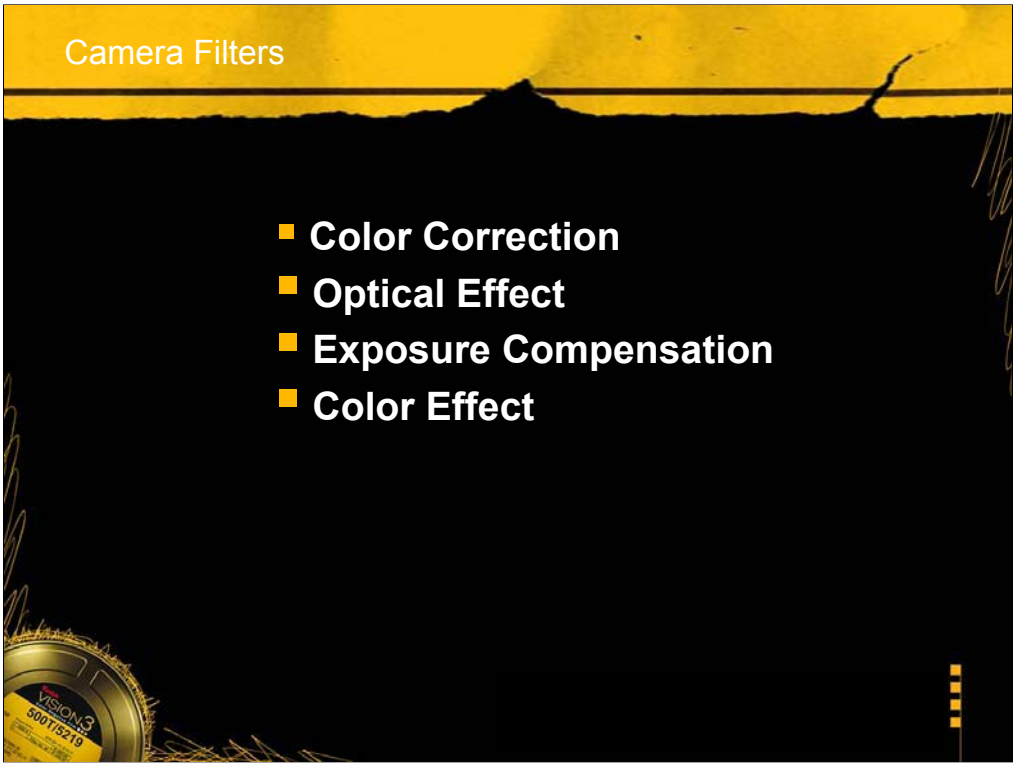
A filter is a piece of glass, gelatin, or other transparent material used over the lens or light source to emphasize, eliminate, or change the color, density, or quality of the entire scene or certain elements in the scene. In this chapter, we'll look at filters that are "necessary" to correct for mismatched film and lighting, then we'll take a look at how filters can be used to create a "look."

Optical filters provide the means to profoundly affect the image you create. They are most often used at the lens during the actual shooting, but can also be physically inserted into telecines and scanners, and can be virtually applied when the image exists in data space.



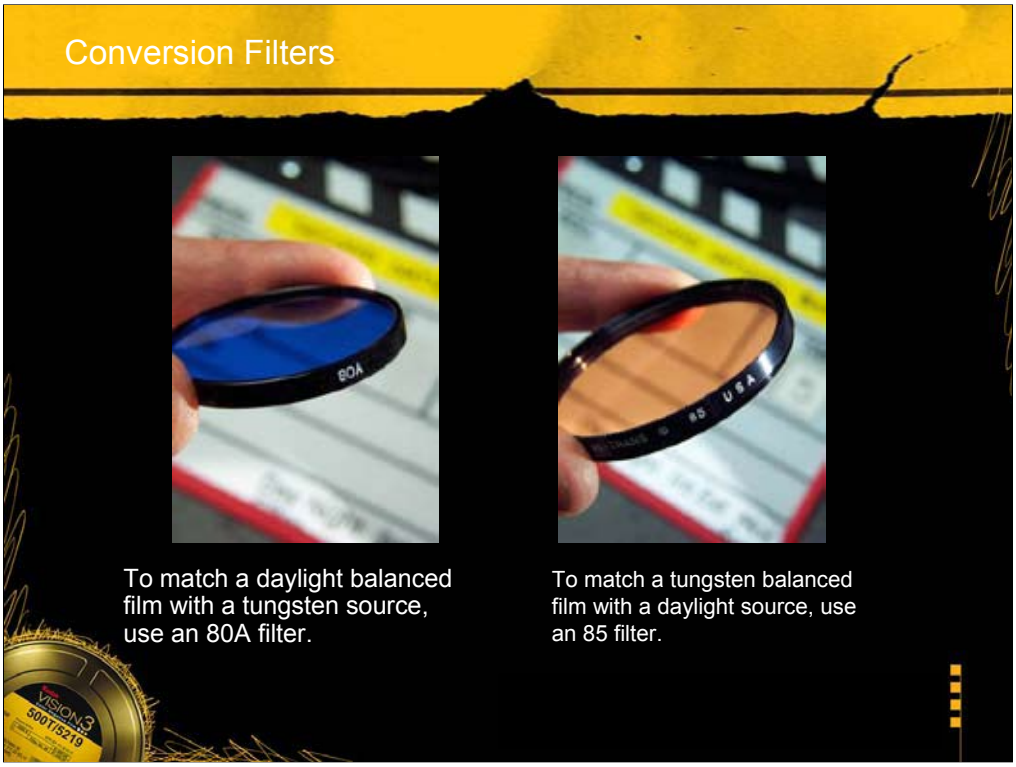
Filters can be regarded as belonging to one of four general types:

•**Color correction**—broadly, these are filters that affect the daylight/tungsten balance and the green/magenta shift of the light that passes through them. The most common of these is the 85 filter, which corrects daylight to tungsten. This is the filter we use when we shoot a day exterior with tungsten balanced film. There are many grades, colors and densities of this type of filter, designed to allow us to deal with nearly any color of light and make it a color that the film can manage. They are categorized as conversion, light balancing, and color compensating filters.

•**Optical effect**—these filters, like the polarizer, the star filter, or the split field diopter, redirect or selectively refract the light passing through them. The polarizer is commonly used to reduce glare and eliminate reflections. It does this in the same way as do your sunglasses, by allowing only aligned, parallel wavelengths of light to pass through its density. It is especially effective in enhancing the deep blue of the sky.

•**Exposure compensation**—filters that affect the quantity of light passing through with minimal impact to the color or quality. The significant member of this group is Neutral Density. ND filters come in a variety of densities, usually in one-stop increments.

•**Color effect**—these filters selectively apply an overall color bias to the image. Popular choices include tobacco, sepia and coral. The enhancing filter is a specialized version that intensifies the saturation of only the red tones in the image. Graduated filters, so-called grads, affect a selected portion of the image by manipulating the filter in a rotating matte box. One of the most popular, the sunset grad, applies a warm tone to the top-most part of the image and enhances the warm sky of an actual or contrived sunset without affecting the bottom half of the image.



Color motion picture films are balanced in manufacturing for use with either tungsten light sources (3200K) or daylight (5500K). Color conversion filters can be used to match a film and a light source that have different color balances.

Conversion Filters

Filter Color	Filter Number	Exposure Increase in Stops	Conversion in Degrees K
Blue	80A	2	3200 to 5500
	80B	1 2/3	3400 to 5500
	80C	1	3800 to 5500
	80D	1/3	4200 to 5500
Amber	85C	1/3	5500 to 3800
	85	2/3	5500 to 3400
	85N3	1 2/3	5500 to 3400
	85N6	2 2/3	5500 to 3400
	85N9	3 2/3	5500 to 3400
	85B	2/3	5500 to 3200

These filters are intended for use whenever significant changes in the color temperature of the illumination are required (for example, daylight to artificial light). The filter may be positioned between the light source and other elements of the system or over the camera lens in conventional photographic recording.

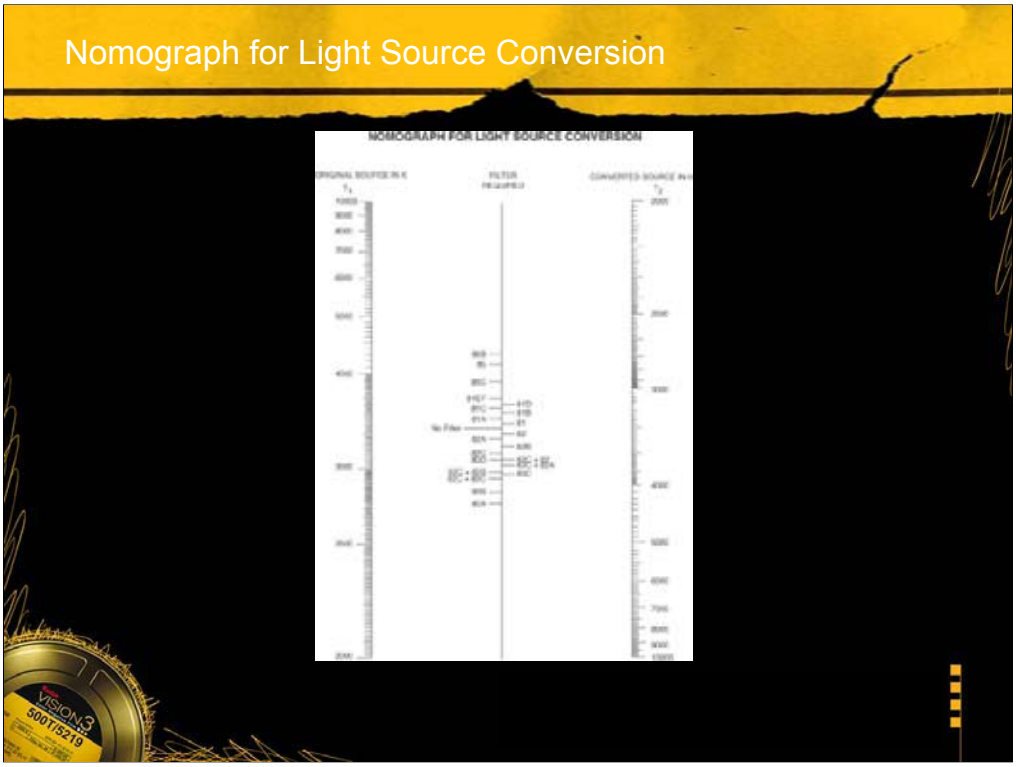
Note: Proper exposure compensation should be made for each filter placed on the camera lens. Filters absorb part of the light that would normally strike the film, so the exposure must be increased—usually by using a larger aperture. Filtration is based on the light source and the film type. Film datasheets for KODAK Motion Picture Films note exposure compensation for commonly used filters.

