



Rollei R³

A convincing film and development concept for all areas of pictorial
black-and-white photography.

Product information and instructions for use

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Foreword and Rollei's target specifications

As a world-renowned pioneering camera manufacturer, it is one of Rollei's major concerns to make sure that discriminating photographers can rely on an uninterrupted, long-term supply of high-quality monochrome film. In order to create a film that lives up to these expectations, Rollei decided to enter into a joint venture with MACO, the Hamburg black and white specialists. For the purpose of this cooperation, Rollei set forth a number of requirements that would have to be fulfilled by this film. (The order of entries in the following list is arbitrary and has no bearing on priorities.)

- Ensuring B+W film production on a very high quality level.
- Providing special quality parameters that create a genuine alternative to current high-quality films of leading manufacturers.
- Production and quality assurance according to ISO 9001 certification.
- Complete line of 35mm, roll and sheet film.
- Quality assurance at user's end through sensitometric strips.
- PET film support for LE500 (certified by R.I.T., Rochester Institut of Technology), the same film base being used for 35mm and roll film.
- Sheet-film quality so high (PET 175 μm) that the material becomes a viable alternative to glass plates.
- Elimination of well-known flatness problems of PET film base without compromising positive characteristics, such as dimensional stability due to "non-curling" back coating.
- Film support not dyed gray; instead, use of a transparent polyester support.
- For optimum sharpness, the antihalation coating is applied directly below the emulsion.
- To create a film that can replace several materials of different speed, various light-sensitive emulsions are applied with silver-halides of different size. In a process similar to that used for making color film, three emulsions of different sensitivity are coated. In conjunction with suitable developers, these cover the range from ISO 25 to ISO 6.400.
- The top layer is a protective supercoat that shields the material against aggressive photo solutions, above all in reversal processing.
- Extended spectral sensitivity, from ortho to panchromatic, right up to IR.
- Cubic texture of silver halides instead of flat crystals.
- Considerably improved flatness over other PET materials due to "non-curling" coating. Similar to properties of triacetate film.
- No special developer required; good results if processed between ISO 200 and ISO 400 using the general D-76 world standard.
- Well-suited for machine processing at temperatures up to 40°C.
- No special storage temperatures in distribution area or at point of use.
- Highly resistant to temperature fluctuations when used in extreme climatic conditions (desert/Antarctica). No tearing of film support, no frilling of emulsion.

The following companies have contributed to development of the new type of film:

ROLLEI Fototechnic, Braunschweig.

Above all providing technical specifications and supporting the different stages of development by Rollei Quality Control.

MACO PHOTO PRODUCTS, Hamburg/Stapelfed.

Implementation of Rollei's photochemical specifications resulted in an outstanding product, manufactured and quality-controlled in Germany.

TURA, Düren.

By advanced manufacturing techniques and quality control.

The result is ROLLEI R³, a film "Made in Germany".

Characteristics and uses

ROLLEI R³ is a low to high-speed black-and-white negative film of high acutance, based on the use of classical cubic crystals. The film speed actually used is a function of the type of development.

In conjunction with depth developers, optimum results can be attained above all between ISO 25 and 200.

In conjunction with fine-grain compensating developers, optimum results are possible primarily between ISO 100 and 6.400.

ROLLEI R³ is highly responsive to specific developer properties. As a result, the selection of the developer is decisive for adapting the material to individual requirements.

Sensitization goes up to about 710/730 nm, which makes the material SUPER-APOCHROMATIC. Its sensitivity to infrared can be utilized photographically only if a black filter with a cut-off wavelength of 700 nm is employed.

The emulsion of ROLLEI R³ is made up of three extremely thin layers with silver halides of different size and three different degrees of sensitivity. This technology leaves a very wide margin for controlling the properties of the material by suitable selection of developers and development time. As a result, ROLLEI R³ allows the entire spectrum from fine-grain low-speed images (ISO 25/15°) to maximum-speed images (ISO 6400/39°) to be used with considerably better shadow detail and finer tonal rendering than with films pushed the conventional way.

