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Training Manual

:Anapurna

printing White Ink

AGFA

Contents

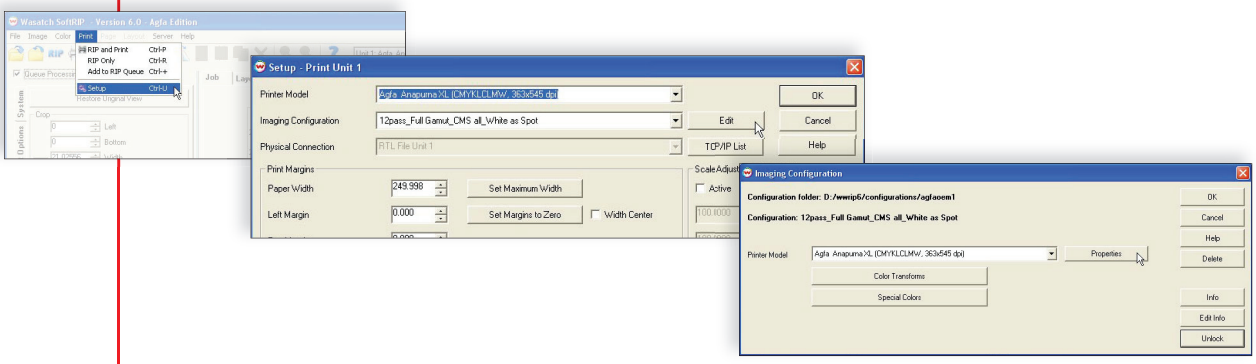
1. Introduction.

This manual will give you an overview of the possibilities of white ink printing on the :Anapurna engines. The different options of the Wasatch SoftRIP will be explained and some tips and tricks will learn you how to achieve the desired result.

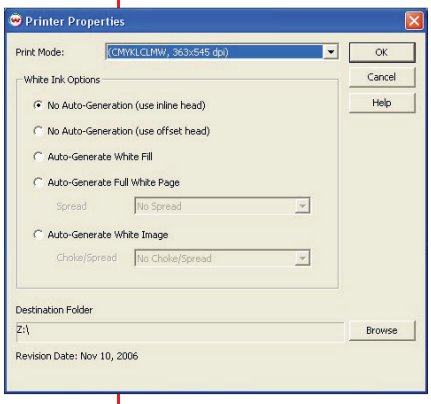
Printing with UV-curable inks, will compel you to preserve certain procedures, especially when using white ink. The maintenance & cleaning procedures will help you to keep all nozzles free and will expand the lifetime of your print heads. Be advised that the daily maintenance of your engine is the key to obtaining the best print quality!

2. Wasatch SoftRIP.

All the :Anapurna engines are delivered with the Wasatch SoftRIP. This software will process all jobs and generate RTL-files of these jobs. You can determine different parameters like the print quality, color management, size,... of every job. One of these parameters is the imaging configuration. In this option you can set the desired white ink setting to achieve the desired result. You can either choose for an auto-generating option and the SoftRIP itself will create a white ink separation, or you can determine the white ink area in a creative application using a dedicated spot color.



2.1 Printer Properties window.



You find 5 different settings for white ink printing in the printer Properties window. You can access this window by choosing the Setup menu, selecting an image configuration, left click on edit and the select the properties button. Make sure that you select a printer mode which uses white ink (CMYKLCLMW). If not, the white ink options will be grayed out. The printer properties window will pop up and you can see the 5 different white ink settings:

- No Auto Generation (use in-line head)
- No Auto Generation (use offset head)
- Auto Generate White Fill
- Auto Generate Full White Page
- Auto Generate White Image

To show the difference between the 5 print strategies, a file was designed in Adobe Illustrator CS2 using a Spot White in the logo, the outline text 'FORUM' and the text 'snowboarding'. The file was printed with the 5 different printstrategies onto a red banner media.

a. No Auto Generation (use in-line head).

