

# FILM FORMATS

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**8 mm film** is a motion picture film format in which the filmstrip is eight millimeters wide. It exists in two main versions: regular or standard 8 mm and Super 8. There are also two other varieties of Super 8 which require different cameras but which produce a final film with the same dimensions.

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## Standard 8

The standard 8 mm film format was developed by the Eastman Kodak company during the Great Depression and released on the market in 1932 to create a home movie format less expensive than 16 mm. The film spools actually contain a 16 mm film with twice as many perforations along each edge than normal 16 mm film, which is only exposed along half of its width. When the film reaches its end in the takeup spool, the camera is opened and the spools in the camera are flipped and swapped (the design of the spool hole ensures that this happens properly) and the same film is exposed along the side of the film left unexposed on the first loading. During processing, the film is split down the middle, resulting in two lengths of 8 mm film, each with a single row of perforations along one edge, so fitting four times as many frames in the same amount of 16 mm film. Because the spool was reversed after filming on one side to allow filming on the other side the format was sometime called Double 8. The framesize of 8 mm is 4,8 x 3,5 mm and 1 m film contains 264 pictures. Normally Double 8 is filmed at 16 frame/s.

Common length film spools allowed for filming about 3 to 4 min at 12, 15, 16 and 18 frames per second.

Kodak ceased producing standard 8 mm film in the early 1990s. Black and white 8 mm film is still manufactured in the Czech Republic, and several companies buy bulk quantities of 16 mm film to make regular 8 mm by re-perforating the stock, cutting it into 25 foot (7.6 m) lengths, and collecting it into special standard 8 mm spools which they then sell. Re-perforation requires special equipment. Some specialists also produce super 8 mm film from existing 16 mm, or even 35 mm film stock.





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## Super 8

Super 8 is a motion picture film format that was developed in the 1960s and released on the market in 1965 by Eastman Kodak as an improvement of the older 8mm home movie format. Because of smaller sprocket holes that increased the image area of frame it featured a better quality image, and was easier to use mainly due to a cartridge-loading system which did not require re-loading halfway through shooting. The Super-8 standard also specifically allocates the rebate opposite the perforations for an oxide stripe upon which sound can be magnetically recorded.

There are several subtypes of Super-8 film all of which have the same final film dimensions, but the Kodak system was by far the most popular.



## The Kodak Super 8 system

Launched in 1965, the film comes in plastic light-proof cartridges containing coaxial supply and takeup spools loaded with 50 feet of film. This was enough for about 3 minutes of continuous filming at 18 frames per second. A 200-foot reel later became available which could be used in specifically-designed cameras, but

it is no longer produced. Film was almost always a reversal stock.

The plastic cartridge could be loaded into the camera in seconds, without the need to directly thread or even touch the film. In addition, coded notches cut into the cartridge signalled the film speed to the camera to allow automatic film-speed setting.

Color stocks were generally available only in tungsten (3400K), and almost all Super 8 cameras come with a built-in 85A daylight conversion filter, allowing for both indoor and outdoor shooting.

The original release was a silent system only, but in 1973 a sync-sound version was released. The sound film had a magnetic soundtrack, and came in larger cartridges than the original so as to accommodate a longer film path (required for smoothing the film movement before it reached the recording head), and a second aperture for the recording head. Sound cameras were compatible with silent cartridges, but not vice versa. Sound film was typically filmed at a speed of 24 frames per second. Kodak discontinued the production of Super 8 sound film in 1997, citing environmental regulations as the reason.

Kodak (as of 2004) still manufactures several color and black-and-white Super 8 reversal film stocks, and even introduced new emulsions since year 2002. The most popular Kodak stocks usually have been either Kodachrome, a fine-grain color reversal stock or Ektachrome, and usually tend to be quite slow, usually around ISO 25, although there are known stocks that go up to ISO 100 and higher. Ektachrome VNF was discontinued by Kodak in 2004, again citing environmental reasons. At about that time, Kodak introduced a Super 8 negative stock, ISO 200. Kodak also reformulated the emulsions for the B&W reversal stocks Plus-X (ISO 100) and Tri-X (ISO 200), in order to give them more sharpness.

While Kodak Super 8 mm cartridges cannot be reloaded, a reloadable cartridge was manufactured in the former USSR.