Another specialty of ROLLEI R³ is its antihalation layer that is coated directly on the transparent film base. This results in greater sharpness, since reflections are not allowed to penetrate the film support before being reduced, but are eliminated even before they can enter the base.

ROLLEI R³ is suitable for all kinds of pictorial applications. This applies above all to portraiture, but also to theater and available-light photography.

A new field of application for this type of film is architectural photography. Here, sheet film and very low ISO values are widely used in order to attain extremely high resolution and fine grain.

The film may be processed in many different B+W developers, with a wide margin of control.

The glass-clear material of the PET support makes the material suitable for use as B+W slide film. A special protective SUPERCOAT results in greater resistance to aggressive photo chemicals.

The polyester film support guarantees the highest level of archive stability.

Available sizes

35mm	double perforated, 135-36 + 17 m + 30.5 m	
Sensitometric strips	pre-exposed to ISO 400, complete with reference strip	
Roll film	size 120	
Sheet film	6.5 x 9 cm	50 sheets
	9 x 12 cm	50 sheets
	10.2 x 12.7 cm / 4"x 5"	50 sheets
	13 x 18 cm / 5"x 7"	50 sheets
	18 x 24 cm	50 sheets
	20.3 x 25.4 cm / 8"x 10"	25 sheets
	Roll of 50.8 cm / 20" wide x 10 meters long	

If ordered, any format will be made to customers' orders, for example for panoramic photography, astronomical photography, etc. For details, please contact:

Photo@mahn.net regarding prices, delivery, etc.

Specifications

Sensitization

Super-panchromatic, approx. 380 nm to 710/730 nm

Speed

Standard nominal speed is ISO 200/24° to ISO 400/27°.

Depending on type of development and prewashing.

Effective speed can be varied from ISO 25/15° to ISO 6400/39° by selection of developer and development time.

Film base

35mm film: Polyester, undyed, 100µm

Roll film: Polyester, undyed, 100µm

Sheet film: Polyester, undyed, 175µm

With "non-curling" backside coating to improve flatness.

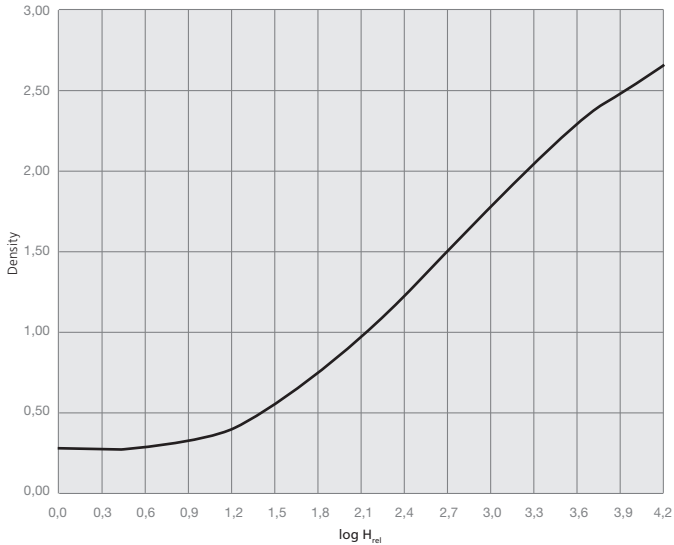
Resolving power

100 lp/mm at nominal speed of ISO 400/27° up to 300 lp/mm at nominal speed of ISO 25/15° and 1:1000 contrast.

Processing

In complete darkness

Characteristic curve



Film storage

As with all light-sensitive materials, it is recommended not to leave the material exposed to direct sunlight, strong heat (e.g. in a car) or high relative humidity. The expiry date printed on the material applies to storage at room temperature of 18° - 22°C. If stored at 8°C, the shelf life of the material will be extended by approx. two years. Material stored at low temperature should be left to adopt the ambient temperature before it is removed from its packing and exposed to ambient air. If the film is much colder than the ambient air, there is a risk of condensation.