This can be used for spot colors and multichannel files. This uses the white print head that is in-line with the other print heads (head n° 7). You will have to pinpoint the white selection in your image, using the "spot color replacement" tool (see 2.4). If you choose this setting, the white ink can not be printed on top or underneath another color. If it would be possible, you will see coalescence occur. The white ink is not cured before the colored ink is placed on top of it so the inks will be mixed and the result will look very dull.
(imaging configuration : xxx_White as Spot)

b. No Auto Generation (use offset head).

This can be used for spot colors, and multi-channel files. This uses the leading white print head (head n°8). The generation of the white ink separation will be done by selecting the white area via the "spot color replacement" tool (see 2.4). This setting will print white ink next to the other colors. If you want to print white underneath other colors, you have to select an auto-generate option.
The result will be the same as 'No Auto Generation (use ine-head)' strategy, but it will be printed with the other white print head.

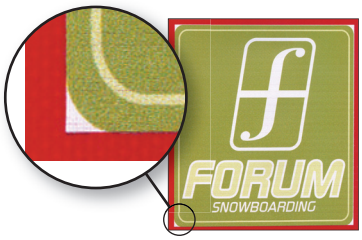
c. Auto Generate White Fill.

White is printed at any point where no other color is being printed. The Wasatch SoftRIP will use the pixel info of the image to determine where white ink has to be printed. Pixels containing color information with cmyk values of 0,0,0,0, will be printed with white ink. When one of the color values is 1 or bigger (e.g. cmyk 0,1,0,0), the Wasatch SoftRIP will not generate any white. So the :Anapurna engine will only print white on places where there is "zero pixel info", using the in-line print head (head n°7).

As you can see in the example above, the background color of the image is a mix of white dots and colored dots. The Wasatch SoftRIP will calculate the use of the white ink on raster level. So if you're not using a full tone (100%) in your image, the Wasatch SoftRIP will start generating white dots in between the raster points.

(imaging configuration : xxx_White Fill on NO Color)

d. Auto Generate Full White Page.



Generates a white rectangle for the whole ripped page size. When the Wasatch SoftRIP has finished ripping your image (with or without layout), there will be a white separation generated with the same dimensions as the bounding box of your file. So if your image has, f.e. round corners, the white area will not be the same as the edges of your image.

If you place two images beside each other in the layout window for e.g. dual board printing, the Wasatch SoftRIP will generate a white selection behind the complete layout. Be aware that the :Anapurna engine will also print white ink between the two images, probably onto your conveyor belt. So don't forget to mask the areas of your conveyor belt between the two substrates.

When selecting the "auto generate full white page" mode, the spread option will become active. Choosing a 1/8 inch spread applies a white spread in the margin or nesting gap of the page size. This 1/8 inch spread is only intended to work on jobs sent through the "Manual Print Layout".

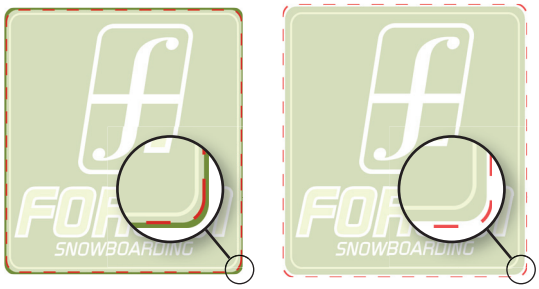
(imaging configuration : xxx_White Behind Entire Page)

e. Auto-Generation White Image.

White is placed underneath every non-zero pixel. White ink will only be printed underneath the pixels containing color information. Areas that are defined as white (cmyk 0,0,0,0), will be left transparent.

When you select this option, the drop down menu of the choke and spread option will be enabled. Choke and Spread allow you to control how the white ink is laid down around the edges in the image. The choke option will retract the white selection underneath the image. So if you've printed your image with the "no choke/spread" option and there is a little white border coming out underneath your image, you can adjust this using the choke option. Choke 'erodes' the white from the edges.

