

BK79-H Apollo Printheads User's Guide

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Manual History

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1.1 Description

The BK79 Series Apollo printheads are based on HP Thermal Ink-Jet (TIJ) technology which utilizes multiple ink cartridges to provide print coverage ranging from 1 to 4 inches. The 4 available Apollo printheads available are:

1. BK791-H-15 – Apollo Printhead, 1”
2. BK792-H-15 – Apollo Printhead, 2”
3. BK793-H-15 – Apollo Printhead, 3”
4. BK794-H-15 – Apollo Printhead, 4”

Each printhead is designed to mount on a standard Buskro bridge and can be independently adjusted in terms of height, lateral position, and relative angle to the transport tabletop. In addition, due to the symmetry of the design, each printhead can be mounted on either side of the bridge to simplify configuration changes.

The Apollo series printheads are also fully compatible with standard Buskro controllers equipped with Compose IQ software. This technology is also capable of running in conjunction with other available print technologies such as the Atlas and Aurora.

1.2 Specifications

1.2.1 Apollo Specifications

Item	Specification	Note
Vertical Resolution	600 DPI	
Horizontal Resolution	150, 200, 300, 400, 600 DPI	Software-selected
Ink Supply	Ink cartridge (42 mL)	HP51645A, 1/2" vertical coverage
	Bulk ink system (370 mL)	C8119A, 1/2" vertical coverage
Ink Type	Pigmented, water based	Versatile
Printhead Type	Thermal ink-jet (TIJ)	
Firing Frequency	13 KHz	
Power requirement	5V @ 0.4A, 28V	
Print swath – Vertical	1" (25.4 mm) 2" (50.8 mm) 3" (76.2 mm) 4" (101.6 mm)	2 x HP51645A ink cartridges 4 x HP51645A ink cartridges 6 x HP51645A ink cartridges 8 x HP51645A ink cartridges

1.2.2 Controller Specifications

Item	Specification
Environment	Microsoft Windows
Imaging software	Compose IQ
Fonts	True type – 4 to 32 point size
Graphics	Bitmap, JPEG, PCX, wmf
Functions	Operator, Setup, Diagnostics, Layout, Job management, Reports
Production reports	Daily, job and machine production, audit Crystal reports
Record control	Re-print, re-cue, search, position
Address recovery	Infinite - Any record within the database
Operator display	Active display of records, single record
Auxiliary controls	Stacker/Diverter operation

1.2.3 Apollo Production and Consumption Rates

Resolution ¹ (DPI)	Production ² (pieces/hour)	Consumption ³ (Pieces/84 mL)	Cost ⁴ \$/1000	Surface Speed (in/s)	Print Swath (horizontal)
110 (100)	40,000	150,000	\$0.48	130 (3.4 m/s)	39.5" (1003 mm)
165 (150)	25,000	100,000	\$0.72	87 (2.2 m/s)	39.5" (1003 mm)
220 (200)	21,000	75,000	\$0.96	65 (1.7 m/s)	39.5" (1003 mm)
330 (300)	14,000	50,000	\$1.44	43 (1.1 m/s)	27.8" (706 mm)
440 (400)	10,600	37,500	\$1.92	33 (0.9 m/s)	20.5" (521 mm)
660 (600)	7,100	25,000	\$2.88	22 (0.6 m/s)	13.1" (333 mm)

Note:

- ¹ The Apollo Printhead can operate at either resolution. The resolution used depends on the accompanying print technology.
- ² The Production Count is based on a No. 10 envelope (9.5" Long) and a 1.5" gap between pieces. Longer pieces would decrease the production rate. The production rating is based on operating frequencies and is the theoretical maximum based on software constraints. Actual production rates may differ based on acceptable print quality.
- ³ Ink consumption and cost per 1000 pieces is based on a six line address containing on average 100 characters using an Arial 11 point font. Specifications are based on empirical study, and where not obtainable, on manufacturer's specifications.
- ⁴ Costs are based on the use of two 42 mL ink cartridges at \$35.99 (HP MSRP) per cartridge. Use of a bulk ink system (\$100) would approximately result in a 70% savings.

1.3 Inkjet System Drawings

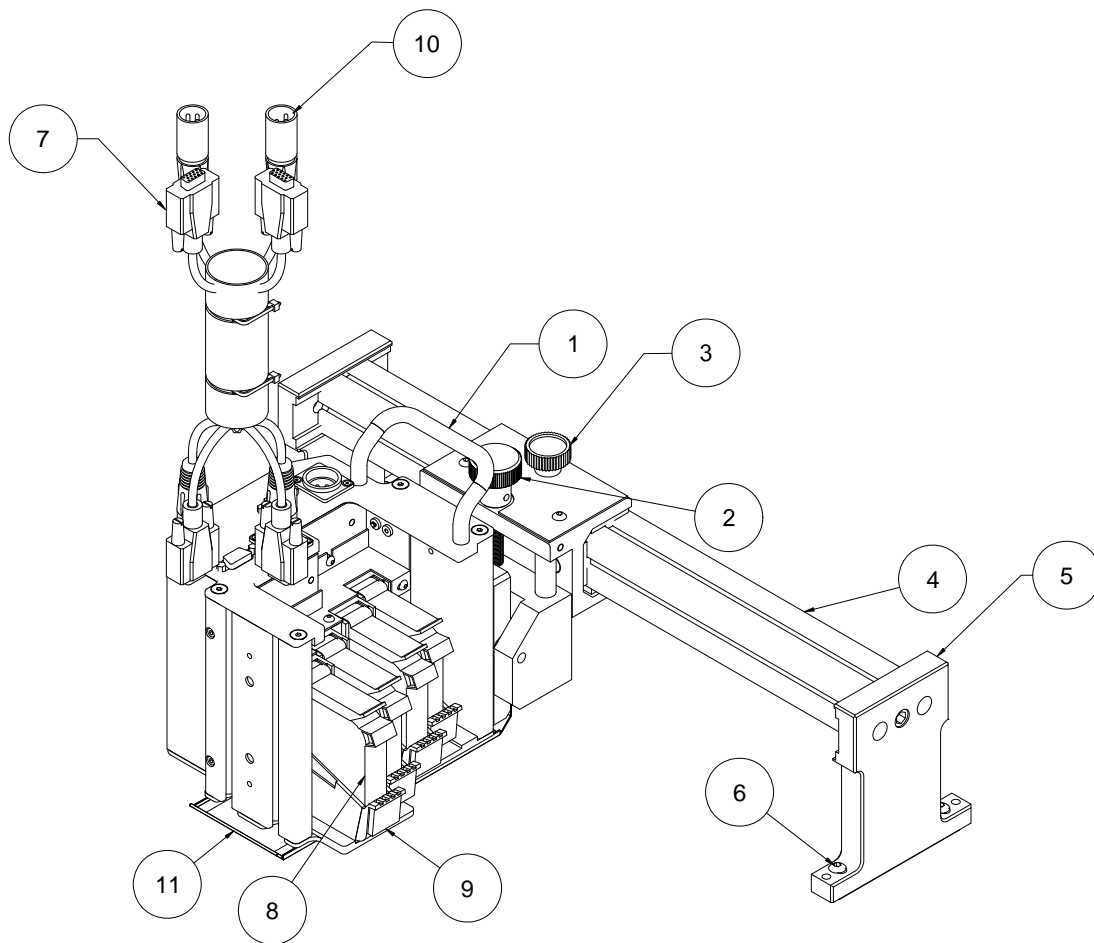
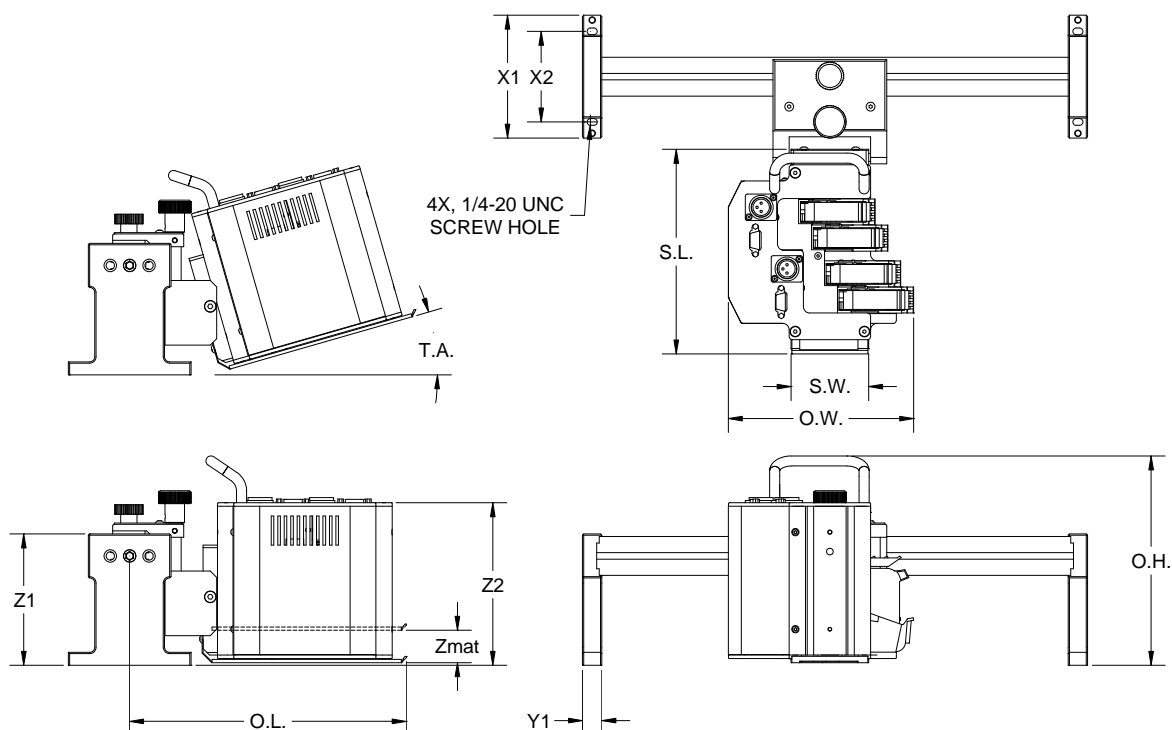


Table 1-1: *Apollo Printhead Components (BK792-H-1 Shown)*

Item	Description
1	Printhead Handle
2	Height adjustment knob
3	Lateral adjustment release knob
4	Bridge Rail (Available in different lengths)
5	Bridge rail mount (Two per bridge)
6	Mounting Screw (Four ¼-20 UNC)
7	Printhead Data Cable
8	Ink Cartridge, HP45A (42 mL)
9	Cartridge Holder (Stall)
10	Printhead Power Cable
11	Printhead Shield (Standard and Reverse shields included)

Table 1-2: *Apollo Printhead Dimensions (BK792-H-1 Shown)*

Symbol	Description	Dimensions	
O.W.	Overall Width (BK791-H-15, 1")	6.16"	156 mm
	Overall Width (BK792-H-15, 2")	7.17"	182 mm
	Overall Width (BK793-H-15, 3")	8.23"	209 mm
	Overall Width (BK794-H-15, 4")	9.26"	235 mm
O.L.	Overall Length (BK791-H-15, 1")	8.20"	208 mm
	Overall Length (BK792-H-15, 2")	10.70"	271 mm
	Overall Length (BK793-H-15, 3")	12.95"	329 mm
	Overall Length (BK794-H-15, 4")	15.67"	398 mm
O.H.	Overall Height (1-3")	8.09"	205 mm
	Overall Height (4")	11.74"	298 mm
S.L.	Shield Length (BK791-H-15, 1")	5.41"	217 mm
	Shield Length (BK792-H-15, 2")	7.91"	201 mm
	Shield Length (BK793-H-15, 3")	10.16"	258 mm
	Shield Length (BK794-H-15, 4")	N/A	N/A
S.W.	Shield Width (BK791-H-15, 1")	3.00"	76 mm
	Shield Width (BK792-H-15, 2")	3.00"	76 mm
	Shield Width (BK793-H-15, 3")	4.00"	102 mm
	Shield Width (BK794-H-15, 4")	5.05"	128 mm
X1	Bridge Rail Mount Length	4.75"	123 mm
X2	Bridge Rail Mount Screw Spacing	3.50"	89 mm
Y1	Bridge Rail Mount Thickness	0.75"	19 mm
Z1	Bridge Rail Mount Height (BK79)	5.00"	127 mm
	Bridge Rail Mount Height (BK80)	6.00"	153 mm
Z2	Height to top of Printhead	6.28"	160 mm

2.1 Apollo Printhead

The BK79 Series Apollo Printheads are reversible, HP-based products that are available in one of four styles depending on the desired vertical coverage (Table 2-1).

Table 2-1: *BK79 Series Apollo Printhead Styles*

Printhead	Vertical Coverage		Cartridges Used
BK791-H	1"	25.4 mm	2
BK792-H	2"	50.8 mm	4
BK793-H	3"	76.2 mm	6
BK794-H	4"	101.6 mm	8

Due to the symmetry of the design, each Apollo printhead is capable of mounting on either side of a standard bridge using the same mounting assembly. The only difference between a standard and reverse head is the shield that is used to prevent material contact with the cartridge face. Fortunately, the shield can be easily exchanged and both the standard and reverse shields are included with the printhead.

Some general features of the Apollo printheads are:

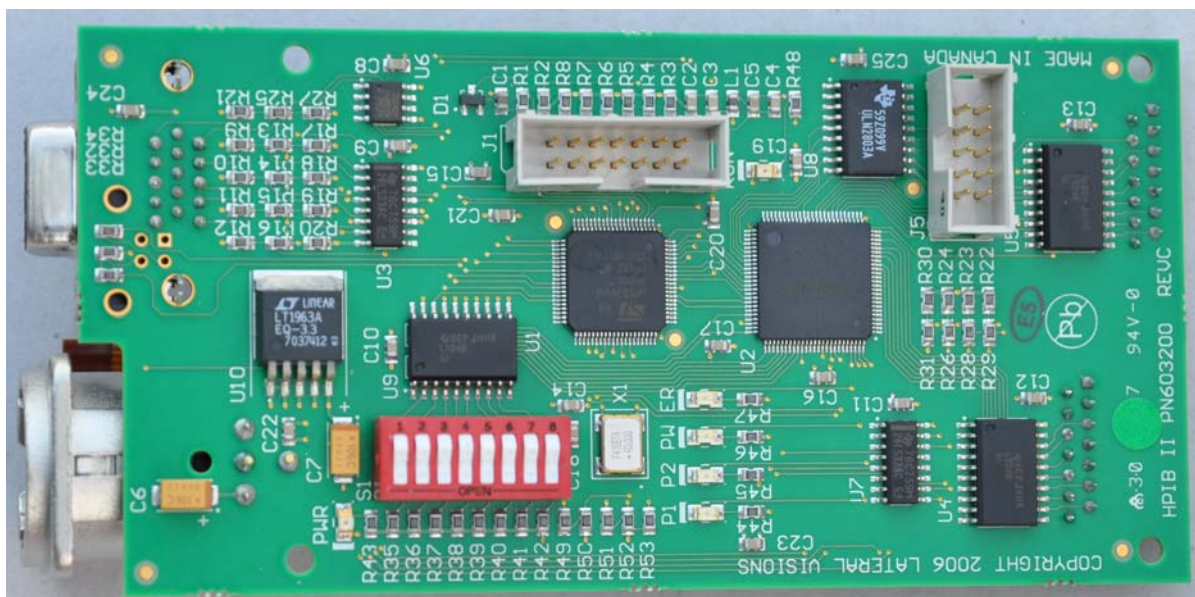
1. Individual height control for each printhead (for material up to 1.25" thick).
2. Replaceable ink cartridges or optional bulk ink supply for reduced operational costs.
3. Universal front and back mounting for flexibility in multiple head configurations.
4. Spring-loaded head leveling design.
5. Convenient access for maintenance and service.

