Operations Guide

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Revision History

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4.06	R5.2.2.	21-Dec-22	• Updated Table 8 with minimum PDF page length • Added Section 6.7 Hydration Examples, from Tech Bulletin TB0011 • Minor editorial updates
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4.02	R4.2.3	16-Sep-21	• Updated 4.4 Internal RIP Mode – Print PDF Files Using Demo GUI and 4.5 Internal RIP Mode – Print PDF Files Using Kenmarecat to remove the statement that PDF must not be A4 landscape when printing multiple copies • Added 4.6 Print a Large PDF File • Added 6.2 Log Capturing and Analysis • Added 6.3 Determine the System Branding • Deleted the previous section 7 Consumable Replacement and moved the content to the *DuraFlex Service and Repair Guide* • Added 7.5 Recovery • Added 8 Prepare a System for Relocation • Added 9 Prepare a Print Module for RMA • Minor editorial updates
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Contents

Figures

Tables

1 Introduction

This document is part of the OEM-facing technical documentation suite for Memjet DuraFlex® module-based printing systems. It references, and therefore requires access to, additional documentation available for download from your Memjet Partner Site.

1.1 Aim and Audience

The aim of this document is to provide Original Equipment Manufacturers (OEMs) with the operational procedures for a DuraFlex-based printing system.

This document is intended for OEM personnel who are using and operating the print unit.

1.2 Prerequisites and Scope

The reader is expected to be familiar with Memjet inkjet printing technology, its applications, and implementation. This document does not cover the design, installation, or servicing of a DuraFlex-based printing system. The reader needs to:

- ensure that the DuraFlex printing system has been installed following the instructions in the *DuraFlex Installation and Commissioning Guide*.

Note:	Documents referenced above are available for download from your Memjet Partner Site.

1.3 Typographic Conventions

Throughout this document, the following typographic conventions are used:

`Code Character`	`Courier` font is used to identify HTTP GET and POST commands with associated arguments, as well as references to source code, job states, registry settings, directory/file names, XCI commands, and XML settings.
Bold	Text that appears on-screen in the user interface is shown in **bold font**. This includes UI buttons, engine states, warning codes, and fault codes.
Yellow Highlighting	Yellow highlighting indicates sections that are new or updates in this version of the document, compared to the previous version.

1.4 Related Documentation

Other documents, besides this guide, provide further details for specific readers:

- *System Overview* – For OEM managers and non-technical personnel charged with evaluating the DuraFlex components for use within their products. This document describes the DuraFlex concept and Memjet-supplied DuraFlex components and gives an overview of the operational considerations. It introduces the components an OEM is required to design and manufacture to ensure the DuraFlex Modules function as designed in a DuraFlex-based print engine.
- *Mechanical and Fluidic Databook and Design Guide* – For mechanical design engineers and developers, providing details of the Memjet hardware modules and components (including printhead and maintenance system) and specifications of the ink delivery system fluidics.
- *Electrical Databook and Design Guide* – For electrical design engineers and developers, providing details of the Memjet power requirements, electronic assemblies, and connections.
- *Software Databook and Design Guide* – For software and firmware engineers who need to understand the software interfaces, commands, scripts, and reference software applications.
- Installation and Commissioning Guide – For OEM personnel who are installing and commissioning a new printing system.

- *Operations Guide* – For OEM engineers and operators to perform operational tasks.
- Troubleshooting Guide – For OEM engineers and technicians to identify symptoms and resolve issues.
- *Service and Repair Guide* – For OEM engineers and technicians to perform DuraFlex inspection and maintenance tasks and component and consumable replacement.
- *Job Submission Library Guide* – For OEM software engineers to incorporate the Job Submission Library (JSL) into their chosen Raster Image Processor (RIP).
- *Technical Bulletins* – For various audiences to announce product or process update or to provide specifics on single-subject technical topics.
- *CAD and Schematics* – For various audiences to provide detailed dimensions related to specific areas.

Note:	All technical documentation is available on your Memjet Partner Site.

1.5 Glossary

For terms, acronyms, and abbreviations used in this guide and some product-specific terms, see the *DuraFlex Glossary*.

Note:	This document is hyperlinked to the glossary. For offline reading, download the DuraFlex Glossary file from your Memjet Partner Site.

1.6 Additional Documentation or Access

For additional product-related technical documents, go to your Memjet Partner Site.

If you need Partner Site access, enter a case in Service Desk (*https://OEMsupport.memjet.com*), send an email to Memjet Customer Support (*customer.support@memjet.com*), or contact your Technical Account Manager.

2 Operations

2.1 Overview

To ensure the DuraFlex printing system operates correctly, *Table 1* contains a list of recommendations on how to use the system safely.

Table 1 – System Operation Recommendations

Task	Reason
Follow the recommended KWS settings	Prevents the printhead from being damaged by dehydration and possible dry firing from nozzles.
Power off the system before any electrical connection is performed	Ensures the safety of the operators and protects the electrical components.
Follow all contamination control procedures	Fine microstructures in the printhead can be blocked if external contamination enters the system.
Ensure the aerosol extraction system (AES) has been calibrated. Once calibrated do not adjust the AES fan power supply voltage.	Too much or too little aerosol extraction can affect print quality
Ensure the AES is running before starting a print job	Running the print engine without aerosol extraction may cause ink residue to build up in critical areas
Ensure that the system has been deprimed before removing the printhead	Prevents ink spills within the print engine.
Printhead should be capped (in the CAP position) when it is not in use, if the printhead has been inked (including deprimed state)	Prevents printhead dehydration and ensures maximum lift of the printhead when not in use.
Printheads remove from the print engine should be stored correctly.	Any residual ink in uncapped printheads will dry and may cause blockages within the printhead nozzles.

2.2 Logging into the PES

With the removal the Demo GUI, commands will need to be entered via the PES interface.

1. Ensure the PES interface is open in the frontend mode:

```
cd /opt/memjet/PDL/test_rigs/latest/bin/python start.py --mode=frontend
```

2. For the list of common service commands, refer to *Table 11*.

2.3 Start of Day or Shift

Perform light or medium system maintenance before starting to use the printer.

2.4 End of Day or Shift

1. Do not power off the DuraFlex printing system at the end of the day.
2. Perform a light service and ensure the printhead is left in a capped position.

Note:	To avoid dehydration, always keep the printhead capped when not in use.

2.5 Printhead Prime Confirmation

The system needs to be in `PRIMED_IDLE` status prior to printing (or when not in use).

When the system is in the `PRIMED_IDLE` status, it performs the following periodic maintenance tasks:

- Spits once every 2 hours
- Flushes once every 10 hours
- Performs a light service 15 minutes after the most recent print job
- Performs a 4-min printhead calibration flush routine once a week

If it reads `DEPRIMED_IDLE`, the OEM should perform priming, and the status will change to `PRIMED_IDLE`.

Note:	The system will not print or run periodic maintenance until it is successfully primed.

2.6 Cap the Printhead

To avoid dehydration, the printhead should always be capped when not in use. During an error condition, the printhead can also be moved to the CAP position.

1. Use the PES command `startMovingPrintheads()` to cap the printhead.

2.7 Shut Down the Printer

Typically, the DuraFlex system should not be shut down and should be kept running, but when shutdown is necessary:

1. Use the PES command `shutDownEngine()` to shut down the engine.
2. Turn off the AES fan power supply, ensuring that you do not adjust the voltage.

3 Prepare to Print

3.1 Color Profiles

During installation, color profiles (`.icc` files) are stored in the printer, see the *DuraFlex Installation and Commissioning Guide* for more details.

Note:	If the OEM attempts to run a color profile that does not exist or if its filename is mis-spelled, the system will use the default `.icc` file.

When printing in the Internal RIP mode using kenmarecat select any of the "`PreRev2`" `.icc` files from the `/opt/memjet/Kenmare/data/profiles/` folder.

Note:	The "`PreRev2`" `.icc` profiles are also suitable for Rev2 ink.

Table 2 shows the corresponding color profiles for each print mode.

Table 2 – Mapping Between Print Mode, Utility, and Color Profiles

Mode	Utility	Color Profile	Comments
External RIP	Gborcat	No color profiles	N/A
Internal RIP (Embedded RIP)	Kenmarecat	User-selectable reference set at 1600 dpi or 954 dpi. Options include all available profiles in the `/profiles` folder including `PreRev2`, plain, matte, treated, and glossy.	OEM can select to render intent or BPC (black point compensation). BPC is included in software release.
Internal RIP	Reference host driver	User-selectable reference set at 1600 dpi or 954 dpi. Options include plain, matte, treated, and glossy.	N/A

3.2 External RIP Mode

In the print units, the External RIP mode is supported. In this mode, TIFF files need to be converted to GBOR format for printing.

3.2.1 Individual TIFF Files (for Single Page GBOR)

Each individual TIFF file can be converted to the corresponding GBOR file. Single source files must comply with the requirements given in *Table 3*.

Table 3 – TIFF File Requirements

Feature	Value	Notes
Resolution	1600 dpi Horizontal × 1600 dpi Vertical	For 18 IPS print mode
	1600 dpi Horizontal × 954 dpi Vertical	For 30 IPS print mode
Width	Up to 20,436 pixels.	Padding will be applied if the width is less than 20,436 pixels.
Height	≥ 1 inch (25.4mm)	
Color space:	KCMY, 8 bits or 1 bit.	If it is 8 bits, the image will be half-toned with the supplied dither (or a 50% comparison if none is supplied). It is optional to compress TIFF files.
File support	Supports KCMY or grayscale TIFF files.	

3.2.2 Create a GBOR File Using Tifftogbor

Ensure that ABT Tools is installed on the Windows Client PC, which contains the `tifftogbor.exe` utility and the dither (`.dm`) file.

For more information on how to install the ABT tools, refer to the *DuraFlex Installation and Commissioning Guide*.

Note:	If the OEM attempts to run a dither that does not exist or if its filename has been mis-spelled, the system will use the default `.dm` file instead.

To create a GBOR file, convert from a TIFF file:

1. Open a Windows PowerShell terminal.
2. Change to the directory containing the target TIFF file.
3. Run the `tifftogbor.exe` command in Windows PowerShell to convert from TIFF format to GBOR.

   The recommended usage is:

   ```
   tifftogbor.exe [options] [file.tif] [file.gbor]
   ```

   Below examples show how to build a GBOR file from a single TIFF:

   - For 1600 DPI:

   ```
   tifftogbor.exe -P fastQuadcolor -c M,K,C,Y -D 18-8-3-7-bn-512x512-lin-V1.3.1.dm
   -R 1600 file.tif file.gbor
   ```

   - For 954 DPI:

   ```
   tifftogbor.exe -P fastQuadcolor -c M,K,C,Y -D 18-8-3-7-bn-512x512-lin-V1.3.1.dm
   -R 954 file.tif file.gbor
   ```

4. Multiple TIFF files can be converted to GBOR if all files have the same pixel width and are longer than the minimum length (1 inch is recommended). To convert multiple TIFF files into one GBOR, use the following command:

   ```
   tifftogbor.exe -P fastQuadcolor -c M,K,C,Y -D 18-8-3-7-bn-512x512-lin-V1.3.1.dm
   -R 954 file_1.tif file_2.tif file.gbor
   ```

3.2.3 Tifftogbor Options

To view a complete list of options, run the command `tifftogbor.exe --help` in Windows PowerShell.

Table 4 shows some important options that you can customize.

Table 4 – Tifftogbor Options for Input Format Conversion

Option (Complete Form)	Option (Short Form)	Description
`--resolution`	`-R`	Configure the resolution. Accepted values include 1600 and 954.
`--dither`	`-D`	Specify the dither. It requires a `.dm` file.

3.3 Keep Wet Spit (KWS) Settings

Keep Wet Spit keeps unused nozzles hydrated during printing run to improve print quality. During installation, KWS user multiplier is set to **3.33** for a cut-sheet system or **1.5** for roll-to-roll (see *DuraFlex Installation and Commissioning Guide*). These are temporary settings to maintain printhead health.

The OEMs must adjust the KWS user multiplier via the **Multiplier** setting in the `hwparamstore.json` file, based on specific use case, environment, and system configuration. A higher KWS level implies a higher density of KWS drops overlaid in the image.

Note:	The KWS level calculated based on user multiplier and several other factors will be rounded up to an integer (unit: Hz).

3.3.1 Set KWS User Multiplier in `hwParamstore.Json` File

To find the current KWS setting and adjust the user multiplier:

1. The default KWS value will be used when the KWS user multiplier is set to **1.0**, which is the minimum meaningful value. During installation, the multiplier is set to **3.33** for cut-sheet system or **1.5** for roll-to-roll. These values will maintain printhead life, but it may be higher than the final setting and need further adjusting. To change this value, enter the desired KWS multiplier for each ink color. The system will calculate and use the new KWS value.

Note:	The KWS user multiplier for each ink color can be set independently. The value range of multiplier is from **1.0** to **9.99**. The multiplier can be a decimal value. If the user multiplier is set to **0**, the KWS will be disabled.

2. After setting the KWS user multiplier, perform the dehydration test in Section *3.4 Dehydration Test* to optimize the KWS level and maintain printhead health.

Note:	The user multiplier, print speed, and resolution are used by the DuraFlex printing system to compute the actual KWS level for a given print job. Once the user multiplier is set for a given system configuration, the system will adjust KWS per the job parameters.

See *Table 5* for more information, in which the user multiplier is set to **1.0**.

Table 5 – KWS Rates at Different Print Speeds for the Default User Multiplier 1.0

Print Speed (ips) at 1600dpi	Print Speed (ips) at 954dpi	C (Hz)	M (Hz)	Y (Hz)	K (Hz)
18	31	6	9	6	8
17	30.1	7	9	7	9
16	28	7	10	7	9
15	25	8	11	8	10
14	23.5	8	11	8	11
13	22	9	12	9	11
12	20.5	9	13	9	12
11	18.5	10	14	10	13
10	16.5	11	16	11	15
9	15	12	17	12	16
8	13.5	14	19	14	18
7	11.7	16	22	16	21
6	10	18	26	18	24
5	8.4	22	31	22	19
4	6.7	27	38	27	36

3.4 Dehydration Test

To find an appropriate KWS user multiplier that maintains printhead health in an OEM's environment and specific product architecture, set the system to a KWS level that is higher than needed to ensure printhead health. Then, print a series of plots to check performance and look for signs of dehydration.

Visible signs of dehydration include:

- A fuzzy leading edge on the printed image (*Figure 1*).
- Wide areas of an image missing color (white streaks), which gradually become narrow as fresh ink replaces dehydrated ink.
- Severely misdirected ink dots, which often land slightly ahead of the leading edge of an area filled with color.

If the testing plots indicate no dehydration at the lower levels, reduce the user multiplier and print to verify at the new level.

Note:	Cut-sheet systems may behave significantly different from web systems (roll-to-roll) due to the commonly used vacuum belts. For cut-sheet systems, start at a higher KWS user multiplier than for web systems.

Figure 1 – Print Showing Dehydration (Fuzzy Leading Edge)

To perform the dehydration test:

1. Download the test suite (`suite_kws_check_500pages.bn1600.suite.gbor`) from the Software section of the DuraFlex Library.
2. Start with a high KWS setting:
   - For a cut-sheet system, set KWS user multiplier to **3.33**
   - For a roll-to-roll (web) system, set KWS user multiplier to **1.5**

   These are higher than the expected final settings and will ensure that the printhead safely passes the first round of testing.
3. Enable the External RIP mode and print the test file. For more information on how to print a GBOR file, see Section *4.3 External RIP mode – Print GBOR Files*.

   The `suite_kws_check_500pages.bn1600.suite.gbor` file consists of KCMY start bars, 500 pages of blank media, and KCMY end bars. The images are 12.7 inches (324.4 mm) wide, equal to the width of an A3 printhead. These are for the 1600 dpi print mode.

   The number of KWS pages is specific to each use case. For example, if mid-job service occurs at 500 pages, run the test at 500 pages. For longer applications, the page count can be adjusted.

Figure 2 – Source TIFF Dehydration Images

4. Inspect the test bars for signs of dehydration:

   - If there are signs of dehydration in any color:

     a. Increase the KWS user multiplier (see Section *3.3.1 Set KWS*) and repeat the steps above.

   - If there are no signs of dehydration:

     a. Use the current KWS user multiplier.
     b. (Optional) Decrease the KWS user multiplier to reduce KWS visibility and waste ink, then repeat the steps above.

3.5 Remove Queued Print Jobs

Perform the following operations to check or clear the queue:

1. Use the `getStatus()` PES command to check the job queue.
2. Use the `clearJobQueue()` PES command to clear the queue of all existing jobs.

4 Printing

4.1 Print Modes

The table below lists the print modes with each utility and the required input format for printing.

Table 6 – Print Modes and Supported Formats

Modes	Utility	File Format	Comments
External RIP	Gborcat	GBOR	N/A
Internal RIP (Embedded RIP)	• Kenmarecat	PDF/X-1a	OEM must convert the file to PDF/X-1a format. Reference host driver can be used for the PDF conversion. The OEM can also choose another tool.
	Reference host driver	Any commonly used format	DuraFlex will convert the file to a format that the system can recognize.

4.2 Set RIP Mode

Starting from software release R4.2.x, the print unit will initially boot in the Technictl mode and you will be required to set the RIP Mode to internal or external.