Selecting the spread option, will result in the opposite behavior of the white ink. Instead of reducing the white ink area, it will increase the dimension of the white ink separation. A white border will come out underneath the image. Spread expands the white over the edges.



choke spread

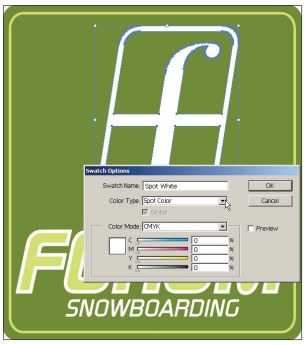
You can choose between different intensities for the choke or spread option (small, medium or large).

(imaging configuration : xxx_White Behind Image)

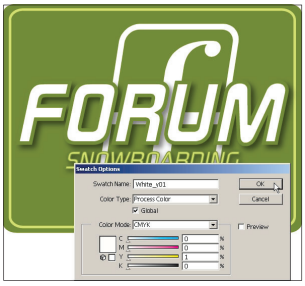
2.1 Creating an image with spot color.

If you want to work with the “no auto generation” modes, your image data has to contain information which triggers the Wasatach SoftRIP. Because the Wasatach SoftRIP does not support multiple layer files, you can not use images where the white ink is determined in a separate layer. The image will be flattened before you can choose the white ink strategy. So if you put a layer for the white ink underneath the image, this data will be lost when the Wasatch SoftRIP opens and renders the file.

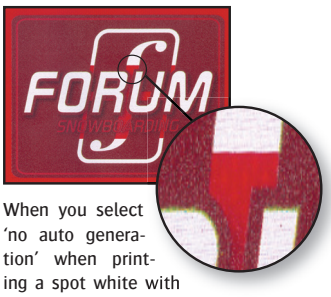
The only right way to determine a white ink separation, is using a vector based application like Adobe Illustrator. Generate a new spot color e.g. “spot white” and use this color to fill the areas which should be printed with white ink. Remember that it is not possible to define these spot color areas as pre-white ink that should cover the same positions as the colored inks.



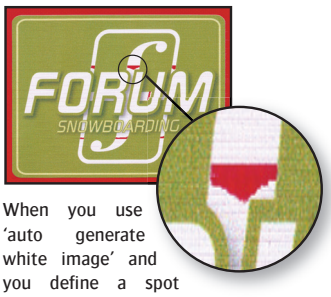
When you apply certain filters (dropshadow, transparancy,...) onto a white spot area, Wasatch will not be able to correctly render an apply the spot white. Parts of the spot white will get no coverage at all. If you want to have white behind the entire image (including the dedicated spot white), you can use the following work around:



- Define in your creative application a color that consists of 1% C,M,Y or K instead of a pure white. When you select “auto-generation behind white image” in the Wasatch SoftRIP, white will be printed in the 1% color area.
- If your image is already imported in Wasatach, you can also use the ‘spot color replacement’ tool to change the definition of your spot white to a 1% color (see 2.4). Instead of entering a value in the 5th color channel, just use the CMYK values to define your 1% color.
- You can also use this workaround to define parts where you want to print white as a spot color (1% color) and transparent areas in your image (dedicated spot white). When you use the ‘auto-generation white image’, white will be printed behind the 1% color information and the 0% areas will be left transparent.



When you select ‘no auto generation’ when printing a spot white with a dropshadow, certain parts of the spot white will have no coverage.



When you use ‘auto generate white image’ and you define a spot white, normally there should be white printed underneath the entire image. If you used a dropshadow, some parts of the spot white will have no coverage.

When you use ‘auto generate white image’ and you define the spotwhite as a 1% color, the spot white will be treated not as a spotwhite, but as a normal color. It results in print with entire white ink coverage underneath the image.

2.3 Spot White versus Pre-White.

The main difference between the spot-white and the pre-white is the difference in print heads that will be used. Pre-white will always be printed with the offset head (head n° 8). If you've defined a spot-white, you can choose between the in-line or the offset head by using different print strategies (see 2.1.a or 2.1.b). It is not possible to steer both heads at the same time.