Film loading

Important note:

ROLLEI R³ is a super-panchromatic film. In other words, it is much more sensitive to strong daylight than panchromatic films whose spectral sensitivity usually ends around 700 nm. ROLLEI R³ therefore should be loaded in the camera or film magazine only in subdued light, outdoors at least in your own shadow. **Exposed film should be kept exclusively in its black cartridges or in complete darkness**, otherwise the film packed in 35mm cassettes will show gray lateral stripes, while roll film will be exposed through the film leader.

For this reason, films entrusted to a professional laboratory for development should likewise be mailed and kept in their protective cartridges. Since the protective cartridges at least for ROLLEI R³ roll film are undeniably a cost factor, laboratories should be requested to return them to customers.

The polyester film support is much stronger mechanically than normal triacetate bases. As a result, the material exhibits a certain amount of stiffness. **This may cause medium-format roll film to snap open as the tape holding the roll is removed.** This behavior of PET has irritated quite a few photographers who were unaccustomed to this phenomenon from the usual triacetate films. We would like to call your special attention to this behavior because photographers handling their first rolls of Rollei R³ film occasionally see this behavior of modern PET film supports as a disadvantage. Meanwhile, more and more film manufacturers are converting from triacetate to PET film supports, and in a few years' time, this information will probably be common knowledge.

When loading medium-format roll film in your camera, it is therefore advisable not to hold it at the spool ends, but to grip the film roll with moderate pressure in the center.

It should also be noted that undue force exerted when advancing the film (e.g. if you are unaware that the end of the film has been reached) should be avoided at all costs. With triacetate film, this practice – which is not recommendable in any case – will probably result in damage to the film perforation. ROLLEI R³ will not normally tear, i.e. the entire force will act on the mechanics of the camera and might damage the latter.

Exposure and film speed

The film speed given for certain combinations of developer and development time applies primarily to daylight (5400 K). In view of the fact that the material is more sensitive to long-wave (red) light than panchromatic film, its effective speed may be slightly higher with tungsten light or at sunset. If no exposure meter is available, you may use the following approximate values, based on ISO 200/24°, for unfiltered shots. Vary the values accordingly for other film speeds.

It is advisable to bracket the exposure with one f-stop below and one above the given value.

Sunshine in high mountains	1/250 s, f/22
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Beach or snow in bright sunlight	1/250 s, f/22
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Bright sunlight (so-called „Sunny 16 Rule“)	1/250 s, f/16
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Sunshine and low stratus clouds	1/250 s, f/11
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Cloudy, sunshine	1/250 s, f/5.6
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Overcast, open shade	1/250 s, f/5.6
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Exposure metering

“Correct” exposure can be determined by a number of different techniques. It is beyond the scope of these instructions to describe them all.

However, the following hint is of great importance:

In spite of its unique push behavior, an increase in speed will result in higher contrast even with ROLLEI R³. The effective speeds given that are higher than the standard speed of ISO 200/24° therefore call for a suitably fine-tuned metering technique. While standard speeds are determined on the basis of shadow detail, effective speeds are based on mid-tones. Above all when working with increased speed, it is therefore advisable to take a reflected-light reading of the mid-tones (skin tones, medium gray) or to take incident readings. In addition, it is good policy to **bracket the exposure of important shots by an additional one-stop overexposure**, which may also serve to guard against metering errors.

Filter factors

Filters absorb part of the incident light, which is why exposure needs to be longer than in unfiltered shots. The numbers in brackets are the corresponding Wratten designations.

Filter	Increase exposure by factor	Open aperture by steps
Yellow (# 8)	1.5 to 2	1/2 to 1
Deep yellow (# 15)	2 to 3	1 to 1 1/2
Yellow-green (# 11)	2 to 3	1 to 1 1/2
Orange (# 21)	3 to 4	1 to 2
Red (# 25)	4 to 8	2 to 3
Deep red (# 29)	8 to 16	3 to 4

The values given apply to daylight photography.

Tungsten light has a larger red component than daylight. As a result, it is attenuated less by yellow, orange and red filters. In this case, it may therefore be advisable to increase the exposure by a factor of only 0.2 to 0.5 or, alternatively, to open up the aperture by only 1/3 to 1/2 f-stop.

