MUTOH INDUSTRIES LTD.
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General information on (UV) ink handling

As Digital UV-curing inks are still new to the inkjet print market, operators must use them in the correct way. When using, various precautionary measures must be taken. To do so, the chemicals in all of our products are independently verified and the results of chemical assessment and first aid measures are summarized in our Safety Data Sheets (SDS). Keep the latest SDS for the ink to be used nearby your printer so that operators can read it anytime.

Operators have to be careful that there is a possibility that your skin comes in contact with or you inhale uncured ink or ink mist such as during printing, disposing of waste ink and so on.
SDS is subject to change without notice. The latest version is available from the following site:

- MUTOH INDUSTRIES LTD. https://www.mutoh.co.jp/support/index.html
- MUTOH Europe nv https://mutoh.eu/en/support/download-sds-sheets
- MUTOH AMERICA INC. https://mutoh.com/sds-sheets/

Uncured UV printed materials contain hazardous substances described in each SDS. Wear protective equipment to avoid skin contact with uncured substances as instructed in SDS. Even after they are cured, irritating or sensitizing substances may remain on the print. Be careful with end usage and handling.

When using (UV) ink, MUTOH recommends that the printer operating space should be ventilated (5 to 10 air changes per hour as a guide) or well-ventilated using a local ventilation equipment.
Before use of our inks, we advise that you read and study the above information and transfer this knowledge to those who use our inks.

Sincerely,

Hiroshi Yoshino

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Mutoh Industries Ltd.

Director/ Quality Center

Cautions for printer installation environment and usage

[Calculation condition]

- Installation site: 270 m^3 (10 m x 9 m, Height 3 m)
- Ink specific gravity: 1.077 g/cm^3
- The amount of ink used: 100 ml/hr
- The amount of ink mist generated during printing: 1 ml/hr if maximum is 1%
- Table 1 shows LD50 or LC50 of chemical substances that have high acute toxicity (extracted from SDS Section 11)

Table 1. LD50/LC50 of high toxicity chemical substances in MUTOH UV inks

Acute toxicity		US61	US11	UH21
Oral	[mg/kg]	1,860	928	1,790
Inhalation	[mg/ℓ] [g/m^3]	1.6	0.55	2
Dermal	[mg/kg]	1,700	2,000	2,000

- Based on the US61 SDS Section 8, the limit value of DNEL (derived no effect level) according to Regulation (EC) No. 1907/2006]: 0.7 mg/kg ≈ 0.7 g/m^3

1. Acute toxicity and control parameter

Workplace concentration = (1 ml/h x 1.077 g/cm^3) / 270 m^3 = 0.004 g/m^3hr

If US61 is continuously used in the operating space for approximately 400 hours without any ventilation, it will reach the concentration that could induce acute inhalation toxicity.

For acute dermal toxicity, the threshold for a body weight at 50 kg is 85 g. The ink that is exposed as mist is 1.077 g per hour. Therefore if the entire skin is continuously exposed to ink mist for 79 hours without any ventilation it will reach the concentration that could induce acute dermal toxicity.

1,700 mg/kg x 50 kg = 85 g

1 ml/hr x 1.077 g/cm^3 = 1.077 g/hr

In addition, US61 ink is substantially below the limit value of DNEL (0.7g/m^3) according to (EC) No. 1907/2006 and exempt from the requirements of special ventilation equipment.

These calculation results are similar in all three types of MUTOH UV inks placed on the market.

Many countries have fresh air ventilation requirements for buildings so unventilated environment is not possible. The requirements for air change rate per hour (ACH) varies depending on the country. However, based on the ventilation required by usage and installation environment (CBM) regulated by Building Standards Act in Japan, 5 to 10 air change rate per hour is recommended for printer operating space as a guide.

Table 2. Building Standards (in Japan)

	ACH	Fresh air supply
Non-residential site (obligations in Building Standards Act)	>0.3	81 m^3/h
Warehouses (Guideline for Building Equipment Design Standards)	5	1,350 m^3/h
Print/ Copy room	10	2,700 m^3/h

2. Other cautions to take

When printing with (UV) ink, the distance between the print head and print media (print gap) must be set to 1.2 to 1.3 mm (it varies depending on the printer model). Too large print gap will easily cause ink mist as ink drop cannot land on the media. The larger the print gap is, the more it will generate mist, not only contaminating media and printer but also causing adverse effect to printer operating space as mist spreads over the work environment. If ink mist is on the print head, it could cause jetting failure. If on the UV lamp, it could cause curing defects.

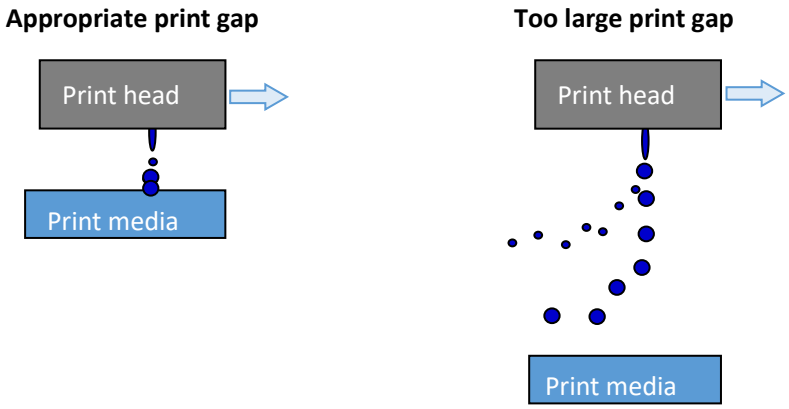

Fig.1. Schematic diagram of mist generation

To print on objects, mask the area where an object is not placed. Borderless or bleed printing on objects will generate mist.

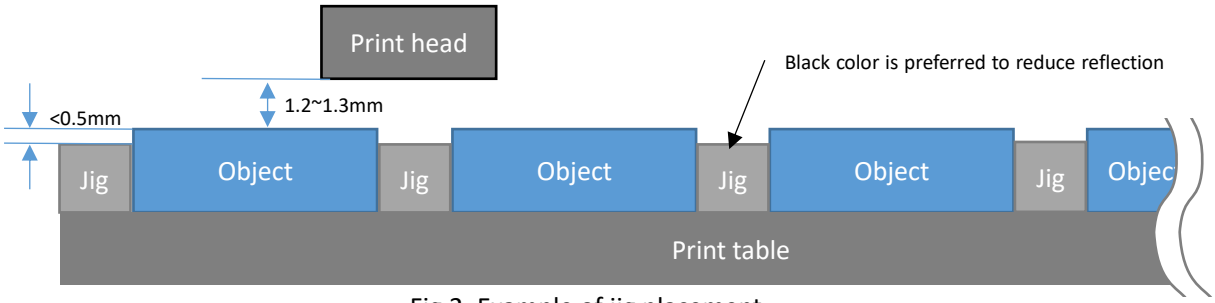

Fig.2. Example of jig placement