Super 8 Cartridge



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**Single-8** is a film format introduced by Fujifilm of Japan in 1965 as an alternative to the Kodak Super-8 format. As an 8mm-wide cartridge-loading amateur motion picture film, the concept is quite similar to Super 8, and indeed the film itself is the same dimensions as Super 8, but the cartridges and cameras were entirely different. Single-8 cartridges are B-shaped, on two separate spools unlike the coaxial system of Super-8. As a result, Single-8 film offered unlimited rewind, whereas Super-8 rewind was limited to several seconds and relied on there being sufficient empty space within the cartridge for the rewound film to pile up inside.

Single-8 uses thinner but stronger polyester-based stock and the cartridges had the design advantage of using a better-quality camera pressure plate to hold the film in place during exposure than Super 8's use of a plastic plate built into the cartridge. Although never as popular as Super 8, the format continued to live in parallel. As of late 2004, Fuji still manufactures Single-8 film.

### **The Fujifilm Single-8 system**

Fujifilm of Japan developed an alternative format called **Single 8**, which was released in 1965 as an alternative to the Kodak Super 8 format.

Although the final film is dimensionally identical to the Kodak film, it is loaded into quite different cartridges and cameras. It has a polyester base that is thinner than the Kodak films, so splicing the two formats together in a finished film may require adjustment of the projector's focus at the join.

The Single 8 cartridge is B-shaped, with the film on two separate spools unlike the coaxial system of Kodak. As a result, Single 8 film offered unlimited rewind, in contrast to the Kodak system which was limited to several seconds and relied on there being sufficient empty space within the cartridge for the rewound film to pile up inside.

The Single 8 cartridge was designed to use the camera's film gate to hold the film in place during exposure, in contrast to the Kodak system which had a plastic

gate built into the cartridge. As a result, Single 8 theoretically offers better image steadiness than Super 8.

Although never as popular as Super 8, the format continues to live in parallel. As of late 2004, Fuji still manufactures Single-8 film.

Fuji Single-8 Stock



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## Double Super-8

Double Super 8 mm film is a 16 mm wide film but has Super 8 size sprockets. It is used in the same way as standard 8 film in that the film is run through the camera twice, exposing one side on each pass. During processing, the film is split down the middle and the two pieces spliced together to produce a single strip for projection in a Super 8 projector. Because it has sprockets on both sides of the film, the pin-registration is superior to Super 8 film and so picture stability is better.

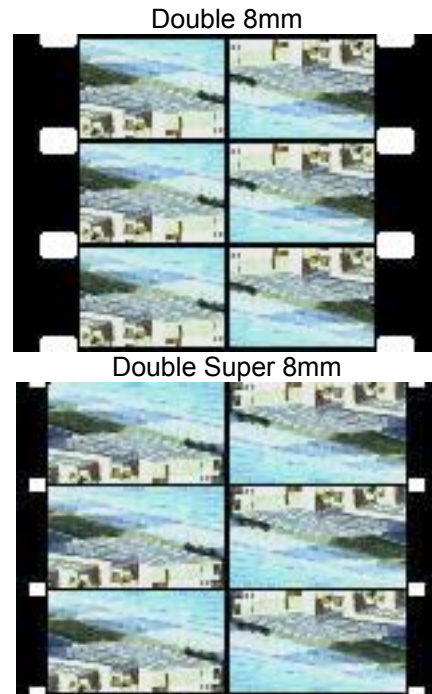
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## Popularity

A Super8 Film cartridge in a Canon Super8 Camera

Amateur usage of Super 8 has been largely replaced by video, but the format is sometimes used by professionals trying to imitate the look of old home movies, or create a stylishly grainy look. Many independent filmmakers such as Derek Jarman and Mark Pirro have made extensive use of 8mm film, and it appears to have made something of a minor comeback in both the art and experimental film world. Oliver Stone, for example, loves to use it in his more recent films, such as *The Doors*, *Natural Born Killers*, *Nixon*, *U Turn*, and *JFK* where his DP Robert Richardson employed it to evoke a period or to give a different look to scenes. Until 1999, the University of Southern California's famous School of Cinema-Television required students to shoot their initial projects using Super 8, but the dwindling availability of equipment and processing facilities eventually forced the

school to switch these classes to Digital Video. However it is still used elsewhere by film students who wish to learn the basics of shooting and editing.



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### PolaVision Phototape

An instant motion picture film, Polavision, was introduced by Polaroid in 1978, with an image format similar to Super 8mm film, and based on an additive color process. Polavision required a specific camera and tabletop viewer, and was not a commercial success, but did lead to the development of an instant 35mm color slide film.