Printing sequence:

- pre-white : print white -> curing -> print colors -> curing
- spot white : print white + colors -> curing

If you combine a predefined spot-white with an auto generating strategy, all data will be sent to just 1 print head: the offset head. Make sure that you've pinpointed the spot-white with the "spot color replacement" tool (see 2.4).

2.4 Spot Color Replacement

The Spot Color Replacement toolset provides precise controls for spot color printing. Spot colors can be used to bypass color management altogether by directing output to individual print heads containing custom formulated ink.
In the 'Spot Color Replacement' area of the Special Colors window select the type of images you wish to affect: Vector Graphics Only, or both Vector and Raster Graphics. Checking the Vector Graphics Only radio button ensures that spot colors (such as corporate logos) are individually color managed with no fear of corrupting embedded photographs (raster graphics).
Checking Vector and Raster Graphics allows you to manipulate the indexed TIFF files common in digital fabric and textile design.

a. Two ways to select spot colors:

- Use the special Colors window in Color menu.
  When an indexed, or limited-color image is previewed, use the Add Indexed Colors button on the Special Colors screen to read these colors into the window. After a pause, you will be asked if you wish to add the colors to the list. This is a quick way to make entries to the Spot Color Replacement window.
  The window on the Special Colors screen shows information in three columns. The Color Value column shows the original color and its color values. All colors are specified using the 0 – 255 range, whatever color space they are in. If no replacement color has been specified, the color square to the left is a solid block. If a replacement color has been specified, the color block is split. The left side shows the original color and right half shows the replacement color.
  The Replacement column shows the values of the replacement color. If no replacement color has been specified, the values are the same as those in the left hand (Color Value) column.
  In order to specify a replacement color, double-click on the original color in the left hand column. This launches the Spot Color Replacement screen.

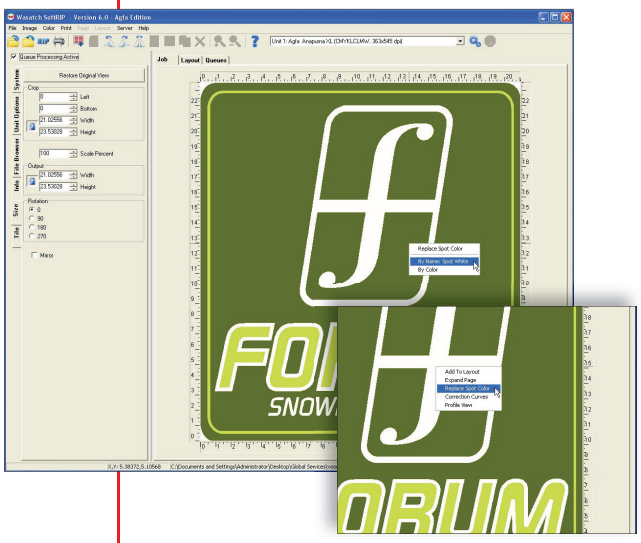
- Right-click on the preview image.
  The other method for making an entry to the spot color replacement list (on the Special Colors screen) is to right-click on any location in a previewed image, launching a pop-up menu. The "color to be replaced" can be "CMYK", "RGB", or "Gray".
  Selecting Replace Spot Color from the pop-up menu launches the Spot Color Replacement screen, as well as the Special Colors screen if not already open. The Replace Spot Color window may also be launched by double-clicking on any color in the Special Colors window, as previously noted.

b. Automatic spot color replacement.

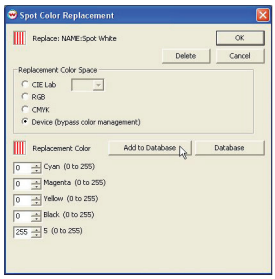
Spot color replacements can be defined using "named" colors within the application software that drives Wasatch SoftRIP. This leads to some attractive workflow options. When right-clicking on a "named" spot color, Wasatch SoftRIP allows the definition of a replacement that will be applied to all colors bearing that name. For example, the name "White" can be assigned to a print head that contains white ink, and then the use of this print head can be directly specified by the graphic artist running the creative software. The "tint", or "percentage" specifications made in the application software are applied to the replacement color, allowing such things

as a “white gradient” to be produced by the artist. (“Tint” information only applies to CMYK and Device color, not to Lab or RGB color.) Enter the values of the replacement color directly into the windows in the Replacement Color area. You may change the Replacement Color space to “RGB”, “CMYK”, “CIE Lab” or “Device” before you enter new values.

