

## TECHNICAL INFORMATION

# MULTIGRADE RC EXPRESS PF

VARIABLE CONTRAST, BLACK AND WHITE PAPER  
SPECIALLY DESIGNED FOR HIGH SPEED PRINTING APPLICATIONS

ILFORD MULTIGRADE RC Express PF is a high speed, variable contrast, black and white photographic paper on a 190g/m<sup>2</sup> resin coated base. It is specially designed for high speed printing applications, where automatic and semi-automatic printers, printer-processors and minilabs are used.

**Fast printing**

The sensitivity of MULTIGRADE RC Express PF is optimised for very short exposures, which ensures high printing throughput.

**Bright white base tint**

The preferred base tint of most users.

**Cool image colour**

The preferred image colour for most photofinishing applications, giving more customer acceptable prints first time.

**Sharp images**

The bright white base tint and cool image colour enhances the sharpness of many subjects.

**Excellent gloss**

Superb results with all drying methods.

**High productivity and easy to work with**

MULTIGRADE RC Express PF has excellent reciprocity characteristics. This means that its speed, contrast level and range are maintained at very short exposures. In particular, MULTIGRADE RC Express PF maintains a good maximum contrast.

**Good prints from over- and under-exposed negatives**

The contrast level and wide contrast range of MULTIGRADE RC Express PF deals with most under- and over-exposed negatives.

**Very high levels of first-time-acceptable prints**

The combination of cool image colour, bright white base tint, excellent gloss, enhanced sharpness and the contrast level and range of MULTIGRADE RC Express PF gives prints with punch and sparkle, even from less-than-ideal negatives.

**Good latent image stability**

MULTIGRADE RC Express PF gives good print-to-print consistency during production.

**Robust**

MULTIGRADE RC Express PF is very robust. It is highly resistant to physical damage during printing and processing.

**Long lasting prints**

MULTIGRADE RC Express PF is very resistant to the effects of atmospheric pollution on unprotected images.

**Compatible**

MULTIGRADE RC Express PF is compatible with all conventional black and white exposing and photofinishing equipment found in professional labs. It is suitable for printing all black and white negatives, including chromogenic negatives, such as ILFORD XP2 SUPER.

**Technical support**

Process control and technical support are available to help you use ILFORD products in your equipment.

**Product range**

MULTIGRADE RC Express PF is available in the full range of rolls in 1M glossy and 44M pearl. Rolls are mostly supplied EO (emulsion out), but EI (emulsion in) are also available. Roll sizes include widths from 8.9cm up to 25.4cm (3½–10in), and lengths from 76m to 400m (250–1315ft). A range of mural and cut sheet sizes are also available.

**Bulk quantities for large volume users**

For large volume users, a complete bulk delivery package is available of MULTIGRADE RC Express PF paper in sacks, along with film processing and paper processing chemicals in 25 litre drums and 205 litre barrels.

## **OVERVIEW OF PRINTING MACHINES**

The main objective of machine printing is to get as many acceptable, saleable prints as quickly as possible, from a wide range of negatives using a first time exposure.

Most printers used for black and white are usually appropriately modified colour printers. They are converted for black and white printing by using dedicated black and white software programmes, sometimes in association with hardware changes. Some colour printers can give limited performance without modification, and some printers are designed specifically for black and white printing.

Although printers vary considerably in their specification, their principles of operation are very similar. To get the best from MULTIGRADE RC Express PF paper, the user must know the type of system they have, and calibrate the printer according to the manufacturer's instructions.

Overall, printers divide into two broad groups: automatic printers and semi-automatic printers.

### **Automatic printers**

Automatic printers need minimal operator intervention, once they have been calibrated and set up for the production run. They measure each negative for density and contrast, and automatically adjust the duration and colour of the exposing light to produce an acceptable print. They have fully automated and synchronised negative and paper transport systems.

### **Semi-automatic printers**

Semi-automatic printers measure each negative for density, but not for contrast, and automatically adjust the exposure to produce a print of acceptable density. The contrast for each print is selected by the printer operator from a range of pre-calibrated buttons. The contrast of each print depends on the operator's judgment of the negative, their print contrast preferences and the calibration of the button used. The paper transport is normally automatic, but the negatives are often moved by hand.