1. Log in to DuraFlex using PuTTY with the credentials (use `duraflex` for username and password).

   When the login is successful, the PuTTY terminal should respond with a shell prompt:
   `[duraflex@servername ~]$`

Note: Alternatively, use Windows 10 SSH if that is available. For example,
`ssh duraflex@192.168.100.200`

2. Change directory to the `hwparamstore.json` file location:

   `cd /opt/memjet/kareela/data`

3. Open and edit the `hwparamstore.json` file:

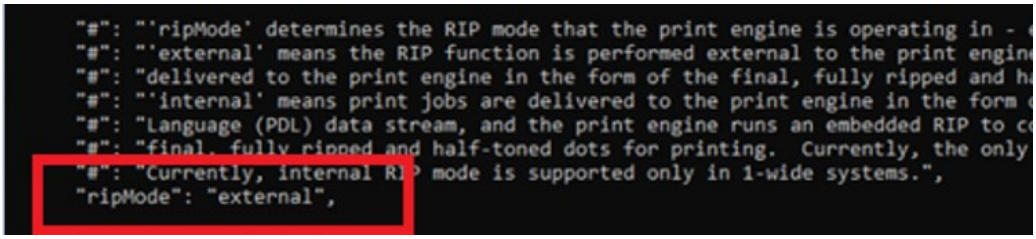
   a. Run the command to open the text editor:

      `sudo vi hwparamstore.json`

   b. Change the value of the `ripMode` variable to match the desired RIP mode.

      For example, if changing the RIP mode to the external RIP mode, set the `ripMode` variable to "`external`"; as shown in *Figure 3*.

Figure 3 – RIP Mode Set to "external" in the JSON File



Similarly, if the internal RIP mode is intended, set the ripMode variable to "internal".

   c. Save the `hwparamstore.json` and exit from the `vi` text editor.

Note: It is a new feature in R4.2.x that the OEM must update the `ripMode` variable in the `hwparamstore.json` file to set the RIP mode.

4. Use the following to enable the same RIP mode that you have set in `hwparamstore.json`.

   Using a PuTTY terminal:

   a. Disable the current RIP mode:

      `dtpStop`

   b. Power cycle the DuraFlex system.
   c. Enable the internal or external RIP mode:

      `dtpUseInternalRip` or `dtpUseExternalRip`

Note:	To change the print mode, the print unit must be in the OFF state.

4.3 External RIP mode – Print GBOR Files

Note:	The External RIP mode is also called “RIP Bypass” mode.

4.3.1 Prerequisites

- External RIP mode is enabled.
- ABT tools is installed, which contains the `gborcat.exe` utility.

  For more information on how to install the ABT tools, refer to the *DuraFlex Installation and Commissioning Guide*.

4.3.2 Use the Gborcat Command

The `gborcat.exe` command is automatically set up during the software installation.

1. Open a Windows PowerShell terminal.
2. Run the `gborcat.exe` command to send the GBOR file for printing:

   ```
   gborcat.exe [options] [file.gbor]
   ```

   The full path to the GBOR file location is required. For example, to print 10 copies, use the command:

   ```
   gborcat.exe -h<hostname> -c10 -v ContainingFolder/Filename.gbor
   ```

   The hostname has been set during installation. For more information about hostname, see the *DuraFlex Installation and Commissioning Guide*.

4.3.3 Gborcat Options

To view a complete list of options, run the command `gborcat.exe --help` in Windows PowerShell.

Table 7 shows options for printing GBOR files.

Table 7 – Gborcat Options for GBOR Printing

Option (Complete Form)	Option (Short Form)	Description
`--help`	`-H`	Display help information.
`--host=HOST`	`-hHOST`	The hostname or IP address of the Datapath PCA.
`--verbose`	`-V`	Display additional information to standard error.

Option (Complete Form)	Option (Short Form)	Description
`--copies=N`	`-cN`	The number of non-collated copies to output/print of each input page. The default is to output one copy.

Note: The DuraFlex system's internal RIP supports only files in PDF/X-1a format. If the selected PDF file is not in this format, the internal RIP will not process the PDF.

4.4 Internal RIP Mode – Print PDF Files Using Kenmarecat

4.4.1 Printing Specifications

Table 8 – Internal RIP Mode Printing Specifications for PDF

	Maximum Printable Width (mm)	Minimum Page Length (mm)	Maximum Page Length (mm)	Maximum Individual Image Within the Page (mm)	Maximum File Size (Megabytes)
A3 Printhead	324	12.75	710	600	128.4
A4 Printhead	220				

4.4.2 Prerequisites

- Enable the Internal RIP mode.
- Download the OEM ISO installation package, which contains the `kenmarecat.exe` utility.
- Set up Datapath PCA hostname.
- Confirm that all PDF files meet the following requirements:

  a. PDF files are in PDF/X-1a format.
  b. All pages must be at the same width.

4.4.3 Set up Kenmarecat

The `kenmarecat.exe` utility is provided with the OEM ISO installation package.

1. Open the `7-201-3-2-1-KenmareJobData_src-MJ1.x.x.zip` file from the installation package.
2. Copy the `kenmarecat.exe` utility to the desired location on the Client PC.

4.4.4 Use the Kenmarecat Command

1. Run the `kenmarecat.exe` command with the appropriate options to choose the color profile, number of copies, resolution, etc. This will send the input to the printing system.

   The recommended format is:
   ```
   kenmarecat.exe [options] [file]
   ```

   The following shows an example command with options:
   ```
   kenmarecat.exe -iID1035_1699_Thunderbolt_MKCY_140_HigherGamut -n1 -c2 -a1 -v -x1600 -y1600 -m2xQuadColor -h<hostname> /<path>/<filename>.pdf
   ```

2. With the removal of the Demo GUI, commands will need to be entered via the PES interface. First ensure the PES interface is open in the frontend mode:

   ```
   cd /opt/memjet/PDL/test_rigs/latest/bin/python start.py --mode=frontend
   ```

3. Use the PES interface to print the PDF file submitted by `kenmarecat.exe` command. Enter `printing.start()` to begin printing.

4.4.5 Kenmarecat Options

To view a complete list of options, run `kenmarecat.exe --help` in Terminal.

The table below shows Kenmarecat options for printing PDF files.

Table 9 – Kenmarecat Options for PDF Printing

Option (Complete Form)	Option (Short Form)	Description
`--help`	`-?`	Display help information.
`--jobName=NAME`	`-nNAME`	Configure the job name.
`--dither=NAME`	`-sNAME`	Configure the dither (screen).
`--profile=NAME`	`-iNAME`	Configure the ICC profile.
`--numPdfCopies=N`	`-cN`	Configure the number of copies of the whole document.
`--numPageCopies=N`	`-aN`	Configure the number of copies of each page within the document.
`--variableData`	`-v`	Enable variable data mode.
`--xResolution=DPI`	`-xDPI`	Configure the X resolution in dpi.
`--yResolution=DPI`	`-yDPI`	Configure the Y resolution in dpi.
`--host=HOST`	`-hHOST`	The hostname or IP address of the Datapath PCA.
`--verbose`	`-V`	Display additional information to standard error.
`--bpc=MODE`	`-bMODE`	Configure the Black Point Compensation (BPC) mode to be `on` or `off`. Color management needs to be `on`. For example, `--bpc=on` or `-bon`
`--colorMgt=MODE`	`-gMODE`	Configure the color management mode to be `on` or `off`. For example, `--colorMgt=on` or `-gon`
`--intent=INTENT`	`-rINTENT`	Configure the rendering intent to be one of the following values: • `relative` • `absolute` • `saturation` • `perceptual` Color management needs to be `on`. For example, `--intent=absolute` or `-rabsolute`

4.5 Print a Large PDF File

If a PDF file is larger than 128 MB, it is unable to fit into Kenmare buffer. Perform the following tasks:

- split it into multiple pieces and join them into one print job
- verify the data buffer level in the PES API
- create a new `.cfg` file to configure the number of pages

4.5.1 Split the PDF File and Join the Pieces

1. Use your preferred software to split the PDF file into pieces approximately 60 MB in file size.

   Splitting the large PDF file into 60 MB pieces means that kenmarecat can download two (2) files, and when it finishes ripping one file, the next one can start the ripping process immediately. This will minimize the chances of data underrun.

2. Save the pieces into multiple files in the same order as they show in the original PDF file.

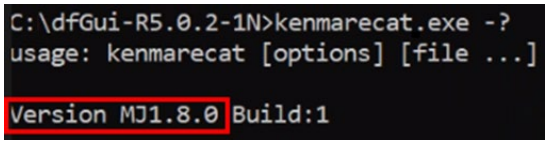
   For example, `file1.pdf`, `file2.pdf`, `file3.pdf`, and so on.

3. Use kenmarecat version MJ1.8.0 or higher to join the multiple pieces of the PDF file into a single job.

   a. Check the kenmarecat version:

   `kenmarecat.exe -help` or `kenmarecat.exe -?`
   The response will show the version.

Figure 4 – Kenmarecat Version in Command Response



   b. Use kenmarecat to join the pieces of the PDF file:

   `kenmarecat -v -hHOST file1.pdf file2.pdf fil3.pdf …`
   Replace `HOST` with the DuraFlex hostname or the Datapath PCA IP address. Kenmarecat will send all pieces in sequence, and the DuraFlex software will join them into one job.

Note:	List the pieces in the same order as they show in the original PDF file. The sequence will affect the print output.

   c. Use the PES interface to print the job submitted by kenmarecat.

4.5.2 Check the Data Buffer

Starting from R4.2.3, the DuraFlex software reports the print data buffer level to the PES API. Be sure to install R4.2.3 or higher on the printing system and check the `PmStatus.printDataBuffer` level.

4.5.3 Configure the Number of Pages

The system uses a default configuration file `/opt/memjet/kenmare/config/default.cfg` to set the following values:

```
numPageData=256
numRasterBuffers=1372
```

To change the setting for the number of pages:

1. Open a PuTTY terminal and log in to DuraFlex.

2. Start the PES interface in the frontend mode.

```
cd /opt/memjet/PDL/test_rigs/latest/bin/
python start.py --mode=frontend
```

3. Change to the following directory:

```
cd /opt/memjet/kenmare/config/
```

4. Create a new file with the extension `.cfg`:

```
touch filename.cfg
```

5. Use a plain text editor, e.g. vi to open the file:

```
sudo vi filename.cfg
```

6. Add the following two (2) lines into the file, such as:

```
[RipMemoryPreferredDimensions]
numPageData=350
```

Note:	The value `350` above is only an example. For the application, contact your Memjet Technical Account Manager (TAM).

7. Save and close this file.
8. Power cycle the system to make the changes take effect.
9. After the restart, search the Kenmare log for `numPageData=350` (or the preferred value).

   If it can be found, the configuration is successful.

4.6 Reference Host Driver Printing

4.6.1 Prerequisites

The following must be performed before printing:

- Internal RIP mode is enabled
- Reference host driver is installed

  For more information on how to install the reference host driver, refer to the *DuraFlex Installation and Commissioning Guide*.

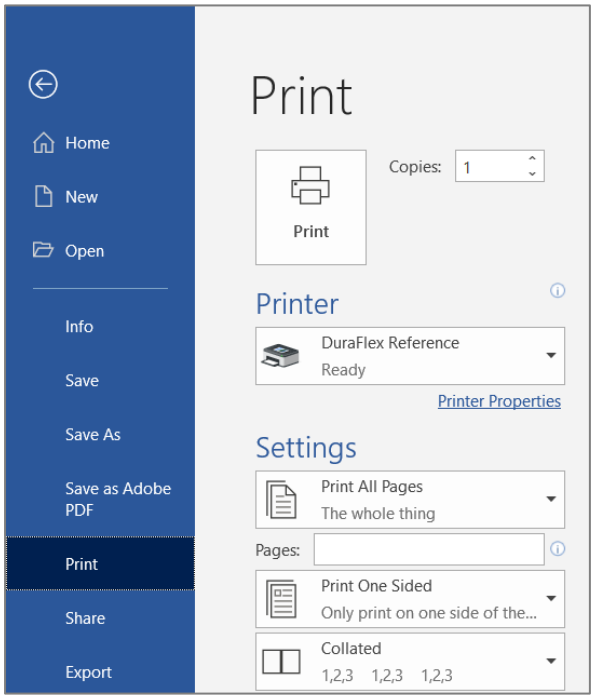
4.6.2 Use the Reference Host Driver

The reference host driver converts commonly used file formats into an input format that the DuraFlex printing system can recognize. After the reference host driver is installed, it shows **DuraFlex Reference** in the printer list (*Figure 5*).

To submit a print job from a software application that supports printing:

1. Open the software application (e.g., Microsoft Word), select **Print**, and choose **DuraFlex Reference**.

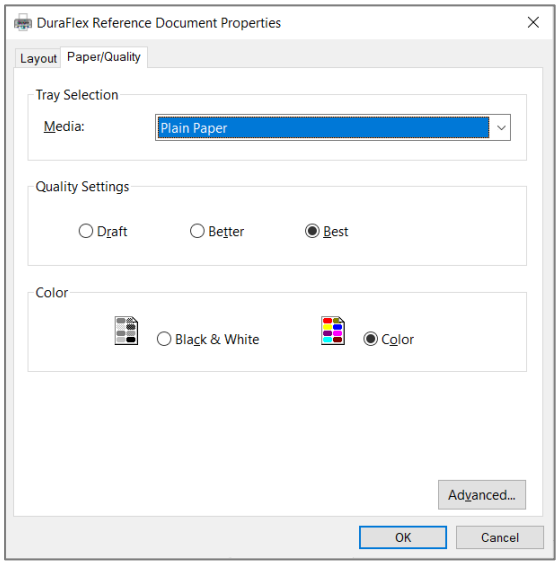
Figure 5 – DuraFlex Reference Example



2. To view the DuraFlex Reference properties, click **Printer Properties**. The DuraFlex Reference Document Properties window opens.

3. Click **Paper/Quality** to view or adjust media type, quality settings, and color mode.

Figure 6 – DuraFlex Reference Document Properties Window



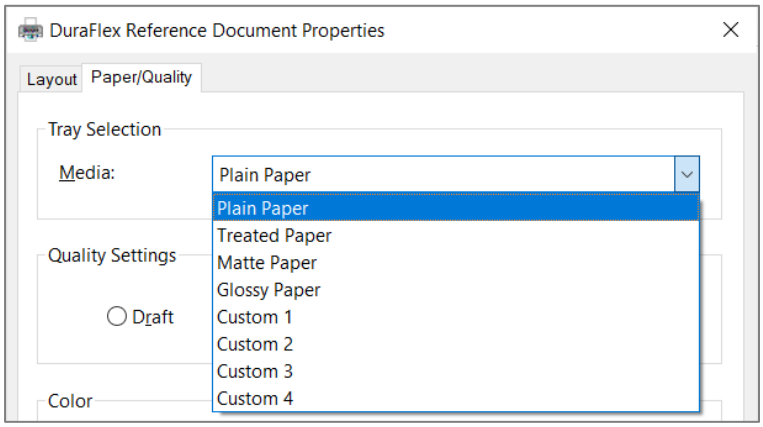
For example, if you want to change the media type, expand the **Media** dropdown list (*Figure 7*), and choose one of the options:

- Plain
- Treated
- Matte
- Glossy

- Custom 1 to 4

See *Table 2* for more details to choose the appropriate option.

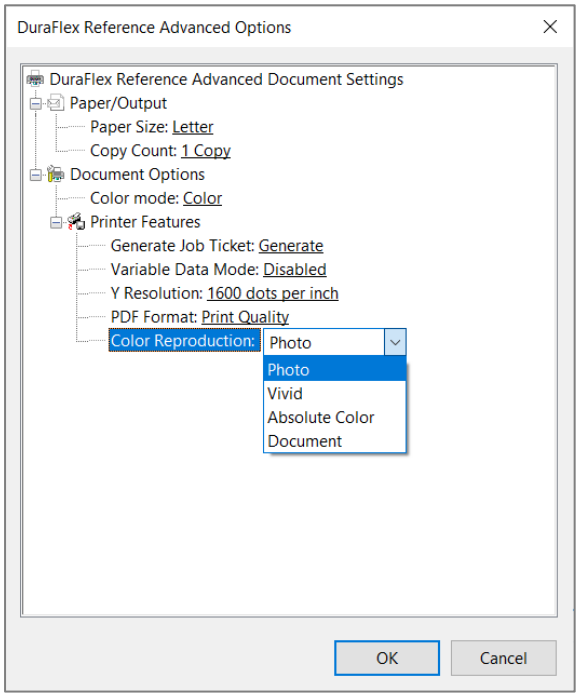
Figure 7 – Supported Media Types



4. To view or adjust the advanced settings, click **Advanced…** in the DuraFlex Reference Document Properties window. The DuraFlex Reference Advanced Options window displays.

   Figure 8 shows a combination of Memjet-provided parameters and third-party parameters:

Figure 8 – DuraFlex Reference Advanced Options Window



Note:	For more information about the third-party parameters, contact your Memjet Technical Account Manager (TAM).

- Third-party parameters used by Reference Host Driver:
  - Paper size
  - Color mode
  - PDF format

- Memjet-provided parameters:
  - Copy count
  - Variable data mode
  - Y resolution
  - Color reproduction (See *Table 10*)

The table below explains the meaning of the color reproduction options and how they map to rendering intent and black point compensation (BPC).

Table 10 – Mapping Between Color Reproduction Options, Rendering Intent, and BPC

Color Reproduction Option	Rendering Intent	Black Point Compensation (BPC)
Photo	Perceptual	On
Vivid	Relative	On
Absolute Color	Absolute	Off
Document	Saturation	Off

5 Printhead Maintenance

Table 11 shows a brief list of PES interface operations to preserve and maintain print component health. Refer to the PES Interface API in the *DuraFlex Software Databook* for more details.