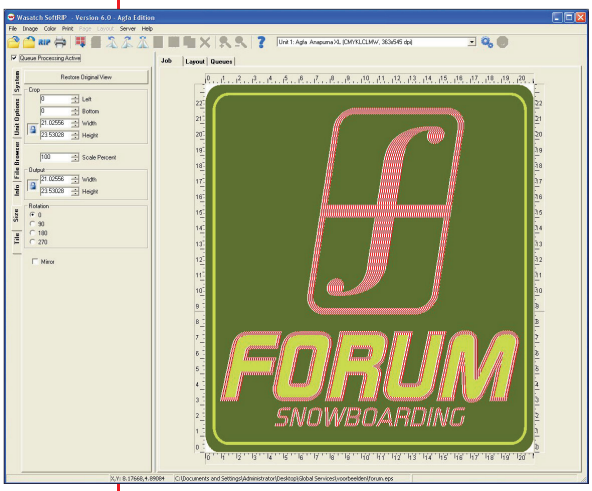
c. Step by step: a practical example.



- Open an image in the Wasatch SoftRIP.
- Select an imaging configuration for white printing (CMYKLCLMW).
- Right click in the preview image on the part that is a dedicated spot color.
- Select ‘Replace Spot Color’ in the pop-up window.
- Select ‘By Name’ in the pop-up window.
- The Spot Color Replacement window will open where you find the name and color values of the selected color.
- Left click on the option ‘Device (Bypass Color Management)’.
- A 5th color value will appear in the bottom of the window. Set all color values at 0, except for the 5th color where you enter the amount of 255 (caution: not 100%, but 255 levels).



- Select the button ‘Add to database’ and Wasatch will ask you to define a new color name.
- If there isn’t already a database present, you will have to create a new database.
- After selecting ok in the Special Color window, you’ll be asked to give a new imaging configuration name. If you’re working with a standard Agfa Imaging Configuration, you will have to change the name because the standard configurations are locked.
- The selected color will be marked with a red hatching mark in the preview image.

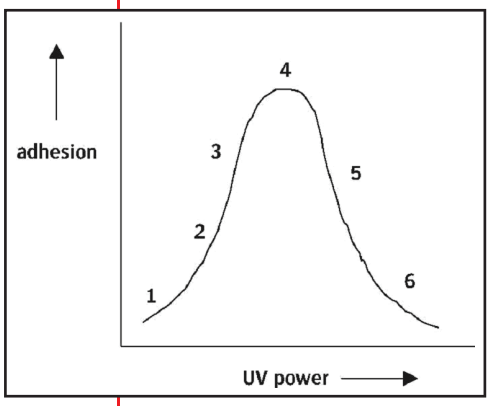


- The database is linked with a certain imaging configuration. So when you use the same imaging configuration on other images, spot colors with the same name will automatically be recognized and converted.

3. Adhesion issues.

3.1 Relation Curing - Adhesion.

There is a relation between curing and adhesion. Curing is a complex process that depends on numerous parameters (type of substrate, ink layer thickness, curing power, etc.). The thought "the higher the curing power, the better the curing, the better the adhesion" is not correct. The figure underneath shows the wide range of results that one can expect:



- 1: Little or no exposure, ink remains liquid
- 2: Partial curing (usually surface only) with possible "skinning" and generally poor adhesion to the substrate
- 3: Tacky surface, common to under curing
- 4: "Correctly cured" with no tack, low odor, flexible and with good adhesion
- 5: Increased surface hardness that can become brittle with poor over printability
- 6: Primary ink surface not receptive to secondary inks resulting in poor adhesion and low flexibility

Be also aware that certain substrates (e.g. transparent PP Priplak Coteline 455g) only allow half of the lamp power of the :ANAPURNA (X)L printer.