Time exposures and reciprocity

In the case of film, the reciprocity law, according to which the amount of exposure remains constant if the aperture is closed down by one step and exposure time is doubled, generally holds only when exposure times are neither too long, nor too short, usually between 1/2 s and 1/1000 s.

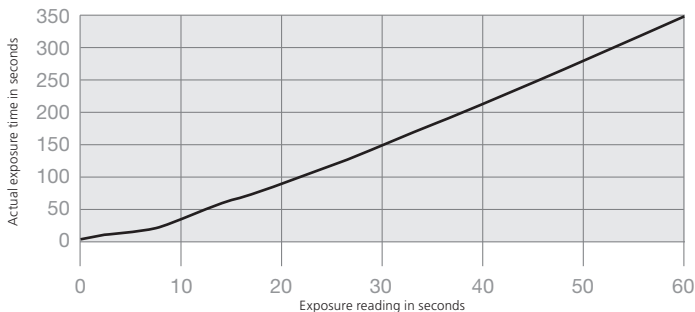
In the case of long exposure times, the so-called reciprocity error or Schwarzschild effect will be encountered. For example, if you obtain a meter reading of 4 s, your exposure should actually be 10 s. The following correction values may serve for general orientation.

Meter reading [s]	Actual exposure time [s]
1	2
2	4
4	10
8	20
15	60
30	150
60	350

For important shots, bracket your exposure with one f-stop over and under. Applying this correction by varying the aperture has the advantage that the correct exposure time need not be recalculated for every exposure.

The reciprocity error results in steeper contrast, since lights require less of a correction than shadows. Films with long-time exposure therefore benefit from compensating development, for example with ROLLEI R³ HIGH SPEED DEVELOPER.

Reciprocity-error diagram



Traveling with film

ROLLEI R³ film is not very critical with respect to storage conditions. It does not require the precautions usually taken for infrared film (cool storage, loading in complete darkness). In general, light-sensitive material should be stored in a cool, dry place.

X-ray checks at airports

No problems should be encountered with airport x-ray machines marked "filmsafe", even in repeated checks (min. up to five times). However, things are different if films are packed in check-in baggage, since this is automatically subjected to higher x-ray doses if it also contains highly absorbent items, such as electronic power-supply units. The higher x-ray dose may then become apparent. It is therefore generally advisable to keep films in your carry-on baggage.

Very high-speed film (from about ISO 1600/33°) is different. Here, veiling and a loss of shadow contrast may occur even at low x-ray doses in "filmsafe" machines. We suggest that you have these films inspected manually.

Film development by professional laboratories

If you do not develop your own ROLLEI R³ film, you may entrust material exposed for ISO 200/24° to any "ordinary" processing outlet. However, over or underexposed material should preferably go to a professional lab. These should be given the corresponding exposure information on the film for optimum development. Photographic laboratories generally use fine-grain compensating developers that are a very good basis for optimum results. If you have a chance to make personal contact with the professional laboratory, request the material to be PRE-WASHED.

Since ROLLEI R³ is a novel type of B+W film, professional labs should be given certain basic information:

- ROLLEI R³ 35mm and roll films should always be kept in their black polyethylene cartridges.
- The films should be removed from their protective cartridges only shortly before loading, keeping in mind that their spectral sensitivity goes above 700 nm.
- Hot drying should, if possible, be avoided.
- We recommend cold drying with a special wetting agent.
- Ordinary wetting agents should be avoided.
- Special wetting agents, such as ROLLEI R³ WETTING AGENT SUPERCONCENTRATE are urgently recommended for polyester film.
- The black protective roll-film cartridges should be returned to the photographer.

Loading film in film-tank reels

ROLLEI R³ 35mm film comes in welded metal cassettes. Unlike conventional triacetate film supports, the polyester support of ROLLEI R³ is much more robust and tear-resistant. It is therefore not generally possible simply to tear off the film trailer from the spool core. When loading ROLLEI R³ in film-tank reels, be it in the darkroom or in a changing bag, scissors must therefore be at hand.