Table 11 – Printhead Maintenance Operations

Task	PES Command	Description
Cap the Printhead	`startMovingPrintheads()`	Printhead should be in capped position when not in use to prevent nozzles dehydrating.
Light Service	`startServicing()`	Perform at the beginning and end of the shift to make sure nozzles are clean. If any printhead health issues, perform light service to restore nozzle health.
Medium Service	`startServicing()`	Perform if light service is not successful in recovering the Printhead print quality. Medium service uses a higher suction vacuum than light service.
Heavy Service	`startServicing()`	• A heavy service consumes significant waste ink and time and is not needed during normal operations. • Only perform this rarely and only if successive light and medium services do not recover print quality. **CAUTION:** Never perform more than two heavy services back-to-back, or the WIMM tank may overflow. If the OEM system has a custom WIMM drain system, the default minimum time can be modified via the `hwparamstore.json` file.
Replace Wiper	`replaceWipers()`	Moves the wiper carriage to the loading/unloading position
Prime	`startPriming()`	• Circulates ink from the ink reservoir to the printhead. • Initialize the printing system before priming to avoid the valve being left in an unknown position.
Deprime	`startDepriming()`	• Drains ink from the printhead to the ink reservoir. • Initialize the printing system before depriming to avoid the valve being left in an unknown position.
Remove the Printhead	`startMovingPrintheads()`	Use this to move the printhead into position for replacement

6 Intra Job Maintenance

This section describes the PES API (Kareela) support for various types of in-job maintenance, that is, additional ink ejection which can be coordinated with a job's print data in datapath pipeline (Gymea) to improve print quality. There are 4 distinct types of maintenance:

- declog
- pre-page spitbars
- inter-page spitbars
- KWS

These, together with 'sacrificial' pages and inter-page gaps, can be combined in various ways to achieve a wide variety of maintenance regimes.

Section 6.7 provides a number of examples of how the different hydration modes can be combined

6.1 Where Ink Gets Ejected

This section describes various settings provided in the PES API (Kareela) and the effect they have upon where ink is ejected.

6.1.1 Vertically

Ejection of ink in the vertical dimension (direction of media movement) is synchronized to OEM-provided input signals i.e., media encoder and optional top of form (TOF) signal. Each set of media timing signals and the printheads that use them is called a media timing group.

The position of media as it moves through the engine is tracked according to the media encoder input signals. This allows pages to be printed and other maintenance ejections to occur at the correct vertical scale, independent of media speed.

The vertical positions on the media where the engine can start printing a page are referred to here as top-of-page points. If the optional TOF input signal is being used then the points on the media where the TOF signal becomes active (adjusted for the distance from the sensor to the print zone, using the `mediaReadyOffset` setting) become candidate top-of-page points. If a TOF signal is not used, then top-of-page points implicitly occur as soon as vertical space is available for printing.

As a top-of-page point passes under an individual printhead it will, if ready, begin printing the next page of the current print job.

As shown in *Figure 9*, preceding each top-of-page point there is an optional pre-page spit target area onto which maintenance ink (declog and pre-page spitbars) can be ejected. There are two types of pre-page spit target area:

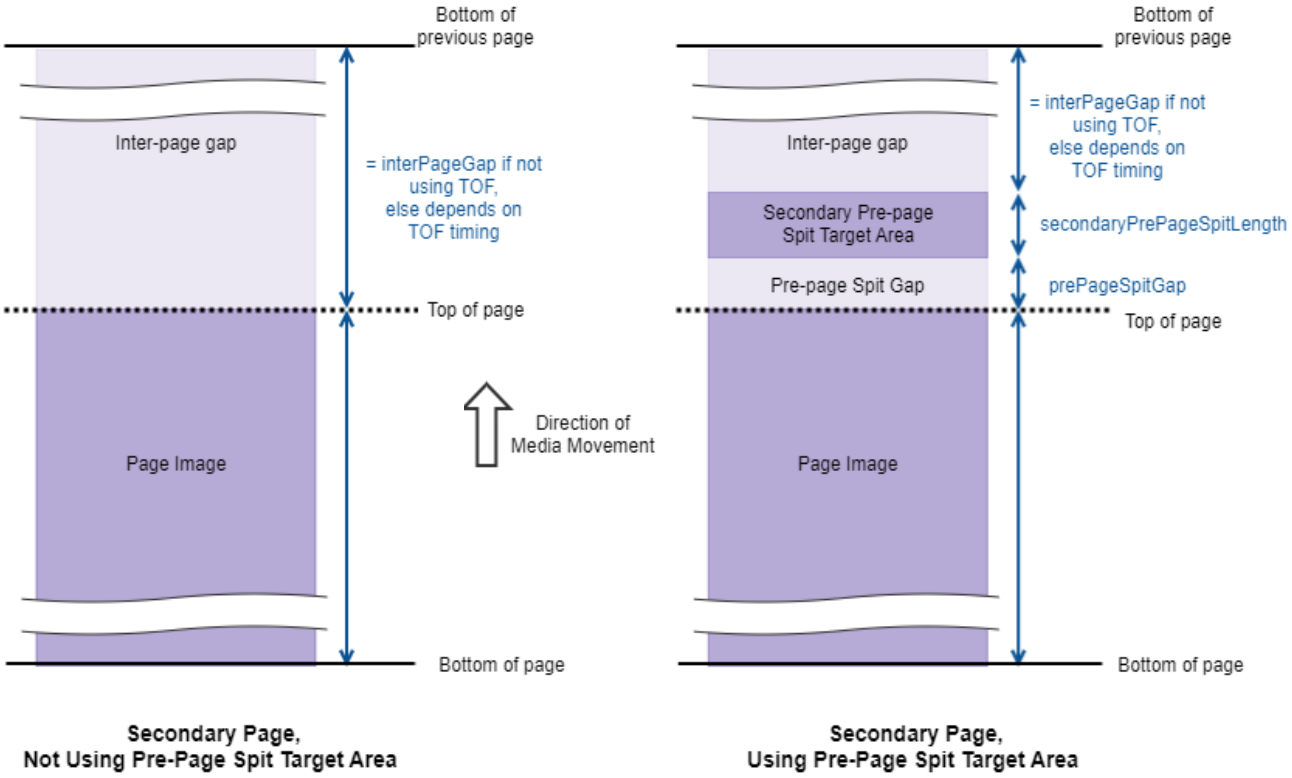
- a first pre-page spit target area, which precedes the first page of a job chain. That area's length is configured by the engine's `firstPrePageSpitLength` setting, and the gap between the bottom of that area and the top-of-page point for the first page is configured by the engine's `prePageSpitGap` setting.
- a secondary pre-page spit target area, which precedes all other pages of a job chain. That area's length is configured by the engine's `secondaryPrePageSpitLength` setting, and the gap between the bottom of that area and the top-of-page point for the page that follows is configured by the engine's `prePageSpitGap` setting.

In this document the term pre-page spit target area is used to refer to both types of target area.

The type of pre-page ejections, and therefore whether the pre-page spit target area is used at all, is configured through the engine's `declogMode` and `prePageSpitIntensityPct` settings.

Any vertical distance remaining between the bottom of a page and the next page's pre-page spit target area (or its top-of-page point if the optional pre-page spit target area is not being used) is known as an inter-page gap. The length of this gap will depend upon the relative time between consecutive TOF input signal transitions. If a TOF signal is not used, then an inter-page gap with length equal to the engine's `interPageGap` setting will be synthesized. If a TOF signal is not used and the `interPageGap` setting is zero, and no pre-page spit target area is configured, then there will be no gap between pages i.e., the top of a page will begin printing immediately after the bottom of the previous page.

Figure 9 – Inter-page Gap and Target Area Definitions



6.1.2 Horizontally

Ejection of in-job maintenance ink (KWS, inter-page spitbars, pre-page spitbars and declog) is performed across the entire width of each printhead.

6.2 Types of Pre-page Ejection

There are two types of pre-page ejection:

- **Declog**: an energetic ejection of ink, across the entire printhead, which aims to clear any partial clogging of nozzles due to dehydration.
- **Spitbar**: regular printing type of ejection, across the entire printhead. Each color can be configured to print at a specified print density.

Pre-page spitbars are enabled when the `prePageSpitIntensityPct` settings for one or more colors are set to be greater than zero. If pre-page spitbars are enabled, then they appear before each page in a pre-page spit target area.

In some declog modes declog ejections and spitbars must share the pre-page spit target areas. Declog will start at the top of the pre-page spit target area and continue for the configured number of

lines. However, the number of declog lines will be truncated if necessary to ensure that declog does not extend beyond the target area. Pre-page spitbars are placed at the bottom of the pre-page spit target area.

Declog takes precedence over spitbars, so where they would overlap, only declog ejections will appear. Thus if, for example, declog is configured such that it completely fills (or over-fills and so is truncated to fill) the target area then no pre-page spitbars will appear.

If truncation of the declog ejections become likely, the sacrificial modes may be more appealing.

There are some constraints in the current implementation:

- the length of all pre-page spitbars will be limited to the smaller of `firstPrePageSpitLength` and `secondaryPrePageSpitLength`.
- further, if spitbars are enabled but there is **no** declog, then the length of both first and secondary pre-page spit target areas will be the smaller of the two. For example: if `firstPrePageSpitLength` = 20mm and `secondaryPrePageSpitLength` = 10mm, and there is no declog, then a 10mm spitbar will appear before both first and secondary pages. If declog **is** enabled, each pre-page spit target area where declog will appear will be its configured length, but the spitbar component printed in the area will be limited to the smaller of `firstPrePageSpitLength` and `secondaryPrePageSpitLength`. Thus, in the earlier example, when declog will appear in the first pre-page spit target area then it will be 20mm long, with declog positioned starting at the leading edge, and a 10mm spitbar positioned to end at the trailing edge (possibly partly or completely replaced by declog if they overlap). And when declog will appear in the secondary pre-page spit target area then it will be 10mm, with declog at the leading edge and spitbar effectively filling the remaining (if any) portion of the 10mm area.
- the intensity value used for a spitbar will be the `prePageSpitIntensityPct` setting value rounded to the nearest multiple of 10. For example, setting `prePageSpitIntensityPct` to a value of 5 to 14 inclusive will result in a spitbar with intensity of 10% for that color.
- when determining how many declog ejections will fit into a given vertical area, the maximum allowed speed is used, rather than the intended speed of the job. If intended speed is less than the allowed maximum speed, The effect is that less declog ejections are used than would have fit at intended speed.

6.3 Declog Modes

Note that declog is time based. Due to the nature of a declog spit, each spit takes a fixed amount of time, and, once it starts, is synchronized with media movement. Thus, at slow speed it will be vertically more concentrated in an area, as speed increases it will be more spread out.

The detailed configuration to be used for declog ejections for the two types of pre-page spit target area (first and secondary) are set in the `hwparamstore` JSON file. This config includes the number of lines of declog to be ejected. This number is treated as an 'ideal', but the actual number used may be reduced if that is necessary to restrict the declog ejections to keep within the corresponding pre-page spit target area, given the intended media speed for the job being printed. If the number of lines of declog must be reduced in either or both pre-page spit target areas then this will be reported by the engine, by setting `FIRST_PAGE_SPIT_TRUNCATED` and/or `SECONDARY_PAGE_SPIT_TRUNCATED` conditions in the `engineStatus` field of the `AllStatus` structure when the job starts printing. The detailed declog config for the sacrificial page or pre-job declog, if they are enabled, will be the `hwparamstore` JSON file settings for the first pre-page spit target area.

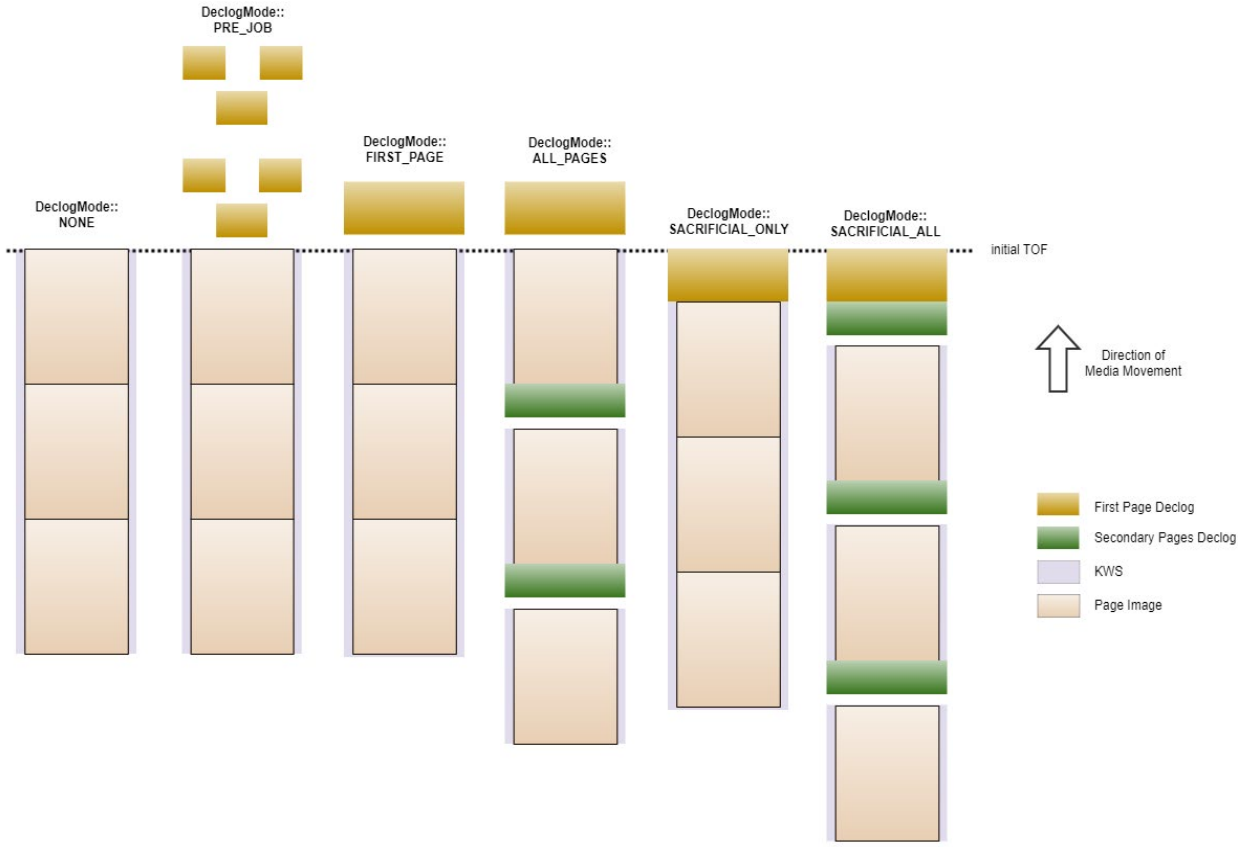
Declog modes when not using a TOF signal for all pages

`TofSyncMode::NONE` or `TofSyncMode::FIRST_PAGE` can be used on a roll-fed printer, which doesn't use a TOF sensor input signal to synchronize all pages.

Figure 10 shows the ejections for a 3-wide printer when the various `DeclogModes` are combined with these `TofSyncModes`, using configuration:

- pre-page spit target areas defined (`firstPrePageSpitLength` and `secondaryPrePageSpitLength>0`)
- pre-page spitbars are disabled (`prePageSpitIntensityPct = 0`)
- no inter-page gap (`interPageGap = 0`)
- a small gap after the pre-page spit target area (`prePageSpitGap > 0`)
- KWS is enabled
- inter-page KWS is disabled (`allowInterPageEjections = false`)

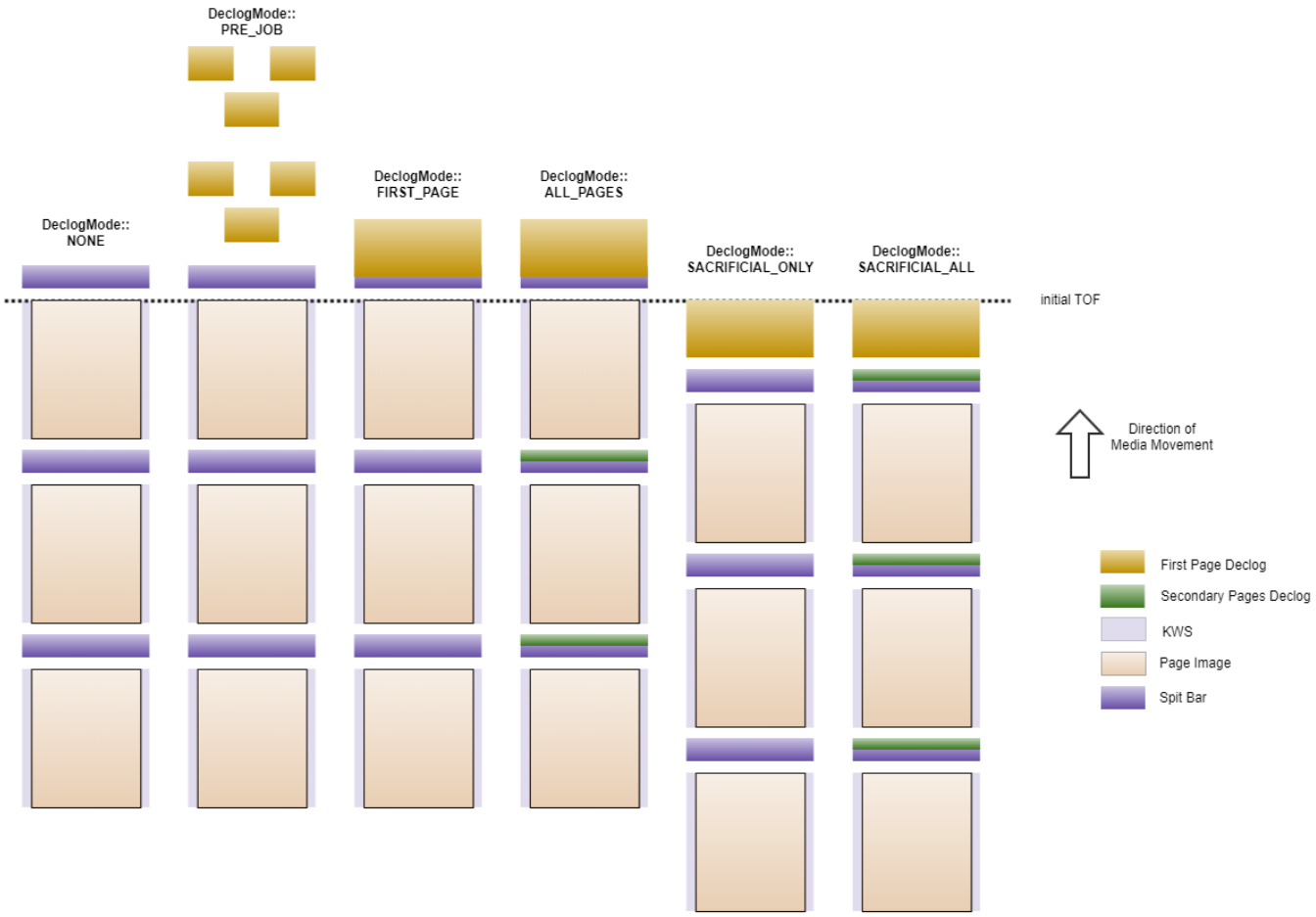
Figure 10 – Various Declog Modes for 3PH-Wide System



The key difference between `PRE_JOB` and the other declog modes is that `PRE_JOB` is performed on all printheads simultaneously, so it is spread over a greater distance; where it lands is not related to the first pre-page spit target area, and `firstPrePageSpitLength` is ignored. For printheads with large Y-offsets, there may be a significant gap between the end of `PRE_JOB` declog and top of the first page. For the other, `non-PRE_JOB` modes the declog is synchronized so that each printhead completes declog close together, either in the pre-page spit target area or on the sacrificial page.