PolaVision Kit



PolaVision Cassettes, etc.



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**9,5 mm film** is an amateur film format introduced by Pathé Frères in 1922 as part of the *Pathé Baby* amateur film system. It was conceived initially as

an inexpensive format to provide copies of commercially-made films to home users, although a simple camera was released shortly afterwards. It became very popular in Europe over the next few decades and is still used by a small number of enthusiasts today. Over 300,000 projectors were produced and sold mainly in France and England, and many commercial features were available in the format.

The format uses a single, central perforation (sprocket hole) between each pair of frames, as opposed to 8 mm film which has perforations along one edge, and most other film formats which have perforations on each side of the image. The single hole allowed more of the film to be used for the actual image and in fact the image area is almost the same size as 16mm film. In the later sound films, a 1 mm magnetic soundtrack was added, reducing the width of the image by 1 mm.

The width of 9.5 millimeters was chosen because 3 strips of film could be made from one strip of 35 mm film. This was useful when duplicating films because only 1 strip of 35 mm had to be processed. Then the sides, which contained the 35 mm sprocket holes, were cut off, the remaining film was cut into 3 strips, and the central sprocket holes added to each new strip.

The projection system also incorporated a way to save film on non-moving titles. A notch in the film was recognised by the projector which would then project that same frame for 10 seconds. By this method, 10 seconds of screen time was available for 1 frame of film, rather than the 160 frames required if the film was projected at the normal rate.

#### Technical specifications

- Film width: 9.5 mm
- Image size: 6.5 x 8.5 mm
- Image area: 55.25 mm
- vertical pulldown
- 1 central perforation per frame
- 49.4 frames per foot (7.4 mm per frame)
- 135.1 frames per metre
- 100 feet = approx. 5 minutes at 24 frame/s
- Soundtrack: magnetic, 1 mm wide
- Sound-Image frame interval: 28 frames

9.5mm



### **Neuf-cinq (nine-five)**

After thirty years of experimentation with different widths in 1922 one was marketed which stood a better chance. In December 1922 Pathé introduced its home cinema, *Le Cinéma chez soi*, called the *Pathé Baby*.  
*Unspliced 9,5mm film*

Between the perforations of 35mm film three rows of 9,5mm were slit (see *image*).

The projector came first. Its transportation mechanism was almost identical to the Lumière Cinématograph of 1895. The apparatus projected a steady image of amazing clarity considering the lamp of 6 Watt. Cassettes with lengths of 9 or 15 meter 9,5mm film could be bought or rented from depots. These films stood out by their great definition. They were reduced from Pathé's considerable 35mm archive. Subjects included newsreels, documentaries, comedies and feature films. Some were colored by a stencil imprint method. An ingenious system was used to prolong the projection time. By means of notches in the film a mechanism was set into motion in the projector by which certain images - titles or close-ups - could be frozen for a few seconds.

*Pathé Baby set*

In 1923 a camera with hand crank was marketed. It being small in size, handy and economical, made it popular in a short time. It was for the first time that amateur film gained a wider acceptance. It is estimated that some 300.000 projectors were sold. What happened to all of them is another matter. They are not that often being offered for sale nowadays.

As a result of later developments the size never became popular in the U.S.A. In Europe it was. Even in Japan imitations of 9,5mm movie cameras and projectors were manufactured before the war (Cine Rola). In 1938 9,5mm sound film was introduced with the *Pathé Vox* sound-projector.

It may come as a surprise to some but 9,5 mm still has a following. Cameras and projectors are still manufactured, or more precisely, modern equipment is being



converted to this size. Films are still re-perforated by some firms and developing facilities are available, given enough patience.

Internationally 9,5mm fans form a closely knit community holding yearly global gatherings. The best nine-five films of that year are projected then.

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## **16 mm film**

16 mm film was initially created in the 1920s as an inexpensive amateur alternative to the conventional 35 mm film format. Thanks to the compact size and lower cost, 16 mm was quickly adopted for use in professional news reporting, corporate and educational films, and other uses, while the home movie market switched to even less expensive 8 mm film.

16 mm was extensively used for television production in countries where television economics made the use of 35 mm too expensive, as is the case in Britain.