Light Balancing Filters

Filter Color	Filter Number	Exposure Increase in Stops	To Obtain 3200K From	To Obtain 3400K From
Bluish	82C + 82C	1 1/3	2490K	2610K
	82C + 82B	1 1/3	2570K	2700K
	82C + 82A	1	2650K	2780K
	82C + 82	1	2720K	2870K
	82C	2/3	2800K	2950K
	82B	2/3	2900K	3060K
	82A	1/3	3000K	3180K
	82	1/3	3100K	3290K
Yellowish	81	1/3	3300K	2510K
	81A	1/3	3400K	3630K
	81B	1/3	3500K	3740K
	81C	1/3	3600K	3850K
	81D	2/3	3799K	3970K
	81EF	2/3	3850K	4140K

Light-balancing filters enable the photographer to make **minor adjustments in the color quality** of illumination to obtain cooler or warmer color rendering. One of the principal uses for KODAK Light Balancing Filters is where light sources frequently exhibit color temperatures different than that for which a color film is balanced. When using a color temperature meter to determine the color temperature of prevailing light, you can use the table below, which converts the prevailing temperature to either 3200K or 3400K.

Nomograph for Light Source Conversion

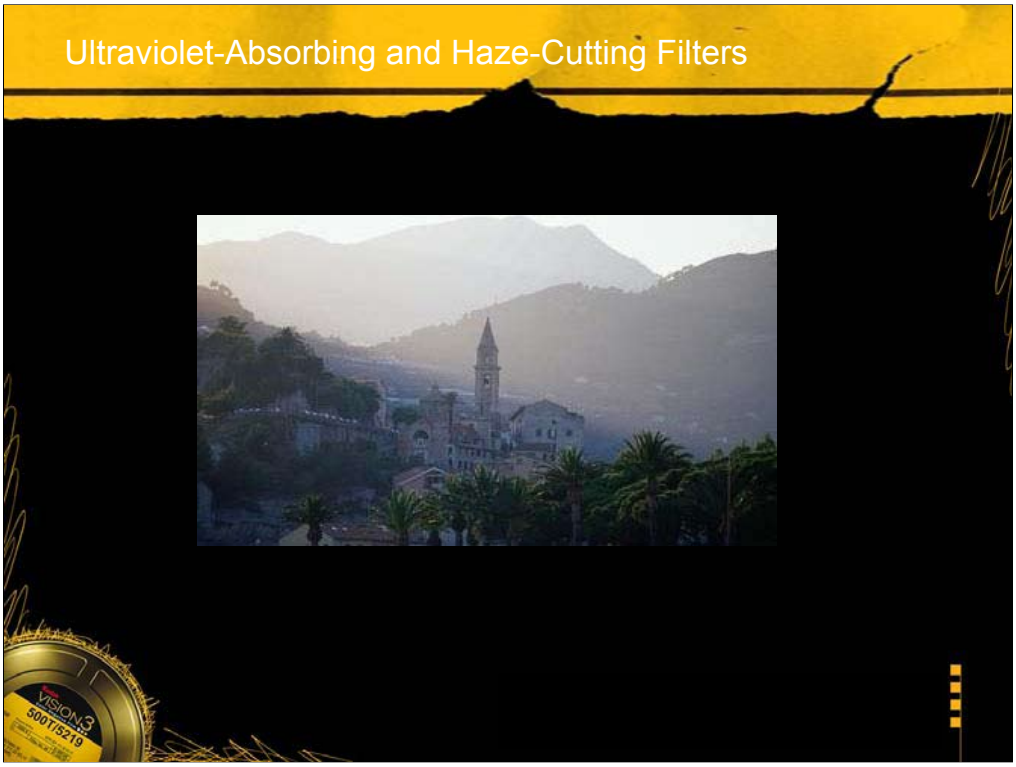


This nomograph can be used to find the approximate filter for a particular conversion by placing a straightedge from an original source (T1) to a second source (T2). The appropriate filter can be found on the centerline.