Semi-automatic printers include small stand-alone printers, printer enlargers, combined printer processors and printer enlarger processors. The processing function does not add any complexity to the printing function.

**HOW MULTIGRADE PAPERS WORK** Black and white variable contrast papers are sensitive to both blue and green light. The print contrast is changed by varying the balance of blue and green light in the exposure. When more blue light is used, the contrast becomes harder. When more green light is used, the contrast becomes softer.

Variable contrast papers are usually more sensitive to green light. Therefore exposures using green light are usually shorter than those using blue light. Minimum exposure (and hence maximum printing speed) is achieved with no filtration, that is, with white light.

### **LIGHT SOURCES**

MULTIGRADE RC Express PF is designed for use with tungsten or tungsten halogen light sources. These are the light sources most commonly used in printer systems. Although alternative light sources are rarely used, MULTIGRADE RC Express PF can also be exposed with cold cathode (cold light) light sources designed for variable contrast papers. Other cold cathode (cold light) and pulsed xenon light sources may give a reduced contrast range.

### **EXPOSURE CONTROL IN PRINTERS**

During use, the light source in a printer is normally on constantly. Many printers have multi-lamp heads to decrease exposure times. Exposure is controlled by a combination of lens aperture, shutter and filters. The lens aperture is normally fixed, but can be adjusted if necessary. The shutter normally has no manual controls. The filters are often not fixed, and can move through the light path, so part of the exposure can be unfiltered, that is to white light. Using moving filters and white light enables exposures to be very short, for example, in the region of 50 milliseconds for a 'normal' negative.

The exposure given to a negative is linked mainly to its density, but contrast also has an effect. The higher its density is, the longer the exposure needs to be. The lower its contrast is, the longer the exposure needs to be: this is because the exposure is made with mainly blue light – see 'How MULTIGRADE papers work'. The connection between exposure and contrast is controlled by the calibration of the printer's software.

### **CONTRAST CONTROL IN PRINTERS**

MULTIGRADE RC Express PF can give a wide contrast range with most printers. This ensures it can print with ease a wide variety of negatives.

The contrast range and grade spacing achieved with individual printers depends on several factors. These include the filter type, the filter characteristics, the software program and the care taken to calibrate the printer. Please refer to the instructions supplied with your printer. Contrast is also referred to as slope, gradation or gamma by printer manufacturers.

There are two filter systems used in colour printers: subtractive (cyan, magenta and yellow) and additive (red, green and blue). Subtractive is the most common. The filters used to expose black and white variable contrast paper are either yellow and magenta or blue and green. General purpose black and white variable contrast papers have no sensitivity to cyan or red light. Whichever filter system is used, the light used to expose the paper is always a combination of blue and green light.

The software controlling contrast is in two parts: the film channel data and the paper channel data. Changes in contrast are made by changing the balance of blue and green light. This is controlled by a combination of the data set in the film channels and the paper channels.

### **GETTING THE BEST RESULTS WITH MULTIGRADE RC EXPRESS PF**

The appearance and quality of the finished print and the productivity of the printer depends on the data that has been entered in its film and paper channels.

The film channel data defines the density characteristics (and the contrast characteristics with automatic printers) of a film or group of films and the adjustments that are needed to produce a 'normal' print from a range of exposures. The paper channel data defines the speed characteristics (and the contrast characteristics with automatic printers) of an individual paper, as well as the print size (enlargement), crop (magnification) and paper surface (eg, glossy or pearl).

### **Automatic printers**

In automatic printers, each negative is measured for density and contrast. These measurements are compared with the parameters set up in the film and paper channels, and the exposure and contrast are set automatically.

Automatic printers are often set to cope with a film exposure range of -3 stops to +5 stops. The data needed to do this is determined by practical picture testing, and for best results, this should be carried out with films processed by the lab's own film processing systems. With some software, the film channel data can be refined to compensate for certain types of negative, for example, flash shots, snow scenes, dominant sky, blank negatives, totally exposed film etc. Correct set up of the film channel data can enhance productivity greatly.