2.2 Electronic Components

The two main electronic components in the Apollo printhead are the HP Interface Board and the Pen Driver Boards. There is one HP Interface Board and two Pen Driver Boards for each inch of print. The HP Interface Board acts as a liaison between the two Pen Driver Boards and the IA card (installed in the computer controller). It essentially translates image data from the controller to the Pen Driver Boards which regulate the ink cartridge voltage and temperature.

2.2.1 HP Interface Board

Figure 2-1: *HP Interface Board*



2.2.2 HP Interface Board DIP switch settings

In order for the printhead to properly function, the DIP switches on the HP Interface Board must be properly set.

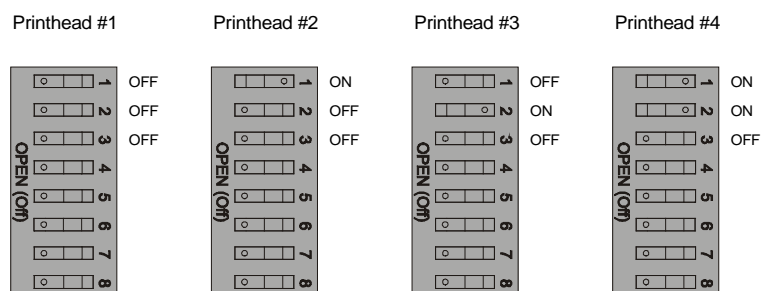
Table 2-2: *HP Interface Board DIP Switches*

DIP	Description
1, 2, 3, 4	Print Bar Address (See Table 2-3)
5	Protocol Type As Follows (e.g. set when combined with Atlas or Aurora): OFF: Old Protocol (Use with SSB Electronics, e.g. BK700, BK705) ON: New Protocol (Use with HCC Electronics, e.g. BK1710, BK1720)
6	OFF: Reserved.
7	Turn ON to re-program the Altera CPLD.
8	Turn ON to enter the firmware update mode.

Table 2-3: *Head Address Settings (DIP 1-4), 0 = Open (OFF) 1 = ON*

DIP 1	DIP 2	DIP 3	DIP 4	Description
0	0	0	0	Print Bar 1
1	0	0	0	Print Bar 2
0	1	0	0	Print Bar 3
1	1	0	0	Print Bar 4
0	0	1	0	Print Bar 5
1	0	1	0	Print Bar 6
0	1	1	0	Print Bar 7
1	1	1	0	Print Bar 8
0	0	0	1	Print Bar 9
1	0	0	1	Print Bar 10
0	1	0	1	Print Bar 11
1	1	0	1	Print Bar 12
0	0	1	1	Print Bar 13
1	0	1	1	Print Bar 14
0	1	1	1	Print Bar 15
1	1	1	1	Print Bar 16

Note: Print Bars 9-16 are only available on IA Card Systems using “New Protocol”.

Figure 2-2: *Example Settings for Four BK791-H-1 Apollo Heads*

Note: Always turn off power to the printheads before changing the DIP switch.

2.3 Mechanical Components

The Apollo printhead assembly consists of three basic elements: The printhead body (main housing for the electronics and the cartridges), the mounting assembly (connects the printhead body to the bridge), and the shield (protects the cartridge from contact with the transported material).

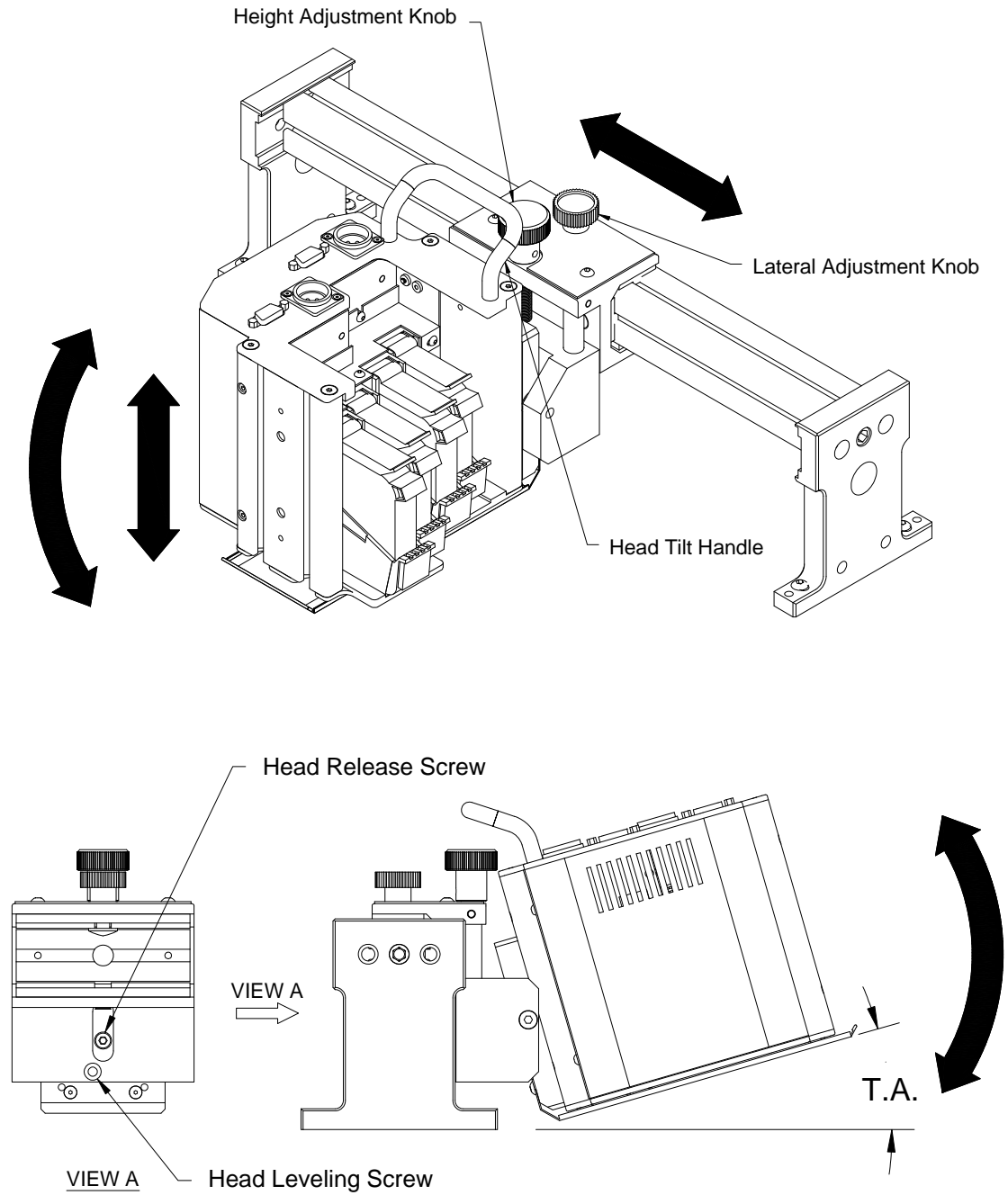
2.3.1 Adjustments

The Apollo printhead can be adjusted laterally, vertically, and angularly (Figure 2-3). Lateral adjustment along the length of the bridge is done by turning the Lateral Adjustment Knob and sliding the printhead to the desired location. Once in position, the knob is tightened to lock the printhead in place.

Height adjustment is achieved by turning the Height Adjustment Knob. A clockwise rotation raises the printhead while a counter-clockwise rotation lowers it. The adjustment provides the ability to accommodate material as thick as 1.25 inches and allows for fine adjustment to maximize the quality of print. This is done by lowering the printhead as close to the material as possible without interfering with product flow.

Angular adjustment is also known as printhead leveling. This is done by turning the Head Leveling Screw. A clockwise rotation increases the tilt angle (T.A.) while a counter-clockwise rotation decreases it. The optimum results will be achieved when the printhead is parallel to the transport tabletop. It is also possible to tilt the head temporarily without using the screw in order to wipe the cartridges.

It is also possible to remove the printhead body from the mounting assembly. This is done by loosening the Head Release Screw and sliding the printhead body up until it detaches from the mounting assembly.

Figure 2-3: *Apollo Printhead Adjustments (BK792-H-1 Shown)*

3.1 Installation Instructions

The installation of a new printhead is relatively quick and simple. In order to properly install a printhead, reference the following:

1. Ensure that the controller (unit with the computer) power is off.
2. Set the DIP switch settings of each HP Interface Board to match the printhead configuration (Section 2.2.2).
3. Connect the power and data cables from the head to the controller. There is one power and data cable for each HP Interface Board.
4. Install the HP cartridges.
5. Turn on the controller and load Compose.
6. In the Setup Window of Compose, define the head type as **“Apollo Array”**. Set the distance from the photocue for each print bar as shown in Section 3.2.

Note: The data cable number (used to determine which connector on the IA card to plug into) corresponds to the Data channel address setting on each individual HP Interface Board (Table 2-3).

3.2 Printhead Configuration

Before printing is possible, the DIP switch settings on each HP Interface Board must be set and the matching configuration must be entered into Compose. The configuration depends on the quantity and type of printhead(s) used. The general setup formula for Compose can be seen in Table 3-1. The example in Figure 3-1 represents a six inch system with one of each style Apollo head (Head 1 = BK791, Head 2 = BK792, Head 3 = BK793).

Table 3-1: *Horizontal Print Position and Print Bar Number Configuration*

Printhead	Coverage	Print Bar A		Print Bar B		Print Bar C	
		#	Position	#	Position	#	Position
BK791-H	1"	N ₁	X ₁	N/A	N/A	N/A	N/A
BK792-H	2"	N ₂	X ₂ + 2.395	N ₂ -1	X ₂	N/A	N/A
BK793-H	3"	N ₃	X ₃ + 4.79	N ₃ -1	X ₃ + 2.395	N ₃ -2	X ₃

Note: N_n = Bar # (Equals coverage when only it is the first printhead in the system).
X_n represents the distance from the photocue to the first jet on the first cartridge.

The positions are theoretical values and may need slight adjustment.

Figure 3-1: *Example Setup for a 6" System*

3.2.1 Standard Printhead Configurations

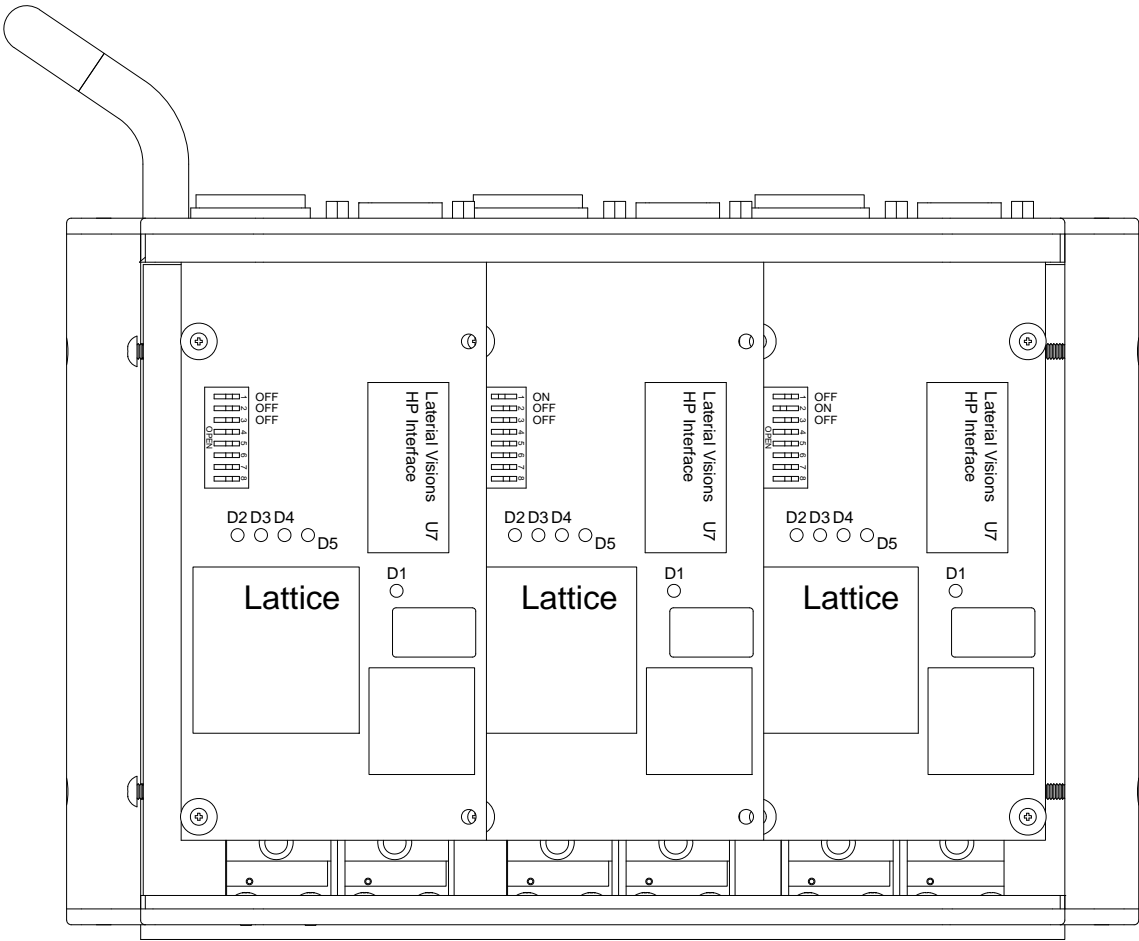
Table 3-2: *Standard Array Configurations*

Channel	1	2	3	4
1B1P	BK791			
HP Interface Board DIP 1	OFF			
HP Interface Board DIP 2	OFF			
HP Interface Board DIP 3	OFF			
Print Bar	A			
Horizontal Position	7.00			
Print Bar #	1			
1B1D	BK792			
HP Interface Board DIP 1	OFF	ON		
HP Interface Board DIP 2	OFF	OFF		
HP Interface Board DIP 3	OFF	OFF		
Print Bar	A	B		
Horizontal Position	9.395	7.00		
Print Bar #	2	1		
2B2P	BK791	BK791		
HP Interface Board DIP 1	OFF	ON		
HP Interface Board DIP 2	OFF	OFF		
HP Interface Board DIP 3	OFF	OFF		
Print Bar	A	A		
Horizontal Position	7.00	X ₁		
Print Bar #	1	2		
1B1T	BK793			
HP Interface Board DIP 1	OFF	ON	OFF	
HP Interface Board DIP 2	OFF	OFF	ON	
HP Interface Board DIP 3	OFF	OFF	OFF	
Print Bar	A	B	C	
Horizontal Position	11.79	9.395	7.00	
Print Bar #	3	2	1	

Note: Position X_n depends on the location of the second bridge.