3.2 Difference in adhesion between the different ink colors.

As mentioned before there are numerous parameters which influence adhesion (type of substrate, curing power, ink thickness, etc.). On certain substrates one can observe differences between the different ink colors. In general one can state that black inks are more difficult to cure. The reason for this is that the black pigment particles absorb a significant amount of the UV light. As a result there is less UV light available to initiate the photo polymerization of the monomers/oligomers. Therefore, these inks cure more slowly and, thus, adhesion is worse. A similar effect is observed for white inks. Here the pigment reflects a significant amount of the UV light, which results in slower curing and worse adhesion.

3.3 Adhesion Promoters.

From practical experience (Dibond, Priplak) we know that adhesion can already be improved by cleaning the substrate with a solvent such as iso-propanol. Adhesion onto aluminum, glass and plastics (e.g. plexi-glass) can be improved by the use of adhesion promoters. We have experienced good results with BondAid I (aluminum, glass) and BondAid II (e.g. Lexan, plexiglass). These materials are commercially available from Triangle Digital (San Leandro CA, USA). However, be aware that the coating quality of the adhesion promoter has a dramatic influence on the adhesion properties.

a. BondAid I™

Designed for hard surface substrates: METAL*, GLASS*, TILE
Formulated for adhesion promotion, cleansing, and static reduction.

- **Adhesion Promoter**
  BondAid I™ is a specially formulated product, designed to improve adhesion, between UV curable ink and hard surfaces such as metal, glass, and tile. BondAid I™ is an optically clear alcohol base coating that works to create a chemical bond between the ink and substrate surface. BondAid™ is a universal product designed to work on many different substrates. Triangle Digital also has substrate specific adhesion promoters. Call us with your job requirements.

- **Cleanser**
  BondAid I™ is also formulated to act as a general cleanser for substrates prior to printing. Being an alcohol based product, simply wipe the substrate surface prior to printing and BondAid I™ will remove dirt and other foreign particles adhered to the substrate.

Static Reducer

BondAid I™ was designed with specific chemical properties that will help reduce static on the substrate being printed on. When used prior to printing, not only will the BondAid I™ remove particles from the surface, it will also decrease the amount of static electricity on the surface, reducing ink drop deflection and the possibility of new particles being attracted to the substrate during printing.

Application Method:

To apply Bondaid:
Clean substrate of dirt and oil
Saturate a lint-free cloth with BondAid™
Wipe the entire substrate surface
Allow the IPA (Alcohol) to flash off – No longer than 30 minutes
Print on surface
Maximum open time is 24 hours. Do not prep the substrate too far in advance.
Depending on the substrate and type of UV curable ink, completion of the chemical bond may take up to 24 hours.
Excess BondAid™ can easily be removed with an alcohol saturated lint free cloth.

b. BondAid II™

Designed for common plastic substrates such as: Acrylic, Lexan™, Styrene™
Formulated for adhesion promotion, cleansing, and static reduction.

Adhesion Promoter

BondAid II™ is a specially formulated product, designed to improve adhesion, between UV curable ink and various plastic substrates such as acrylics and Lexan™. BondAid II™ has had limited success with Styrene. It will not improve adhesion on HDPE/molded plastics.
BondAid II™ is an optically clear alcohol base coating that works to create a chemical bond between the ink and substrate surface. BondAid™ is a universal product designed to work on many different substrates. Triangle Digital also has substrate specific adhesion promoters. Call us with your job requirements.

Cleanser

BondAid II™ is also formulated to act as a general cleanser for substrates prior to printing. Being an alcohol based product, simply wipe the substrate surface prior to printing and BondAid II™ will remove dirt and other foreign particles adhered to the substrate.