The paper channel data defines the speed and contrast characteristics of an individual paper. Again, the data needed to do this is determined by practical picture testing.

The basic method of setting up an automatic printer is to start with 'normal' negatives and adjust the film and paper channels to produce acceptable prints with reasonable exposure times. Prints are then made from a series of known under-

and over-exposed negatives with adjustments made to the film channel to produce an acceptable print from each of these less than ideal negatives.

The above process must be repeated for each combination of film and paper channels used. However, this process can be speeded up because most software allows data to be copied between channels. To complete the printer set up, production runs should be made and monitored. The film and paper channel data is then adjusted according to the print results seen during production.

### **Semi-automatic printers**

The basic method of setting up a semi-automatic printer is to start with 'normal' negatives and adjust the film and paper channels to produce acceptable prints with reasonable exposure times. By changing the software data, each contrast button is adjusted to have a different combination of blue and green light. If this is done correctly, when a 'normal' negative is printed using each button in turn, the result should be a set of matched density prints, that have evenly spaced contrast steps from soft to hard.

Once this has been established, the printer operator can choose the appropriate contrast button to produce a 'normal' print from a wide range of negatives.

**EXPOSURE CONTROL IN ENLARGERS**

MULTIGRADE RC Express PF can be exposed in most enlargers.

**ISO speed**

The speed of MULTIGRADE RC Express PF depends on the filtration used during exposure.

MULTIGRADE RC Express PF unfiltered has a paper speed of ISO P640.

**ISO paper speed**

MULTIGRADE RC Express PF paper and MULTIGRADE filters

---

Setting	00	0	1	2	3	4	5
Speed (P)	250	—————	—————	—————	250	125	125

---

The above values are representative of those obtained when machine processing the paper to ILFORD recommendations.

**CONTRAST CONTROL IN ENLARGERS**

When using an enlarger, contrast is controlled by using MULTIGRADE hand filters, the MULTIGRADE 600 equipment, other MULTIGRADE equipment, variable contrast enlarger heads or colour enlarger heads.

The twelve MULTIGRADE filters are numbered 00–5 in 1/2 steps, with the lowest filter number corresponding to the softest contrast. The exposure time for filters 00–3 1/2 is the same; that for filters 4–5 is double.

The ILFORD MULTIGRADE 600 professional exposing system replaces the standard lamphouse on the most popular professional enlargers, and controls the exposure and contrast. The control unit, power supply and probe complete the system.

**Contrast range**

The contrast range of MULTIGRADE RC Express PF paper extends to seven full grades of contrast, sufficient to cater for most under- and over-exposed negatives. This contrast range is maintained at very short exposure times.

The chart gives the ISO range figures (ISO standard 6846 – 1992) for MULTIGRADE RC Express PF. These figures give a guide to selecting the appropriate paper contrast for a given effective negative density range.

MULTIGRADE RC Express PF unfiltered has an ISO range of R100.

**ISO range**

MULTIGRADE RC Express PF paper and MULTIGRADE filters

---

Setting	00	0	1	2	3	4	5
Range (R)	180	160	120	100	80	60	50

---

The above values are representative of those obtained when machine processing the paper to ILFORD recommendations.

ISO range figures may be helpful if there is some means of measuring the effective density range of the image as projected on the enlarger baseboard – such as with a photometer. As an example, for a negative with an effective density range of 1.02 log exposure units, multiply this figure by 100 and choose the nearest ISO range figure from the table – in this case 100. Try printing this negative with MULTIGRADE filter 2 on MULTIGRADE RC Express PF paper.

**MACHINE PROCESSING**

MULTIGRADE RC Express PF paper can be processed in all conventional machines for black and white resin coated papers. It is not suitable for activation type processing.

Most black and white paper processors are of either the roller transport or leader belt type. MULTIGRADE RC Express PF is fully compatible with both types. Many larger processors use a hot air drying system. MULTIGRADE RC Express PF glossy paper has an excellent gloss finish with this type of dryer.

ILFORD 2000RT chemicals are recommended for processing MULTIGRADE RC Express PF paper, but all conventional black and white machine processing chemicals can be used.