Channel	1	2	3	4
2B1D1P	BK791	BK792		
HP Interface Board DIP 1	OFF	ON	OFF	
HP Interface Board DIP 2	OFF	OFF	ON	
HP Interface Board DIP 3	OFF	OFF	OFF	
Print Bar	A	A	B	
Horizontal Position	7.00	$X_2 + 2.395$	X_2	
Print Bar #	1	3	2	
2B3P	BK791	BK791	BK791	
HP Interface Board DIP 1	OFF	ON	OFF	
HP Interface Board DIP 2	OFF	OFF	ON	
HP Interface Board DIP 3	OFF	OFF	OFF	
Print Bar	A	A	A	
Horizontal Position	7.00	X_3	X_4	
Print Bar #	1	2	3	
2B1T1P	BK791	BK793		
HP Interface Board DIP 1	OFF	ON	OFF	ON
HP Interface Board DIP 2	OFF	OFF	ON	ON
HP Interface Board DIP 3	OFF	OFF	OFF	OFF
Print Bar	A	A	B	C
Horizontal Position	7.00	$X_5 + 4.79$	$X_5 + 2.395$	X_5
Print Bar #	1	4	3	2
2B2D	BK792		BK792	
HP Interface Board DIP 1	OFF	ON	OFF	ON
HP Interface Board DIP 2	OFF	OFF	ON	ON
HP Interface Board DIP 3	OFF	OFF	OFF	OFF
Print Bar	A	B	A	B
Horizontal Position	9.395	7.00	$X_6 + 2.395$	X_6
Print Bar #	2	1	4	3
2B1D2P	BK791	BK791	BK792	
HP Interface Board DIP 1	OFF	ON	OFF	ON
HP Interface Board DIP 2	OFF	OFF	ON	ON
HP Interface Board DIP 3	OFF	OFF	OFF	OFF
Print Bar	A	A	A	B
Horizontal Position	7.00	X_7	$X_8 + 2.395$	X_8
Print Bar #	1	2	4	3
2B4P	BK791	BK791	BK791	BK791
HP Interface Board DIP 1	OFF	ON	OFF	ON
HP Interface Board DIP 2	OFF	OFF	ON	ON
HP Interface Board DIP 3	OFF	OFF	OFF	OFF
Print Bar	A	A	A	A
Horizontal Position	7.00	X_9	X_{10}	X_{11}
Print Bar #	1	2	3	4

Figure 3-2: *Example DIP Settings for a BK793-H Printhead (1B1T Configuration)*



Note: The DIP switch settings (From left to right when looking at the front of the printhead as shown in Figure 3-2) reflect the Channel number in Table 3-2.

3.3 Software Adjustments

The main software adjustments for the printhead can be found in the **Setup** dialog box (Figure 3-1) in Compose. In this window the type of printhead, temperature, print bar locations, and head alignment can be adjusted.

Note: More detailed software information can be found in the Compose manual.

3.3.1 Printhead Type Selection

In order for the Apollo head to function properly, the “**Apollo Array**” must be selected. This is true for all three sizes. In Compose V5.02 the printhead type will be listed as “**HP Array**”. Versions of Compose before V5.02 are not compatible with the Apollo printheads.

3.3.2 Printhead Temperature Control

The nominal temperature for the Apollo printhead is 40°C. This can be adjusted by pressing the arrow icons beside the temperature reading in the **Setup** dialog box. The actual temperature can be viewed in the **Diagnostics** window. Note that one bar thermometer in the **Diagnostics** window indicates two ink cartridges. It is not possible to determine the temperature of each individual cartridge.

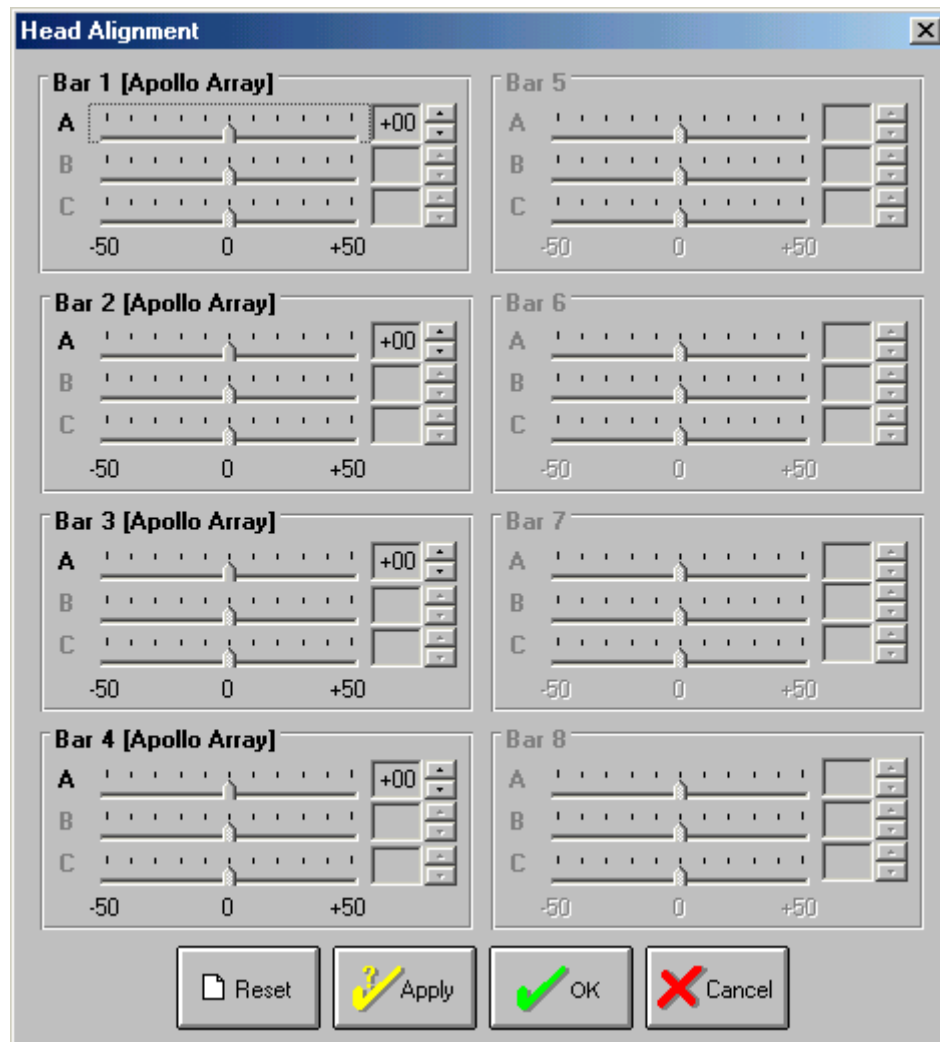
3.3.3 Print Bar Horizontal Position

In order to accurately position the print on the product, the print bar positions must be set properly. By definition, the position of the print bar is the distance in inches from the centre of the photocue sensor to the leading edge of the first print cartridge in the print bar. Coarse adjustment is achieved by entering in the print bar locations in the **Setup** window while fine adjustment is achieved in the **Head Alignment** dialog box (In the **Setup** window). The print bar positions for coarse adjustment are described in Section 3.2.

Note: A Print Bar is defined as a pair of ink cartridges in the Apollo printhead.

In order to eliminate horizontal misalignment between cartridges, the **Head Alignment** tool can be used for fine adjustment (Figure 3-3) to shift each print bar left or right. For large differences, the coarse adjustment should be used.

Figure 3-3: *Print Bar Fine Adjustment*



Note: It is recommended that a test pattern be used in conjunction with the coarse and fine adjustments. This makes it easier to visualize misalignment.

4.1 General Maintenance

In order to obtain good print quality, the printheads must be properly maintained. During printing, ink and paper dust can build up on the printhead resulting in poor print quality. As a result, each ink cartridge must be properly cleaned.

The general procedure for cleaning an ink cartridge is to wipe the printhead with a moist cotton TexWipe® cloth. Only distilled or de-ionized water should be used to avoid mineral deposits from building up on the cartridge. Although TexWipe® cloths are recommended, any cloth with the following qualities are acceptable:

- Soft (to avoid printhead scratching)
- Fibreless (to avoid small fibres from blocking the nozzles)
- No chemical additives

Note: Never use industrial paper towels, toilet paper, or sponges to wipe the printhead.

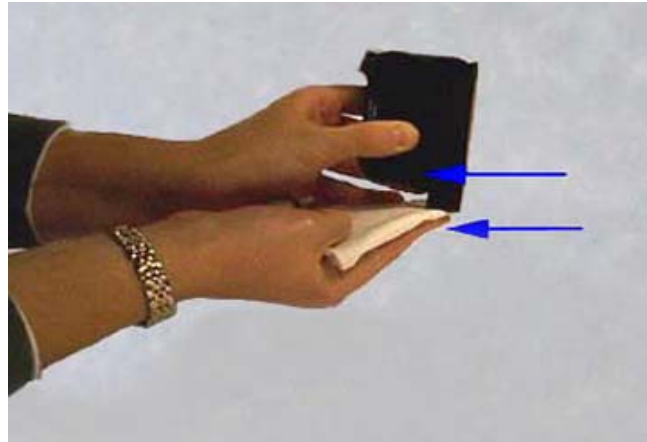
4.1.1 Printhead Cleaning

There are two main methods of cleaning the ink cartridges. Either each individual ink cartridge can be removed from the stall and wiped, or the entire printhead can be tilted to wipe multiple cartridges simultaneously. The method used depends on the preference of the operator. When cleaning the printhead, the following must be considered:

1. Use a soft, fibreless cloth.
2. The cloth must be moist with de-ionized or distilled water before wiping.
3. Wipe the cartridges in the direction of the nozzle rows (Figure 4-1).
4. Wipe the cartridges with the cartridge pointing down (printhead down).
5. Do not apply heavy pressure while wiping. A gentle wipe is sufficient.

Note: Never shake, drop, or hit the ink cartridge. This can result in the formation of bubbles near the ink firing chambers which will result in poor print.

Figure 4-1: *Direction of wiping*



4.1.2 Interconnect Pad Cleaning

If needed, the interconnect pads on the cartridge can be cleaned with a moist cotton TexWipe[®] cloth or Q-Tip. However, it is important to ensure that the interconnect pad is dry before reinserting the cartridge back into the printhead (otherwise an electrical short may occur resulting in permanent damage).

4.1.3 Printhead Purging

If the printhead is inactive for an extended period of time, ink may dry in the nozzles forming “ink plugs”. This would result in missing lines of print. When this occurs, the cartridges should first be wiped (Section 4.1.1). Once this is done, the ink plugs can be forced out or purged by printing test patterns at high resolutions (i.e. 600 DPI). This process should be repeated until the missing lines are eliminated.

4.1.4 Cartridge Disposal and Clean-up

The ink cartridges can be disposed of in normal garbage. In the case of ink spills, soap and water is sufficient for cleaning. Lava brand soap is also known to be effective to remove ink from hands.

4.1.5 Cartridge Storage




For short term storage (less than 2 days, 1 day if the environment is hot and dry), the cartridges can remain in the printhead. For long term storage, remove the cartridges from the printhead and keep them in an area that is relatively free of dust and paper particles. In addition, the storage area should not be dry.

Note: One option for long term ink cartridge storage is to place the cartridges in a Tupperware container with a damp sponge or towel to maintain humidity. This will help to prevent the printhead from drying out.

5.1 Troubleshooting

The following chapter is a brief description of problems that may be encountered over the life of the printhead. The recommended solutions are also provided in Table 5-1.

Table 5-1: *General Troubleshooting*

Problem	Example	Action
Cartridge will not print.	Sheet is blank even after it has gone underneath the printhead.	<ul style="list-style-type: none"> • Confirm Compose is set to enable printing. • Wipe and purge printhead. • Re-insert the cartridge into the printhead. • Install a new ink cartridge. • Ensure the tape is off the ink cartridge printhead.
Missing lines/streaks in text or graphics.	 <p>Michael Harp Hewlett Packard 16399 West Bernardo Drive San Diego CA 92127-1899</p> 	<ul style="list-style-type: none"> • Wipe and purge printhead. • Re-insert the cartridge into the printhead. • Clean the interconnect pads. • Install a new ink cartridge.
Ink streaks around text or image.	 <p><u>quickly dominated the Brazil team.</u> controlled Brazil's Oscar Martinez.</p>	<ul style="list-style-type: none"> • There is an ink buildup. Wipe the cartridges.

Assembly Drawings

Appendix A

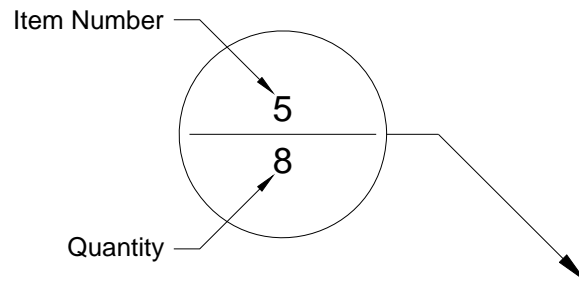
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Balloon Annotation and Parts Listing



Item	Part Number	Quantity	Description	Reference
1				
2				

The following is a description of how to interpret the information in this section:

Item:

This column indicates the item number used for each unique part in an assembly drawing. It is matched with the top number in the balloon pointing at the associated part.

Part Number:

This column represents the Buskro part number.

Quantity:

This represents the total number of a given part in an assembly. It is matched with the bottom number in the balloon pointing at the associated part.

Description:

This column contains a brief description of the part.

Reference:

This column indicates the page location for sub-assemblies.