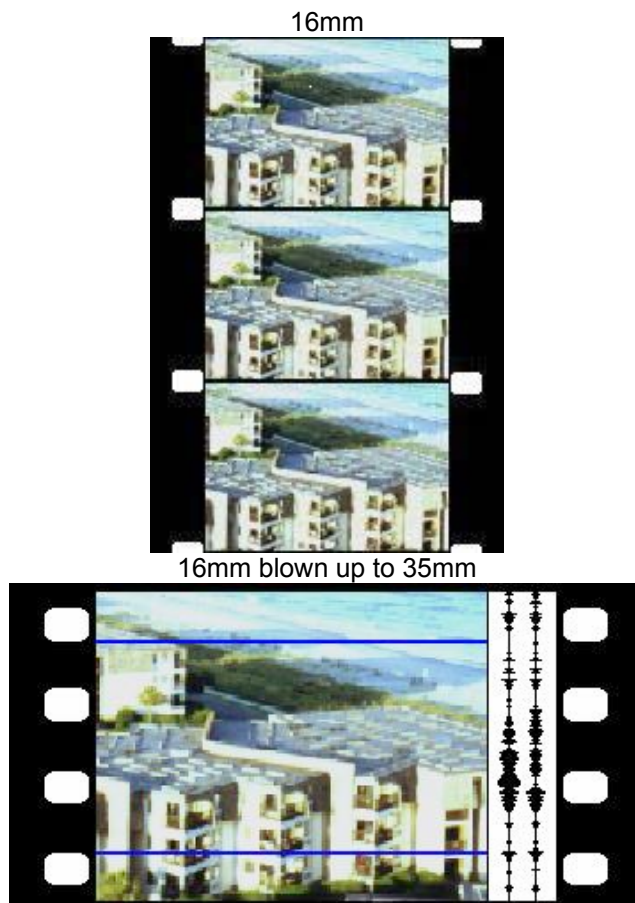
Double-sprocket 16 mm film has perforations down both sides at every frame line. Single-sprocket only has perforations on one side of the film. The picture area has an aspect ratio of 1.33, and there is space for a monophonic soundtrack. Double-sprocket 16 mm stock is slowly being phased out by Kodak, as single-sprocket film can be used by both 16 mm and Super 16 productions.

Today, most of these uses have been taken over by video, and 16 mm film is used primarily by budget-conscious independent filmmakers. The variant called Super 16 mm, Super 16, or 16 mm Type W uses single-sprocket film, and takes advantage of the extra room for an expanded picture area with a wider aspect ratio of 1.67. Super 16 cameras are usually 16 mm cameras which have had the film gate and ground glass in the viewfinder modified for the wider frame. Since Super 16 takes up the space originally reserved for the soundtrack, films shot in this format are often blown up to 35 mm for projection.

The two major suppliers of 16 mm film today are Kodak and Fujifilm. Today, 16 mm film is used mostly for student and documentary films, with some Super 16 used for HD (Hi-Def) production.

In Britain most exterior television footage was shot on 16 mm until the 1980s, when the development of more portable television cameras and videotape machines led to video replacing 16 mm in many instances. Some drama shows and documentaries were made entirely on 16 mm, notably *Brideshead Revisited*, *The Jewel in the Crown*, *The Ascent of Man* and *Life on Earth*. The advent of

digital television and widescreen sets led to the widespread use of Super 16. However, improvements in film stock have resulted in a dramatic improvement in picture quality since the 1970s.



#### Technical specifications

- \* 40 frames per foot (7.6 mm per frame)
- \* 400 feet = about 11 minutes at 24 frame/s
- \* vertical pulldown
- \* 1 perforation per frame

#### 16 mm

- \* 1.33 aspect ratio

- \* enlarging ratio of 1:2.18 for 35 mm prints
- \* *camera aperture*: 0.404 by 0.295 in (10.26 by 7.49 mm)
- \* *projector aperture* (full 1.33): 0.378 by 0.276 in (9.60 by 7.01 mm)
- \* *projector aperture* (1.85): 0.378 by 0.205 in (9.60 by 5.20 mm)
- \* *TV station aperture*: 0.380 by 0.286 in (9.65 by 7.26 mm)
- \* *TV transmission*: 0.368 by 0.276 in (9.34 by 7.01 mm)
- \* *TV safe action*: 0.331 by 0.248 in (8.40 by 6.29 mm); corner radii: 0.066 in (1.67 mm)
- \* *TV safe titles*: 0.293 by 0.221 in (7.44 by 5.61 mm); corner radii: 0.058 in (1.47 mm)