**Note** Photographic chemicals are not hazardous when used correctly. Always follow the health and safety recommendations on the packaging. Photochemicals material safety data sheets containing full details for the safe handling, disposal and transportation of ILFORD chemicals are available from ILFORD.

**ILFORD chemicals**

ILFORD 2000RT developer/replenisher and ILFORD 2000RT fixer/replenisher are designed for machine processing ILFORD and all quality photographic papers. They are supplied as liquid concentrates and are diluted 1+4 to make tank or replenisher solution. They are commonly available in 5 litre units and 2x5 litre packs. Larger sizes are available.

For large volume users, a complete bulk delivery package is available of MULTIGRADE RC Express PF paper in sacks, along with film processing and paper processing chemicals in 25 litre drums and 205 litre barrels.

**Setting up processors**

The time/temperature table below is a guide to setting up processors for MULTIGRADE RC Express PF paper using ILFORD 2000RT developer/replenisher and ILFORD 2000RT fixer/replenisher. The processing time and temperature should be checked in the processor. For further guidance, contact your local ILFORD company or distributor.

**Suggested development times**

The preferred temperature range is 20–30°C/68–86°F. These suggestions are only a guide.

Temperature (°C/°F)	Development time (sec) including transfer time to next tank
20/68	46
25/77	32
30/86	22
35/95	15
40/104	12

These times are for replenished systems with a solution life of up to three months. Replenishment rates will vary with processors, but a guide for developer replenishment is 150–250ml/m<sup>2</sup> (14–23ml/ft<sup>2</sup>) of paper processed. The development times are also for non-replenished systems, with a maximum solution life of seven days.

**Suggested fixing times**

The same times and temperatures as for development can be used for fixing. The actual fixing time, however, is shorter, and 20 seconds is ample above 20°C/68°F. These recommendations are suitable for both replenished and non-replenished systems. In replenished systems, the replenishment rates will vary with processors, but a guide for fixer replenishment is 300–450ml/m<sup>2</sup> (28–41 ml/ft<sup>2</sup>) of paper processed. For non-replenished systems, the maximum paper throughput is 4m<sup>2</sup>/l (44ft<sup>2</sup>/US quart) of working strength solution. The maximum silver concentration in the fixer bath can be 4–6g/l.

**Note** If fixing is not complete, then adequate washing is impossible.

**Washing times**

The efficiency of the wash and water consumption depends on the processor design and water temperature. As a general rule, wash for at least 15 seconds at temperatures above 5°C/41°F.

**Hot air drying**

Use temperatures up to 85°C/185°F.

**ILFORD processors**

ILFORD 2000RT developer/replenisher and fixer/replenisher are recommended for use with all ILFORD black & white paper processors.

For a moderate throughput of cut sheets, the ILFORD ILFOLAB 2150RC table-top processor is recommended. Dedicated ILFORD 2150XL developer and fixer kits are recommended for use with this processor.

### **DISH/TRAY PROCESSING**

MULTIGRADE RC Express PF can be processed in the same way as other resin coated papers. The recommended ILFORD chemicals are ILFORD MULTIGRADE developer, ILFORD ILFOSTOP PRO stop bath and ILFORD RAPID FXER or ILFORD HYPAM FIXER. Processing details are supplied with the chemicals.

### **AFTER PROCESS TREATMENTS**

MULTIGRADE RC Express PF responds in the same way as other resin coated papers to the usual techniques of toning, chemical reduction and retouching. It can be mounted using the standard techniques for resin coated papers.

### **PRINT FINISHING**

MULTIGRADE RC Express PF is compatible with all machines, processes and techniques normally used to cut and pack photographs.

### **SAFELIGHT RECOMMENDATIONS**

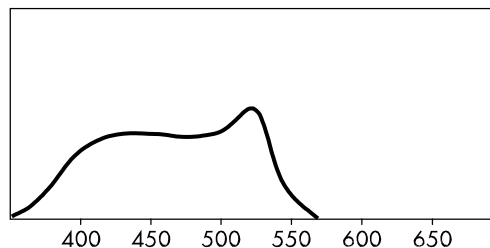
MULTIGRADE RC Express PF can be used with most common safelights for black and white papers. The ILFORD safelights are especially recommended as they generally allow darkrooms to be brighter, but completely safe, for MULTIGRADE RC Express PF and many black and white papers.