Table A-1: *Printhead, Apollo, 1" w/Rail Mount (BK791-H-15)*

Item	Part Number	Quantity	Description	Reference
1	404510	2	Screw, BHCS, 10-32 UNF x ¼"	
2	9102207	1	Shield, 1" HP Printhead, Reverse	
3	9102276	1	Shield, 1" HP Printhead	
4	9103180A	1	Cable, Apollo Printhead Umbilical, 1"	Page A-20
5	BK791-H	1	Printhead, Apollo, 1"	Page A-7
6	BK79M-H	1	HP Printhead Slide Assembly	Page A-11

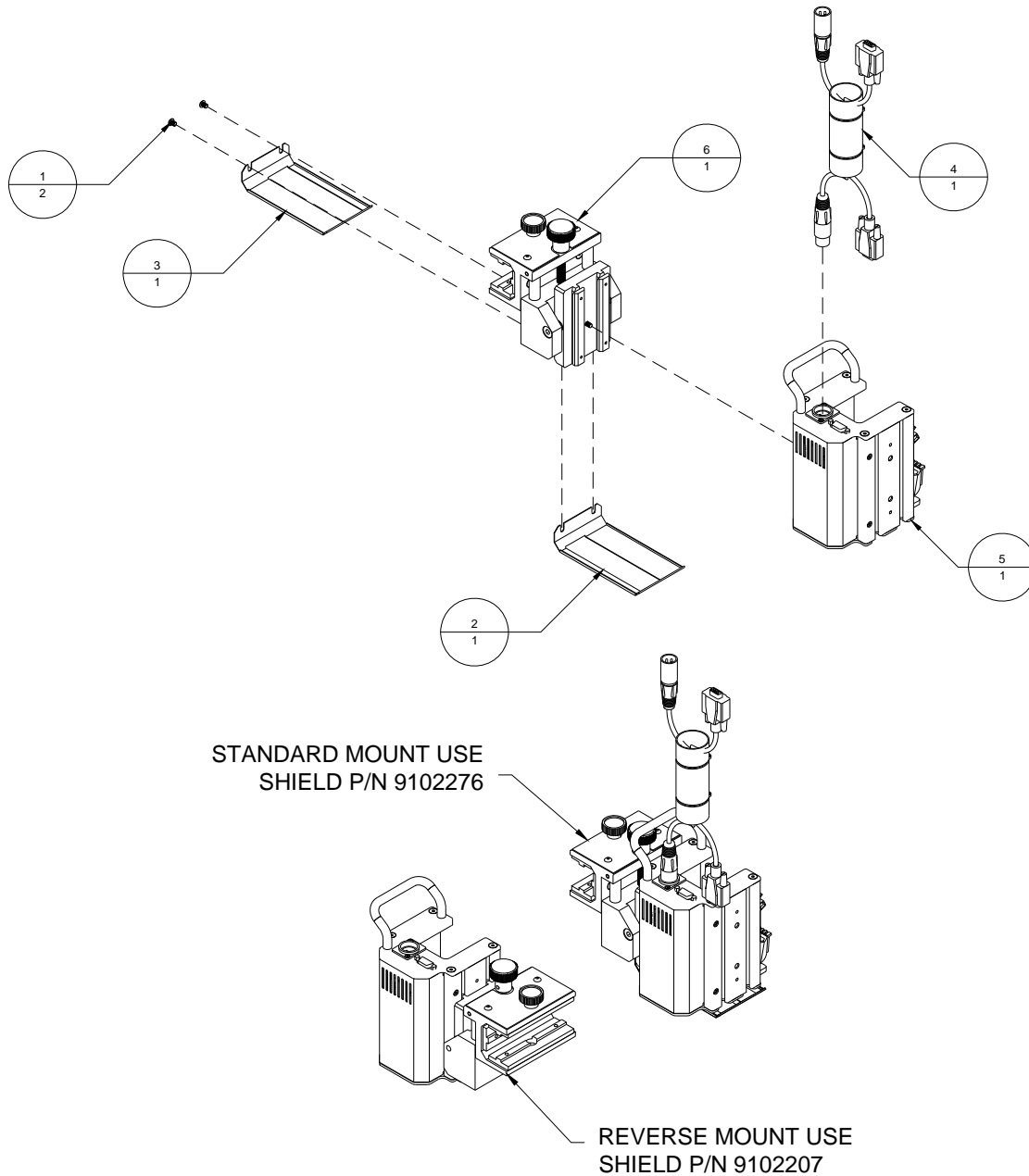
Figure A-1: *Printhead, Apollo, 1" w/Rail Mount (BK791-H-15)*

Table A-2: *Printhead, Apollo, 2" w/Rail Mount (BK792-H-15)*

Item	Part Number	Quantity	Description	Reference
1	404510	2	Screw, BHCS, 10-32 UNF x 1/4"	
2	9102193	1	Shield, 2" HP Printhead	
3	9102208	1	Shield, 2" HP Printhead, Reverse	
4	9103181A	1	Cable, Apollo Printhead Umbilical, 2"	Page A-21
5	BK792-H	1	Printhead, Apollo, 2"	Page A-8
6	BK79M-H	1	HP Printhead Slide Assembly	Page A-11

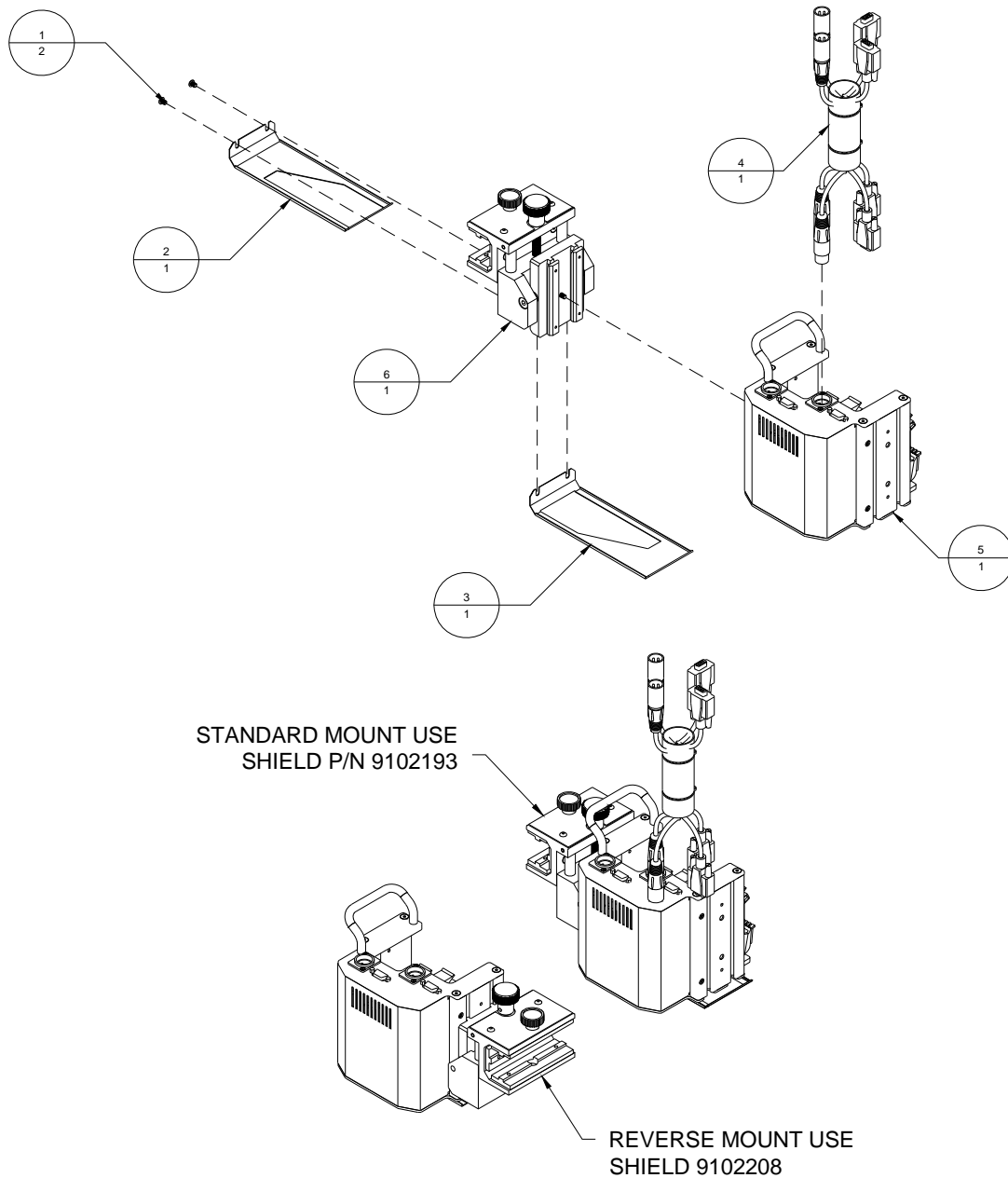
Figure A-2: *Printhead, Apollo, 2" w/Rail Mount (BK792-H-15)*

Table A-3: *Printhead, Apollo, 3" w/Rail Mount (BK793-H-15)*

Item	Part Number	Quantity	Description	Reference
1	404510	2	Screw, BHCS, 10-32 UNF x ¼"	
2	9102210	1	Shield, 3" HP Printhead, Reverse	
3	9102275	1	Shield, 3" HP Printhead	
4	9103182A	1	Cable, Apollo Printhead Umbilical, 3"	Page A-22
5	BK793-H	1	Printhead, Apollo, 3"	Page A-9
6	BK79M-H	1	HP Printhead Slide Assembly	Page A-11

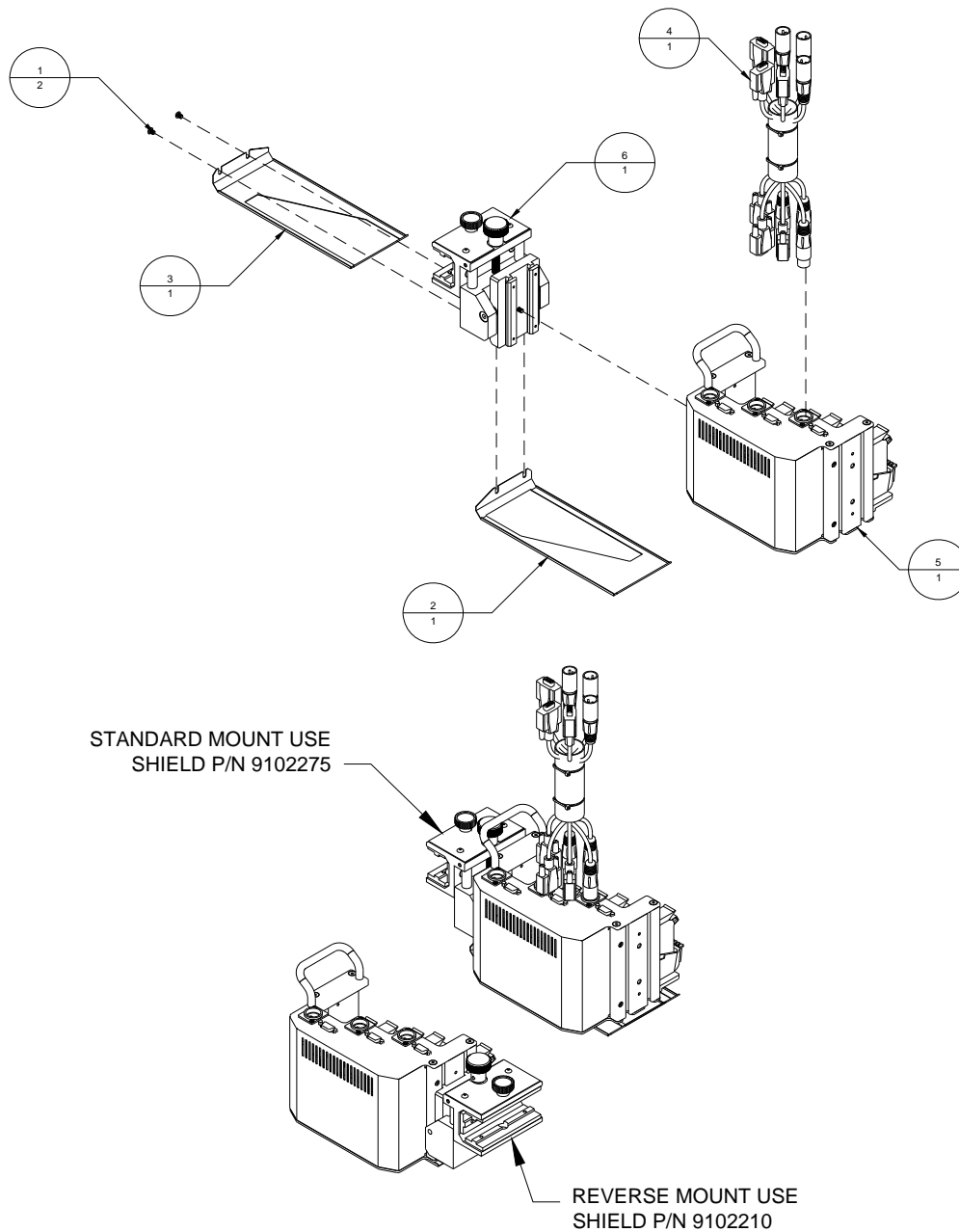
Figure A-3: *Printhead, Apollo, 3" w/Rail Mount (BK793-H-15)*

Table A-4: *Printhead, Apollo, 4" (BK794-H-15)*

Item	Part Number	Quantity	Description	Reference
1	9102711A	1	Cable, Apollo Printhead Umbilical, 15'	Page A-15
2	9103660	1	Shield, Short, Apollo	
3	BK794-H	1	Printhead, Apollo 4"	Page A-10
4	BK80M-2	1	Printhead Mount, 80 Series, Apollo	Page A-12

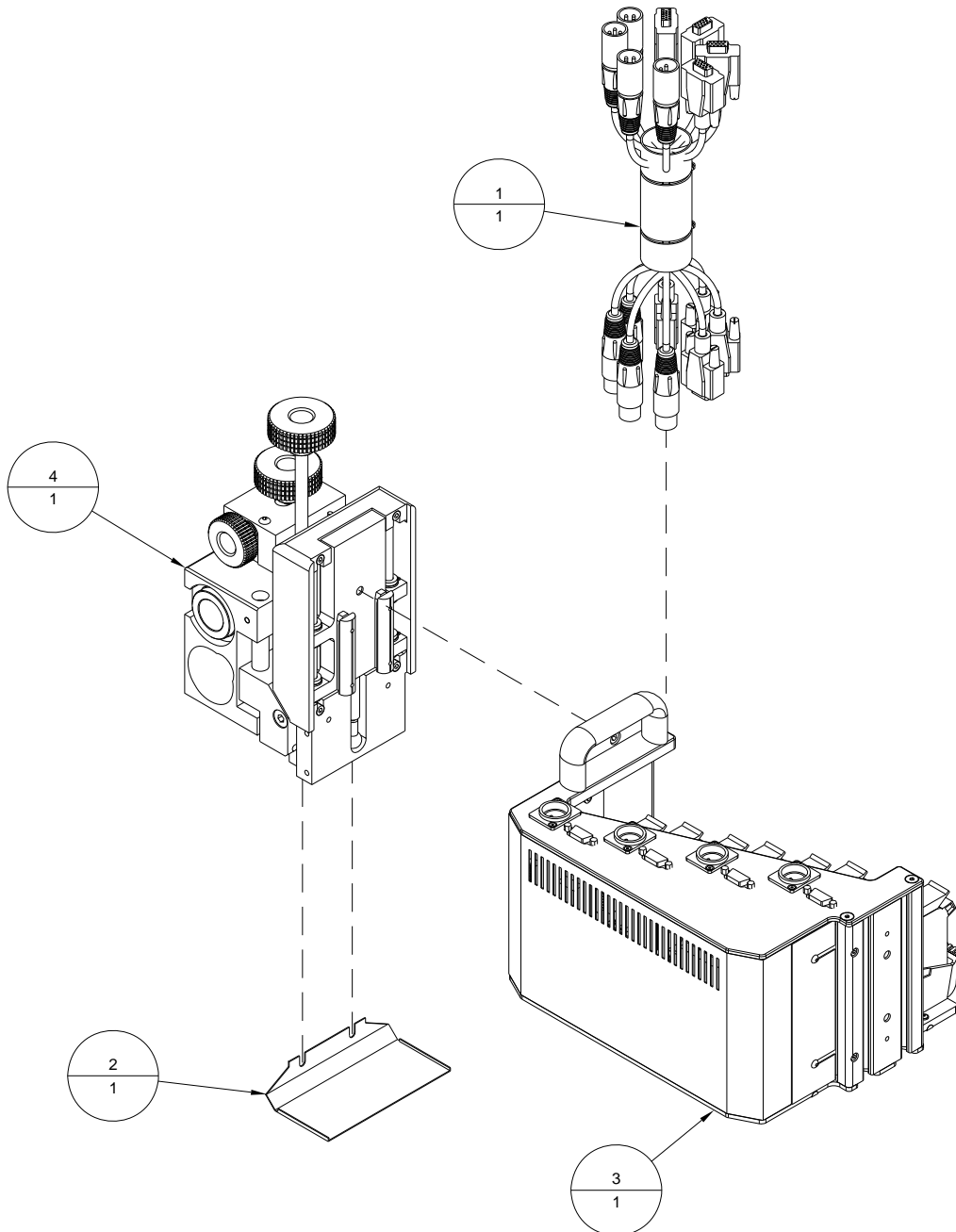
Figure A-4: *Printhead, Apollo, 4" (BK794-H-15)*