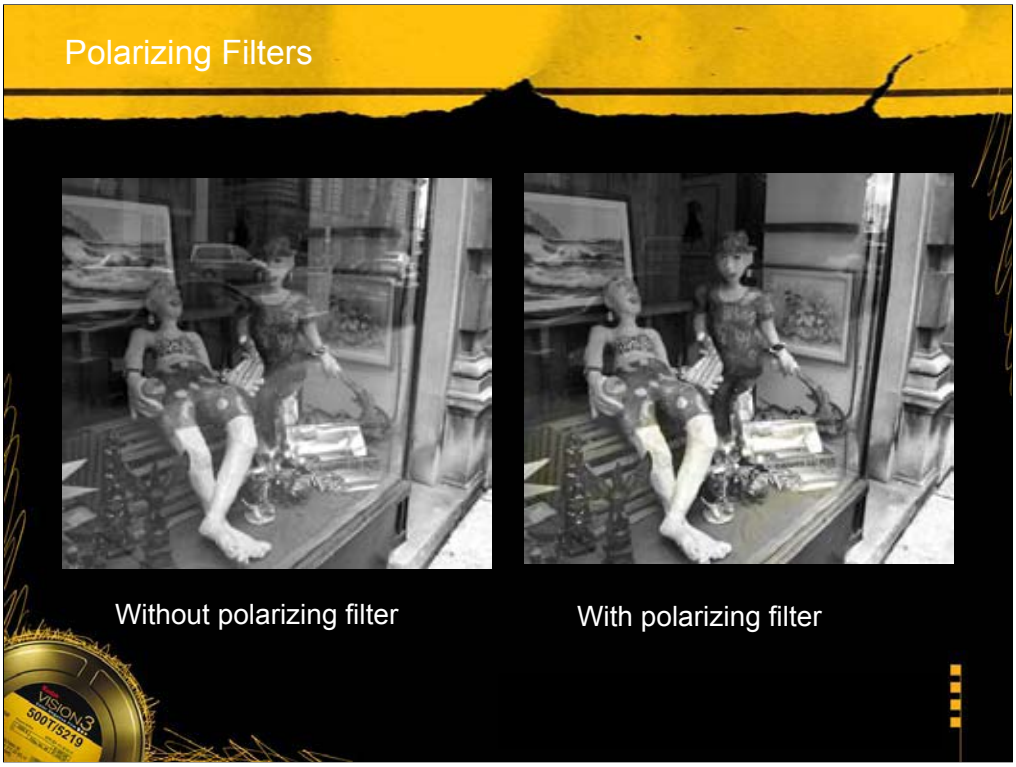
A color compensation (CC) filter controls light by attenuating principally one or two of the red, blue, or green parts of the spectrum. They can be used singly or in combination to introduce almost any desired color correction. You can use CC filters to make changes in the overall color balance of pictures made with color films, or to compensate for deficiencies in the spectral quality of the light to which color films must sometimes be exposed. Such corrections are often required, for example, in making color prints or in photography with unusual light sources. if the color balance of a test is not satisfactory, you can estimate the extent of filtering required to correct it by viewing the test print through color compensating filters.

Color compensating filters are available in several density values for each of the following colors: cyan, magenta, yellow, red, green, and blue. The density of each color compensating filter is indicated by the number in the filter designation, and the color is indicated by the final letter. In a typical filter designation, CC20Y represents a "color compensating filter with a density of 0.20 that is yellow."

An orange Coral filter can be used as an alternative to the standard conversion filters, such as an 85 filter. Coral filters are available in a series of gradually increasing saturation—from 1/8 to 8. Each step increases the color temperature correction by approximately 250K. This range of choice allows the cinematographer to make the scene incrementally warmer or cooler—or even to change the color during a scene, either for an effect, or to counteract the naturally changing color of the sunlight. Straw filters are also used for alternative color correction.



Photographs of distant landscapes, mountain views, snow scenes, scenes over water, and sometimes aerial photographs in open shade made on color films balanced for daylight are frequently rendered with a bluish cast. This is caused by the scattering of ultraviolet radiation to which the film is more sensitive than the human eye. A 1A (skylight filter) absorbs ultraviolet light. By placing this filter over the lens, you can reduce the bluish cast and obtain a slight degree of haze penetration.



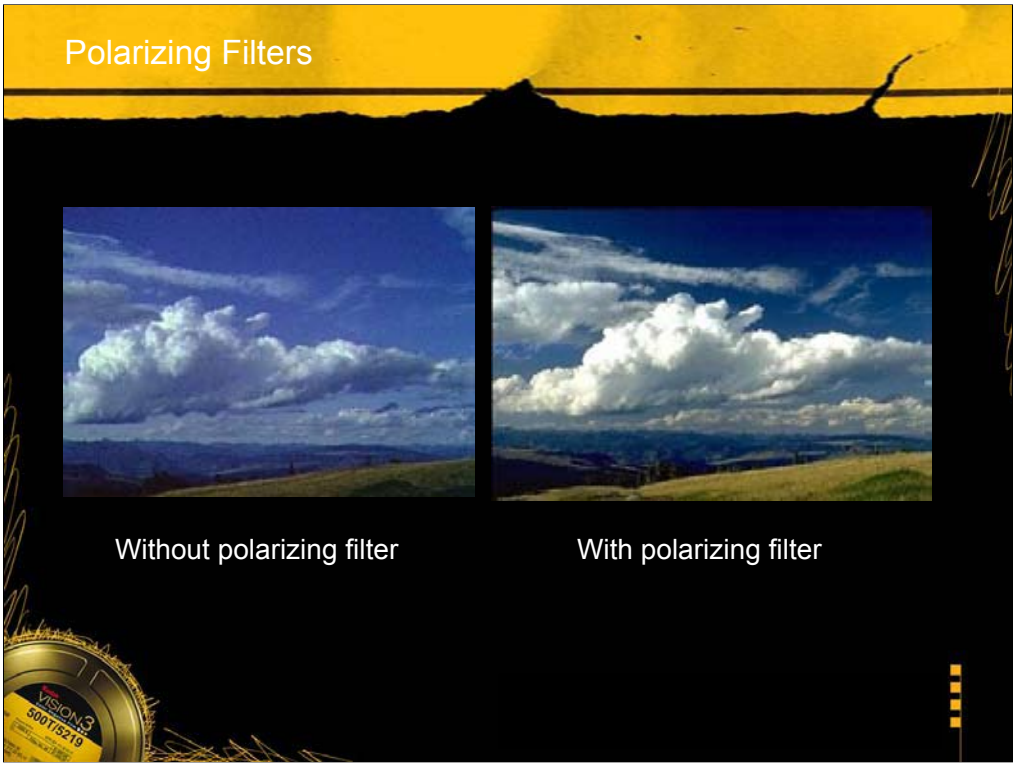
Polarizing filters (also called polarizing screens) are used to subdue reflections from surfaces such as glass, water, and polished wood, and for controlling the brightness of the sky. The amount of polarized light from a particular area of the sky varies according to the position of the area with respect to the sun, the maximum occurring at an angle of 90º from the sun. Therefore, **avoid panning the camera** with a polarizer because the sky will become darker or lighter as the camera position changes. The sky may appear lighter than you would expect for these reasons:

•A misty sky does not photograph as dark as a clear blue sky. You can't darken an overcast sky by using a filter.

•The sky is frequently almost white at the horizon and shades to a more intense blue at the zenith. Therefore, the effect of the filter at the horizon is small, but it becomes greater as you aim the camera upward.

•The sky near the sun is less blue than the surrounding sky and, therefore, is less affected by a filter.

When you begin making exposures with a polarizing filter, remember that this filter has a typical filter factor of 4 (increase exposure by 2 stops). This factor applies regardless of how the polarizing filter is rotated.



Another example of polarizing filter.

Neutral Density Filters

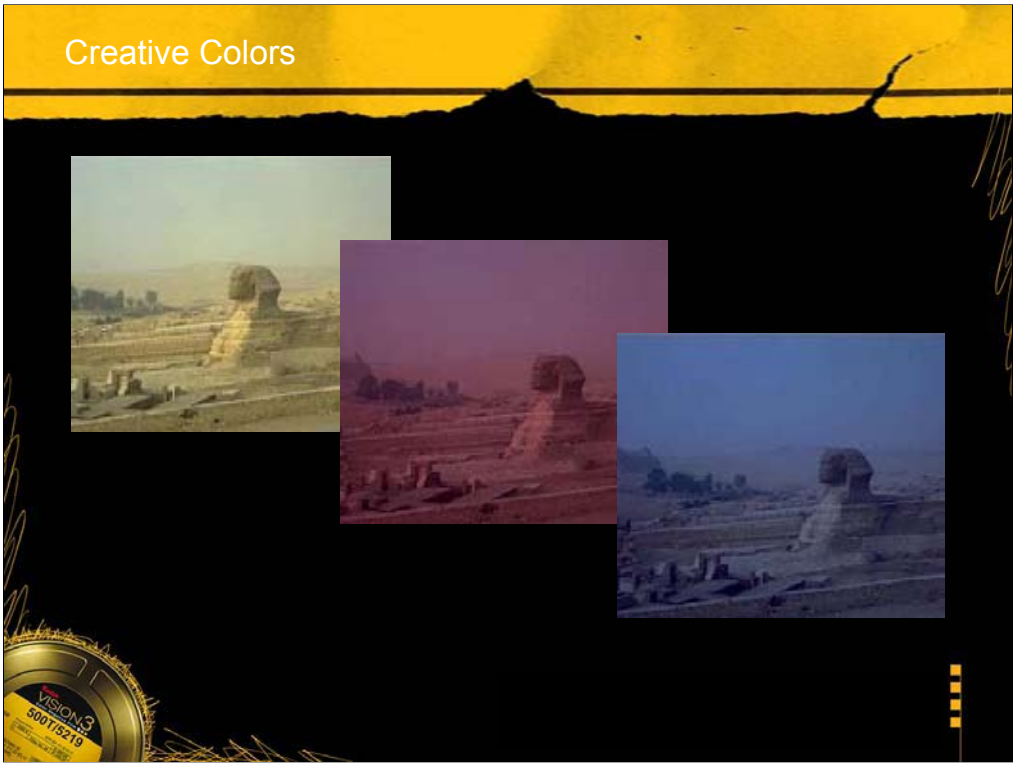
Neutral Density	Percent Transmittance	Filter Factor	Exposure Increase in Stops
0.1	80	1 1/4	1/3
0.2	63	1 1/2	2/3
0.3	50	2	1
0.4	40	2 1/2	1 1/3
0.5	32	3	1 2/3
0.6	25	4	2
0.7	20	5	2 1/3
0.8	16	6	2 2/3
0.9	13	8	3
1.0	10	10	3 1/3
1.0 + 0.1	8	12	3 2/3
1.0 + 0.2	6	16	4
1.0 + 0.3	5	20	4 1/3
1.0 + 0.4	4	24	4 2/3
1.0 + 0.5	3	32	5

In black-and-white and color photography, filters such as the KODAK WRATTEN Neutral Density Filters No. 96 reduce the intensity of light reaching the film without affecting the tonal rendition in the original scene. In motion-picture work or other photography, neutral density filters allow use of a large aperture to obtain differential focusing. You can use them when filming in bright sunlight or with very fast films without having to use very small lens apertures. This gives you more control over the depth of field in your scene.