Static Reducer

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Print on surface
Maximum open time is 24 hours. Do not prep the substrate too far in advance.
Depending on the substrate and type of UV curable ink, completion of the chemical bond may take up to 24 hours.
Excess BondAid II™ can easily be removed with an alcohol saturated lint free cloth.

4. Storage recommendations.

All issues concerning white UV-ink, are the direct outcome of the chemical composition of the ink. The risk of sedimentation exists because the white pigments have a higher density then the surrounding vehicle. Also the risk of polymerization increases when the inks are exposed to temperatures above 24°C.
Note that this a common problem of all white UV-inks that are available on the market so also our competitors suffer. Storing your inks in the right conditions, will prevent a lot of issues.

4.1 Storage conditions.

Recommended transportation conditions and warehouse temperatures are between 4°C and 24°C (ideal = between 4 - 10°C). Exposure to light (especially direct sunlight), higher humidity and/or temperature can affect the product performance. It is therefore advised to keep the ink in the sealed and closed bottle inside the cardboard box until usage. When adding new ink to the machine, do add the whole content of the bottle.

4.2 Shelf life.

The white ink has a shelf life of 6 months when stored under optimal conditions. It is important to check the age of the ink before opening the bottle. The production date can be found on the bottle ("FABR.DATE xxxx.yy").
The first 4 digits (xxxx) refer to the production year. The digits after the dot (yy) refer to the month. Thus FABR.DATE 2006.10 indicates that the ink was manufactured in October 2006.
The production date can also be deducted from the batch number, which is also on the label. For instance I42604501. The first 2 digits after the I represent a production cycle of 8 years, numbered from "00" up to "96", starting from January 2003 (January 2003 being "00"). In the above example the number "42" corresponds to the (production) month of June 2006.

4.3 Before use.

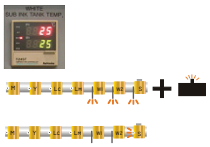
White ink bottles should be thoroughly shaken before opening it. Maintain a period of 5 minutes between shaking the bottle and pouring it into the main ink tank. Air bubbles, which were formed during shaking, will get the time to raise to the surface.

5. Maintenance Procedures.

WHITE INK MAINTENANCE PROCEDURES

1 Every morning when not using white

Leave white sub ink tank temperature at 25°C
Set the white ink valves to "S"
Switch solution valve to "S"
flush cleaning solution through the white heads untill you see a clear curtain
Switch solution valve back to "I"
Clean the head base plate with a cloth saturated with cleaning solution
Clean the head surface with a fiber-free cloth.



2 Before lunch

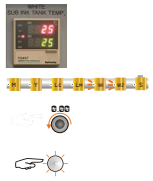
Repeat step 1

3 Every evening

Repeat step 1

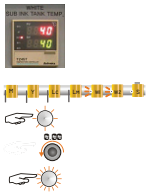
4 Engine storage at the end of the week

Flush cleaning solution through the heads:
First purge the 4 right heads (Lc, Lm, W1, W2), close them and in the second stage, purge the remaining 4 left heads (K, C, M, Y).
Finally, open the 4 right heads again, and purge all 8 heads together now.
By doing so, you'll have the most optimal cleaning pressure.
Switch all heads, and the Solution valve back to "I".
Set the Neg. Vacuum Pressure to "0", leave the system for 1 minute
(Ink will now start dripping out the heads)
Empty the sub-airtank by opening the tap (use a tube into a PE-bottle)
(Sub-airtank is located at back of carriage)
Restore the Neg. Pressure back to "-.034"
Perform a Large Purge
Clean the Head Base Plate with a cloth saturated with cleaning solution
Clean the heads with a fiber-free cloth
Check the nozzle's on "weeping" or with a Jet Test.
If all nozzles are present, the engine can be left in the Purge Position, with the Grid pushed backwards.
Replace the towels in front of the Purge grid, and check/clean the whole Purge station environment
Check the purge and home grid for cured ink
Clean the encoder strip
Clean the Quartz plate of both UV-lamp houses with alcohol. (underside of lamps)