Prewashing

ROLLEI R³ has a water-soluble antihalation layer.

Prewashing is recommended above all for the following two reasons:

Due to the emulsion technology used in ROLLEI R³, prewashing will increase film speed by about one f-stop.

Soaking the gelatine is highly recommended for uniform development. Before development, prewash the film for 30 to 60 seconds in tap water, moving it uniformly but moderately (e.g. one inverting cycle every 2.5 to 3 s).

Water temperature should be the same as that used for development.

Note:

Due to removal of the water-soluble antihalation layer, the wash water will be colored when discarded. This is normal. A single wash cycle, as described above, is sufficient.

Developers and development time

The following development times are approximate and intended only as guidelines for individual optimization. They hold for a gamma of 0.65 that is considered appropriate for diffused-light enlargers.

In view of variations in individual processing technique, the values should be optimized to suit your own personal requirements.

Due to the unique structure of ROLLEI R³, the developer has a strong effect on film speed, grain and acutance.

Proper selection of developer and development time allows control of effective film speed over a previously unknown wide range.

ROLLEI R³ is particularly well-suited for low-light photography.

With proper processing, the effective speed of the material can be pushed up to ISO 6400/39° and more. This will inevitably result in coarser grain. The diagram at the bottom illustrates the development times for ROLLEI R³ HIGH SPEED DEVELOPER in graphical form and allows the derivation of intermediate values.

The following developers are highly recommended:

Desired effect	Developer
Finest grain and optimum tonal rendering	ROLLEI R ³ LOW SPEED
Highest film speed, optimum sharpness	ROLLEI R ³ HIGH SPEED
Standard for good image quality and normal speed	Any commercial fine-grain compensating developer

This is where the special features of ROLLEI R³ come in.

By proper choice of the developer, the user has unprecedented control over the result.

Experience has shown that photographers' first trials of Rollei R³* frequently were unsatisfactory.

This is why we would like to provide some basic information directed at both photographers and darkroom technicians:

The new ROLLEI R³ is a **multilayer film**. It therefore calls for comparatively strong exposure if it is to be processed in a professional laboratory instead of by the photographer.

In "home" processing, **prewashing** is essential.

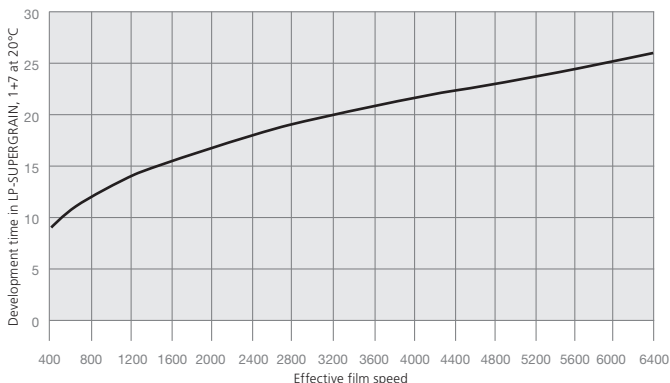
ROLLEI R³ will give unsatisfactory results if **development** was **too short in relation to exposure**.

The following should therefore be noted:

Too short a development will give rise to very coarse grain and very thin negatives – in short, an unsatisfactory result.

If development was – within certain limits – too long, however, no photochemical drawbacks will be encountered, except perhaps for steeper gradation and, as a result, minimization of the extremely rich tonal rendering.

Development-time diagram



* even if well-experienced

Development-time table

Unless otherwise noted, the development times suggested apply exclusively in conjunction with the prewash suggested and inverting cycles of 30 s.