## Super 16

- \* 1.66 aspect ratio
- \* *camera aperture*: 0.493 by 0.292 in (12.52 by 7.41 mm)
- \* *projector aperture* (full 1.66): 0.463 by 0.279 in (11.76 by 7.08 mm)
- \* *projector aperture* (1.85): 0.463 by 0.251 in (11.76 by 6.37 mm)

Super 16



Super 16mm blown up to 35mm



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### 17.5 MM

Pathe introduced this size, to compliment their 9.5mm film, about 1926 as a silent film Sound was added about 1933

Before the World War 2, 17.5mm film was used in 4823 cinema's in France

Birt Acres demonstrated a 17.5mm camera, patented on 9 June 1898, to Croydon Cine Club on 25 January 1899

It was named "The Birtac" and was sold only in the UK for about 10 guineas (£10.50p about 10 to 14 weeks wages for the average person at this time) It was a hand turned wooden camera taking 50 foot of the standard 35mm film split down the centre By reversing the lens, and adding a lamphouse, the camera became a projector

Another 17.5mm camera appeared in the UK about March 1899

T. C. Hepworth demonstrated it at the London Camera Club, and it could be brought for 11 guineas (£11.55p) as a combined camera/projector

Other 17.5mm systems were "La Petite Cinematographe", 1900 using film perforated in the centre of the frame line

The first German Ernemann Kino cine camera (1903) which again used centrally perforated 17.5mm filmstock to produce a picture of 16mm x 10mm

The Duoscope apparatus, introduced in 1912, used a 17.5mm film with two perforations on the line between the frames

A built-in electric lamp enabled the device to also act as a projector

In 1917 another 17.5mm product was launched by Movette Inc. of Rochester, New York

The Movette used magazine loaded 17.5mm film with two circular perforations

on each side of the frame

Although the negative film used in the camera was still the highly inflammable nitrate stock, positive projection prints were made on the Eastman safety stock

In 1926 the Pathé company launched a new 17.5mm size, presumably as a competitor to 16mm, as their smaller 9.5mm gauge had already become popular

The new Pathé 17.5mm gauge, launched as the "Rural" in France, used safety stock with a picture size of 9mm x 12mm, and was shown at the Société Française de Photographie on 10 February 1926

Printed films were produced by printing in pairs on specially perforated 35mm safety stock by reduction from 35mm originals

It seems, in France, the size was intended for use in the smaller country district (hence 'Rural') cinemas on the Pathé circuit

Marketing in France began in earnest in 1927, but problems with equipment and film production, together with obtaining film distribution rights slowed business

In the UK the silent 17.5mm system was hardly advertised at all by the UK company Pathéscope

### **28 mm** -*Pathé Kok*

In 1912 Pathé introduced with far more success a 28mm size for safety film. The width deviated in order to prevent flammable normal sized film be used for the projector, the *Pathé Kok* (see image). *28 mm film* In France the film had on the left side three perforations per frame and on the right side one. The single right side perforation was to make framing unnecessary.

*New Premier Pathescope*

When during WW1 imports from France into the U.S.A. came to a halt *Victor* introduced their Safety and Home Cinema projectors for 28mm films perforated with three perforations per frame on both sides.

*Victor 28mm projector*

Pathé's distributor *W.B.Cook* designed a completely new motorized projector, the *New Premier Pathescope* (see photo). Not many were sold, however. Keystone and other manufacturers also introduced a 28mm projector, but reverted soon again to the 35mm size.

The *Pathé Kok* projector (The name was taken from from the newly patented logo of a cock) was equipped usually with a dynamo. So it could be used on the not yet electrified countryside. At the same time 28mm cameras were marketed.

The emphasis was on showing theatrical films copied from the large film library of Pathé, however.

Initially the new size seemed to do well and was accepted as a standard size for the home cinema. By 1918 10.000 projectors were sold.

The projector enjoyed quite some popularity. In the United States 28mm was accepted as a standard size for portable film projectors by the Society of Motion Picture Engineers. 935 Titles were for rent.

Later developments made the format decline in popularity. Yet the Kok projectors are a showpiece in a collection nowadays, especially so because of its splendid design resembling a robust old-time sewing machine.