Figure 11 is similar to *Figure 10* except with pre-page spitbars enabled and an inter-page gap introduced:

Figure 11 – Various Declog Modes with Spit Bars Enabled



6.4 Declog Modes with TOFs For All Pages

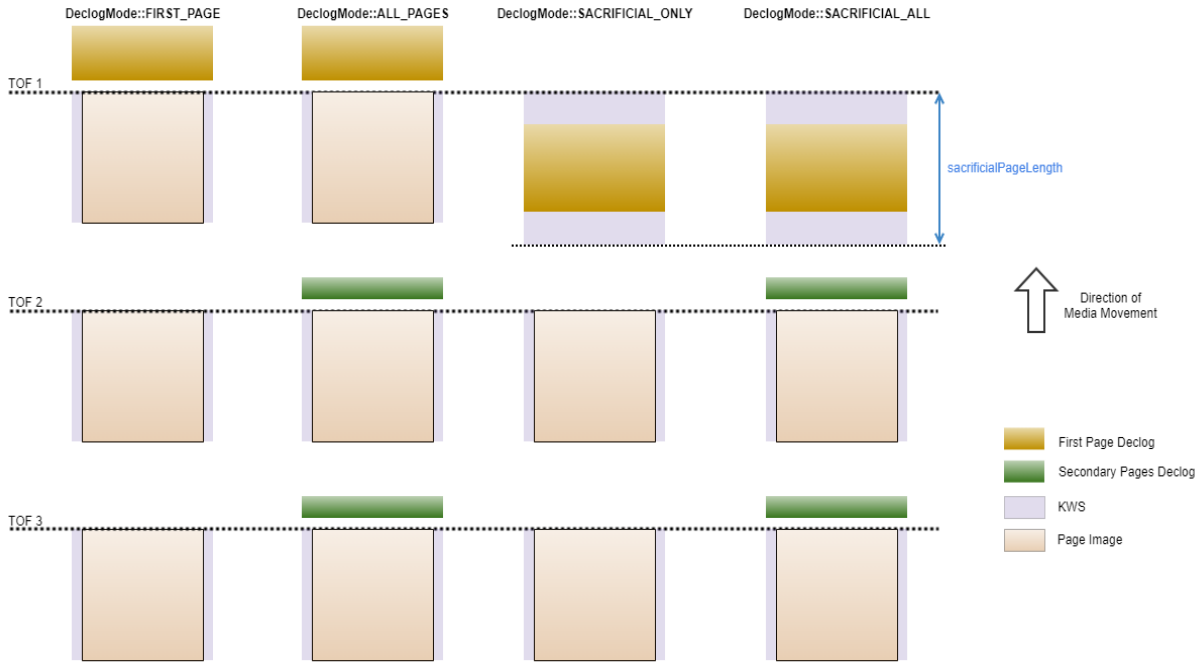
`TofSyncMode::ALL_PAGES` and `TofSyncMode::TRANSACTIONAL` modes are used when a TOF signal is being used to synchronize all pages, typically used for cut-sheet printing.

The following diagram shows the resulting ejections when various `DeclogModes` are combined with these `TofSyncModes`, using configuration:

- pre-page spit target areas defined (`firstPrePageSpitLength` and `secondaryPrePageSpitLength > 0`)
- pre-page spitbars are disabled (`prePageSpitIntensityPct = 0`)
- a small gap after the pre-page spit target area (`prePageSpitGap > 0`)
- KWS is enabled
- inter-page KWS is disabled (`allowInterPageEjections = false`)

The `DeclogMode::NONE` and `DeclogMode::PRE_JOB` modes are not shown.

Figure 12 – Declog Modes with Top of Form Signals

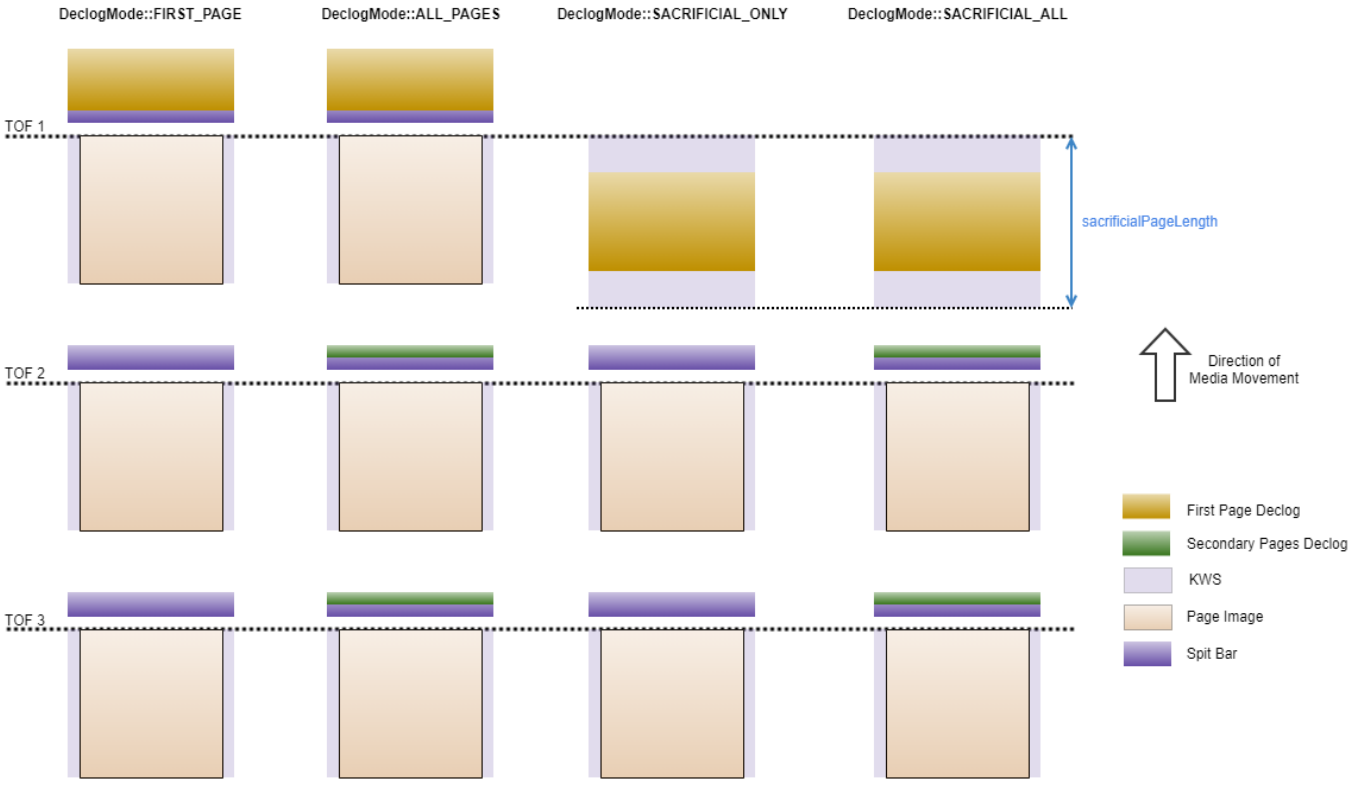


The `FIRST_PAGE` and `ALL_PAGES` modes perform declog only into the pre-page spit target areas (first and/or secondary). Because declog takes a fixed amount of time to complete, for higher media speeds declog requires a greater length of media. Hence to make a desired amount of declog fit in the pre-page target area either a longer target area is required, or the declog will be truncated.

Note:	The length of the target area plus pre-page spit gap must be less than the `mediaReadyOffset` setting, which is the distance from the TOF sensor to the top-of-page point.

If both of those options are undesirable, then one of the sacrificial declog modes can be used. Those modes allow declog to occupy up to the `sacrificialPageLength` setting after the first TOF i.e., the first sheet in a sheet-fed engine is sacrificed for declog and the first page image is instead printed after the second TOF.

Figure 13 – Declog Modes with Top of Form Signals and Spit Bars



6.5 Inter-page Ejections

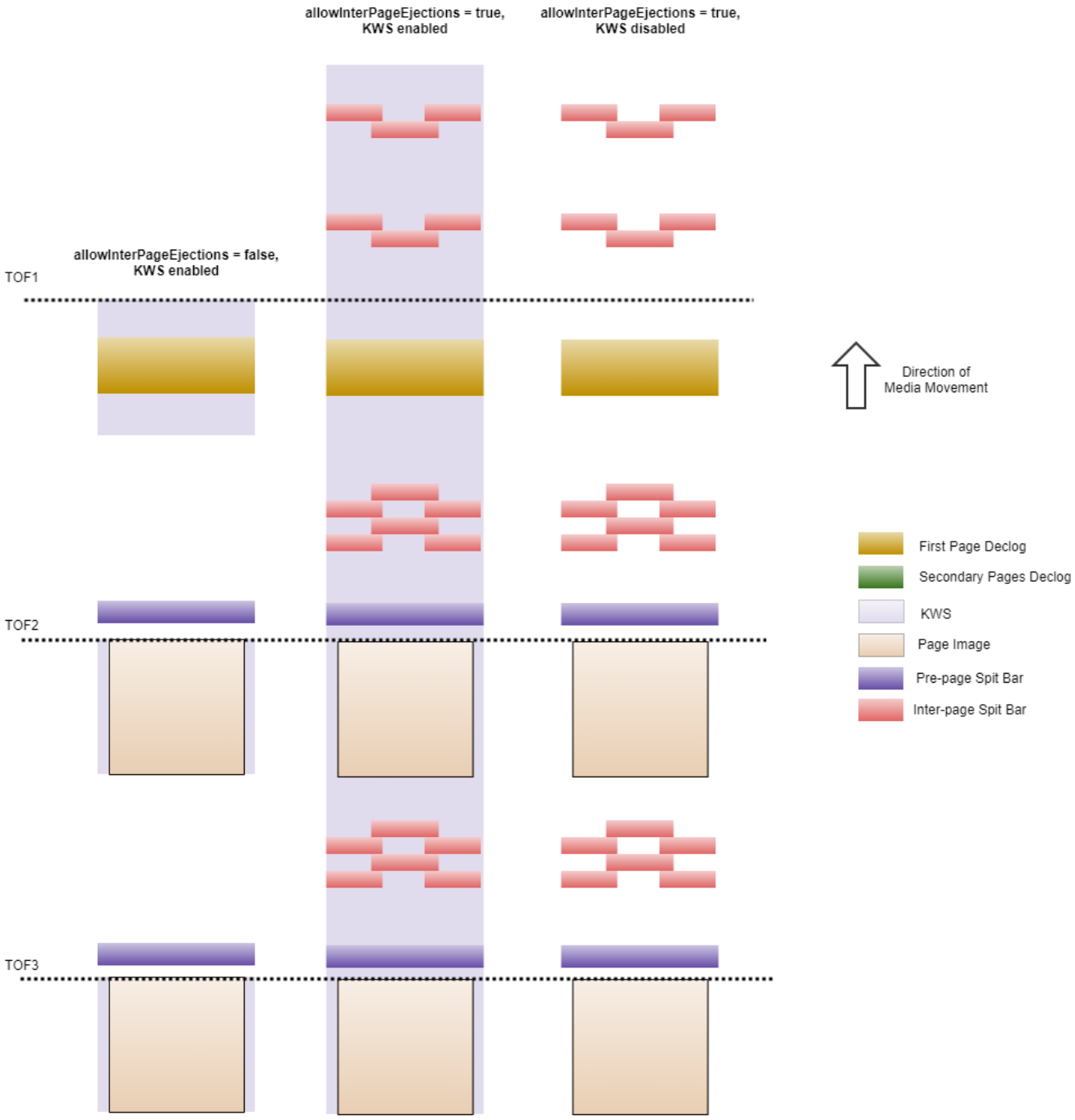
The `allowInterPageEjections` setting specifies whether the engine is allowed to eject certain types of maintenance ink onto otherwise-unused vertical space before the first page or in the inter-page gaps between secondary pages. As shown in *Figure 14*, these ejections are:

- KWS: If KWS is enabled, it will be ejected, at the configured KWS rate, before the first page (and before the first pre-page spit target area, if one is configured), and in inter-page gaps (and before the secondary pre-page spit target area if one is configured).
- Inter-page spitbars: These will be ejected periodically and appear before the first page and in inter-page gaps if those gaps are large enough. Note that inter-page spitbars only appear before pages that are TOF triggered; for example, when using `TofSyncMode::FIRST_PAGE` inter-page spitbars will only appear before the first page, and not between subsequent pages. Typically, inter-page spitbars are used for periodic hydration of the printhead in scenarios where the inter-page gap is longer than expected, for example a mis-pick on a sheet-fed machine. Note that inter-page spitbars are in addition to the maintenance spitting in the pre-page spit target areas, which is controlled by the `prePageSpitIntensityPct` setting. The detailed configuration to be used for inter-page spitbars is set in the `hwparamstore` JSON file.

On roll-fed printers, users might choose to allow inter-page ejections because that ink would land safely on waste media. Sheet-fed engines where ejection of ink without a sheet under the printhead is not acceptable will typically be configured to disallow it.

The following diagram compares the effect of disallowing versus allowing inter-page ejections, combined with KWS enabled/disabled. In all cases `SACRIFICIAL_ONLY` declog mode is used with pre-page spitbars enabled.

Figure 14 – Inter-page Ejections and Spit Bar Options



6.6 Keep Wet Spit (KWS)

Keep Wet Spit is also part of in-job maintenance. The KWS rate can be configured in the PES API, via the `userKwsMultiplier` in the `KPesSettings.thrift` IDL.

Horizontally, KWS ink is ejected across the entire width of each printhead. Vertically, KWS ink is ejected onto each printed page, and optionally during inter-page gaps, including the gap before the first page. It is controlled by the `allowInterPageEjections` PES API setting.

6.7 Hydration Examples

This section outlines a number of examples of printhead hydration configurations. It is important to review the *DuraFlex Software Release Notes R5.2.2* to understand the variety of options and constraints related to these and other configurations. Not every possibility is listed, instead, some common options are shown to provide an example for how the configurations work. The configurations rely on a mix of settings in `hwparamstore.json` and via the PES interface. Hence, some options must be configured prior to run time while others can be adjusted in between print jobs or prior to print jobs.

An additional constraint is that there must be enough distance between the TOF and the print zone to accommodate the variety of hydration ejections that are configured. For these examples, the assumption is that the `mediaReadyOffset` (i.e. TOF offset) plus the `yOffset` is at least 300 mm. Also, any modes that require an interpage gap must have sufficient space to fit the desired hydration ejections. Note that when the settings chosen are not valid, there will be information in the log files that explain the constraints. Here is an example of the constraints for `DeclogMode` set to `ALL_PAGES`:

`DeclogMode::ALL_PAGES` requires:

1. `firstPrePageSpitLength` to be greater than 1148.87µm
2. The sum of `firstPrePageSpitLength`, `prePageSpitGap`, and `interPageGap` must be less than the smallest `mediaReadyOffset` setting + `yOffset`
3. `secondaryPrePageSpitLength` to be greater than 1148.87µm
4. The sum of `secondaryPrePageSpitLength`, `prePageSpitGap`, and `interPageGap` must be less than the smallest `mediaReadyOffset` setting + `yOffset`

There are two types of parameters for some settings. For parameters, such as `declogMode`, there is a default initial setting that can readily be changed via the PES interface by reading the settings via `getSettings()`, modifying the `declogMode` value, then writing the settings back via `storeSettings()`.