5 Before printing white

Move the shuttle to the purge postition
Set white sub ink tank temperature to 40°C and wait untill value is reached
Make sure the white ink valves are set to "I" and the colour valves to "S"
Push the purge untill white ink starts dripping from the bottom of the white heads
Set the negative pressure to zero and let all heads weep for two minutes
Restore the negative pressure
perform a small purge (short pulses)
clean the surface of the white heads with a fiber free cloth
Set the colour valves back to "I"



6 After a white printing job is finished

Set white sub ink tank to 25°C
Set the white ink valves to "S"
Switch solution valve to "S"
Flush cleaning solution through the white heads untill you see a clear curtain
Switch solution valve back to "I"
Clean the head base plate with a cloth saturated with cleaning liquid
Clean the head surface with a fiber-free cloth.

!

Store white ink bottles at temperatures < **24°C** and preferrably between 4 and 10 °C

Shelflife of white ink = **6 months** . Shelf life expired = throw ink away

Whenever you are not running white ink during the day, your heads should be flushed with cleaning solution to avoid curing of white ink onto the nozzle plate. White ink in heads only when printing!

Always wear gloves and protective glasses when performing maintenance routines

6. FAQ's about inkjet.

6.1 What is inkjet printing?

Inkjet printing is defined as a non-impact printing technology in which droplets of ink are jetted from a small aperture directly to a specified position on a media to create an image. Inkjet printing can be divided into two types: continuous inkjet (e.g. used in industrial applications to mark and code packaging (bottles and cans), and drop-on-demand (DOD) inkjet. Unlike the continuous inkjet, DOD inkjet delivers ink to the substrate only when the internal printhead receives a specific digital signal. The two most popular types of DOD inkjet printers are thermal and piezoelectric.

6.2 What is an inkjet ink?

An inkjet ink is one of the consumables being used during the inkjet printing process. One can identify four types of inkjet inks:

- Water-based inks
- Solvent-based inks
- Oil-based inks
- UV-curable inks

6.3 What is a UV curable inkjet ink?

UV stands for ultra violet, which refers to the wavelength of the light being used for the curing process of UV curable inkjet inks. Ultra-violet light is electro-magnetic radiation situated between 200 and 380 nm (visible light goes from 380 to 720 nm and IR light from 720 nm to 1 m) A UV curable ink is composed of different chemical components developed in such a way that the ink, after curing with UV light, meets the characteristics of the application. A typical UV ink formulation contains the following chemical components:

- Monomers
- Oligomers
- Pigment
- Photo-initiator(s)
- Additives

After being jetted onto a substrate, the UV curable ink is immediately cured upon radiation with UV light. During this curing process the monomers and oligomers immediately polymerize resulting in solidification of the ink on the substrate. Since UV light does not have enough energy to start the polymerization process, photo-initiators are added to the formulation. These compounds generate free radicals or cations which are needed to start the polymerization process (cross-linking). This process is simply called "UV-curing". Since the UV curing process is affected by oxygen, it can be significantly improved by curing under an inert atmosphere (i.e. nitrogen gas). Be aware that the final adhesive strength, rub and scratch resistance is obtained after 24hr. There are 2 types of UV-curable inks commercial available today:

- Free Radical
- Cationic

:ANAPURNA inks are free radical UV curable inks.

6.4 Is the UV-cured ink 100% solid after exposure to UV light?

The curing process is very complex since numerous parameters, such as the thickness of the ink layer, the type of substrate, the UV light source used, the exposure time, the atmosphere, etc. can all affect the polymerization process. This means that there is always a possibility that a small part of the monomers and oligomers has not been cured and thus remains for a certain amount of time in the ink layer. This is an important issue when it comes to food packaging applications.

6.5 What about the price of UV curable inkjet inks?

Over the years water, solvent and oil-based inkjet inks have matured. UV curable inkjet inks, however, are still in a development phase. Furthermore, UV curable inks are formulated based on much more advanced ingredients (e.g. photo-initiators, monomers, oligomers). As a result the prices of UV-curable inks are generally higher.