28mm Print



**35 mm film** is the basic film format most commonly used for both still photography and motion pictures, and remains relatively unchanged since its introduction in 1889 by Thomas Edison. The photographic film is cut into strips 35 millimeters wide, with six perforations per inch (4.23 mm per perforation) along both edges.

The origin for the 35 mm size is an Eastman Kodak 70 mm roll film for photography, being cut in two. William Kennedy Laurie Dickson, working for Edison, then cut four round perforations per frame along both edges. The format was initially called *Edison size*. The flattened perforations were introduced by Bell & Howell around 1900, which remain to this day for camera original film. Kodak-Standard perforations were introduced some ten years later for projection use.

A variation used by the Lumière Brothers used a single circular perforation in the centre of the film between frames.

The film format was introduced into still photography as early as 1913 (the Tourist Multiple) but first became popular with the launch of the Leica camera, created by Oskar Barnack. In normal still photography use, the film, with Kodak Standard perforations, is used horizontally, with each frame having an aspect ratio of 2:3, a size of 24 x 36 mm. See the 135 film section.

In the conventional motion picture format, frames are four perforations tall, with an aspect ratio of about 4:3. Still cameras in 35 mm and the VistaVision motion picture format use a horizontal frame with is eight perforations wide, resulting in a wider aspect ratio of 3:2 and greater detail, as more film area is used per frame.

The commonly used anamorphic widescreen format Cinemascope uses the conventional four-perf frame, but an anamorphic lens is used on both the camera and projector to produce a wider image, today with an aspect ratio of about 2.35. The image as stored on the film appears horizontally compressed.

Most films today are shot and projected using the 4-perforation format, but cropping the top and bottom of the frames for a medium aspect ratio of 1.85 or 1.67. In television production, where compatibility with an installed base of 35 mm film projectors is unnecessary, a 3-perf format is commonly used, giving the 16:9 ratio used by HDTV and reducing film usage by 25%.

When sound was introduced to the cinema, after some initial attempts at using synchronized record cylinders, *etc.*, the sound started to be stored optically

directly on the film. This analog soundtrack takes up a small strip to the left of the picture area. The film picture size of silent movies was 24 mm by 16 mm giving an aspect ratio of 3:2 or 1.5:1. After the introduction of sound, the width of the picture was reduced to 21.333mm to give an aspect ratio of 4/3 or 1.33:1 (known as standard or Academy ratio) by the Academy of Motion Picture Arts and Sciences. The *flat* (non-anamorphic) aspect ratio is presently 1.85:1.

New digital soundtracks introduced since the 1990s include Dolby Digital, which is stored in between the perforations; SDDS, stored in two strips along the outside edges (beyond the perforations), and DTS, where sound data is stored on a separate compact disc synchronized by a timecode track stored on the film just to the left of the analog soundtrack. Because all these soundtrack systems appear on different parts of the film, one movie can contain all of them and be played in the widest possible number of theaters.

### Technical specifications

Technical specifications for 35 mm film are standardized by SMPTE.

- \* 16 frames per foot (19 mm per frame)
- \* 1000 feet = about 11 minutes at 24 frame/s
- \* vertical pulldown
- \* 4 perforations per frame (except if using 3-perf for origination)

### 35 mm spherical

- \* 1.37 aspect ratio on camera negative; 1.85 and 1.66 are hard or soft matted over this
- \* *camera aperture*: 0.866 by 0.630 in (22 by 16 mm)
- \* *projector aperture* (full 1.37): 0.825 by 0.602 in (21 by 15 mm)
- \* *projector aperture* (1.66): 0.825 by 0.497 in (21 by 13 mm)
- \* *projector aperture* (1.85): 0.825 by 0.446 in (21 by 11 mm)
- \* *TV station aperture*: 0.816 by 0.612 in (21 by 16 mm)
- \* *TV transmission*: 0.792 by 0.594 in (20 by 15 mm)
- \* *TV safe action*: 0.713 by 0.535 in (18 by 14 mm); corner radii: 0.143 in (3.6 mm)
- \* *TV safe titles*: 0.630 by 0.475 in (16 by 12 mm); corner radii: 0.125 in (3.2 mm)

### Super 35

- \* 1.33 aspect ratio on camera negative
- \* *camera aperture*: 0.980" by 0.735"