The entry in the PES IDL file for `declogMode` looks like:

```
optional KPesCommon.DeclogMode declogMode;
```

For parameters that are set up “with a factory default,” such as `firstPrePageSpitLength`, the “`isFactoryDefault`” property of the parameter must be set to False, along with setting the value property. The entry in the PES IDL file for `firstPrePageSpitLength` looks like:

```
optional KPesCommon.DistanceUmWithFactoryDefault firstPrePageSpitLength;
```

Setting these parameters looks like:

```
settings = pes.getSettings()
settings.firstPrePageSpitLength.isFactoryDefault = False
settings.firstPrePageSpitLength.value = 90000
pes.storeSettings(settings)
```

For reference, the declog modes are mapped to integers as follows:

```
NONE = 1
PRE_JOB = 2
FIRST_PAGE = 3
ALL_PAGES = 4
SACRIFICIAL_ONLY = 5
SACRIFICIAL_ALL = 6
SYSTEM_DEFAULT = 7
```

For the examples, assume the following are the initial PES interface parameter settings:

```
settings = pes.getSettings()
settings.declogMode = 7
```

```
settings.allowInterPageEjections.isFactoryDefault = True
settings.prePageSpitIntensityPct[1].isFactoryDefault = True
settings.prePageSpitIntensityPct[2].isFactoryDefault = True
settings.prePageSpitIntensityPct[3].isFactoryDefault = True
settings.prePageSpitIntensityPct[4].isFactoryDefault = True
settings.firstPrePageSpitLength.isFactoryDefault = True
settings.secondaryPrePageSpitLength.isFactoryDefault = True
settings.prePageSpitGap.isFactoryDefault = True
settings.interPageGap.isFactoryDefault = True
pes.storeSettings(settings)
```

Similarly, these are the initial `hwparamstore.json` settings:

Example hwparamstore.json:

```
"inJobMaintenance":
{
    "defaultFirstPrePageSpitLengthUm": 0,
    "defaultSecondaryPrePageSpitLengthUm": 0,
    "defaultPrePageSpitGapUm": 0,
    "defaultSacrificialPageLengthUm": 0,
    "defaultInterPageGapUm": 0,
    "defaultDeclogMode": "PRE_JOB",
    "defaultPrePageSpitIntensityPct":
    {
        "cyan":    0,
        "magenta": 0,
        "yellow":  0,
        "black":   0
    },
    "defaultAllowInterPageEjections": false,
    "declog":
    {
        "firstPage": {
            "declogSpits": 20,
            "preheatOnDurationNsec": 27,
            "preheatOffDurationNsec": 437,
            "preheatPulseCycles": 25,
            "mainPulseDurationNsec": 347,
            "span": 20
        },
        "secondaryPages": {
            "declogSpits": 20,
            "preheatOnDurationNsec": 27,
            "preheatOffDurationNsec": 437,
            "preheatPulseCycles": 25,
            "mainPulseDurationNsec": 347,
            "span": 20
        }
    },
    "interPageSpitbars": {
        "cyan":
        {
            "delayLines": 1000,
            "periodLines": 100,
            "heightLines": 10,
            "mask": 255
        },
        "magenta":
        {
            "delayLines": 1000,
            "periodLines": 100,
            "heightLines": 10,
            "mask": 255
        },
        "yellow":
        {
            "delayLines": 1000,
            "periodLines": 100,
            "heightLines": 10,
            "mask": 255
        },
```

```
            "black":
            {
                "delayLines": 1000,
                "periodLines": 100,
                "heightLines": 10,
                "mask": 255
            }
        }
    },
```

6.7.1 Example 1 – Pre-Job Declog, KWS Between Pages, no Interpage Spit Bars

This configuration will trigger a declog spit right after the printhead reaches the print zone and then start printing KWS. This is the typical setup for a standard roll-to-roll print configuration and can work well for a cut sheet system with the proper level of KWS configured.

Modify the `heightLines` to zero for each of cyan, magenta, yellow, and black in the `interPageSpitbars` section of `hwparamstore.json` to disable spit bars.

Example hwparamstore.json:

```
        "interPageSpitbars": {
            "cyan":
            {
                "delayLines": 1000,
                "periodLines": 100,
                "heightLines": 0,
                "mask": 255
            },
            "magenta":
            {
                "delayLines": 1000,
                "periodLines": 100,
                "heightLines": 0,
                "mask": 255
            },
            "yellow":
            {
                "delayLines": 1000,
                "periodLines": 100,
                "heightLines": 0,
                "mask": 255
            },
            "black":
            {
                "delayLines": 1000,
                "periodLines": 100,
                "heightLines": 0,
                "mask": 255
            }
        }
```

- Set `declogMode = 2`
- Set `allowInterPageEjections = TRUE`

Example PES commands:

```
settings = pes.getSettings()
settings.declogMode = 2
settings.allowInterPageEjections.isFactoryDefault = False
settings.allowInterPageEjections.value = True
pes.storeSettings(settings)
```

6.7.2 Example 2 – Declog Prior to Each Page, KWS Between Pages, No Interpage Spit Bars

This configuration will trigger a declog spit prior to the start of the first page and then prior to the start of subsequent pages. KWS will print between pages. The interpage gaps must be spaced enough to allow the set declog print length. This means that for cut sheet applications, the media must feed with gaps larger than the `secondaryPrePageSpitLength`. For roll-to-roll applications, the `interPageGap` must be set to a value larger than `secondaryPrePageSpitLength`.

The settings shown here with a length of 50,000 µm are an example. The size can be tuned for a particular application. It is useful to check the size of a start-of-job declog spit and use that length for the `firstPrePageSpitLength` to ensure good hydration. The length of a start-of-job declog gets longer as print speed increases.

If the `prePageSpitGap` is 0, the print will start immediately after the declog spit.

Modify the `heightLines` to 0 for each of cyan, magenta, yellow, and black in the `interPageSpitbars` section of `hwparamstore.json` to disable spit bars.

- Set `declogMode = 4`
- Set `allowInterPageEjections = TRUE`
- Set `firstPrePageSpitLength = 50000`
- Set `secondaryPrePageSpitLength = 50000`

6.7.3 Example 3 – First Page Declog, KWS Between Pages, and Inter-page Spit Bars

This configuration will trigger the declog spit just before the first page of a job and will enable spit bars in-between subsequent cut sheet pages.

The default configuration for spit bars will produce a black spitbar 10 lines tall (in the print direction) that first prints 1000 lines after the end of the previous page and then repeats every 100 lines. The settings can be changed in the `hwparamstore.json` file to suit specific needs based on the print environment, print system configuration, and time between cut sheet pages.

Modify the `heightLines` to 10 for each of cyan, magenta, yellow, and black in the `interPageSpitbars` section of `hwparamstore.json` .

- Set `declogMode = 3`
- Set `allowInterPageEjections = TRUE`

6.7.4 Example 4 – Sacrificial Page Declog, KWS Between Pages, no Inter-page Spit Bars

This configuration will start printing KWS but will not trigger a declog spit until the first page of a job triggers the TOF. This is typically used for cut-sheet applications where it is desirable to avoid spitting the declog spit onto a belt (assuming no spittoon).

Change the `heightLines` to for cyan, magenta, yellow, and black to equal zero (0) in the `interPageSpitbars` section of `hwparamstore.json`.

- Set `declogMode = 5`
- Set `allowInterPageEjections = TRUE`

6.7.5 Example 5 – First Page Declog, KWS Between Pages, Inter-page Spit Bars, Pre-page Spits, Pre-page Spit Gap

This configuration will provide a strong amount of hydration and is useful for longer gaps between cut sheet pages, extra airflow in the print zone, and dry conditions.

It sets up a declog spit just before the first page, has a pre-page spit 10 mm tall, has interpage spit bars 10 lines tall starting after 1000 lines from the prior page and repeating every 100 lines, and provides a 10 mm gap between interpage spit bars and pages (based on `prePageSpitGap`). It is more suitable for cut sheet applications with a spittoon due to the number of spits between pages.

Modify the `heightLines` to 10 for each of cyan, magenta, yellow, and black in the `interPageSpitbars` section of `hwparamstore.json`

- Set `declogMode = 3`
- Set `allowInterPageEjections = TRUE`
- Set `prePageSpitIntensity = 50`
- Set `firstPrePageSpitLength = 90000`
- Set `secondaryPrePageSpitLength = 10000`
- Set `prePageSpitGap = 10000`

7 System Diagnosis

7.1 10G Ethernet Connection Bandwidth Test

This section provides steps to perform an iperf test to check the maximum achievable bandwidth of the 10G Ethernet connection between the Windows 10 Client PC and the DuraFlex print unit.

To ensure the fast delivery of RIP data from the Client PC to DuraFlex, the 10G Ethernet connection needs to provide adequate bandwidth. To avoid data underrun, a minimum bandwidth of 3 Gigabits/sec is required. The maximum achievable bandwidth can be influenced by multiple factors, including computer hardware, drivers, Ethernet cables, etc.

7.1.1 Prerequisites

- From your OEM Partner Site (**DuraFlex > Software > Tools**), download the following file:

  `MJ-iperf-3.1.3-win64.zip`

Note:	Only use this file for the specific test, since it includes a bug fix for the general iperf test available from the Internet.

7.1.2 Procedure

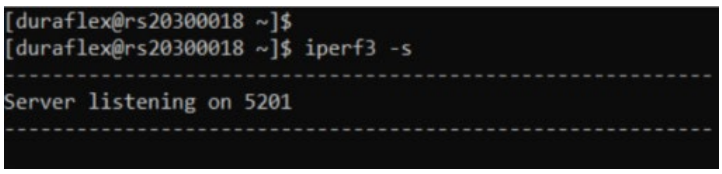
To run the iperf test:

1. Copy the `MJ-iperf-3.1.3-win64.zip` folder to the Client PC and unzip this folder.
2. Use PuTTY or the Windows `ssh` command to log in to DuraFlex with username `duraflex`.
3. On the DuraFlex system, run the following command:

   `iperf3 -s`

   Figure 15 shows the response to the command.

Figure 15 – Response to "iperf3" Command on DuraFlex



4. On the Client PC, open a Command Prompt window (CMD).
5. Change directory to the unzipped `MJ-iperf-3.1.3-win64` folder (*Figure 16*).

Figure 16 – Response to "cd" Command on Client PC

6. In the Command Prompt window, run the following command:

```
iperf3.exe -c 192.168.111.1
```

Figure 17 shows the response of running this command on the Client PC.

Figure 17 – Response to "iperf3.exe" Command on Client PC

```
C:\Users\Desktop>cd C:\Users\Desktop\Desktop\MJ-iperf-3.1.3-win64

C:\Users\Desktop\Desktop\MJ-iperf-3.1.3-win64>iperf3.exe -c 192.168.111.1
Connecting to host 192.168.111.1, port 5201
[  4] local 192.168.111.2 port 54666 connected to 192.168.111.1 port 5201
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.00   sec   758 MBytes  6.35 Gbits/sec
[  4]   1.00-2.00   sec   758 MBytes  6.36 Gbits/sec
[  4]   2.00-3.00   sec   758 MBytes  6.36 Gbits/sec
[  4]   3.00-4.00   sec   760 MBytes  6.37 Gbits/sec
[  4]   4.00-5.00   sec   760 MBytes  6.38 Gbits/sec
[  4]   5.00-6.00   sec   759 MBytes  6.37 Gbits/sec
[  4]   6.00-7.00   sec   759 MBytes  6.37 Gbits/sec
[  4]   7.00-8.00   sec   759 MBytes  6.37 Gbits/sec
[  4]   8.00-9.00   sec   760 MBytes  6.38 Gbits/sec
[  4]   9.00-10.00  sec   758 MBytes  6.36 Gbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-10.00  sec  7.41 GBytes  6.37 Gbits/sec                  sender
[  4]   0.00-10.00  sec  7.41 GBytes  6.37 Gbits/sec                  receiver

iperf Done.

C:\Users\Desktop\Desktop\MJ-iperf-3.1.3-win64>
```

Figure 18 shows the response on DuraFlex.

Figure 18 – Response to "iperf3.exe" Command on DuraFlex

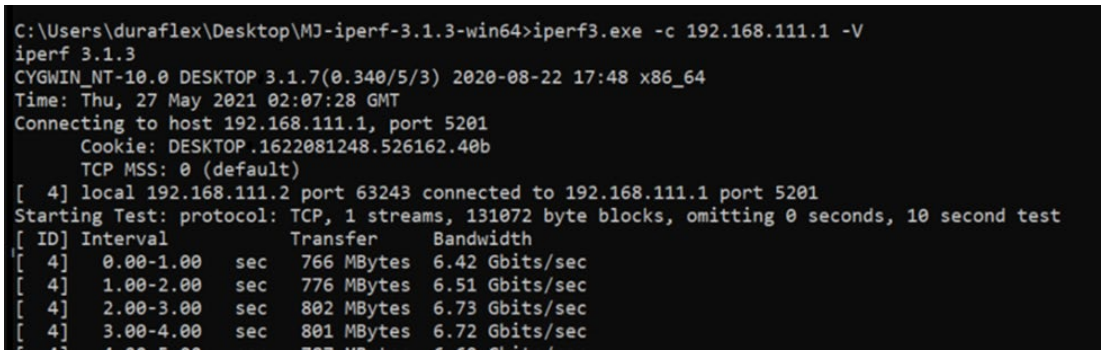
```
C:\Users\Desktop>ssh duraflex@rs20300018
duraflex@rs20300018's password:
Last login: Wed Oct  7 10:50:54 2020 from 192.168.100.110
Last login: Wed Oct  7 10:50:54 2020 from 192.168.100.110
[duraflex@rs20300018 ~]$
[duraflex@rs20300018 ~]$
[duraflex@rs20300018 ~]$ iperf3 -s
-----------------------------------------------------------
Server listening on 5201
-----------------------------------------------------------
Accepted connection from 192.168.111.2, port 54713
[  5] local 192.168.111.1 port 5201 connected to 192.168.111.2 port 54714
[ ID] Interval           Transfer     Bandwidth
[  5]   0.00-1.00   sec   734 MBytes  6.16 Gbits/sec
[  5]   1.00-2.00   sec   762 MBytes  6.39 Gbits/sec
[  5]   2.00-3.00   sec   761 MBytes  6.38 Gbits/sec
[  5]   3.00-4.00   sec   763 MBytes  6.40 Gbits/sec
[  5]   4.00-5.00   sec   761 MBytes  6.39 Gbits/sec
[  5]   5.00-6.00   sec   763 MBytes  6.40 Gbits/sec
[  5]   6.00-7.00   sec   761 MBytes  6.38 Gbits/sec
[  5]   7.00-8.00   sec   762 MBytes  6.39 Gbits/sec
[  5]   8.00-9.00   sec   762 MBytes  6.39 Gbits/sec
[  5]   9.00-10.00  sec   761 MBytes  6.39 Gbits/sec
[  5]  10.00-10.04  sec  26.6 MBytes  6.34 Gbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bandwidth
[  5]   0.00-10.04  sec  0.00 Bytes  0.00 bits/sec                  sender
[  5]   0.00-10.04  sec  7.44 GBytes  6.37 Gbits/sec                  receiver
-----------------------------------------------------------
Server listening on 5201
-----------------------------------------------------------
```

As shown in *Figure 17* and *Figure 18*, the bandwidth in this test is between 6.16 to 6.4 Gigabits/sec, which exceeds the 3 Gigabits/sec minimum requirement.

Note:	Add `-V` to the command to see the `iperf3` and `cygwin1.dll` versions, i.e. `iperf3.exe -c 192.168.111.1 -V`

In *Figure 19*, the version of iperf is 3.1.3, and the version of the Cygwin is:
`CYGWIN_NT-10.0 DESKTOP 3.1.7(0.340/5/3) 2020-08-22 17:48 x86_64`

Figure 19 – Cygwin and iperf Versions



7.2 Capture the Log Files

This section shows the OEM how to capture the log events while the system is running. For more details about analyzing logs, see the *DuraFlex Troubleshooting Guide*.

To capture the log files:

1. Log in to DuraFlex using WinSCP.

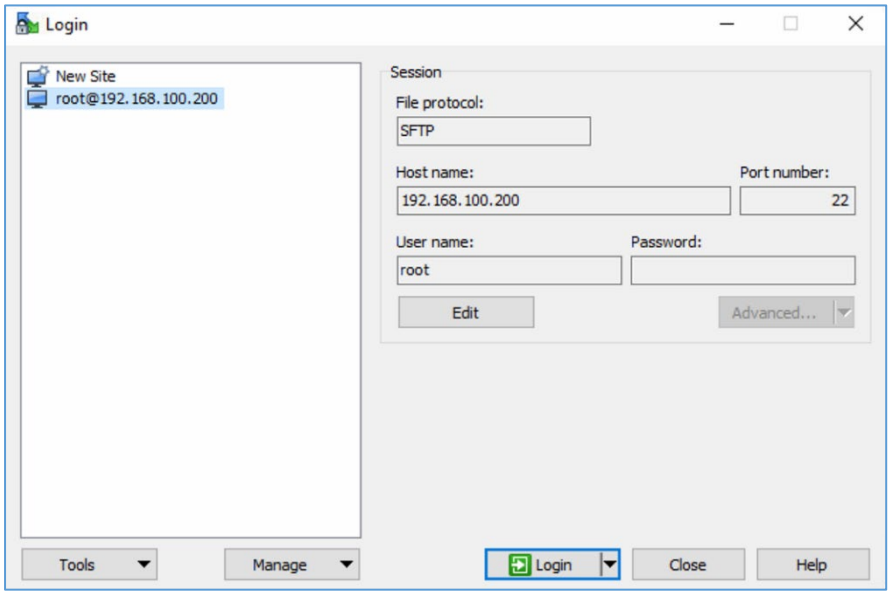
   a. Open WinSCP.
   b. In the Login window, enter the values into the fields below:

   - File protocol: SFTP
   - Host name: 192.168.100.200
   - User name: root

Note:	For the WinSCP password, contact your Memjet Technical Account Manager (TAM) for more information.