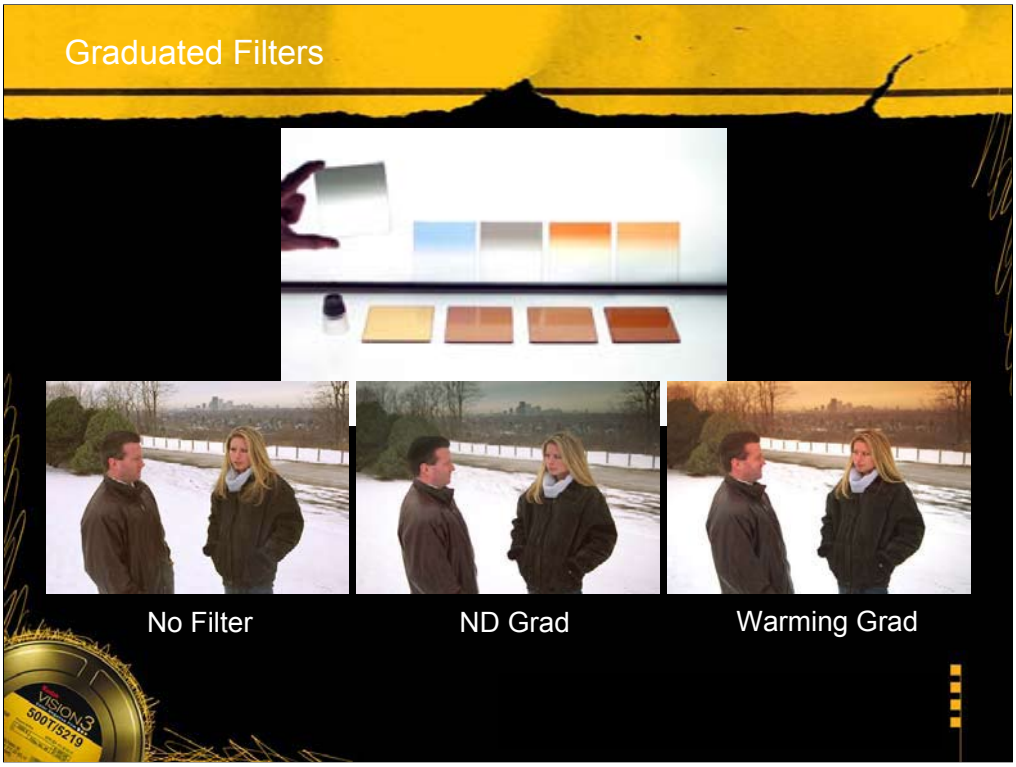
Also available are KODAK WRATTEN Gelatin Filters with combinations of neutral density and color conversion filters (for example, No. 85N3 and 85N6). These filters combine the light-conversion characteristics of KODAK WRATTEN Gelatin Filter No. 85 with neutral densities.

Made from "rare earth" elements, these filters absorb or remove certain narrow bands of color in the spectrum, transmitting the adjacent colors. The resulting effect is an intensifying or enhancing of the saturation intensity of the transmitted colors. This is most evident with red – the adjacent muddy brown and orange colors are absorbed, leaving the purer crimson and scarlet reds emphasized, prominent and exaggerated. Greens are also emphasized, but to a lesser degree.

Enhancing filters are used to emphasize color in a scene, such as fall foliage. They are also useful in bringing out contrast in desert landscapes and aerial panoramas. Skin tones can be affected.



Color filters can change the look or mood of a scene. Certain colors have become standards. Common warming filters include Tobacco, Antique Suede, and Chocolate. The colors usually come in a range of grades, or degrees of saturation, such as Tobacco 1, 2, and 3. Cooling filters include various shades of blue—tropic blue, sapphire blue, storm blue, and other colors, such as grape.



Exterior shots often include a sky that is much brighter than the land below. Graduated filters are used to balance such exposures—the bottom half is clear, the top has color or a neutral gray. The top part absorbs some of the sky light, darkening the sky and balancing it with the land.

The most common graduated or "grad" filter is neutral density. These darken the sky without affecting the color. They can often make blue sky and clouds visible in a scene that would otherwise be burned out (white) by overexposure.