Table A-5: *Printhead, Apollo, 1" (BK791-H)*

Item	Part Number	Quantity	Description	Reference
1	401010	2	Screw, FHCS, 4-40 UNC x 1/4"	
2	401310	10	Screw, PHMS, 4-40 UNC x 1/4"	
3	402240	4	Screw, SHCS, 6-32 UNC x 5/8"	
4	402510	5	Screw, BHCS, 6-32 UNC x 1/4"	
5	403510	2	Screw, BHCS, 8-32 UNC x 1/4"	
6	404020	8	Screw, FHCS, 10-32 UNF x 3/8"	
7	404050	2	Screw, FHCS, 10-32 UNF x 3/4"	
8	440530	4	Washer, #6 Nylon	
9	615322	2	Female Screwlock, 4-40 UNC	
10	9100141	1	Printhead Support Chip (No longer used)	
11	9100220	1	Board, HP Interface	
12	9100228	2	Board, HP Pen Driver	
13	BKINK-VERBK40	2	Ink, HP Cartridge, Black	
14	9100294	2	HP Flex Cable	
15	9101774	1	Handle, Double Curved	
16	9102189	2	Mounting Extrusion, HP Printhead	
17	9102217	1	Frame, 1" HP Printhead Top	
18	9102218	1	Frame, 1" HP Printhead Bottom	
19	9102219	1	Cover, 1" HP Printhead	
20	9102272	1	Bracket, 1" HP Head Board Mount	
21	9102273	1	Cover, 1" HP Head Board	
22	9102277	2	HP Pen Stall	
23	9102703	1	Label, Apollo Dipswitch Settings	

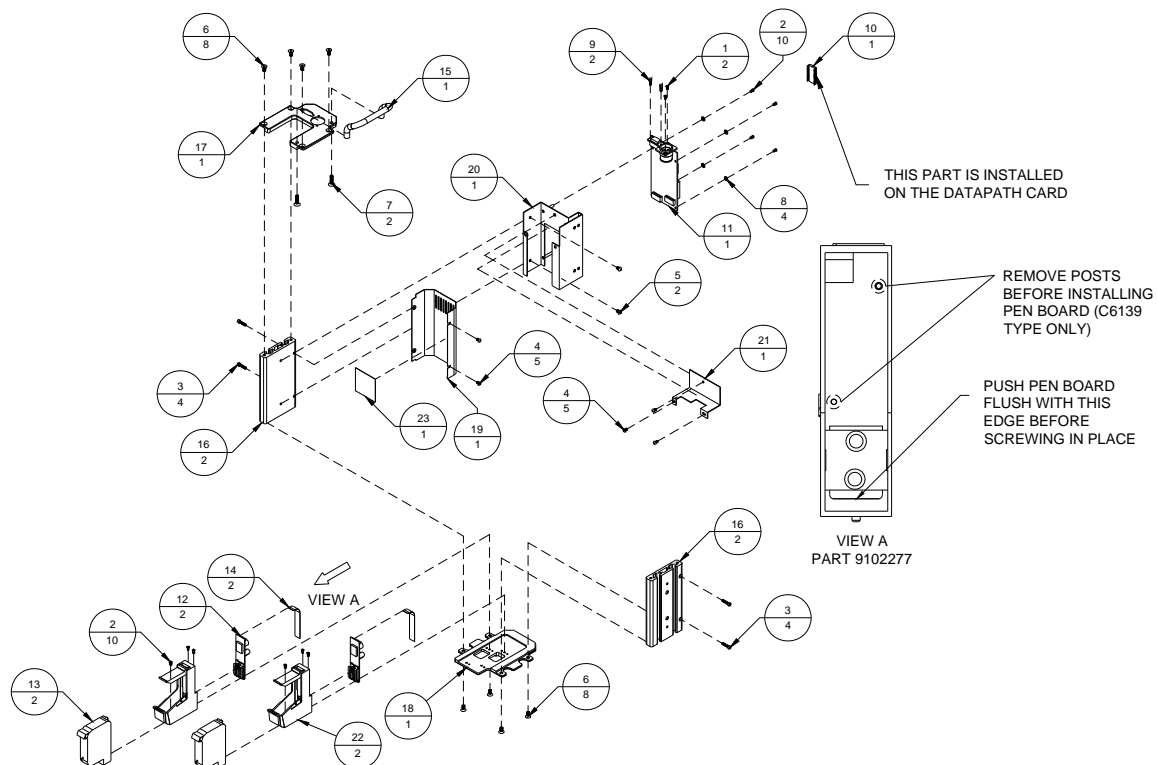
Figure A-5: *Printhead, Apollo, 1" (BK791-H)*

Table A-6: *Printhead, Apollo, 2" (BK792-H)*

Item	Part Number	Quantity	Description	Reference
1	401010	4	Screw, FHCS, 4-40 UNC x 1/4"	
2	401310	18	Screw, PHMS, 4-40 UNC x 1/4"	
3	402020	1	Screw, FHCS, 6-32 UNC x 3/8"	
4	402240	4	Screw, SHCS, 6-32 UNC x 5/8"	
5	402510	7	Screw, BHCS, 6-32 UNC x 1/4"	
6	403510	2	Screw, BHCS, 8-32 UNC x 1/4"	
7	404020	8	Screw, FHCS, 10-32 UNF x 3/8"	
8	404050	2	Screw, FHCS, 10-32 UNF x 3/4"	
9	440530	6	Washer, #6 Nylon	
10	615322	4	Female Screwlock, 4-40 UNC	
11	9100141	2	Printhead Support Chip (No longer used)	
12	9100220	2	Board, HP Interface	
13	9100228	4	Board, HP Pen Driver	
14	BKINK-VERBK40	4	Ink, HP Cartridge, Black	
15	9100294	4	HP Flex Cable	
16	9101774	1	Handle, Double Curved	
17	9102186	1	HP Printhead Top Frame, 2"	
18	9102187	1	Frame, 2" HP Printhead Bottom	
19	9102188	1	Cover, 2" HP Printhead	
20	9102189	2	Mounting Extrusion, HP Printhead	
21	9102190	1	Bracket, 2" HP Head Board Mount	
22	9102191	1	Bracket, Printhead Board Support	
23	9102277	4	HP Pen Stall	
24	9102356	1	Bracket, Support	
25	9102703	1	Label, Apollo Dipswitch Settings	

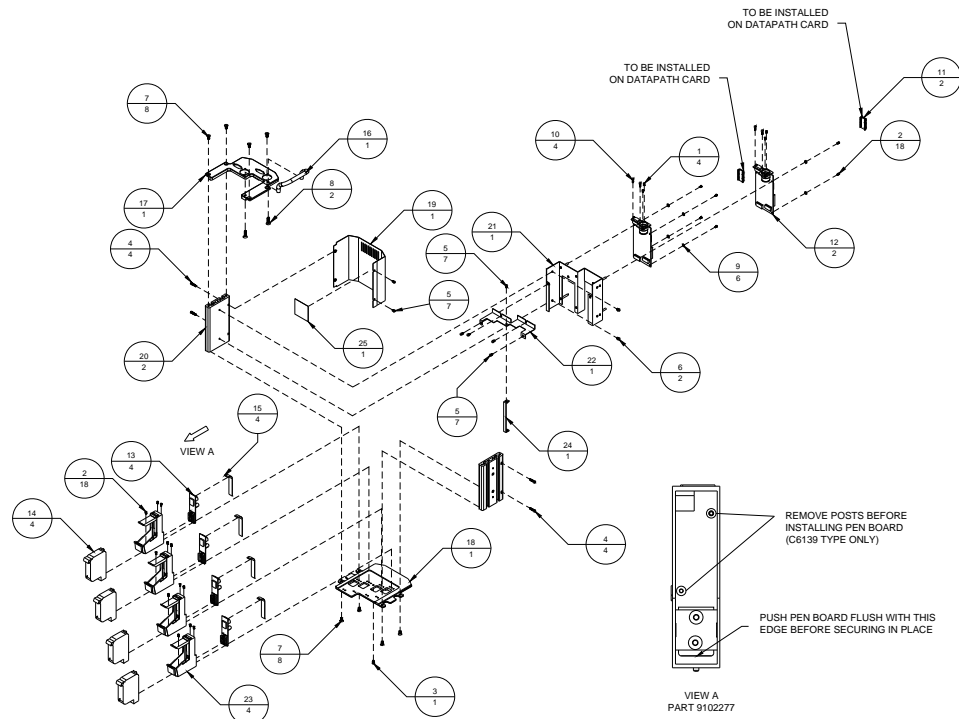
Figure A-6: *Printhead, Apollo, 2" (BK792-H)*

Table A-7: *Printhead, Apollo, 3" (BK793-H)*

Item	Part Number	Quantity	Description	Reference
1	401010	6	Screw, FHCS, 4-40 UNC x 1/4"	
2	401310	26	Screw, PHMS, 4-40 UNC x 1/4"	
3	402020	2	Screw, FHCS, 6-32 UNC x 3/8"	
4	402240	4	Screw, SHCS, 6-32 UNC x 5/8"	
5	402510	9	Screw, BHCS, 6-32 UNC x 1/4"	
6	403510	2	Screw, BHCS, 8-32 UNC x 1/4"	
7	404020	8	Screw, FHCS, 10-32 UNF x 3/8"	
8	404050	2	Screw, FHCS, 10-32 UNF x 3/4"	
9	440530	8	Washer, #6 Nylon	
10	615322	6	Female Screwlock, 4-40 UNC	
11	9100141	3	Printhead Support Chip (No longer used)	
12	9100220	3	Board, HP Interface	
13	9100228	6	Board, HP Pen Driver	
14	BKINK-VERBK40	6	Ink, HP Cartridge, Black	
15	9100294	6	HP Flex Cable	
16	9101774	1	Handle, Double Curved	
17	9102189	2	Mounting Extrusion, HP Printhead	
18	9102212	1	Frame, 3" HP Printhead Top	
19	9102213	1	Frame, 3" HP Printhead Bottom	
20	9102214	1	Bracket, 3" HP Head Board Mount	
21	9102215	1	Cover, 3" HP Printhead	
22	9102216	1	Cover, 3" HP Head Board	
23	9102277	6	HP Pen Stall	
24	9102356	2	Bracket, Support	
25	9102703	1	Label, Apollo Dipswitch Settings	

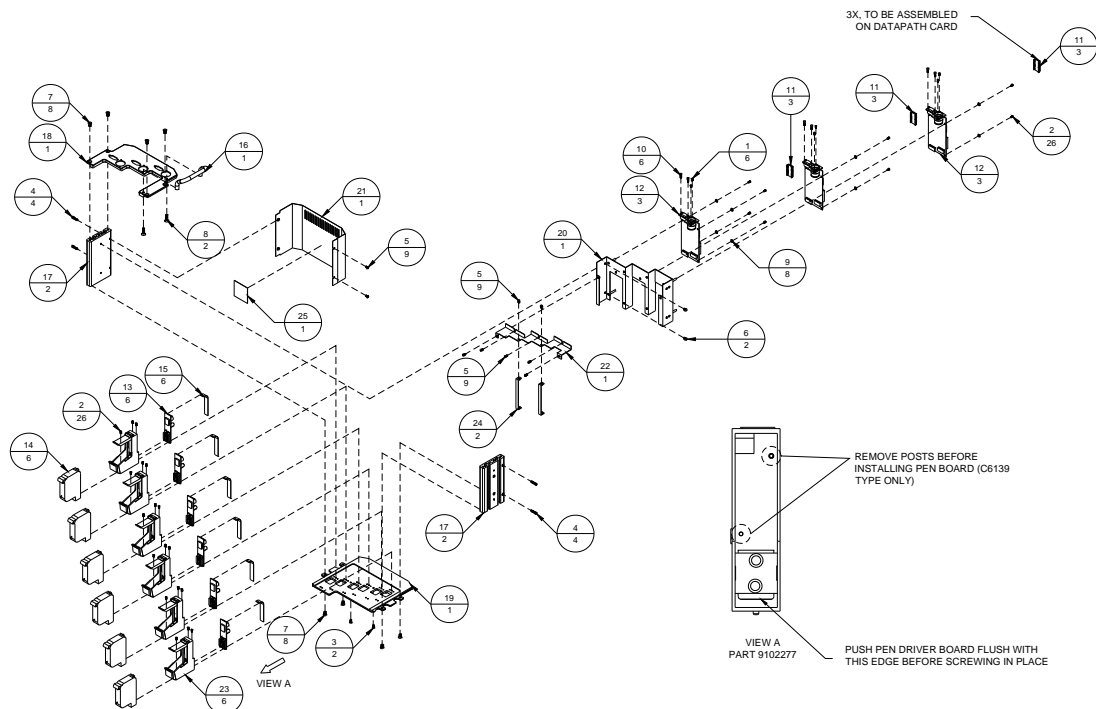
Figure A-7: *Printhead, Apollo, 3" (BK793-H)*

Table A-8: *Printhead, Apollo, 4" (BK794-H)*

Item	Part Number	Quantity	Description	Reference
1	402240	4	Screw, SHCS, 6-32 UNC x 5/8"	
2	402510SS	6	Screw, BHCS, 6-32 UNC x 1/4"	
3	404020	6	Screw, FHCS, 10-32 UNF x 3/8"	
4	404070	2	Screw, FHCS, 10-32 UNF x 1"	
5	405050	2	Screw, FHCS, 1/4-20 UNC x 3/4"	
6	405230	1	Screw, SHCS, 1/4-20 UNC x 1/2"	
7	9102189	2	Mounting Extrusion, HP Printhead	
8	9102277A	8	Apollo Stall Assembly	Page A-14
9	9102703	1	Label, Apollo Dipswitch Settings	
10	9102846	1	Handle, Pull, 1/4-20	
11	9103647	1	Plate, Bottom, 4" Apollo	
12	9103648	1	Plate, Top, 4" Apollo	
13	9103649A	4	Apollo Interface Board Assembly	Page A-19
14	9103650	1	Cover, Inside, 4" Apollo	
15	9103651	1	Cover, Top, 4" Apollo	
16	9103652	1	Cover, Side, 4" Apollo	
17	9103676	1	Block, Locking Apollo	
18	BKINK-VERBK40	8	Ink, HP Cartridge, Black	