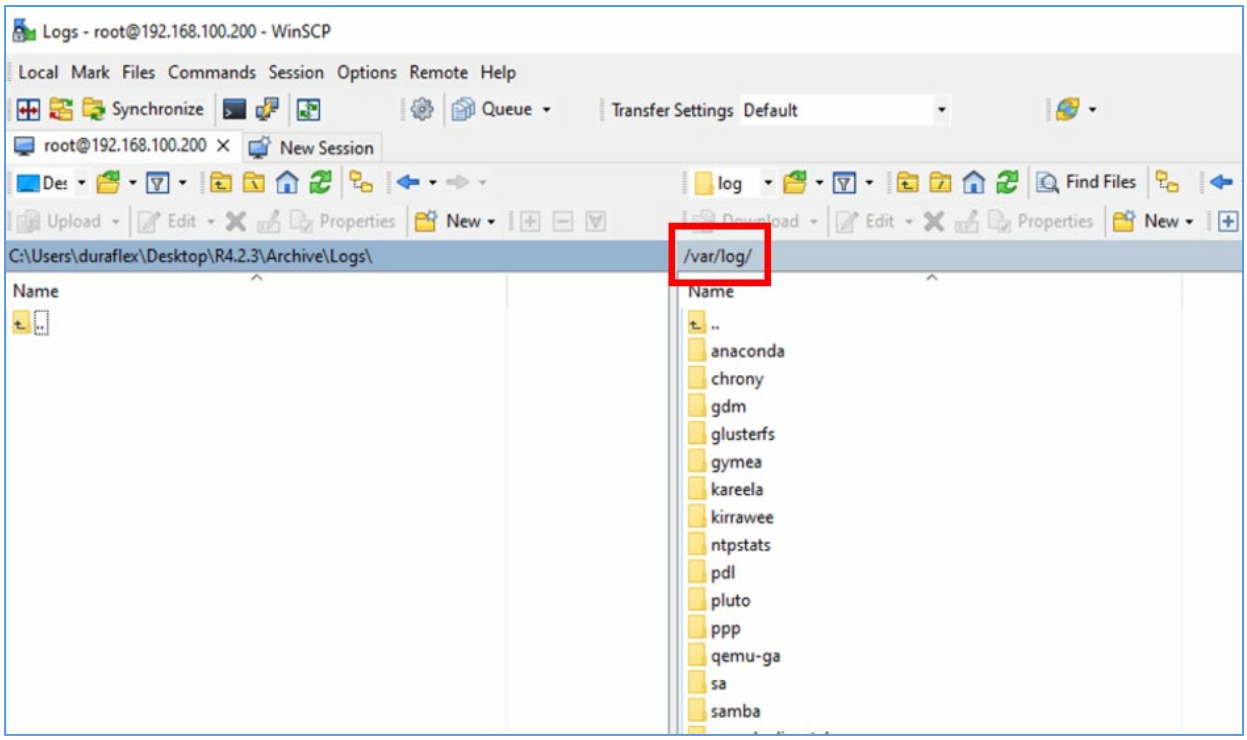
   c. Click **Login**.

Figure 20 – WinSCP Login Window



2. In WinSCP, browse to the `/var/log/` folder to view the subfolders and files.

Figure 21 – Log File Location

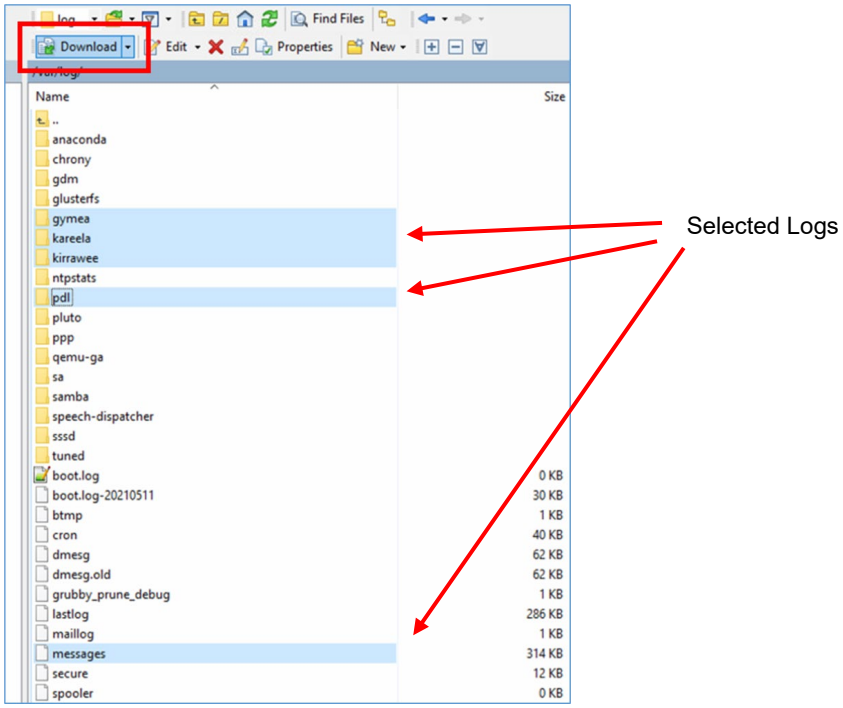


3. Select the folders named `Kareela`, `Gymea`, `Kirrawee`, `Kenmare`, and `PDL`, and the file named `messages`.

Note:	The `Kenmare` folder will display only when Internal RIP mode is enabled.

4. Click **Download**.

Figure 22 – Folders and Files Selected for Downloading



7.3 Determine the System Branding

From DuraFlex software version R4.2.3 onwards, the NGQ QA subsystem is enabled by default. Therefore, bulk ink supply QA devices and brand-specific license files (PrinterKeyStore certificates) are required, and evaluation licenses no longer work.

To determine the brand of a DuraFlex print unit, use the entries in the Gymea log, which are similar to the following example:

- `2021-06-03T11:34:08.826209+10:00 RS20300139 Gymea0: <I> [] QaLssMgr: Device: PRINTER (bus 00, 0x7e), uniqueId: 206E220ABC7A0C0139, partId: 81001006/2, license: 1006, type: PRINTER.`
- `2021-06-03T11:34:08.826643+10:00 RS20300139 Gymea0: <I> [] QaLssMgr: Device: PRINTER Certificate Sequence Number 1.`

The entries above indicate that the print unit is configured for an OEM Evaluation License (1006).

For use with software version R4.2.3 and higher, OEMs must use their branded licenses. See the *DuraFlex Installation and Commissioning Guide* for how to add the NGQ license.

8 Prepare a System for Relocation

This section provides instructions to shut down a running DuraFlex system and partially disassemble it to move it to a new location. This is also known as “wet shipping”. For example, a system may need to be moved from one building to another, shipped from an OEM to end users, or sent to and from a trade show. Follow the steps from beginning to end to ensure the correct order.

Note: It is the responsibility of the OEM to safely pack and ship the system. Consult your Memjet Technical Account Manager for guidance.

8.1 Required PPE, Tools, and Supplies

Gather the items in the table before beginning this procedure.

Table 12 – Required PPE, Tools, and Supplies

Quantity	Type	Description
1 set	PPE	Clothing protection (smock, jacket, etc.)
1 pair	PPE	Safety glasses
As needed	Supply	Powder-free, nitrile gloves
As needed	Supply	Lint-free wipes
As needed	Supply	Cable ties
1	Tool	Allen key set
1	Tool	Diagonal cutter
1	Tool	Tubing cutter
1 pair	Tool	Scissors
1	Supply	Printhead protective case (*Figure* 23)
2	Supply	Ink port covers (*Figure 23*)
2	Supply	Fluidic coupling covers (*Figure* 24)
1	Supply	Shipping plate
As needed	Supply	Tape
As needed	Supply	Anti-static foam

Note: Use a sturdy crate, anti-static wrap, and non-collapsible packaging material to hold the Print Module securely during shipping.

Figure 23 – Ink Port Covers and Printhead in Protective Case

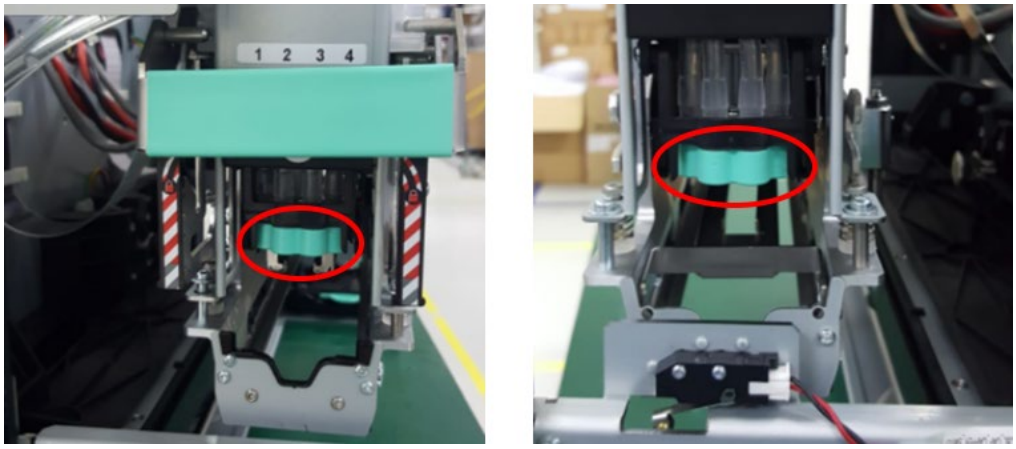
Figure 24 – Green Fluidic Coupling Cover

8.2 Procedure

Note:	When working with tubing, ensure that it is not kinked, twisted, or pinched.

1. Wear safety glasses, clothing protection, and gloves (as listed in *Table 12*) during this procedure.
2. Deprime the DuraFlex printing system.
3. To move the Printhead Cradle to RAISE position and the Cap to HOME position, use one of the following methods:
   - Use the OEM Printer Control Software.
   - Use the PES interface:
4. Remove the printhead.
5. Clean and store the printhead according to the *DuraFlex Printhead Storage and Shipping Guide*.
6. Install the fluidic coupling covers (qty: 2, one on each side) to protect the fluidic couplings from contamination (*Figure 25*).

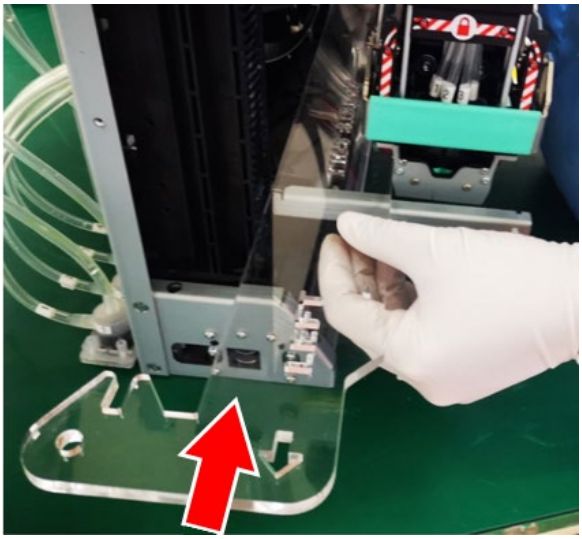
Figure 25 – Fluidic Coupling Covers



7. Power down the DuraFlex printing system.

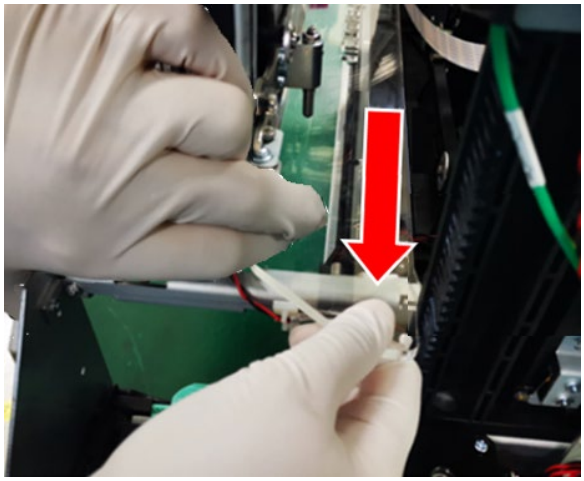
8. Carefully slide the shipping plate into the **left** side of Print Module to insert it (*Figure 26*).

Figure 26 – Insert Shipping Plate



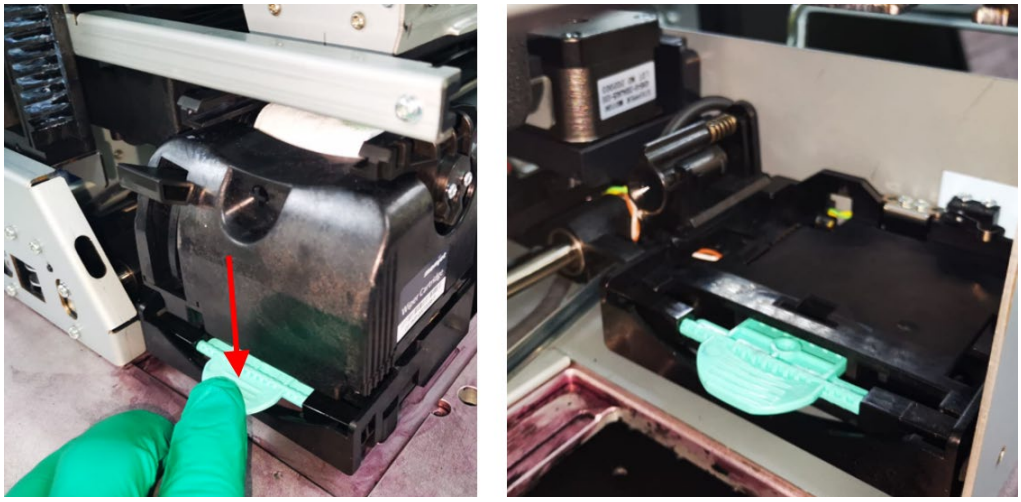
9. Use your other hand to slightly pull the shipping plate towards the **right** side of Print Module to engage it. (*Figure 27*)

Figure 27 – Engage Shipping Plate



10. Tape the green printhead latch to the Print Module so that it does not move during shipping.
11. Push down on the green tab to remove the wiper cartridge from the wiper carrier.
12. Store the wiper cartridge in its original packaging or a clean plastic bag at room temperature.

Figure 28 – Remove Wiper Cartridge



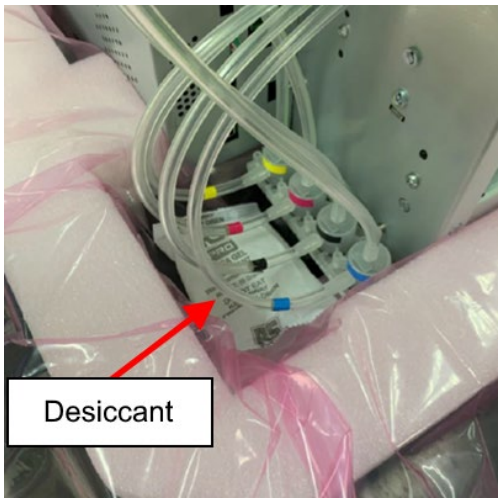
13. When shipping BIDS components or IDS blades with ink inside, do not tilt the unit more than 30°.
14. Add the packing foam under the printhead and tape it into place (*Figure 29*). The tape should be applied to the front and back of the Print Module.

Figure 29 – Foam and Tape

15. Place the Print Module packing foam on a clean work surface (*Figure* 52).
16. Place the anti-static PE sheet on top of the packing foam and place the Print Module on top of it.
17. Place lint-free, ink-absorbing material close to the Printhead Fluidic Couplings (capped with green covers), Pinch Valve, and Circulation Pumps to minimize the chances of residue ink leaking.

18. Add a pack of desiccant at the location shown in the picture below:

Figure 30 – Desiccant Placement



19. Wrap the Print Module using the anti-static PE sheet. Use tape to secure the wrapping in place.
20. Place the Print Module in a crate.
21. Place the top piece of foam onto the Print Module.
22. Put the wiper cartridge in anti-static bubble wrap and seal it with transparent tape. Then place it into a crate and close it.
23. Place the wiper cartridge box into the compartment on the top piece of foam.
24. Close the crate and secure it with tape.
25. Place the packaged Print Module on a pallet and use straps to secure it to the pallet for shipping.

CAUTION:	Do not stack pallets.

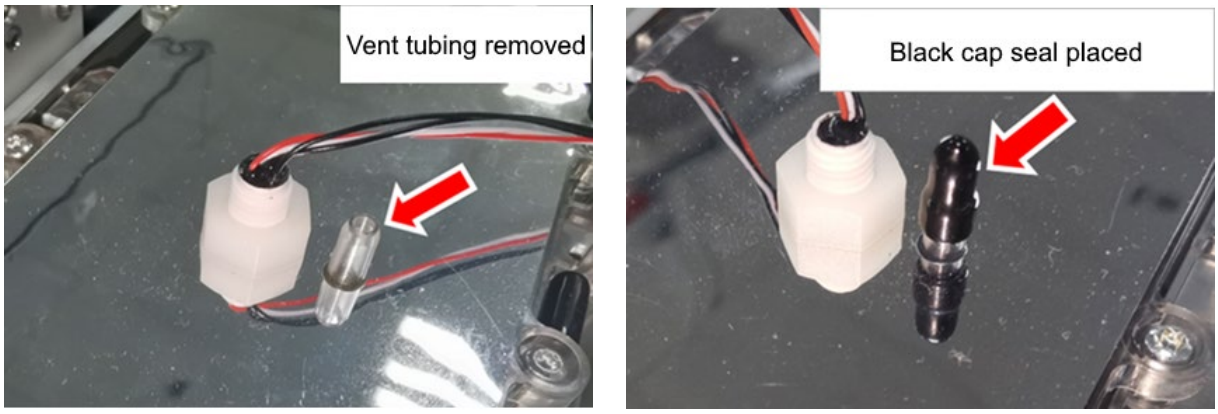
26. Place a Do Not Stack cone on top of the crate.
27. Secure all tubes to fittings with cable ties if any of the following are true:
    - the tubes are full of ink (e.g. IDS Blades to FIDS).
    - the tubes are long and heavy.
28. Secure long and heavy tubes to external support (e.g. a frame).
29. Secure the tubes to the Pinch Valve, ensuring that the tubes are not twisted.
30. Ensure that all components of the printing system are secured with tight screws.