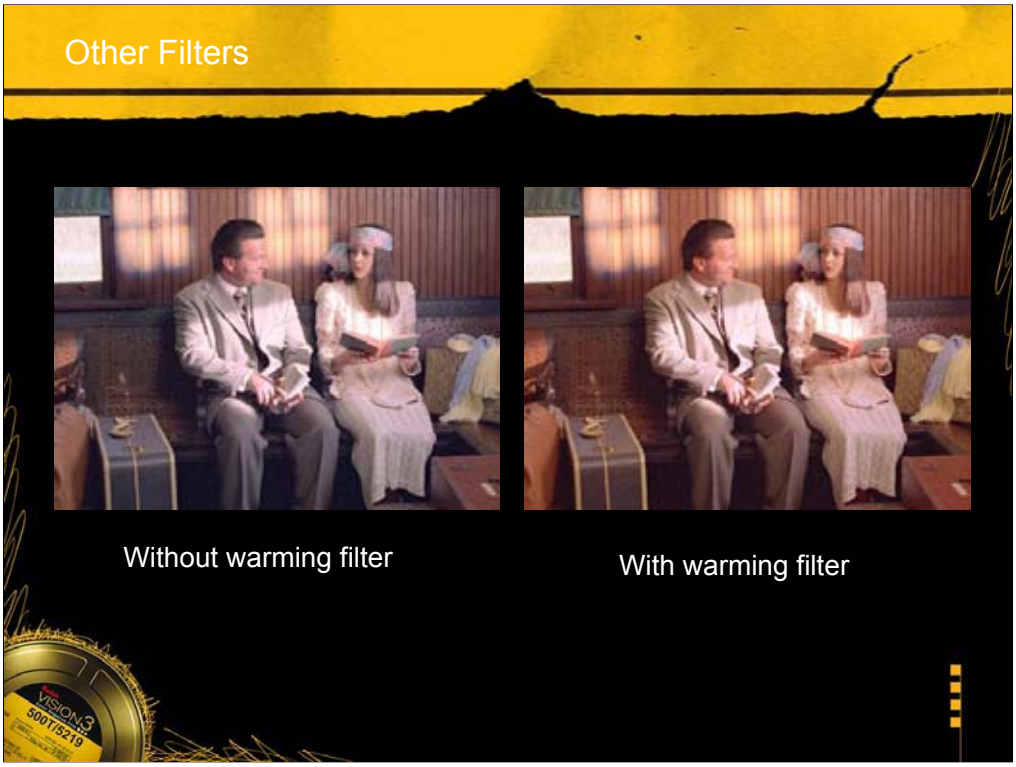
Grad filters are also available in most of the creative colors. Blue grads are often used to enhance the sky in a shot. A blue grad can be positioned over the sky, combined with a tobacco over the desert dunes below, for a saturated, striking effect.

The transitions between the clear and color halves come in three versions: hard, soft, and attenuated. The hard transition makes the full change from clear to full saturation with little or no transition area. This type is used for static scenes divided by a straight line, such as the horizon on the sea. The soft transition has a band in which the color blends smoothly into the clear, allowing the effect to be hidden within the scene. The third type, attenuated, blends density throughout the length of the filter. An attenuator is used for scenes where it's more difficult to hide the grad effect.

Combination color grads use overlapping bands of several colors to create

Color filters are used in black-and-white photography to control the contrast of tones in a scene. In color photography, color creates contrast and differentiates subjects of comparable brightness. Without color, equally bright surfaces may blend together. Color filters, which selectively transmit their own color, and absorb the others, can create tonal differences in an otherwise flat scene. A green filter can be used to separate green shrubbery from surrounding brown hills, for example. The shrubbery will appear lighter than the surrounding browns.

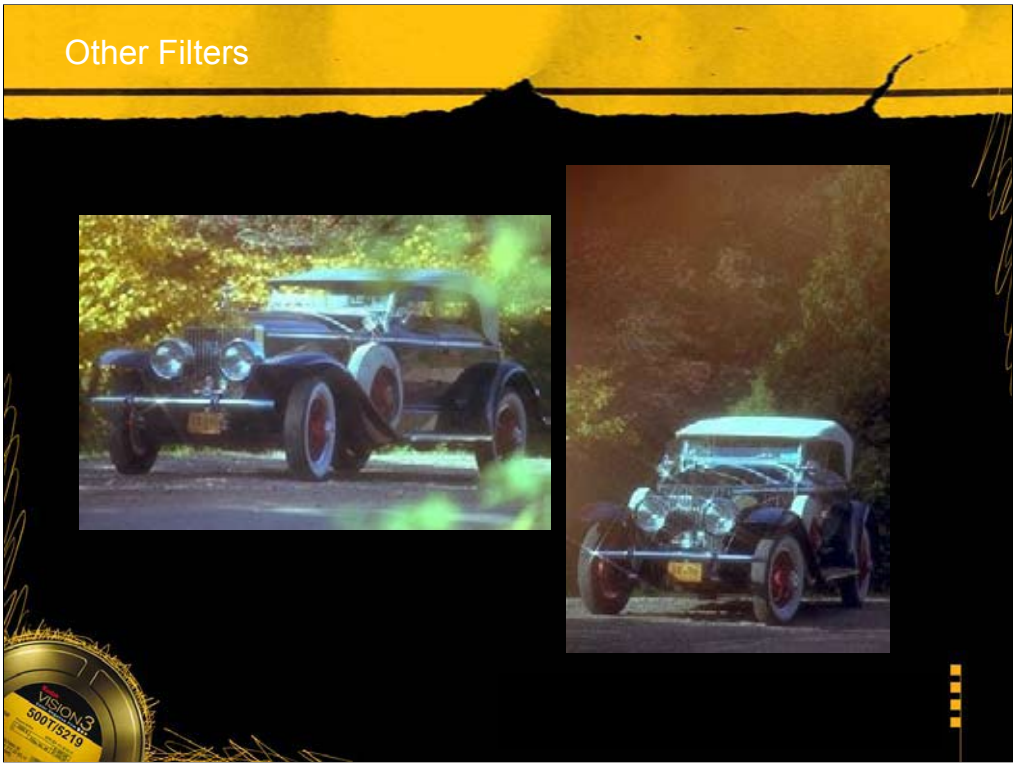
Color filters are often used to darken a blue sky captured on black-and-white film. Most panchromatic films have a higher sensitivity to blue than human perception. In a scene with blue sky and clouds, the film may expose the blue sky as brightly as the white clouds, effectively erasing the clouds. By selectively absorbing the blue with a complementary color filter, the sky darkens and the clouds emerge. A yellow filter (KODAK WRATTEN Gelatin Filter No. 8) will emulate human perception. An orange filter will absorb more blue, making a darker sky, and a red filter will have the strongest effect, making some deep blue skies turn black.