Developer	Meter set to ISO	Min. development time in minutes
Rollei R ³ HIGH SPEED 1+7	100	9 – 13
	200	10 – 14
	400	11 – 14
	800	14 – 18
	1.600	18 – 22
	3.200	23 – 26
	6.400	29 – 32
Rollei R ³ LOW SPEED 1+4	25	20 – 22 (24°C)
	50	21 – 23 (24°C)
	100	22 – 24 (24°C)
	200	23 – 25 (24°C)
Kodak D-76™	200	10
	400	14
Kodak HC-110™ Dil. B	400	14
Kodak Xtol™ 1+2	200 to 400	24 – 29
Ilford ID-11	400	14
Ilford Perceptol	200	14
Champion Promicrol 1+14	400	14
	400	10 (24°C)
	1.600	21
	1.600	15 (24°C)
Champion Promicrol 1+9	400	10
	400	6.5 (24°C)
	1.600	14
	1.600	9.5 (24°C)

Temperature and processing time

To obtain consistent results, it is generally advisable to run all processes at the same temperature, usually 20°C. Should it become necessary to use type D76 or ROLLEI R³ HIGH SPEED developer at a different temperature, use the correction values below, unless other data are available.

20°C	No correction
21°C	- 5%
22°C	- 10%
23°C	- 15%
24°C	- 20%
25°C	- 30%

Stop bath

It is the primary purpose of a stop bath to neutralize alkali carried over by the film, in order to prevent the fixing bath from losing its effectiveness due to a growing pH value. When processing film, a stop bath between the alkaline developer and acid fixing bath is not absolutely required.

The following recommendations apply if you use a stop bath

Stop bath	Dilution	Soaking time in minutes
LP-CITRIN	1+19	1
LP-Citrodur	1+16	1
LP-ECOSTOP	1+7	1

If no acid stop bath is used, rinse 2x 30 s at 20°C under constant movement in order to prevent contamination of the fixing bath by residual developer.

Fixing

We recommend ROLLEI R³ HIGH ENERGY FIX 1+7 to 1+9, an advanced high-performance fixing bath on an ammonium-thiosulfate base.

It is advisable to determine fixing time before the actual process with the aid of a clearing test on a piece of undeveloped film (e.g. the leader). To do this, immerse the piece of film in the solution and measure the time it takes to clear completely.

If the fixing bath is used several times, clearing will take longer with the number of films processed. When the clearing time reaches twice the value of a fresh bath, the solution should be discarded and a fresh bath used.

The two-bath method is the most effective way of fixing. In this, two fixing solutions are prepared and stored in separate containers. The film is first fixed in bath 1 for half the time determined.

Then, bath 1 is returned to its container and the film fixed once more for the same time in bath 2. When a clearing test shows that bath 1 is exhausted, it should be discarded and replaced by bath 2, and a fresh bath 2 should be prepared. This method ensures optimal utilization of the capacity of the fixing bath combined with positive fixing.

If clearing time is not measured, a fixing time of three minutes at 20°C is recommended for a fresh fixing bath.

Washing

The use of running tap water for washing is advisable only if a constant temperature of approximately 20°C is guaranteed. With normal house taps this is not generally the case. A more economical and safer approach then consists in cascade washing with water of approx. 20°C. The following cycle is recommended:

- Step 1.** Fill tank with water of 20°C, invert five times, leave to stand for 5 min.
- Step 2.** Change water, invert 10 times, leave to stand for 5 min.
- Step 3.** Change water, invert 20 times, leave to stand for 5 min.
- Step 4.** Pour out water, ROLLEI R³ WETTING AGENT superconcentrate.

Note:

After the first two rinses, the wash water usually appears colored. This is due to the residue of the antihalation layer.

Wetting agent

Finally, a wetting bath should be used. This should be prepared with distilled water to avoid drying marks due to hard water and static charging of the film. The latter will attract dust particles.

We recommend ROLLEI R³ WETTING AGENT 1+1.000, to be applied one minute without movement (to avoid foaming, see below).

The wetting agent should not be overdosed. It can be used several times only if several films are processed one directly after another.

Foam does not clear the film surface easily. This is why water should be added to the wetting agent only slowly to avoid foam generation. It is helpful to prepare the wetting bath together with the developer. Any foam generated during mixing will then have time to disintegrate while the film is being processed.

Drying

The use of squeegee tongs is discouraged because it tends to scratch the film. After the wetting bath, with the film still in the tank reel, try to shake off as much water as possible from the film surface. Then remove the film from the reel and hang it up to dry in a dust-free place for several hours, e.g. overnight. Attach a weighted film clip to its bottom end for better flatness.