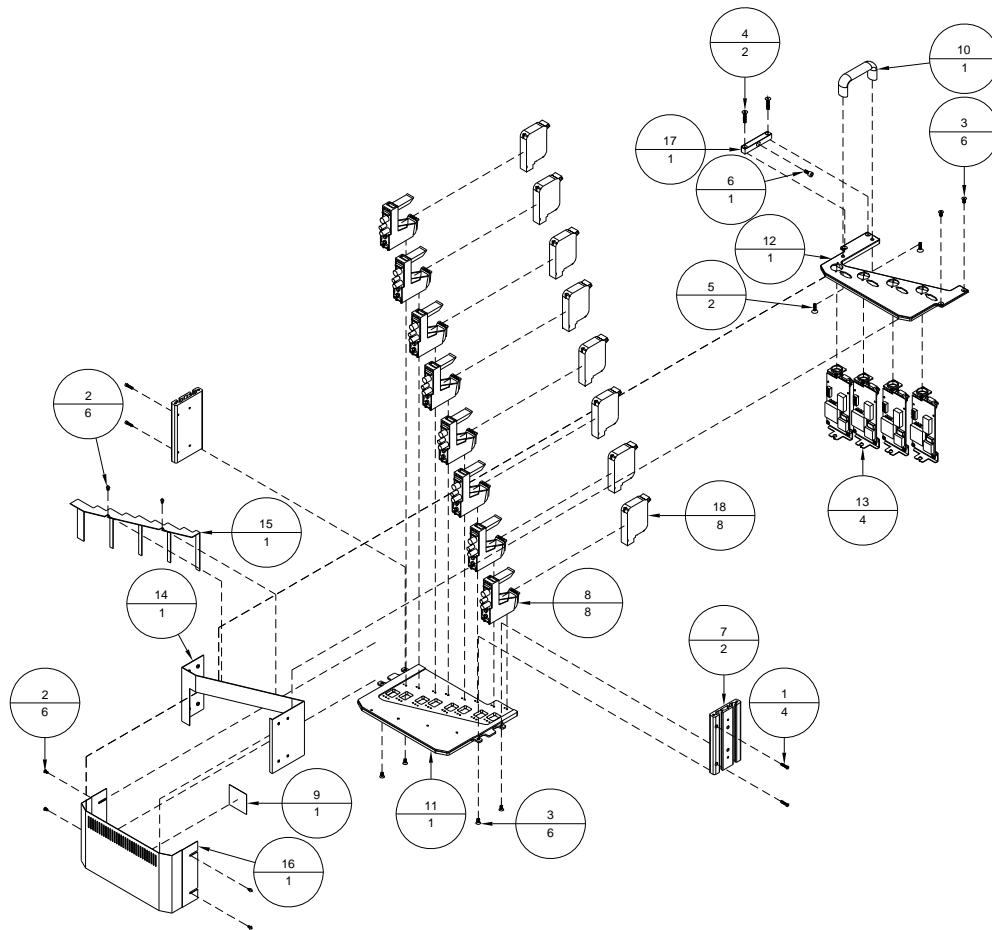
Figure A-8: *Printhead, Apollo, 3" (BK794-H)*

Table A-9: *Printhead Slide Mount, HP, BK79 Series (BK79M-H)*

Item	Part Number	Quantity	Description	Reference
1	402070	4	Screw, FHCS, 6-32 UNC x 1"	
2	405230	1	Screw, SHCS, ¼-20 UNC x ½"	
3	443830	1	Spacer Washer, 3/8 ID x .031 THK	
4	9101874	2	Spring, Compression	
5	9101994A	1	Rail Mounting Assembly	Page A-13
6	9102127	1	Screw, SHCS, ¼-20 UNC x 1.25", S.S.	
7	9102194	1	Mounting Block, HP Printhead	
8	9102414	2	T-Nut Profile, HP Printhead Slide	
9	9102592	1	Shoulder Bolt, 3/8" x 3 ½, 5/16-18 UNC	
10	9102593	1	Spring Compression, 3/8" I.D.	
11	9102596	1	Mounting Block, Printhead Slider	

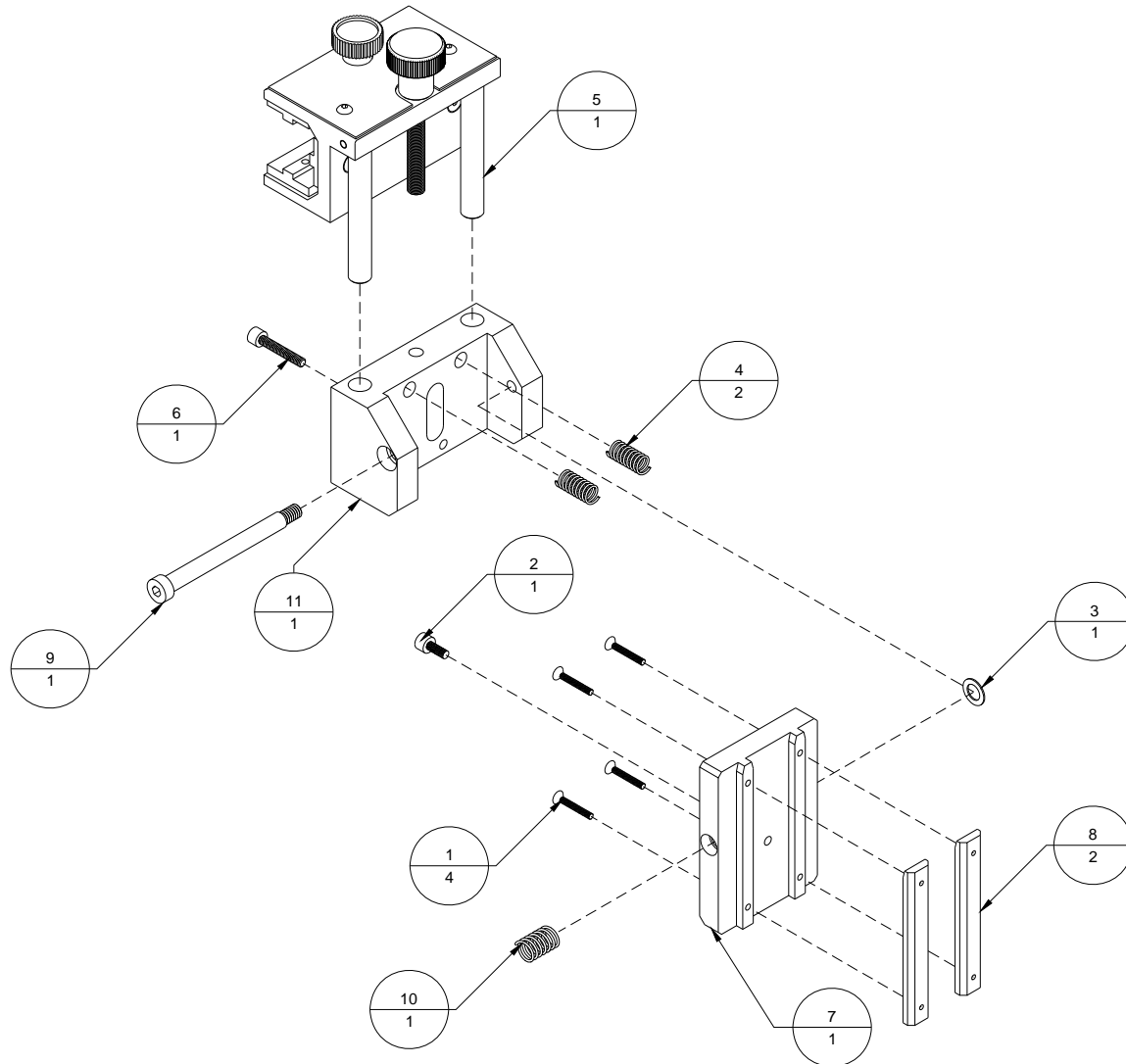
Figure A-9: *Printhead Slide Mount, HP, BK79 Series (BK79M-H)*

Table A-10: *Printhead Mount, 80 Series, Apollo (BK80M-2)*

Item	Part Number	Quantity	Description	Reference
1	9102819A	1	Bridge Mount Assembly	Page A-16
2	9103645A	1	Printhead Support Assembly	Page A-18

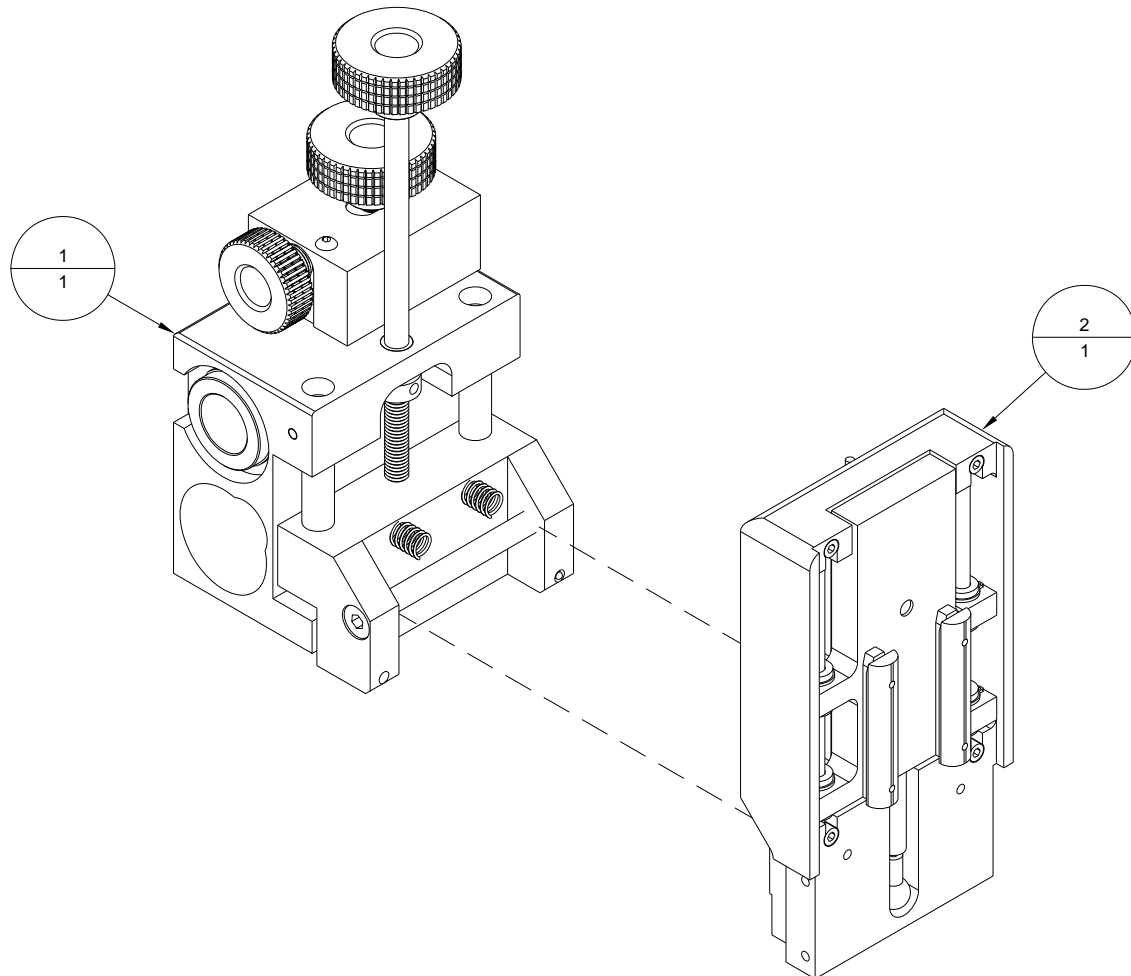
Figure A-10: *Printhead Mount, 80 Series, Apollo (BK80M-2)*

Table A-11: *Rail Mounting Assembly (9101994A)*

Item	Part Number	Quantity	Description	Reference
1	404030	6	Screw, FHCS, 10-32 UNF x 1/2"	
2	404510	2	Screw, BHCS, 10-32 UNF x 1/4"	
3	404807	3	Screw, SHSS, 10-32 UNF x 3/16"	
4	438010	1	Knob, Gate Adjustment	
5	505463	1	Flange Bushing, 1/4 ID x 3/8 OD x 3/8 LG.	
6	505464	1	Flange Bushing, 1/4 ID x 3/8 OD x 1/2 LG.	
7	9101128	2	Dowel Pin, 1/2" DIA x 4"	
8	9101398	1	Economy T-slot Stud, 5/16-18 UNC x 1"	
9	9101603	3	Bearing Pad, 15 Series, 4.3" Lg.	
10	9101994	1	Rail Mounting Bracket	
11	9101995	1	Rod, Threaded, 3/8-24 UNF	
12	9102155	1	Rail Bracket Cover	
13	9102240	1	Knob, Thumb, Knurled	

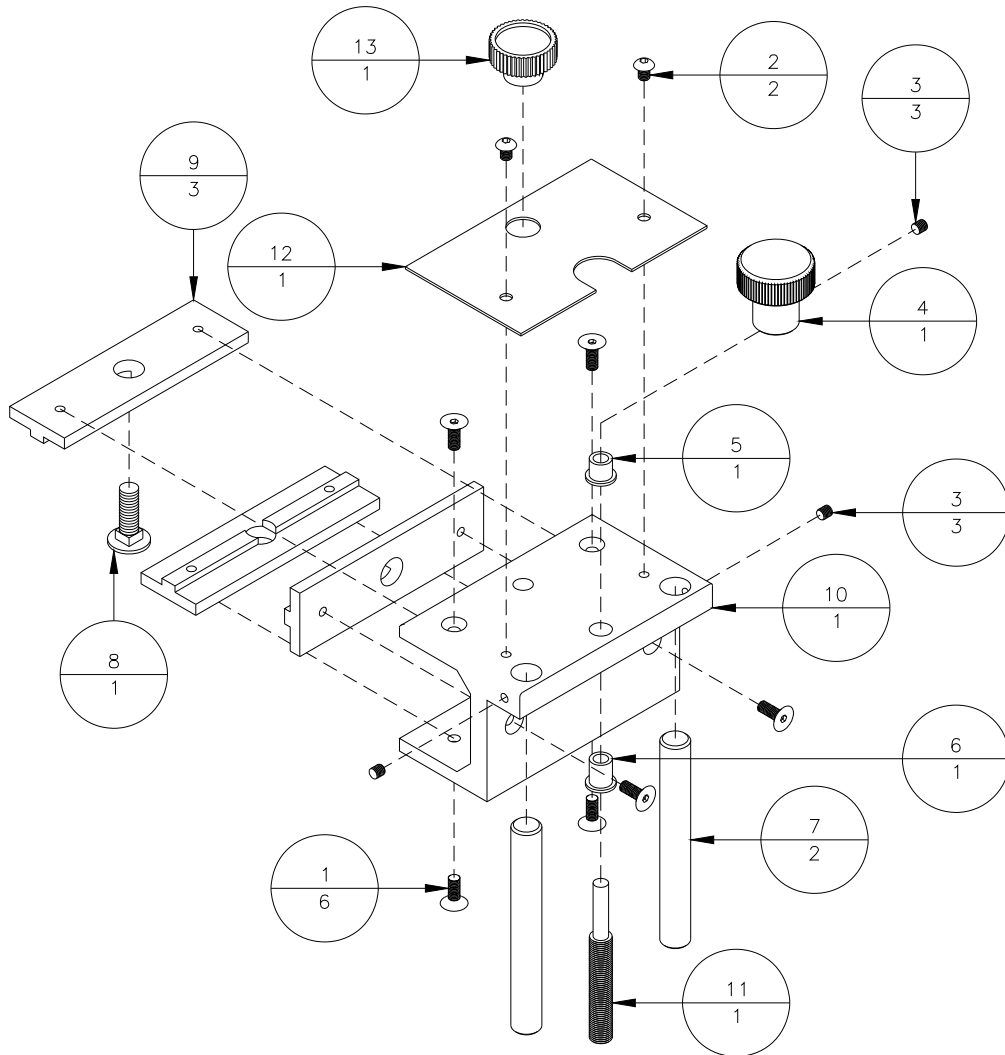
Figure A-11: *Rail Mounting Assembly (9101994A)*

Table A-12: *Apollo Stall Assembly (9102277A)*

Item	Part Number	Quantity	Description	Reference
1	401310	3	Screw, PHMS, 4-40 UNC x 1/4"	
2	9100228	1	Board, HP Pen Driver	
3	9102277	1	HP Pen Stall	