These filters are often used to create various special effects:

A **warming filter** can make a scene more yellow to simulate late afternoon.

A **soft-focus filter** can give the illusion of another time or soften blemishes on skin.



Here's another example. This 1929 Rolls Royce was photographed with a diffusion filter and a star effect filter.

Special effects filters, to provide color bursts, stars, and otherworldly effects are used to color scenes in ways that never occur in the real world.

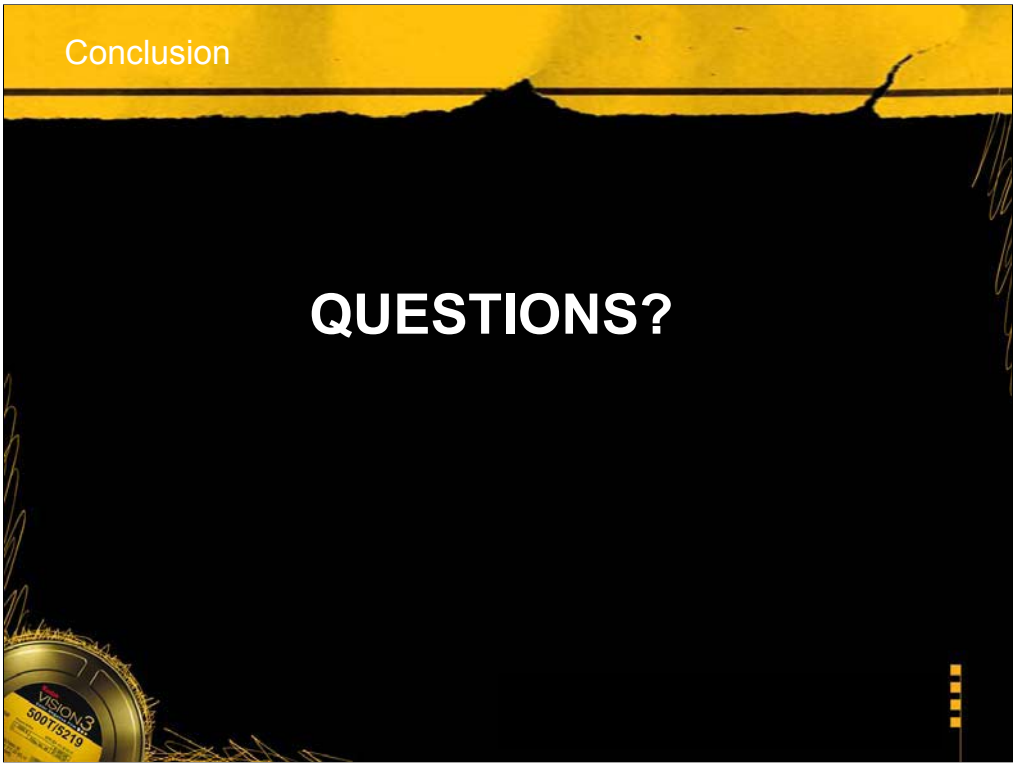
Filters are used to modulate the color and quality of light and are available in many colors. Filter swatch books are used to compare and select filters. Printed information is interleaved with the swatches that typically include filter name, product number, percentage of light transmission, and sometimes a spectral transmission graph that demonstrates the colors or portions of the spectrum transmitted and absorbed.

A number of color filters have been developed specifically for motion picture use, and manufacturers usually differentiate between those and traditional theatrical colors. Theatrical colors are more saturated and often called party gels.

Color lighting filters, or gels, include color correction gels and creative color gels. Color correction gels change light's color temperature according to the cinematographer's needs. Film stocks and lighting are balanced for fixed color temperatures. Filters allow manipulation of a scene's color balance—either the entire image or selected areas within the frame. Creative gels range from subtle tints, which only slightly change the hue of a light, to saturated deep colors that can create striking effects.

After extended use, heat and light fade a gel's color, and the gel should be replaced. The closer the gel is mounted to the lamp, the hotter it gets, and the quicker it fades. Mounting a gel further from the lamp, such as in a frame supported by a C-stand, and allowing air ventilation between the lamp and the gel can extend the useful life span of a color gel.

There are also a number of diffusion filters available for lights that affect the quality of the light from the light.



This concludes the chapter on Filters.