not be lubricated, it should be done to assure a smoother projection. Most laboratories do apply a lubricant when necessary. Caution: Solvent film cleaners or lubricants require adequate ventilation and avoidance of prolonged contact with skin. If these precautions cannot be met, employ a professional firm to clean and lubricate the films. Also, local municipal codes must be strictly adhered to in using and disposing of any solvents.

Theatrical 35 mm release prints require considerably higher levels of lubrication to provide trouble-free performance during projection nuns. Since the required amount of lubricant is excessive for overall application, it is applied to the perforated film edges only on the emulsion side. During windup, some of the lubricant transfers to the film edges on the support side. The edge-wax solution consists of 50 grams of paraffin wax dissolved into 1 1itre of inhibited 1.1.1 Trichloroethane and is usually applied by a special edge-waxing machine. For more information, refer to the SMPTE Recommended Practice, RP151-1989, Lubricatlon, Print.