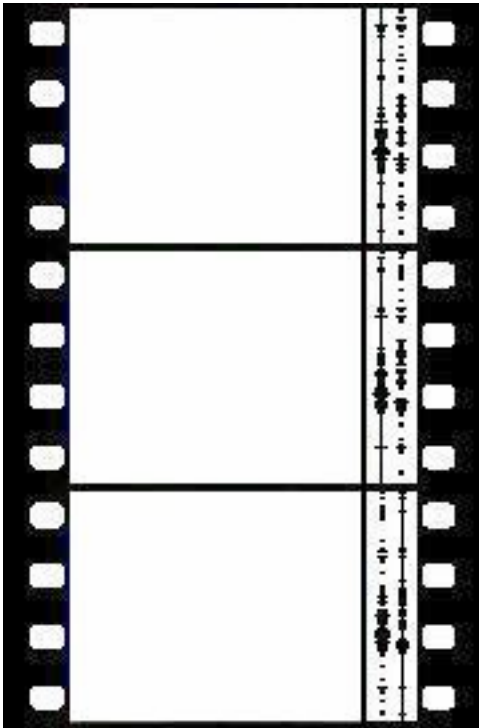


- \* *picture used* (35 mm anamorphic): 0.945" (24.00 mm) by 0.394" (10.00 mm)
- \* *picture used* (70 mm blowup): 0.945" (24.00 mm) by 0.430" (10.92 mm)
- \* *picture used* (35 mm flat 1.85): 0.945" (24.00 mm) by 0.511" (12.97 mm)

### 35mm anamorphic

- \* 2.40 aspect ratio, horizontal squeezed to fit 1.37 camera negative

35mm Print



**Super 35** is a motion picture film format that uses exactly the same 35 mm film stock as standard 35mm, but puts a larger image frame on that stock.

Super 35 became popular in the mid 1990s. It is often associated with director James Cameron who has made frequent and effective use of the format.

Super 35 is a production format. Theatres do not receive or project Super 35 prints. Rather, movies are *shot* in a Super 35 format but are then processed optically into one of the standard formats to make release prints.

The Super 35 image size is .980" x .735", compared to the standard Academy 35 mm size of .864" x .630" and thus provides 32% more image area than standard 35. Ironically, Super 35 is simply the original frame size that was used in 35mm

silent films. That is, it is a return to the way the film stock was used before the frame size was shrunk to allow room for a soundtrack.

Super 35 competes with the use of the standard 35mm format used with an anamorphic lens. In this comparison, advocates of Super 35 claim an advantage in production costs and flexibility; detractors complain of a loss in quality when used to make 1:2.35 theatrical prints.

Super 35 uses standard "spherical" camera lenses, which are cheaper to rent—a factor in low-budget production—and provide a wider range of lens choices to the cinematographer. The chief advantage of Super 35 in productions such as James Cameron's is its adaptability to different release formats. Super 35 negatives can be used to produce high-quality releases in any of several currently popular formats: standard theatre 1:2.35 anamorphic film, 16:9 video, or pan-and-scan 4:3 video.

Theoretically, 1:2.35 release prints made from Super 35 should have slightly lower technical quality than films produced directly in the anamorphic format, because part of the Super 35 image is thrown away when printing to this format. This is partially offset by Super 35's use of a large film area to begin with. Films produced in Super 35 include *Terminator 2*, *Top Gun*, and *Titanic*. Films like these demonstrate that in skilled hands any loss in quality need not be appreciable to the untrained eye.

35mm with no Sound Lines (Super 35)



Super 35 transferred to 35mm "Scope" format (Anamorphic)



Super 35 to 35 Scope projected



## DUPLEX

In 1915 the Duplex Corporation proposed an economical use of the 35mm film size, by splitting the frame up in two halves and copying existing 35mm films on to 35mm stock without splitting the film up.

Special Duplex projector lenses were to be made available to project the 10 x 19mm half frame onto the screen.

I have a brochure but have been unable to find any reference that the system was seriously considered, or the Duplex lenses ever made available.

Duplex half frame film



## 42mm

Another proposal came in 1922 for a **42 mm** size to accommodate a 7mm optical sound track to existing 35mm film by the German Triergon company.

42mm film



## 70 mm film

[70 mm film (or 65 mm film) is a high-resolution motion picture film format. As used in camera, the film is 65 mm wide; for projection 2.5 mm are added along each outer side of the perforations for magnetic strips holding six tracks of surround sound, although in truth, the magnetic sound system is used now rarely. Each frame is five perforations tall, with an aspect ratio of 2.20.