Note:	For peripheral components, such as the Power Supply Unit or WIMM, that may be "hanging" off the print unit, add support to prevent them from falling off, in case any screws become loose during transportation.

31. To prevent ink leaking from IR tank:

    a. Remove the vent tubing from the IR Tank.
    b. Place the black Cap Seal on top of IR tanks (1 for each color, 4 in total).

Figure 31 – Cap Seal on Top of IR Tank



32. Drain ink (if any) from the WIMM tank.

    a. Use a hemostat to clamp the tube (from WIMM to BIDS) at the “WASTE IN” end:

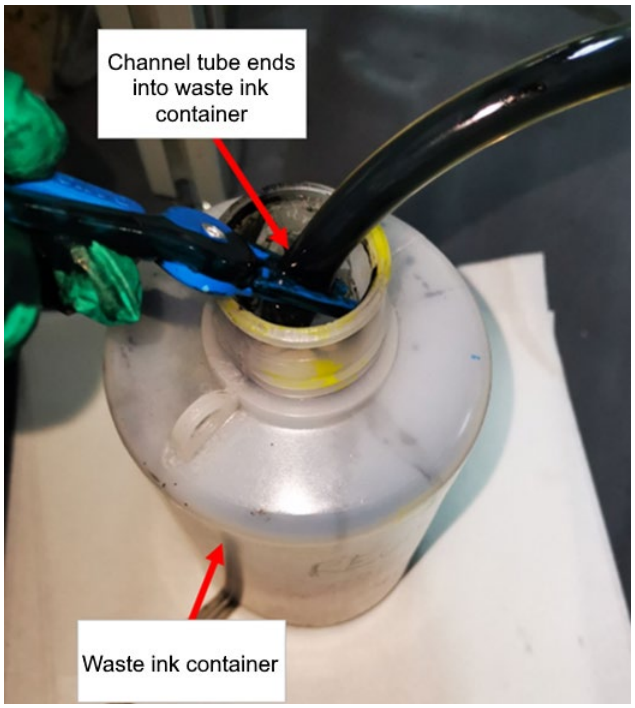
Figure 32 – Hemostat in Place on “WASTE IN” Tube (BIDS Box)

    b. Disconnect the tube from WIMM to BIDS.

Figure 33 – Disconnect "WASTE IN" Tube (Example IDS Frame)

c. Place the end of the tube in the waste ink container.

Figure 34 – Place Tube into Waste Ink Container



d. Remove the hemostat to allow waste ink to flow from the WIMM tank into the waste ink container by gravity.

33. Disconnect the CPC female connector from the Supply Line tube. Use a hemostat to hold the tube end if necessary.
34. Place the bulk ink supply into a sealed plastic bag.
35. Place the bag into a sturdy box.
36. Use foam to protect the ink connector from pressure or contacting the box during shipping. Place additional foam around the bagged bulk ink supply to keep it from shifting during shipping.

9 Decommissioning a System

This section provides instructions to shut down a running DuraFlex system and disassemble the full system for shipping.

Note:	It is the responsibility of the OEM to safely pack and ship the system. Consult your Memjet Technical Account Manager for further information if required.

9.1 Required PPE, Tools, and Supplies

Gather the items in the table before beginning the procedure.

Table 13 – Required PPE, Tools, and Supplies

Quantity	Type	Description
1 set	PPE	Clothing protection (smock, jacket, etc.)
1 pair	PPE	Safety glasses
As needed	Supply	Powder-free, nitrile gloves
As needed	Supply	Lint-free wipes
As needed	Supply	Cable ties
1	Tool	Allen key set
1	Tool	Diagonal cutter
1	Tool	Tubing cutter
1 pair	Tool	Scissors
4	Tool	Hemostat
4	Supply	Cap – Vinyl, ID 0.25”, length 0.5”
4	Supply	Cap – Vinyl, ID 0.125”, length 0.5”
1 set	Supply	Original packaging for the Print Module
1	Supply	Printhead protective case (*Figure* 42)
2	Supply	Ink port covers (*Figure* 43)
1	Supply	Shipping plate
As needed	Supply	Tape
As needed	Supply	Anti-static foam

Figure 35 – Printhead with Port Covers Installed and in Protective Case

Note:	If the original packaging is not available, use a sturdy crate, anti-static wrap, and non-collapsible packaging material to hold the Print Module securely during shipping.

Wear safety glasses, clothing protection, and gloves (as listed in *Table 13*) during the procedures below.

9.2 IDS Procedure

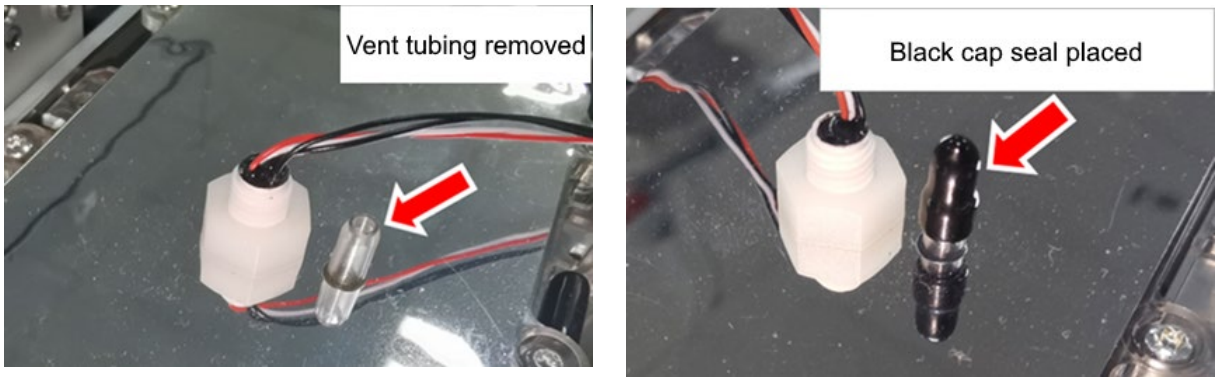
Note:	When working with tubing, ensure that it is not kinked, twisted, or pinched.

1. Secure all tubes to fittings with cable ties if any of the following are true:
   - the tubes are full of ink (e.g. IDS Blades to FIDS).
   - the tubes are long and heavy.
2. Secure long and heavy tubes to external support (e.g. a frame).
3. Secure the tubes to the Pinch Valve, ensuring that the tubes are not twisted.
4. Ensure that all components of the printing system are secured with tight screws.

Note:	For peripheral components, such as the Power Supply Unit or WIMM, that may be "hanging" off the print unit, add support to prevent them from falling off, in case any screws become loose during transportation.

5. To prevent ink leaking from IR tank:
   a. Remove the vent tubing from the IR Tank.
   b. Place the black Cap Seal on top of IR tanks (1 for each color, 4 in total).

Figure 36 – Cap Seal on Top of IR Tank



9.3 WIMM Procedure

1. Drain ink (if any) from the WIMM tank. Use a hemostat to clamp the tube (from WIMM to BIDS) at the “WASTE IN” end.

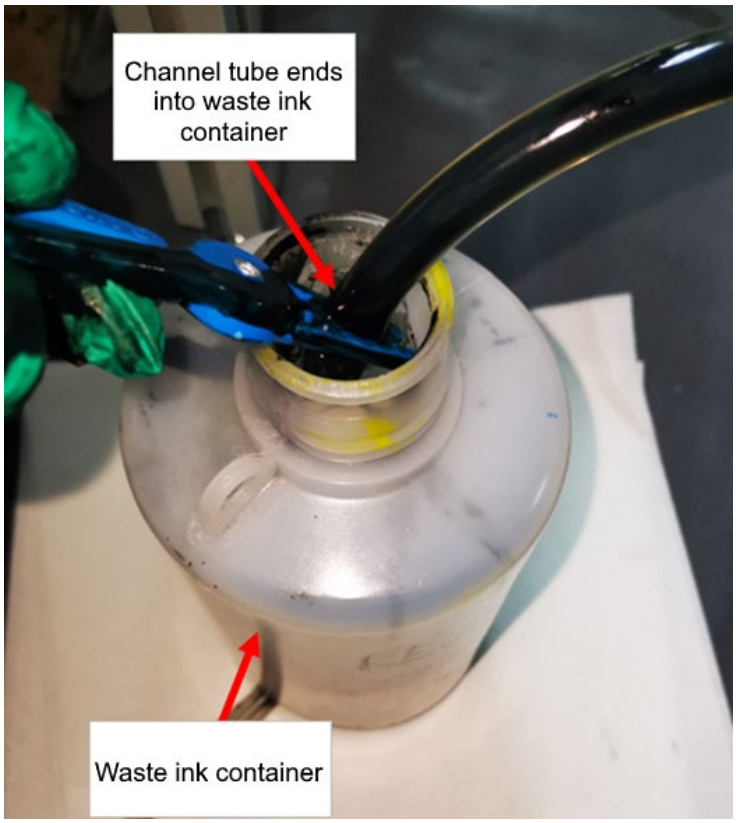
Figure 37 – Hemostat in Place on “WASTE IN” Tube (Example BIDS Box)

2. Disconnect the tube from WIMM to BIDS.

Figure 38 – "WASTE IN" Tube Disconnected (Example IDS Frame)

3. Place the end of the tube in the waste ink container.

Figure 39 – Waste Ink Tube in Waste Ink Container



4. Remove the hemostat to allow waste ink to flow from the WIMM tank into the waste ink container by gravity.

5. Disconnect the CPC female connector from the Supply Line tube. Use a hemostat to hold the tube end if necessary.

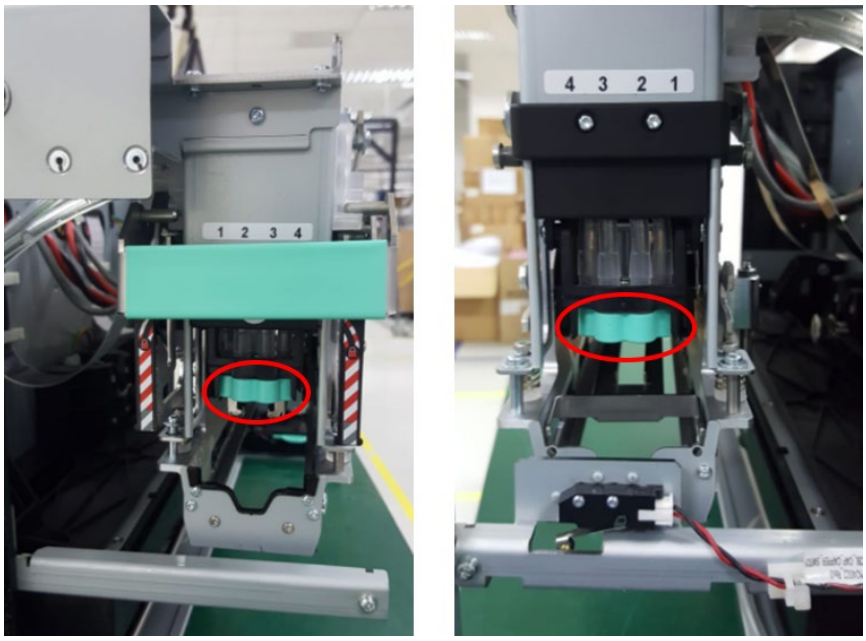
6. Place the bulk ink supply into a sealed plastic bag.

7. Place the bag into a sturdy box.
8. Use foam to protect the ink connector from pressure or contacting the box during shipping. Place additional foam around the bagged bulk ink supply to keep it from shifting during shipping.

9.4 Print Module Procedure

1. Deprime the DuraFlex printing system.
2. To move the Printhead Cradle to RAISE position and the Cap to HOME position, use one of the following methods:
   - Use the OEM Printer Control Software.
   - Use the PES interface
3. Remove the printhead.
4. Clean and store the printhead according to the *DuraFlex Printhead Storage and Shipping Guide*.
5. Install the fluidic coupling covers (qty: 2, one on each side) to protect the fluidic couplings from contamination.

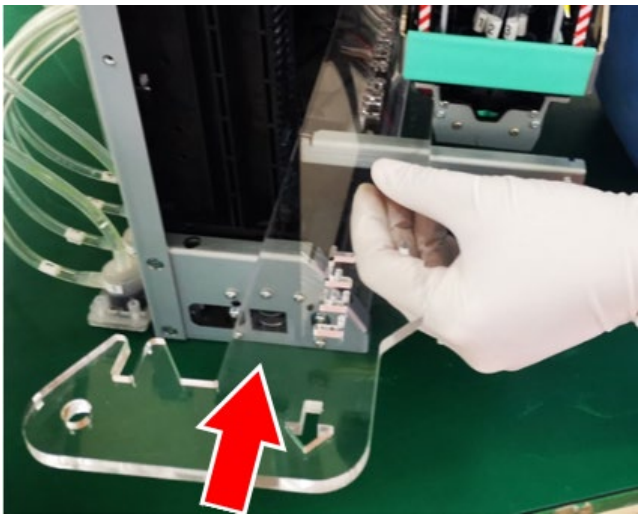
Figure 40 – Fluidic Coupling Covers Installed



6. Power down the DuraFlex printing system.

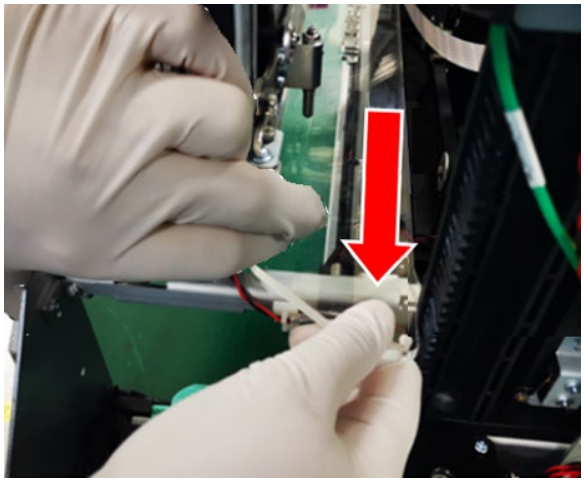
7. Carefully slide the shipping plate into the **left** side of Print Module to insert it.

Figure 41 – Install Shipping Plate



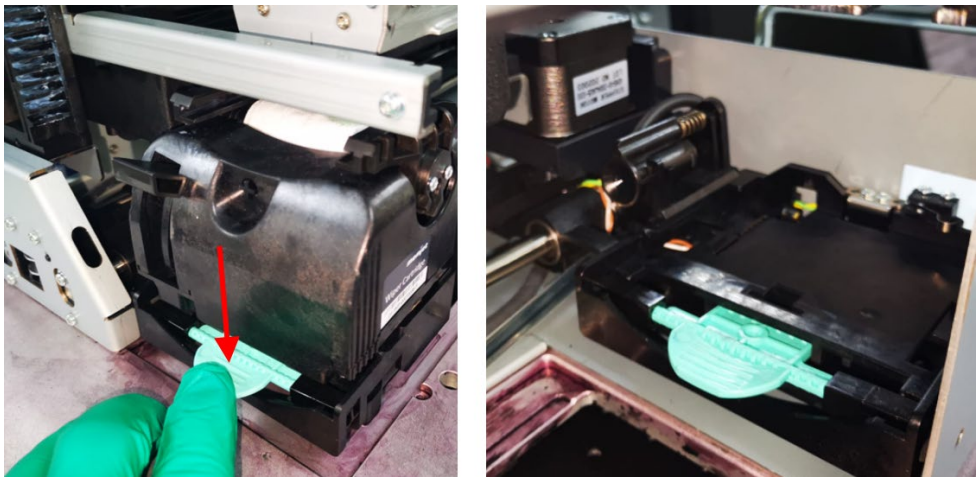
8. Use your other hand to slightly pull the shipping plate towards the **right** side of Print Module to engage it.

Figure 42 – Engage Shipping Plate



9. Tape the green printhead latch to the Print Module so that it does not move during shipping.
10. Push down on the green tab to remove the wiper cartridge from the wiper carrier.
11. Store the wiper cartridge in its original packaging or a clean plastic bag at room temperature.