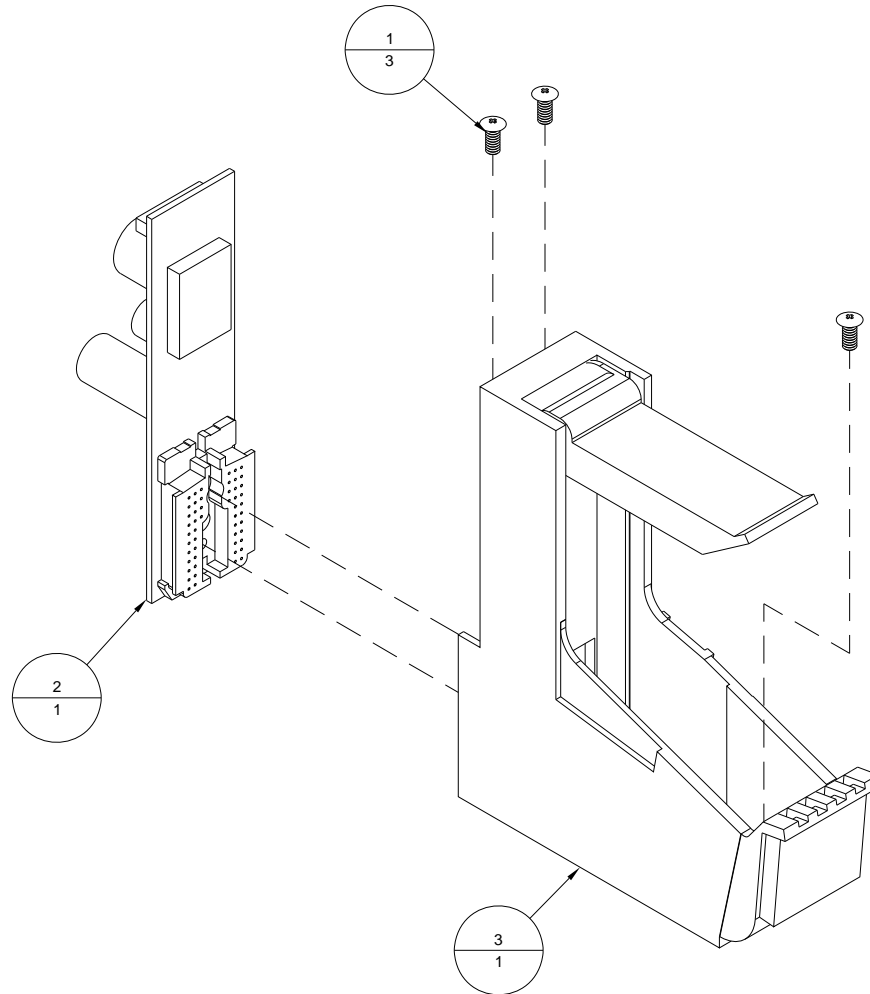
Figure A-12: *Apollo Stall Assembly (9102277A)*

Table A-13: *Umbilical Assembly, BK794, Apollo, 15' (9102711A)*

Item	Part Number	Quantity	Description	Reference
1	615140	2	Lashing Tie	
2	9100261A	4	Cable, HP Printhead Power	
3	9101776	148"	Sleeving, Braided Expandable	
4	9102603	2 x 2"	Shrink Wrap, 1 ½" OD, ½" ID	
5	9102687A	4	Cable, Printhead Data, 15'	

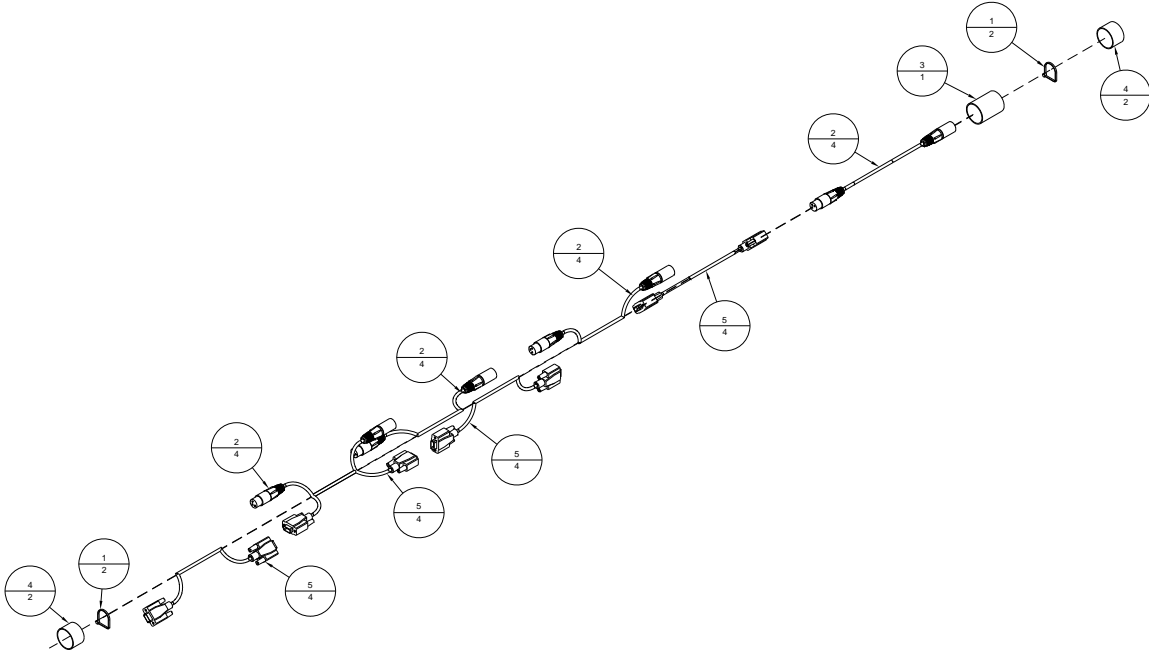
Figure A-13: *Umbilical Assembly, BK794, Apollo, 15' (9102711A)*

Table A-14: *Bridge Mount Assembly (9102819A)*

Item	Part Number	Quantity	Description	Reference
1	131020	1	Collar, 3/8" ID	
2	9106246	4	Linear Bearing, 1" ID	
3	402850	2	Screw, SHSS, 6-32 UNC x 3/4"	
4	404520	7	Screw, BHCS, 10-32 UNF x 3/8"	
5	404807	2	Screw, SHSS, 10-32 UNF x 3/16"	
6	436060	4	Spring Pin, 1/8" Dia. X 1"	
7	439009	3	Lockwasher, No. 10	
8	505384	1	Flange Bushing, 3/8 ID x 1/2 OD x 1/2 Lg.	
9	9101128	2	Dowel Pin, 1/2" Dia x 4"	
10	9101874	2	Spring, Compression	
11	9102592	1	Shoulder Bolt, 3/8" x 3-1/2", 5/16-18 UNC	
12	9102819	1	Mount, Linear Bearing, Automatic	
13	9102877	1	Bearing, Thrust, 1/4" ID	
14	9102879	1	Rod, Threaded, Thickness	
15	9102883	1	Mounting Block, Slider	
16	9102884	1	Plunger, Spring Loaded, Threaded, 1/4-20 UNC	
17	9102885	1	Knob, Diamond Cut, Knurled, 2" Dia	
18	9103460A	1	Locking Mechanism	Page A-17

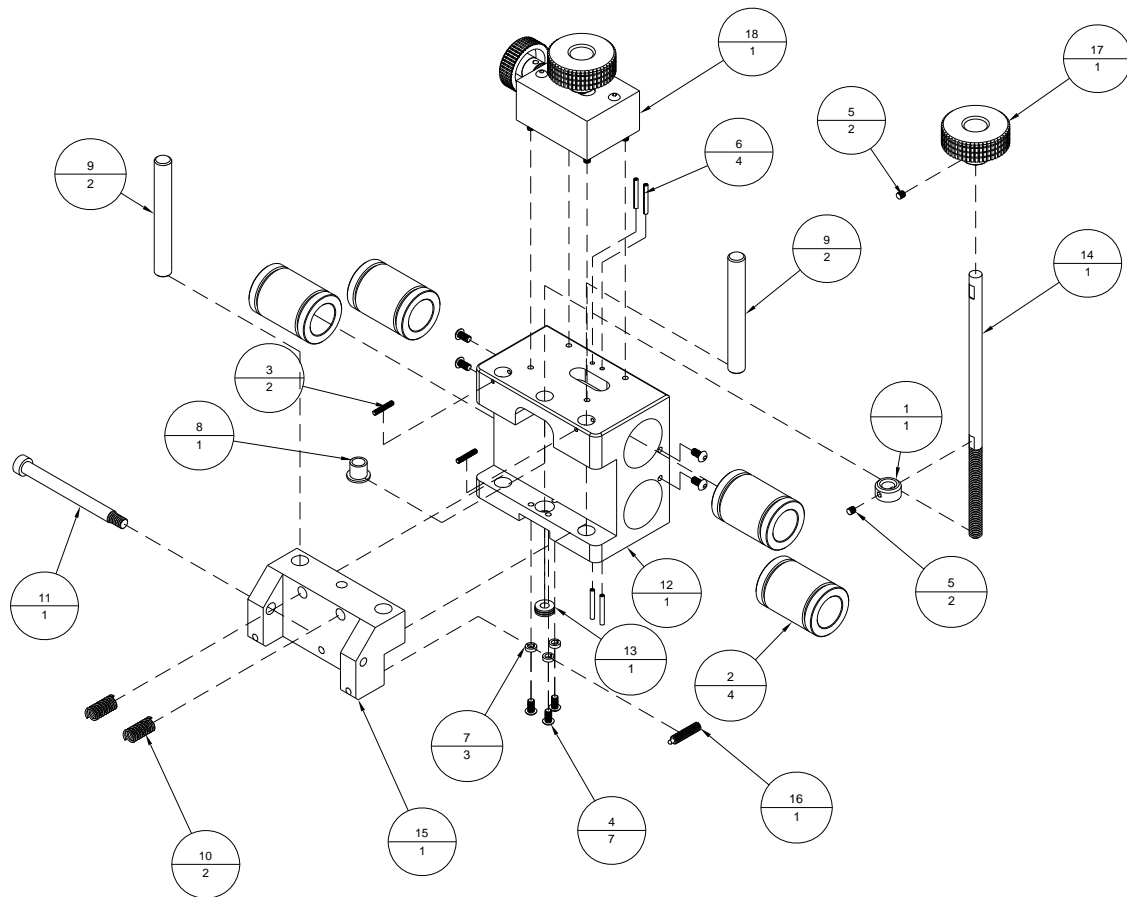
Figure A-14: *Bridge Mount Assembly (9102819A)*

Table A-15: *Locking Mechanism (9103460A)*

Item	Part Number	Quantity	Description	Reference
1	404275	4	Screw, SHCS, 10-32 UNF x 1-1/4"	
2	404510	2	Screw, BHCS, 10-32 UNF x 1/4"	
3	404805	4	Screw, SHSS, 10-32 UNF x 1/8"	
4	404807	2	Screw, SHSS, 10-32 UNF x 3/16"	
5	436348	2	Dowel Pin, 1/4" Dia. x 2"	
6	442530	3	Spacer Washer, 1/4" ID x 0.032 Thick	
7	505056	6	Flange Bushing, 1/4 ID x 3/8" OD x 1/4 Lg.	
8	9102885	1	Knob, Diamond Cut, Knurled, 2" Dia.	
9	9103457	1	Knob, Diamond Cut, Knurled, 1.57" Dia.	
10	9103458	1	Threaded Rod, 3/8-16 UNC	
11	9103459	1	Slider Nut, 3/8-16 UNC	
12	9103460	2	Bracket, Slider Block	
13	9103461	1	Threaded Rod, 3/8-24 UNF, Lateral Adjustment	
14	9103462	1	Cover, Lateral Adjustment Mechanism	
15	9103463	1	Pin, Brass, 3/16" Dia. X 0.6" Long	

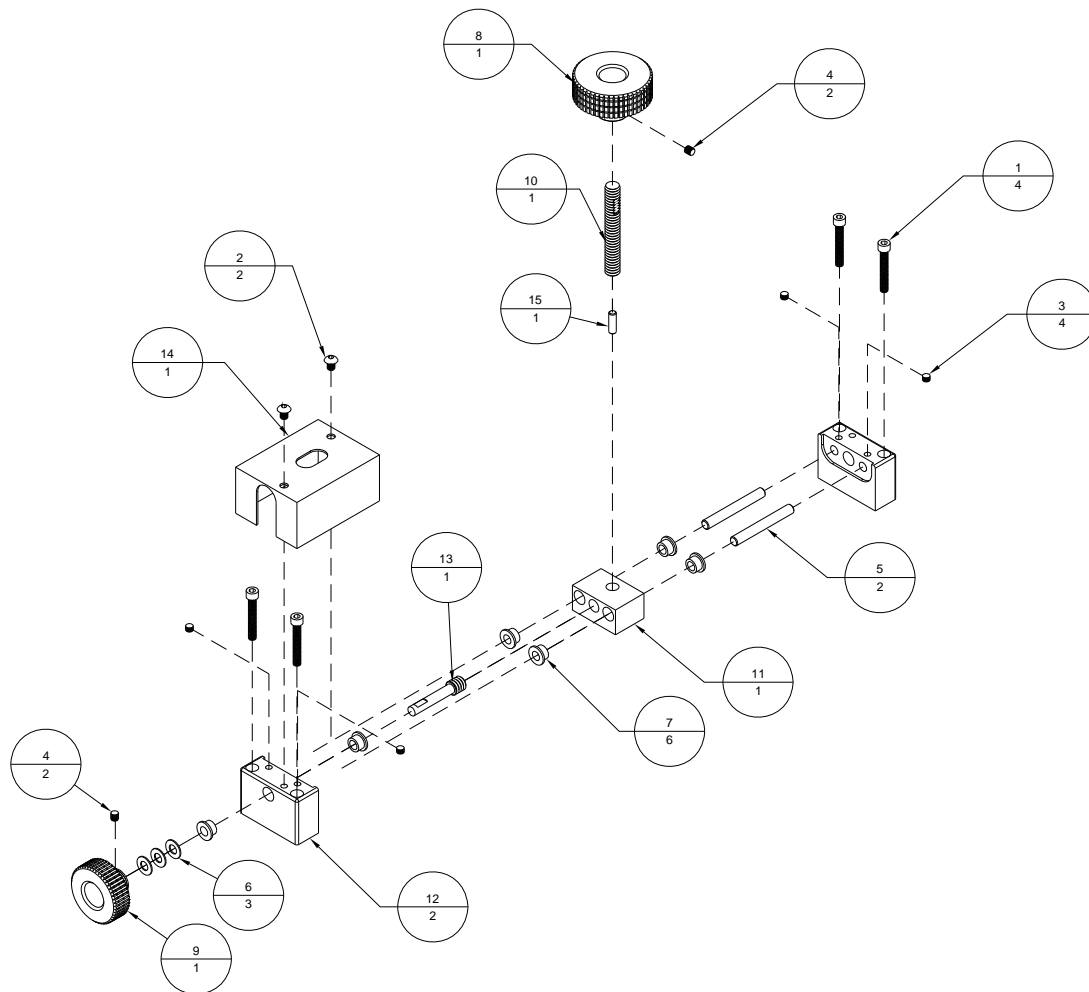
Figure A-15: *Locking Mechanism (9103460A)*