Note: During long-term storage under unfavorable conditions, the popular cellulose-triacetate supports tend to shrink (right up to peeling of the emulsion) and to disintegrate. The Image Permanence Institute has proved that in the case of storage in a humid, hot place serious damage is possible after only five years. By contrast, there is no such risk with polyester supports.

Polyester (PET) is highly resistant to environmental effects, dimensionally very stable and mechanically more robust than cellulose triacetate. However, polyester supports tend to preserve the curvature they are given during manufacturing, unless they are weighted down during drying. This is why roll films with a polyester base should be maintained under tension with a weighted clip for several hours. If normal weights (even up to several kilograms) are used, there is no risk of tearing of roll film. However, make sure the film is safely suspended, but do not use clips perforating the film because these holes might tear.

If a drying cabinet is used, keep its heater turned off. Use of a hair dryer is not recommended, since these tend to blow dust particles onto the film, which will embed themselves in the moist film surface and can hardly be removed without damage to the film.

Enlargement

(Detailed information on the combination between film and developer)

Enlargements made from ROLLEI R³ film are particularly outstanding due to the unique emulsion characteristics of the material.

We should distinguish between optically **extremely acute** and **extremely fine-grain** negatives.

Let us start with depth developers:

Developers such as Ilford Perceptol, Kodak X-TOL, LABOR PARTNER CUBE XS, MOERSCH TANOL or ROLLEI R³ LOW SPEED in combination with STRONG EXPOSURE will give fine-grain results extremely rich in tonal values, above all between ISO 25 and 200.

The grain itself (used, for example, for pictorial effect) is extremely fine, depending on the characteristics of the developer used. The supply of TECHNICAL FILMS may be expected to be limited in the years to come so that it is worth checking in how far ROLLEI R³ film may be used as a successor to these materials. It may well be that the aforementioned developers do not always produce the desired results. We therefore would like to call your attention to the special LABOR PARTNER LP-DOCUFINE LC developer. This combination has already given outstanding results in astronomical, architectural and many critical scientific applications.

SCANNING: These negatives give results of outstanding fine grain when scanned.

However, when these film negatives processed with depth developers are blown up with conventional analog techniques, there may be an undesirable side effect: The gradation of the photographic paper has to be biased for HIGH CONTRAST to prevent shadows from blocking up and the enlargement from looking flat and without depth.

This corrective action will result in a reduction of tonal detail.

Consequently, if you are more interested in sharply defined grain, you should prefer fine-grain compensating developers. However, here too there are noticeable differences. Not necessarily quality differences, but differences of a purely creative nature.

Photographers using ROLLEI R³ film for the first time have complained about the "hard grain". This will appear above all if ROLLEI R³ HIGH SPEED developer is used. By direct comparison with KODAK D-76, it is acutance that is enhanced.

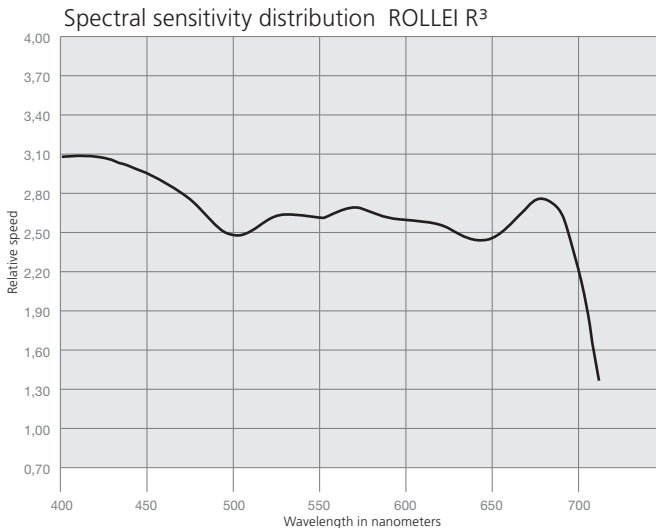
Photo-murals based on a technology such as KODAK D-76 tend to show a finer silver-halide grain with a softer edge. On the other hand, photo-murals based on a technology such as ROLLEI R³ HIGH SPEED exhibit a silver-halide grain of greater acutance with a considerably sharper edge.