ILFORD safelights are the ILFORD SL1 darkroom safelight or the ILFORD 902 (light brown) safelight filter fitted in a darkroom lamp (for example, the ILFORD DL10 or DL20). A 15W bulb is recommended with these safelights.

For direct lighting, do not expose the paper to the safelight for more than 4 minutes, and the distance between the paper and the safelight should be a minimum of 1.2m/4ft.

Other filters can be used, for example, the Kodak OC and the Agfa-Gevaert G7, or the Philips PF710 safelamp.

### **Wedge spectrogram to tungsten light (2850K)**



Wavelength (nm)

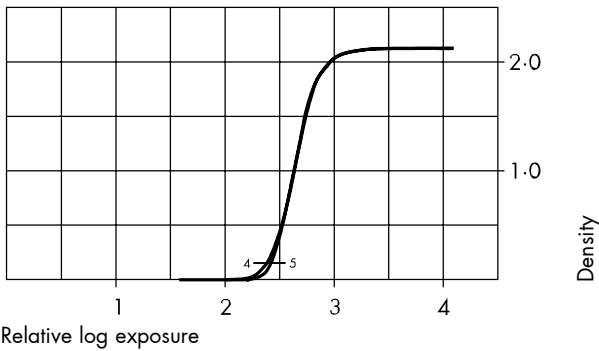
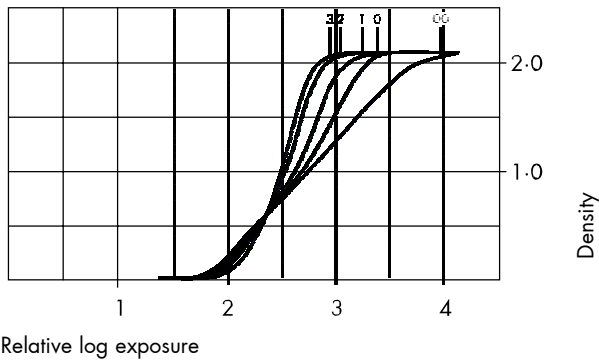
### **RECIPROCITY**

All photographic papers lose speed and contrast at exposures that are very short (less than 1 second) and very long (more than 100 seconds). MULTIGRADE RC Express PF is designed to be used in high speed exposing systems with very short exposures. Speed and contrast loss is minimised at exposures below 1 second.

### **LATENT IMAGE STABILITY**

No significant change in picture quality will be seen when MULTIGRADE RC Express PF is left for 24 hours after exposure and before processing. This helps to ensure consistent print quality from one end of the paper roll to the other.

**CHARACTERISTIC CURVES**



MULTIGRADE RC Express PF glossy or pearl paper exposed with MULTIGRADE filters 00, 0, 1, 2, 3, 4 and 5. Developer: ILFORD 2000RT in the ILFORD ILFOLAB MG 2650 processor.

**STORAGE**

**Unprocessed paper**

Store unused MULTIGRADE RC Express PF paper in a cool, dry place in its original packaging. Avoid conditions of high temperature and/or high humidity. MULTIGRADE RC Express PF will keep in excellent condition for up to three years when stored as recommended.

**Prints**

MULTIGRADE RC Express PF prints which have been processed as recommended in this leaflet will have a more than adequate storage life for most purposes.

MULTIGRADE RC Express PF is resistant to the effects of atmospheric pollution on images. However, print life will be shortened in some adverse storage conditions, or if the print is exposed to oxidising gases.

It is recommended that prints made for long term display are toned or laminated to protect them from the oxidising gases that are found in many environments.

A wide range of fact sheets is available which describe and give guidance on using ILFORD products. Some products in this fact sheet might not be available in your country.

**HARMAN technology Limited**, Ilford Way,  
 Mobberley, Knutsford, Cheshire WA16 7JL, England  
[www.ilfordphoto.com](http://www.ilfordphoto.com)