Table A-16: *Printhead Support Assembly, Apollo (9103645A)*

Item	Part Number	Quantity	Description	Reference
1	402250	4	Screw, SHCS, 6-32 UNC x ¾"	
2	404230	4	Screw, SHCS, 10-32 UNF x ½"	
3	404510	2	Screw, BHCS, 10-32 UNF x ¼"	
4	437050	8	Retaining Ring, ½" ID, External	
5	9101996	1	Gas Spring	
6	9102126	1	Locknut, M4 x 0.7, Nylon Insert	
7	9102341	4	Bushing, Linear Ball Bearing	
8	9102411	2	Rod, 0.25" OD x 5.19" Lg.	
9	9102594	1	Mount, Printhead Solid	
10	9102792	1	Plunger, 3/8-16 UNC, Lever Type, Non-Locking	
11	9103645	1	Shuttle Block, Solid Mount, Apollo	
12	9103672	2	Profile Bar, Apollo Bar	

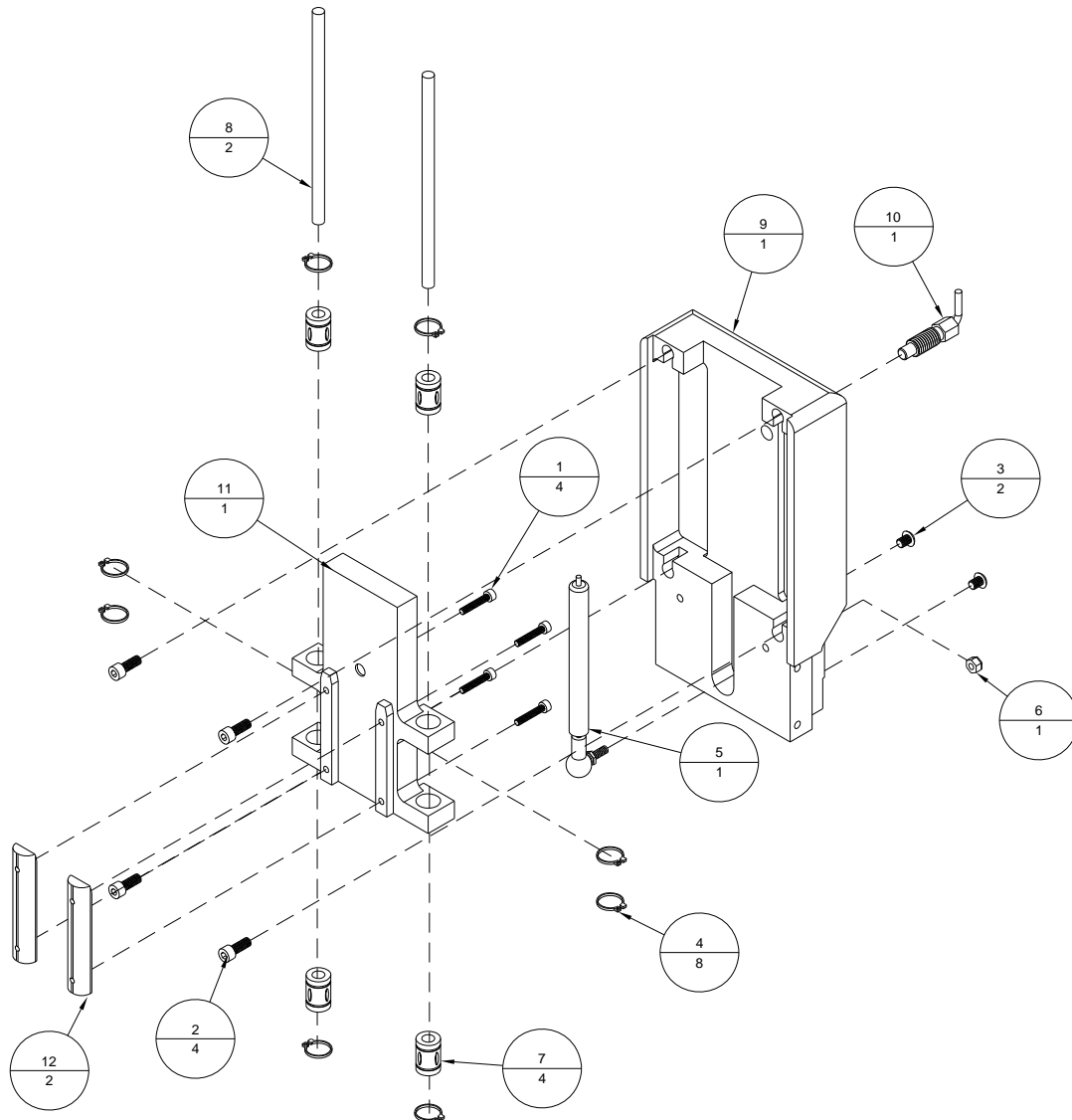
Figure A-16: *Printhead Support Assembly, Apollo (9103645A)*

Table A-17: *Apollo Interface Board Assembly (9103649A)*

Item	Part Number	Quantity	Description	Reference
1	401010	2	Screw, FHCS, 4-40 UNC x 1/4"	
2	401310	2	Screw, PHMS, 4-40 UNC x 1/4"	
3	403510	1	Screw, BHCS, 8-32 UNC x 1/4"	
4	440530	2	Washer, #6 Nylon	
5	615322	2	Female Screwlock, 4-40 UNC	
6	9100220	1	Board, HP Interface	
7	9103649	1	Brace, Apollo Interface Board	

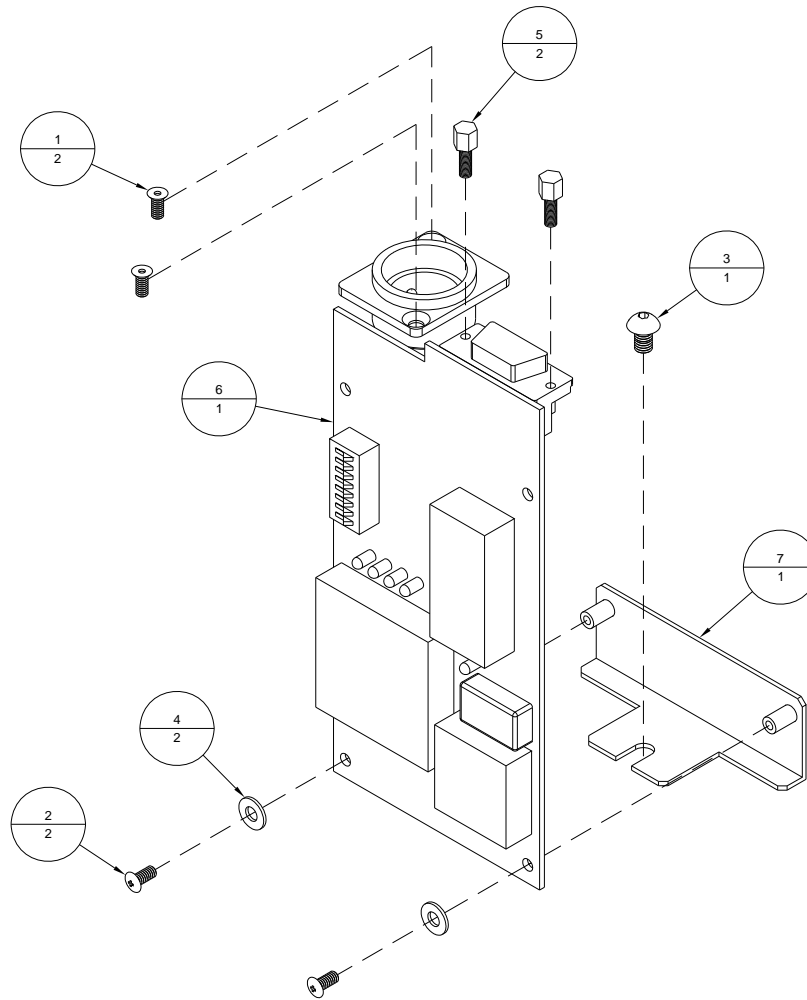
Figure A-17: *Apollo Interface Board Assembly (9103649A)*

Table A-18: *Umbilical Assembly, BK791, Apollo, 15' (9103180A)*

Item	Part Number	Quantity	Description	Reference
1	615140	2	Lashing Tie	
2	9100261A	1	Cable, HP Printhead Power	
3	9101776	148"	Sleeving, Braided Expandable	
4	9102603	2 x 2"	Shrink Wrap, 1 ½" OD, ½" ID	
5	9102687A	1	Cable, Printhead Data, 15'	

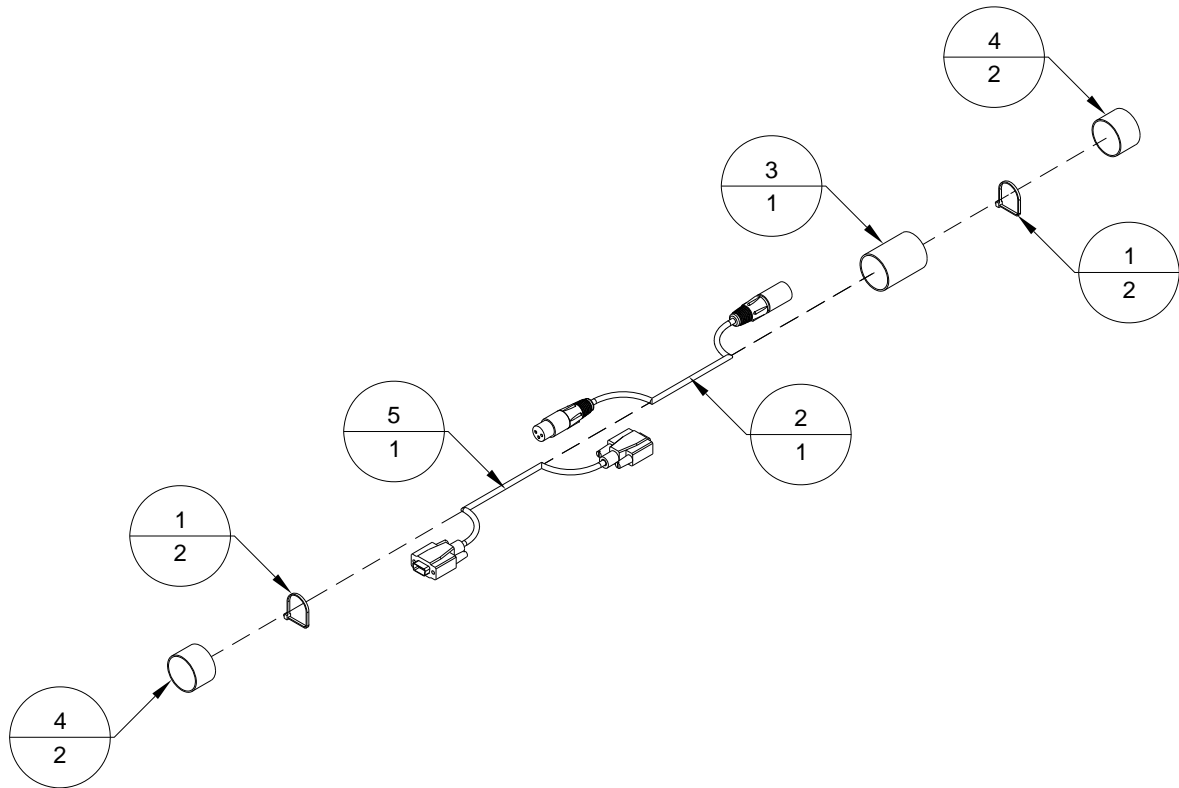
Figure A-18: *Umbilical Assembly, BK791, Apollo, 15' (9103180A)*

Table A-19: *Umbilical Assembly, BK792, Apollo, 15" (9103181A)*

Item	Part Number	Quantity	Description	Reference
1	615140	2	Lashing Tie	
2	9100261A	2	Cable, HP Printhead Power	
3	9101776	148"	Sleeving, Braided Expandable	
4	9102603	2 x 2"	Shrink Wrap, 1 ½" OD, ½" ID	
5	9102687A	2	Cable, Printhead Data, 15'	

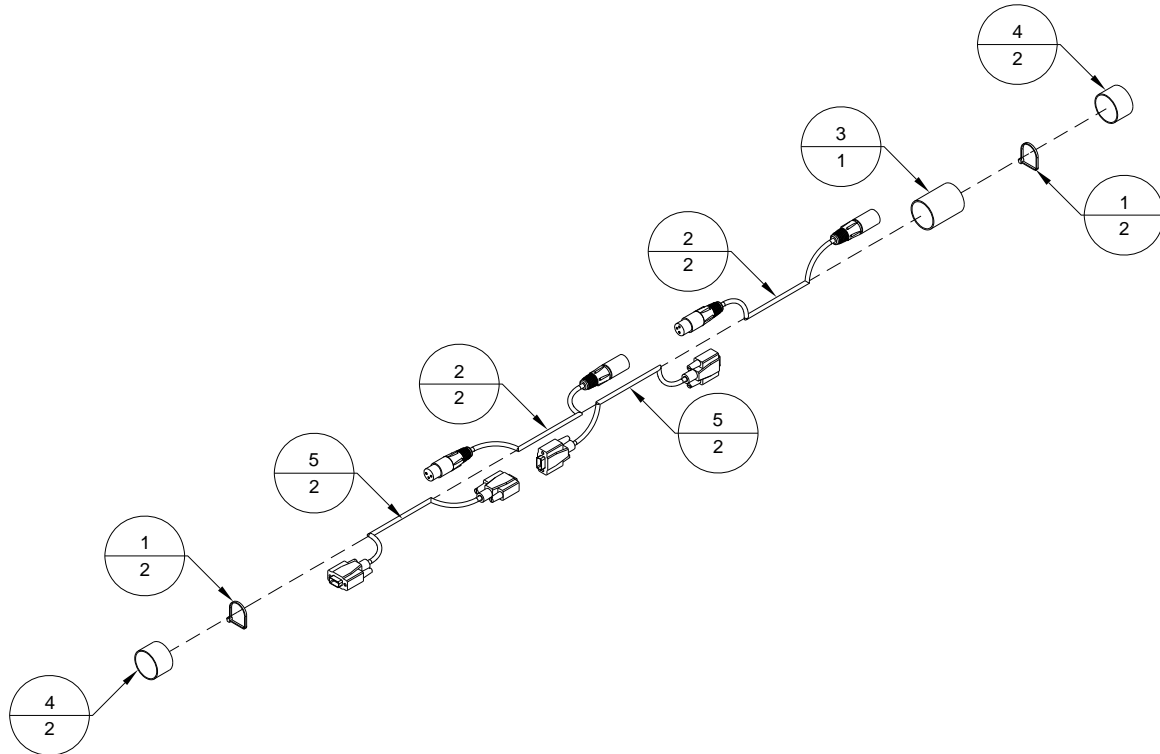
Figure A-19: *Umbilical Assembly, BK792, Apollo, 15" (9103181A)*

Table A-20: *Umbilical Assembly, BK793, Apollo, 15' (9103182A)*

Item	Part Number	Quantity	Description	Reference
1	615140	2	Lashing Tie	
2	9100261A	3	Cable, HP Printhead Power	
3	9101776	148"	Sleeving, Braided Expandable	
4	9102603	2 x 2"	Shrink Wrap, 1 ½" OD, ½" ID	
5	9102687A	3	Cable, Printhead Data, 15'	

Figure A-20: *Umbilical Assembly, BK793, Apollo, 15' (9103182A)*