These negatives cannot be scanned with so fine a grain. But they are ideally suited for even very large analog enlargements. Here it is not the hard gradation that has to provide "crispy" images – acutance alone is quite enough. Although these enlargements reveal their true grain if viewed from a short distance, they convince from a normal viewing distance by their clearly better tonal rendition!

This is a matter of taste, of the individual perception of the photographer.

Unlike in conventional film, in which these characteristics are generally given with only a minimum margin of control, ROLLEI R³ film opens up a host of individual creative effects.

Sensitization



Scanning negatives

Its transparent film support predestines ROLLEI R³ for scanning in film and flat-bed scanners with a transmitted-light adapter. In principle, you should proceed as described below to make optimum use of the wide density range of the film and its outstanding tonal rendition. For procedural details, please consult your scanning software.

- Prescan your negative. Adjust the scanning area so that the unexposed edge is excluded. This will exclude unexposed parts of the negative so that the effective density can be well distributed over the available pixel range. If the edge of the film is to be included in the scan as part of the picture, it may later be included again in Step 3, after exposure has been set. It is then probably reproduced black in the scan.
- Adjust resolution and color mode. Unless a small file is desired for special reasons, best results are normally achieved with maximum resolution. This also holds for gray-value resolution: If your scanner is capable of generating 16bit files (or higher), use that option. Any reduction of resolution – be it optical or in tonal values – should be applied only in the last step, i.e. immediately before output.

Some photographers opine that B+W negatives should also be scanned as color negatives, with the conversion to gray values being made only with the editing software.

- Use the preview histogram to adjust exposure and contrast of your scanner so that the effective density range is distributed over the range of available pixels (e.g. 0 ... 256 in 8bit files). This will exclude the density range not used in the negative (densities below basic veiling and above the highest density used in the negative) so that the available range of pixels is optimally utilized for good tonal rendition. This step is important although your editing software will allow certain adjustments, because a marked increase in contrast in your editing application may produce peaks and gaps in the histogram that can become apparent in the finished picture due to posterization and color fringes. It is not advisable to use fine adjustments in your scanner software. These should preferably be made in your editing software that generally offers a larger monitor image and higher color fidelity.
- Scan your negative with these settings.

Please note that image-cleaning and repair functions (correction of dust and scratches) on the basis of infrared scans do not work with silver-halide negatives. These functions were developed for color film and can be used in B+W photography only with chromogeneous film because they require the image to be transparent to infrared – a fact that is not given in silver-based negatives.

Unsharp masking should be avoided when scanning because it tends to increase graininess. If you wish to use the Unsharp Masking function, use it in your editing software where it can be more finely adjusted.

Using test strips

Test strips are a precise tool helping users to control exposure and development. A test strip is an undeveloped sensitometric wedge with defined exposures.

The code given for the different test strips stands for the amount of pre-exposure.

Code G5CBA means:

- Exposure with sensitometric daylight
- Basic illuminance 160 lux
- Exposure time 0.02 s
- Exposure steps with 0.15 density

Exposure steps of 0.15 means that starting with a density of 0.20 exposure in every following step was 0.15 density less. Light attenuation of 0.15 density is equivalent to a reduction of luminous flux by the factor $\sqrt{2} \approx 1.414$. In other words, exposure from one step to the one following the next is reduced to one half.

Density D has the following relationship with light transmission TAU:

$$D = \log (1/\text{TAU})$$

Thus the following exposures result for the different fields:

1 st field:	2.02 lux seconds (lx s)
2 nd field:	1.43 lx s
3 rd field:	1.01 lx s
4 th field:	0.717 lx s

etc.

The strip contains 30 pre-exposed steps. For easier orientation, there is a small bright line after step 16.

A comparative analysis of the strip allows conclusions to be drawn as to gradation and speed. A brightness shift on the wedge by one step is equivalent to a speed difference of ISO 1.5°.