Film formats with a width of 70mm have existed since the early days of the motion picture industry. The first 70mm format was most likely Cinéorama (not to be confused with the entirely distinct "Cinerama" format), started in 1914 by Raoul Grimoin-Sanson. Two other formats, Panoramica and 20th Century Fox's Grandeur, began distribution in 1929 and 1930, respectively.

It was, however, the "Todd-AO" format, introduced in the 1950s, that popularized the format, owing to the wide screen, sharp picture and, most importantly, high quality sound. The advent of low-grain film stocks and availability of digital soundtrack systems for less expensive and more widely projectable 35 mm film led to a decline in use of this expensive format in the 1990s. *Lawrence of Arabia* is a well-known film in 70 mm format; the clarity of its picture is apparent in theaters, though much less so on VHS or DVD.

There is a subset of 70 mm film known as Showscan, in which the picture is captured and shown at 60 frames per second, which can have beneficial effects on qualities like image strobe, flicker, and grain. It never caught on with mainstream cinema, and is primarily used for theme park simulation rides.

A horizontal variant of 65 mm/70 mm, with an even bigger picture area, is used for the high-performance IMAX and Omnimax formats. The Dynavision and Astrovision systems each use slightly less film per frame and vertical pulldown to save print costs while being able to project onto an IMAX screen. Both are rare, Astrovision more or less exclusively occupying Japanese planetariums.

Steven Spielberg's *Close Encounters of the Third Kind* was mainly shot on 35 mm film, but the effects sequences were shot on 70 mm film. Special effects man Douglas Trumbull (who later invented Showscan) decided to do this so that there would be no loss of quality that might subconsciously "warn" moviegoers of an impending effects sequence.

Starting in the late 1950s and continuing until the mid-1990s, many 35 mm films were converted onto 70 mm prints for premiere showings in large cities or venues which could accompany the format. Often this was not just for issues of image size, but more because of the six magnetic sound tracks available (versus two optical sound tracks on 35 mm) with 70 mm prints. Since the introduction of DTS, SDDS, and Dolby Digital, 70 mm lost this advantage, and a significantly lower number of 70 mm prints are struck today.

The last major studio feature film to have been shot entirely on 65 mm is Kenneth Branagh's *Hamlet*. Since then, the format has been occasionally used for visual effects shots. Recently, big waves in the 70 mm enthusiast crowd were made upon rumors that Terrence Malick would shoot *The New World* (2005) entirely on 65 mm; this was determined to be too expensive for the entire shoot, however, although certain portions were indeed shot in 65 mm.

65 mm Negative



70mm Release Print



### Technical Specs

Standard 65 mm (5/70) (Todd-AO, Super Panavision)

- \* spherical lenses
- \* 5 perforations per frame
- \* 12.8 frame/ft (42 frame/m)
- \* vertical pulldown
- \* 24 frames per second
- \* camera aperture: 2.066 by 0.906 in (52.48 by 23.01 mm)
- \* projection aperture: 1.912 by 0.816 in (48.56 by 20.73 mm)

- \* 1000 feet (305 m), about 9 minutes at 24 frame/s = 10 pounds (4.54 kg) in can

Showscan Same as Standard 65 mm except

- \* 60 frames per second

IMAX (15/70)

- \* spherical lenses
- \* 15 perforations per frame
- \* horizontal pulldown, from right to left (viewed from base side)
- \* 24 frames per second
- \* camera aperture: 2.772 by 2.072 in (70.41 by 52.63 mm)
- \* projection aperture: at least 0.80 in (20 mm) less than camera aperture on the vertical axis and at least 0.016 in (0.4 mm) less on the horizontal axis

Omnimax Same as IMAX except

- \* special fisheye lenses
- \* lens optically centered 0.37 in (9 mm) above film horizontal center line
- \* projected elliptically on a dome screen, 20 degrees below and 110 degrees above perfectly centered viewers

Dynavision (8/70)

- \* fisheye or spherical lenses, depending on if projecting for a dome or not
- \* vertical pulldown
- \* 24 or 30 frames per second
- \* camera aperture: 2.080 by 1.480 in (52.83 by 37.59 mm)

Astrovision (10/70)

- \* vertical pulldown
- \* normally printed from an Omnimax negative
- \* projected onto a dome
- \* almost exclusively in use only by Japanese planetariums
- \* the only 70 mm format without sound, hence the only with perforations next to the edges