Figure 43 – Remove Wiper Cartridge



12. Disconnect all external cables that are connected to the Print Module, including:

- Power Supply Unit (PSU) cable
- Encoder cable
- TOF sensor cable
- 1 GbE and 10 GbE Ethernet cables
- BIDS PassThrough PCA cable
- WIMM cable
- WIMM Pressure Sensor PCA cables

Figure 44 – PSU Cable Details

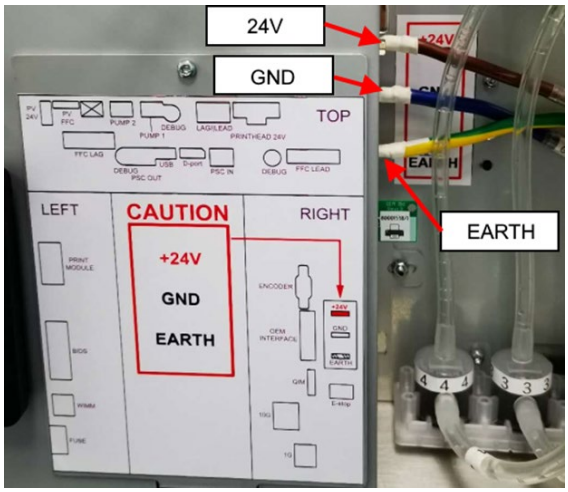


Figure 45 – Encoder Cable and TOF Cable Locations

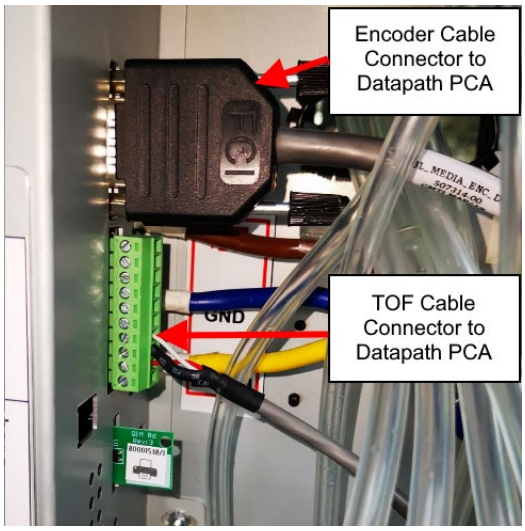
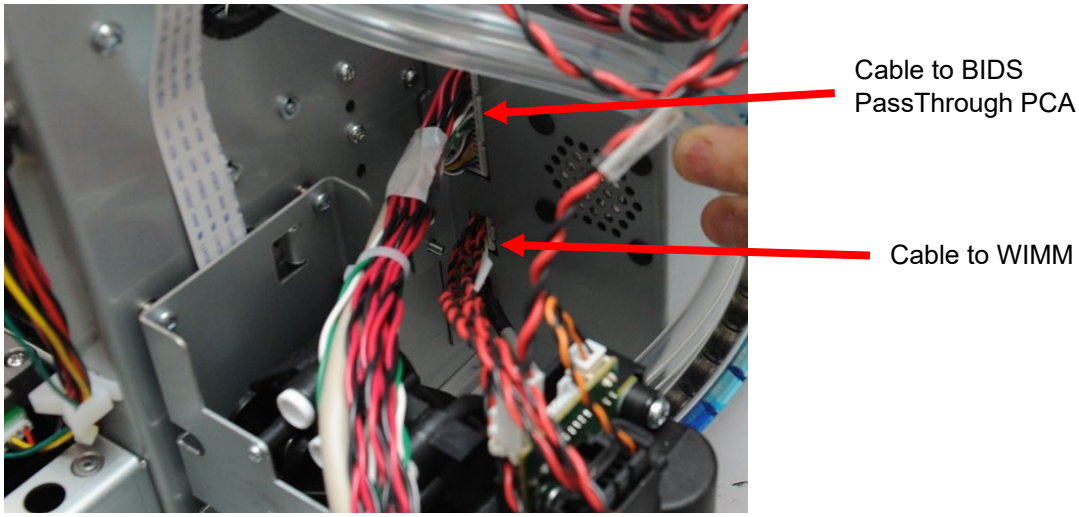


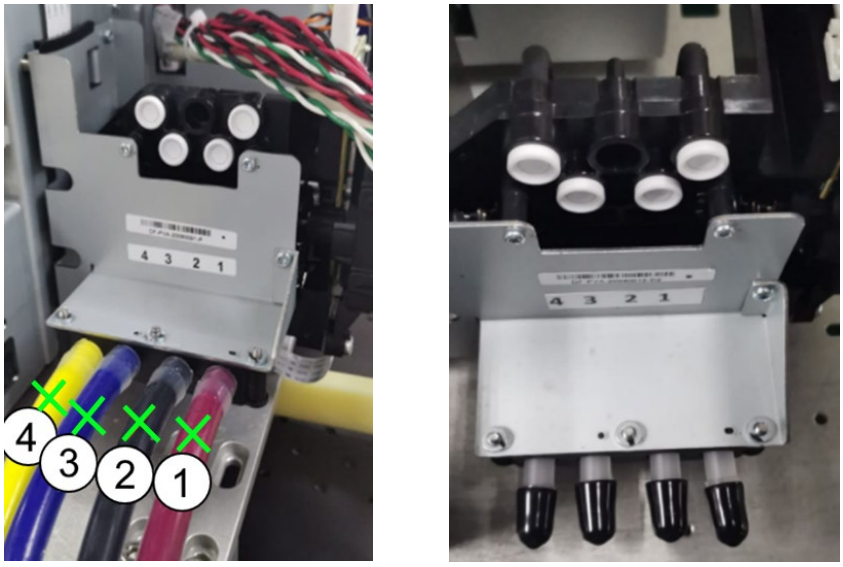
Figure 46 – Cable to BIDS and Cable to WIMM



13. Use four (4) hemostats to clamp all the Feed Line tubes at the Pinch Valve inlet, labeled 1-4 in *Figure 47*.

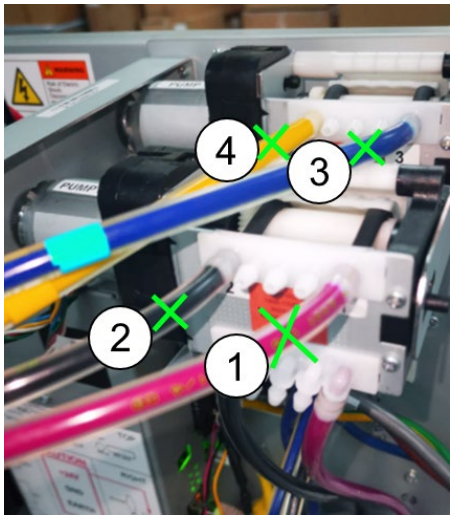
14. Use a tubing cutter to cut the four (4) tubes at the locations shown by the green "X" as shown in *Figure 47*. Then immediately install a clean cap (vinyl, ID 0.25”, length 0.5”) onto each of the cut feed line tubes to prevent contamination from entering the Pinch Valve.

Figure 47 – Feed Line Clamp and Cutting Locations and Installed Clean Caps



15. Use a clean tubing cutter to cut the four (4) Return Line tubes near the outlets of the Circulation Pumps. The cutting points are shown as “X” in *Figure 48*.

Figure 48 – Return Line Tubes at Circulation Pump Outlets

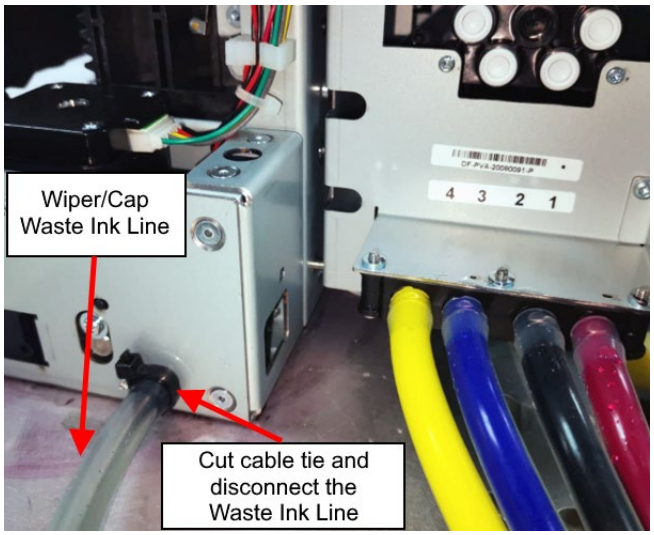


16. Immediately install a clean cap (vinyl, ID 0.125”, length 0.5”) onto each of the Circulation Pump outlet barbs to prevent contamination from entering the Circulation Pumps.

17. Locate the Waste Ink Line on the right side of the Print Module and carefully cut the cable tie.

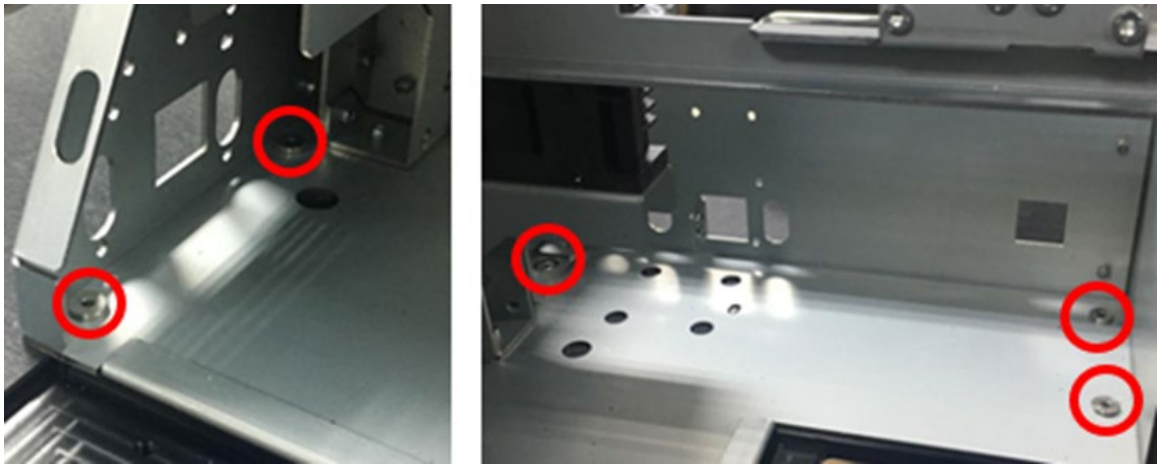
18. Disconnect the Waste Line tube from the Print Module.

Figure 49 – Cable Tie and Waste Line on Right Side of Print Module



19. Remove the five (5) ultra-flat head mounting screws that secure the Print Module to the print bar. Keep all the original hardware, do not discard.

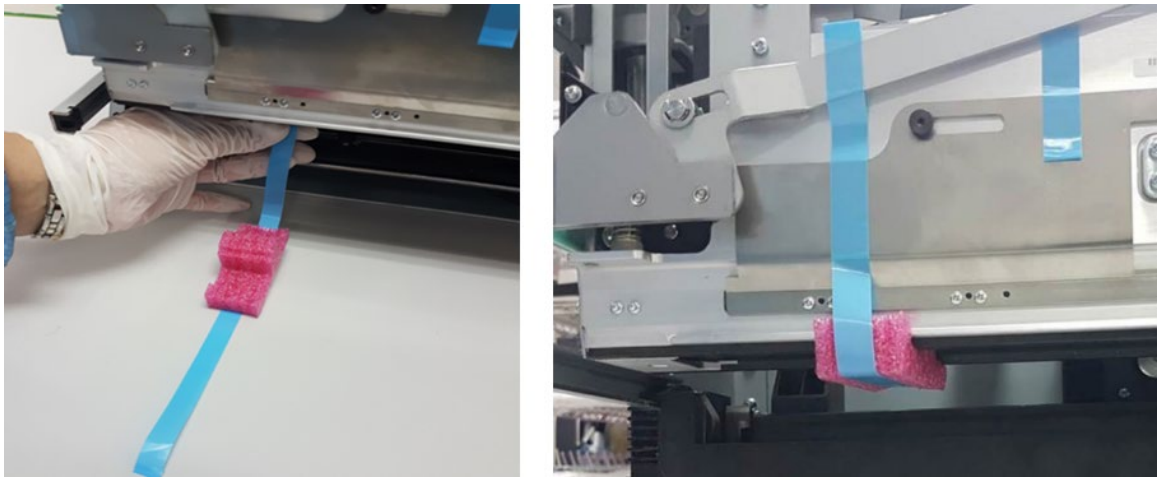
Figure 50 – Print Module Mounting Screw Locations



20. Position the packing foam under the printhead and tape it into place (*Figure* 51).

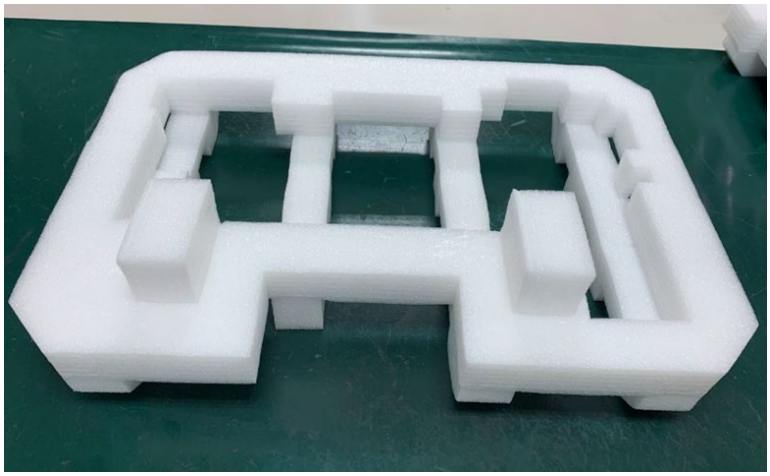
    The tape should be applied to the front and back of Print Module.

Figure 51 – Foam and Tape Installation Location



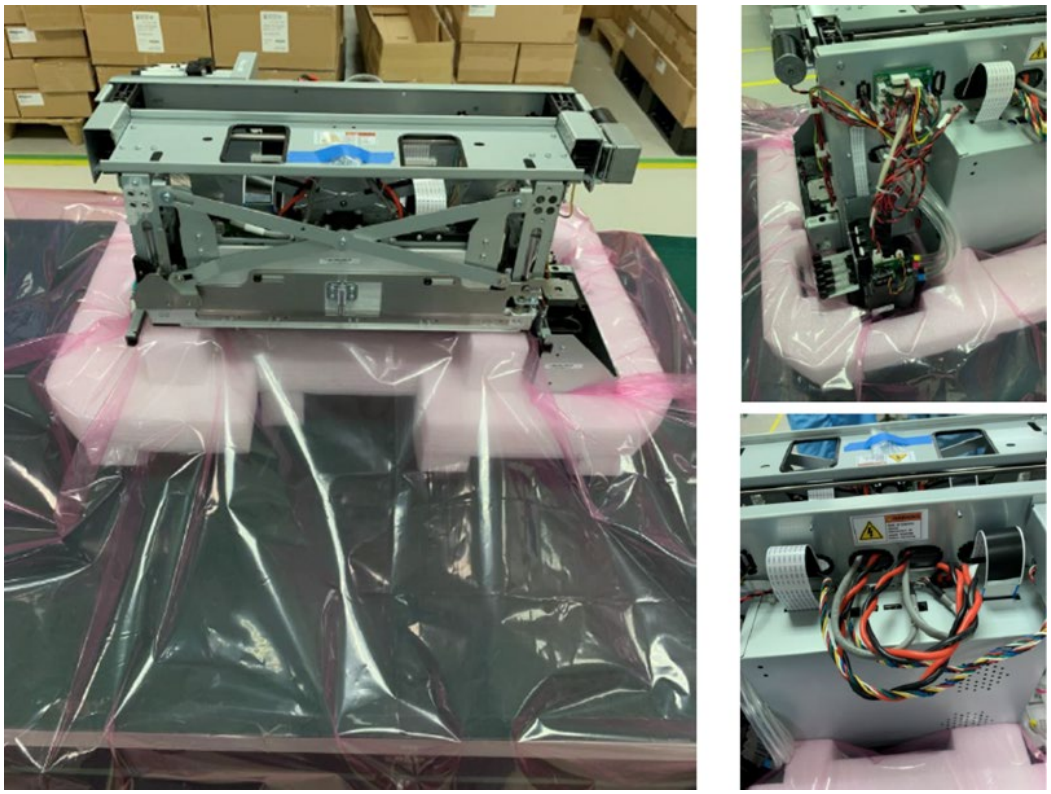
21. Place the Print Module packing foam on a clean work surface (*Figure* 52).

Figure 52 – Packing Foam



22. Place the anti-static PE sheet on top of the packing foam and place the Print Module on top of it.

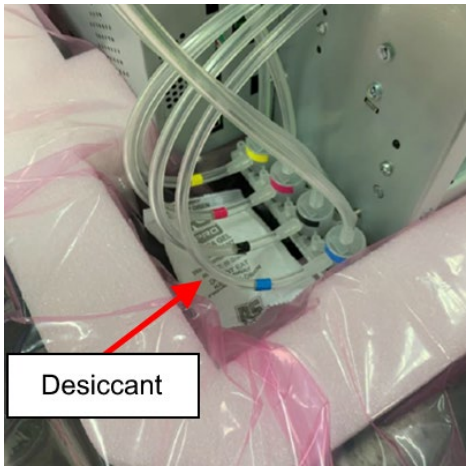
Figure 53 – Print Module on PE Sheet



23. Place lint-free, ink-absorbing material close to the Printhead Fluidic Couplings (capped with green covers), Pinch Valve, and Circulation Pumps to minimize the chances of residue ink leaking.

24. Add a pack of desiccant at the location shown in the picture below:

Figure 54 – Desiccant Placement



25. Wrap the Print Module using the anti-static PE sheet. Use tape to secure the wrapping in place.

Figure 55 – Wrapped Print Module

26. Place the Print Module in a crate.
27. Place the top piece of foam onto the Print Module.
28. Use anti-static bubble wrap to completely cover the wiper cartridge and seal it with transparent tape. Then place the wrapped wiper cartridge into a box and seal it with tape.
29. Place the wiper cartridge box into the compartment in the top piece of foam.
30. Close the crate and secure it.
31. Place the packaged Print Module on a pallet and use straps to secure it to the pallet for shipping.

CAUTION: Do not stack pallets.

32. Place a Do Not Stack cone on top of the crate.